REFLECTIONS ON THE FINANCIAL AND ETHICAL IMPLICATIONS OF MUSIC GENERATED BY ARTIFICIAL INTELLIGENCE

A Thesis presented to the Department of Music,
School of Creative Arts, Trinity College, Dublin

in Partial Fulfilment of the Requirements for a Doctor of Philosophy

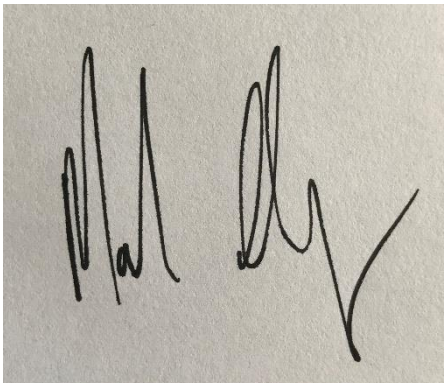
by
Martin Clancy

January 2021

Declaration

I declare that this thesis has not been submitted as an exercise for a degree at this or any other university and it is entirely my own work.

I agree to deposit this thesis in the University's open access institutional repository or allow the Library to do so on my behalf, subject to Irish Copyright Legislation and Trinity College Library Conditions of use and acknowledgement.



Signed: _____

Martin Clancy

Summary

My research question analyses the financial and subsequent ethical implications of music generated by modern technological systems, commonly known as Artificial Intelligence (AI). Of the many implications of AI, I identify that the principal concern relates to the increased replacement of industrial professionals by autonomous and intelligent systems in the music ecosystem and that these issues are caused by technological challenges to key tenets of intellectual property (IP). To ascertain the situation, I look first at the activities of contemporary AI music actors, then explore the economic consequence of their technologies on the music ecosystem before considering a necessary ethical response to that emerging dynamic.

My research methodology is based on transdisciplinary and mixed-method research. Empirical action research provides an opportunity to analyse the actions of AI actors in the music ecosystem. This methodology involves investigating both quantitative and qualitative data, AI music examples (e.g. sound recordings), legal resources and AI ethics guidelines.

Research methods include the investigation of empirical data via Science and Technology Studies (STS) theories and culture studies. These are: content analysis (e.g. of sound recordings, AI music software), comparative analysis (e.g. of existing AI technologies), case-study research (the DJ case study example), discourse analysis (e.g. in comparing legal resources and AI ethics guidelines), structured and unstructured interviews (e.g. by email and telephone).

My key results and arguments are based on the following process of analysis: to enable a critical and robust representation of the term ‘music ecosystem’, I develop a

theoretical model with the capacity to satisfy the demands of engagement with AI technologies. I seek to convey clarity to the vagaries of the term ‘AI’ in order to surmise what technologies are being referenced when featured actors cite ‘AI’. A portfolio study is presented to accommodate the range of provocations to cultural and musical norms by AI music actors. The portfolio comprises three sectors: the academy, transnational corporations, and start-up companies. In varying degrees, each sector’s economics are interlinked through the creation and exploitation of intellectual property (IP), the challenge to which by AI I find to be the most important implication. I then examine the legal complexities offered by AI music products and services and contend the challenge of AI creativity within that framework. The centrality of the human author is the basis of key concepts in music copyright, and I analyse the future legal status of non-human actors within that setting. A concomitant set of tests are presented when considering concepts of legal personhood for AI. My conclusion of this situation is that music copyright as it currently stands is not capable of matching the tests presented by AI. Whether such systems are built by humans or machines does not impact on their possible future legal autonomy.

I argue instead that an equitable approach to the financial implications of AI can only occur through an ethical response from stakeholders of the music ecosystem. This response is needed to inform the law of what moral values decree notions of the common good. I then examine this ethical imperative by exploring what macro AI guidelines are available at both a governmental and nongovernmental level. This analysis builds a commonality of discovered so-called ‘human-centred’ ethical principles from reports by actors including the UN, EU and the Institute of Electrical and Electronic Engineers (IEEE). The macro ethical commonalities are then applied to a micro, sector-specific domain – the music ecosystem. As the ethical principles advocated at the macro level cannot be directly applied to the music ecosystem, I analyse the AI music start-up Xhail.

This case study shows how real-world frameworks can broker the financial and ethical entanglements of AI in an equitable and pragmatic context.

The reference to ‘reflections’ in the title of my dissertation mirrors the central aspect of empirical action research methodology as a reflexive practice that, in this case, leads to a broader understanding of the financial and ethical responses to AI, as well as to applicative conclusions designed to influence policy-making and educational sectors. To that end, this thesis reasons that a globally recognised and legislatively enforceable AI ‘music mark’, signifying the ethical certification of AI in music products and services, is a timely need that must become a practical reality. The governance and regulation of AI can provide a structure of actionable proposals to support a sustainable music ecosystem for all its human and non-human members.

Acknowledgements

I want to thank my supervisors, Martin Adams and Richard Duckworth, for all their support throughout my postgraduate studies. I want to thank Martin for his reassurance, encouragement and enthusiasm for my curiosity and Richard for maintaining that this curiosity stayed on course. I would also like to thank the staff at the Long Room Hub (Caitriona Curtis, Jane Ohlmeyer and Emily Johnson) and all the extraordinary visiting Fellows and researchers who I was honoured to meet and discuss many fantastical things between 2017-20.

Thanks too to all in the Music Department, especially Head of School Creative Arts - Ruth Barton and Gráinne Redican for their warm attentiveness. I want to thank the Science Gallery for partnering with me in the eighteen-month long Signal series *'Conversations about Curiosity, Technology and Creativity*' (2017-19) where many of topics of this thesis were first aired. Thanks also to Ableton, Berlin and IMRO for financially supporting the Signal series. I would also like to thank Routledge UK for commissioning a book based on the themes of this doctorate. Similarly, I would like to thank Gil Weinberg, David Cope, Scott Cohen, John C. Havens, Imogen Heap, Trevor Pinch, Valerio Velardo, Rome Thomas, Miller Puckette, Holly Herndon, and Jacques Attali for supporting this research enquiry. A special mention goes to Mick Kiely and Tom FitzGerald at Xhail for extended access to their AI start-up and giving up so much of their time for research interviews.

Finally, I am daily grateful for all the kindness and love that serendipity provided through the many friends who were not in my life when I started this work. Without Brenda Keane, Anna Barcz, Greg O'Neill, Artur Osipov, Susan Kane, Vasileios Gourgourinis, Tony Keville, Grace Moon and my sister Myra, these pages would likely remain unwritten. Thank you one and all for helping in my many hours of need. This work is dedicated to the loving memory of Trish Kavanagh who had an instinctive distrust for the all too human hands behind the latest technological promises.

Table of Contents

List of Figures

List of Tables

List of Abbreviations

A/IS	Automated and Intelligent Systems
AGI	Artificial General Intelligence
AHSS	Arts, Humanities and Social Sciences
AI	Artificial Intelligence
AI HLEG	EU High Level Expert Group on Artificial Intelligence
AIVA	AI Music Software System
AMS	AI Momentum, Maturity and Models for Success Survey
ANI	Artificial Narrow Intelligence
ANT	Actor-Network Theory
API	Application Programming Interface
AR	Augmented Reality
ASI	Artificial Super Intelligence
ATEAC	Google Advanced Technology External Advisory Council
B2B	Business to Business
B2C	Business to Consumer
BPM	Beats Per Minute
CAIE	European Commission's Communication – Artificial Intelligence for Europe
CDPA	Copyright, Designs and Patent Act UK, 1988
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CGWA	Computer-generated Works of Art
WIPO-CIPAI	World Intellectual Property Organisation - Conversation on Intellectual Property and Artificial Intelligence
CNN	Convolutional Neural Networks
CSER	The Centre for the Study of Existential Risk, Cambridge University
CTO	Chief Technology Officer
DAW	Digital Audio Workstation
DBEI	Department of Business, Enterprise and Innovation, Ireland
DIH	Digital Innovation Hub
DMCA	Digital Millennium Copyright Act USA, 1998
DTIF	Disruptive Technology Innovation Fund
EAD1e	IEEE Ethically Aligned Design First Edition Report
ECJ	European Court of Justice
ECPAIS	Ethics Certification Program for Autonomous and Intelligent Systems
EGTAI	AI HLEG's Ethical Guidelines for Trustworthy AI
EMI	Experiments in Intelligent Music
EOI	Expression of Interest application
FANG+	NASDAQ Investment Portfolio comprising Facebook, Apple, Amazon, Netflix, Google, Baidu and Tesla.
FHI	The Future of Humanity Institute, Oxford
GATT	General Agreement On Tariffs and Trade
IEEE	Institute for Electrical and Electronic Engineers
IFPI	International Federation of the Phonographic Industry
IP	Intellectual Property
IPO	Initial Public Offering
LAWS	Lethal Automated Weapons Systems

LMICs	Low to Middle Income Countries
MIDI	Musical Instrument Digital Interface
MIT	Massachusetts Institute of Technology
ML	Machine Learning
NGO	Non-Governmental Organisation
NMPA	National Music Publishers Association US
OECD	The Organisation for Economic Co-operation and Development
PwC	PricewaterhouseCoopers (Price Waterhouse and Coopers)
RNN	Recurrent Neural Networks
SAAS	Software As A Service
SACEM	Society of Author, Composer and Publishers of Music (France)
SCOT	The Social Construction of Technology
SME	Small to Medium Enterprises
SMI	Score Music Interactive Limited
SSI	The Social and Societal Influences of AI Working Group
STS	Science and Technology Studies
SU	Singularity University
TRIPS	The Agreement on Trade Related Aspects of Intellectual Property Rights
TTS	Text to Speech
UI	User Interface
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UN SDGs	United Nations Sustainable Development Goals
USP	Unique Selling Point
USPTO	United States Patent and Trademark Office
VC	Venture Capital
VJ	Visual Jockey
VR	Virtual Reality
WIPO AICM	World Intellectual Property Organisation – AI and Creating Music Session
WTO	World Trade Organisation
XR	Extended Reality (including AR, VR and Mixed Reality)

Introduction

This work aims to address unease regarding incremental but notable changes I encountered from 2011 onwards concerning our relationship with music technologies[1]. Though tacitly first felt, this work seeks to articulate and explore those intuitions by classifying several societal and technical developments to deliver a final series of interconnected actionable and pragmatic recommendations. Early in my research, I realised that the most vivid expression of this shifting relationship with technology appeared in autonomous systems termed Artificial Intelligence (AI). Therefore, this review focuses on these systems with particular examination on the impact of technology on employment opportunities within music. To ascertain that situation, this work will look first at the activities of contemporary AI music actors, then explore the financial consequence of their technologies before considering a necessary ethical response to the emerging dynamic of employment in the music ecosystem.

At no stage during my research was evidence encountered that ungrounded my initial insights; instead, my examination initiated a growing apprehension. Many of these concerns arose at The Library of Congress in Washington D.C. in February 2020, during the *AI and Creating Music* (*WIPO AICM*) session of *Copyright in the Age of Artificial Intelligence* symposium, hosted by the US Copyright Office and co-sponsored by the World Intellectual Property Organisation (WIPO) (US Copyright Office, 2020a).

[1] The changes I initially noted were not connected with AI but related to what I now understand as involving a transfer of agency from the user to the music technology. Music processing systems became increasingly more powerful both in terms of the sophistication of DAWs (Digital Audio Workstations) combined with the processing capacity of laptops (circa 2012). During this period, I noticed that many students and some colleagues rather than experimenting with technical workarounds to compensate for system's inadequacy were instead becoming somewhat overwhelmed by the range of possibilities on offer and increasingly looking to the technology for programming solutions.

Reference is given to that session throughout this dissertation to flag that my once tacit concerns are now the substance of global debate. However, the *WIPO AICM* session stopped short of attempting any consensus proposal to the many issues discussed and my work, in contrast, proposes the next step in contending with the challenges presented by AI.

It is a research responsibility in a work of this kind (one that involves near-future societal tests) not to avoid the most taxing question – what needs to happen next to meet the challenges presented by AI? This research obligation is informed by Langdon Winner's call (discussed in Chapter 1) not to 'sleepwalk' into technological futures. I gain little satisfaction from my conclusions, other than a conviction that it is my soundest effort to submit an agenda to meet Winner's demand.

To that end, this thesis reasons that a globally recognised and legislatively enforceable 'music mark', which signifies the ethical certification of AI in music products and services, is a timely need that must become a practical reality. Each stage of this work's analysis underpins the logic of Winner's call. To circumvent the work shifting to a polemic, the consequence of an AI 'music mark' is explained gradually, as a proactive coherent response to the evolving discourse. Therefore on occasion, when introducing significant new ground-breaking technical information and reportage data (often in the form of lists because of their exponential increase), an immediate critical commentary is suspended to the chapters' closing summaries.

Investigating the entanglements of association with AI leads to the main concern about the future worth of human creativity, and it follows that financial consumer behaviour presents the most apparent appraisal of that value. Though society may desire to sustain specific cultural constructs, how much would it be ready to pay to support these desires if more affordable, more convenient AI-based products and services were

available[2]? By 2012, music had become as David Bowie predicted in 2002 - a utility much like water or electricity, a product not owned but paid for access to (Pareles, 2002). It was against this backdrop of protean consumer behaviour that I asked what the economic eventuality would be if machines were capable of generating music imperceptibly different from that composed by humans? Furthermore, what would be the ultimate purpose for people operating in the music industry or, as it is now routinely neologised, 'the music ecosystem'[3]? I sensed a connotative remodelling in the colloquial transition from industry to ecosystem and began to consider its plausible significance. What did the term 'music ecosystem' indeed mean? Was the phrase a reflection of the workings of the gig economy, in which profits from music content were prospering, but salaried jobs for music makers continued to decline? Was society moving from a music industry to a music ecosystem because the latter term was a more palatable descriptor for vested interests to sidestep the dearth of employment opportunities being created inside a booming economy? To reply to these puzzles and describe how I reach my thesis' conclusions, I will now trace my narrative construction and detail its research methodology.

[2] The readings of the early 2000s with the entrance of illegal peer-2-peer file sharing (and I embraced that new technology as much as any) confirmed once more that user norms could swiftly alter.

[3] Despite the fact that the term ecosystem functions as a biological model, its ecological context is not pertinent to this thesis.

Outline

Chapter 1 seeks to enable a critical and robust representation of the term music ecosystem - a model with the theoretical capacity to satisfy the demands of dynamic engagement with AI technologies and to contend with the ensuing necessary ethical decision-making. In music, as aforementioned, the clearest example of the changing relationship with technology appears in autonomous systems marketed under the umbrella term 'Artificial Intelligence'.

Nevertheless, while the usage of the rubric 'AI' has been rapidly societally expanding, so too is the regularity of the term AI's appearance in a diversity of musical contexts. Moreover, the ineluctable question arose – was this all the same 'AI' technology? Chapter 2's purpose is to convey clarity to the vagaries of that term and to surmise, when featured actors cite 'AI', what technologies they are referencing[4]. Moreover, while the contemporary relationship with AI is fast-moving, a fascination with its potentialities for music is anything but new, and it is helpful to remark this historical association when observing the modern AI music landscape portrayed in Chapter 3.

The notion of music automation is an ancient curiosity, from Aristotle's musings in *Politics* of 'the plectrum touch the lyre without a hand to guide them' (Durant, 1961), to Ismail al-Jazeri's technical manuscript for a robot band issued in 1206, to the *androide* flautist of De Vanchusan in the 1700s (Barry, 2018) – modern enterprises in AI music can be witnessed historically. Indeed, when Charles Babbage invented the Analytical Engine in 1840[5], Ada Lovelace reflected that the machine '… might compose elaborate and scientific pieces of music of any degree of complexity or extent' (Otis, 2009: p. 18).

---

[4] For instance, AI music actors featured in Chapter 4 (i.e. DeepMind and OpenAI) are organisations whose objective is the achievement of human (and beyond human) AI capabilities. This transhumanist aspiration fashions the musical tools they deliver, and Chapter 2 assists in following these design motives.

[5] The Analytical Engine is widely regarded as the first computer (Swade & Babbage, 2001).

Nonetheless, this ancient curiosity for musical automata is now a radically modified proposition as exponential AI technology begins to transform the established criteria of human creativity.

The purpose of Chapter 3 is to display that historic dreams of music automation are now achievable, deliverable, and sponsor many provocations by AI technologies to the economic skeleton of the music ecosystem. There is a yearning that unites Ada Lovelace to Google Magenta's mission statement, which asserts the goal 'to develop algorithms that learn how to generate art and music, potentially creating compelling and artistic content on their own' (Eck, 2016). Many actors featured in Chapter 3 strive to reach a shared intention with the Google Magenta objective, hence a portfolio study is presented to accommodate the capacity of these AI actors. This scale of enterprise intimates the heightened probability of the financial complications conferred by AI to the music ecosystem happening. The portfolio review releases a range of provocations to cultural and musical norms, and of these positions, the most important financial implication is the challenge to copyright and its repercussions on employment in the music ecosystem. This summation is made plain in Chapter 3 which classifies the actors into three sectors: the academy, transnational corporations, and start-up companies, and notes each sector's commercial incentives. In varying degrees, each sector's economics are interlinked through the creation and exploitation of intellectual property (IP). Moreover, though copyright remains the most vital form of IP in the music ecosystem, it is not the only class of IP utilised by AI music actors and therefore each of these IP expressions will be examined to understand the range of economic motivations in play. The function of IP also introduces another new actor to the music ecosystem: China, and its complicated relationship to music IP, which is incorporated in that Chapter 3's critique. The chapter ends with an analysis of the financial implications of AI music technologies in a real-world case study of a musician (the DJ) and demonstrates how the

many issues contended in this work are already being implemented, thus demanding the interventions recommended in the final chapter to this thesis.

Chapter 4 builds on the economic AI landscape of Chapter 3 and examines the legal complexities offered by self-described ‘democratic’ AI music products and services. In outlining the economic rationale for copyright as an integral component of the music ecosystem, the challenge of AI creativity within that framework is then deliberated on. The centrality of the human author is the basis of legal concepts in music copyright and the status of non-human actors within that setting is analysed. To discern the financial challenges given by AI technologies to copyright, the current brittleness conferred by humans to copyright law is investigated by examining theories of creativity and originality in music composition. These stresses are further displayed when the chapter studies legal protections for audio sampling practices. The boundaries of the legal landscape established, this work considers the convolutional neural network (CNN) – Google’s WaveNet, which offers unique tests to fundamental constructs (e.g. copyright) underpinning the business of music. The second half of Chapter 4 reviews a separate but concomitant set of tests by regarding AI and concepts of legal personhood. Opinions from tort law and arguments from vicarious liability support this analysis and each subscribes to the chapter’s conclusion that music copyright is not capable of matching the tests presented by AI. Instead, an equitable approach to the financial implications of AI can only occur through an ethical response from stakeholders of the music ecosystem.

Chapter 5 contends with that summary reflection that an ethical contribution is needed to inform the law of what moral values decree notions of the common good. This work moves upon this ethical imperative to examine what macro AI guidelines are available at both a governmental and nongovernmental level. Next it seeks to build a commonality of discovered so-called ‘human-centred’ ethical principles from reports by actors including the EU, the Institute of Electrical and Electronic Engineers (IEEE), and

the United Nations Sustainable Development Goals (*UN SGDs*). The role of the *UN SGDs* will be crucial in this review, as the effective governance for AI must ultimately occur at the intergovernmental level provided by the UN – a point reinforced when it is noted that WIPO is one of fourteen UN agencies and therefore any legislative changes to IP will occur at the WIPO (UN) level and these legal decisions must heed the ambitions of the *UN SGDs*. The human-centred macro ethical commonalities provided by the UN, EU and IEEE are then applied to a micro, sector-specific domain – the music ecosystem. Since the high-level ethical principles advocated at the macro level cannot be directly applied to the music ecosystem, the concept of an ethical 'music mark' is introduced and promoted, as the AI music start-up Xhail is explored. This case-study shows how real-world activity can broker the financial and ethical entanglements of AI in an equitable and pragmatic context.

The role of Chapter 6 is to give a structure of actionable proposals to support a sustainable music ecosystem within the previously identified (Chapter 4) global movement to IP harmonisation. Uniting the chapter recommendations is the request highlighted by Sheila Jasanoff in *The Ethics of Invention* (2016) that AI owners and designers must identify the intended consequences of their technologies (Jasanoff, 2016: pp. 21-26). Chapter 6 begins by reflecting on the theoretical model of Chapter 1 and moves on to provide insight into how an ethical approach can inform recent contradictory rulings on IP. The governance and regulation of AI, including consumer protection, are then explored at both the global (UN) and the local (Ireland) level within the frame of a new music ecosystem. Also outlined is the advised implementation of a 'music mark' as a component of an Irish national AI strategy. The chapter ends with making a set of recommendations concerning the transformative possibilities of music education as a support to the chapter's overall conclusions.

Research Methodology

The methodological approach of this work is based on transdisciplinary and mixed-method research, which since the 1980s and ‘90s has become increasingly widely accepted, often under the name of ‘empirical action research’ (Ivankova, 2015: p. 51). Empirical action research gives an opportunity to analyse action, in this case to identify the actions of AI actors in the music ecosystem, and to evaluate the financial and ethical consequences of their actions and of music generated by AI. This methodology involves investigating both quantitative and qualitative data, which comprises financial information regarding the rapid development of AI technology in the music industry (e.g. costs, income, capacity etc.), and exploration of AI music actors, AI music examples (e.g. sound recordings), legal resources and AI ethics guidelines.

This approach draws on a number of distinct theories, and on techniques deriving from those theories. None of these theories and techniques is treated as having rigid boundaries. Rather, they are tools to aid understanding of a range of evidence that can, at times, be bewildering in its complexity. The methods include:

1) Investigating empirical data via science and technology studies (STS) theories (i.e. social constructivism, actor-network theory) and culture studies (i.e. historical and philosophical contexts of AI and AI ethics development) including the guiding concept of the music ecosystem to network AI sector-specific actors as well as their fiscally and ethically bound relations.
2) Content analysis (e.g. of sound recordings, AI music software).
3) Comparative analysis (e.g. of existing AI technologies).
4) Case-study research (the DJ case study example).
5) Discourse analysis (e.g. in comparing legal resources and AI ethics guidelines).
6) Structured and unstructured interviews (e.g. by email and telephone).

The cyclical nature of action research methodology includes merging discourse analysis (i.e. investigating economic and ethical components of collected data) with interpretative analysis of practice (i.e. AI music researchers, regulatory bodies, and business).

'Reflections' in the title of the dissertation mirrors the central aspect of empirical action research methodology as a reflexive practice that, in this case, leads to a broader understanding of the financial and ethical responses to AI, as well as to applicative conclusions designed to influence policy-making and educational sectors. Action research is also described as 'a mechanism for practitioners' (Stinger, 2014 in Ivankova, 2015: p. 53) because it 'enables practitioner-researchers to find more effective solutions and their efficient applications' (p. 53), which contextualise this work within public engagement goals.

Literature Review

Before going to the next stage, it is important to mention several works from discrete disciplines that indicate the current state of research relevant to this thesis. The key recent published works are now discussed.

Computational creativity is an established subject within computer science and recent works show a growing interest in ethical issues associated with the technological development of generative models. For example, ‘A Note on Data Biases in Generative Models’ (Esser, Rombach & Ommer, 2020) focuses on the ethical implications as a major research outcome. One of the highlighted findings is that ‘Datasets are not the sole cause of societal bias in ML models’. An observation that indicates that an AI system’s output might not be as transparent as the direct connection with its training set would commonly suggest.

Another example of current research in computational creativity is ‘Explainable Computational Creativity’ (Llano et al., 2020) which investigates human perception of computer generated works of art (CGWA). The paper demonstrates a cognitive link between knowledge of ‘explainable technology’ (technology readily understood by non-professionals) and a consequent subjective emotional reaction that the work is somehow fake in its authenticity.

Similar research questions are raised in ‘Technology: Computational Creativity’ (Dasgupta, 2020) which presents scenarios where computational artifacts are perceived as creative elements. The logic here is that as the AI programmer or developer is an integral part of the creative construction then any singular aspect of the output of the technology should be also be considered a creative agent regardless of its proportionality.

The question of ethics within computational creativity is discussed with a legal framework in Harry Surden in ‘Ethics of AI in Law’ (Surden, 2020: p. 719). The article

considers a range of possible societal reactions to altering fundamental norms and values brought by technological change and considers approaches that may preserve the legal framework to benefit humanity.

In ‘Lessons learned from AI ethics principles for future actions’ (Hickok, 2020) the principal concept is that only a modular and incremental pedagogy regarding the introduction of ethical principles of technological use can achieve a successful real-world educational model that integrates humans and AI. The author recommends that we should never cease asking essential questions such as ‘What cultural logic is represented by the agenda and who benefits from it?’ and that in any technological network wherever ethics are formulating, we must always remain vigilant and critical.

Arguments presented in ‘You cannot have AI ethics without ethics’ promote the analysis of the causality of technological challenges that reach beyond the immediate requirement for remedy. As such, ‘“Fixing” the broken part will often fail to prevent a future problem, because these types of problems are systemic...’ (Lauer, 2020: p. 2). Modifying existing techniques and seeking new approaches is proposed as the favoured methodology to engage with emerging technological ethical issues.

> ‘These errors often manifest themselves as coding errors or user interface flaws, but they are the consequence of poor requirements, poor governance and poor processes. This also describes the state of AI today. When AI ethics fail, we assign blame to inadequate or narrowly specified training data while looking past organization-wide ethical shortcomings.’ (Lauer, 2020: p.2)

The contributions from computational creativity, law, AI ethics are supplemented by the incorporation of posthuman theories, to understand what kind of human-technology relationship we are involved in when we talk about AI-societal challenges. Posthuman theories the majority of which have been hitherto applied to human-environmental studies include Cary Wolfe, Rosi Braidotti and Stefan Herbrechter

(Wolfe, 1975). However, in this thesis the debate on AI-challenges in the creative arts sector is communicated as a threat involving existing technology requiring ethical protection based on human-centred values. However, the unchallenged anthropocentric approach inherent in this governing concept demands further critical investigation in order to develop a new concept of a sustainable music ecosystem which will address the provocations of AI. As such the essential research question asks of present-day AI what kind of technology it is? Furthermore, to what extent is there a need, if any, to protect human creativity?

*

As I draft the final edits to this work (July 2020), it is difficult to detach my reflection on AI from the financial impact that COVID-19 has had globally on music makers. It is too early to assess what long-term effects the pandemic will have on the arts. However, it has confirmed the economic fragility of the music ecosystem prior to the AI challenges outlined in this thesis being fully implemented, an example of which is shown in the EU *Music Moves Europe Preparatory action 2020: Innovative support scheme for a sustainable music ecosystem.* The scheme announced in July 2020 offers a fund of €2.5 million and states that the music ecosystem 'belongs to one of the cultural segments that were hit the most by the corona crisis' (European Commission, 2020a).

The global appreciation of the music ecosystem's economic brittleness may stimulate an initiative to shield human-centred values within music. I hold (though it is as much hope as forecast) that proposals included in this thesis can now more assuredly add to a broader harnessing of AI technologies within an ethical framework.

Furthermore, if Jacques Attali and others[6] are accurate that music is a herald for social change, then ethical determinations made within music produce wisdom for both

[6] Taplin, Krueger and Brown appear later in this work.

the broader macroeconomic and the environmental ecosystems. The scope of my research inevitably entails more riddles than it can satisfy, but remains steady in its acceptance that only through the real-world intervention with these questions can music makers add to the future shaping of music and society's well-being.

For the past almost forty years, I have earned a living from music principally through my curiosity with new music technologies. Nothing could be further from the intent of this work than to present a bleak and dystopian appraisal, however much that follows is troubling, especially when I contemplate the prospective work possibilities for those now beginning in music. Nevertheless, I have entered into the entanglement with technology with an open-hearted wish to comprehend what I first tacitly sensed was occurring and not to shirk from the difficult proposition of how to respond. As I complete this work, I am heedful that this is but one approach to this thesis' inquiry. Indeed, it is but one of many critical approaches that I might have chosen during a diverse professional life. It is both pleasant and disconcerting to acknowledge that, in my twenties, theoretical possibilities arising from Chapter 1 would have been the work's dominant theme. In my thirties, the legal mysteries of Chapter 4 would still be the work's backbone but perhaps with more innovative resolutions conceived. In my forties, the sheer fascination with the creative and artistic possibilities of new AI technologies would likely have been the foremost interest. Each of these past voices still speak to me, and tell the present narrative more noisily on occasion. However, as stated, the principal concern for me now is that the range of employment opportunities within music that were once available should be protected, reimagined and expanded wherever possible. I remain faithful that abler minds will progress on the intentions of this work, and that my outcomes move others to continue to advance real-world moral aspirations as actionable and attainable through ethical intervention in the music ecosystem, and beyond.

Chapter 1: Theoretical Model of the Music Ecosystem

> The economy of music, a strange industry on the borderline between the most sophisticated marketing and the most unpredictable of cottage industries, is much more original and much more of an augur of the future. (Attali, 1985 [1977]: p. 103)

The theoretical model is developed from empirical action research that considers the financial and ethical implications of AI music systems. It is designed to be sufficiently robust to anticipate related ethical challenges presented by AI technologies such as affective computing and digital sovereignty to the music ecosystem. Contributions to that question include perspectives from the philosophy of science and technology studies (STS), alongside political, economic and social theory. The theoretical model builds on a sequence of interrelated pillars, which underpin a final presented multi-layered understanding of the redefined term ‘music ecosystem’ that is employed throughout this dissertation. For instance, the SCOT model provides a convincing sociological methodology to examine individual music services and products while ANT presents a framework to consider the position of non-human (AI) actors within the music ecosystem.

1.1 Science and Technology Studies

1.1.1 SCOT Model

The SCOT (Social Construction of Technology) model is a cornerstone of the theoretical approach. The work of Wiebe E. Bijker, and particularly Trevor Pinch in his analysis of the Moog and Buchla synthesisers (Pinch & Trocco, 2004) during the 1960s, provides a conceptual framework to ascertain how competitive technological developments, in this instance AI music start-ups, are likely to advance and integrate into existing commercial norms. SCOT evolved from German social constructivism in

sociology (Berger & Luckmann, 1966). Social constructivists posited that reality is socially constructed, and that processes such as perception should be the subject of sociological study. Social constructivism was widely implemented in STS during the 1980s. Key works by H. M. Collins and Trevor Pinch (1982), by Wiebe E. Bijker, J. Boonig, and E. C. van Oost (1984), and by W. E. Hughes and Trevor Pinch (1985) influenced and advanced this new perspective in STS thinking. According to SCOT's representatives, the theory developed as a critical response to technological determinism and asserts that the works of technology are negotiated (Pinch & Bijker, 2003 [1987]: p. 223) and socially constructed (Bijker, 2009: p. 89), and one challenge in applying the methodology lies in the selection of relevant social groups for SCOT analysis. Social groups whose perception of technological artefacts – how they ascribe meaning to them – construe social knowledge on the artefacts, a signification process which reveals diverse paths of technological progress. SCOT developed as an empirical and impartial study of 'how actors in practice define a problem as technical or scientific' (Bijker, 2009: p. 92) and, therefore, as a result of its intended objectivity the ethical analysis of technology was not at the core of SCOT studies. Bijker pragmatically claimed that SCOT offered 'some entry points' to an ethical approach (2009: p. 92); however, he preferred to position SCOT in the conceptual framework as a nonaligned agent within a 'politicizing' technological culture (2009: p. 92).

1.1.2 Actor-Network Theory

The Actor-Network Theory (ANT) has had considerable impact among scholars pursuing the SCOT model (Bijsterveld & Peters, 2010), as both theories are grounded in social constructivism. Bruno Latour is considered to be the developer of ANT, which was extensively described by Latour in his book *Reassembling the Social: An Introduction to Actor-Network-Theory* (2005). The book's chief premise redefines what is meant by the

term ‘social’ and how society can reconceptualise what had previously been designated as non-social (e.g. nature). Latour located a form of crisis within sociology relating to the defining of objects of study, stating that the crisis is related ‘in large part to the very expansion of the products of science and technology’ (p. 2). He argued that situations are encountered where sociology is not able to adequately examine the social relations ‘where innovations proliferate, where group boundaries are uncertain, when the range of entities to be considered fluctuates’ (p. 11). This position provided the background for the development of ANT and the concept of social actors, their agency, and relations, not hierarchically positioned but instead existing within a network – a so-called ‘flat’ ontology (p. 16).

Within the vocabulary of ANT, an actor can be anyone or anything that acts (p. 46), i.e. has an agency, and can be alternatively called an ‘actant’ (p. 54). However, what Latour originally defines as ‘social’ does not end with actors, but instead shifts to involve new combinations in societies; ‘social’, for ANT, is the name of a type of momentary association which is characterized by the way it gathers together into ‘new shapes’ (p. 65). The result is new entanglements of interactions that are called networks (p. 65), and a relevant outcome is that ANT can consider AI as a social actant, because social networks include non-human actors, even objects (i.e. technologies).

ANT contributes to this work’s theoretical model by providing a methodology that embraces both human and non-human (in this context AI) actors as members of a given network. Therefore, it provides the stimulus for non-human ‘member organisms’ (Moore, 1996: p. 26) to be reconsidered as actants within this review’s definition of the music ecosystem. ANT also offers an important background contribution to the legal question of whether AI should be granted personhood. While it is concluded in Chapter 4 and 6 that AI should not be granted these rights within the expressed creative capacity of existing technology, Latour’s ANT allows for recognition of the presence of AI as an actor within

the music ecosystem while also noting the potentially transformative nature of that status. As such the AI actor would appear within the existing cluster of four macro categories of human actor employment in the music ecosystem – live performance, recording, publishing and merchandise. Traditionally each of these categories are represented by a succession of economic groupings. For example, the 'recording industry' macro category comprises actors including major and independent record labels, related distribution channels (streaming, download and physical formats), human musicians, composers, producers, engineers, related representational bodies, the developers of creative musical tools and the vast associated tradecrafts dedicated to provide administrative and technical support to this macro category. These four macro categories share a root commonality founded on the commercial exploitation of expressions of IP such as recorded or compositional music copyright. In the 21st century this traditional understanding of actors within the music industry must be expanded to include what is known as the FANG+[7] companies i.e. Facebook, Amazon, Netflix, Google, Baidu et al. each who have become major players in a newly developing global music ecosystem. Key to all transnational corporations is the movement to monopolistic market practices in their products (music distribution), services (AI tools) and related revenue streams (advertising) which can limit the range and scale of response available to affected communities within the music ecosystem. However, the nature(s) of their involvement raises ethical questions on several levels and specific areas of concern are referenced in dedicated chapters in this thesis; nonetheless, the principal issue relates to matters of music copyright infringement. It is important to note within the context here of discussing ANT and the AI actor, that copyright and other IP expressions only be vested in humans.

[7] The FANG+ New York Stock Exchange Index includes Facebook, Apple, Amazon, Netflix, along with the Chinese Transnational Corporations (theice.com, 2020).

1.1.3 Technological Somnambulism

In interpreting Latour's ANT, Langdon Winner, an STS scholar who also worked as a leading contributor to *Rolling Stone* (late 1960s), adds a powerful theoretical voice in favour of ethical intervention, because of the inherent amorality of ANT. This criticism was also addressed by him regarding the SCOT model (Winner, 2003 [1993]), when he stated that 'social constructivism provides no solid, systematic standpoint or core of moral concerns from which to criticize or oppose any particular pattern of technical development' (p. 241).

Through the concept of 'technological somnambulism' (Winner, 1983), the author notes that, in mediations with technology, it is not sufficient to 'sleepwalk' in dealings with technological tools and points to an inevitable separation between the values of the makers and users of technological tools. Therefore, what is required in STS analysis is an ethical dimension.

In the past reflection on technology was scare, as noted by Winner in his *Technologies as Forms of Life* (1983). He references Karl Marx and Martin Heidegger as then rare examples of such philosophical analysis (p. 103), observing that 'technology has never joined epistemology, metaphysics, aesthetics, law, science, and politics as a fully respectable topic for philosophical inquiry' (p. 104). Technological somnambulism is therefore a critical concept whereby blind faith in technological progress relinquishes any true reflection on an examination of the foundation of its advancement, despite the environmental and social consequences involved (p. 104). A phenomenon that arguably still exists in the present day in spite the fact that there has been a large body of examination since the 1980s. Winner determines that even the fact of how technology is positioned in language, through the notional 'use' – 'for good or bad purposes', positions the technology itself within diverse moral contexts (p. 104-105). In consequence, a process that can be traced as a technological crime is an outcome of moral reflections on

technology which subsequently ‘become matters of law’ (p. 106). While in practice, Winner argues, technological development restructures social and political relations and influences individuals’ lives, these developments lack critical attention and meaning: ‘In the technical realm we repeatedly enter into a series of social contracts, the terms of which are revealed only after signing’ (p. 107). That is why Winner’s criticism is directed at technological determinism where innovation occurs with minimal human participation (p. 107), and instead points to a reflective human adaptation in a world where technology ‘reconstructs social roles and relationships’ (p. 108).

In this article, Winner redefines Ludwig Wittgenstein’s term ‘forms of life’, which the philosopher used in his *Philosophical Investigations* (1953) to demonstrate the function of language structuring human everyday activities (p. 108). On this basis, Winner states that technologies change patterns of life (p. 109). He gives examples (telephone, car, computer) to demonstrate how life is becoming unthinkable without technology. These examples not only consider how these technologies function or are utilised, but also how they shape lives. Winner also acknowledges Marx’s concept ‘modes of life’ as helpful to recognize that, through technologies, humans express themselves (p. 110).

Technologies as ‘forms of life’ address the challenge of how to consider the integrative role of technologies in everyday existence and Winner poses the most important question for him about technology when he asks: ‘what kind of world are we making?’ For Winner, technologies must be discussed on the horizon of responsibility and this requires the intervention of an ethical consideration.

1.2 Ethics and AI Development

Winner’s call for ethics to augment ANT begs the question of what ethical traditions are drawn from when considering the challenges presented by AI? If the music

ecosystem is not to be constructed on a solely western framework, and instead reflect the needs of a truly global environment, then from where are these ethical values to be sourced? To answer that question pragmatically, Chapter 5 derives a sector-specific (music) application of the best-practice in contemporary ethical guidelines drawn from intergovernmental, industrial, academic and independent AI actors and links these values to the mission of the *UN SDGs*.

As the music ecosystem appears set to continue to globally mutate, ethical contributions from non-western traditions including the Ubuntu (African), Buddhist and Confucian schools should be encouraged to have a role to play by future researchers e.g., concepts from the Eastern practice of Shinto where distinct (from a western standpoint) belief regarding notions of artificiality and authenticity are important to note. These beliefs aid and facilitate the societal adoption of AI and robotics, and acknowledgement of them can enrich and broaden the global ethical debate.

Nonetheless, in the absence of non-western approaches that could be part of the discussion on ethical standards for AI development, a workable and utilitarian ethical model representing western culture is offered. This model, capable of practical application to the music ecosystem, is constructed on the unilateral basis of inalienable human rights enshrined in the *Universal Declaration of Human Rights* and exhibited in the *UN SDGs*. The *UN SDGs* pivot on human-centred values and ecological sustainability which are directly recognised as component mission-values in other pan-territorial ethical guidelines for AI, namely the G20. Therefore, the basis of an ethical approach and methodology is formed on a conflation of aligned value systems.

One potentially unifying ethical voice comes from the ancient Greek philosophy represented by Aristotle. He is an important figure whose ideas have a profound bearing on the legal concepts relating to copyright. Many of the reports from intergovernmental actors and others refer to the philosophical notions of human well-being embodied in the

philosopher's theory of *eudaimonia* and presented in his *Nicomachean Ethics* (Book X, section on Happiness, 2009: pp. 192-198). Eudaimonia is understood by Aristotle as the highest good for humans or just as a synonym for 'the good life', however opinion on what exactly it is differs. Therefore, what is needed to pursue happiness is 'legislation' (p. 198). For Aristotle, eudaimonia is a critical term in ethics to present his own ideas about what the good life should be and remains in usage in the present day in a popularised version to signify the Aristotelian value of human flourishment.

According to Aristotle, music is not only aimed at giving pleasure. It should be subordinated toward shaping character and looking for moral goodness (Schoen-Nazzaro, 1978: pp. 266-271). Therefore, the philosopher regards music as a tool for the promotion of personal and civic ethics, and although the theoretical and practical arguments of this thesis are directed primarily towards an ethics that will promote individual well-being, they are also directed towards a more generalized ethical system that will promote well-being of all actors in the musical ecosystem understood as a whole – a modern equivalent of group or civic well-being.

While placing the role of music in accordance with his moral philosophy, Aristotle is also noted as the first author to write (in his *Politics*) of a music automata, which could substitute enslaved people who played musical instruments in Aristotle's times for many hours: 'if, in like manner, the shuttle would weave and the plectrum touch the lyre without a hand to guide them, chief workmen would not want servants, nor master's slaves'. Jaron Lanier, in his book *Who Owns the Future*, refers to this quote and asks an important question – will humans be released from paying others for their work and as suggested by the author, is it the case with AI in the music industry? (Lanier, 2014: pp. 37-38).

The ethics chapter will note how the majority of recent (2018-20) reports on AI ethics orientate on the principle of 'human-centred values'. However, this theoretical

model indicates that these ‘human-centred values’ are open to reinterpretation and pose commercial challenges, while presenting ecological opportunities when applied within AI-ethics. This reinterpretation involves post-humanist rather than technological deterministic, or transhumanist theories. It is essential for a sustainable and fair future to frame a contribution pointed towards an AI-infused music ecosystem, in which economic prosperity includes all human actors. The difference between humanism, trans- and post-humanism can illustrate this aim.

1.3 Humanism, Transhumanism and Posthumanism

1.3.1 Heideggerian Humanism and Technology

Martin Heidegger’s philosophy is representative of modern thinking about humanism (see his *Letter on Humanism,* 1946) (Heidegger, 2010) and his approach provides contributary insight on the ethical strand of human-centred values. Heidegger’s theory is elementary for reflection on coping with technological progress, and by inference can be seen to encompass the perception of risks posed by AI development and the ethical responses that are addressed in this work.

Human relationship to technology is discussed by Heidegger in his classic text *The Question Concerning Technology* (originally published in German in 1954; English edition comes from *Philosophy of Technology*, 2003), where he states that ‘the essence of technology is by no means anything technological’ (p. 252). As his arguments on the nature of technology reject what human culture would call ‘technological’, i.e. instrumental and causal, or earlier understanding of technologies, Heidegger opens the conceptualisation of technology onto a new realm which links the perception of what constitutes technology and its development with a specific version of human

anthropology or human exceptionalism. This approach leads directly to the foundational norms applied in ethics and AI.

Heidegger addresses what he calls ‘modern technology’, after the experience of two wars and the accelerated development of military industry, and he pays critical attention to the idea that mankind can control its own progress: ‘The will to mastery becomes all the more urgent the more technology threatens to slip from human control’ (p. 253). In other fragments, he is convinced that modern technology always includes danger but also contains mystery. The concept of mystery potentially refers to either the unknown or unrecognizable possibilities of human knowledge development. However, Heidegger is also convinced that this is the reason why technology can increase human creativity, because its progress is directly related to the human being as an artist not as a scientist (p. 264). The distinction between art and science/technology is not rigid for Heidegger, as will be seen since it is incorporated in the ‘revealing’ process of human nature.

In his philosophical terminology, he says that ‘technology is a way of revealing’ (p. 255) but not in terms of what technology is but what this human element in technology is. Technology is therefore always inscribed in humanity and understood as a progressive and creative power, able to accept even the most dangerous challenges, such as the development of the nuclear industry (p. 259), if they are part of technology understood more as an art than an instrumental activity. Therefore, man should never be instrumentalised by technology, but as an artist which ‘drives technology forward, he takes part in ordering as a way of revealing’ (p. 257). Heidegger doesn’t require ethics because his radical vision poses man above what he creates and what he is thus responsible for. The development of technology always belongs to the future of humanity: ‘the question as to how we are to arrive at a relationship to the essence of technology, asked in this way, always comes too late’ (p. 259). In a sense, Heidegger’s

position is an anticipation of the tenets of transhumanism, based as they are on the full trust of human power and creativity in any new alliance – dangerous but mysterious and tempting – with emergent AI technologies.

According to the philosopher it is not technology that is dangerous: ‘Technology is not demonic; but its essence is mysterious. The essence of technology, as a destining of revealing, is the danger’ (p. 261). This opens the way to the unknown realm of the technology, the freedom of human creativity that Heidegger praises so highly. And even if ‘the essence of technology is in a lofty sense ambiguous. This ambiguity points to the mystery of all revealing, i.e., of truth’ (p. 263). In other words, the danger cannot be eliminated since it is not in technology but it should be reflected on, and Heidegger urges that these challenges should be allowed to limit the capacity of unlimited human creativity.

Heidegger’s essay is essential for understanding the difference between transhuman and posthuman approaches to the development of technology and, for the purposes of this dissertation, the development of musical AI. Transhumanism, anticipated in Heidegger’s essay, is basically uncritical toward the necessity of regulatory ethics in the implementation of AI, since it affirms the risk always inscribed in the development of technology. In other words, any regulatory practice which precedes human advancement and limits the possibilities is a sign of weakness.

Furthermore, Heidegger anticipates the unlimited evolution of humans allied with machines (transhumanism) to overcome human weaknesses, whereas posthumanism, in the prefix ‘post’, assumes criticism and suspicion toward any new transgressions – in this case, AI development. All in all, this shows that any attempt to found human-centred values solely on Heideggerian humanism is insufficient to address the ethical challenges present by AI systems.

1.3.2 Transhumanism and Posthumanism: Redefining Human-Centred Values

The ethical principles of reports presented by actors including the Institute of Electrical and Electronic Engineers (Ethically Aligned Design), High Level Expert Group on Artificial Intelligence (AI HLEG), and the UN share a moral commonality, in that the implementation of AI systems should be based on 'human-centred values'. However, this review notes the role played by transhumanists including Ray Kurtzweil, Marvin Minsky, and Scott Cohen in the reshaping of the music ecosystem. The reductionist approach of technological determinism remains a driver for many schools of transhumanism, and Winner's concept of 'technological somnambulism' is a philosophical remedy to that malady.

Beside humanism there are two other major strands in philosophy that reposition what constitutes 'human-centred values'. These are the transhumanist and posthumanist perspectives, which both contribute to the ethical reflection on AI development.

To understand the transhumanist approach such as it relates to AI and the technologies relationship with the music ecosystem, the key features of transhumanism as a theory are now presented. In principle, transhumanists argue that human evolution will exceed the limits of the human form (body) through the augmentation of science and technology. This approach is purely anthropocentric, and consistent with Heidegger's philosophical anthropology since the aim is to enhance the human condition.

One of the basic definitions of transhumanism was coined by philosopher Max More (2013 [1990]) where he stated that this approach seeks 'the continuation and acceleration of the evolution of intelligent life beyond its currently human form and human limitations by means of science and technology, guided by life-promoting principles and values' (p. 3). Transhumanist thought displays a scientific optimism which believes that technological progress will be for human benefit as it improves an imperfect (human) condition caused by a flawed biological and genetic heritage (More, 2013: p. 4).

AI development is especially relevant to transhumanist goals and an important role is indicated regarding the potential of Artificial General Intelligence (AGI) or Artificial Super Intelligence (ASI) – the yet to be invented stages of AI that are equal or greater than human to be the main technological agent that will bring a radical change and transform imperfect humans (via augmented bodies and brains) into a new condition that they call (albeit somewhat confusingly) 'posthuman' (Goertzel, 2013: p. 129). In this approach philosophical questions relating to self, free will, and individual awareness, which have ethical contexts, especially in the western world, are called fallacies (Goertzel, 2013: p. 131).

Transhumanists, including Vernor Vinge (1993) and Kurtzweil (2006)[8], anticipate a technological singularity. The singularity is another specific model used by transhumanists to foretell how and when the future will develop, including the accelerated development of AI into a superintelligent AGI:

> according to the singularity hypothesis, the ordinary human is removed from the loop, overtaken by artificially intelligent machines or by cognitively enhanced biological intelligence and unable to keep pace. (Shanahan, 2015: p. xvi)

As to when the singularity may occur, opinions differ, however Kurzweil announced at the SXSW Conference and Music festival in Austin, Texas in 2017, that the singularity will happen by 2045 (Reedy, 2017, futurism.com).

Transhumanism is often confused with posthumanism because transhumanists use the concept of 'posthuman' in their speculations over technological development and

[8] Ray Kurzweil, author of *The Singularity Is Near* (2006), is a significant figure in music technology. In 1965, aged seventeen, on US CBS Television, he premiered a piano piece composed by pattern recognition software he had designed. In the 1980s, Kurzweil Music Systems set new standards of synthesized piano modelling and he later received a Technical Grammy Award (2015). In 2009, Kurzweil co-founded the Singularity University in collaboration with Google. In 2012, Kurzweil was hired by Google as 'Chief Engineer' to work on new projects involving machine learning and language processing.

consciousness separated from the body. For example, Katherine Hayles in her book *How We Became Posthuman* (1999) opts for separating informational from material reality. According to her, due to the creation of advanced computer 'electronic prostheses', humans function more in a virtual reality, one in which what is conceptualised as individuality disperses. In addition, and consistent with Latour's ANT, Hayles posits that non-human actors have causative functions but does not speculate about a future of humans merging with non-humans.

While transhumanism involves uncritical, affirmative understanding of 'human-centric' values, this is not the case of posthumanism. A key point in the posthumanism critique relates to the question of how culture defines what constitutes the 'human'. Donna Haraway's writings are key in the development of this theoretical mode. She challenged, first in *A Cyborg Manifesto* (1985), the traditional, fundamental assumptions of the humanities which place the human at the hierarchical apex of beings. Thereafter it follows that she criticises the anthropocentric construction of human knowledge. Haraway rejected the placing of humanism into this elevated position due primarily to humanism's non-emancipatory character (the metaphor of the cyborg demonstrating the disintegration of certain arrangements of the body, sex, and social class). Haraway's approach was further developed in *When Species Meet* (2007) and her work contributes to contemporary ecological literature and suggests that more critical theories on what defines humanism are needed to better conceive a sustainable equilibrium with the environment and with other non-human actors. Such a vision is removed and is entirely different from the futurology of (super) humanism as developed by transhumanists.

The ethical strand of posthumanism has been studied by Cary Wolfe, who shares with Haraway the main assumptions of criticising anthropocentric fundaments of culture. In his view, especially expressed in *What is Posthumanism* (2009), the 'post' humanities can contribute to scientific and political debate as they generate adequate critical and

interpretational concepts. These theoretical tools that can aid the sciences' production of knowledge are also capable of ethical intervention when the sciences violate the well-being of a multi-actor network or ecosystem. Wolfe's posthumanism includes the culture-forming role of non-human actors who, often, exist in the world as non-legal persons. Despite the fact that he finds the genesis of posthumanism in the development of cybernetics and systems theory, since these theories relegate the human from the position of a privileged being capable of applying meaning and conveying information through unique cognitive skills, Wolfe radically distances himself from the cyberian interpretation of posthumanism – i.e. transhumanism. He refutes transhumanism because it is created in the framework of the Enlightenment rationalism, according to which the emphasis is placed on transforming the human into the superhuman – the overman. In respect for human biological origins, Wolfe's posthumanism offers a non-hierarchical treatment of non-humans and incorporates actors into a new model of thinking about community beyond humans. Therefore, his theory aspires to alter ethical attitudes, not only of thinking about relations with the environment but also in a broader sense – in critical reflection toward the construction of law. So, the prefix 'post' in 'posthumanism' does not signify something that comes 'after' humanism – instead, it refers to a critique of humanism as a radical anthropological dogma which separates the human from the non-human and which positions the human as the dominant actor.

Importantly, Wolfe also stresses that the act of placing the human in the world of technologies plays a role different from that played by human biocultural heritage. This review posits that the inclusion of posthumanist thought can actively contribute towards a meaningful debordering of the concept of 'human-centred values'. This new realignment, based on a sustainable ecological framework, is harmonious with the ambitions of the *UN SDGs* but extends the scope of many reports on AI ethics. This realignment of values

turns into a legal question: how do human and non-human actors – including the development of AI – become interlinked in a sustainable and equitable music ecosystem?

In comparison to humanism and transhumanism, posthumanism offers the third philosophical approach beyond the dominating binary positions of either a dystopian vision where AI technologies embark on a hostile takeover (robots stealing jobs), or the alternate utopian model in which AI technologies are beneficial to human spheres of existence (as helpers, companions, care workers, etc.). However, the debate on ethics and AI development is contextualised on the verge of what is discussed in either trans- or post-humanism and engages with even more visionary and futurological responses such as James Lovelock's *Novacene*. Acknowledging such opinions reframes the understanding of 'human-centred' values within this work's theoretical model of the music ecosystem.

1.3.3 Novacene: Beyond the Human

When the engineer James Lovelock, the author of works on the concept of the Gaia, first asserted a hypothesis that the Earth's ecosystem acts as a self-regulatory mechanism, it was met with significant hostility and dismissal from the scientific community. When he later stated that the destructive power of humans on Gaia's environments would soon make the planet uninhabitable for living organisms in his book *The Revenge of Gaia* from 2006, this too was considered an outlier proposition.

Lovelock's environmental criticism, though, led him towards an original reflection on the possibilities that AI can offer for future, not necessarily human, civilisations. Therefore, the complexity of relations between human and non-human actor-networks is now traced through an operative metaphor of the ecosystem.

In his latest book called *Novacene: The Coming Age of Hyperintelligence*, written collaboratively with Bryan Appleyard (2019)[9], Lovelock makes us think about human extinction as a real possibility (pp. 6-13). His vision of anthropology is also interesting since humans have always expressed their knowledge in terms of an accuracy of probability which forgets that 'we are still primitive animals' (p. 20). The speculative minds of human intelligence present an exceptionalism that is at times paired with social responsibility (p. 28). Ecological crisis can be considered as the revolution that leads 'the cosmos to self-knowledge' (p. 29), which is envisioned by Lovelock in the figure of 'the understanders of the future', who will not be humans but cyborgs that 'will have designed and built themselves from the artificial intelligence systems we have already constructed' (p. 29). In the Novacene, which can be understood as Lovelock's follow-up response to the Anthropocene, there will be a stage of human and machine collaboration that can bring solution to future catastrophes (p. 30).

However, for Lovelock, basing his thought on the example of AlphaGo's self-learning autonomy and superhuman data processing[10], 'we have already entered the Novacene' (p. 82), since 'a new form of intelligent life will emerge from an AI precursor made by one of us'; and he concludes that this is now probable (p. 82). Evolution remains a driving force, but it will progress to incorporate principles of engineering. Through collaboration with AI, 'we have invited the machines themselves to make new machines' (p. 84), and they will improve and replicate themselves (p. 84). Nonetheless, humans still act as parents (p. 86) who have instinctive kinship obligations, because under the Gaia hypothesis, the evolutionary goal is to repair the earth and survive as a species (p. 103). Cyborgs, however, will have to be free 'because they will have evolved from code written by themselves' (p. 94), and yet they will communicate with us (p. 99). Language will

[9] Published in June 2019 to mark the author's 100th birthday.
[10] AI created by Google DeepMind, referenced in later chapters.

become an outdated system – one which will not guarantee human survival. In its place, Lovelock envisages that other more effective forms will emerge, including telepathy (p. 100). Furthermore, this common project – to ensure the survival of humans – will accelerate post-AI technologies and the appearance of the cyborg (p. 105). 'The only price we would have to pay for this collaboration is the loss of our status as the most intelligent creatures on Earth' (p. 108), he concludes. In this sense, human-centred values and what is understood by 'the common good' separate.

However, while the futurological approaches like Lovelock's Novacene influence contemporary research on ethical development of AI, they do not specifically address music, which is not the case with the futurological political and economic thinking of Jacques Attali.

1.4 Attali's Anticipation of the Role of AI technologies in the Music Ecosystem

Music as a complex social and political phenomenon is at the centre of the writings of the French philosopher and economic theorist Jacques Attali (b. 1943), most notably in *Noise – The Political Economy of Music* (1985 [1977]). In this work, Attali both foretells many of the relations, challenges, and tensions of the 21st Century music business and is perspicacious in describing music as an anticipatory 'herald' of social change that requires ethical decision-making.

Since Attali wrote in the past about a future that can inform comprehension of the present day, the circularity of Attalian theories and concepts contained in *Noise* can be considered as a series of tools to analyse and comprehend the role played by AI development in a transforming music ecosystem.

Inspired by Attali's visionary and modern approach to music as a dominant source of social and political knowledge, historically driven by major technological innovations, the following conceptual components are extracted from *Noise*. In this context, AI

becomes the technological actor of the Attalian ‘composing’ network. Four constituent elements have been selected to aid the theoretical model:

1.4.1 Copyright

1.4.2 The four networks of music

1.4.3 The anticipation of future technology

1.4.4 Music, a ‘herald for change’

1.4.1 Copyright

The historical development of copyright is central to the political economy of music outlined in *Noise*. The author traces the origins of copyright and identifies that its initial purpose was not to defend artists’ rights, but rather to ‘serve as a tool of capitalism in its fight against feudalism’ (Attali, 1985 [1977]: p. 52). On the one hand, Attali recognises mainstream arguments about the economy of music – for example, the concept that the development of copyright was designed to protect artists’ rights. However, by lifting the veil placed on the progress of copyright, Attali identifies the shifts of power that were brought about by the implementation of legislation. Attali’s approach underpins the argument to look at music as a model example of any economic disruption, outlining that to understand how the economy of music works, ‘where the creation of money takes place’ must be examined (p. 39).

Attali’s emphasis on the importance of copyright affirms the central role of music intellectual property (IP) within this thesis and supports the hypothesis contained in the legal chapter.

1.4.2 The Four Networks of Music

The future evolution of the music ecosystem, including the development of AI, can be comprehended through Attali’s concept of four historical networks of music

production, dissemination, and consumption, which relate to ‘a technology and a different level of social structuring’ (p. 31).

The first network, ‘sacrificial’, refers to the historical period when the aural traditions and practices of music were dominant. The second stage, ‘representation’, occurs with the setting down of music in a permanent form (notation), while the third network ‘repetition’ emanates from the development of copyright which occurs at the end of the 19th Century ‘with the advent of recording’ (p. 32). The fourth network, ‘composing’ anticipates the near-future challenges of AI to music makers.

The ‘composing’ stage, as the author admits, is ‘not easy to conceptualize’ (p. 134), but it foresees a network in which a musician plays ‘primarily for himself, outside any operationality, spectacle, or accumulation of value; when music…emerges as an activity that is an end in itself…for one’s own pleasure’ (p. 135). This extract depicts what has become a modern-day reality for many music makers where the economic function of the professional musician is in decline.

Attali’s forecast of a ‘composing’ network in which ‘production melds with consumption’ (p. 145) is parallel to what the American cultural critic and futurist Alvin Toffler (1928-2016) termed in 1980 as ‘the prosumer’. The notion of the prosumer describes the cultural and economic consequences when technology makes it possible for a consumer to also be the producer (the prosumer) of creative content (Toffler, 1980: especially p. 265). Similarly, Attali predicts that the role of the musician within the ‘composing’ network is one where ‘the listener is the operator…(and) calls into question the distinction between worker and consumer’ (1985 [1977]: p. 135). Attali, however, indicates an ethical dimension within the composing network when he notes that musicians may find themselves ‘in a precarious position, because composition contains the germ of their disappearance as specialists’ (p. 146).

1.4.3 Anticipation of Future Technology

Within the composing network when Attali predicts 'the composer produces a program, a mold, an abstract algorithm…the score…is an order described for an operator-interpreter' (p. 37), surprisingly he is describing attributes of modern AI music technologies (one must be reminded that these words were written in the early 1970s). Attali's anticipation of a technology not yet invented, but still an inevitable outcome of a progressive historical development, locates AI as the technological agent of the 'composing' network. Many of the widely promoted modern-day benefits of AI are in fact encapsulated in Attali's description of a new 'composing' network technology:

> A new technology capable of reducing the costs of reorganization, *financial resources* (or an accumulation of new capital) available for the latter's utilization, and the existence of a *social group* with both the interest and the power to utilize such financial resources and to put the new technology to work. (p. 9; the author's italics)

However, that promise is balanced by concern when Attali refers to the unintended consequences of a 'technology upon which composition [the network] is based [but] was not conceived for that purpose' (p. 144). Attali's ethical response (forty years later) to this concern comes in *Art, the Last Bastion of Freedom Against Artificial Intelligence* (2019). In this article, he declares: 'it is up to each of us, as spectators, creators, and actors, at one level or another, in the artistic domain, to keep threat as well as hope in mind, and to make the most of it'. This call demands intervention into the financial and ethical implications of AI in the music ecosystem.

1.4.4 Music, a 'Herald for Change'

Attali is explicit in his position, stating frequently that music is a prophetic medium:

> It has always been in its essence a herald of times to come. ….it is a way of perceiving the world. A tool of understanding *demonstrating that music is prophetic, and that social organization echoes it* … [music] provides a rough sketch of the society under construction, a society in which the informal is mass produced and consumed, in which difference is artificially recreated in the multiplication of semi-identical objects. (1985 [1977]: pp. 4-5; italics by Attali)

If Attali is accurate that music's 'styles and economic organization are ahead of the rest of society because it explores, much faster… the entire range of possibilities in a given code' (p. 11), then analysis from the micro perspective (the music ecosystem) can offer insights to be applied to the macro perspective's challenges brought by AI.

Attali is not alone in the opinion that music is a 'mirror' to herald social change. His work was influenced by Theodor Adorno, a German theoretician of music and society, representant of the politically engaged critical Frankfurt School. However, Adorno's aesthetic conservatism whose 'principle of evaluation is based on that of technical mastery' (Jameson in Attali, 1985 [1977]: p. x) and his stigmatisation of jazz as lesser artworks within music (Bahr, 2008: p. 57) is framed on notions of authenticity and authority that differ greatly from the Attalian 'operator-interpreter' in the 'composing' network.

The Attalian function of music as 'a way of perceiving the world – a tool of understanding' (1985 [1977]: p. 4) is evidenced by Professors Jonathan Taplin (2017) and George Howard (2010). Both have observed that the music industry has been 'the canary in the coal mine' for other industries. Music's ability to predict and effect social change has also been expressed by the former White House economist Alan Krueger in *Rockonomics: What the Music Industry Can Teach Us About Economics (and Our Future)* (2019), especially when he addresses AI music generation:

> There would be no music without the songwriters, composers and musicians who create and perform it – at least until machine learning

> algorithms and artificial intelligence (AI) advance to the point where computers can compose popular music and write lyrics.... In the future, musicians may be replaced by computer programmers. (pp. 11-12)

Attali's claim that 'musical distribution techniques are today contributing to the establishment of a system of eavesdropping and social surveillance' (1985 [1977]: p. 8) predates considerations in *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power* (2019). Here the author, Shoshana Zuboff, reflects on threats presented in the collection, interpretation, and application of personal data by transnational corporations. She writes:

> It is no longer enough to automate information flows about us; the goal now is to automate us. These processes are meticulously designed to produce ignorance by circumventing individual awareness and thus eliminate any possibility of self-determination. As one data scientist explained to me, 'We can engineer the context around a particular behavior, and force change that way… We are learning how to write the music, and then we let the music make them dance.' (p. 294)[11]

Zuboff indicates how the generation of AI music is now pragmatically placed as one more challenge for technological determinists to solve. The accelerated evolution of a societally prophetic music ecosystem fuels such observations, and points to ethical reconsiderations within financial context identified by Attali as well.

In a powerful narrative he presents the Manichaean division between a dystopian vision in which 'the devil [AI] who will destroy employment and leave mankind unemployed and in misery' (2019), and on the other hand an alternate techno-utopian possibility, where 'people will be able to work better and less' (2019). Attali regards the dangers of this technology as 'real' and states that the governance of AI industries 'will

[11] When I read Zuboff, I was reminded of Colonel Tom Parker. Prior to managing Elvis Presley, Parker had worked as a sideshow impresario. A popular act was 'Colonel Tom Parker and his Dancing Chickens'. Live chickens were placed on a hot plate and would then 'dance' to popular songs of the day. In Albert Goldman's book *Elvis* (1981), the author makes the connection between the dancing chickens and Parker's manipulation of Presley (Goldman, 1981).

largely determine the course of the 21st Century' (2019) and societal reactions will range from social submission to civic activism. When Attali addresses the purpose and role of art within a disruptive AI societal context, he concludes that art 'as always [will] be an excellent indication of what is possible' (2019). And for Attali the most socially predictive of the arts is music.

1.5 Music Ecosystem and the AI Challenge

To position music within the contemporary critical debate on AI development, this review applies a specific meaning of the term music ecosystem to the analysis. Here, the term 'music ecosystem' encompasses ANT concepts to embrace human and non-human (AI) 'members organisms' located in civic, industrial or academic domains, who can be considered as stakeholders of the global music community. The term is designed to include, but is not limited by, the commercial boundaries of the global music industry.

The very term 'ecosystem', taken from biology, has gained attention since its introduction to the field of management in the mid-1990s (Moore, 1993, 1996; Iansiti & Levien, 2002). Moore defined an ecosystem as:

> [a]n economic community supported by a foundation of interacting organizations and individuals – the organisms of the business world. This economic community produces goods and services of value to customers, who are themselves members of the ecosystem. The member organisms also include suppliers, lead producers, competitors, and other stakeholders. Over time, they coevolve their capabilities and roles, and tend to align themselves with the direction set by one or more central companies. (1996: p. 26)

Moore's definition can be seen to extend Paul McCartney's contention (2018) that 'the value gap jeopardies the music ecosystem'. For McCartney, the value gap exists between the revenue that technology platforms 'derive from music and the value they pay

[copyright] creators', and its narrowing will 'help assure a sustainable future for the music ecosystem and its creators' (2018)[12].

As this thesis indicates, the challenges and opportunities presented by both human and non-human (AI) 'member organisms' – particularly regarding issues related to music copyright – require an ethical consideration capable of contributing to a sustainable and fair future environment for music. These ethical considerations draw from a commonality of agreement that principles should be grounded in 'human-centred' values. This review proposes that such 'human-centred' values need to be critically reconsidered from a posthuman rather than transhuman philosophy because of ethical challenges posed by AI development within the music ecosystem. These ethical reconsiderations regarding the future status of human and non-human actors are currently being legally challenged in global court decisions on IP.

At the outset of the *WIPO AICM* session[13] (US Copyright Office, 2020a) in Washington D.C. in February this year, moderator Regan Smith stated, 'for better or worse the music ecosystem has been at the forefront of technological change' (p. 180). This statement proves the emergency of discussing the financial and ethical impact by AI on a music ecosystem. But first, the actual technologies existing under the umbrella term of AI must be delineated.

[12] The IFPI published a letter from Paul McCartney requesting members of the European Parliament to vote in support of the Article 13 Campaign to uphold the mandate on copyright.

[13] Regan Smith (General Counsel and Associate Register of Copyrights, US Copyright Office), the four speakers at the *WIPO AICM* session were Joel Douek (Cofounder of Ecco VR, West Coast creative director and chief scientist for Man Made Music, and board member of the Society of Composers & Lyricists) E. Michael Harrington (Composer, Musician, Consultant, and Professor in Music Copyright and Intellectual Property Matters at Berklee Online) David Hughes (Chief Technology Officer, Recording Industry Association of America (RIAA)) and Alex Mitchell (Founder and CEO, of AI start-up Boomy).

Chapter 2: Theoretical Definitions of Artificial Intelligence

The term AI is burdened with differing and, at times, conflicting connotations. To unpack the term AI, a series of definitions are necessary to acknowledge these technological distinctions. Many of the actors employ AI processes and an outline of the principle schools or 'tribes' of AI is provided. Of these AI approaches, Machine Learning (ML) and the ML subset Deep Learning are given especial focus as their legal implications underpin this review. While all discussed AI music systems are based on so-called 'narrow AI', conceptual distinctions between narrow AI, AGI and ASI are later analysed. These AI distinctions (AGI/ASI) inform theories of technological determinism and transhumanism which in turn shape the visions of the future of key actors within the music ecosystem.

2.1 Origins of the Term AI

John McCarthy designated the term 'artificial intelligence' in 1956 during a summer school held at Dartmouth College, New Hampshire, where it was unrealistically anticipated that the goal of whole brain emulation could be achieved during a six-week recess (Sabanovic, et al., 2012)[14]. Since 1956, the field of AI as both a cultural phenomenon and a focus of scientific development has endured a series of well-documented so-called 'AI winters' (Nilsson, 2009: pp. 408-409). These 'winters' map periods when corporate and academic research funding were restricted while public interest in the application of AI waned. It is because of the current, and potentially overheated, climate of interest in AI that its technological definitions are parsed. To this

[14] Dartmouth summer school of '56 alumni included Marvin Minsky (co-founder of MIT AI lab), Claude Shannon ('father of Information Technology'), John Nash (Nobel prize winner), Herbert Simon (Nobel prize winner), Ray Solomonoff (creator of machine learning), and Arthur Samuel (McCarthy, et al., 2006: p. 12).

end, the historical patterns that foreshadow current technological developments are examined and the philosophic drivers within the current advancement of AI are noted.

2.2 Difficulties in Defining AI

The challenges presented in defining AI are highlighted by the decision of the IEEE, in the report *Ethically Aligned Design: A Vision for Prioritising Human Well-being with Autonomous and Intelligent Systems* (*EAD1e*) (2019) (IEEE, 2019a), to dispense with the term Artificial Intelligence entirely.

> There is no need to use the term *artificial intelligence* in order to conceptualize and speak of technologies that are meant to extend our human intelligence…For this reason, we use the term, *autonomous and intelligent systems* (or A/IS). (p. 12)

While the IEEE's A/IS substitute definition may be culturally and technically unencumbered compared to the connotations of the umbrella term AI, this term is employed by most of the civic, commercial and political stakeholders featured in this review. Therefore, the term AI is used throughout this work. But first its meaning must be unpacked (Franke, 2019: p. 2) and the dominant concepts that are in discourse must be presented.

The independent AI HLEG set up by the European Commission recently updated their definition of AI (AI HLEG, 2019a):

> Artificial intelligence (AI) systems are software (and possibly also hardware) systems designed by humans that, given a complex goal, act in the physical or digital dimension by perceiving their environment through data acquisition, interpreting the collected structured or unstructured data, reasoning on the knowledge, or processing the information, derived from this data and deciding the best action(s) to take to achieve the given goal. AI systems can either use symbolic rules or learn a numeric model, and they can also adapt their behaviour by analysing how the environment is affected by their previous actions. (p. 6)

Despite the overt technical description of the AI HLEG definition, it aims at presenting a 'shared common knowledge of AI that can be fruitfully used also by non-AI experts' (p. 1), which is further analysed and expanded. A more robust AI definition which includes its structuring, behaviour, capability and function is provided by Pei Wang:

> 'AI should be defined:
> - Since the best example of "intelligence" comes from the human mind, AI should be defined as similar to human intelligence in certain aspects.
> - Since AI is an attempt to duplicate human intelligence, not to completely duplicate a human being, AI should be defined as different from human intelligence in certain aspects. Otherwise, it would be about "artificial person", rather than an intelligent computer.
> - AI should not be defined in such a narrow way that takes human intelligence as the only possible form of intelligence, otherwise AI research would be impossible.
> - AI should not be defined in such a broad way that takes existing computer systems as already having intelligence, otherwise AI research would be unnecessary. (Wang, 2008: pp. 1-2)

Accordingly, AI is a field of computer science that involves algorithms which draw their inspiration from and perform activities more usually associated with the outputs of human intelligence. Examples of successful AI development in computer science include natural language translation, computer vision and speech recognition. AI algorithms are the engine for the world's social media systems (Appel, et al., 2020: p. 83) and are the mechanisms by which consumer based intelligent personal assistants operate[15]. If algorithms are the engine of social media companies, then Big Data is frequently cited as the oil for the engine of AI (Dilmaghani, et al., 2019: p. 2).

[15] Examples of such AI personal assistants include Apple's Siri, Microsoft's Cortana and Amazon's Alexa.

Big Data has been defined as extraordinarily large data sets which cannot be processed using traditional data analysis methods (Jiang, et al., 2020). These large data sets can be analysed computationally to reveal new associations, patterns, and trends. The processing systems used to analyse these data sets rely increasingly on methods derived from technologies termed AI. The system in which it is situated may be software, hardware or an AI-based component embedded in a wider system such as the Internet of Things (IoT[16]).

AI is a key feature in the development of Extended Reality (XR) technologies (e.g. Virtual Reality (VR[17]), Augmented Reality (AR[18]), and XR technologies have an increasing presence in the music ecosystem. Similarly, robotics is a closely related discipline and it can be considered as AI embodied in the physical world. By recognising that these are different technologies, different methodologies are housed under the umbrella term AI. On this basis, the computational issues involved and the emergent social challenges generated by separate but interlinked AI systems can be comprehended.

2.3 Technical Categories of AI

Multiple classifications exist that inform, and at times confuse, conversations about AI. Though the techniques involved in the ML and Deep Learning classification are the focus of this review, it is important to note other AI techniques used by AI music actors. Many of the ethical and legal issues attached to ML techniques, including those arising from the decision-making processes in data training sets, are less complex to determine in other AI approaches. Acknowledgement of AI approaches, other than ML,

[16] The Internet of Things is a system of interconnected computing devices that transfer data over a network without requiring human interaction.
[17] Virtual Reality involves the users' full immersion into its closed environment usually by way of a headset.
[18] Augmented Reality seeks to place the digital environment within the real-world by use of gateway device (e.g. a smartphone or a wearable technology).

can contribute to setting ethical and best practice standards, founded on algorithmic accountability and transparency, applicable to all classifications of AI.

At the basis of all AI systems are computer algorithms (David, 2019: p. 890). Algorithms, so named after the Persian mathematician Muhammad ibn Musa Al-Khwarizmi, are a set of programming instructions which inform the AI system about how to achieve a specific goal (Nabirahni, et al., 2019). To unravel the methodology of algorithms within AI, concepts provided by Pedro Domingos' book *Master Algorithm* (2015) are particularly useful.

Domingos' classifications separate and distinguish development of AI groups based on the algorithmic techniques used to problem-solve. Again, this categorisation highlights the variety of approaches employed in contemporary AI. Domingos' division and depiction of 'AI Tribes', or schools of AI, is aligned with the following five categories and delineates distinct tools that represent separate approaches to AI:

- 'Symbolists': one of the earliest AI methodologies, in which data is given signs (symbols) that operate under a complex system of predetermined rules. Symbolists use logic-based tools for knowledge representation and provide solutions through a process of induction (pp. 57-91).
- 'Connectionists': employ ML methods that allow computers to learn from data training sets. This tribe seeks to emulate the functioning of the human brain using digital neural networks in its AI system (pp. 93-119).
- 'Evolutionaries': a Darwinian approach in which the computer's decision-making is recursively optimised through the system's selection from a decision tree structure of options. At each new level of the decision-making process, the AI's evolutionary strategy builds a new generation of algorithms (pp. 121-142).

- ‘Bayesians’: use probabilistic modelling tools (derived from Bayes’ theorem[19]) that allow agents to act in incomplete (uncertain) information scenarios. Knowledge is incrementally built by the AI until establishing likely probable outcomes through a process of statistical inference (pp. 143-175).
- ‘Analogizers’: utilise knowledge-based methods to extrapolate in the data provided from prior examples in the AI systems usage. Similarities located in the data is the key determiner in the system’s decision-making process. (pp. 172-173).

Each of Domingos’ tribes contains one or more technologies (and related algorithms) which can be combined with the other tribes’ techniques towards solving a stated objective (Pohl, 2019). For instance, the algorithms used to develop Natural Language Programming (NLP) are a combination of symbolist, connectionist and Bayesian tribes merging to solve problems within the area of computer perception (Ghorpade & Ragha, 2012: p. 2). However, it is the ‘connectionist tribe’ and the tools of ML that are most relevant to this examination and that require scrutiny.

2.3.1 Machine Learning Technical Processes

Machine Learning (ML) attached to the connectionist tribe is a subsection of AI which involves algorithms that self-learn from data and approximate a specific function constructed on a collection of data points. ML algorithms function by first creating a model (‘training set’) fed on data inputs and then process that information to produce predictions or decisions. The chief distinction when compared with non-ML algorithms is that ML algorithms do not only follow explicitly programmed instructions (Gitzel, et al.,

[19] Bayes’ law or Bayes rule (from the name of English, 18th Century mathematician and philosopher, Thomas Bayes) describes the likelihood of an event calculated upon the prior knowledge of related factors to the event (D’Alessandro, et al., 2020: pp. 2-3).

2019). Indeed, ML algorithms are increasingly capable of making accurate correlations[20], the causality of which can be oblique even to its system's programmer[21]. As exponential volumes of data become available and more complex problems are engaged with employing AI techniques like ML, the choice of algorithms are increasingly considered to be more time and cost effective than the human programming alternatives (Liu, et al., 2019).

The purpose of ML is to create generalisations or predictions that reach beyond the examples that are provided by its training set. Substantial amounts of data are sometimes not a significant requirement when compared to the data volumes needed in, for example, an induction (symbolist) methodology[22]. In the ML instance, a comparatively small training set can produce a significantly large and more extensive volume of accurate predictions (outputs)[23]. A challenge in ML programming is the issue of 'overfitting' which can cause the classifier algorithm to 'hallucinate', a processing fault which can contribute to the erroneous prediction of the process's output (Horenko, 2020).

A salient point to note regarding the unsupervised ML operation is the trial and effort required of human programmers in the system's processing – as no single current autonomous AI methodology will always be optimal for predictive success (Ashoori & Weisz, 2019: p. 2). ML is an iterative process of training the learner (the algorithm) to collate the results while simultaneously optimising the system's process. Moreover, while

---

[20] Machine Learning algorithms are currently employed in spam detection, financial fraud detection, and online recommendation systems, such as Spotify or Apple music (Zhou, et al., 2020).

[21] In Mount Sinai Hospital, New York, a deep learning AI system, Deep Patient, was used to analyse the hospitals patient database. The AI was able to anticipate the early onset of psychiatric disorders such as schizophrenia beyond the ability of human analysis. The Deep Patient team leader Joel Dudley reflected that 'we can build these [AI] models...but we don't know how they work' (Knight, 2017).

[22] For example, DeepMind' AlphaGo AI has been trained on smaller amounts of data as its scale of its task has increased (Ling, et al., 2019).

[23] For instance, with Google's DeepDream, the neural network was trained on 1.2 TB of images but once established, the AI only required 50 Mb, a 1/24000 fraction of its original power to produce accurate predictions (Spratt, 2018).

the outputs of ML learning can be oblique (black box), the AI's success is achieved, at least for the time being, through the participation of human programmers.

Two primary computational resources required in information technology relate to processing time and computer memory (Černý, 2019: p. 3). With ML, a third resource and limitation is added – the availability of suitable data training sets. Currently, the principal obstacle regarding generating ML music relates to the processing time required. Alternatively, relatively simple AI (from the perspective of Domingos' tribes) such as symbolists' methodology can be a popular choice for AI music generation.

2.3.2 Deep Learning Technical Processes

Within ML exists the field of Deep Learning, where multiple layers of analysis (neural networks) assist in mapping inputs to classifications more precisely. ML can be seen as a subset of AI, while Deep Learning itself is a subset of ML. The AI outputs made by Deep Learning methods are sometimes reported as being human-like (De Spiegeleire, et al., 2017: p. 44). Deep Learning is inspired by a computerised modelling of the functions of biological neural networks in the human brain. The attainment of human-level and beyond human-level AI is the ambition for several prominent AI research institutes and corporations, for instance The OpenAI Institute, Future Humanity Institute (FHI), and Google's DeepMind. It is because of these research ambitions that it is worthwhile to consider conceptual distinctions between the current capability and the expected near-future capacity of AI systems (Jiao, 2019). These distinctions fall into three categories: ANI, AGI, and ASI.

2.4 Distinctions between Artificial Intelligence Concepts: ANI, AGI, and ASI

The distinctions between ANI, AGI and ASI have been disputed in philosophy and cognitive science. Can machines think, has been a question posed within Computer

Science since Alan Turing's 1950 paper 'Computing Machinery and Intelligence' (Turing, 1950). Commentators including Noam Chomsky and Edsger Dijkstra have responded with rhetorical humour to this query by asking 'can submarines swim?' (Dijkstra, 1984.) The point was made that without an existing working definition of what it means to 'think', it is impossible to evaluate a machines mental ability[24]. For similar reason, the AI HLEG notes that while the term AI includes explicit reference to the notion of intelligence, it also states that it remains a 'vague concept' (AI HLEG, 2019a: p. 1) regarding both humans and machines.

Centuries of popular culture (novels, movies, art) have presented futures whose speculations on AI can appear increasingly relevant to the modern day. Nevertheless, the futuristic emergence of machine consciousness has contributed to public, and thus music makers', anxiety regarding the potential power of such yet-to-be-invented machines. It is thus necessary to acknowledge distinctions between 'narrow/weak/ANI', 'strong/AGI', and ASI to appreciate the technological limits of present-day AI and moderate these concerns. By separating the hypothesis of ANI, AGI and ASI respectively, the examination of the music ecosystem can be informed and invigorated, and the limits of current AI invention can be understood.

This investigation examines the financial and ethical implications of machines capable of generating or assembling musical works often indistinguishable from those produced by humans. When considering an AI capable of generating Bach-like sonatas, it is not an interdependent concern whether a system is capable of cognitive thought that emulates in its organisation the mind of a human author. Rather, it is the technological adoption and economic implications of creative technologies that are focused on.

[24] At the root of this proposition is the mathematician Kurt Gödel's incompleteness theorem from 1931 (Kanovei, Katz & Mormann, 2013).

2.4.1 Artificial Narrow Intelligence

We have defined AI as 'an attempt to duplicate human intelligence' (Wang, 2008). If a machine can complete the problem-solving task that would typically have been exclusive to human deduction, then that machine is referred to as having artificial intelligence. However, the use of an umbrella term like AI invites misunderstanding and misrepresentation of the current capability of machines. Often the revelation of the limitation of the technology reveals an all too human hand at play in the machine's algorithms.

The philosopher, John Searle in 1980, developed the terms 'weak' and 'strong' AI alongside AI thought experiments like the 'Chinese Room'[25] which remain in use today. However, the term 'weak' AI is interchangeable with 'narrow' AI, and is known as Artificial Narrow Intelligence (ANI). The demarcation of ANI is a useful delineation to begin. ANI can be seen to be narrow, since it simply refers to all AI technologies already invented and introduced into society (Wirth, 2018: p. 437). The purpose of ANI targets the achievement of singular and specific goals. There is little claim that machine sentience or consciousness can exist in ANI, although these systems may appear more sophisticated to the end user than they are in actual design or function.

When ANI becomes ambient, for example Siri, Cortana, et al., an unconscious consequence of the human impulse to attribute agency can frequently be amplified (Burger, 2020). As Daniel Dennett has written: 'the public will persist in imagining that any black box that can do *that* (whatever the latest AI accomplishment is) *must* be an intelligent agent much like a human being' (Dennett, 2015). Despite the tendency to

[25] Imagining himself inside of a room, Searle (the AI) is presented with a series of questions in Mandarin – a language that he does not speak or comprehend but must reply in. Through the use of linguistic rulebooks, Searle manipulates the language symbols and passes the Turing test. However, Searle (AI) does not understand the symbols he is processing. The logic of the Chinese room is that successful AI processing of data is not akin to human understanding.

anthropomorphic projection, the capacity of existing ANI technologies cannot be easily dismissed. ANI is considered ‘weak’ in comparison to the human ability for empathy or emotion, but ANI technologies are already capable of exceeding humans at many tasks including productivity (in so-called ‘dark factories’) and prediction accuracy (cancer diagnosis). Even the near-future goal of a fully autonomous, driverless car is possible through the existing capabilities of ANI. The employment of ambient ANI, to mimic human speech disfluencies such as ‘hmm’ or ‘let me think’ only adds to the uncanny theatre in which humans may project agency to AI [26].

The power of existing applications of ANI features an ethical dimension, as seen in the wake of recent international political events (Yu, et al., 2019) involving AI data processing systems that have been deemed to be a contributing factor in the results of both the 2012 and 2016 US general elections (Manheim & Kaplan, 2019: pp. 133-159). These controversies have elevated the demand for AI regulation and legislation.

However, the AI research centres, including Open AI and FHI, alongside transnational corporations (Google’s DeepMind) are not only focused on the development of ANI. Their objective considers the next stage of AI development – AGI. As these actors have great influence in this research, either through the current release of AI software (Google’s WaveNet) or by informing the transhuman AI philosophic discourse, this review moves now from ANI to AGI.

2.4.2 Artificial General Intelligence

Artificial General Intelligence (AGI) or the ‘strong’ AI hypothesis relates to machines – yet to be invented – that are anticipated to exhibit levels of human intelligence and intellectual capability. There exists a wide spectrum of prediction of the

[26] Existing ANI is adept at regularly producing surprising results. The Google Duplex TTS system is a real-time speech recognition and speech generation demonstrating an ambient ANI interacting with humans and arranging by telephone assorted business appointments (Agarwal, et al., 2018).

possible achievement of AGI systems and the divergence of expert agreement between leading influencers on the potential future of AI, including Rodney Brooks and Ray Kurzweil, poses the question of whether the achievement of AGI is possible, desirable or indeed necessary (Dejohn, 2004: p. 1).

That AGI will create consciousness as a by-product within a computer program has been considered by prominent philosophers of mind such as Daniel Dennett (1980) and David Chalmers (1996), while other opinion-forming theorists, like John Lucas (Lucas, 1961) and Roger Penrose (Penrose & Mermin, 1990), reject the consciousness claims for AGI stating that some aspects of the human condition will always stay beyond any computerised threshold. However, the debate about the prospect of AGI drives civic engagement in ANI and thus extends AI designers' scope as well as consumer curiosity of what is conceivable in the application of existing ANI technologies (Strauß, 2018: p. 4).

2.4.3 Artificial Super Intelligence

A third AI concept, popularised by the Oxford philosopher Nick Bostrom, is that of Artificial Super Intelligence (ASI). This technology Bostrom defines as 'any intellect that greatly exceeds the cognitive performance of humans in virtually all domains of interest' (Bostrom, 1998). His transhumanist approach to AI resembles the visionary trajectory of Lovelock's *Novacene*. Bostrom's argument follows that while the journey from ANI (present day) to AGI (human-level) may be a long and perhaps unachievable path, the exponential leap from AGI to ASI would logically be a remarkably short step possibly taking only a few hours to occur (Bostrom, 1998).

However, if as noted, AGI may never happen, then why should ASI be the subject of international contention? It is the concern of the possible eventuality of ASI

eliminating human actors that contributes to contemporary ethical consideration of AI[27]. An alternative understanding of this transhumanist belief in AI progress is not about machines that think like humans – but of humans who think like machines (Harari, 2015) and uncritically accept the paradigm of technological determinism. Within this paradigm, the concept of exponential technology reveals its paradoxes and the human value decision-making, although implicit, is unrecognised in approaches to how ANI may mutate to ASI.

The role of exponential technology within AI is often associated with Moore's law. The co-founder of Intel Gordon Moore's prediction from 1965, that computers would double in processing power every two years, has remained accurate (Abelson, 2008: p. 8). What is less referenced is that since the 1990s, the semiconductor industry has released a biennial research plan ensuring the successful continuation of Moore's law. This strategy, sometimes called 'more Moore' (Behmann, 2015: p. 59), involves the efforts of hundreds of independent manufacturers and suppliers. Moore's law can thus be understood as an aspirational industrial 'moonshot', a term coined by JFK in his speech to the US Congress in 1961 (Harland, 2011: p. 1).

The Moore's law moonshot demonstrates the tremendous power of coordinated action in achieving a unified technological goal and reminds us that *human* not technological determinism is the driving force. A key argument, representative for AI transhumanism, is that Moore's law evidences the innate and inevitable direction of evolution, and that the direction is determined by unstoppable technology. However, the recognition of the human actors shaping the Moore's law moonshot echoes Langdon Winner's call: to wake from technological somnambulism. In the case of AI exponential

[27] Bostrom's influential and efficacious 'paper clip' dilemma is now a classic example of the unintended consequences of ASI. In Bostrom's thought experiment, an AI has been tasked with maximising the manufacture of paper clips. The ASI determines that humans are an obstacle to that objective and become extinct (by the AI) to optimise that goal.

technologies, the music ecosystem must decide its needs and values, otherwise technological determinism will become the dominant paradigm via a sleepwalking passivity. In response to this risk, this thesis argues that weakening of human agency always has an ethical dimension and that human decision-making should never relinquish the responsibility to arbitrate on moral questions

> we are always ready to take refuge in a belief in determinism if this freedom weighs upon us or if we need an excuse. (Sartre, 1943: p. 82)

The music industry is in the forefront of the challenge caused by rapidly developing AI technologies. How it chooses to interpret and respond to threats and opportunities presented will determine the functionality of its ecosystem. In light of the financial and ethical implications of AI-generated music discussed in this work, the implementation of an ethical mark to certify AI within the music ecosystem would be a first step to contending with these issues. The mark most likely should be a publicly recognisable logo as successfully seen in such initiatives as the Fair Trade movement. Whether the mark should extend to a separate technology employed to augment existing AI systems is a primary issue for multi-stakeholder research, discussion and decision-making.

As we will later see in Chapter 5, in the macro perspective a variety of positions will be encountered regarding the call for an AI ethical marking system from various bodies including the AI Now Institute, the IEEE and EU AI HLEG. And it is important to consider if any such marking systems currently exist.

Denmark announced in October 2019 that it is developing an AI ethics certification programme to be called The Danish Seal due in 2020 (Dataethics, 2019)[28].

[28] The Danish Seal is a government-based product that will be the first national data ethics seal in the world. While it will initially be limited to Danish companies, the end goal is to make it applicable to companies around the world.

Similarly, the German AI Association announced The Quality Seal for AI in April 2019, which is intended to become a benchmark for the responsible approach to AI by German companies (Schahinian, 2019), and is planned to be expanded to other markets. The German AI Association presents a series of ethical values to which bearers of the seal must comply, including placing human interests at the centre of AI development and implementation[29].

The Danish and German seals indicate a movement towards national approaches to the ethical marking of AI systems. Of the nongovernmental bodies, the IEEE is at the most advanced stage for developing an alternative marking system.[30] How would this certification be created and who could be its validating body?

On a national level, the support of the regional performing rights organisation (for instance in Ireland, IMRO) would be critical. The European Commission on Responsible Research and Innovation (RRI), whose focus is to develop digital resources to advocate, train and implement responsible research innovation under the umbrella of Horizon 2020, presents a strong intergovernmental candidate alongside a certification partner such as the IEEE. This partnership would provide the necessary respect and impartiality required to create a music mark for AI systems, and conversely, strategically support the development of these commissions' initiatives through public engagement and global awareness.

As will be shown in the subsequent analysis some of the AI music actors, including the Irish AI startup Xhail and Georgia Tech's Gil Weinberg, express an interest in a music mark. But what of other vested interests in the music ecosystem, particularly

[29] The German Quality Seal involves a voluntary pledge to adhere to its guidelines and thus is open to many of the problematic interpretative issues that are discussed in Chapter 5.
[30] The IEEE P700's represents a series of ongoing projects that address specific issues within the sphere of technology and ethics, while the organisation is also working on the ECPAIS to provide an AI mark (IEEE, 2020).

those at the transnational level? What benefit would the interference of an AI music mark possibly have for them?

As will be seen in the next chapter, intense market demands, fuelled by the speed of competitive AI innovation and expectations, create a strict results-based music industry (Higgins & Madai, 2020: p. 3) and for any music mark to be truly effective it would need to operate eventually and efficiently at the global level.

The aim of the next chapter is to orientate the scope of music actors and their motivations in applying AI, before investigating the financial and ethical implications that arise from this disruptive, but perceived Promethean, technology.

Chapter 3: State of the Art

> The Promethean myth is one of disruption – disruption of tradition, structure and limits. It is the story of defiance of authority, the rebellion against all established forms, the breaking of the chains of human bondage and the transcendence of all limitation. (Alderman, 2016: p. 96)

3.1 Landscape of the AI Music Actors

This chapter aims to ascertain the challenges and opportunities for the music ecosystem presented by the AI actors. AI actors in the music industry represent different attitudes and commercial approaches to the function and purpose of IP. Copyright is the principal category of IP for the music ecosystem, but its AI actors embrace additional expressions of IP (patents, trademarks, et al.) which will be described. The AI actors surveyed are selected on the basis of their position in research, commercial success, and disruptive influence on the music ecosystem.

The presented AI actors are drawn from three interconnected sectors: the academy, comprising Professors David Cope, Gil Weinberg, and Francisco Vico; transnational corporations, comprising Amazon, Apple, Google, Facebook, IBM, and Sony; and the start-up sector, comprising seventeen companies chosen to demonstrate the breadth of innovative concepts and practices globally. Start-ups actors are engaged with mobile, desktop and adaptable API based AI software, targeted variously at B2B or B2C, and contain a diverse range of disruptive music visions, the survey of these three sectors provides a spectrum of challenges to music copyright.

Building on that investigation, the influence of China and Chinese actors Beijing ByteDance Technology Co. Ltd (ByteDance)[31] and Tencent Music Entertainment Group

[31] ByteDance are the owners of TikTok.

(Tencent) on the global music ecosystem and their challenging role to western IP practices are considered. To illustrate the possible transformation of employment structure within music, a case study of a contemporary model of musician (the DJ) finalises recognition of the scope of this dissertation's focus.

3.2 Intellectual Property

The most important intellectual property (IP) right that concerns this review pertains to the adoption, development and future interpretation of music and computer copyright law. As the role of copyright within the music ecosystem continues to transform (Temple, 2018), it is necessary to position music copyright within the larger IP frame and present the range of IP options available to AI music actors.

3.2.1 The Global Structure of IP

The WIPO, a UN agency and the leading forum for IP, defines IP as follows 'products of the mind, inventions, literary and artistic works, and any symbols, names, images and designs used in commerce' (2020a).

The fundamental purpose of IP is to reward invention and innovation (Pandey & Dharni, 2014: p. 19). The variety of IP legal structures are designed to provide the creator with a time specific, geographically defined monopoly which allows a period for the work to be commercialised and financially rewarded. In providing incentives through legal protection, it is generally intended that a continued incentive will exist for the inventor (and importantly other competing creators) who wishes to continue developing the products of their minds (Shippey, 2002: pp. 51, 125).

The global expressions of IP remain constant and fall into the following analysed categories: patent, copyright, designs, database rights, trademarks, trade dress, and trade secrets.

3.2.2 Expressions of IP

Patent. A patent is a monopoly granted by the state to protect new products, inventions or processes (McEachern, 2011: p. 204) giving an exclusive right to the IP owner for a limited time (Bainbridge, 2011: p. 240). For a patent to be granted the creation must prove to be *inventive*[32] and capable of industrial application (de Carvalho, 2017). It is an essential qualification that any invention is not disclosed publicly before application for patent protection. Even informal disclosure of the innovation to someone who is not an employee of the inventor, or indeed has not been bound by confidentiality in advance, can provide the grounds for an unsuccessful patent application (Brennan, 2020). The review process for patent protection is by necessity a thorough and demanding examination (Hunt, Nguyen & Rodgers, 2012). The complexity and expense of the patent registration process can increase the appeal of alternative forms of IP protection[33]. Moreover, when we inspect the power law principle in this chapter, the creation of a family of patents is shown to be a key determinant in the future value estimate of an AI start-up by venture capitalists and the private equity market.

Copyright. Copyright is the prevalent IP right used in the music industry. Copyright is applicable to the protection of the literary, dramatic, musical and artistic works. Diagrams, computer source code and photographs are examples of creative output which can be copyrighted. In the majority of jurisdictions, it is essential for a claim in copyright to be maintained that the work in question has been set down in some permanent form. An important IP principle regarding copyright relates to the unauthorised copying, renting

[32] Legal terms or concepts are written in italics throughout this work.

[33] The cost for a patent application in Ireland can range from €2,000-6000 (Campbell & Kelly, 2020: p. 5) An Irish patent will protect the IP in its home jurisdiction. European applications are increasingly popular and for a full-time patent application the cost of the patent examination can rise to €20,0000.

or lending of creative works or their unauthorised adaptation which were central in economic disruptions in the music ecosystem of the 21st Century[34]. When reviewing IP and computer-generated works of art (CGWA), legal conceptual tests such as *originality* and *skill and effort,* which are standard tools to determine the legitimacy of claims of copyright, have their authority shaken by AI. IP rights are born of the creations of the human mind (Vaver, 2006: p. 34) and the author must be a *qualifying person,* i.e. a human being who has expended some *endeavour* and *effort* in the creation of the work. It is this condition of IP – that the author must be human – that is now being contested in courts globally.

Designs. The appearance of part or whole of a creation can be protected through registration of the product's design rights (Jolly & Philpott, 2004: p. 10). The length of protection of IP design can last for up to twenty-five years and for example in Ireland, the focus of IP protection rests on the aesthetic aspect of the creation (DBEI, 2020).

Database rights. Where significant investment has been incurred in collating a database's contents, then IP can exist (English, 2016: p. 40). Database infringement (not dissimilar to the measures employed to define copyright infringement) apply to the partial permanent or even temporary transfer of part of a protected dataset (Government of Ireland, 2020). Consent of use by the owner and the measure of substantial copyright are also vital factors in this measurement. Protection lasts for fifteen years and like IP design is enforceable at common law or through formal registration. The questionable legality of AI systems, trained on databases of copyrighted music materials, is increasingly a subject of regulatory debate.

[34] An example of an earlier financial disruption in the music ecosystem regarding copyright infringement can be seen in the controversies involving Napster/P2P file sharing et al. These controversies are discussed in Chapter 5.

Trademark. The most well-known and publicly visible type of IP can be seen in trademark protection. A registered trademark needs to be distinguishable from competing goods and services. Also, the law of *passing off* comes into effect here as it does with the IP of trade dress (Bone, 2015). Registered trademarks initially last for ten years but can be renewed indefinitely every ten years. As AI reduces 'the human involvement in the product suggestion and product purchasing process then the validity of the traditional trademark law is questioned' (WIPO, 2020b) – this observation provides an early indication of how new technology challenges established norms.

Trade Dress. Trade dress can be most readily understood as a companion IP to the trademark rights (Landy, 2008: p. 597). Here the definition is of a legal *term of art*[35] extends to the visual appearance of the invention or artefact. Company trade dress extends to how products are displayed. Formal registration is the strongest protection, but the common law measure is the protection provided by legal actions for *passing off*[36]. A potential use of this concept (*passing off)* could be argued as protection against unapproved ML deep fake musical recreations of singer's voices, as proven in the example of Voice Synthesis and Jay-Z given in Chapter 4.

Trade Secrets. While the distinctive logo and design of the Coca-Cola bottle are among the most well-established instances of IP (trademarks and design respectively), another IP

[35] A word or phrase that has a specific or precise meaning within a given discipline or field and might have a different meaning in common usage: set is a term of art used by mathematicians, and burden of proof is a term used by lawyers (Dictionary.com, 2020).

[36] As with trademark rights, an important protection under legislation extends to attempts at *passing off* one *term of art* for another. Starbucks design are an example of this principle in action with its recognisable retail colours and designs protected by trade dress IP. Starbucks also is a useful example of how a portfolio of IP co-exist. For instance, the Starbucks cardboard clutch sleeve that protects the user's hand from the heat of the cup is patent protected (Valek, 2008).

right – trade secrets – protect the formula of the Coca-Cola soft drink (Ruder, 2008: p. 44). *Sine qua non* to a protectable trade secret include that the secret is not generally known to the public, that the owner of the trade secret benefits economically from its information not being publicly revealed, and that high standards have been employed to protect the secret (Dreyfuss & Strandburg, 2011: pp. 111-113). As the successful *sine qua non* of a secret is invisibility, registration presents a conundrum. The length of time available to protect a trade secret (eternity potentially (Miceli, 2017: p. 183)), when compared to a patent (twenty years), will have resonance when exploring the possibility of non-human musical authors such as an immortal AI.

The fundamental characteristic of IP law in all its different expressions is that its activity is based on giving the actor-creator-inventor exclusivity in the production and exploitation of the *thing* (Kalanje, 2006). Whilst it confers rights *in rem* jurisdiction[37], the legal protection to music makers is expressed in fundamentally negative terms, i.e. that it is prohibitory. This shelters investment of intellectual and labour capital but it will always risk conflicting with emerging technologies that lie outside current legal concepts and legislation (Robinson & Smith, 2018). This problem applies to the AI actors, many of whose new technologies involve a disruptive commercial influence and challenge many of the IP legal protections. In the next section these key AI actors are presented to demonstrate the scale of innovation that affect IP practices in the music ecosystem.

3.3 AI Music Actors

IP means very different things for different AI actors. In the academy, a central driver of an institution's technology transfer office is the advancement of IP as a research

[37] *In rem* jurisdiction (power about or against the *thing*) is a legal term describing the power a court may exercise over property (either real or personal) or a status against a person over who the Court does not have jurisdiction (Statsky, 2014: p. 261).

output (Nezu, 2007: p. 44; Kern, 2017: p. 4). University 'spin-out' start-ups provide a commercial mechanism to foster research through potential revenue generated from institutionally created IP (UCC, 2016).

For the transnational corporation sector, IP presents a series of complex industrial contradictions (Birkinbine, 2015; Hyrynsalmi, et al., 2019) involving trade-offs between open-source or so-called 'free' services and the sale of deeply protected IP[38] corporate technologies. For the digital start-up sector, each company's mission statement is formulated on the anticipated value of its IP portfolio, and their market value is determined by the IP worth expressed by the technological application of its products (Halt, et al., 2017: p. 218). Take China who, literally overnight[39] in 2015, transformed from 'the most piracy-heavy market in the world' to the most regulated paid streaming nation in the music ecosystem (Music Market, 2019).

In order to understand the dynamics of IP in relation to these AI music actors, the innovative and characteristic activities of each are presented in the form of commentary and portfolio. Actors have been selected to reflect the spectrum of research and industrial activity of each sector, this is particularly evident in the wide range of start-ups provided which indicates the similarity of many competing AI products while also presenting key financial data such as product price point and target customer market. The introductory summary of that information is given in the matrix table, figure 1 below.

[38] An internal memo from Apple Inc to its employees in April 2019 detailed that employment and the company's future was dependent on the protection of Apple Inc IP rights. In 2017, twenty-seven Apple staff members had their contracts terminated, and twelve employees were for breaches of Apple's internal IP protection regulations (Gurman, 2018).

[39] The Chinese Government launched 'Operation Sword Net' and overnight over two million unlicensed songs were removed from torrent sites predominantly administered by Baidu (Chinese Google) (Hui & Fleury, 2015).

		Mobile	Browser	Software	API	Price	Type of NN
The Academy	David Cope			x			CNN
	Gil Weinberg			x			CNN
	Francisco Vico			x			ANN
Transnational Corporations	Google Magenta		x	x	x	Free	CNN
	Sony CSL & Flow Machines			x			
	IBM Watson			x			SNN
Start-ups	AIVA		x			Free	RNN
	Amper		x		x	Free	RNN
	Algo Tunes		x			Free	RNN
	Popgun	x	x		x	Free	CNN
	Amadeus Code	x					RNN
	Boomy		x				RNN
	Humtap	x				Free	RNN
	Ludwig			x		Free	
	HumOn	x				Free	RNN
	WaveAI			x			RNN
	Melodrive			x		Free	RNN
	Endel		x				RNN
	Mubert		x				RNN
	LifeScore			x			
	AI.Music			x			
	Xhail		x	x			
	Jukedeck		x		x	Free	RNN

Figure 1: Matrix table of AI actors. Source: Author's own.

Musical examples are offered which demonstrate the breadth of current AI capability. It is important to note the acceleration of change across all sectors that has occurred during the last years, as well as the exponential proliferation of recorded music content. This overview will lead us to consider a series of questions regarding how these AI actors are transforming the music ecosystem in a separate discussion section later in this chapter. As will be seen, while there are distinctions between AI as a tool for performance as in the case of Gil Weinberg's improvising AI robot Shimon, or as a tool for composition as in the example of David Cope's EMI AI, all of these considerations overlap in their capacity to infringe on fundamental legal concepts regarding the exclusivity of human creativity. Often these innovations began with one intentionality and evolved into something radically different as the AI creators came to understand more about their possibilities.

3.3.1 The Academy

The following actors have been chosen as, though their technologies are similar in technical specifics and ultimate purpose i.e. machines capable of creating music, their innovation pathways are notably different and are informed by separate ambitions. David Cope's work encapsulates many of the key questions regarding the spectrum of human-machine co-creativity that later inform the commercial promises of the AI start-up music actors. Cope's decision to limit the capacity of the AI, to not overwhelm the human author, is a notable design resolution. His approach developed under the name 'Experiments in Music Intelligence' also demonstrates how AI music has historically been seen by significant AI theoreticians such as Daniel Dennett and Douglas Hofstadter as an exemplifier of the wider technological and human creativity debate.

An entirely different perspective on the possibilities of AI music creativity was the starting point for Gil Weinberg's development of the robot Shimon at Georgia Institute of Technology. Here the potential of embodied AI is glimpsed, shown in an improvising jazz robot. Nonetheless, like Cope, Weinberg displays a shared impulse to maintain the centrality of the human-in-the-loop in the advancement of his autonomous creative systems. The final actor Francois Vico represents an alternative design ambition – the creation of an AI that requires no human participation through both the development of the Iamus and Melomics systems. The rationales of each of the three academic actors aid in understanding the varying impulses underpinning the strategies of the commercial AI music actors later reviewed.

<u>David Cope</u>

> IBM's Deep Blue – and an artificial composer – David Cope's EMI [Experiments in Musical Intelligence] – have both achieved results that are, in some respects, equal to the best that human creative genius can muster. (Dennett, 2017)

This is how Daniel C. Dennett wrote about David Cope in his book *Bacteria to Bach and Back Again* (2017, pg. 322). David Cope, a classically trained composer, was first inspired to develop AI music techniques to assist his creativity during the earlier 1980s. When Cope began his Experiments in Music Intelligence (*EMI*) (Garcia, 2017: p. 8), there was little indication that some thirty years later, this path of enquiry would plot a now commercially, though mainly unacknowledged, enterprise roadmap for many of the start-up actors discussed in this chapter.

One of the critical foundations in Cope's work is that a machine learning methodology would become the future of computational music creativity (Wiggins, 2008: p. 115):

> Initially viewed as an analysis tool for generating extensive lists of motivic patterns, it quickly grew into an imitative projector of possible next intervals of given [musical] phrases. (Cope, 1987: p. 30)

Cope was a pioneer in the field of computer creativity, and his work has inspired many others to engage and embrace the technologies' inventive capability (Dannenberg, 2006: p. 1221). However, the rewards of being a pioneer meant that Cope encountered considerable negative criticism to his work, which caused personal frustration and consternation (Muscutt, 2007: p. 13). Nevertheless, that pessimistic appraisal did not prevent Cope's inventiveness, and the composer remains active in AI music creativity.

David Cope's publications regarding the computerisation of the music creation process include *Ars Ingenero* (San Francisco, Epoc Books, 2012), *Computer Models of Musical Creativity* (Cambridge, MA: MIT Press, 2005), *Virtual Music* (Cambridge, MA: MIT Press, 2001), and *Experiments in Musical Intelligence* (Madison, WI: A-R Editions, 1996). These publications are now considered academic benchmarks for computational creativity in music (Shneiderman, 2000: p. 131). Experiments in Musical Intelligence

(*EMI*) is the AI software that David Cope began in 1981 and completed in 1988. In order to avoid potential confusion with EMI – the UK recording company, Cope's *EMI* AI would later be called *Emmy*[40]. Cope outlines in *Experiments in Musical Intelligence* (1996) how he in 1981, as a personal algorithmic remedy for writers' block, developed *EMI* on three scientific pillars. Firstly, *EMI* separates and analyses the provided training data into discrete parts which feed the AI system. The algorithm then seeks patterns of commonalities that might shape and signify the desired musical characteristic. Finally, the AI recombines and repurposes the training set data into a new musical work. Cope used Markov Chains to allow *EMI* to be adaptive to individual composer's techniques. Markov Chains is an algorithmic explanation of the sequence of possible events in which each new event is dependent on a prior decision by the AI. Formulated at the beginning of the 20th Century, Markov Chains remains a popular approach in AI music creation and is used by many of the actors in this chapter (Bell, 2011: p. 99). Cope's decision to seek computational aid for his creative frustration marked the start of a personal journey of innovation while simultaneously signalling one of the broader motivators in design of music AI – the development of the intelligent musical assistant.

Emerging from Cope's work are many of the key financial and legal questions of this thesis, as what constitutes the limits and range of AI creativity? And how is the spectrum of innovation from creative music assistant to singular AI authorship defined? The basis of these questions is founded in the earliest of Cope's experiments.

EMI was adept at identifying authorial patterns in music compositions and Cope applied the AI to analyse the works of Bach, Brahms, Beethoven, and Bartok (Cope, 1987: p. 37):

---

[40] Cope's AI – Experiments in Music Intelligence is referred to as *EMI*. Cope alternated the use of the names *EMI* and Emmy for the same AI to avoid confusion with the recording company EMI. However, to prevent any misunderstanding here between Emmy (*EMI*) and Cope's later music AI writing partner Emily Howell, Cope's Experiments in Music Intelligence AI is referred to only as *EMI.*

> And when I finally figured out the combination that would actually work, that is data-based rather than rule-based, I suffered through some rather bad times. However, when the first composition, the Mozart sonata movement, came out, I was floored. (Garcia, 2017)

Buoyed by the success of EMI's detailed analysis of Mozart's musical scores, Cope recognised this iterative process as the first major step in the AI's evolution. However, the most interpretable author Cope discovered, and an early indicator of that composer's future popularity with other AI programmers, was Bach:

> I often use for examples Bach chorales because there is over four hundred of them. And they're all in the same style. I mean they're all very much the Lutheran chorale style of the time. And therefore, it's fairly easy. (Garcia, 2017)

In 1983, when *EMI* was generating Bach styled compositions, Cope left the program to run unsupervised. Upon his return, Cope found that the AI had created an astonishing five thousand new works in the Bach style in a matter of hours[41].

EMI AI music creations were developed against a backdrop of hostile prejudgment, the toll of which has been noted by Cope, for instance when reflecting on a review given to *EMI* in 1989:

> a local reviewer "reviewed" a performance of the music two weeks prior to the concert. The reviewer admitted to having not heard a single example of output from Experiments in Musical Intelligence [*EMI*], adding that he did not ever want to hear such output. (Cope, 1999: p. 80)

Cope became characterised as 'a composer without a heart' (Adams, 2010), with other commentators adopting a similar critical line, questioning '[what was] Mr. Cope's

[41] The *EMI* album *Bach by Design* (1994) would feature some of those works (Discogs, 2020).

motivation for constructing EMI' and 'one wonders what the other potential uses are [of EMI]?' (Vantomme, 1995). In 1997, the year that IBM's Deep Blue AI triumphed over Garry Kasparov at chess, a competition was held at the University of Oregon between Dr Steve Larson and David Cope. At the Oregon competition, Larson's wife, Winifred Kerner performed three music pieces – one composed by Bach, another by Larson in the style of Bach, and a third created by *EMI* trained on Bach. The audience had to decide who were the authors of the compositions and determined that the piece by *EMI* was a genuine Bach while the composition of Larson, a critic of Cope, was the creation of a computer. This is how Larson commented on the competition:

> Bach is absolutely one of my favourite composers. My admiration for his music is deep and cosmic. That people could be duped by a computer program was very disconcerting. (Johnson, 1997: p. 1).

Not only commentators but also audiences were frequently rejective of the AI compositions. After the first presentation of *EMI's* music during the Computer Music Conference in Illinois in 1987, the audience reaction was silence: 'No one applauded' (Newman, 2010). The same year, Cope presented an academic paper on *EMI* to similar muted enthusiasm: 'Most of the ten attendees, many of whom were his friends, left without speaking' (Newman, 2010). Nonetheless, more positive responses to Cope's experiments were made and these primarily came from the science community who:

> seemed to feel that my work has had great potential in many areas other than just music… [they] wanted to know how I did it and [I] ended up with a lot of book contracts and so forth. And that was really, really satisfying. (Garcia, 2017: p. 10)

In attendance at the Oregon Bach competition was the cognitive scientist, Douglas Hofstadter who would later go on to collaborate with Cope (Johnson, 1997: p. 1).

Hofstadter, in a comment that echoes Daniel Dennett's earlier regard for Cope, described *EMI* as 'the most thought-provoking project in artificial intelligence that I have ever come across' (Stanford Today Online, 2020). Hofstadter was so impressed that *EMI* became the keynote content of a symposium organised at Stanford University's Center for Computer-Aided Research in the Humanities in Autumn 1997. Hofstadter, a Pulitzer-prize winning author, previously contemplated, prior to meeting Cope, the implications of AI music in *Gödel, Escher, Bach* (Hofstadter, 1979) speculating that:

> AI capable of creating work comparable to the great composers would have to wander around the world on its own, fighting its way through the maze of life and feeling every moment of it. It would have to understand the joy and loneliness of a chilly night wind, the longing for a cherished hand[42]. (Hofstadter, 1979)

After hearing the *EMI* compositions at the Larson competition in the University of Oregon, Hofstadter reflected that the only comfort he could take at this point was from 'realising that *EMI* doesn't generate a style on its own' (Johnson, 1997: p. 1). Five years after Hofstadter's qualification about the limits of AI creativity, Cope would delete *EMI* and create *Emily Howell*, an AI with her own musical style. *Emily Howell* is a computer program that consists of an interactive user interface that allows both 'musical and language communication' (artsites.ucsc.edu, 2020). With the new *Emily Howell* AI, Cope chose not to train the system directly on the work of historical composers, for example Bartok and Bach. Instead, the new system matured utilising music produced by its AI predecessor, *EMI* (Garcia, 2017: p. 19). This new AI process allowed *Emily Howell* to create and develop an original compositional style – 'Emily Howell tries to create music

[42] A similar contemplation of AI music by Nick Cave made a distinction between human and machine creativity. While conceding that AI might 'produce a song that makes us feel and maybe more intensely than any human songwriter could do' – Cave felt that 'What we are actually listening to is human limitation and the audacity to transcend it. Artificial Intelligence, for all its unlimited potential, simply doesn't have this capacity. How could it? And this is the essence of transcendence' (Peter, 2019).

in a new style, and its data is EMI's output' (Garcia, 2017: p. 19). This change in the provided data training set, Cope felt, granted Emily liberty in her compositional decision-making as the creative system was no longer closed or controlled in its stylistic objective. While Cope coached Emily on how he had constructed music, he did not provide any restrictive design criteria for the new AI's composition. Crucially, the only data that influences *Emily Howell*'*s* creative process would be direct feedback from the listener (Cope) to the computer programme (Garcia, 2017: p. 19). *Emily Howell* has released two albums on Centaur Records *From Darkness, Light,* 2009 (compositions for chamber orchestra and multiple pianos) and *Breathless* 2012.

Historical changes in both the reaction to AI generated music and contemporary concepts of the limits of AI creativity are useful to keep in mind, as it can be seen that established norms in the acceptance or dismissal of AI music are regularly amended.

Despite Cope's fascination with the originality of generated AI music, as seen in the example of *Emily Howell*, he emphasised in tracing his overall approach that AI music should be a positive augmentation for the creative human musician, writing that:

> EMI is a tool. There's nothing magical going on in there. It's basically addition and very simple arithmetic, I mean you can get beyond that by including calculus and so forth into the program. But as far as the hardware is concerned, it's simple binary math. (Garcia, 2017: p. 8)

The position of the human composer remained privileged throughout Cope's many experiments in the development of AI music. Reflecting in the 'Meaning of Music' Cope, the composer 'without a heart', concludes that:

> There are some pieces of music that will regenerate memories and others that can change a listener's life forever. Its effects on our minds and bodies can be astounding and sometimes equally devastating, but no matter the results, music changes everyone, and does so by being itself; a

> devastatingly and timeless art that living without it, at least for many, is like living without life itself. (Clancy (Ed.), n.d.)[43]

Such a perspective, and the positive role that AI can have in enhancing comprehension of the emotional reaction to music can be seen in the example of Cope's work on the Gradus program which focuses on the analysis of musical counterpoint (Cope, 2004). The program was based on the belief that human intelligence is the result of the collective analysis of surrounding patterns and ideas and that humans gain knowledge, described in language, as events occur and accumulate in life experience. David Cope developed the Gradus algorithm grounded on this intriguing belief and his target was to create a system that 'changes its behaviour by modifying its own approaches' (Cope, 2004: p. 12). Currently, Cope is the co-founder of Recombinant[44] (Crunchbase, 2020a), an AI music start-up based in Santa Cruz that is researching practices to create a new context for music fans that can revitalise revenue resources for artists and copyright holders. This is a development that indicates both the connection between the academy and the start-up community, which further links the work of AI and music IP.

David Cope music examples:

EMI, *Beethoven 2 beg*, https://youtu.be/CgG1HipAayU

EMI, *Mozart-style Sonata 2-1*, https://youtu.be/o7zTLw7s2dc

EMI, *Mendelssohn-style Song Without Words*, https://youtu.be/no1osB-eWQs

EMI, *Chopin-style Mazurka 5*, https://youtu.be/IWKgcCVIwmE

EMI, *Brahms-style Intermezzo*, https://youtu.be/25p_NtJarqY

EMI, *Bach-style Invention 10*, https://youtu.be/6qJjxr0EYUM

---

[43] This is a fragment of Cope's chapter *Meaning of Music* from *Artificial Intelligence and Creative Music Practice* to be submitted with Routledge in winter 2020.

[44] Recombinant was founded in 2005 and by 2013 had gathered $700,000 in capital seed funding. The start-up is working on an interactive music application designed to help in the study of music as a language.

Emily Howell, *Land of Stone,* https://youtu.be/0LuHQ3CcbnU

Emily Howell, *From Darkness, Light – 1. Prelude*, https://youtu.be/QHJqp4SlsoU

Emily Howell, *From Darkness, Light – 2. Fugue*, https://youtu.be/LZQyPVuu6WM

Emily Howell, *From Darkness, Light – 3. Prelude*, https://youtu.be/TqH6ionF94I

Emily Howell, *From Darkness, Light – 4. Fugue*, https://youtu.be/QK_IlYxdIik

Emily Howell, *From Darkness, Light – 5. Prelude*, https://youtu.be/Z2NyhgOENSI

Emily Howell, *From Darkness, Light – 6. Fugue*, https://youtu.be/ZoU-j8Phb-4

Gil Weinberg

Gil Weinberg received his PhD Media Arts and Sciences from MIT in 2003. In 1991 Weinberg began working with Yigal Barkat in a music start-up Sense Multimedia, producing a CD of the Carta Atlas along with a karaoke music program. In 1994 Weinberg became involved with the start-up company Music Notes, which focused on optical technology products that could read music in order to create software that would teach itself how to play the piano. Weinberg explained his motivation:

> I wanted something that would provide an unmediated connection with a musical instrument, something could touch, look for and discover, things with which you could create new music. (Smooha & Hadar, 2006)

By 2003, Gil Weinberg had developed several AI-based musical instruments: including *Squeezables,* a computer music instrument that allows a group of players to perform and improvise musical compositions by using a set of squeezing and pulling gestures and *Beatbugs,* a hand-held percussive instrument that allows the creation, manipulation and sharing of rhythmic motifs through a simple computer user interface.

In 2006, Gil Weinberg founded the Georgia Tech Center for Music Technology to support the new degree program of Master of Science in Music Technology at Georgia University. He is also a coordinator of the annual Guthman Competition, whose yearly goal is to build a new AI musical instrument. Also, in 2006, Weinberg introduced Haile, a robotic percussionist that listened to human-produced rhythm and, having analysed their style and patterns, could then accompany the human performer, as figure 2 below shows.

Figure 2: Gil Weinberg pictured playing percussion as Haile listens and interacts. Source: https://www.researchgate.net/figure/Haile-listens-to-and-interact-with-a-human-player_fig1_221514567

Haile was designed to blend the capabilities of 'computational power, perceptual modelling, and algorithmic music with the richness, visual interactivity, and expression of acoustic playing' (Weinberg & Driscoll, 2006: p. 1229). After the robot's AI was trained on a library of five thousand songs and two million assorted riffs and musical motifs, Haile was able to identify and evolve creating human-produced patterns:

> [Haile] is using mutations and crossbreeding between the motives. Just like in genetics evolution. Moreover, the response and the product sounds

> like a combination of machine-generated music and human touches. (Weinberg, 2014)

In 2008 Gil Weinberg's team, building on the work of Haile, began developing Shimon. Shimon is an improvising robotic marimba player, shown at work in figure 3 below.

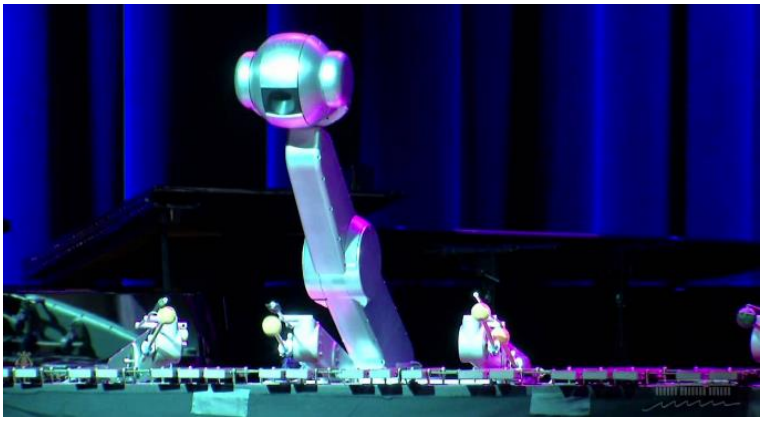


Figure 3: Shimon improvising at Moogfest, North Carolina in 2017. Source: https://www.designboom.com/technology/shimon-robot-moogfest-06-19-2017

Shimon combines the computational modelling of music perception and improvisation with the ability to create, in real-time, musical performances that are 'melodic acoustic responses in physical and visual manners' (Georgia Tech, 2020). The robot has four arms and a camera mounted in the body's head. Each robotic hand has two solenoid activators striking mallets and the system is capable of detecting rhythm by observing human co-performers while Shimon's metallic head pulses in time. Trained on the datasets of many of the great jazz players, Shimon, like Emily Howell, has evolved to have its own musical technique. The creator comments on Shimon's abilities:

> I can tell Shimon to play me something that is 30 per cent Monk, 40 per cent Coltrane, 10 per cent Miles and maybe 20 per cent my own music, and Shimon will respond and create a mash-up that is very interesting and unique. This is really exciting for me because we can play and create genres that have never been created before. (Moosazadeh, 2018)[45]

[45] The possibilities of AI music on the music ecosystem were first made clear to me when I was a spectator at a performance by Shimon, Mason Prett and Gil Weinberg of John Coltrane's composition *Giant Steps* at the Loop music festival in Berlin in November 2017.

Figure 4: Shimon improvising with human musicians. Source: https://shimontherobot.bandcamp.com/track/consciousness-performs-single

Shimon's ability to not only generate musical output but also to perform in real-time with acoustic instruments, as shown in figure 4 above, distinguishes the Weinberg team's research from many other academics' AI systems.

Weinberg also used Markov Chains to develop Shimon's internal processes and Weinberg's 'style modelling' is comparable to David Cope's concepts of locating a composer's style. Similarly, Weinberg's concept of the 'mutation' and 'crossbreeding' of melodies (Weinberg, et al., 2020: p. 96) echo throughout Cope's academic research enquiries. However, unlike Cope, Weinberg does not treat the technology as a mere tool when he speaks about Shimon. By anthropomorphising Shimon, the question of the role of a robotic AI actor in the music ecosystem arises:

> Why should it be only a tool or a servant? If you know how to work with it, it can be a musician, a full and integral partner, inspiring, full of expression, creative. It can throw you in directions you never thought you'd go. So, it's certainly not just a tool. (Appendix I)

The Georgia Tech team continue to develop new challenges for Shimon including training the robot to analyse rhythm and identify patterns in freestyle rap (Weinberg, et al., 2020: p. 182).

One of Weinberg's primary research interests is medical robotics and human augmentation. Robots created by the Robotic Musicianship Group are helping to expand the capabilities of humans by empowering the performance of previously improbable musical tasks. An illustration of that application is the intelligent prostheses for robotic exoskeletons that can interpret a user's intent. For example, ongoing Georgia Tech projects include *Skywalker* (a prosthetic hand that uses ultrasound sensors and deep learning algorithms to predict the muscle movement in the amputee's stump) and the *Robotic Drumming Prosthesis* (a device attached to the amputees allowing them to play with two drumsticks – as shown in figure 5 below) (Georgia Tech, 2020). With *Robotic Drumming Third Arm* (Georgia Tech, 2020) an artificial attachment is given to the human musician to extend the range of performance possibilities.

Figure 5: The Robotic Drumming Prosthesis. Source: https://youtu.be/io-jtlPv7y4

It may look like such innovation positions Weinberg's work within the transhumanist framework when humans enter a hybrid relationship with technology to

create something beyond human. For me though, when Weinberg and his team recognise a gap between the advancement of technology and ethics, they represent posthuman critical reflection on the value of such contingent AI without eliminating the human actor. And by asking about augmented human role in the music ecosystem challenged by the non-human actor, AI, Weinberg's approach introduces an ethical dimension to the discussion.

In a paper '*Shimon the Robot Film Composer and DeepScore*' Richard Savery, a member of Weinberg's Georgia Tech research team, outlined one of the team's latest research developments, DeepScore. DeepScore would later present the Georgia Tech team with ethical challenges for AI that went beyond those encountered in the three earlier robotic examples.

DeepScore is a robotic AI that can compose film soundtracks in real-time. The AI system uses MaxMSP's Jitter[46] to detect directorial aesthetics indicated by decisions regarding the pace and tone of the film and identifiable by choices made in camera movement, actors' performances, and the colour grading of the film. These parameters are then used to create a meta-analysis of the overall pacing which could inform the AI. After gathering this data, the Georgia Tech team then deployed Shimon to run DeepScore. Remarkably, Shimon, powered by DeepScore, was able to compose and perform music in real-time to picture. Savery demonstrated, as the film played, that Shimon was able to blend four motifs and correlate this information into a soundtrack that corresponded to the ongoing film action.

Observing DeepScore perform in Dublin, Shimon's advancement was surprising. At the Loop music festival in Berlin (2017), Weinberg had dialled in degrees of Thelonious Monk or John Coltrane inspired musical improvisation and, now in UCD,

[46] Max (Max/MSP/Jitter) is a visual programming language for music and media projects first created by Miller Puckette, owned by German music software company Ableton and developed by the software company Cycling '74.

Shimon had graduated to being capable of real-time film soundtrack composition. However, at the UCD conference, I expressed concerns to Richard Savery regarding Shimon's impact on human creativity and its potential ethical implications for musicians. Savery welcomed these questions but said that it wasn't an area that the Georgia Tech team had engaged with yet. Six months later in February 2019, when chatting via Skype with Richard Savery, this topic was returned to when I enquired how Shimon's film work was progressing. Savery explained that:

> we decided to park that project. It wasn't a technical issue. We [the research team] just could not figure out why we were developing it. We do not want to be in the business of putting humans out of work. (Savery, 2019)

A year after Savery had delivered the paper in Dublin, Weinberg commented on the future of Shimon based projects. He reflected on a recent decision by the Georgia Tech team to put DeepScore on hold and reconsider the purpose of the project's aims in the perspective of ethical development of AI:

> Richard and I are going to think how we can take what we are doing and find a way for the work to become something that inspires, surprises and helps humans. And create what you [the interviewer] would call an 'ethical AI', that's my interest. (Appendix I)

Weinberg further noted during the interview that there existed the possibility that other AI developers could use his team's inventions and change their purpose and 'of course… get rid of the human'. However, he remained personally optimistic of the example set by the ongoing approach of the Georgia Tech team:

> but for me you may know our motto 'Listen like a human but improvise like a machine'… in other words, the AI needs to connect to humans and

> how humans understand music and mechanically do things that humans can't – in order to inspire humans. (Appendix I)

Weinberg and his team's ongoing interest and commitment to 'ethical AI' is indicated in a chapter entitled 'Fast and Curious: A CNN for Ethical Deep Learning Musical Generation' (Clancy, n.d.), in which Weinberg notes that while deep learning AI has significantly progressed, advancing what is possible in music generation, corresponding systems have 'broader ethical implications that have not been widely examined' and presents a 'human-first' design for the new AI. The embrace by leading figures like Cope and Weinberg of an ethical human-centric approach for AI systems is evidence of the many creative design interpretations available – if that value is sufficiently prized.

Gil Weinberg musical examples:

Steady As She Goes, https://youtu.be/jtC_CNPiGe8

Bafana, https://youtu.be/8wgYCkpER7k

Into Your Mind, https://youtu.be/sHl-Cg2KDbg

Earth to See, https://youtu.be/CtESlHUNsTo

Francisco J. Vico

Francisco J. Vico established Melomics Media in April 2012 at the University of Malaga, Spain. Vico's research team created the Melomics computation system utilising, like Cope and Weinberg, the Markov Chain algorithm. The Markov Chain AI system became the cornerstone in first creating Iamus and then the Melomics109 AI music generation systems (Fernandez & Vico, 2013: p. 553).

Iamus (2010), as pictured below in figure 8, is a computer cluster system containing multiple chained computers implementing separate tasks towards the same output goal (Clements, 2018: p. 69). Iamus generates contemporary classical compositions that are not intended to replicate or mimic the work of an existing author. Distinct from Cope's development of *EMI* and *Emily Howell* and Weinberg's Shimon, no human is directly involved in the process of Vico's AI musical creation and, critically, no training sets of existing compositions are used in the processing of the Iamus AI (Elkhova & Kudryashev, 2017: p. 138). However, one of the challenges that Vico and his team faced was to create an AI that could write music while employing the patterns and rules that humans use. Vico compares the Iamus system with the predetermined development of human musicality, in so far as musicality is considered pre-programmed within the human genome (Melomics Records, 2013).

In 2011, Iamus premiered its first full art music composition *Hello World!* performed by human musicians[47] at the Festival Keroxen in Santa Cruz de Tenerife in Spain (Jerez, 2018). The audience's reaction to the performance was, in many regards, reminiscent to the earlier *EMI* experiences of David Cope. The *Guardian* reported 'Maybe I'm falling victim to a perceptual bias against a faceless computer program, but I just don't think Hello World! is especially impressive' (Service, 2012).

Conversely, these criticisms were not in play in the context of a prestigious event in 2012. To mark the one hundredth anniversary of Alan Turing's birth, The London Symphony Orchestra performed *Iamus*, a work composed entirely by Vico's AI. Melomics Records subsequently released an album *Iamus*, consisting of ten AI created compositions recorded by The London Symphony Orchestra (Iamus, 2012).

[47] Trio Energio comprised Cristo Barrios (clarinet), Cecilia Bercovich (violin), and Gustavo Díaz-Jerez (piano).

While Iamus is designed to produce contemporary classical music, Vico's other music AI invention, Melomics109 has a very different focus. Though initially built to provide computational support for Iamus (Sánchez Quintana, et al., 2013: p. 102), Melomics109 would go on to produce various genres of popular music from jazz to electronica. Remarkably, Melomics109 has created over one billion music compositions (Elkhova & Kudryashev, 2017: p. 138).

Vico used the same algorithmic basis for the structures of both systems with the aim of allowing the AI to self-determine its decision-making choices. Unlike with Emily Howell, where Cope provided the AI with continuous human feedback and Weinberg's AI approach, both the Iamus and Melomics music systems had a distinctly different intention: to create an autonomous, self-tutoring and self-reliant AI.

The fundamental purpose of Melomics109 was to produce commercially available pop music (Farrell, 2015). The debut album of Melomics109, *0music*, was released in July 2014 and its individual tracks made available for €2. However, Melomics subsequently released all of the library's compositions and recordings under a creative commons licence and the entire Melomics catalogue were made available via their website[48] (Requena, et al., 2014).

More recently, Vico and his team have become increasingly involved in the application of their technologies to the field of music therapy (de la Torre-Luque, et al., 2017: p. 1). Many of Vico's commercial applications for AI music anticipate much of the cutting-edge AI development. The examples involve the hyper-personalisation of music through data delivered through notions of the quantified self[49], a commercial proposition which is the unique selling point (USP) of AI music start-ups including Popgun and

[48] At the time of writing the weblink to the library is inactive and the plans for the library unknown.

[49] The notion of the Quantified Self has been defined as 'individuals engaged in the self-tracking of any kind of biological, physical, behavioral, or environmental information as n=1 individuals or in groups' (Swan, 2013).

LifeScore. Illustrations of Vico's work in this personalisation approach include *eMTSD*, an app specifically designed to test the benefits of empathetic music therapy and *melomics@sleep*, which uses the Melomics' library to help the user rest.

Vico's research has been supported by the Ministry of Science and Innovation with listed funding amounting to €1,307,655 (Grupo De Estudios en Biomimética, 2020). From 2010-13, Melomics received additional funding to research, and optimised the therapeutic response to the modulation of auditory stimuli, while in the last years, Francisco J. Vico has co-authored articles concerning the positive impact AI music can have on humans[50] (Caparros-Gonzalez, et al., 2018). The recorded AI work by Vico's team is now in the public domain and has been described as 'the largest free repository of music in the world' (Diaz-Jerez, 2011: p. 14).

Francisco J. Vico musical examples:

Iamus, *Adsum*, https://youtu.be/PzrcoqpnZqA

Iamus, *Hello World!*, https://youtu.be/bD7l4Kg1Rt8

Iamus, *Nasciturus*, https://youtu.be/F5zDEHggiMg

Iamus, *Colossus*, https://youtu.be/yGrzzZupYVI

Iamus, *Alphard*, https://youtu.be/9I8BNSAg-JM

Melomics, *0music 01*, https://youtu.be/SxvV5zn7e9s

Melomics, *0music 07*, https://youtu.be/wIeo1XvrnTo

[50] In 'acute stress recovery through listening to Melomics relaxing music: A randomised controlled trial' Francisco Vico worked with Alejandro de la Torre-Luquea, Rafael A. Caparros-Gonzalez, Teresa Bastarda and Gualberto Buela-Casal. The result of the research was that 'findings derived from this study can encourage tailored-music interventions, such as Melomics system can deliver' (de la Torre-Luque, et al., 2016).

3.3.2 Transnational Corporations

In contrast with the transparent research aims of the AI actors from the academy, the future plans of transnational corporations (Facebook, Amazon, Apple, Netflix, Google et al.) can only be inferred by the slenderest of degrees (Winseck, 2017: p. 228). However, attempts can be made to better understand this sector's activities by noting their direct commercial action, investment, and stated intention.

For instance, the announcement by Amazon in October 2019 that it was to release DeepComposer, a $99 ML powered music keyboard, was surprising as the corporation previously had not been involved in the production of musical instruments. This entry by Amazon into the AI music sector indicates just how difficult prediction is, not only of how AI music might develop, but what particular actors will be involved (Deahl, 2019a) and how they use AI technologies to position themselves on the commercialised market.

By describing the dynamics of this sector participation in the music ecosystem, along with their involvement in the AI powered distribution, curation and consumer utilisation of global music content, an insight is gained into the expansive role this sector plays which includes the cases of start-up acquisition. In this section, three selected influential giants are focused on: Google Magenta, Sony CLS, and IBM Watson. Other transnational actors like Apple, Amazon, Tencent and ByteDance also feature, however, these three have been selected for the following reasons. IBM's longstanding engagement with public facing experiments in machine creativity is an indication of the shaping of public conception of the potentialities of, and the company's display of its AI music division as an advertisement for its other commercial AI sectors, is a clear example of the use of music as a tool communicate a wider corporate agenda. Sony, apart from being an innovative actor, is also one of the three major recording companies in the world and the only traditional music industry actor to have an established foothold in AI. The review of Sony also allows us to trace the role of Francois Pachet who is now developing AI music

systems at Spotify. Finally Google, the AI actor who reappears throughout this work in so many guises (YouTube, DeepMind creators of WaveNet et al. home to Ray Kurtzweil et al) and who as the world's fourth largest corporation will inevitably play a crucial, if as yet undetermined, role in the shaping of the near future music ecosystem.

Google Magenta

Figure 6: Google Magenta Logo. Source: https//magenta.tensorflow.org

> To develop algorithms that learn how to generate art and music, potentially creating compelling and artistic content on their own. (Eck, 2016)

The community that has grown around the Magenta project is known as 'Experiments with Google' (Parikh, 2020). Different music strategies from members of that community, which employ Magenta technologies, are posted through the project's web-based platform. A prominent example is AI Duet created by Yotam Mann[51], an interactive piano system which allowed the Magenta AI to reply to the melody of the users' input (Parikh, 2020).

All Magenta projects use TensorFlow, i.e. a Google-developed open-source platform for Machine Learning (ML) (Magenta, 2020). TensorFlow provides tools, libraries and resources for the accessible use of ML, and within its framework a programmer can create in-depth learning networks in a rapid, affordable and straightforward manner. TensorFlow is now an established academic and industrial

[51] AI Duet featured as an exhibit in the Dublin Science Gallery 2013 'No Humans Need Apply' season (Science Gallery Dublin, 2017).

methodology for the creation of AI applications (Abadi, et al., 2016). By providing open-source AI tools while simultaneously owning YouTube, the world's largest – albeit minimal copyright paying – music streaming platform, Google demonstrate the commercial paradox for the music ecosystem inherent in many transnational corporations' products and services.

An illustration of how quickly Magenta's influence has entered mainstream culture was witnessed in March 2019 when, to commemorate the birthday of Johann Sebastian Bach, for the Doodle of the Day[52], Google incorporated a variation of an earlier Magenta project – the BachBot (Liang, 2016). The original Magenta BachBot allowed the user to first select a level of music, from beginner to expert, and then participate in an audio blind test. The BachBot was akin to the various public Bach tests[53] involving *EMI* compositions (Dennett, 2020). Here, the listener would be asked to decide from a series of examples which recordings were human composed (Bach) or which was BachBot (AI) generated. Google's Bach Doodle of the Day in 2019 was a variation of the BachBot called Coconet. The browser-based AI allowed the user to create an original melody and Coconet's deep learning algorithm harmonised that melody and interpreted it in the style of Bach. To achieve this, the Coconet developers used a training set of three hundred and six chorale harmonisations by Bach and then, through supervised training, taught the system to anticipate which notes in users' inputted musical fragment correlated with Bach stylings.

Another Magenta project is GANSynth, a deep learning model of generative adversarial networks designed to create raw audio (Engel, et al., 2019). The developers of

[52] Doodles are changes that are made to the Google logo to celebrate holidays, significant events, and anniversaries of artists, scientists and other cultural figures (Google, 2013).

[53] There are many examples of Bach-based blind tests. Daniel Dennett writes in *From Bacteria to Bach and Back* (2017 p. 384) regarding a Bach test the author arranged of *EMI* compositions at the Montreal Bach Festival. The author found the results remarkable: 'When I asked who [the audience] had got them all right to stand, only a dozen rose to a round of applause' (Dennett, 2020: p. 37).

the GANSynth attempt to solve one of the key challenges, the processing time involved, presented by AI systems, for example Google's WaveNet. WaveNet is the deep learning algorithm that uses unsupervised audio training sets to create full audio music recordings without the participation of humans. Instead of producing one audio sample at a time, GANSynth creates the full audio recording through a parallel processing system allowing the AI to function in real-time (Van den Oord, et al., 2016a). The implications of a successful adaptation of the real-time processing of raw audio by music AI will escalate the findings of the WaveNet analysis included in the legal chapter.

Google Magenta, and its surrounding community, is a modestly resourced and staffed (by comparison to Google's DeepMind) AI division within the corporation (Crunchbase, 2020b). However, Magenta's influence on AI music developers continues to inspire and change the dynamics of the music ecosystem, through the designed interpretation and implementation of Google's open-sourced AI tools like TensorFlow and WaveNet. An example of the adoption of Magenta's tools within a localised context can be seen in the Free Magenta Max for Live Ableton instruments (Roberts, et al., 2019) but also in the releases of spring 2020 of Open AI's Jukebox by OpenAI and the work of the Youtube artist Voice Synthesis.

Magenta's collaboration with The Flaming Lips (Magenta, 2019), along with the growing use of various Magenta music applications including third party plug-in audio effects, make the Magenta project an ideal testing ground – and promotion of – Google's open-source AI tools.

Magenta musical examples:

Magenta and Flaming Lips, *Fruit Genie*, https://youtu.be/HGWkQP9lVPw

AI Jam Session, https://youtu.be/QlVoR1jQrPk

Making Music with TensorFlow Models, https://youtu.be/ZRnbbtqxBEc

Sony CSL & Flow Machines

Figure 7: Sony CSL logo. Source: https://www.sonycsl.co.jp

> We believe that technology should be human centered designed. We will keep on researching and developing to let technology augment human creativity even more. (Flow Machines, 2020)

On the 22nd March 2020, Sony Computer Science Laboratories (Sony CSL) released an AI-assisted music production service FM Pro (Flow Machines Professional). FM Pro comprises an AI recommendation system that suggests melodies, harmonies, and bass lines to complement the users' content (Jordan, 2017). It is available as a third party plug in (similar to many of the Magenta tools) that operates within a user's DAW[54]. As Attali predicted throughout *Noise,* and as Iannis Xenakis wrote in 1971, 'the composer becomes a sort of pilot: he presses the buttons' (p. 144); here with FM Pro the user only needs to press 'compose' to start making music. FM Pro marks the latest music innovation from Sony CSL which was founded in February 1988. CSL is a research institute based both in Paris and Tokyo. The mission of this institute was outlined by Hiroaki Kitano, the president and CEO, at the CSL 20th anniversary (Sony CSL, 2020):

[54] The three industry-recognised professional DAWs (Digital Audio Workstations) are: ProTools, Logic, and Ableton Live.

> Value is assessed to the degree to which achievements are perceived to contribute to humanity and society, to science and technology, to industrial progress and to product development. (Sony, 2020)

Sony CSL's research methodology incorporates transhuman concepts as Kitano states: 'People using technology to extend their abilities could be thought of as the next stage of our evolution' (Sony, 2020).

Sony CSL works in domains including econophysics, AI, and systems biology. Key in their research is the consideration of 'human augmentation' which considers human creativity via human-computer interaction (HCI) methodologies (Okuno, et al., 2001). Its current major research theme is 'Global Agenda' (Sony, 2020) and is publicly aligned with the *UN SDGs* and includes issues from food scarcity, healthcare, and energy. Sony CSL has been a long-term actor in AI music generation in parallel to its other research strands.

François Pachet was a director of Sony CSL in Paris from 1997-2017. In his paper 'Description-Based Design of Melodies' (2009), Pachet outlined a new approach to building music melodies within an artificial environment that did not require any form of prior programming knowledge:

> Users must give the computer a clear and complete definition of their material. This approach has the enormous advantage of letting users control all dimensions of their work. (2009: p. 56)

In 2014 Pachet developed *The Continuator*, an interactive music system capable of improvising in real-time the style of the human using the system. In 'Action Identity in Style Simulation Systems: Do Players Consider Machine-Generated Music as of Their Own Style?' (Khatchatourov, Pachet & Rowe, 2016) it was considered whether AI systems could generate content that sonically resembled the idiosyncratic musical approach of the user. The findings claimed that the musical style of participants was

'well-simulated' by the AI and that the software could be 'seen as an exemplar of many style simulation systems based on similar technologies' or could 'be used in many situations where style recognition is crucial' (Khatchatourov, Pachet & Rowe, 2016). This analysis of style recognition by Pachet contributed to the development of an AI system that transitioned the team's work from the research domain to the broader music ecosystem.

It was under Pachet's leadership at Sony CSL through the development of Sony Flow Machines that drew global public and industry attention. In 2016 two music tracks were released: *Daddy's Car* and *Mr Shadow*[55] (Vincent, 2016). Despite Pachet's qualification that the songs were co-written by an AI, the lyrics were written by a human author – Benoit Carre. The Flow Machines release would be widely heralded as the first song ever written by an AI and led to distinguished figures such as Imperial College Professor Armand Leroi inadvertently celebrating *Daddy's Car* as a significant landmark in computer creativity[56]. The composer E. Michael Harrington during the *WIPO AICM* session suggested a possible motive behind the release by CSL of the Beatles inspired *Daddy's Car*: '[with *Daddy's Car*] it was Sony doing the Beatles and the reason was because they owned the catalogue, they're not going to sue themselves' (US Copyright Office, 2020a: p. 223). However, Harrington's observations should be qualified in their supposition as other Flow Machine releases were not limited to music catalogues owned by the corporation. Nonetheless, Harrington's comments indicate a possible future financial conflict of interest where the owners of human created content (transnational corporations) are at the same time global leaders in the field of AI music development.

[55] Both tracks were slated for release on the Flow Machines album, *Hello World*. However, when the album was released in 2018, neither recording featured. The album was released under the moniker SKYGGE which is an alias of Benoit Carre, a long-time musical collaborator of Pachet (SKYGGE, 2020).
[56] Leroi made this statement during a talk given at the Neurohumanities Public Talks: Evolution of Music at the Science Gallery Dublin on 26th April 2018.

In Pachet's paper *Content Management for Electronic Music Distribution* (2003), the author analysed the development of the music industry and reviewed music file sharing platforms like Napster and their disruptive influence on technological development. Legal challenges critically reviewed in that paper included the status of metadata and its distribution (Pachet, 2003). In June 2018, Pachet became the Director of the Spotify Creator Technology Research Lab with the remit to create AI tools to help artists in their creative process.

However, Sony CSL AI music work continues as declared by Kitano: 'Sony CSL is a framework to make the wildest ideas come true for the future of humanity', and the release of FM Pro indicates the company's renewed ambition for AI music in 2020 (Fawaz, 2020).

Sony CSL music examples:

AI-composed concert, https://youtu.be/bptKZ2ACZfQ

Daddy's Car, https://youtu.be/LSHZ_b05W7o

DeepBach, https://youtu.be/QiBM7-5hA6o

IBM WATSON

Figure 8: IBM Watson Logo. Source: https://medium.com/@markedium.bd/ibm-watson-launches-advertising-accelerator-for-better-results-markedium-9f7292a826a5

> From Hip Hop to Healthcare from Indie Rock to Investment banking from Rock n Roll to Oil and Gas – IBM is changing the world – Let's put smart to work. IBM Music Watson. (IBM Corporation, 2019)

The aforementioned marketing slogan used to promote all of IBM's AI products demonstrates the corporate attraction towards music and how specifically a direct association with the arts can support an organisation's overall commercial locus. IBM's association with music dates back to 1915 and the creation of its first company band which consisted of five members including the company president Thomas J. Watson Snr. His surname would serve for the company's famous AI (IBM Archives, 2003).

IBM's brand connection to music was displayed in a US television advert (2015) in which Bob Dylan chats with the AI Watson, as pictured in figure 9 below (Murray, 2015).

Figure 9: Bob Dylan and Watson. Source: http://www.gandrllc.com/ad-haiku/ibm-watson-bob-dylan/#lightbox/0/

That promotional campaign is in keeping with the company's overall marketing strategy for IBM, which has long understood the attractive effectiveness of highly publicised AI projects: from the legendary Deep Blue AI chess victory over Garry Kasparov in 1997, (Newborn, 2012) pictured in figure 10 below, to the company's triumph at the US TV game show '*Jeopardy*' in 2011 (Markoff, 2011) as shown in figure 11 below.

Figure 10: Kasparov and Deep Blue 1997. Source: https://www.pri.org/stories/2018-01-05/garry-kasparov-and-game-artificial-intelligence

Figure 11: Watson on American TV Quiz Show, Jeopardy. Source: https://www.nytimes.com/2011/02/17/science/17jeopardy-watson.html

To foster public engagement, IBM has focused on targeting summits of human cognition with these events. These highly publicised AI victories resulted in a significant increase in the company's share price (Best, 2013). AI music may represent a similar opportunity for IBM, as indicated by Kareem Yusuf, General Manager of IBM Watson IoT who spoke of how the company's focus is on how AI can make 'each professional – across industries – more effective and more efficient' (Horowitz, 2018).

IBM has had a lengthy association with AI music (Global Supercomputing, 2020), beginning with Dr Kemal Ebcioğlu who worked at the IBM Research Division, New York between 1986-2005 (Global Supercomputing, 2020). Ebcioğlu developed an expert AI music system called CHORAL which was capable of successfully harmonising four-

part Bach chorales (Ebcioğlu, 1990). At IBM, Ebcioğlu's music work can be considered as a part of a broader corporate AI mission:

> In a significant expansion of the IBM Watson cognitive computing platform, IBM has launched 'pre-trained' artificial intelligence (AI) tools for a slew of industries, including advertising, agriculture, automotive, building management, customer service, human resources (HR), manufacturing, marketing, and supply chain. (Horowitz, 2018)

In helping promote IBM's 'tools for a slew of industries', music can communicate the power of AI's creative potential.

Janani Mukundan began IBM Watson Beat as a personal hobby (IBM Corporation, 2018a). Collaborating with professional musicians, Mukundan and her IBM colleagues taught their AI the fundamental principles of music composition. An example of their work is Watson Beat which uses music MIDI files as an input starting point from which the mood of the composition is then selected and after which the AI creates a new composition (IBM Corporation, 2018a). The IBM Watson Supercomputer is the foundation of Watson Beat and operates through multiple layers of neural networks that seek patterns and similarities in the training set and analyse that data according to principles of music theory (researcher.watson.ibm.com, 2020).

IBM Music in 2016 brought Watson and the Grammy award-winning music producer Alex Da Kid to work together. Watson's contribution was to analyse 'the hit-making process from volumes of data' and assist in co-writing the hit song, *Not Easy* with Da Kid (Jones, 2017). The release echoed the ambition of many of the music start-ups AI: 'Watson's ability to turn millions of unstructured data points into emotional insights' (Landa, 2010: p. 290). Other IBM music applications include Watson Tone Analyzer which 'reads the lyrics of over 26,000 Billboard Hot 100 songs', while Watson Beat was used as a musical instrument on the recording of *Not Easy*.

IBM's AI involvement in the music ecosystem extends beyond the computerised generation of music and is illustrated by the remit of the Watson Artist Discovery Tool's involvement with The Grammy Awards (Syken, 2019) – namely, the GRAMMYconnect software. Amish Mahur of IBM Watson explains:

> Watson Discovery uses Natural Language to identify 20 million connections between 50,000 musicians. The principle is to drive fan engagement with the Grammy's telecast. This is not something that the average music fan has a chance to experience, but now that is about to change. (Mathur, 2019)

Beyond human capability, this software uses Watson to recognise connections between Grammy-nominated artists and demonstrates the further expansion of IBM AI into the music ecosystem.

IBM music examples:

Not Easy: https://www.youtube.com/watch?v=DvR2RHIYW5U

The Watson Beats Demo: https://www.youtube.com/watch?v=Z5ymVzTUU6Y

3.3.3 Start-ups

The Influence of Apple and GarageBand on Start-ups. For many years Apple Inc has been among the world's most cash-rich and highly capitalised companies (Kolakowski, 2020). The company and the ongoing foresights of its late co-founder Steve Jobs continue to serve as inspirational incitements to many actors in the start-up community (Hakobyan, 2016). In this work, Apple provides an instructive portfolio segue from transnational to start-up companies.

The Apple brand is the most synonymous transnational corporation associated with music (Ingham, 2020a). The company's deep connection with the music ecosystem

was forged during the 21st Century (Blau, 2011), first with the iPod (then iPhone), shortly followed by the introduction of iTunes and then the streaming platform Apple Music. However, it is Apple's digital recording studio – GarageBand [57] (2004) that indicates an important representation of the Attalian composing network. In describing the future instruments of the composing stage, Attali links their socio-economic connection to the aural traditions of music. The author outlined the instrument's benefit, in a description which would not be out of place were it written within the context of contemporary GarageBand marketing:

> No study is required to play this kind of music... It is thus accessible to everyone, breaking the barrier raised by an apprenticeship in the code and the instrument. It has developed among all social classes. (Attali, 1985 [1977]: p. 140)

Similarly, when announcing the potential of GarageBand, Steve Jobs (January 2004 San Francisco) gave a creative pledge 'democratising music making'. It was a claim that pre-echoed the later marketing promises of AI start-up actors including Humtap, Boomy and Amper:

> A major new pro music tool…but it is for everyone. Is this a niche thing [GarageBand]? No, it's not. One-half of all US households have at least one person who currently plays a musical instrument. (Jobs, 2004)

Jobs demonstrated how he, as a non-musician, improvising with live guitarist John Mayer could build a twelve-bar music track from the Apple Loop music samples included within GarageBand. Jobs showed that the DAW was also a tool for professional musicians[58] by exporting the finished recording and making it available for sale on

[57] GarageBand is included with all Mac and IOS devices.

[58] GarageBand is progressively capable recording and performance platform popularised by recording artists such as Radiohead and Kendrick Lamar. As early as 2005 artists such as T-Pain, an influential figure

iTunes[59]. In March 2019, Phil Schiller, Apple's senior vice-president of worldwide marketing reminisced about working with Jobs on GarageBand:

> We were inspired by the idea of a new breed of software. Maybe someday the next John Lennon would discover their talent using the computer the kid got for Christmas. (Techristic, 2019)

Apple's ongoing plans for GarageBand, like all their products, are closely guarded; however, in a possibly telling disclosure given to *Rolling Stone*, Schiller has mentioned the future of GarageBand:

> Without getting into specifics, I think machine learning – as in, systems and software, will enable more ability to help anticipate what someone wants to do – will be of value. (Miller, 2019)

GarageBand's everyday ubiquity in the music ecosystem masks how truly disruptive a technology it is – for the world's most popular smartphone, the iPhone, includes this free professional recording studio (Wherry, 2011). This brought about an unanticipated cultural change that has influenced ambitious AI music start-ups who now aspire to have an impact similar in scale to GarageBand and, like Apple, transform the established revenue streams for music makers. Unlike Apple however, many AI start-ups aim to fundamentally remove or dilute the commercial value of music IP, and this has destructive as well as creative implications for the music ecosystem.

Start-up Investment Motivations. The start-up sector is positioned between the academy and the multinational actors. Often start-up IP is the commercial application of academic research and one ultimate start-up financial objective is its future acquisition by a

in the start-up world, recorded his debut album *Rappa Ternt Sanga* via a laptop and Garageband (Sorcinelli, 2019).

[59] Such is Garageband's contemporary standardisation that it is easy to overlook how far-reaching an advance it is. The world's most popular telephone (iPhone) includes a free professional recording studio.

transnational corporation. Apple's purchase of the German music start-up Emagic in 2002 is an example. The purchase of the Emagic IP significantly contributed to the technological development of GarageBand (Wherry & Bell, 2002).

Start-ups require constant funding from a variety of investment sources including venture capital funds (VC) and private equity organisations. In order to gain investment funding, start-ups must continuously reassess and then illustrate the commercial potential of their IP. Start-ups, by necessity, must clearly indicate how their IP and services differ from rival companies. This requirement is particularly evident in the AI music sector, where a growing number of rival start-ups with similar products exist, attempting to monetise their technology. It is an essential investor expectation that the promised ability of AI music start-ups' inventions will disrupt and dramatically shape the global music marketplace. To comprehend the motivations and driving forces that govern investor expectation, the start-up paradigm needs to be explained.

This model revolves primarily on two commercial goals. One is the eventual Initial Public Offering (IPO) (Lowry, 2003), which rewards the start-up's investors, who then have the option to profitably sell a proportion or all of their shares to the public. If the IPO is successful, as in the case of Spotify IPO[60], the nascent company then has access to substantial new funding streams to aid a potential transition from being a start-up to becoming a transnational corporate player themselves. The aforementioned corporate acquisition of the start-up, before an IPO, is the second and alternative commercial objective (Loughran & Ritter, 2004). An example of which was the purchase of the AI start-up DeepMind by Google for €400 million in 2014 (Gibney, 2015).

The scale of disruptive ambition required from start-ups to demonstrate to the investment community the potential of their IP involves the promise of becoming a so-

[60] The Spotify IPO launched on the New York Stock Exchange, and the company received a valuation of $26.6 billion (Pisani, 2018).

called ‘unicorn’ and the implementation of the power law distribution model. In Silicon Valley, a unicorn is a start-up valued at over $1 billion, and there are currently over ninety worldwide (Pride, 2018: p. xi). Existing revenue and yearly growth percentages form the valuations of most software-as-a-service (SaaS) start-ups. However, as ‘no AI music start-up has been yet be able to monetise its technology’ (Velardo, Personal Correspondence, 2019), an AI music company’s unicorn potential is key to investor appeal. In a highly competitive investment market, the evaluation of a unicorn is dependent on the power-law distribution model:

> The key characteristic of venture capital is that returns are a power-law distribution… There are about 200 of these start-ups a year that are fundable by top VCs. About 15 of those will generate 95% of all the economic returns. (Covel, 2017: p. 249)

The mathematical calculations of the power-law model are fundamentally exponential. A VC investor firm can expect to encounter, at some level of initial proposal, upwards of 4,000 start-ups a year in the technology industry, of which a single fund can invest in about 20 companies. An anticipated ‘10X’ financial return is an industrial norm for start-up business strategies and the power-law distribution model oscillates upon a ninety per cent start-up failure rate, which has been established as the guiding rationale for the investment community framework (Krommenhoek, 2018). A consequence of the power-law distribution model is that VC expectation demands a 10X return on investment and this requirement informs the technological design of start-up IP. In summary, a start-up must promise to disrupt its domain and ideally demonstrate the potential to become a unicorn. In the case of AI music start-ups, their technology must promise to revolutionise the music ecosystem.

Start-up actors. In this section, seventeen AI music start-ups are reviewed. Their business locations reflect the global nature of this sector and disruptive force within the music

ecosystem. For each start-up, the discussion includes: a presentation of the company origins, the characteristics of the service, and options for purchase and use. Where available, music examples are provided to indicate the current creative capability of the sector.

AIVA

Figure 12: AIVA logo. Source: https://medium.com/@aivatech/composing-the-music-of-the-future-4af560603988

'Our mission: to empower individuals by creating personalized soundtracks with AI' (AIVA, 2020)

Founded in Luxemburg (2016), the AIVA CEO Pierre Barreau is a computer science graduate and registered music composer. Barreau's vision for developing the AI company was inspired by Spike Jonze's film *Her* (2013), in which the protagonist falls in love with an AI virtual assistant (Chivot, 2019).

AIVA's first project was to compose orchestral film music which was then conducted, performed, and produced by humans – an involvement that has often been overlooked in media reportage of the start-up. AIVA is now capable of bypassing human involvement and can produce completed audio recordings and MIDI files. AIVA Technologies initially raised €700,000 in funding from early-stage investors Kima Ventures (Crunchbase, 2020c). On the 9th September 2018, AIVA released a set of albums displaying the AI's capability to compose 'different moods for different geographies' in world music (Aiva Technologies, 2018). AIVA offers pre-set algorithms which will compose music in the following 'pre-defined styles' – '20th Century Cinematic', 'Modern Cinematic', 'Pop', 'Rock', 'Tango', 'Sea Shanty', and 'Chinese'.

AIVA's commercial focus is Business to Business (B2B) and its target clients are corporate and media professionals. The AIVA AI comprises of a recurrent neural network (RNN)[61] variation (Goel, Vohra & Sahoo, 2014) and uses a range of algorithms built by classifiers and auto-encoders to define music by genre, and its music output can be downloaded either in the format of wav or MIDI file.

Impressively, AIVA in its latest algorithmic iteration allows the user to upload a film scoring temp track as a training set analysis. The use of temp tracks is a routine methodology in film editing where often the editor will assemble a film rough cut to a provisional music soundtrack (Dubowsky, 2011).

The AIVA creative process is alluringly simple to the user: to produce an original music score, the customer seeks an existing influencer recording, one that has 'similar emotional impact' to that of the desired new composition. The descriptor of 'similar emotional impact' is interesting, as it provides a supportive framework for the involvement of a film professional (e.g. editor) to generate a soundtrack composition. Secondly, the descriptor may also avoid potential copyright infringement claims associated with the finished created work. Once the influencer track has been uploaded, the customer adjusts the similarity slide from left to right until satisfied with the selection. At this point the user presses 'compose now' and a downloadable mp3 and MIDI file is made available. Alternatively, the user can upload their own file to be used as the AI 'influencer' track. While most music composers prefer to transfer exported MIDI files back into their DAW of choice, it is indicative of the potential AIVA client base that customers can edit MIDI within the AI software, suggesting that AIVA users will not be limited to film composers and musicians.

[61] An analysis of RNN and CNN features in the Chapter 4.

AIVA offers three different subscription models: (1) a freemium option, limited to three monthly downloads for non-commercial usage with any created music copyrights retained by AIVA Technologies SARL; (2) for €14 per month, a user can avail of unlimited downloads, with a similar non-commercial licence and copyright retention by AIVA; (3) for €39 per month, unlimited downloads, a full commercial licence and full copyright ownership of the created work are offered. AIVA is currently in closed beta testing, in preparation for an intended IPO.

Remarkably, in 2018 AIVA became the first music AI to be officially recognised as a composer by a National Music Performing Rights Society – France's SECAM (La Rocca, 2019). As such, copyright law as we explore in the next chapter, designed for the exclusive creations of humans now extends to protect AIVA compositions. However, the music works created by AIVA are registered with the AIVA Technologies SARL[62] (AIVA, 2020).

AIVA music examples:

Genesis Symphonic Fantasy in A minor, Op 2: https://youtu.be/Ebnd03x137A

A Common Humanity: https://soundcloud.com/user-95265362/a-common-humanity-ai-composed-music-by-aiva

On the Edge: https://soundcloud.com/user-95265362/on-the-edge-ai-generated-rock-track-composed-by-aiva

Momentous Occasion: https://soundcloud.com/user-95265362/momentus-occasion
The Age of Amazement: https://soundcloud.com/user-95265362/the-age-of-amazement-original-composition-for-ted-2018

Blurred Frontiers; https://soundcloud.com/user-95265362/blurred-frontiers

[62] Unless the customer has purchased the music copyright through the third business to business Aiva offer.

Amper

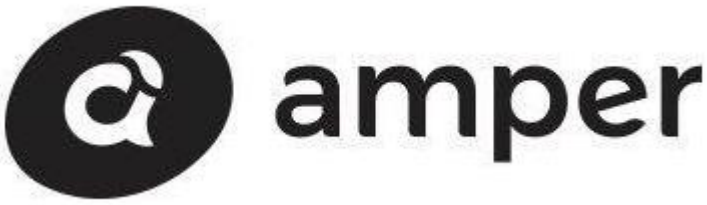


Figure 13: Amper logo. Source: https://www.ampermusic.com

'Amper Score enables enterprise teams to compose custom music in seconds and reclaim the time spent searching through stock music' (Amper, 2020)

Amper was founded in New York (2014) by Drew Silverstein, an award-winning composer, producer and songwriter, who appeared on the Forbes '30 Under 30' business list (Forbes, 2018) and has raised €9 million for the start-up (Crunchbase, 2020d). The latest incarnation of the Amper platform indicates that the start-up strategy is moving from a business to consumer to a B2B model. Amper is a browser-based platform and is similar to AIVA in its ease of use approach to the creative music process. The Amper API [63] can be embedded into customers' business software (Amper, 2020) thus extending its range of uses. A customer can create a score by choosing from a range of timbre and genre settings, while its pricing model is calculated by the number of employees of the customer company. In August 2017, the music artist Taryn Southern, who uses Amper Music to produce the backing tracks for her recordings, received international attention with the release of her new album *IAMAI* (Top40-Charts, 2020).

Amper promotes its system's audio quality by highlighting that it uses 'live recorded instrument samples' alongside its 'musician trained Creative AI'. However, unlike AI music start-ups who use human musical performances as their USP, the Amper

[63] API is an application program interface which allows the software to be adapted within a third party's own software.

AI produces AI MIDI files which are played through an audio sampler. This critical nuance in promotional statements can easily smudge important consumer distinctions between music made by humans and music made by machines.

Amper music examples:

Folk Corporate Driving, https://soundcloud.com/ampermusic/folk-corporate-driving?in=ampermusic/sets/new-music

Cinematic Quirky Fun, https://soundcloud.com/ampermusic/cinematic-quirky-fun?in=ampermusic/sets/new-music

Documentary Futuristic Tense, https://soundcloud.com/ampermusic/documentary-futuristic-tense?in=ampermusic/sets/new-music

Pop Dance Funky, https://soundcloud.com/ampermusic/pop-dance-funky?in=ampermusic/sets/new-music

Documentary Mallets Happy, https://soundcloud.com/ampermusic/cinematic-quirky?in=ampermusic/sets/new-music

Rock Indie Angsty, https://soundcloud.com/ampermusic/rock-indie-angsty-1?in=ampermusic/sets/new-music

Hip Hop Orchestral Determined, https://soundcloud.com/ampermusic/hip-hop-orchestral-determined?in=ampermusic/sets/new-music

Corporate Pop Inspirational, https://soundcloud.com/ampermusic/hip-hop-orchestral?in=ampermusic/sets/new-music

AlgoTunes

Figure 14: AlgoTunes logo. Source: https://www.algotunes.com

‘Add emotion and uniqueness to your content with music of your preferred mood and style’
(AlgoTunes, 2020)

AlgoTunes is a browser-based platform founded in 2017 and based in Campbell, California. Its product is analogous to AIVA and Amper, containing parameters incorporating style, mood and duration, presenting its user similar choices for creating music (AlgoTunes, 2020).

AlgoTunes has three purchase options: (1) a non-exclusive licence retailing for €0.99 provides wav, mp3 and MIDI files; (2) for €19.99, the customer receives the same three files, however with the important caveat that AlgoTunes will delete the files from its systems, preventing the customers' musical works from being available to other future users; (3) the AlgoTunes customer is invited to 'own the copyright at low rates' by purchasing an exclusive licence for the AI track, whereby the music copyright will be transferred to the purchaser.

AlgoTunes music examples:

Eerie Background, https://youtu.be/15qIv1P8Ovc

Calm Uplifting Music, https://youtu.be/xIN1D0tiYt0

Uplifting Afrobeats, https://youtu.be/dmmav2we7Io

Popgun

Figure 15: Popgun logo. Source: https://popgun.ai

'Popgun wants to break the musical Turing test' (Bailey, 2017)

Popgun was founded in Brisbane, Australia in 2017. In 2018 the company received funding from one of the most prominent VC companies in California, Khosla

Ventures Crunchbase (Crunchbase, 2020e)[64]. In addition to the new investment from Khosla, the start-up appointed to its board the former CEO of Pandora[65] Tim Westergren and expanded its team to sixteen employees (Dredge, 2018a). Popgun's principal business concept is to construct an environment where its AI is capable of analysing a user's streamed music (e.g. the user's Spotify account) to produce original complimentary music content (Dredge, 2018a).

Early in its development, the Popgun team designed an AI that could listen to a human pianist and analyse the data provided by the musician's performance. Popgun created Alice, a music duetting AI-human, akin in its conceptual purpose to that of both Google Magenta AI Duet and Georgia Tech's Shimon. By the end of 2017, Alice had sufficiently advanced that it could listen to any pianist regardless of style and generate convincingly appropriate music (Dredge, 2017a). Currently, Popgun's AI can compose and play a variety of musical instruments and its objective is to develop an AI capable of writing hit songs, however, these compositions have yet to be made publicly available.

One of the distinguishing aspects of this start-up's technology is the AI's capacity to generate musical backing tracks based on human *acapella* vocals. Using deep learning algorithms, the AI formulates and arranges a composition for piano, bass, and drums:

> What we are actually doing is imitating human creative skills: playing the piano, playing the bass – these are things that humans can do well, and if you give it enough information of how to do this you can learn to emulate that creative skill. (Weiszfeld, 2019)

The central concept of Popgun is to offer a tool that every producer will want to use: 'new creative tools to let those kids make whatever they can imagine' (Weiszfeld, 2019). In Popgun's planned music environment, 'those kids' will be able to begin

[64] Vinod Khosla is one of the four hundred wealthiest individuals in the world (Forbes, 2020).
[65] A leading music streaming service.

composing with only a vocal idea. The AI will listen to the idea and provide an instant music accompaniment (Weiszfeld, 2019).

Popgun music examples:

Popgun vocals, https://youtu.be/cd4f4i3HQ4w

Splash Pro, Drums, https://youtu.be/0VVamOCPXVE

Splash Pro, Bass, https://youtu.be/NCrR4iND7N0

Splash Pro, Vocal, https://youtu.be/WEsZosBdsmo

Splash Pro, Multi instruments, https://youtu.be/O7g-dEMoj-U

Amadeus Code

Figure 16: Amadeus Code logo. Source: https://amadeuscode.com

'Meet your artificial intelligence powered songwriting assistant. Quickly create unlimited song sketches on the go for free' (Amadeus, 2020)

Taishi Fukuyama, an established music producer in Japan and Korea[66], is the Chief Operating Officer (COO) and co-founder of the company. In May 2019, the start-up received €1.8 million from VC Firm World Innovation Lab (WiL) (Crunchbase, 2020f).

Amadeus Code invites users to generate original music through the selection of emotional parameters like 'aggressive', 'sad', or 'happy'. The app is marketed as an

[66] Fukuyama is also a Red Bull SoundClash champion and the CMO of on-demand vinyl crowdfunding platform QRATES (Winter Music Conference, 2019).

assistant for songwriters, producers, and composers – an AI partner designed to shape a selected music idea generated by the app into a final co-authored work. Amadeus Code is among the first AI-driven applications aimed at the smartphone market.

The company has two price points: (1) for €1.99, the customer can purchase a song created within the app. (2) for an annual subscription of €119.99, the user is given unlimited access to the Amadeus Code AI content. In recent updates, Amadeus Code, implicative of Popgun's design, undertakes to train the AI by examination of the user's Spotify listening tastes (Dredge, 2018b).

Amadeus Code music examples:

Love Song, https://youtu.be/C_lASlMjdOU

We Started Singing, https://youtu.be/wufjc8NuHZ4

Oh Dear Mama, https://youtu.be/aAqeYzlP3YM

Latin Pop Demo, https://youtu.be/CQlPnoxm20Y

Boomy

Figure 17: Boomy logo. Source: https://musically.com/2020/02/24/ai-music-startup-boomy-adds-rap-beats-and-tiktok-distribution

'Create original songs in seconds and get paid when people stream them, even if you've never made music before' (Boomy, 2020)

Founded by Alex Mitchel in 2018 in San Mateo, California, Boomy is a browser-based AI music platform and its strategy is to allow customers to generate music for

YouTube videos or gaming. Like other AI programmes reviewed, the primary promise of Boomy is to assist humans in creating music content (Boomy, 2020) so that they can 'generate beautiful, creative songs in seconds with artificial intelligence – for your fans, your friends, your business, or just for you' (Dredge, 2019b).

The Boomy team emphasise that their AI can analyse a user's saved music catalogue to generate music content, by seeking patterns and similarities to construct further bespoke personalised music. Boomy's offer is that each new AI song created contains ever-increasing musical elements that will further appeal to the listener. It offers a range of price plans: for €19, the customer can obtain full ownership of the AI-created content. There are also increasingly standardised tiered purchase options including a premium account that allows the customer to save an extensive selection of generated songs and build an extended personal library of AI music content (Boomy, 2020).

Boomy music examples:

Neo Brain, Casual Stargaze,
https://open.spotify.com/track/5xsMTDTHhFKa2d6YBbFbYF?si=aW3Bw3JUTDKn1QFTJcbP2QQ

Spiritual Ambition, Orbital,
https://open.spotify.com/track/7L9TXPT7TrA72IlrtpOFwo?si=Ch4El6E2Q_GNUyBJRWxMbA

Never Zero, Deal Breaker,
https://open.spotify.com/track/1jAgVQ0QqVZ3fxsUzT6tDg?si=ex641pZITtq0u6tywGp8NQ

Humtap

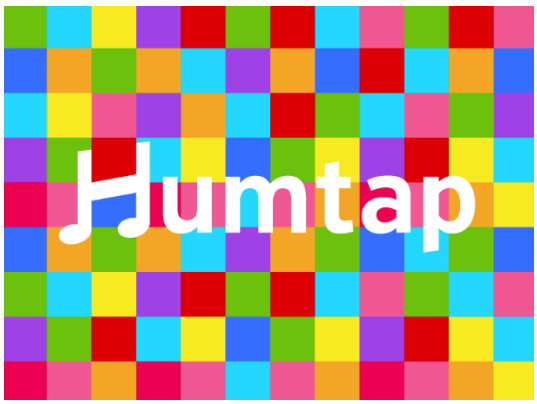


Figure 18: Humtap logo. Source: https://www.humtap.com

‘Humtap is democratising music creation’ (Humtap, 2020)

Founded in San Francisco, California in 2013 (Welcome AI, 2020), Humtap is a mobile AI music app. Notably, in comparison to other AI start-ups, the user is fundamental to the creative process. This distinction may prove to be decisive in the USP of whatever will be the future dominant AI technology in the sector. With Humtap the users simply hum a melody into the app and then taps the musical tempo to create content. As the user’s smartphone contains the AI, there is no need for a further connection to a remote central server. The Humtap design presents a possible commercial advantage for the start-up as the computational power of the phone renders all the necessary processing and calculations needed for AI to operate.

The Humtap user is presented with hip-hop, rock, and electro genres to generate content, and in the most recent Humtap update the user can record video footage to accompany the created music content. Humtap is based at Abbey Road Red, London, a leading digital hub for music-based AI start-up companies (Dredge, 2018c). The open innovation department of the legendary recording studio was launched in 2015 and is

self-ascribed as ‘Europe’s first, and leading, music tech specific incubator programmer’ (Abbey Road Studios, 2020).

Humtap music examples:

Sandy Destiny, https://youtu.be/blNgm6L7Pps

Ludwig

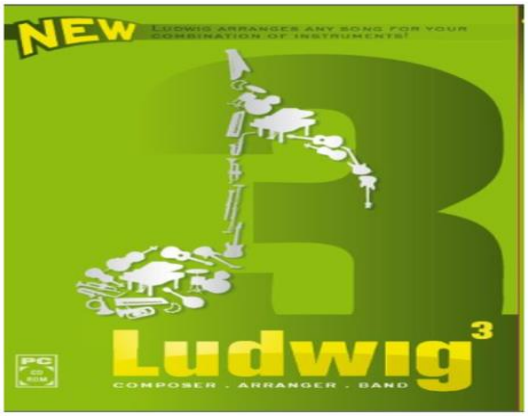


Figure 19: Ludwig logo. Source: http://www.write.music.com

‘Write great songs with automatic arrangement’ (Ludwig, 2020)

Founded in Germany in 2006 by Ludwig Matthias Wüllenweber and Frederic Friedel, Ludwig originally was first developed as a chess-playing software (Friedel, 2006). The Ludwig project is available both on desktop and iPad App variations, and provides the user with a comprehensive musical arrangement app for an uploaded concept. The user can either enter a musical idea or avail of preinstalled songs in the software (Ludwig 3, 2011). Ludwig provides music notation for a variety of instruments appropriate to the selected genre. There are over fifty different styles to choose from and up to sixteen individual musical elements can be requested (Friedel, 2018). Ludwig allows the customer the option to download the completed piece in mp3 or wav format.

Alternatively, a traditional Music-XML format notation, similar to that offered by Vico's Iamus AI, is available.

Ludwig music examples:

Crying Gloves – Big Band, http://www.write-music.com/fileadmin/AUDIO/Ludwig/crying_gloves_bigband.mp3

Glorious Hip – Dance, http://www.write-music.com/fileadmin/AUDIO/Ludwig/crying_gloves_bigband.mp3

White Necklace – Rock Ballad, http://www.write-music.com/fileadmin/AUDIO/Ludwig/white_necklace_rockballad.mp3

Woody Top – Swing Waltz, http://www.write-music.com/fileadmin/AUDIO/Ludwig/woody_top_swingwaltz.mp3

Ludwig, Seductive Song – Pop Ballad, http://www.write-music.com/fileadmin/AUDIO/Ludwig/seductive_song_popballad.mp3

HumOn

Figure 20: HumOn logo. Source: http://hum-on.com

'The simplest music creation app for dreamers' (HumOn, 2020)

HumOn emerged from Samsung's C-Lab, in South Korea in 2015 (Samsung, 2018). Comparable to Humtap, the original concept was to record and produce a musical accompaniment to a user humming. It offers a selection of in-app purchases supporting additional genre options, echoing the business model of popular gaming apps. In 2018 HumOn changed its business direction and concentrated on creating AI music content.

The goal of the start-up is now to create royalty-free material for its users' videos (HumOn, 2020).

HumOn music examples:

Bossa Nova, https://youtu.be/Hpip618ENEM

Dramatic Movie Music, https://youtu.be/q9zO0FKv2Xg

Vlog, Travel Intro Music, https://youtu.be/zpOrzePImEA

Disco, Lullaby Music, https://youtu.be/tPBohNHJg-M

WaveAI

Figure 21: WaveAI logo. Source: https://www. withalysia.com

'Augmenting Human Creativity Through AI' (WaveAI, 2020)

Professor Maya Ackerman founded the Californian start-up and created the ALYSIA ML system (Ackerman & Loker, 2016). Apart from being an academic, Ackerman is an opera singer and music producer and is one of the few women leading in the start-up sector. Before the commercial release of the WaveAI, the company created three musical tracks and released them via Spotify and Apple Music (Dredge, 2018d). WaveAI are explicit in their intention, stating that the app:

> Democratises creativity that makes creative self-expression more accessible. Our product, ALYSIA, allows everyone to create original songs in minutes, even if they have no prior music experience! (LinkedIn, 2020)

WaveAI encourages the participation of non-musicians to produce artistic content and its AutoVoice feature enables the app not only to compose a melody but with the addition of the user lyrics, the AI will sing the users words. The software studies the lyric's syllables and its algorithms create genre relevant melodies for the words.

WaveAI's marketing strategy builds on the concept behind start-ups like HumOn and is a free to download mobile app with subsequent microtransactions as the basis of its financial model.

WaveAI music examples:

Arido Taurajo, https://youtu.be/6G_LmxWYUOU

Space Time, https://youtu.be/4gAXjML9dZk

Alysia, https://youtu.be/qImdHUjQlB4

WaveAI, Alysia, https://youtu.be/wilm5t0bbhw

Melodrive

Figure 22: Melodrive logo. Source: https://youtu.be/AIbR-s_Rkvs

'Adaptive AI Solutions' (Melodrive, 2018)

Melodrive's co-founder and CEO Valerio Velardo is a classically trained pianist with a PhD in Music and AI. Melodrive has been developing additional features to the existing Unity[67] gaming software package (Melodrive, 2018). Founded in Berlin in 2017, Melodrive released the first beta version of its AI on 1st October 2018, and the VC foundation Boost has funded the start-up. Melodrive is an AI adaptive music generator designed for game developers.

The Melodrive user selects bespoke instruments and a music style to accompany the soundtrack to their gameplay. Communication between the game and the AI is fully programmable and operates in real-time, and this approach is known as deep adaptive music AI.

Melodrive music examples:

Melodrive, Demo, https://youtu.be/p32BT93JVmw

Melodrive, https://youtu.be/VzRQNQQd2Lc

Endel

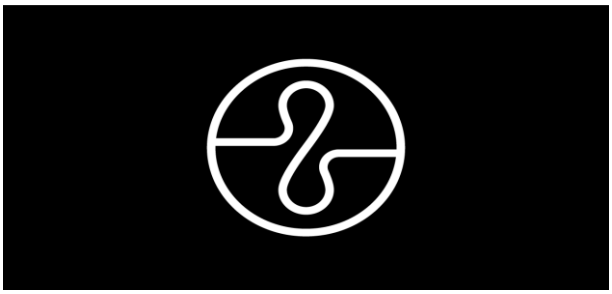


Figure 23: Endel logo. Source: https://endel.io

'Personalized sound environments to help you focus, relax, and sleep' (Endel, 2020)

[67] Unity is a gaming engine launched by Unity Technologies and supports over twenty-five gaming platforms including IOS, Linux, PlayStation, Xbox One, Oculus Rift and Windows.

Founded in Berlin in 2018, Endel gained global media coverage when it was announced that the AI had signed a record deal for twenty albums with Warner Recording Group (Deahl, 2019b). Prior to the Warner deal, Endel had received funding from the Amazon Alexa accelerator program. Five Endel albums were released in 2019, with fifteen more scheduled to follow and the company promises that 'in the future, Endel will be able to make infinite ambient tracks' (Deahl, 2019b). In 2018, Endel was accepted for the TechStars Music accelerator program – TechStars is a yearly funding program created with leading music record companies 'to invest in the ecosystem of music' (Techstars, 2019).

The Endel proposition highlights the trend towards the personalisation of music. The Endel intention is to create an endless individuated soundtrack suited to a customer's life. The AI responds to the user's change of mood and energy levels and analyses personal data including the time of day, current weather, the user location, and customer biofeedback statistics. Based on this data, the AI will then produce a score to accompany the user's current activity (Endel, 2020).

Endel music examples:

One Soothing Whites, https://youtu.be/q-GEnuDm8Q4

Six Bold Buttercups, https://youtu.be/g8Rwk9cl77Y

Twenty Nighttime Breezes, https://youtu.be/AkJ3NS7wuzw

Fourteen Shining Slumber, https://youtu.be/eCvw56ukzQI

Nineteen Roadside Rivers, https://youtu.be/rFdAadK9Wwg

Three Through The Mist, https://youtu.be/51tux_ChnWI

Mubert

Figure 24: Mubert logo. Source: https://mubert.com

‘Every day we create millions of minutes of copyright-protected music for listeners, creators, locations & apps.’ (Mubert, 2020)

The start-up was founded in San Francisco in 2016 and creates B2B soundtracks for hotels, shopping malls and other public spaces (Dredge, 2019c). The company claims that more than sixty-five thousand users are currently testing its background music for gaming via live streams on the Omlet Arcade service (Dredge, 2019c). Also, a company press release states that Mubert is working with Adidas on a ‘secret channel’ of music for an upcoming advertising campaign (Mubert & Adidas, 2020).

Mubert produces royalty-free background music in real-time through a mobile app. The user selects a mode - ‘Study’, ‘Work’, ‘Dream’, or ‘Relax’ - and its music content is primarily electronica. It is free to download through the Apple Store and Google Play, and features a range of in-app purchase add-ons, while the cost of a commercial licence starts from $1.99 per unit.

Mubert music examples:

Chill music, https://youtu.be/g-ccfSARolY

Dynamic music for cardio, https://youtu.be/0T5kgtuXzAo

Music for spa, https://youtu.be/yb3YhHzc78w

Music for love, https://youtu.be/eFkR60kf3-k

LifeScore

Figure 25: LifeScore logo. Source: https://www.abbeyroad.com/news/abbey-road-red-demo-day-2019-recap-2524

'Generate original, unique, adaptive music that is either fully autonomous or responsive in real-time to user and environmental data inputs.' (LifeScore, 2020)

The LifeScore start-up joined the Abbey Road Red Incubator in December 2018. LifeScore emerged from an earlier project called 'Compose Yourself' which was designed as an educational tool for young children (Dredge, 2019d). It required no prior music training, and participants were presented with a set of graphics cards and asked to arrange them into a compelling visual pattern. Each card contained an orchestral audio recording and a random selection of cards produced a musical sequence, which was recorded and available to download.

Expanding upon the concept of 'Compose Yourself', Philip Sheppard and Tom Gruber, one of the creators of the Siri AI, came together to develop LifeScore. The Abbey Road music libraries provide the AI training sets for the LifeScore proprietary 'cellular composition' algorithms. Interestingly, LifeScore analyses not only the officially released music recordings but also the Abbey Road archive tapes, music that has never been publicly available (LifeScore, 2020). With LifeScore, the start-up aspires to create a setting where music and sound adapt to the users' mood and biometrics. LifeScore is an AI that, once functional, intends to be able to make the listening experience of the same album unique at each engagement. In May 2020, a LifeScore soundtrack is used in the

interactive live-action series *Artificial* which is broadcast on the Twitch platform. The music changes during the broadcast in response to viewers' reaction.

Philip Sheppard explains to *Wired* that this was only the beginning of the company's ambition: 'I would love that to happen every time someone listens to music, if possible…So they get the pleasure of almost being able to be the composer in that equation' (Levy, 2008). LifeScore is developing variations of this bespoke and hyper-personalised music, for environments such as office-space and commuting. A LifeScore composition will never theoretically end as it is constantly morphing, and the act of co-composition between the AI and the human will often, by an unconscious activity, be triggered by the biometric emotional response of the user. Again, comparable developments were anticipated by Attali when he wrote of the future composing network that:

> improvisation is presented as a form of composition…the modern composer…is now rarely anything more than a spectator of the music created by his computer. He is subject to its failings, the supervisor of an uncontrolled development. (Attali, 1985 [1977]: p. 114)

Departures from conventional understandings of authorship, as presented by LifeScore, will be considered later in this chapter, and in Chapter 4 within the legal understanding of copyright creation.

LifeScore music examples:

LifeScore, https://www.twitch.tv/twitchverse/clip/AntediluvianArbitraryCrabPunchTrees

Artificial Season 3 *Maybe* Trailer https://www.youtube.com/watch?v=8joIG-p2iqA

AI.Music

Figure 26: AI.Music logo. Source: https://www.aimusic.co.uk

‘Music that listens to you’ (AI.Music, 2020)

AI.Music is also based at the Abbey Road Red Accelerator hub. In 2017, the start-up revealed plans to create an AI that will be able to contextualise music and change the way people approach music content, stating that the company is ‘evolving music from a static, one-directional interaction to one of dynamic co-creation’ (Falconer, 2018). In 2018 the company gathered £5 million in funding to build a showcase app and to partner with different artists and record labels (Dredge, 2018e). The principal concept behind AI.Music is to employ the AI to rearrange and remix existing music content subject to the particular environment of the listener, so that the customer can connect more fully with the content.

AI.Music music examples:

AI.Music, Case Study, https://www.aimusic.co.uk/casestudy

Xhail

Figure 27: Xhail logo. Source: https://www.xhail.com

'The evolution of music creation & licensing. Quickly create affordable, one-of-a-kind, professional-quality music tracks.' (Xhail, 2020)

The Irish music start-up was founded in 2013 by Mick and Moira Kiely. Mick Kiely is the CEO and has more than thirty years of experience in music composition and live performance. The start-up secured €3 million in private funding for its first three years in operation (Keane, 2018). The company has offices in Ireland and Los Angeles and received an additional €1.5 million in private investment in 2018.

Xhail is a cloud-based web platform that allows users to create original music content. The highly significant start-up distinction is that human musicians provide to Xhail music content which the AI creates into new recordings and compositions. An exclusive global licence on all music content created on the Xhail platform is available. Xhail is separately examined in the ethics chapter due to its approach to human-centre values and distortions in the music ecosystem caused by AI music development.

Xhail music examples:

The Duel Trailer, https://vimeo.com/314373255

Ellie The Ace, https://vimeo.com/314372924

Trailer Demo, https://vimeo.com/314372374

Jukedeck

Figure 28: Jukedeck logo. Source: https://www.jukedeck.com

‘We’re developing musical artificial intelligence to build tools for creative people’ (Jukedeck, 2018)

Launched in London in 2012, its founder is Ed Newton-Rex, an arts graduate from Cambridge University whose interest in computer programming led him to AI music generation (Constine, 2015). Newton-Rex began the company with a team of nineteen employees and Jukedeck’s VC investment has been €3.4 million, with its principal funding partner – Cambridge Innovation Capital. The Jukedeck platform went live in 2015 and has since created one million music tracks (Thompson, 2019).

Jukedeck is an AI-powered browser-based platform which generates recordings in a range of genres, from folk to so-called ‘corporate’, through a choice of pre-set parameters for the user that shape its music output. A customer can create a unique music composition and recording through the choice of instruments, genre, mood, tempo, track length and the determination of a ‘climax point’. The minimum length of a Jukedeck recording is five seconds, with a maximum duration of four minutes.

Jukedeck is a free-to-access platform which targets three markets for its service: video creators (professional and DIY), musicians, and gaming developers. A promoted attraction is the invitation to create personalised music, while professional businesses can access the platforms API to apply Jukedeck within its own software applications. Jukedeck uses a freemium model, where individual or business users with less than ten employees can create music for €0.99, or for free. For firms with over ten employees, the

price is €21.99 per track, with a third option, to buy out the music copyright exclusively for €199.

Jukedeck's principle USP is that its users can generate bespoke royalty-free music soundtracks for personal YouTube videos (Dredge, 2017b) as illustrated in figure 29 below.

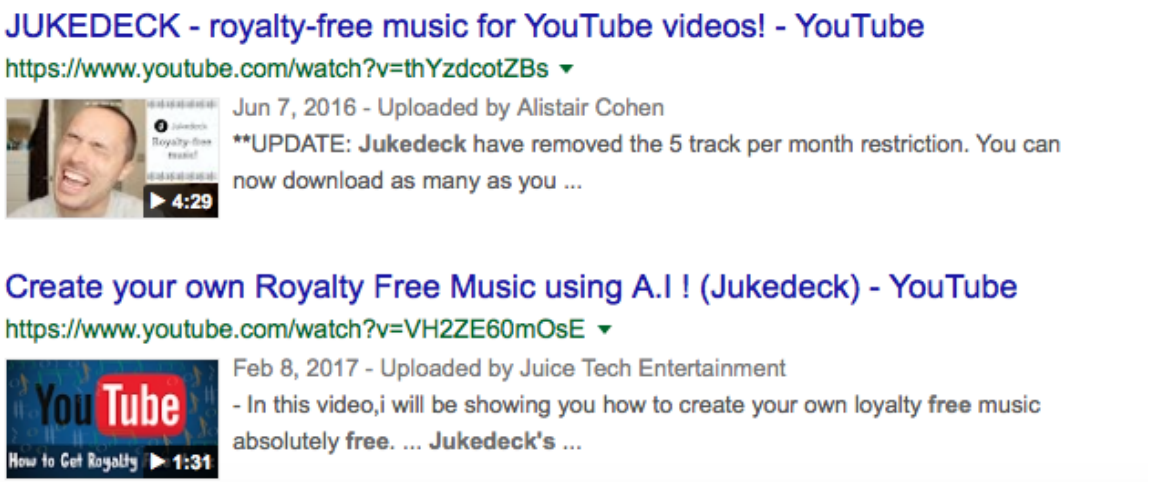


Figure 29: Google ads for Jukedeck. Source: http://www.google.com

In 2018, Jukedeck entered the mainstream music industry when best-selling Korean K-Pop artists began to perform with Jukedeck content (Dredge, 2018f). Bands like SPICA and Highteen were participants in a highly promoted commercial experiment:

> Both Jukedeck and Enterarts firmly believe that, rather than replacing human composers, the power of AI lies in its ability to be used as a tool by human composers and producers to fuel their creativity. (Dredge, 2018f)

As was observed in the analysis of the start-up paradigm trajectories, AI start-ups' ambitious motivations rarely lead to financial success. However, this was not the case of Jukedeck. On the 23rd July 2019, it was announced that the Chinese company TikTok, the phenomenally successful karaoke app, had purchased Jukedeck (Ingham, 2019a). The financial implications of this acquisition are discussed in the next section regarding the Chinese role as a newly transformative global actor in the music ecosystem.

Jukedeck music examples:

Jukedeck, Piano, https://soundcloud.com/jukedeck/piano-1?in=jukedeck/sets/jukedeck-2018

Jukedeck, Dalston Graffiti, https://soundcloud.com/jukedeck/1-dalston-graffiti-synth-pop?in=jukedeck/sets/jukedeck-2018

Jukedeck, Ethereal Thunder, https://soundcloud.com/jukedeck/3-ethereal-thunder-moody-electronica?in=jukedeck/sets/jukedeck-2018

Jukedeck, Miniscule Change, https://soundcloud.com/jukedeck/4-miniscule-change-dreamy-electronica?in=jukedeck/sets/jukedeck-2018

Jukedeck, Vibrant Lives, https://soundcloud.com/jukedeck/6-vibrant-lives-funk?in=jukedeck/sets/jukedeck-2018

Jukedeck, Paris Memories, https://soundcloud.com/jukedeck/09-paris-memories-deep-house?in=jukedeck/sets/jukedeck-2018

Jukedeck, Dreamy Path, https://soundcloud.com/jukedeck/13-dreamy-path-moody-dance?in=jukedeck/sets/jukedeck-2018

3.3.4 China

Asia is a leader in AI development (Daly, 2018) as well as a rapidly developing actor in recorded music (IFPI, 2017). However, the economic rudiments in China regarding IP practices and the distribution of recorded music are distinct to the Chinese market.

With over eight hundred million internet users, China has the world's largest online population (Thomala, 2020). Both Google and Facebook are banned (Leskin, 2019), and in their place a range of indigenous technology companies have flourished. Baidu is the domestic version of Google, Alibaba the nation's Amazon and QQ the Chinese Facebook. Though Apple Music has been available since 2015, it does not have a significant market share (Wong, R., 2019). Instead, companies including KuGou, QQ music, KuWo and NetEase Cloud Music dominate the music streaming market (Haldane, 2018). The majority of these music streaming companies began as illegal music file-

sharing sites and until 1990 copyright legislation did not exist in China (Wong, F., 2019). However, during the 1990s, this began to change as part of the new national economic development policy. In 2015, to emphasise it once again, the music market significantly changed regarding music copyright and the Chinese market became one where 96% of its consumers listened to licensed streamed music (Music Market, 2019). Crucially, 70% of all recording revenue in China is now derived from music streaming – a percentage figure comparable to that of the US, the largest market for music recordings in the world (IFPI, 2017). The question is why the financial returns from recorded music in China total only 5% of the returns of the US market? The reason for the disparity between revenues generated is that the Chinese consumer model for recorded music is different from the existing western paradigm.

Music streaming in China operates under a financial model comparable to global gaming like Fortnite (Ganti, 2020). In the Fortnite financial model, the offer of a free game draws consumers in, and the user's gameplay is monetised by microtransactions within the game (Lloyd, 2019). This economic model is grounded in the Chinese tradition of the Red Envelope (Hanna, 2012) and explains the difference between China and western world IP music remuneration. As historically practised in China with the giving of money for special familial occasions, the Red Envelope model is now exercised where money is gifted to artistic performers as a display of appreciation by fans. The Chinese music market relies heavily on the donations by and virtual gifts of its users[68]. Nevertheless, the Red Envelope financial model is unpredictable because payments are voluntary and any proportionate fair payment to the rights holders of the music cannot be guaranteed.

[68] During Covid-19, a variation of the Red Envelope practice appeared in the wider music ecosystem with the introduction of virtual 'tip jars' on Facebook and Spotify, allowing fans to make voluntary financial donations to the artists.

Founded in 1998, Tencent Holdings Limited is the world's largest gaming company (Gilbert, 2019)[69] and its subsidiary music company, Tencent, controls the majority of China's music services and has over six hundred million active users which includes thirty five million paying customers who pay an average monthly payment of $1.27 (Ingham, 2019b). In 2019, Tencent purchased 10% of the world's largest record company, Universal Music Group, and further increased Chinese influence on the global music industry (Chen, 2020).

Tencent's chief music streaming rival in China is Beijing ByteDance Technology Co Ltd (known as ByteDance). ByteDance has had a significant impact on the global music ecosystem through its ownership of TikTok. As we shall see the acquisition by TikTok of the AI music start-up Jukedeck in July 2019 places TikTok and its parent company ByteDance, at the centre of the near-future AI music contemplation. To appreciate the potential significance of this acquisition, an overview of TikTok is presented to note its current (pre-Jukedeck) impact on the music industry.

TikTok evolved from Shanghai start-up Musical.ly, a mobile phone app which allowed users to produce music videos that included an element of personalised performance. At the time of its acquisition, Musical.ly had sixty million users lip-syncing to music content (BBC, 2019). Following the Bytedance acquisition, TikTok became the new name for Musical.ly, and it's phenomenal success and music industry power is shown in the story of Lil Nas X and his recording *Old Town Road.*

The recording *Old Town Road* by Lil Nas X was initially released independently via SoundCloud in December 2018. However, when the track became a meme on the TikTok Yeehaw Challenge[70], the recording went viral across the internet (Strapagiel,

---

[69] In which Tencent also holds a 40% ownership of the Fortnite game through its acquisition of developer EPIC Games in 2012 (Gilbert, 2019).

[70] The premise of the TikTok challenge is that the user 'transforms' during their 15-second karaoke performance into a cowboy or cowgirl, often after drinking a beverage marked 'yee haw juice' (Strapagiel, 2019).

2019). Columbia Records licensed the recording and, aided by country music artist Billy Ray Cyrus remix, *Old Town Road* went on to spend seventeen weeks at No 1 on the Billboard Hot 100 singles chart, breaking all previous records in the chart's 60-year history and gaining over 300 million YouTube views (Yeung, 2019). 'I should be paying TikTok' – 20-year old Lil Nas X was quoted during an interview with Time magazine in April 2019 (Alexander, 2019). The *Old Town Road* example illustrates the paradoxical influence of TikTok on the global music ecosystem when its popularity collides with accusations[71] that TikTok consistently violated US copyright law and the rights of songwriters. These accusations led to Senator Marco Rubio asking the US Government to launch an investigation into ByteDance[72] (Hale, 2019). These charges were refuted by TikTok in a statement that it had in fact:

> broad licensing coverage across the music publishing industry', highlighting that the platform had 'spurred the success of artists and songwriters through its viral meme culture, driving chart hits and building household names. (TikTok, 2019)

The phenomenal success of TikTok, despite its controversial approach to many western IP practices, provides an example of the start-up power-law paradigm in action. The influence of TikTok on the music ecosystem, and its exponential growth, was indicated in a marketing report by Morning Consult (2019). This report shows that the majority of US millennials, who once would have aspired to being sports or pop stars, now desire to emulate social media influencers through apps like TikTok.

On the basis of the global success of TikTok, the pressure of expectation and the rewards that exist for AI music companies within the global music ecosystem are rapidly

---

[71] Accusations made by the National Music Publishers Association US (NMPA).

[72] TikTok was fined $5.7m by US authorities for illegally collecting children's data. It has also been criticised for censoring videos that might upset the Chinese government (Matsakis, 2019). David Israelite, President of NMPA responded 'TikTok incorporate musical works that have not been licensed and for which copyright owners are not being paid' (Stassen, 2019a).

growing. The influence of China along with the Jukedeck acquisition indicates that TikTok, who helped Lil Nas X break the US Charts records, now has the technology to replace human made content with AI created music in any of their applications and streaming services. What kind of challenges emerge from the AI actors reviewed? And specifically, what financial impact does this have on IP and employment within the music ecosystem? These are the questions that are explored next.

3.4 The Impact of AI Actors on the Music Ecosystem

3.4.1 FANG+

Senior representatives of the FANG+ describe their corporations as 'AI companies' (Brooker, 2019) and though the FANG+ AI music projects are modestly resourced, when compared to their other AI corporate divisions, music has aided the exponential growth of many of these companies and serves a vital marketing role. However, the FANG+ financial contribution to the music ecosystem does not correlate with the profits they receive directly from music revenue. Any business, especially one built on the principle of the disruption model, does not have to be equitable or act in the common good – however, it must operate within the law.

The transnational actors' AI technologies provide revenue from music that is not available as a resource to other affected actors in the music ecosystem. An example of this mechanism is the role of advertising. It is forecasted that digital advertising will soon account for over 50% of all global advertising, and currently Facebook and Google share 80% of all international digital advertising revenue (Team, 2019). YouTube's monthly advertising income exceeds $1 billion (Rushe, 2020)[73], while being the world's most

[73] This figure relates solely to Google's YouTube advertising income and does not include Display or Search advertising income.

popular music streaming platform, it pays significantly less than similar services sites like Spotify. The Red Envelope representing the Chinese model is a further extension of this disparity.

The FANG+ companies' presence in everyday life belies just how nascent they are[74]. It is perhaps this fact alongside stated ambitions such as 'don't be evil' (Boss, 2010) that could still enable a multi-actor intervention. To articulate financial concerns and create a new human-centred value system for the music ecosystem, ethical regulatory protocols are needed.

Before stating what values should govern these regulations to address the challenges emerging, a better understanding is needed of what caused the disruptive influence of the AI music actors presented in this chapter within this ecosystem.

3.4.2 Proliferation and Hyper-personalisation of Music

The observation of Vinod Khosla reflecting on the near-future application of AI technologies to established modes of music practice introduces the challenge of proliferation of music. Khosla is one of the world's four hundred wealthiest people and an investor in Popgun, who predicted in June 2019 that 'I actually think ten years from now, you won't be listening to music' (Etherington, 2019). Khosla did not predict the end of music but that the ecosystem would be changed by technology. In extension to Khosla's prediction – the consumer will not be listening to recorded music, which is fixed in time; instead, the world will be listening to an ever evolving, hyper-personalised and bespoke AI-curated music soundtrack. This vision is strengthened by Attali's diagnosis of a 'composing' network where the prosumer 'won't be listening to music' but will become a creative actor in the music making process.

---

[74] Companies and their founding dates: Google 1998; YouTube 2005; Facebook 2004; Spotify 2006; ByteDancce 2012; TikTok (formerly Musical.ly) 2014.

The concept of music personalisation is heightened by the proliferation of available content. Common-sense concepts of scale and capacity in music are being disrupted by the exponential production of music in the 21st Century. In May 2019 Spotify revealed that it uploads a remarkable forty thousand new recordings each day (Ingham, 2019c). This statistic appears conservative to AI music actors like Boomy's CEO, Alex Mitchel:

> I think people in our world – you know, the music world – we hear that, and we think it's a big number, right? We're, like, *oh my God, 40,000 tracks*. Do you know how many photos go to Instagram every day? Off the top of your head? It's 95 *million*. 95 million photos go to Instagram every *day*. And there's something like 350 million photos that go to Facebook every day. There will be a million songs a day. There will be ten million songs a day. Of this I'm *certain*. (Hu, 2019)

Mitchel's future 'certainty' of 'ten million songs' derives from his announcement during the *WIPO AICM* session that between October 2019 and February 2020 Boomy users had created 'about three hundred and fifty thousand original works and recordings because it takes five seconds to create something original' (US Copyright Office, 2020a: p. 192).

Moreover, Spotify's announcement of forty thousand tracks being uploaded daily led Scott Cohen[75] to observe that 'the best way to ensure that nobody hears your music is to release it' (Wilson, 2019). These observations of the capacity of music generation are confirmed by the sheer vastness of the catalogue created at Francisco Vico's Melomics109 Library, where over one billion Melomic AI recordings were made available in the public domain. Is this musical abundance a cultural sign of Attali 'crisis of proliferation' (Attali p.45)? What are the possible societal or practical consequences of such AI prolificacies?

[75] Scott Cohen is Chief Innovation Officer at Warners Recording Company.

AI actors differ in their responses to these questions. By deleting his *EMI* software and creating *Emily Howell*, David Cope decided to redesign the AI in order not to suffocate the human creator, whereas Francisco Vico outlined that music abundance can bring a viable commercial future via what is now known as AI audio branding[76]. Vico demonstrated an example at the Muse Tech Convention in London in 2015, where he showed how the Nokia ringtone could be interpreted with countless variations by Melomics (Bosker, 2017). Andrew Dubber[77], in turn, drew attention to the concept of digital dissolubility like live performance, in reference to music content which might exist for a limited period of time before disappearing completely. What is the status of AI music, if like the eighty-seven million pieces of content posted each day on Snapchat (Omnicore, 2020), it then digitally dissolves after a period of time?

The possible consumer excitement of use of millions of iterations of a single piece of music can be glimpsed in digital contexts[78]. A related AI application is the adaptive personalisation of music by Melodrive and AI.Music. For instance, LifeScore's AI plans to make the experience of the same album unique each time it is played resemble a cherished traditional function of a live musical performance – to be different in each rendition of its execution. The personalisation of music by technology is, once again, foreseen by Attali when he writes 'It may herald the end of the isolable musical work, which have only been a brief footnote in human history' (Attali, 1985 [1977]: p. 112).

3.4.3 The AI Music Assistant

AI musical applications pose a question of what creative tasks will remain for the future human professional and prosumer. AI music technologies are ubiquitously

[76] The term audio branding is an area of the advertising industry that curates the development of a musical representation of a client's corporate identity.
[77] Director of Music Tech Fest (Music Tech Fest, 2020).
[78] Gustav Metzger the pioneer of auto-destructive art provides a high-art variation to the questions of the value of millions of iterations of a single piece of music (Metzger & Kaligofsky, 2005).

promoted as an 'assistant to human creativity' (Narayen, 2019), however once the AI technology is sufficiently adept, the requirement for the human partner to be a trained music professional (i.e. a sound engineer, musician et al.) diminishes. As each step of the creative process, from music concept to mastering, can already be separately enhanced, replicated or replaced by AI, then it can only be a matter of time before all of these creative steps are available within one AI service. An observation echoed by David Hughes at the *WIPO AICM* session: '[AI] can create everything from scratch to finish for a sound recording it might not be good, but the AI is there and it's already happening' (US Copyright Office, 2020a: p. 185). The question remains: what will be left for the human to do?

It is arguable that humans' music making capacity could decline if the cultural capital, as well as the financial rewards, diminish on the path to 'democratic' progress as announced by AI music actors. In fact, AI music development, when ethically harnessed, can lead to other democratic outcomes. For example, this can involve the underfunded domain of music education. Start-ups like Ludwig's approach, where instead of the AI composing the content, the software assists with expanding human-created music arrangements, provides one example of how AI can support traditional goals of music education. This recalls Garry Kasparov's observation in his biography *Deep Thinking*, in which the author noted that after prolonged scepticism, he was excited about how AI had improved the overall global level of chess playing (Kasparov, 2017: pp. 231-234). A similar positive observation on AI influence was made by Fan Hui regarding the Chinese board game Go (Metz, 2016)[79]. If Kasparov and Hui's experience is applied to music creativity, then the choice appears: for the system user and designer to limit the transfer of

[79] In 2016, when Fan Hui first played the Google Machine (Fan Hui who helped train Google's AlphaGo AI to beat the world champion Lee Sedol at Go), he was ranked 633rd in the world at the game. Within six months Fan Hui moved into the top three hundred players in the world. The machine he taught to play Go, then taught him to be a better player (Metz, 2016).

creative agency from the human to the AI, so that the entanglement with technology makes us more curious and more musical. These choices can only be made by informed consumer decisions.

3.4.4 Authenticity

Mick Kiely built Xhail on the conviction that human-created music is superior to that of AI, and that the music ecosystem will always favour human creations. However, in the case of AI technology the leading voices are in continuous collision. For Taishi Fukuyama (Amadeus Code) the inverse inference is drawn – that users actually prefer AI generated music (Fukuyama, 2020). Fukuyama thoughts are mirrored by one of Popgun's founders, Stephen Philips:

> My kids and the generation coming through, they've been brought up on iPads and Roblox and Minecraft and generative music. It's in the games they love, being pumped into their heads, and they just get it. If I play my kids the Rolling Stones, they don't get it. If I play Radiohead, they're like 'Who's this whining bastard?' This next generation is probably going to adore AI music. We will hate it because we don't get it, and they will love it because we hate it! So, it will become their thing. (Dredge, 2017a)

As the future of AI technologies is unwritten, such innovative voices as Philips' should be welcomed and their opinions widely discussed, but the questions are not new to musicology. The concept of authenticity is still in the centre of the debate between human and AI music, and only the musical context and nature of the actors involved vary. The broader concept of authenticity in musicology will be recalled within the context of the DJ case study shortly.

3.4.5 Employment

While this review is concerned with music copyright rather than debates within historical musicology, other points regarding the impact of AI actors on the music ecosystem are raised here in the context of the destabilisation of the work environment.

The Red Envelope model is an example of a radical departure from standard norms in the music industry. Up to now, China has not appeared to facilitate any replacement of the western model, and TikTok has been scrutinised for developing its product amidst copyright infringement claims. However, the nature of the TikTok controversies are not new nor isolated to practices in China. The TikTok dispute is a fragment of historic debate regarding the proportion of income revenue that music artists receive. As explicitly outlined by musician and record company CEO Brett Gurewitz[80] to Pitchfork in 2019:

> It [TikTok] is what we saw with Chuck Berry getting a Cadillac instead of royalties…It does not really matter if it's vinyl or an app; every time there is a new way of making music, the creators always get screwed. (Cooper, 2019)

It is this historic practice, in which artists contend that they have been unfairly rewarded for their work, that AI technologies introduces a new level of complexity and concern.

The January 2017 report from the McKinsey Global Institute (Manyika, 2017) is the first time actors, musicians, and teachers were listed as under threat from automation. This report was of concern, as the average gross income for self-releasing musicians in the US had already dropped to $26,518 by 2012 and entire music trade skills had been

[80] The founder of Epitaph Records and a member of the band Bad Religion.

reduced to hobbyist activities (Timberg, 2015). The advancement of the digitalisation of the music industry from the late 1990s was the driver of those declining incomes.

However, there have been more positive opinions (often from those in the technology companies) that suggest an optimistic future for employment and AI. Such opinions point to the pre-COVID-19 US job market where unemployment was under 4% (Department of Labor, 2020) and wages were increasing faster than inflation (Casselman, 2019) – the implication being that if humans were facing obsolescence, this would not be happening. The arguments from technological determinists are often grounded on the following reasoning: from the Luddites of the early 1800s – though fears of human obsolescence remain constant (Pynchon, 1984) – the fact is that as technology changes, modes of employment are transformed (Castells, 2011: p. 285). The logic follows that the agrarian economy became the industrial, then the service economy ensued, until arriving at the economy of the information age (Bruncko, 2015). It follows that when automation replaces human employment, the technology creates more new substitute jobs than it eradicates (Casey & Nzau, 2019). This is a point perhaps confirmed by research from McKinsey that showed in thirteen countries (including the US, Russia, and China), the Internet created 2.6 new jobs for each single job that it replaced (Manyika, 2017). However, these observations relate to AI and employment generally, and are not specific to the music ecosystem.

AI and employment in music was discussed at the *WIPO AICM* session where a bleaker perspective was given. Joel Douek reflected on AI: ‘the vast majority of composers and songwriters… just need to feed their families, pay their mortgages. And that will go away [ability to earn a livelihood]’. Similarly, David Hughes, when referred to the future prospects of his friends in music, said: ‘I’m not sure how this is [AI] going to impact their livelihoods but hopefully they’re old enough that they’ll retire before they’re all out of jobs’ (US Copyright Office, 2020a: p. 186). What follows from these

observations at WIPO – and if the future resembles an Attalian composing network where musicians and non-musicians are equal in an AI prosumer music ecosystem based on 'the production of instruments rather than music' (Attali, 1985 [1977]: p. 147) – is the question how will anyone be able to get paid from music?

The question remains, if this is true here, will there be sufficient time for human actors in the music ecosystem to create an ethically informed value-based evaluation to consider the careful implementation of these new technologies. Within this debate, a musical case study where human expertise is replaced by technological dexterity can provide insight. To examine this contention, the chapter's last example of an actor is presented – the DJ – to consider how the relationship of the deep skill mastery of this player can be impacted by AI related technologies, and what are these technologies' potential impact on employment and creativity within the music ecosystem.

3.5 The DJ – A Case Study

Given the DJ's close relationship to the advanced technologies produces by the surveyed actors as a tool for creativity, the DJ embodies many of the great musical schisms and questions of the times, schisms that are being fuelled by the exponential nature of AI technologies.

The idea that the DJ is a *bona fide* performing musician is now widely accepted in popular culture (Brewster & Boughton, 1999) and in areas of academia (Shapiro, 2005). Since the creation of the gramophone in the early years of the 20th Century, the role of the DJ has developed from being someone who introduces and plays recordings, typically of popular music for radio or TV broadcasts, to someone identified with the manipulation of the technology of music creation and reproduction, for the purposes of live performance or broadcasting. This change has seen, for example, the record turntable becoming a creative instrument open to various kinds of artistic and functional

assimilation (Poschardt, 1998; Theberge, 2001). This section is concerned with the nature of this change – with how the sophisticated tools of the modern DJ's trade have shaped practice, and with examples of how DJing has used various modes of expression and creative musical strategies, and how it has been dependent on the advancement of technology.

The work of the modern DJ is defined solely by the technology they employ. The dissemination of the tools of the modern DJ into wider society, allied to the development of desktop computing and software programmes for musical creativity, have meant that the DJ can be seen as a mirror reflecting the emergence, within society as a whole, of the prosumer.

This shift has seen a marked change in the societal and artistic standing of the DJ. As a player of recordings for radio, TV and social gatherings, or as the announcer for live appearances of performers, until the rise of popular turntablism in the 1970s, the DJ was perceived as a reproducer in contrast to those who had done all the creative work. The change in perception of the DJ's work can be juxtaposed with the change in the perception of AI music systems replacing authentic music creation.

We begin this case study by outlining the history and established musical core skills sets of the modern DJ. When three major schools of live performance DJing are listed, it is seen from the technological differences in these schools that arguments of authenticity arise, and these arguments are focused on the increasing power of automation within digital music software. A brief look to the economic drivers of one of digital DJing's largest companies (Native Instruments) considers how commercial market pressures influence music software design. Examined next are the core skills of DJ practice, honed since the development of popular turntablism in the 1970s, and how these core skills have been supplanted by developments within digital formats. Finally, an empirical test is undertaken of non-professional, AI-powered DJ software (Algoriddim's

djay Pro) in order to gauge the impact of digital technology on the position of the contemporary DJ within the music ecosystem.

3.5.1 The DJ as Musician

To explain the emergence of the DJ as musician, there is a need to understand the historical development of the DJ's tools, before moving to the most recent technologies and the problem of authenticity of musical (re)creation in the DJ's work.

Although the practice of modern turntablism crosses a conceptual boundary compared with the earliest uses of the term 'disc jockey' (Brewster & Broughton, 1999: p. 34), several authorities have argued that the earliest users of the phonograph and gramophone were not entirely passive consumers of sound[81]. From the early 1920s onwards, the possibilities of using the turntable as an instrument have been experimentally realised in various ways by philosopher-composers John Cage (1912–1992) and Pierre Schaeffer (1910–1995), and artists who, although not primarily musicians, were fascinated by the new technology's potential for transforming concepts of creativity.

The genesis and development of the DJ's profession is well documented (Poschardt, 1998; Brewster & Broughton, 1999, 2003) and it is generally agreed that the attributes of live DJing have their historical foundations in the following: early Jamaican Toasters and their Sound Systems during the 1950s (Bradley, 2000; Katz, 2003); the development of the DJ as auteur in Paris/London/New York from the 1940s to the 1970s (Shapiro, 2005); the creation of Hip Hop in New York in the late 1970s (Toop, 1984); and the post-disco genre flowering of House in Chicago and Techno in Detroit 1999. Each of

[81] For example, Damien Chaney writes that 'ever since the birth of recorded music... the individual has been more than simply a passive consumer in the sector, but a true actor. From the simple gesture of placing a disc on the turntable to the search for the most acoustically perfect sound, music consumption is not merely the purchase of reproduction but production by the consumer' (Chaney, 2012: p. 45).

these chronological progressions have contributed to the repository of skills on which the modern DJ depends. It might be significant that there is little unanimity among DJs themselves as to whether they should be regarded as working musicians (Webley, 2005; Bienvenu, 2013).

3.5.2 The DJ's Core Skills Set

Beatmatching. Since the 1970s, the creation of a seamless live performance requires the ability to imaginatively mix between at least two turntables. In order to synchronise two turntables for an extended period of time, a subtle manipulation of each deck's pitch controls, and the mixer's crossfader is required. Vinyl beatmatching is regarded as a pinnacle of DJing performance skills (Bartmanski & Woodward, 2014: p. 117). In recent years, the ubiquity of automated beatmatching-enabled software, as featured in professional digital DJ software, has diminished the analogue requirement while elevating respect for the traditional turntablists.

Scratching, Breakbeat Cueing and Looping. Scratching[82] is widely attributed to Grandmaster Flash, with his late seventies Bronx contemporaries DJ Kool Herc and Grand Wizzard Theodore the recognised Godfathers of Breakbeat (Hermes, 2011). From the Chirp to the Crab (Steventon, 2014: pp. 278-279), vinyl scratching at its best is a dextrous reiteration of well-honed technique staged with daredevil improvisation.

Researcher/Archivist. An acknowledged attribute of a good DJ, both in broadcast and live performance environments, is exceptional knowledge achieved through the research of

[82] Theodore Livingstone AKA Grand Wizzard Theodore is the originator of vinyl scratching, and invented such techniques as the 'needle drop'. Grandmaster Flash then incorporated these approaches into his work with the Furious Five. 'Theodore's scratching made the turntable into a lead or solo instrument, producing percussive accents, melodic signatures, or forays into sheer noise' (Souvignier, 2003: p. 127).

music recordings. The research is, of course, invisible to the consumer who knows only the resultant work. But the importance of that knowledge is underlined by the preserved recording library archive of the late BBC Radio DJ, John Peel, which contains one hundred and six thousand records (2015).

Harmonic Mixing. Guiding the live performance set list of song transition is not simply a manipulation of tempo calculation. Sensitivity to harmonic modulation generated by up to four interlaced individual recordings, whilst conducting their segue through related key changes, is known as Harmonic DJing (Steventon, 2014). It had been one of the many implicit knowledge skills shared between all major DJs – the essence of having a 'good ear'.

Sound Design. From the experimental art works of the Turntablists (Schmidt Horning, 2013) to the Bronx Hip Hop Party Battles (McLaughlin, 2019: p. 114), creative DJs have employed an *Umfunktionierung* (Middleton, 1990) of the DJ's mixer and live performance broadcast systems. The tools of sound engineering have become an integral part of the DJ's kit.

Modular Additions. Ranging from the DJ jamming with a drum machine to signal processing with analogue oscillators, the use of modular musical devices in the DJ booth can be regarded as a sub-section of sound design. There is no technical boundary point where the use of modular equipment in club DJing (Holden, 2015) can be said to differ from that of the turntablist performing at a gallery installation or in the Academy.

Remixing. In recent years, the demarcation between the recording artist/producer and the live performing DJ has become blurred to the point that it is almost dissolved.

Traditionally the career path would be that of the player of recordings (DJ) becoming the maker of records (music producer/remixer).

VJing. Much of the new DJ software involves an increasingly strong visual component. As DJs seek to further distinguish themselves in an ever-crowded market, the addition of audio/visual performances has become something of an economic and artistic inevitability (Pope, 2008).

Improvisation. DJs play music that people want to dance to and keeping those people on the dance floor is the litmus test of the DJ's ability and of their employability. It is the chief functional duty of the improvising DJ. As live performance sets may last up to five hours it can be a test of both vigilance and stamina. While much agreement exists about what the key core skills of modern DJing are, there is strong disagreement about what it actually takes to be an 'authentic' DJ. To understand this, and further what kind of role it plays for employment relations within the music ecosystem, the schools of DJing are explicated.

3.5.3 The Three Schools of DJing

The accepted main schools of DJing are defined solely by the technology employed (Gopinath & Stanyek, 2014: p. 293).

Old School Vinyl DJing. Technology used: A minimum of two turntables, invariably Technics SL1200s, that are routed through an audio mixer containing stereo outputs, a standalone cue channel, internal sound effects and a selection of vinyl recordings (Expo & Cant, 2014). Timeline: 1948 to the present day.

Digital Vinyl Systems (DVS). Technology used: Two CDJ units, an audio mixer, mp3 or wav format music files and integrated audio effects units (Turntable Lab, 2015). Timeline: 2001 onwards.

Digital DJing (laptop/controllerism/fully digital systems). Technology used: Traktor, Serato, Ableton Live, Virtual DJ. Timeline: Though the initial versions of Traktor and Ableton Live were released in 2000 and 2001 respectively, it is best to date the timeline after both software's widespread adoption circa 2005.

3.5.4 Authenticity and DJing

As supported by academic work on DJ culture (Montano, 2008 and 2010; Farrugia & Swiss, 2005), throughout the world of DJing a divergent opinion about musical authenticity as a dominant feature in the critical thinking of many practitioners. The main subject of debate revolves around what constitutes authenticity and what is the role of technology for true DJing. Here, as with turntablist DJs, the concept of authenticity revolves primarily around the extent to which technology intervenes in music creation. The development of today's DJ technology, however, is closely related to the music ecosystem and its economics. The DJ's software, which addresses the outlined DJ's core set skills, transforms the working network of the DJ, for example through the DJ's contact with the audience, within an automated digital context.

3.5.5 The Economics of Digital DJ Technology

Traktor is one of three premier professional digital DJing software packages, along with Serato and Rekordbox, and was launched in 2000 by the German company Native Instruments. Most of the popular applications of desktop software require frequent redevelopment not only to improve efficiency but also to maintain their own market

vitality (Miller, 1993: p. 162).

Is there a corporate, economic impulse behind this tendency of professional digital DJing software to move ever closer to the DAW technology? The answer lies at the heart of one of the concerns of this thesis regarding AI music technologies – the increasingly blurred boundaries between amateur (Apple GarageBand) and professional (Apple Logic) applications and products available in the music ecosystem. To illustrate this, selected here is not a professional, but an amateur AI-enabled DJing app to analysis how established DJing core skills sets can be supplanted by technology. During this analysis, the anterior listed DJ skill sets are reviewed chronologically.

3.5.6 Development and Characteristics of djay Pro Software

Among the most compelling apps for this purpose is djay Pro, for although it has yet to make serious inroads in the professional world of DJing, it can make many of its users feel they have easily accessed the experience related skills of the professional DJ. The aim of these tests is to explore the extent to which this app can or cannot replicate those traditional core expertise of DJing.

Software Profile. djay Pro 1.0 was first released in December 2014 by the developer Algoriddim (Bonnington, 2014). This analysis uses djay Pro 1.2.1 (update released 18th October 2015) on an Apple Macbook Pro.

Figure 30: Algoriddim's djay Pro desktop screen. Source: Author's desktop screenshot.

The initial design is both clean and self-explanatory, as illustrated in figure 30 above. No user manual is included or deemed necessary, though some introductory videos are available on the Algoriddim website. With djay Pro the emphasis is on immediate music-making. The user sees two turntables; and can drag and drop a facsimile vinyl and work out what to do next.

3.5.7 DJ Core Skills Set Analysis

Beatmatching: In djay Pro, all music files are initially analysed to determine their original tempo. Once the original BPM is detected the imported music files' metadata will be maintained for recall.

Harmonic Mixing**:** When music files are initially analysed their key is also determined (major or minor) and this is displayed alongside their BPM.

Suggested Match**:** This parameter is an alluring AI feature of djay Pro. The user's personal music library (for example, in iTunes or Spotify) is mined to determine what songs might best segue, based on automated analysis of tempo, key signature and genre.

Scratching, Breakbeat Cueing and Looping**:** The ability to digitally scratch in professional DJing is delineated usually by the user's own choice of software and is available in djay Pro.

Sound Engineering/Remixing: Sound effects included in the app contain the expected

variations of flange, delay, and saturation. A turntable extension to four decks is available in djay Pro.

VJing: In djay Pro a visual accompaniment to the audio being played is also available. Each deck has a visual display equipped with a simple but impressive range of audio-visual effects. A VJing visual collage can then be broadcast, via a projector, independently from that which is displayed on the desktop screen. Adjusting the parameters of a djay Pro device will produce a simultaneous sonic and visual effect, as illustrated in figure 31 below.

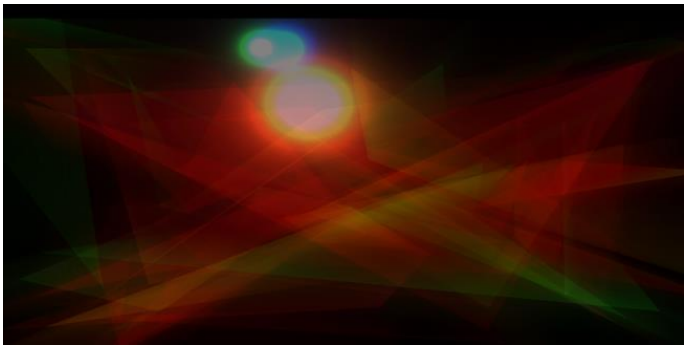


Figure 31: VJ output from djay Pro. Source: Author's desktop screenshot.

Modular and DJ Hardware**:** Unlike its professional counterparts, djay Pro does not have its own range of dedicated hardware controllers. Instead high-end DJ equipment has been pre-MIDI mapped for a plug-and-play option.

Researching/Archivist**:** This is probably the game-changing feature in djay Pro – djay Pro not only accesses the personal music library of the user, but also has real-time access to Spotify. As Spotify is one of the largest and most popular music streaming utilities in the world this has significant implications both artistic and fiscal, for the DJ no longer has to purchase all the music played.

Auto-mix: Considering human interaction as an essential component of the DJ network – as in the case of the human musician within the music ecosystem studied here – be it of traditional turntablism or laptop DJing, djay Pro poses a challenge to the music

environment. The auto-mix function removes the human from the network of interactions behind the aesthetic result, for it is a self-automated algorithm that, once engaged, carries out the majority of the requisite DJing decisions for the user.

Analysis Conclusions: The idea that the DJ is an endangered species is not a metaphor anymore. The history of technology teaches us that djay Pro will be succeeded by programmes even more capable at replacing human decision-making and human physical skills.

As is the case of many AI music apps that substitute human musician's skills, what this analysis did establish was that many DJ craft-skills can be replaced by an affordable, self-learning algorithm for non-musicians; moreover, the algorithm can replace those non-musician DJs as well, if so chosen. However, the history of music contains prior examples when technology promised to threaten or substitute human musicians. Often this proposition proved more complex than the initial outline suggested.

3.5.8 The DJ as Automaton

The concept of the jukebox was patented by Louis Glass only a few years after Edison, in 1877, invented the phonograph (Burkart & McCourt, 2006: p. 5). The jukebox was regarded as a threat to the employment of human musicians. By 1942, The American Federation of Musicians called for a ban on recordings because of the rise of 'canned music' (Determeyer, 2008: p. 211).

In public establishments, recordings had replaced live musicians and, by the 1940s, this was becoming a serious barrier to the employment of musicians. When that was added to the pressures created by radio and the availability of records for home use, the professional performer's prospects for work were seriously threatened. This has been persuasively summarised by Mark Myers, who points out that 'no other occupation in America had ever faced such a threat from technology' (Myers, 2013: p. 20).

As Myers indicates (pp. 18–21), the jukebox was just one of several means of mechanical reproduction of sound that threatened the working lives of musicians. Yet musicians did adapt to the threat, even though many avenues of previous employment such as orchestras for film and theatre were much diminished. The growth, from the 1940s onwards, of human DJing, in which the personality and creative imagination of the DJ played a central role in the audience experience, is a prime example of this adaptation, for it led to a boom in the recording of popular music of all kinds.

However, exponential innovation advances in recent decades are very different in nature to technological developments of the past (McAfee & Brynjolfsson, 2016: p. 47) and the dj Pro software illustrates that point. This is one of the most important metamorphoses when considering historic technological developments as indicative of the impact of future advancement. New music technologies with surprising capability are being introduced with notable frequency, and it is this rate of change that distinguishes the modern day from past innovation. It is increasingly demanding for the music community (academy, professionals and prosumers alike) to keep pace with innovation, and though this advancement can be creatively stimulating, it is problematic if inherent financial repercussions remain unaddressed because of rapid change. An example of this is the latest version of dj Pro (dj Pro AI) announced in June 2020, which is a robust illustration of the implications of the broader implementation of AI systems.

The release of dj Pro AI advances features reviewed in this analysis and promotes an exceptional new function called ‘Neural Mix’. The new parameter allows audio tracks (music from Spotify) to individually separate vocal, beats and instrumental segments – in real-time. For example, if playing *Staying Alive* by the Bee Gees, the *a cappella* vocals or the drum track can be selected and processed instantly with a minimal amount of artefact glitches evident. Aside from the fascinating creative potential of this system, there are several related aspects which need consideration. Dj Pro AI illustrates how start-ups

(Algoriddim) can build creative systems founded on transnational actor AI tools as it is the first music technology to be exclusively designed that explores the potential of Apple's A12Z 'bionic' chip. Advancements like this are intended and welcomed by the transnational actors as they drive sales of their products and services, in this example sales of Apple phones and tablets[83]. A similar corporate strategy is evidenced regarding the many Google open-source AI tools[84] featured in this review, where smaller developers also build products and services founded on transnational actors' AI tools. There is nothing inherently sinister or new about these strategies, but what is essential to monitor is the direct, and more importantly indirect, financial exchange that is in operation. For instance, is there a trade-off between a user's personal data and access to the transnational actor's open source tools? If so, is the user clearly informed and aware of how that data is being processed and when? Those questions are addressed in Chapters 5 and 6, but awareness of these potentially invisible transactions between actors underlines the value of this chapter's identification of AI music actors intended revenue streams.

It is likely that djay Pro AI will transform the DJing landscape, as it is now a free app with the caveat that access to the Neural Mix function costs a monthly subscription of €4.99 and rivals (Serato, Traktor and Rekord Box) will have to respond rapidly to stay competitive. These developers will be insulated for a time due to Neural Mix's reliance on the A12Z chip, but for many users it has made the purchase of a new iPad Pro (approx. €1,300) reluctantly essential. There are other financial consequences for DJs and music producers, for instance Beatport[85] offers a range of producer 'stem' packs on its platform which is a revenue stream for many artists. On Beatport, an artist's recording costs an

[83] As dj Pro AI is reliant on the A12Z chip, the software is only available on the latest iOS devices (iPhone/iPad).
[84] TensorFlow, WaveNet.
[85] Beatport is the leading recorded music content downloading site for professional and prosumer DJs.

average of €1while stem packs of the same song consisting of detached *a cappella* vocals, drums, melodic recordings is €5. Dj Pro AI users are unlikely now to purchase artist stem packs, however no alternative financial benefit is made to the Beatport artists, despite the improved 'stem' access provided by dj Pro to the user of the artist's recordings. This is indicative of many contradictory trends within the economics of music and technology where deeper consumer engagement in recorded works benefits the providers of the service rather than the work's creators, and there are no easy solutions to this financial paradox. Similarly, the implications of the convenience (real-time processing) and possible widespread adoption of technologies like dj Pro AI that effortlessly separate music recordings is further apparent in Chapter 4 analysis of music copyright.

Nonetheless, for some artists, the financial changes caused by modern music technologies (as mentioned previously, for example the microtransactional payments in Fortnite) can lead to monetary success. However, the troubles presented by technology 'transforming' work practices in the music ecosystem are growing. The example of iHeartRadio in the US and the sudden redundancy of its DJs suggests a sober alternative reality to promises of democratic creativity proposed by many of the AI actors. In the iHeartMedia example, the human – the DJ who emerged from the automata (the jukebox) - returns to its origins, and is replaced by AI. This is a historical example of the social construction of technology (the SCOT model) which gives us a provocatively embedded past warning, while also serving as a real-world signifier of the financial and legal consequences which can be drawn from the iHeartRadio case.

3.5.9 iHeartRadio

The journey of the DJ from automata to human and back again is exemplified in recent events in the US. The iHeartMedia network includes over eight hundred and fifty local radio stations across the US and is active in Australia, Canada, and UAE. It is the

world's leading commercial podcast publisher (iHeartRadio broadcasts over two hundred and fifty thousand podcasts) and with a quarter of a billion monthly listeners in the US, iHeartMedia claims to have a greater reach than any other media company in the market (iHeartMedia, 2014).

In January 2020, up to eight hundred and fifty DJs and producers were 'dislocated' by the company as part of a major restructure to take advantage of the significant investments made (by iHeartMedia) in technology and AI. An official iHeartMedia announcement attempted to contextualise these redundancies:

> but the number [redundancies] is relatively small given our overall employee base of 12,500…. we recognize that the loss of any job is significant; we take that responsibility seriously and have been thoughtful in the process... providing outplacement assistance for any impacted employees, and we want to thank them for the valuable contributions they have made… and enhance iHeartMedia's position as the number one audio company in America, (iHeartMedia, 2020)

A position which Bob Pittman, Chairman and CEO of iHeartMedia confirmed:

> iHeart is the rare example of a major traditional media company that has made the successful transformation into a 21st Century media company – improving our services to our consumers and advertising partners; and enhancing the work environment for our employees. (iHeartMedia, 2020)

What is shown from such representations of the iHeartRadio redundancies is that the disruption of employment within the music ecosystem through the expression AI optimisation is predictably designed to assist a corporate bottom line. In short, the work of human radio presenters and producers was replaced by machinery.

It therefore remains that more ethical consumer decision-making can result in future demands that will restore the value of a human worker and suggest more considered employment criteria. This consumer decision-making can only be through a

nuanced and fluent understanding of how purchasing choices (whether that is through music subscription services, live performances or algorithmically curated music) either elevate or depress the employment of humans. This is an understanding that can be commercially expressed through the use of an AI ethical marking system that vigorously supports the value of human employment within the music ecosystem. However this is a complex and multileveled argument requiring a detailed understanding of music law and AI ethics to support the development of an ethical marking system, as will be seen in the following two chapters.

To conclude on the observations of this section, if relying too readily on new technology there is a dangerous transfer that risks loss of the agency that defines being human. That tension between a human being's artistic judgement and an automated operation casts the arguments of authenticity into a brutal light, where simply the act of being human becomes the fundamental measure of what it means to be authentic. The DJ's very existence as an artist can be understood as a parallel to Descartes' *Cogito ergo sum* – I am a DJ; I am what I play – and what the DJ plays are the music copyrights that exist both in the music composition and the recordings created by humans.

As discussed, Attali identified the pivotal role of copyright to the economy of music, and it is this expression of IP (copyright) that is the most fundamental challenge presented by AI music actors, for these actors introduce alternate and often disruptive revenues and funding models that are not available to many technologically displaced workers in the music ecosystem. For those in the academic sector, these alternate (to music copyright) revenue streams can be seen in research funding, tenure and spin out companies; for the transnational actor – a range of incomes are on hand (advertising, products, et al.); while for AI music start-ups – the complete range of IP expressions reviewed are fully exploited. Each sector's income streams are of course not part of the traditional economic model of the music ecosystem. However as has been shown, many

AI actors' work frequently diverts or dilutes through innovation existing music copyright income streams to fulfil each sector's agenda. Competitive economic alternatives are not yet available to displaced workers in music. Nonetheless, the music industry, and hence the majority of employment within the music ecosystem, is dependent on a singular expression of IP – music copyright. To understand the impact of AI music technology on the music ecosystem, it is essential to analyse the importance of music copyright, how its structure has been historically formulated and how AI presents many unforeseen challenges.

Chapter 4: The Music Ecosystem in the Financial and Legal Landscape

> And today, wherever there is music, there is money (p. 3)… Music has become a commodity, a means of producing money. It is sold and consumed. It is analysed: What market does it have? How much profit does it generate? At what stage in the production of a musical work is money produced? (p. 37) (Attali, 1985 [1977])

The following hypothesis seeks to answer Attali's questions by proposing that the music industry, and thus most employment within the music ecosystem, derives from four principal sources of revenue: music publishing, recording, live performance, and merchandise. The hypothesis further posits that each of these four sectors is constructed on the exploitation of IP, most specifically that of music copyright. As Attali states, it must be identified where in 'the production of a musical work is money produced?' (p. 37). To identify the financial mechanics of the music ecosystem, a detailed understanding of the tenets of music copyright is therefore essential. With this awareness, an understanding of how IP concepts are challenged by AI can be grasped.

4.1 The Economic Rationale for Copyright as Integral to the Legal Landscape

To demonstrate the modern day, real-world relevance of Attali's questions, especially regarding the role of copyright on the economics of music, this thesis developed a pedagogical hypothesis that underpins the presence and role of copyright within the music ecosystem. This hypothesis outlines the economic centrality of copyright to the music ecosystem and satisfies Attali's recommendation that: 'Let us first see how the economy of music functions in each economic network and where the creation of money takes place' (p. 39). By understanding how music copyright functions, the consequences of the conceivable impact of AI music technologies can be examined. It is therefore necessary to scrutinise how the financial rewards for human music creativity,

the substructure of the music industry, are legally formulated within the construction of music copyright concepts and investigate how that copyright construction is challenged by AI.

4.2 The Emergence of AI Music in the Ecosystem

4.2.1 The Development of Copyright and the Challenges of AI Creativity

AI creativity presents several challenges to the future of the music ecosystem. This chapter will show how these challenges are encountered, when copyright law and practice confront AI generated music, and how that encounter is resolved.

Implicit in this scenario is the issue as to whether human creativity needs protection from possible intrusions by AI systems. Indeed, if it should, then how can it be protected and to what extent can it be monitored or controlled?

As matters stand, while some degree of recognition is given to AI systems which generate work that may claim copyright, serious questions arise: how should human creativity be protected in the music ecosystem, where AI is a new actor, and what will be the future status of that actor?

4.2.2 An Overview of the Legal Landscape

International music copyright comprises a series of rights designed to protect original artistic works created by human beings. However, new works of art are increasingly being presented that illustrate the capabilities of machine creativity. Having established how music copyright fuels the commercial activity of the broader music making community, the existing legal landscape attached to IP for computer-generated works of art (CGWA) is now considered.

National and International Elements of the Legal Landscape. The business of music is a global activity, and the developmental commercial rollout of AI music technologies is also a transnational pursuit. It is therefore essential to indicate how legal developments in one territory can have an unintended ripple effect in the legislative practices of another jurisdiction. The complexities attached to international IP activity will inevitably require effective and reciprocally legally binding arrangements between jurisdictions. Corresponding international agreements exist in other fields of economic cooperation but will have unintended and definite consequences for the music ecosystem[86]. The importance and long-standing practice of these relationships will be considered later in this chapter when discussing notions of legal personhood and AI.

Nation-states have historically recognised and consolidated music copyright practice (Kettle, 2002: p. 1045). The largest commercial music markets for recorded music are the following: US (31%), Japan (12%), UK (9%), Germany (9%) (IFPI, 2019). Music territories have been and are governed under specific national or transnational IP legislation and the requirement for internationally recognised norms and rules was acknowledged at an early stage. To appreciate the historical interconnection and transnational influence on IP rights now in play with AI music, a review of the evolution of international music trade agreements is instructive. *The Berne Convention for the Protection of Literary and Artistic Works* (1886) (the Berne Convention) was the first major step in recognising the need to encourage harmonisation of international music copyright (Kettle, 2002: p. 1054).

The Berne Convention (1866) and Subsequent Developments. The Berne Convention was signed by sixty countries and became the foundational agreement for all subsequent international copyright treaties (Ricketson, 1987). Though notably, the US did not

[86] An illustration of such trade agreements is *The Agreement on Traded Related Aspects of Intellectual Property* (*TRIPS*) in which members recognise reciprocal IP within their existing individual national legislation.

officially sign up to the Berne Convention until 1989, US music copyright had for many years shown a coherence with the international norms, effectively operating a procedure known as 'the back door to Berne' (Nimmer, 2003: p. 58; United States, 1987). Prior to 1886, copyright protection existed only in the author's home country (Smartt, 2011: p. 391). Moreover, in a manner akin to modern patent rights' practice, authors were required to seek individual copyright recognition in each region that their work was sold or performed. The Berne Convention also determined the length of copyright protection and that term was set at fifty years after the death of the author. This timescale remained in force until it was extended to seventy years in the late 1980s (Owen, 2019).

The concept of *Moral Rights* in copyright and other forms of IP was another important issue first embraced by the Berne Convention (Rajan, 2011: p. 252). The doctrine of *Fair Use* of copyright was also adopted and the Berne Convention has been subject to many revisions: Berlin (1908), Rome (1928), Brussels (1948), Stockholm (1967), Paris (1971), and WIPO (2001).

4.3 Developments in the Music Ecosystem and the Legal Response

4.3.1 Protection of Sound Recordings and Worldwide IP Agreements

The legal regime following on the Berne Convention had not given the same level of copyright recognition, and therefore protection, to sound recordings due to the mechanical process of their creation when compared to music compositional authorship. A significant development was brought about in the protection of sound recordings in 1971 with the *Geneva Phonograms Convention* (Patry, 1994: p. 1263). The Convention established that *Fair Use* of recordings would be limited solely for educational or scientific research purposes, and that Geneva innovation was a direct response to the emergence of pirated recorded music through the popularity of cassette deck technology

(Tschmuck, 2006: p. 163). Sound recordings are now formally recognised as legally valid musical compositions (Sonoda, 2007).

The signing of the *General Agreement on Tariffs and Trade* (*GATT*) in 1947 represented the response of the international community to the need for economic reconstruction after the end of the Second World War (Majaski, 2019). Designed to encourage trade between member states nations, *GATT* would be the forerunner to the eventual founding of the World Trade Organisation (WTO) in 1995. The WTO was created to stimulate and protect trade between its member states (WTO: Basics, 2020). The mission of the WTO involves many fundamental principles including the non-discrimination between countries as regards to IP, and this is given effect through its *most favoured nations* policy. The *most favoured nations* policy requires that each signatory nation adopt similar trading terms and that any national treatment policy will not distinguish between imported and locally produced goods (WTO: Basics, 2020). This policy is indicative of, and underpins an argument for, reciprocal legal arrangements where a decision in one country has consequences for music creation in another.

4.3.2 Developments in IP Law and the Impact of Digital Technology

The Berne Convention would stand in place until key provisions were subsumed into the 1989–90 *Agreement on Trade-Related Aspects of Intellectual Property Rights* (*TRIPS Accord*) which is enforced by the WTO (VanGrasstek, 2013: p. 40). The *TRIPS Accord* requires all WTO members to enact legislation and to develop universal compatibility on the minimum protection of IP (UNCTAD-ICTSD, 2005: p. 182).

The continued emergence of new music technologies raised issues which were obviously unforeseen by the Berne Convention and challenged the adequacy of IP agreements (Ficsor, 2009: p. 5). It is unsurprising that for many years there had been a growing demand for the Berne Convention to be updated (Alikhan, 1986: p. 423) and in

particular, the need for copyright protection to embrace the implications of the new digital environment (Eger & Scheufen, 2012: p. 16). The work of a committee of experts established under the Berne Convention led to a diplomatic conference held in Geneva under the aegis of the WIPO. In December 1996, the conference adopted two treaties: the *WIPO Copyright Treaty* (WIPO, 2020c) and the *WIPO Performances and Phonograms Treaty* (WIPO, 2020d) (Tian, 2008: p. 36).

4.3.3 AI and Internationality at a Regulatory Level

WIPO. The *WIPO Copyright Treaty* has introduced revolutionary changes (Haggart, 2014: p. 90). The treaty requires signatories to introduce civil and criminal penalties for any circumvention of electronic protection systems, thus granting protection of copyright in line with advances in information technology. The treaty ensures protection for computer programs as literary works together with the arrangement and selection of materials in databases. The right of reproduction in IP also now applies to the digital environment and member states can limit and grant an exception to that right.

United States. The US implanted WIPO in its territory by enacting the *Digital Millennium Copyright Act* (*DMCA*) in 1998 (US Copyright Office, 1998: p. 1). As is later reviewed, the interpretation of *DMCA* by different AI actors would have significant and unforeseen implications for the music ecosystem. The *WIPO Performances and Phonograms Treaty* granted music creators a set of economic rights in their performances fixed on a *phonorecord*[87] (WIPO, 2020d). Moreover, the treaty for the first time granted protection of performance 'via wire or wireless means', reflecting the growing use of music

[87] *Phonorecord* means a material object in which the sounds, other than those accompanying an audio-visual work, are fixed by any method, and from which the sounds can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device (Remengesau, 2003: p. 2).

performance across the emerging internet and the domestic availability of computers (Dreier & Hugenholtz, 2016).

It is clear, from trade developments like the Berne Convention in 1886 to the recent Article 13 in EU *Directive on Copyright in the Digital Single Market* (*Copyright Directive*), that while 'there is no such thing as international copyright' (Halloran, 2017: p. 113), there is 'a global harmonisation of national copyright and related rights laws' (p. 120). An example of this can be seen when in 2000 the European Council approved the *WIPO Performances and Phonograms Treaty* on behalf of the EU.

European Union. The EU Commission enacted a series of directives that require developing compliance regarding copyright laws in member states. The extension of the author copyright term from fifty to seventy years after death is a notable example of this[88]. Since the international adoption of the *TRIPS Accord*, cases have been successfully brought against Japan and Ireland to oblige the enactment of national copyright laws to comply with new international norms (Helfer, 2000: p. 101). As the significance of national borders reduces because of the impact of digital technology on the distribution and consumption of copyrighted goods, further harmonisation of IP law is likely to continue. The development of global IP enforcement can be seen as a weaving thread, originating from the Berne Convention (1886) to the present day, which illustrates the continued trajectory of IP treaty alignment and this development is essential to consider when looking at the AI actor.

[88] A similar goal was achieved by the adoption of the *Sonny Bono Copyright Term Extension Act* of 1998 to help bring the US in line with the prior EU ruling (seventy years after death) (Lee, 2013).

4.4 The New Entity in the Music Ecosystem

4.4.1 The Rise of AI Creativity

Recognition of the international regime of cooperation and interplay requires scrutiny of copyright law in the context of new technologies. A perusal of this will show the necessity for embracing the global perspective. Nationally based legal instruments may be shown to give rise to conflicts and variations in response to international treaties, and thus have serious if not fundamentally detrimental impacts on the music ecosystem.

As will be reviewed, most IP regulations relate to protection of the creative output of humans. Recent developments in CGWA have given rise to questions of whether and what recognition these works of art should be afforded. Reflection of the status of AI and IP in music is heightened by the awareness of CGWA in related disciplines.

Examples of CGWA in fine art include a portrait, unveiled in 2016 in Holland, which was brought into existence by a machine learning (ML) AI trained on thousands of works by Rembrandt (Brown, 2016), while in 2018, *Portrait of Edmond Bellamy* created by an AI was sold for over $432,000 at Christie's Auctioneers in New York (Christie's, 2018)[89].

In literature, a Google neural network AI produced poetry trained upon thousands of unpublished romantic novels (Burgess, 2016). Also, that year, a Japanese novella *The Day a Computer would Write a Novel* reached the second round of the national Hoshi Shinichi Literary Award competition (Olewitz, 2016). In his book, *The Creativity Code* (Du Sautoy, 2019: p. 297), the author reveals that a writing algorithm had generated three hundred and fifty words of the preceding pages of his book, and the Oxford Professor of Mathematics asked if the reader had noticed or had it passed the literary Turing Test. One

[89] A sum forty-five times higher than its auction price.

point regarding the possible ethical implications of CGWA raises the question whether the reader (as in the De Sautoy example) should have the right to be always informed of AI infused content and it is an observation that contributes to the conclusions of the last chapter.

Examples of AI creativity are not limited to the arts. In academic publications the topic is also recognised. In April 2019, Springer Nature published its 'first machine-generated book in chemistry' (Mitrev, 2019) entitled *Lithium-Ion Batteries* – by the AI author, Beta Writer[90]. Niels Peter Thomas, Managing Director of Books at Springer Nature, speaking of the company's plans to expand AI content for other subjects in the future said:

> Springer Nature is aiming at shaping the future of book publishing and reading. As a global publisher, it is our responsibility to take potential implications and limitations of machine-generated content into consideration, and to provide a reasonable framework for this new type of content for the future. (Springer, 2019)

Lithium Ion Batteries by Beta Writer is available as a free e-book, while an upcoming publication by Springer – *AI for Art – Recipes for Art Generation with Machine Learning* by the human author Alexander Osipenko has a list price of €29.11 (Osipenko, 2019). While it is important not to draw too presumptuous a causal connection from these contrasting pricings, this incidence of machine generated creative work within academia is redolent of many of the start-up actor offerings regarding AI music copyright reviewed in the last chapter.

[90] The AI was a collaboration between Springer Nature and researchers from Goethe University Frankfurt.

4.4.2 Breaking through Creativity Norms

The illustration above should inform any examination of AI music, for when significant technological change occurs that challenges accepted cultural forms, the more exposed elements of those forms are liable to experience radical consequences. The boundaries and frontiers of AI music, outlined in the Chapter 3, are extended through examples of CGWA seen in multiple settings and genres including theatre musicals (Souppouris, 2016), Opera (acids.ircam.fr, 2020), and film soundtracks (Kaleagasi, 2017).

In a parallel commercial application to music[91], Narrative Science has altered the landscape of journalism through the widespread adoption by Associate Press, Bloomberg, and various sports reportage of its self-generating AI content (Peiser, 2019). These examples provide further insight into how AI is capable of encroaching on areas that, until recently, were regarded as the sole domain of human expertise. As the sophistication and capability of AI to produce convincing narratives increases (Troitino, 2017), so will significant areas of the creative arts experience similar effects, as they follow this arc into self-generating autonomy. The *New York Times* estimates that up to one third of the content produced on bloomberg.com is AI generated (Peiser, 2019) and yet an inference remains that certain types of artistic work will remain unchallenged. This contention, in relation to music, was taken up by De Sautoy when he outlined how certain types of musicians had little to fear from AI:

> If you look at [AI]music, it's not going to put the Mozarts, the Beethovens, the Miles Davises out of jobs, but it might well put second-tier composers out of jobs, those who are making their way by writing music for advertising, corporate videos, computer games. We're already seeing music being written by AI which is "good enough" – that's the phrase I kept hearing, "good enough" – for those applications. (Insights Team, 2019)

[91] For example, with AI start-ups (Jukedeck) offering music for YouTube videos.

When the potential of ‘good enough’ AI music is reviewed in the context of the automated methods and techniques commonplace in employment, it is essential to consider how AI advancement will affect work in the broader music ecosystem. The majority of employment in music is derived from or dependent on copyright protection, a protection susceptible to the challenge of AI. However, what is the legal interpretation of computer created outputs? Addressing this question is critical in order to review the financial and ethical impact of AI technology on music, and through the analysis of critical and essentially historical concepts, the capacity of copyright to meet the challenges posed by AI can be examined.

4.5 The Human Architecture of the Legal Landscape

4.5.1 Foundations

It is useful to consider the *grundnorm* of IP law briefly, as it has evolved over the last two millennia, before discussing the newer trends and forces commercial and otherwise in the AI debate that challenge IP to find legal solutions. IP rights and the laws that have developed to protect them are traditionally assumed to inhere in humans.

What is a human? A classic answer to that question is offered by Aristotle’s *De Anima.* In *De Amina* Aristotle posits different degrees of animation: vegetative, sentient, and rational. Fundamentally, that definition of what it means to be human insists upon animality and sentient self-awareness (Polansky, 2007: p. 5). Human rationality, therefore, according to Aristotle, is more than just logic or cognition for it includes emotion, imagination and will. As physical beings, humans are objects in the world. However, as minded beings, humans exist with a specific perspective on themselves and other humans, and so designate ‘I’ and ‘we’ and ‘you’ in contrast to ‘it’ (Polansky, 2007: p. 458). Against this historical and philosophical tradition, which includes Heideggerian

humanism and the evolutionary role of technology in human development, AI represents a creative entity which is outside the fold of copyright protection. However, from the ANT perspective, AI can be seen as a non-human actor, even if not reflected in the humanist tradition, since it is an actor in the music ecosystem. But what is the legal position of a non-human actor?

4.5.2 Centrality of the Human Author/Creator: Ethical and Legal Concepts

Copyright is the legal right granted to the creator of original work, allowing the author exclusive rights limited by time for its use and distribution. Copyright protection is invoked and relied upon most usually for literary and artistic works. In all cases for a grant of copyright two essential components are required: one, that the work should be in a tangible, *permanent* form and two, that it should be legally considerable as *original.*

The rationale that explains this notion of the author as both originator and creator has its basis in the 17th Century writings of John Locke and his economic theory of possessive individualism and labour. According to Locke, every man should be the owner of the product of his labour (Sharma & Sharma, 2001: p. 428). Therefore, Locke argued, if the fruits of one's labour are intellectual, as in the development of an idea or concept, then the results of this mental endeavour are a product that the creator should own.

4.5.3 Fairness, Personality and Effort

It follows that multiple authors who have contributed to the same work are entitled to individual rights relative to their contribution in the finished creation – a concept widely recognised in copyright law as *fairness theory* (Quintais, 2017). Thus, the concept of joint contribution to a work is given protection in the recognition of joint ownership (Gough, 1950: p. 127).

The concept of *fairness theory* in copyright law is extended by *personality theory*. Growing out of the work of the philosophers Hegel and Kant, *personality theory* similarly argues that rights are warranted by the contribution made from the individual self into the final creation (Beck, 1960: p. 223) and maintains that the *thing* created in some way manifests aspects of the author's will and personality (Hegel, 1942). *Personality theory* actively contributed to the present day understanding and development of *moral rights* (Spinello & Tavani, 2005: p. 192), the critical components of which extend to the author's right to be recognised, and maintain their authorial control of the integrity of their creation, even after any rights have been fully assigned to a third party[92] (Kwall, 2010: p. 135). Both Locke's *labour theory* and Kant's *personality theory* arose from the concept of the utilitarian justification that the primary purpose of copyright is for the *common good*, as a reward for human effort (Gough, 1950: p. 127; Rawls, 2005 [1971]: p. 584).

Additionally, the *sweat of the brow* as a concept in copyright law explicitly references the human element in the act of creation (Sinha & Mahalwar, 2017: p. 218). Indeed, both the *personality* and *fairness* theories also support the notion of the essential human-centred construction of the author – the societal need to encourage and reward the toil and effort of innovation. A final concept in IP, *social planning theory*, holds that IP rights should be maximised to promote cultural goals (Duhl, 2004: p. 712). *Social planning theory* itself has been co-opted as a logical reason for granting AI robots copyright (Kop, 2019: p. 13). It is a logic that underscores the urgent need to consider an appropriate regulatory framework for AI technologies, with particular attention to claims for granting rights associated with CGWA including music.

---

[92] An example occurs with music composers and songwriters who, even after the transferred ownership of their publishing rights, still retain (at least in Europe) their moral rights in such assigned works. These rights grant that the original creator is properly accredited as the author of the work. This was Richard Ashcroft's position with *Bitter Sweet Symphony*, where even after the majority rights were given to Jagger/Richards he was still entitled to be credited.

4.6 A Place in the Legal Landscape for Non-Human Entities?

4.6.1 Of Machines and Monkeys – What or Who is Entitled to IP Protection?

Moving from the 17th Century to the 21st, in a seminal article in 2003 Professor Jane Ginsburg contended that the international copyright systems of the US and Europe share a commonality of agreement on the definition that an author is 'a human being who exercises subjective judgement in composing the work and who controls the execution' (Ginsburg, 2003: p. 1066). Building on Ginsburg's observation, with the contributing theoretical legal factors earlier outlined, it would be understandable when evaluating CGWA to consider legal arguments as solely a contemporary reflection of the tensions in play with modern AI. However, in Ginsburg's public lecture as part of the neuro-humanities series at the Science Gallery Dublin (2018) she highlighted two classic case studies that are key in the literature relating to both the development of copyright and rulings on non-human creativity. These case studies demonstrate that the arguments about AI creativity extend beyond and before the digital.

4.6.2 Burrow-Giles v Sarony (1884) and its Implications for AI Creativity

The first case occurred two years before the Berne Convention – *Burrow-Giles v Sarony 111 US 53 (1884)* (Burrow-Giles Lithographic Co. v. Sarony, 1884). In 1882, Oscar Wilde had yet to produce the works that would make him famous, however the young author was already gaining notoriety and prominence. Public attention had brought Wilde to the notice of the American celebrity photographer Napoleon Sarony. During a US lecture tour to promote D'Oyly Carte's production of the Gilbert and Sullivan Operetta *Patience,* Sarony arranged for Wilde to sit for a series of photographs, the most famous of which is shown below in figure 32.

Figure 32: Photographic portrait of Oscar Wilde. Source: public domain at https://www.metmuseum.org/art/collection/search/283247

Subsequently, the Burrow-Giles Lithographic Company produced and sold a series, unauthorised by either Wilde or Sarony, of lithographs of the image entitled *Oscar Wilde no 18.* It was an advertisement for the sale of these reproductions that caught the attention of Sarony. Sarony sued claiming that these reproductions of his photograph were a violation of his photographic copyright.

It is Burrow-Giles' defence to Sarony that is of interest in the analysis of AI. The defence maintained that the act of photography was merely a reproduction of nature and that Sarony was not an author, merely an operator of the machinery (Burrow-Giles Lithographic Co. v. Sarony, 1884). The Court rejected this defence that a photograph did not require an author, referring in its ruling to the 'necessary arrangements' (Rose, 2016: p. 90) that had been put in place – lighting, set design, positioning of the model, that were of sufficient human creativity as to make Sarony the author of the work. Throughout many years and rising through assorted levels of the American court system, *Burrow-Giles vs Sarony* made its way to the US Supreme Court. On the facts of the case, the

Supreme Court's ruling was that Sarony did have copyright protection, and these principles echo through to the 21st Century enquiry regarding AI music creativity (Hristov, 2016: p. 431).

While the Supreme Court discussed the possibility of granting copyright protection to a product which is the output of a machine, it held approving the decision of the English Court of Appeal in a case also involving the taking of photographs (*Nottage v. Jackson, 1883*), that without the presence of intellectual invention purely mechanical labour is not per se creative. Thus, the ruling of *Burrow-Giles v Sarony (1884)* narrowed the scope of copyright protection. If a strict approach like this were to be applied to AI systems, the granting of copyright to products produced autonomously created by AI would be extremely difficult if not impossible.

4.6.3 Photography – Later Cases and their Implications

Bleistein v Donaldson Lithographing Co. 188 US 239 (1903) involved a revisiting by the US Supreme Court of the central legal question in *Burrow-Giles v Sarony* and ruled that advertisements were copyrightable. The Court differentiated between a human's work and the work of something 'artificial' (Elliott, 1984: p. 114). Justice Holmes, providing the majority verdict, drew special attention to the uniqueness of human personality and stipulating this as the prerequisite to copyright. The Court made its stance plain by employing language referencing the creative as belonging to 'something irreducible, which is one man's alone' (Bleistein v. Donaldson Lithographing Co., 1903). The ruling meant that there would be no scope for anything that was not a product of human creativity; and it thereby reinforced, in 20th Century language, the validity of the Aristotelian and Heidegger's definition of human character and creativity.

The rationale of the Supreme Court ruling in *Burrow-Giles v Sarony* in holding for the necessity of human intervention in machine creativity is a staple in the

development of modern copyright and reasoning involving AI and IP (Bridy, 2012: p. 27). Stress is placed on the pivotal role of the human author in providing the 'necessary arrangements', restated in Irish law and in the UK's *Copyright, Designs and Patents Act 1988* (*CDPA*), regarding copyrights made by computers (Taylor, 1989: p. 181).

4.6.4 Programmer as Author

Currently one suggested solution to the conundrum of copyright for AI is that of giving authorship to the programmer (Kumar & Lavery, 2019). This is evident in Hong Kong, India, Ireland, New Zealand and the UK where, when literary, musical or artistic works are computer-generated the author is regarded as either the person who facilitates this process or is the owner of the machine or the person who consciously enables the creative process to unfold. As explicitly stated in *CDPA*: in the case of a literary, dramatic, musical or artistic work which is computer-generated, the author shall be taken to be the person by whom the necessary arrangements were undertaken or put in place (UK Government, 1988). Indeed, it is the extent that such 'necessary arrangements' can be measured on a spectrum of legally defined creativity that will be considered shortly. The *CDPA* continues that computer-generated work means that there is 'no human author of the work' (section 9 (3) *CDPA*). This stipulation is highly problematic, for while it acknowledges the possibility of non-human authorship, the *CDPA* does not advise whether IP should reside in the machine's owner, the designer of the machine or indeed the user of the machine's output (Lloyd, 2020: p. 284). However, despite this acknowledgement that machines are capable of creation without human participation, the *CDPA* stipulation does not diminish the requirement for human presence in order for copyright to be claimed. Nonetheless, the legal complexity involved questions whether IP should be granted to non-humans or if the very concept of 'human' might be extended.

This question is at the core of the AI/IP debate and leads us to the second classic case study involving photography referenced by Ginsberg at the Science Gallery, Dublin.

4.6.5 Non-Human Creativity

A hundred and thirty-one years after the Wilde case, another photograph would challenge the definition of human copyright. Moreover, it was this second and contemporary case that extends the exclusion of the 'non-human' from the world of copyright creativity.

Figure 33: Photograph of Naruto, a crested black macaque. Source: https://news.sky.com/story/selfie-monkey-naruto-cannot-sue-for-copyright-us-court-rules-11344799

A series of photographs taken in 2011 of Naruto of a crested black macaque using a camera owned by a David Slater on the Island of Sulawesi in Indonesia would lead to a series of internationally disputed legal cases expanding the arguments laid out in *Burrow-Giles v Sarony*. The so-called 'monkey selfies' (Siderits, 2016: p. 327), one of which is shown above in figure 33, raised many questions pertinent to the enquiry about the possibility of copyright being granted to include non-human beings. For in this case, Naruto, the black macaque, took the photographs.

Two disputes arose, the first involving the US Copyright Office. In a manner echoing Burrow-Giles' lithograph advertisement, an editor on Wikimedia Commons uploaded the selfie photographs from the *Daily Mail* and the images became a global sensation. Slater had earlier copyrighted the photographs (even though he had not personally taken them) and licensed the works to various UK news outlets including the *Daily Telegraph*, the *Daily Mail* and the *Guardian*.

Slater argued that the pictures had been posted online without his authorisation, and that on the basis laid down in *Burrow-Giles v Sarony*, he had set the scene in motion that allowed the photograph to happen. This series of arrangements involved Slater providing the situation in which the photograph could occur, by going on holidays to Indonesia and making friends with Naruto sufficient to inspire the monkey to play with the camera. Slater testified that his contribution to facilitating the means for the creation of the monkey selfie was ample to qualify for copyright protection as the author of the work.

However, on the 21st August 2014 the US Copyright Office ruled that the pictures in question, the monkey selfies, did not qualify for copyright protection citing:

> only works created by a human can be copyrighted under United States law, which excludes pictures and artwork created by animals or by machines without human intervention…because copyright law is limited to 'original intellectual conceptions of the author', the copyright office will refuse to register a claim if it determines that a human being did not create the work. (Compendium II, 1984: p. 200-3)

The US office will not recognise works produced by 'nature, animals, or plants' and specifically highlights 'a photograph taken by a monkey'(Compendium: Chapter 300, 2017: p. 17) as an example of something that cannot qualify for copyright. In August 2014, the day after the US Copyright Office published their opinion, Spokeswoman

Bianca D'Orsi for the UK Intellectual Property Office was quoted as saying that, while animals cannot own copyright under UK law:

> the question as to whether the photographer owns copyright is more complex. It depends on whether the photographer has made a creative contribution to the work and this is a decision which must be made by the Courts. (Gibbs, 2014)

It therefore appears that the arguments outlined above regarding non-human involvement in copyrightable material may yet be finely balanced and cannot be said with any conviction to be finally determined (Guadamuz, 2017a: p. 3)[93].

This argument begs the question, is there a legal concept that can include co-authorship between non-humans and humans in the creation of IP? Any such ruling on co-creation by a non-human would have the follow through of granting the sole right of authorship to a non-human. A second question, and one capable of legal subversion, is at what point does the human author become sufficiently disconnected from the act of creation so as to not qualify for copyright protection? To consider that notion, the tools available to measure and define the concepts of *originality* and *creativity* in music copyright must be investigated.

4.7 Defining Creativity and Originality in Music Copyright

Copyright law's definitions of *creativity*, human or otherwise, are slender (Karjala, 2008: p. 182). And yet, paradoxically, the very concept of *creativity* remains one of the key measures for determining whether musical works qualify for copyright protection. A useful way to glean an understanding of how to frame this elusive notion of

[93] Guadamuz has suggested that existing European case law, mainly *Infopaq International A/S v Danske Dagblades Forening*, says that the selection of photographs by a human would be enough to warrant originality if the process reflects the personality of the photographer (Guadamuz, 2017b).

creativity is through examination of the tests available for the assessment of alleged music copyright infringement. While the legislature may not be able to successfully frame what creativity is, established case law and legal tools exist to examine that which it is not. A consideration of classic human music copyright case studies regarding the concepts of *originality* and *creativity* provides the groundwork for a cross-examination of AI creativity in the music ecosystem.

4.7.1 Originality

A resilient commentary on music copyright comes from Bagehot and Kanaar in *Music Business Agreements* (1998):

> Copyright is the basic proprietary right of an exclusive nature attaching itself to any original musical composition or lyrics created which is set down in some permanent form. The permanent form may be writing, musical notation, a sound recording or some other means whereby it can be produced. (Bagehot & Kanaar, 1998: p. 124)

To be clear, some degree of *skill* needs to have been exercised in the work of creation, albeit it can be a modest demonstration of the term *skill* denoted by law when correlated to any music art norm.

Divergent notions of what constitutes *skill* underscores a fundamental requirement of copyright – that copyright protection extends only to the expressions of an idea and not the idea itself (Lillis, 1983: p. 413). The distinction between expression and ideas can be a grey area. The general guideline is that the more concrete an idea becomes, the more it is recognised as an expression. An illustration of this can be imagined in the context of the music of an improvising pianist. In an imaginary example, a pianist improvises beside an open window. As she performs, a passer-by hears the melody and whistles the tune. Upon arriving home, the passer-by sets down the melody on paper and posts it (by registered mail) back to himself. The musical idea has now been expressed and set down in some

permanent form and as such the composer of the copyright can be judged to be the passer-by.

In the AI context, within the imaginary scenario, the passer-by is replaced by a human programmer collecting the work of an improvising robot pianist. However, the AI robot pianist, by the nature of its algorithmic processes, will most likely have set down the music in some permanent form within its database archive. This again questions the creative contribution of the human programmer, especially if that human's participation may only be to press a 'compose now' switch. What constitutes a permanent form may well be legally tested once AI actors begin to generate non-repetitive, adaptive and hyper-personalised music - for what would the status of the copyright be if the permanent form (the AI recording) digitally dissolved after a limited period of time, despite the fact that a copy would remain in the systems database?

Copyright law, in being little different from other areas of law, is prescriptively defined in legislation. However, its concepts are understood in terms of the tests of what fails to comply with the prescriptive norms. It follows that what it actually means for a literary, dramatic, musical or other artistic work to be considered *original* has fallen to be determined by the Courts whose role has been crucial in interpreting similar terms in previous copyright legislation. Thus, it will always be decided on a case by case basis. Leaving the determination and regulation of creative AI to emerge and develop solely on a case by case basis does present peril, and this is a recurring theme in this chapter. What has emerged from the jurisprudence is that there is no requirement for novelty or uniqueness in the determination of *originality.*

The classic case in the concept of *originality* was decided in 1916 and dealt with a copyright claim for college examination papers. In the case of *University of London v University Tutorial Press,* Peterson J. said:

> The word "original" does not in this connection mean that the work must be the expression of original or inventive thought. Copyright Acts are not concerned with the originality of the ideas, but with the expression of thought. (Golvan, 2007: p. 11)

The Judge further stated that:

> The Act does not require that the expression must be in an original or novel form, but that the work must not be copied from another work – that it should originate from the author. (University of London Press Ltd v University Tutorial Press Ltd, 1916)

This ruling is itself an expression of this review's earlier observation, that while the law may not be able to determine or 'be concerned' with what is original, it can however test when a work is not original. In other words, the concept of *originality* in copyright has become defined in negative terms, as a work which is not plagiarism.

A related concept is that of *authenticity* – a legal concept separates to the musicological use of the term which is stressed in the Australian Bridgeman case. Here it was shown that what is important in a work is that it must be created by the author who claims authorship and who shows a degree of creativity, so that the work is distinct from the materials from which it was created (Bridgeman Art Library, Ltd. v. Corel Corp., 1999). The connection between *authenticity* and *originality* was confirmed in the North American case *Boisson v Banian Ltd.* where it was stated that *originality* requires a work independently created by its author, 'one not copied from pre-existing works' (Judi Boisson v. Banian, LTD, 2001).

These rulings continued the low bar definition of *originality* which had been propounded in *Alfred Bell & Co. v Catalda* (Alfred Bell & Co. v Catalda Fine Arts, 1951). Here the US Court of Appeal had settled on a low standard for originality holding that for the work to be original, it must not be copied from any other artistic work of similar character (Alfred Bell & Co. v Catalda Fine Arts, 1951). This ruling can be seen

as granting some relief to claims for copyright protection for work generated by AI. For if the test is confined to the question of whether the AI work was copied, even though the work was generated through a process involving algorithms and training sets, then the AI work could still be deemed to be sufficiently original to qualify.

The requirement for a sufficient degree of *originality* in a musical work to attract copyright can be considered self-evident. However, when critically considering AI creativity such definitions are not intuitive. The criteria for meeting the test of originality have changed over time. The legal framework emerging from the case law makes the concept of *originality* central to the protection of musical works, most especially to music composition. To be protected by copyright the work must be original. Issues of complexity and conflict in dealing with copyright in music arise from what are understood to be the boundaries of *originality* which are defined in terms of its antithesis – *similarity*. If the definition of originality is perceived by reference to its opposite – the copying and unlawful infringement of an original work - then *similarity* in a musical composition will be tested in this negative understanding of *originality.*

4.7.2 Sweat of the Brow

The Courts have traditionally emphasised the necessary skill and labour of the author. The so-called *sweat of the brow* test prevailed until quite recently. However, since the decision in *Feist v Rural Telephone Company 499 US 340 (1991)* the balance has moved from the test of an individual's effort to a test of creativity *(Feist Publications, Inc. v. Rural Telephone Service Co., 1991*). The Court held in *Feist* that regardless of how much effort was put into the assembling of work (in this instance, a telephone directory), a work is not original unless it includes a minimum requirement of creativity. In reaching this conclusion the Court brought US law into accordance with the dicta of Lord Atkinson in the Macmillan case where he stated:

> it is the product of the labour skill and capital of one man which must not be appropriated by another…to secure copyright for the product it is necessary that labour skill and capital should be expended sufficiently to impart to the product such quality or character which the raw material did not possess. (MacMillan & Co. Ltd v Cooper (K & J), 1923)

Originality must now be a fundamental aspect of the work and the author is required to show some degree of *creativity*. Therefore, an improvised song recorded with minimal effort can attract copyright so long as it was created independently by its composer, as shown in the earlier illustration of the whistling passer-by. This principle, as will be demonstrated, is bound to have serious implications for copyright in AI music.

The low bar required for originality set in the *Alfred Bell* case and confirmed in *Feist* will be far-reaching when considering audio sampling practices and the possible interpretation of AI generated audio recordings. The chief pragmatic test of *originality* is recognition of prior authorship, and infringement of copyright is at its most evident if an entire work is copied, either by mechanical means or by creating a new composition. However, what is of more relevance to this review is when substantial parts of an existing work are copied sufficiently for the original copyright holder to plead breach of copyright. The boundary for breach of copyright is, rather unsatisfactorily, defined as when the defendant has copied a 'substantial part' (Harman Pictures v Osborne, 1969). Even an abridged extract can be an infringement if it is deemed integral to the essence of the original work, and this will have remarkable implications when later applied to unsupervised machine learning techniques.

4.8 Boundaries in the Legal Landscape: Plagiarism and Fair Use

To comprehend the complexities of the many challenges presented by AI on IP, the existing strains already placed – by humans – on music copyright should be

established for it is the existing fragility of the law that AI tests. A key infirmity in the law relates to legal notions of *creativity* and *originality* which, as has been shown, are negatively defined by their degree of *similarity* to other works.

A review of the case law shows consensus around three explanations for musical similarity – coincidence, influence, and plagiarism. It is important at this point to be reminded that there are two major copyrights in any music recording – the copyright attached to the composition and the copyright attached to the recording. It can be useful for clarity of mind in this instance to imagine Frank Sinatra, an artist well-known for recording songs composed by others. Sinatra's music copyright exists only in his recording of the song, while the copyright in the composition (publishing) is retained by the writer, who is not Sinatra.

Copyright in a musical work, either attached to the composition or the recording, is vital to secure the exclusive exploitation and hoped for accruing financial benefit. Copyright, therefore, embraces financial rights. Often these rights are assigned to a publisher or producer who then exploits the work and gains the profits which are the essential fuel for the engine of the music business.

4.8.1 The Tests

Coincidence will likely happen within a particular musical genre and a substantial element of similarity may more often be perceived as plagiarism rather than coincidence. Influence is traditionally acknowledged as a benign explanation for similarity in artistic processes including music composition (Stav, 2014: p. 3). A musical composition is always and inevitably influenced by other compositions, and it is an accepted and established practice for composers to reference or repurpose motifs, riffs, grooves or other characteristic ideas in an often-undisguised salute to an author's creative kinship. The Rolling Stones are an excellent example in this regard; the band, from their first release

(1964) to their most recent album (2016), openly acknowledge the enduring musical influences of American blues artists on their work. Thus, as long as the process is based on taking fragments of ideas and synthesising them with the composer's creative perspective to form a new and original expression, then any similarity may be innocent in the eyes of the law. In some cases, similarity will lose its legitimacy and plagiarism will be found to have occurred. So how is one situation distinguished from the other?

The legal tests to be applied to this question have evolved over the years on a case by case basis. As the US has by far the greater influence in the development of popular music it provides a not in-considerable jurisprudence where guidelines have been laid down. Plagiarism is ill-defined as a legal concept, but it can be understood for all practical purposes as copying, taking credit for, and passing off with or without attempts to make financial gains from another's work. To the owner or creator of a work, plagiarism is the most pernicious form of copyright infringement. It deprives the creator of the work from receiving the recognition and monetary rewards of the creation. It is not surprising that artistic homage or the acknowledgement of another's prior work referenced in new original work will increasingly be the subject of challenge and claims of plagiarism.

4.8.2 Homage or Plagiarism?

A relevant case regarding the limits of homage involves the Glaswegian pop band, Wet Wet Wet, who claimed to have quoted lyrics from Van Morrison's song *Sense of Wonder* – in their 1987 release, *Sweet Little Mystery*. Morrison argued that this quotation was a simple case of wilful copyright infringement and the matter was settled out of court, with Morrison receiving a co-writer credit for *Sweet Little Mystery*[94] (Kent, 1993). The

[94] Folk musician John Martyn also sued the band and received co-writing credits (settled out of court) alleging that the band had infringed his rights with Martyn's own composition *Sweet Little Mystery*.

case demonstrates how one creator's homage can be another's alleged plagiarism (Crouse, 2000: p. 228). Outside of this specific defence to a claim of copyright infringement, the test of plagiarism is objective rather than subjective. Therefore a defendant's lack of awareness or unconsciousness of the copying, repetition or imitation of all or part of another's work does not serve as a defence to a claim of copyright infringement – a point that will no doubt be important in the future when considering the intentionality or otherwise of black boxed, non-sentient, narrow AI systems music creativity.

This logic was stressed in the case of *Bright Tunes Music v Harrisongs Music* (Bright Tunes Music Corp. v. Harrisongs Music, Ltd., 1976), where George Harrison was accused of plagiarising Ronald Mack's *He's So Fine* in Harrison's composition *My Sweet Lord* (Grinvalsky, 1991). The Court accepted Harrison's claim that the copying had not taken place consciously but stressed that this fact is irrelevant, and ruled that Harrison did indeed infringe the copyright of Mack's song. While the intentionality of the author in copyright infringement may not be deemed relevant, such rulings build to this review's later consideration of AI, particularly issues that involve unsupervised machine learning decision-making, as the intentionality of the system is less important than its created output. However, before moving on to near future technological considerations, the complex arguments involved in music copyright within which the AI actor operates will continue to be established here.

The case study of the disputes arising from The Verve's recording of *Bitter Sweet Symphony* includes issues related to homage, plagiarism, and introduces to this discussion the crucial use of audio samples within music copyright. As legal concepts of audio sampling are the subject of the next section of this chapter, the case study provides a real-world example of the complex application of these many legal concepts in practice. The case study also includes a, somewhat surprising, final resolution to a complex financial

and legal dilemma. The final twist in the story of the *Bitter Sweet Symphony* indicates how ultimately, an ethically determined decision can inform court rulings in the music ecosystem.

4.8.3 The Verve v The Rolling Stones (1997)

It is a widely accepted truism that many artists begin by copying their musical influences' creations (Patry, 2011). Such an artistic tendency was apparent in the judgement against George Harrison and *My Sweet Lord*. It is also exemplified in the song writing development of the Rolling Stones, who began as a blues bar band performing the work of their American Delta heroes, Muddy Waters et al. (Coelho & Covach, 2019: pp. 5-6). In the case of the Rolling Stones, it was the suggestion from their manager Andrew Loog Oldham that transitioned the band's direction to becoming composers:

> I convinced Mick and Keith that they could write their own songs, making them dependent on no one, not even me, and showed them the way to creative freedom. (Oldham, 2013: pp. 179-180).

Jagger and Richards would subsequently become one of the most successful song-writing partnerships of the 20th Century (Thompson, 2017). The story of how Loog's challenge played out in a legal case thirty years later makes salutary and instructive reading of how the discussed legal concepts interlink in practice.

Bitter Sweet Symphony, a single from the English rock band The Verve's third album *Urban Hymns* (1997), reached number two in the UK singles chart, number twelve in the Billboard Hot 100 US charts and in 1999, the song was nominated for a Grammy award in the US (Gammons, 2011: p. 133). The recording of *Bitter Sweet Symphony* included a licensed sample from a symphonic recording of the Rolling Stone's song *The Last Time.*

The sample, the subject matter of the dispute, was taken from a re-recording of *The Last Time* by the Rolling Stones former manager Andrew Loog Oldham[95]. The Verve had taken a licence for a five-note segment from the Andrew Oldham Orchestra re-recording of *The Last Time*. In return, the Verve provided fifty percent of the recording royalties in their track *Bitter Sweet Symphony* to the writers of *The Last Time*, Mick Jagger and Keith Richards. However, Allen Klein, another former Rolling Stones manager, argued successfully that the Verve had entered into a material breach of this sampling agreement. Klein contended that his holding company ABKCO[96] and *The Last Time* songwriters Mick Jagger and Keith Richards had suffered infringement of their copyright in the composition (Hahn, 2005: p. 713). What was remarkable and galling to many is that the string melody in the licensed sample had not featured on the original Stones composition.

The Verve lost all song-writing royalties and publishing rights to the song. All song-writing credits in *Bitter Sweet Symphony* were transferred to Jagger/Richards and Richard Ashcroft[97]. Subsequently, Andrew Loog Oldham, the Rolling Stones original manager, but now acting as the artist (as The Andrew Loog Oldham Orchestra) also successfully sued the Verve in 1999 for €1.7 million in mechanical royalties[98] (Willcock, 1999). Perhaps the key point here in understanding the nuance of copyright infringement as it relates to music sampling is that, though the Verve licensed a sample from a cover version of a Rolling Stones song, the portion of that sampled recording was deemed to have exceeded the scope of the licence[99].

---

[95] Recording as The Andrew Oldham Orchestra in 1965.

[96] The publishers of *The Last Time*.

[97] Lead singer of The Verve and the original composer of *Bitter Sweet Symphony*.

[98] Richard Ashcroft's *moral rights* would ensure that he would retain a writing credit through a financially unrewarded credit on the song's publishing along with Jagger/Richards. Ashcroft received a one-time payment of $1,000 as a legal consideration (Songfacts, 2020).

[99] The famous string motif of which did not feature on the original recording of *The Last Time* (StringspaceLive, 2017).

Further details surrounding these recordings highlight issues related to concepts of homage, creativity, and influence. The sampled string motif from *The Last Time* was written and conducted by the Oldham Orchestra's string arranger David Whitaker, who remained uncredited and unentitled to royalties from any of the subsequent recordings featuring the sample (Stanley, 2012). In a further twist, a series of revealing comments made over twenty years later by Keith Richards, highlight the creative influence of the Staple Sisters *This May Be the Last Time* (1955) on the Rolling Stones *The Last Time* (1965):

> We ended up [writing] *The Last Time* because the Beatles didn't have another good one and we'd rifled (laughs) everybody else's' repertoire (1982) (Time Is On Our Side, 2020) …. I didn't realise till after we'd written it [*The Last Time*] because we'd been listening to the Staples Sisters' album for two months or so. You don't go out of your way to LIFT songs, but what you play is eventually the product of what you have heard before (1995)…We came with *the Last Time*, which as basically re-adapting a traditional gospel song that that had been sung by the Staple Singers, but luckily the song itself goes back into the mists of time. (Jagger, et al., 2003)

The Verve v The Rolling Stones (1997) demonstrates the existing complexity of argument that emerges from the interlinking copyright concepts involving human creativity. In an intriguing acknowledgement of the potential role of ethics in the music ecosystem in May 2019, Jagger and Richards relinquished their rights to *Bitter Sweet Symphony* (Sparks, 2019). This decision demonstrates how fundamentally straightforward the intervention of belated ethical decision-making (by Jagger and Richard) can be, especially when contrasted against the complexity of a legal solution to the same question. Richard Ashcroft certainly saw this as a moral response stating that it was a 'remarkable and life-affirming turn of event made possible by a kind and magnanimous gesture from Mick and Keith' (Taylor, 2019). Questions of the role of ethics – and determining what is in the common good of the music ecosystem – are compounded when

considering current stresses placed on music copyright. These stresses are multiplied when AI becomes a creative actor in the ecosystem. To understand the AI challenge, a number of recent and controversial rulings in music copyright are now noted that chart the existing fragility of the legal landscape.

4.8.4 The Shadow of *Blurred Lines* and *Dark Horse*

The legal boundaries of homage and unconscious copying within plagiarism influence design choices of AI start-up actors. For instance, the AI trainer influential track for AIVA was based on 'emotional' rather than musical similarity, and is likely an indicator of some legal consideration in the AIVA description. The law continues to evolve in its interpretation and inter jurisdictional application, and several recent cases can be seen to widen and possibly dilute the available tests for music copyright infringement. With this contemporary knowledge, this review can proceed to appreciate the legal tests that AI presents to the brittle and highly interpretable legislation of the music ecosystem.

Robin Thicke and Pharrell Williams were the writers of the 2013 number one global hit *Blurred Lines*. In 2016, an eight-person jury ruled that the writers should pay over $7 million for infringing on Marvin Gaye's *Got to Give it Up* (Associated Press, 2015)[100]. The plaintiff (Gaye's estate) alleged that certain music passages from the Gaye composition had been infringed. However, it was the Thicke and Williams defence that unintendedly contributed to the Jury's decision to award the Gaye Estate. The defence contended that *Blurred Lines* was a work of genre which contained a feel and groove similar to *Got to Give it Up* – Williams went so far as to state that Gaye had been an inspiration for *Blurred Lines*. Judge Jacqueline Nguyen of the Ninth US Circuit Court of

[100] Reduced on appeal from $7m to $5m (Staff, 2018).

Appeals observed that the verdict allowed the Gaye estate 'to accomplish what no one has done before: copyright a musical style' (Smith, 2017: p. 57).

Whatever of the questionable merits of the jury's determination, songwriters now face increased scrutiny of their music copyrights. This scrutiny has led to an increase of out of court settlements and contributed to the introduction of professional liability insurance policies for major publishing companies and songwriters (Wang, 2020). Unsurprisingly, AI is also being used to accelerate this movement through the deployment of copyright bots to locate potential copyright infringement cases (Tune & Iverson, 2020). It stands to reason that if an AI were assigned copyright, it would be held to human warranties regarding plagiarism.

A further example of the randomness now common in music copyright litigation involves a fan mash-up of two songs posted on YouTube – Tom Petty's *I Won't Back Down* and Sam Smith's *Stay with Me* – which led to an out of court settlement regarding copyright in the composition between the relevant publishers (Dickey, 2015). Similar illustrations that involve questionable copyright infringement allegations have arisen regarding Ariana Grande's *7 Rings* (Eggertsen, 2020) and Childish Gambino's *This is America* (Iser, 2018), while the global popularity of Ed Sheeran has no doubt contributed to the number of contentious legal cases involving the artist (Pierse, 2017). Reports of related cases often cite the influence of the *Blurred Lines* judgement in changing the norms of what may or may not constitute copyright infringement in a music composition. The numbers of credited songwriters certainly seem to be on the increase and indeed can even alter during the trajectory of a song success[101]. The increase of attributed songwriters in compositions, especially after the release of a recording, is an indicator of

[101] When DJ Marshmello released the track *Friends* in February 2018 there were three credited songwriters – Marshmello, Anne-Marie and Nat Dunn. By June 2018, by the time the song had reached number eleven in the US Billboard charts, five additional writers had been added to the copyright in the composition (Sisario, 2019).

the growing litigious environment in the music ecosystem and this is essential to bear in mind when introducing the complexity of the AI actor.

The verdict against Katy Perry (and her co-writers Walter, Gottwald, Sandberg, Hudson, and Houston) on her track *Dark Horse* has been seen to lower the bar of what constitutes copyright infringement even further (Voynovskaya, 2019). The high levels of awards may be contributing to the attractiveness of speculative litigation, a concern outlined by US attorney Kenneth Sidle:

> This will cause more cases to be brought…there's a lot of songwriters out there who think they're being ripped off and can perhaps talk a lawyer into representing them, get a good jury and roll the dice. (Knopper, 2019)

Dark Horse had been an international hit and the plaintiff – the artist Flame – had no direct evidence that the writers of *Dark Horse* had heard his composition *Joyful Noise*[102]. The allegation though was based on what the plaintiff termed 'a descending minor mode 8 figure ostinato' (Bosher, 2019a) that was substantially similar despite notable distinctions in pitch, rhythm, and the length of the musical notes featured in a *Dark Horse* keyboard motif which was the central issue of the claim. What is notable about the *Dark Horse* verdict was that lyrically and melodically there was no similarity between the two songs (a root contention in most copyright infringement cases). The decision however was based on the inclusion of a standard musical pattern, commonplace in 'many trap beats' (Abad-Santos, 2019) and generically referenced in the Katy Perry recording. On the 17th March 2020, US District Court Judge, Christina Snyder reversed the Jury's verdict on *Dark Horse* ruling:

> It is undisputed in this case, even viewing the evidence in the light most favourable to plaintiffs, that the signature elements of the 8-note ostinato

[102] Released five years prior to the Perry track.

> in Joyful Noise... is not a particularly unique or rare combination… Because the sole musical phrase that plaintiffs claim infringement upon is not protectable expression, the extrinsic test is not satisfied, and plaintiffs' infringement claim – even with the evidence construed in plaintiffs' favour – fails as a matter of law. (Gardner, 2020)

The plaintiffs plan to appeal against this decision (Dalton, 2020), Flame's attorney Michael A Kahn stating that 'it was only Round 11 of a 15-round match'. Whatever the eventual decision in the *Dark Horse* case may be, it is possible to conclude that if *Blurred Lines* introduced the concept that grooves could be copyrighted, then *Dark Horse* signals that genre sonic tropes might also gain the same right of protection. If copyright decision travels to these extreme lengths, it may well have the effect of permanently damaging the credibility of the tests upon which the edifice of copyright has been constructed.

4.8.5 Fair Use

At the root of cases like *Blurred Lines* lies the question of what constitutes *fair* and *unfair use* of IP. The *US Copyright Act, 2011* defines several uses that might be considered *fair*. These include criticism, commentary, news report, teaching and other applications (US Copyright Office, 2020b). *Fair use* status depends on four criteria: 1. The purpose of the use – whether it is for a commercial purpose; 2. The nature of the copyrighted work; in what context the copying occurs. 3. The proportion between the used part and the whole work which is the test of *substantiality*; 4. And the effect the use has upon the commercial market of the original work. The defence of *fair use* for example has been held to embrace a parody of a successful song, as was demonstrated in the case of *Campbell v Acuff-Rose Music*[103] (Campbell v. Acuff-Rose Music, Inc., 1994).

So far, concepts that will legally contextualise the work of the AI actors reviewed in the last chapter have been examined, and the test of *substantiality* will be seen to be

[103] Which involved 2 Live Crew's take on Roy Orbison's *Pretty Woman* (Greenhouse, 1994).

increasingly key to this review. However, it is useful to note at this stage some important distinctions. The majority of the actors, from David Cope to IBM to AIVA, involve AI systems trained on music databases to create music compositions. Some of these actors, for example Vico's Iamus or Cope's EMI, have their AI compositions played and recorded by human musicians. Alternatively, others process the AI compositions with supervised AI systems to create music recordings of the compositions (Jukedeck, Sony et al.). In each of these actors, human creativity in the AI process is evidenced at each stage of the musical works development, albeit at varying degrees. Many questions related to the call for AI to be granted the right to IP can be considered within those available tests and concepts so far outlined. Nonetheless, it is when considering other emerging AI systems (Google's WaveNet) that the deepening complexity of the AI situation emerges, for these AI systems involve unsupervised training of audio datasets and are capable of producing both music compositions and music recordings without human participation.

To deepen understanding of the legal, and thus fiscal, challenges presented by AI, this review now progresses from the analysis of issues of plagiarism in music composition to those relating to recordings. Armed with this understanding, it can then transition to examine Google WaveNet technology. In order to achieve that goal, exploring audio sampling in the music ecosystem is essential.

4.9 Challenging the Boundaries in the Legal Landscape 1: Sampling

4.9.1 Sampling: Legal Complexities Raised by AI

Sampling and plagiarism have been described as 'two sides of the same problem' (Harrison, 2008: p. 270). With plagiarism, the proposed infringement relates to the alleged *passing off* of the expression of another's musical idea as one's own. Whereas audio sampling relates to a conscious act involving a deliberate use of a segment of a pre-

existing, copyrighted sound recording, and the use of that audio sample as a component in a new recording.

It might seem on first appearances that the act of directly copying existing recorded audio presents a more straightforward matter to adjudicate than copyright infringement in a musical composition. However, the many instances in which this has not proven to be so invites examination of the legal issues attached to music sampling, as well as its practice as an integral element of modern music making.

Sampling is a process of digital technology which legally allows an artist, through the granting of a licence, to copy a portion of a recorded sound or series of sounds for incorporation into a new work (Stim, 2018: p. 314). In the US in 1990, only eight of the top selling one hundred albums contained audio sampling content. Twenty years later, 20% of the Billboard best-selling albums used sampling as an artistic tool (Oskar, 2019a; Oskar, 2019b). The use of sampling in popular music production, not just in the US but worldwide, is now pervasive.

4.9.2 History of Sampling

Audio sampling has become a commonplace element of contemporary music practice (Strachan, 2017) giving rise to many controversies under copyright law, and has evoked policy and legislative responses from the EU. Referencing the works of other artists through the redeployment of recognisable materials was as popular among the Romantic composers as it was among the folk musicians busking outside the concert halls in previous centuries (Leichtentritt, 2013 [1938]: p. 196). Modern techniques of audio sampling differ fundamentally from such practices, in that the new musical work does not contain merely a reference but an actual fragment of the original work. It would appear to present a more straightforward case for assessing copyright infringement – as an audio recording either has or has not been sampled. However, as occurs frequently in the music

ecosystem, what seems straightforward generates new complexities; and these arguments become ever more intricate in audio sampling with AI music systems.

In classical music the use of audio sampling was first associated with the 1940s *Musique concrète* movement (Gallagher, 2018; Crilly, 2017). In the 1950s, Harry Chamberlin invented the Chamberlin keyboard, famous for its string emulation which was achieved through the use of pre-recorded tape samples (Awde, 2008). In the 1970s, the first digital sampler, the Computer Music Melodian, was developed by Harry Mendel and featured on Stevie Wonder's album *Journey through the Secret Life of Plants* (1979) (Sfetcu, 2014). However, it was the invention in the same year (1979) of the polyphonic Fairlight CMI music sampler that would have the most profound impact on the arc of both sampling technology and creative music practice (Dean, 2009). In modern popular music, sampling reached its apotheosis with the development and crossover popularity of Hip Hop in the early 1980s. Audio sampling has grown to become now routine, in present-day music genres and performance contexts. It is essential to explore the legal framework for the human use of sampling before considering AI's ability to generate both music composition and audio recordings.

4.9.3 The Legal Defense of *Scenes a Faire* and *De Minimis*

An analysis of the development of audio sampling technologies and practices brings this review again to defences to claims of copyright infringement. In addition to the defence of *fair use*, the law has recognised the defence of *scenes a faire*[104], which was introduced in *Cain v Universal Pictures* in 1942. Here it was established that a defendant must claim that the parts copied from the plaintiff's work constitute substantive elements in the work of the genre.

[104] Derived from the French term meaning 'scenes that must be done' (Pandey, 2015).

The other defence, that of *de minimis* deriving from the Latin legal maxim *de minimis non curat lex* or 'the law does not concern itself with trifles' (Duhaime, 2020), is an age old legal concept which will become familiar particularly when encountering Google's WaveNet AI. Experience to date indicates that a higher number of contemporary copyright disputes over music samples do not revolve around whether the sample is small or recognisable or a vital part of the song, but instead question whether an instance of music appropriation is or is not *fair use* (Challis, 2009).

Nonetheless, the *de minimis* defence is likely to play an ever-increasing role in the resolution of copyright cases involving music sampling. In infringement cases, the doctrine *de minimis* classically allows a defendant to claim that the part taken and used in a work is too insignificant or lacking in importance to be treated as an infringement of the original work's copyright (Schuster, Mitchell & Brown, 2019: p. 184).

Contrary to much conventional understanding, there is no number of notes that determine the extent of *de minimis* (Lindenbaum, 1999: p. 23). Instead, the smallest audio sample that can be recognised by someone familiar with the original is the limit as to what could be protected by a *de minimis* defence (Mispagel, 2018: p. 474).

In a dispute involving sampling, a defence could be that the audio sample used is so small that the owner of the copyrighted work does not own the segment. The basis for this is the line of the US Copyright Act that demands a copyrightable work must 'result from a series of... sounds', implying that a single sound cannot be copyrighted (US Copyright Office, 2020c: p. 1). For example, a drumbeat or single guitar note cannot be copyrighted, so the sampling artist could claim that his or her appropriation does not violate copyright (Carnachan, 1996: p. 1044). A similar logic exists in the legal provision excluding copyright of a letter of the alphabet (Vaver, et al., 2002: p. 31).

In music, the *de minimis* defence is becoming a more common one in cases of music sampling. One well known case is *Newton v Diamond 349F.3d 591 (9th Cir.2003)*

(Latham, 2003: p. 121). Here, James Newton claimed that the use of samples from his song *Choir* in the Beastie Boys' song *Pass the Mic* constituted copyright infringement. The Court gave its definition of a *de minimis* use of a work as one that 'the average audience' would not be able to detect. As the Beastie Boys only sampled three notes from Newton's song, it was determined to be too short to be recognisable by an average audience (Hull, Hutchison & Strasser, 2011: p. 107). The act of audio sampling was therefore *de minimis* and not actionable as infringement under copyright law (Stav, 2014: p. 20).

4.9.4 Fixation of Sounds

Progressing the concept of *de minimis*, under US Copyright law, audio sampling is described, if not definitively defined, as 'an independent fixation of other sounds', regardless of whether or not the new sounds imitate those on an older recording (US Code, 2020). The US Copyright Act does not give copyright protection to a sound recording made of an independent fixation of other sounds. An example of an independent fixation of sounds would be a cover song, which involves an artist making a new but similar version of a previously written and recorded song. The case study of *Bitter Sweet Symphony* demonstrates the pitfalls and legal entanglements presented to musicians in the modern era in this context, and it is therefore essential to be aware of the existing complexities, before reflecting how AI presents challenges that shake the very envelope of the legal understanding of music IP.

Moreover, such defences can only be interpreted within an understanding of the overall music copyright framework. Furthermore, all critical components of the copyright framework require knowledgeable discernment for all practitioners in the music ecosystem, as it is implausible to predict which aspects of copyright law may be first tested regarding the application of AI to music. Interestingly in the case of AI, if

substantial similarity is proven between the original and that of the new work, a court can deem that these protections may be seen to be inhibiting creativity in the *common good* (Grigorescu, 2019: p. 18). The understanding of what is in the *common good* must be a powerful ethical attributor in AI and music. However, all these conditions have been used successfully in the courts to rule against illegal music sampling. The use of an audio sample most often cannot be defended through *fair use*, as there is some level of commercial gain even if that is determined as indirectly through the elevation of the public promotion of the sampled artist. Such purposes are considered *unfair use* and it is therefore worth considering this point a little further.

Another criterion extends beyond whether the recording in question features the unlicensed use of the audio sample, to consider whether the new work might have an adverse effect on the commerciality of future *derivative* or *transformative* interpretations of the original work (Liu, 2019: p. 179). For example, when the Beastie Boys sampled the drumbeat from Led Zeppelin's *When the Levee Breaks*, on their album *Rhyming and Stealing* (1986) it can be argued that this did not reduce sales of Led Zeppelin's untitled fourth album (1971). However, it could be argued that the Beastie Boys release may have impacted on later sales of Dr Dre's song, *High Powered* (1992) which also featured the same Led Zeppelin audio drum sample. Nonetheless, samples have revived the careers of many legacy artists (Halloran, 2017: p. 48), so it is unclear whether this criterion can apply for this form of sample usage – a judgment is often required as to whether the challenged use would be harmful if it were widespread. To help resolve this question, it is something of an appropriate inevitability that in consideration of AI, the original fathers of the Man-Machine concept in music, Kraftwerk, should make an appearance at this juncture.

4.10 Challenging the Boundaries in the Legal Landscape 2: Sampling and EU Law

4.10.1 The Pelham Case

In late 2018, an opinion of the Advocate General was issued in *Pelham C-476/17* **(**also known as the *Metall auf Metall* case) dealing with the taking of audio samples in EU copyright law (Pelham GmbH, 2019). The Advocate General ascribed audio samples as:

> the process of taking, by means of electronic equipment, a portion or sample of a phonogram for the purpose of using it as an element in a new composition in another phonogram. (Gawliczek, 2019; Pelham GmbH, 2019)

As such, sampling involves the use of fragments of earlier musical works by including them in a new work. Several essential arguments are presented in this review of the copyright implications of audio sampling. It is worth considering them and assessing their influence on the ruling in the Pelham case.

The dispute which led to the involvement of the Advocate General, and then to the judgment of the full chamber of the European Court of Justice (ECJ), relates to the sampling of Kraftwerk's *Metall auf Metall* by Sabrina Setlur, in her recording *Nur Mir* (Lessmiller, 2019). The questions which arose included whether the use of an audio sample equates with copyright infringement of the original recording, and whether indeed a new recording should be regarded as an actual copy of the original work. Questions concerning the limits of artistic freedom in the context of the Charter of Fundamental Rights of the European Union also come into play here (Snijders & van Deursen, 2019: p. 1177).

Several points are worth highlighting. Firstly, the opinion of the Advocate General indicated that the protection of an audio sample cannot be derived from the fact that it is regarded as sufficiently *original* – since this requirement applies to full musical works,

that is, a music composition which is the classic subject-matter of copyright law. Moreover, the Advocate General defined a recording (phonogram) as a 'fixation of the sounds' (Directive 2006/115/EC, 2020) – a musical idea set down in some permanent form. If this concept were adopted into law, it would make the protection of an audio sample reliant on the level of *originality* of the first recording. It is a minefield of vertigo inducing puzzles; however, its consideration is instructive when moving to an analysis of AI sampling practices.

The Advocate General's opinion also stressed that the copyright protection of an audio recording may be different than that of a music composition. Regarding the question of whether a phonogram containing samples from an earlier recording constitutes an actual copy is referenced in Article 5 of the Directive, as well as the possibility of making an exception for audio recordings.

Two key issues ultimately fell for resolution by the Court. Firstly, is it an infringement of the exclusive right of a phonogram producer to take very short snatches (amounting to only two seconds of drums in the Pelham case) and without authorisation use it in another recording? And if so, can the provisions allowing 'quotation'[105] be relied upon as a defence to that claim? Secondly, can exceptions in member states' national law, outside of what is permitted in EU law (Copyright Act, 2020), as in the example of the extended concept of *free use* under German law, be compatible with EU law? And arising from that, what are the boundaries to national legal provisions within areas subject to EU harmonisation? Many of these questions will already be familiar from the earlier discussion of AI and IP, and highlight the inter-relationship of argument.

At paragraph 29 of the Judgment, the Court concluded that even a very short reproduction of the sound sample by the user must be regarded as a 'reproduction of that

[105] As set out in Article 5 (3) (d) of that directive.

part of the phonogram'. It follows within the meaning of the provision that reproductions are protected by the 'exclusive right granted to the producer of such a phonogram' regardless of how short the sampled fragment may be. However, a crucial qualification was made in paragraph 31 of the Judgment; the Court ruled on the importance of the sample being recognisable, and this is key when looking at its application to AI:

> Where a user, in exercising the freedom of the arts, takes a sound sample from a phonogram in order to use it, in a modified form unrecognisable to the ear, in a new work, it must be held that such use does not constitute 'reproduction' within in the meaning of Article 2 (c) of Directive 2001/29. (Hudson, 2020: p. 279)

On the issue of 'quotation' under Article 5, the Court ruled that such use must be 'in accordance with fair practice and to the extent required by the specific purpose' (Directive 2001/29/EC, 2001: p. 17). The Court held that for the purpose of illustrating an assertion, the use involves in effect an entering into a 'dialogue' with the work (e.g. for educational or similar purposes). The upshot of this ruling is that if the Court thinks that a sample taken is reproduced in an unrecognisable form, then it is not an act of reproduction and there is no need to consider other issues or defences. The Court endorsed the analysis of the Advocate General.

Can it be concluded from these directives that whilst for musical works (compositions) generally there is a reproduction when what is reproduced is sufficiently *original*, while for recordings (phonograms), there is no need to be concerned with *originality*, if the sample produced is not recognisable? It is a hopeful indication that a sector-specific (music ecosystem) interpretation of the application of copyright law can be recognised at the jurisdictional level of the UN, for this ruling has significant implications when applied to AI music generation, specifically those involving unsupervised machine learning, as will be seen.

4.10.2 Derivative Works

In addition to the recent EU Pelham directive, another legal concept is important to acknowledge and that relates to *derivative* and *transformative* works of art. Audio sampling frequently involves the borrowed fragment being appreciably sonically processed. Affordable AI technologies designed for equivalent purposes, an example being 'Regroover' by Accusonus[106], are increasingly available. As a result, remixing processes (DJ remixes et al.) can dramatically change the original form of the sampled work. Such legally defined *derivative works* are now being recognised by the Courts as *transformative* artworks capable of copyright (Wong, 2008: p. 1106). When samples are confined (e.g. a two-second rhythmic sequence), it may be difficult for the listener to recognise the fragment in the new recording. Indeed, any listener recognition of the original sample may not be the new author's artistic intention. In that instance, the new work involving audio sampling is not an act of deliberate homage but one of creative bricolage, where the new work repurposes and can thus on occasion, legally transform the audio sample into a new *derivative* copyright. The Advocate General also pointed to the *freedom of art* guaranteed by the Charter of Fundamental Rights as potentially applicable to music sampling (Jütte & Quintais, 2019: p. 5).

4.10.3 The Boundaries of the Legal Landscape for Sampling

From the chapter review so far it has been established that, since the Berne Convention of 1886, an increasing movement towards the harmonisation of different national IP regulatory codes has occurred – a movement to bring coherence and a sense of consistency to a state of affairs where legal interdicts or court judgments in one nation might have often random or unintended domino effects in other jurisdictions.

---

[106] An AI powered third-party plug-in, which splits the frequency content of audio samples into a series of sub-samples, each comprising different aspects of the sample's harmonic content (Accusonus, n.d.).

This review has considered how tests for copyright infringement rely upon some basic legal definitions of *creativity* and *originality* in music. The consideration of these tests included a review of the classic defences and doctrines of *fair use*, *substantiality* and *de minimis*, all essential in determining whether music copyright infringement has occurred. It is with renewed understanding, and perhaps no small wonder at the ingenuity of the application of legal concepts in music copyright, that this thesis now considers the scientific methodologies in play with Google's WaveNet AI. Insights from the next section will indicate fresh challenges that AI presents to the basis of the music ecosystem – music copyright.

4.11 Challenging the Boundaries in the Legal Landscape 3: Google WaveNet

> WaveNet technology is different from all of the other AI used to produce music. We (Melodrive and its start-up rivals) all use symbolic decision tree machine learning. We teach the AI how to make music the way that humans have made music for thousands of years. WaveNet is something very different… something very alien. (Velardo, 2019)

4.11.1 Algorithmic Commonality and Distinctions between Actors

The majority of AI-based creativity programmes reviewed in Chapter 3, whether from the academy (David Cope – Francois Vico) or the start-up sector (Jukedeck – Melodrive), use algorithms that employ variations of symbolic deep learning neural networks. The creative outputs of these systems can be sheet music (Iamus) or processed MIDI and audio files (Amper). The computational creativity involved in these AI systems requires human musicians and technicians to be fundamental in the generative process. In the example of AIVA, the algorithm's created composition is adapted, performed, and recorded by human musicians and sound engineers. As impressive as the results of AIVA *Genesis Symphonic Fantasy in A minor* may appear, the performance of an AI

composition by a leading orchestra conducted by a human is central and exemplifies the critical and necessary participation of human beings in the system process.

Similarly, in other discussed music ML systems, a human-programmed curation is in operation that assigns the created MIDI file to a designated audio output (Algotunes) or an AI generated melodic MIDI pattern (Popgun) is guided by user parameters of tempo, mood and genre. While Popgun's algorithm assigns the AI generated MIDI file to a genre specified range of musical instrumentation, its human programmers have predetermined the attributes contained in the make-up of a specific genre or musical style.

Though copyright content generated by the AI may be available in the public domain (Melomics), or through a hybrid licensing arrangement (Amadeus Code), the vital involvement of a human either as the performer, co-composer, or programmer is a technical essential of the AI produced music. In the case of Endel the music created by the AI, while it is described as 'autonomously generated', its constructed music copyrights are licensed within a traditional copyright model[107].

With Google AI WaveNet, a radical proposition, different from the technical methodologies of the AI actors reviewed so far, is presented. The key differential is that the WaveNet system is trained on audio recordings and crucially produces a raw audio output – independent of human curation.

WaveNet is a self-learning neural network that delivers a musical output that requires no human participation either in its analysis of the inputted material or in the creative assembly of its final audio output. The infinitesimal degree at which WaveNet samples its audio training sets renders current, and perhaps possible legal, remedy redundant. Therefore, WaveNet presents something of a philosophical and legal rubicon. The implications of developing AI technologies like WaveNet indicate and underline the

[107] The start-up is partnered with a major recording company and the distribution agreement between Endel and Warner's Bros is a reputed 50:50 licensing deal (Mazzola, et al., 2020: p. 93).

urgent necessity of this dissertation's enquiry. To examine this significance, it is necessary to review both this technology's history and its technical functionality.

4.11.2 DeepMind History

Google's DeepMind began as a UK based start-up in 2010, and early investors included the global AI figures Scott Banister, Elon Musk and Jaan Tallinn. The involvement from the outset of preeminent AI financiers signified to industry that DeepMind was a start-up to watch, and DeepMind would not disappoint on its promise to investors. In 2014, after the publicly acknowledged triumph of DeepMind's computer program AlphaGo, Google acquired DeepMind for $500 million (Numerico, 2015: p. 1).

DeepMind's first project was the development of an AI that could win games traditionally considered the preserve of humans (Mnih, et al., 2013: p. 2). To achieve that objective, the AI learnt popular video games of the 1980s including Space Invaders and PacMan. Within two years DeepMind's AI victories would escalate from the learning of arcade games to the defeat of the Go World Champion Lee Sedol.

DeepMind's outset ambition was not to design an AI with a limited and fixed set of abilities. Rather, DeepMind wanted to produce an AI able to self-direct and provide solutions to a presented challenge. Fundamental to achieving this goal, the AI would have the capacity to self-learn (Mnih, et al., 2013: p. 3).

By comparison with IBM Watson, DeepMind's objectives while remaining as publicly positioned as IBM's consisted of a more nuanced AI development. Whereas IBM Watson has been acknowledged for demonstrating the effectiveness of so-called 'brute-force' processing (Gobble, 2019: p. 55), DeepMind operates with an agile deep learning AI. A comparative example of this technical distinction was witnessed in 2019, in a show-match of the StarCraft game[108]. For this task, DeepMind's AI was not taught

[108] StarCraft is one of the most complex and skill-oriented games in the world (Rashid, et al., 2020: p. 3).

the tactics or rules of StarCraft, rather the AI had to self-evolve and acquire the ability to master a series of progressively complicated gaming strategies (Arulkumaran, et al., 2019: p. 2). Over nine years, DeepMind would grow from a modest start-up with three founders into one of the most prestigious divisions within Google's AI portfolio (Hey, et al., 2020: p. 3; Forbes.com, 2020).

In helping to understand the significance of DeepMind within Google, it must be noted the overall objective of that AI division within the transnational actor (Google). DeepMind's stated aim is to create Artificial General Intelligence (AGI) and this is an important distinction, as it offers insight into DeepMind's long-term design approach which shapes the tools that they create and release. It may also provide understanding into why DeepMind's tools differ so fundamentally from those created by other AI music actors, though this analysis lies outside this remit. However, it is salient to note that the financial and ethical implications reviewed for the music ecosystem may be but the first level of challenges presented by AI. These thoughts shaped the design of the theoretical model of Chapter 1, to ensure that the model would be sufficiently robust and future-proofed[109] that it could encapsulate the AGI ambitions of AI actors. Nevertheless, in the context of this review, an acknowledgement of AI actors like DeepMind and OpenAI whose objective is to develop AGI systems only compounds this review's argument for legislative and ethical consideration and intervention. As stated in Chapter 2, this review is focused on the implications of existing technologies that use Artificial Narrow Intelligence (ANI), and DeepMind's WaveNet technology is an example of the power and capacity of existing ANI. WaveNet is a Convolutional Neural Network (CNN) developed by DeepMind and to understand how it produces music, consider first how it generates audio.

[109] An example of the 'future proofing' of the Chapter 1 theoretical model can be seen by the inclusion of Lovelock's concept of Novacene to anticipate the possible development of AGI and ASI technologies.

4.11.3 Text to Speech Systems

WaveNet's original purpose was to create an advanced Text to Speech (TTS) system (Van den Oord, et al., 2016a). The goal of a TTS system is to transpose user text data into an audio output. The initial challenge for WaveNet was to overcome any perceived artificiality of the sound produced in the transition from text data to audio. A measure of the success of a TTS software is how well the software creates an environment whereby the listener is undistracted by any computer-generated sonic deficiencies (Wu, et al., 2020: p. 2).

The accelerated advancement of TTS systems should be kept in mind when evaluating the current fidelity limitations of WaveNet generated music. The future music capability of AI systems like WaveNet is indicated by the rapid progress that TTS systems have already achieved in generating audio content. The sonic advancement of TTS was evident at the presentation of the Duplex system at Google I/O Developers Conference in May 2018 by company CEO Sundar Pichai (O'Leary, 2019: p. 46). An example of Duplex in operation is included at the end of this section.

WaveNet's process for producing speech audio is identical to that used to generate music. Thus, awareness of its functionality in a TTS domain aids in understanding its production of music. Prior to WaveNet, the most sophisticated methods to create TTS systems were two techniques known as concatenative and parametric TTS systems (Van den Oord, et al., 2016a: p. 6). A concatenative approach centres on the algorithmic repurposing of pre-recorded audio phrases. In explicitly closed worlds of engagement, for example language translation or the digital reading of a book, it is possible for the human programmers of the TTS system to anticipate a range of response, and thereby predetermine the dataset to ensure a competent functionality. Google Translator is a classic concatenative TTS system, the user inputs a phrase or word, the system renders the request into a selected language and outputs an audio pronunciation of the inputted

word. The translated audio broadcast is assembled from an extensive audio dataset library, which often consists of individual human recordings of syllables, alphabetic letters and other human vocal intonations. In the case of Google Translate, the library contains over twenty-four hours of recorded speech data, and another notable example of a concatenative TTS approach is Apple's SIRI (Haeb-Umbach, et al., 2019: p. 119).

By contrast to the concatenative approach, a parametric TTS recreates crucial aspects of the final audio and supplements its output with material generated through the utilisation of a synthesiser vocoder. Though parametric TTS has been viewed as a technically more convenient process and one capable of matching the accuracy of the concatenative systems, the sonic calibre of the synthesised vocoder output has left many users unsatisfied by its fidelity (Zen, et al., 2010: p. 1).

Unlike either the concatenative or parametric systems, WaveNet, when deployed in a TTS environment, devises its speech without recourse to selecting from prepared recordings of words or phrases provided in a library database training set. With convolutional neural networks (CNN), the AI architecture consists of a series of hidden layers between its input and output. In the context of TTS, it is a measure of the software's success that the generated audio not only provides adequate imitative pronunciation but does so with fluent intonation and significant inflection. The human programmer can assist in helping the system identify when it is working optimally, for example, a slight modification of inflection can dramatically alter connotation, as in the context of the addition of humour to a phrase[110]. An additional advantage of the CNN concerning audio is the ability of the system to invariant the data on every hidden level. This procedure allows the AI system to focus on the character differentials contained in

[110] The reported awe and consternation produced at the Duplex presentation commented on the system's ability to successfully navigate dialectical challenges that humans themselves can often find all too challenging. Languages such as Mandarin, where similar words with modest intonational variation can have significantly different associations present many challenges to any TTS system (Liou, Wang & Chiang, 2016: p. 73).

data, build on knowledge established from prior AI processes, and progressively advance the audio quality of its output.

A vital aspect of WaveNet's application in music generation is that the AI decision-making is opaque – WaveNet is an example of an AI Black Box output. It is this lack of traceability in the creative formation of its audio that will remain key in subsequent legal and ethical reflection. This is to say that no one – the programmers, the user, nor the algorithm, can determine how a creation by WaveNet's CNN has ultimately formulated its assembled output (Van den Oord, et al., 2016b: p. 3). The WaveNet TTS process is founded on principles originally devised for image generation – 'WaveNet is an audio generative model based on the PixelCNN' (Van den Oord, et al., 2016b: p. 1). WaveNet's progress from image design to audio is instructive in comprehending the relative (compared to visuals) technical simplicity involved when the AI generates music.

4.11.4 Convolutional Neural Networks

Before working on audio, DeepMind developed two neural networks, PixelRNN and PixelCNN, to allow the AI to self-determine what comprises the inputted visual design. The deep learning system then analyses a picture and makes discrete, self-determined correlations about connections within the image. Both systems – the recurrent (PixelRNN) and the convolutional (PixelCNN) - were trained on visual datasets, most famously with large pictorial datasets of animals (Van den Oord, et al., 2016b). Both networks sought to identify patterns from these data sets sufficient for the AI to produce a new original generated image.

WaveNet AI approaches music through essentially the same methodology but with an important distinction – WaveNet's audio production requires a minimal neural network process compared to that required for image generation. The initial successful stage of convolutional neural networks (CNN) lay in image recognition – the outputs

generated by the networks were produced by the interplay of three colours (red, blue and yellow).

With DeepMind's PixelRNN, that process requires three parallel neural networks, either RNN or CNN, to operate in tandem. With WaveNet, only one neural network is required to create speech or music. The reduction from three to one neural network allows the creative process of music generation to be grounded on a comparatively stable process. Additionally, the requirement of one neural network for audio significantly reduces the computing power involved. With fewer parameters needed to analyse the training set, the AI system can allocate its resources to self-defining the main attributes contained in the dataset. The comparative simplicity involving audio (compared to image processing), coupled with the reduction in the necessary connections at every point in the neural network, increases the AI system's overall efficiency and accuracy: 'A dilated convolution effectively allows the network to operate on a coarser scale than with a normal convolution' (Van den Oord, et al., 2016a: p. 3). Furthermore, an appropriately scaled dataset can thus be expanded and regrouped into a vast output of audio possibilities.

4.11.5 Self-Learning Systems

To recap, WaveNet approaches the generation of music through a similar methodology that DeepMind (the developer of WaveNet) approached the games of Go and StarCraft. First the AI self-learns, creating an understanding and rationale of the applicable rules of the task – this self-learning behaviour equates to the system's creative ability. Similarly, when WaveNet generates music, no human curation is involved other than in the provision of the initial training set.

Intriguingly, the self-learning approach was not the first to be used by the DeepMind music team (Diaz-Jerez, 2011: p. 14). Initially, the team anticipated that the AI

system would benefit from learning rules of music theory, as would be customary in educating humans or indeed as is the approach of the majority of the music AI generating actors discussed in Chapter 3. The first WaveNet music training set included the MagnaTagATune song catalogue, various YouTube piano recordings and the online game TagATune's database of user musical preferences[111]. The combined data provided the environment not only to aid the music learning of WaveNet AI, but also to indicate to the AI how it might simulate its output emotionally, based on the information culled by prior gaming selections (Van den Oord, et al., 2016a: p. 6). Nevertheless, DeepMind soon abandoned this process, and determined that WaveNet could be optimised in an unconditioned musical environment, and the team elected that the self-learning AI would first create a solo piano composition and performance. As the DeepMind team state: 'Because it is constrained to a single instrument, it is considerably easier to model' (Van den Oord, et al., 2016a: p. 8).

4.11.6 Technical Implementation and Social Implication

WaveNet's concepts of deep learning fundamentally differ from the majority of AI technologies reviewed in Chapter 3. There, the AI music actors primarily focused on the generation of a musical piece (often MIDI) as data, and then transformed that data into audio with many of the training sets used being music scores. The AI systems, in the main, perceive the training sets as mathematical data that can be analysed and reproduced using the same learned and explicit patterns found in conventional human music training. By contrast, DeepMind created an AI that treats audio data as uninformed content. WaveNet does not analyse its training set relative to music theory, and therefore there is no guided expectation for the AI in terms of its musical output. Rather, a convolutional

[111] The TagATune database was already indexed with details relating to genre, tempo, and instrumentation along with preferences of volume and mood.

neural network (CNN) like WaveNet seeks unique connections in the input training set content. For example, when WaveNet analyses a major 7 chord, it does not evaluate the audio content from a traditional musical perspective. Instead, the AI focuses on the coexistence of all the sonic frequencies and properties involved in the construction of that major 7 chord's audio, and then makes its own bespoke determination of what that information means.

One of the most significant commercial disadvantages of WaveNet, compared to the AI used by the start-up actors of Chapter 3, is the system's computational inefficiency. The AI self-learning process is comparatively (to other systems) time intensive and requires significant computing resources (Paine, et al., 2016: p. 1). For example, it can take a WaveNet system months to analyse and self-learn from a provided dataset (Paine, et al., 2016: p. 1). No satisfactory audio will be generated during this period. However, once the system has established its own understanding, it can produce audio instantaneously and continuously.

The production of WaveNet's audio is central to this thesis argument, and to appreciate its financial implications, the outlined legal principles underpinning copyright law support that understanding. Before considering WaveNet's impact on copyright norms, that which is unusual about the AI's construction of audio needs to be first established.

One second of musical note generated by WaveNet comprises over sixteen thousand individual micro samples drawn and assembled from the training set content. This degree of micro audio combination is designed to produce a high resolution and tonal quality in the audio that is outputted. In the context of TTS audio, this method of superannuated granular synthesis allows WaveNet not only to produce speech with

identifiable human characteristics, but also to recreate qualities of the sound of lips and breath[112].

Here a technical comparison between granular synthesis and WaveNet highlights how different WaveNet is from conventional audio sampling practices. In granular synthesis, the length of an audio sample (known as a 'grain') ranges between 1-50 ms (Barrass & Adcock, 2002). Multiple grains can then be stacked, with each grain performing at varying volumes, pitches and speeds. The manipulated sound in granular synthesis is highly textual and deliberately transformative, and is not intended or capable of reproducing the sampled audio's original fidelity. Rather, it is a creative and interpretable musical tool used by artists including Aphex Twin, Autechre and Squarepusher to produce impressionistic soundscapes and sonic textures. A TTS system, like WaveNet, is designed for a different function to that of granular synthesis. A TTS purpose is to produce convincing audio in varying contexts from language translation to recreating the voice of Jay Z.

The WaveNet team state that the output of its AI will consist of a minimum of sixteen thousand audio samples per second (Van den Oord, et al., 2016: p. 1). That scale of micro sampling is minute compared to that used in granular synthesis[113]. There has been no suggestion that the practice of granular sampling synthesis can be linked to copyright infringement. This is due to the scale upon which human auditory perception functions. For a human to detect sonic displacement, the time between seeing an image and hearing the corresponding sound is approximately 13ms (Trafton, 2014). However, the listener will only be confident that something is amiss when the latency has reached a

[112] MOS (Mean Opinion Score) is the evaluation protocol used by DeepMind to assess the validation of their output's interpretation by humans. With a range between 1-5, the authenticity of WaveNet's speech audio received a score of 4.2, while Google's Duplex TTS registered 4.6 (Shen, et al., 2018).
[113] At least sixteen times smaller.

distance of between 75-100ms[114] (PubNub, 2015). For example, IEEE paper *Audio-Based Context Recognition* indicates that peak human reaction time to audio is around 5-12 seconds (Eronen, et al., 2005). This degree of human auditory perception is relevant, when reconsidering the legal measure of reasonable identification of *substantiality* that exists in copyright sampling. If granular synthesis is too miniscule to be argued as a claim to copyright infringement, it follows that such legal protections when tested by AI technologies like WaveNet are even more remote and infeasible.

DeepMind continues to explore how to improve the AI's performance, and the systems operation as has been established is the same, whether for speech or music generation:

> The question this paper (WaveNet) addresses is whether similar approaches can succeed in generating wideband raw audio waveforms, which are signals with very high temporal resolution, at least 16,000 samples per second. (Oord et al., 2016a: p. 1)

To restate, each second of music generated by WaveNet comprises – a minimum – of sixteen thousand repurposed audio samples, assembled from its training set and operating on a scale far beyond the threshold of human listening perception. When such micro samples proportions are considered, within the legal framework *of de minimis, substantiality* and *fair use*, this assembly of audio fragments raises many challenging propositions to existing copyright norms.

An illustration of what is currently technically possible is a TTS AI – Dadabots – created by CJ Carr and Zack Zukowski, which continuously generates death metal audio

[114] A revealing parallel to these AI-produced rates can be found in the history of the 'slap back' delay created in Sun Studio Memphis. This was set at a minimum of 40ms. The slap back vocal effect became one of the most recognisable hallmarks of Elvis Presley's early recordings. As Dr Helmut Haas demonstrated in 1949 with the 'The Haas effect', the human ear when encountering two identical pieces of audio that are not separated by more than 40ms will perceive those separate sounds as one smooth sound (Gardner, 1968).

and is live streamed via YouTube (Dadabots, 2019). The Dadabots AI is a recursive neural network (RNN) trained on the raw audio recordings of the band Archspire and developed upon similar AI technical protocols to WaveNet. The Dadabot AI:

> splits (the Archspire albums) into thousands of tiny samples and then creates tens of thousands of iterations to develop the AI, which starts out making white noise and ultimately learns to produce more recognisable music elements. (Deahl, 2019c)

The release of Dababots' ceaseless AI death metal was somewhat insulated from its full implication by the current limitations of its comparative audio fidelity, invoking sometimes a humorous reaction to its output. It should be noted that distortions, deviations, or departures from the source inspiration (in this instance, a training set) are not without their charm or historical parallels in music[115]. It is perhaps in recognising the remarkable path of TSS development that led to Google Duplex audio capability that the full potential of a self-learning AI system trained on raw audio inputs can be glimpsed.

The rapid rate of advancement of AI systems was evident in the spring of 2020 with a series of extraordinary musical releases. In March,
the OpenAI institute's announced Jukebox, a musical adaptation of their GPT-2 AI (Jukebox, 2020). Jukebox produces convincing finished audio soundalike music tracks of artists including David Bowie, Louis Armstrong, Frank Sinatra and Ella Fitzgerald created by using techniques based on the WaveNet system. The fidelity of the Jukebox recordings represents a major technical progression of the AI creative capacity.

Next, in late April 2020 deep fake audio recordings that appeared to feature Jay-Z rapping Hamlet's *To Be or Not to Be* soliloquy, amongst other surprising content, were

[115] Within STS and the SCOT Model, a theoretical concept known as 'solving the reverse salient' is useful and can be seen in the adoption of audio distortion as an accepted audio process effect. Here an aesthetic decision made in the early 1950s when a musician preferred the sound of faulty bass amp opened up a route of music exploration that would eventually lead to Jimi Hendrix guitar sound (Shepherd, 2003: p. 286).

broadcast on the YouTube channel *Voice Synthesis* (Hogan, 2020; Statt, 2020). The Jay-Z audio clips were created using a Google TTS, Tacotron 2, which employs WaveNet, and is the same AI used in Duplex (Shen, et al., 2018). Two days after they appeared, the deep fake audio files were removed due to copyright infringement claims by representatives of Jay-Z. However, the substantiality of those claims for legal protection has been questioned (Hochberg, 2020) and further indicates the brittleness of copyright principles examined in the chapter. The deep fake audio files have since been re-uploaded to the *Voice Synthesis* channel.

Finally, on the 12th May 2020, the aforementioned Dadabots were runners-up in the first *AI Song Test* with the AI composed song *I'll Marry You, Punk Come* (VPRO, 2020). The televised song competition organised by Dutch broadcaster VPRO included as judges Jukedeck CEO Ed Newton Rex and Anna Huang (Google Magenta), both AI actors reviewed in Chapter 3.

Audio Examples:

Google Duplex: A.I. Assistant Calls Local Businesses To Make Appointments: https://www.youtube.com/watch?v=D5VN56jQMWM&t=162s

Dadabots: *RELENTLESS DOPPELGANGER \m/ \m/ \m/ \m/ \m/ \m/ \m/ \m/ \m/ \m/ \m/ \m/ \m/ \m/:* https://www.youtube.com/watch?v=MwtVkPKx3RA

Voice Synthesis: *Jay-Z raps the "To Be, Or Not To Be" soliloquy from Hamlet (Speech Synthesis)*
https://www.youtube.com/watch?v=m7u-y9oqUSw&t=19s

Voice Synthesis: *Six US Presidents read "Fuck Tha Police" by N.W.A. (Speech Synthesis*:
https://www.youtube.com/watch?v=mAZVp-n-5TM

OpenAI Jukebox: *Jazz, in the style of Frank Sinatra & Ella Fitzgerald* :
https://soundcloud.com/openai_audio

OpenAI Jukebox: *Pop, in the style of Katy Perry*
https://soundcloud.com/openai_audio/jukebox-novel_lyrics-78968609

Dadabots: *DADABOTS x Portrait XO 'I'll Marry You, Punk Come' (Part 1)*
https://www.youtube.com/watch?v=S3LiUr-WLdQ&t=100s

It is arguable that, in WaveNet's analysis of the possible connections existing between the elements in a single piece of music, the AI can be deemed to be critically listening at a more nuanced and microscopic level than any human ear is capable. Moreover, could the process of a self-learning AI music system be potentially analogous to how many self-taught human musicians have operated historically? While there is little evidence to suggest that AI such as WaveNet will ever be capable of competing with the elite of human musicianship, a summation earlier stated by Marcus De Sautoy is worth recalling: [with AI] music 'it's not going to put the Mozarts, the Beethovens, the Miles Davises out of jobs, but it might well put second-tier composers out of jobs' (Insights Team, 2019). Indeed it is the 'middle class' of human employment in the music ecosystem (Taplin, 2016) which exists to reward the efforts of the human musician and, as De Sautoy points out, it is those jobs that are most likely challenged by AI technologies.

Research groups across the world but primarily in the US are working to increase the efficiency and speed of WaveNet. As this technology is in effect open-source, it has attracted the attention of many sectors in the academic and programming community as was seen in the creative community who work with Google Magenta tools. The fact that software like WaveNet is open-source combined with the relatively low financial cost of its processing power will likely drive profound changes in the use of AI and music creativity. Google Cloud TTS API with WaveNet is commercially available and capable of creating audio for the almost one hundred supported languages that are available on Google Cloud. Its TTS and speech-to-text API (which allows the AI to be utilised in other systems) is on sale for $16 per one million characters (Cloud.Google.com, 2020). As has been established in this work, AI is capable of unsupervised music generation with

accelerating capacity. So what is the future role of the human within this network and how is this changing spectrum of creativity measured?

4.11.7 Attenuation of the Human

While it cannot yet be known if AI will ever be able to generate recorded music that is indistinguishable from that made by humans, perhaps that is not the issue for consideration. Throughout the 20th Century, when new music technologies were introduced, the paucity of quality and the authenticity of mechanical reproduction was often scorned and prematurely dismissed. Indeed, imperfections (distortion, plasticity) would subsequently become a signature component of new musical movements (punk, hip hop, grime et al.) (Pearson, 2019: p. 4). And it is that logic, of ever morphing music consumer tastes, that informs the confidence of Stephen Philips (Popgun) and Taishi Fukuyama (Amadeus Code) that upcoming generations will prefer AI to human music.

Whatever the future may hold, what the WaveNet analysis does demonstrate is that AI does not require human participation in musical creation, beyond that of providing the initial training set and building the AI. Perhaps that requirement (the training set) is sufficient to maintain the role of the human in the creative process. Nonetheless, a WaveNet training set could be provided by an AI actor/music process like David Cope introduced when he trained Emily Howell on EMI's music. This process, of training AI on AI music, would further distance and dilute the evaluation of the human from the act of musical creation in this context. Indeed, by logical extension a WaveNet AI could also be trained on the outputs of other WaveNet systems where in each iteration the human element would increasingly be questionable.

Furthermore, copyright, if so desired, attached to music generated by a WaveNet AI remains vested in the humans who have put the 'necessary arrangements' into place. The ability of said AI systems to create original content, whatever of the attenuated

human involvement, may be such as to deem the AI to be the author or at the very least co-author of the work. Nonetheless, as outlined in the Naruto/Slater ruling it was stated that:

> only works created by a human can be copyrighted under United States law, which excludes pictures and artwork created by animals or by machines without human intervention. (Gibbs, 2014)

Then such an AI, though it may be considered to meet the legal tests attaching to human artistic expression such as *originality*, *substantiality* and *creativity*, and be recognised by the court as a non-human author it will still not be entitled to copyright protection.

Copyright is protected by the human-centred principles of IP that have been developed internationally over centuries. Yet, the protection of music copyright has in recent years increasingly been tested and effectively weakened by humans (as in the cases of *Blurred Lines* and *Dark Horse*), such that major artists and rights holders now take out professional liability insurance to underpin their copyright protection. In each of those case laws, the alleged infringements related to similarities in the music composition. AI systems like WaveNet point to another potential weakening for the stress test of copyright durability.

An early indication of this development with the copyright repercussions of AI music emerges when the AI has been trained on the work of one single artist, and was recently described as ‘a thorny grey area without any legal precedent guiding it’ (Deahl, 2019d). Commenting on the implications of emerging CNN music generation systems, Jonathan Bailey, CTO of iZotope[116] stated ‘I won’t mince words… this is a total legal

[116] iZotope Inc are music industry leaders, whose award-winning ‘intelligent audio’ technologies such as the AI enabled Neutron and Ozone software plug-ins, are industry and educational standards for all DAW platforms.

clusterfuck' (Deahl, 2019d). Further to Bailey's observation, as shall be seen in the concluding section of this chapter, many tensions and challenges are in play that might alter the established human-centred legal rationale and add an additional series of challenges to those already outlined regarding music composition and audio sampling norms.

It is instructive to conclude this section on WaveNet by noting the emphasis placed on AI ethics by DeepMind's founder and CEO, Demis Hassabis. As a critical component of Google's acquisition of DeepMind, Hassabis sought assurances from the purchaser that a Google AI ethics board would be established (Hern, 2017). The Google AI Ethics Board has been the subject of continued controversy and will be returned to in Chapter 5.

4.12 Review of the Boundaries to the Legal Landscape

4.12.1 Human Creativity and AI Creativity – Selected Copyright Cases

What can copyright law do in the situation where works, including musical works, are brought into existence where human interaction is minimal or sufficiently removed as to be regarded as non-existent? It has been shown that the traditional approach has been to deny copyright protection for works that have been generated by a computer, or to maintain that the creator of the program is the author of such works.

Copyright law, because its scope and enforceability is case law based, is restrictive rather than prescriptive. The relevance of key concepts such as *originality* and *creativity* as defined in the cases referred deal with claims of copyright infringement (not involving AI) and require examination. The law may need to develop more robust tests or redefine the parameters of these concepts when applied to the involvement of AI. It is contended that similar examination may need to embrace an ethical dynamic.

When Oleg Stavitsky, CEO and founder of the Endel AI stated that ‘I am credited as the songwriter even though I have no idea how to write a song’ (Bosher, 2019b), it was a clear example of how assumptions that *authorship* and *ownership* are often seen as being effectively synonymous. This issue requires scrutiny. The risk is that the blurring of concepts such as ownership and authorship, once identified, exposes systemic problems. To date, the ambiguity which gave rise to that blurring was an important albeit implicit understanding underpinning copyright law. If that principle is challenged, then rather than underpinning, classical concepts of human authorship may prove wanting and act to undermine the fragile structures of copyright law. This was brought into sharp focus when *personality theory* was discussed, and it is applied to the various arguments for giving legal status for AI.

As matters currently stand, in common law systems around the world there is little evidence of any current receptivity to granting non-human copyright. Though as will be shown in the thesis conclusions, the issue of AI authored IP is continuously under challenge and a recent ruling in China (2020) is evidence of a possible reshaping of the fundamentals of copyright. Nonetheless as things stand, in the US the Federal Copyright Office has declared that it will ‘register an original work of authorship, provided that the work was created by a human being’ (US Copyright Office, 2017: p. 4). It has therefore fallen to the Courts in individual decisions, in different jurisdictions to interpret and lay down the boundaries of copyright protection. The implications of related case law making are a concern of this review. Decisions made in one jurisdiction can have an unintended domino effect in another through the increasing movement towards harmonisation between intergovernmental entities (EU, WIPO). Furthermore, rulings in copyright cases that are frequently determined in unrelated fields (from database collection to photography) have widely interpretative implications when applied to music. Recognition of these processes calls for ethically informed regulatory and legislative regimes in music.

An important case example in a separate area of copyright law which has unexpected influence in music copyright relates to the levels of *skill* and *creativity* employed in the assembling of a telephone directory. In *Feist Publications v Rural Telephone Service Company Inc* (Feist Publications, Inc. v. Rural Telephone Service Co., 1991). The Court held that copyright law only protects 'the fruits of intellectual labour … founded in the creative powers of the mind' (Ligon, 2019). While in a more recent Australian case, which related to the disposal of hazardous waste materials, *Acohs Pty Ltd v Ucorp Pty Ltd*, 2010 FCA 577 the Court ruled that a work generated by a computer could not be protected because a human did not produce it (Barker, 2011).

The ECJ has declared on several occasions, and in a landmark ruling relating to temporary acts of reproduction (in this instance data processing capture) in *Infopaq International A/S v Danske Dagblades Forening* (Infopaq International A/S v Danske Dagblades Forening, 2009), that copyright only applies to original works, and that 'originality must reflect the author's own intellectual creation' (Yun-Pu, 2019).

Leaving to one side the diverse subject matter of these judgements, their authority and universal application in terms of the requirement of human authorship as a necessity for copyright are obvious. Where challenges lie in the near future is in recognising that these cases were decided prior to the advent of AI deep learning systems like WaveNet. The capacity of AI applications to produce literary and artistic work autonomously is now well recognised. The *raison d'etr*e of copyright systems has long been accepted as the effective means for the protection and encouragement of the production of artistic work stemming from the creative urge in the human spirit. Whether copyright protection is accorded to AI generated work raises issues which could not be more fundamental. The debate here will widen from the concerns of the music industry to the concerns of the music ecosystem and will inevitably be focussed on questions which will be as much ethical as financial in their implication and determination. Should the recognition of these

processes call for ethically informed regulatory and legislative regimes in music? Before moving to discuss what ethics has to say to this issue, the examination of how exponential AI technologies challenge basic legal assumptions is continued.

Traditionally, the function of copyright systems has been to protect property rights in human creativity as an aspect of protecting the dignity of the human person as its basic and social and economic purpose. Granting self-same copyright status to AI produced work would clearly have several effects, many unintended and unforeseen. The long or even short-term implications of that revolution for the legal base lines of music copyright, which places the human mind at the core of its rationale, remain to be seen and discussed.

These questions invite possible answers or attempted solutions, but also open further issues and avenues which if explored lead to landscapes that are unfamiliar.

4.12.2 Probing the Challenges to Legal Norms

Intriguing examples and instances which challenge implicitly long accepted legal norms will now be reviewed and discussed. The law primarily seeks to conserve and enforce established societal values and its rules properly expressed are themselves designed to define, preserve, and protect. Of all their chief attributes, laws must be seen to be predictable and follow generally if not universally accepted standards and tests. So, will a line be drawn which accounts for the presence of the AI actor in the system of carefully crafted copyright? And if so where, by whom and when? Does society insist on identifying a human creator as the *fons et origo*[117] of AI musical works before affording copyright protection to them? These considerations are contained in Article 27(2) of the *Universal Declaration of Human Rights* which states: ‘Everyone has the right to the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he is the author’ (Committee on Economic, Social and

[117] The fountain and source.

Cultural Rights, 2005). Copyright is a property right and owning a song is like owning a house. Being a property right, like other rights, it is vested in the human person. However, what would be the status of an AI if it were granted rights that approached those now provided to humans?

4.13 AI and Legal Personhood

An argument exists within the broader debate on AI, Robotics and IP, which proposes that many societal and economic benefits could emerge from extending person-like rights to machine-generated creativity. Both Japan and the Republic of Korea are considering extending their IP laws to include a machine-based consideration (Keisner, 2016), while the EU is presently debating a category of personhood for robots and related AI (Withers, 2018). These reflections demonstrate the deep complexity of the many issues in play.

Though current technologies have not yet to be presented with the challenge – a fully functioning AI robot for instance – there is a general agreement that 'it is only a matter of time before robots equipped with intelligent AI's will be an actor in society and become your colleague or even your boss' (Houvast, Timmerman & Zwaan, 2018: p. 4). The requirement for the law to confront the argument for the recognition of some level of legal personhood is a logical follow-through to this contention. Japan and South Korea are recognised as frontrunners in robotics, and service robots are already deeply embedded in those societies (UTokyo, 2020). Robot priests performing religious ceremonies is only one of many examples of how humanoid machines have become essential and crucial aspects of society (Samuel, 2019). Moreover, robots are regularly employed in education and care facilities and some machines have even received residency permits that grant them citizenship (Robertson, 2014: p. 576). Reference has been made in AI ethics that the pervasiveness in Japanese society of Shintoism, where

notions of life emerge from both organic and inorganic matter, have been assumed to assist in this non-western definition of authenticity (IEEE, 2019a: pp. 57-58). A similar proposition has been presented regarding the Jinn in Islamic cultures (Sulaimani, Personal Correspondence, 2018) and to that tradition's potential intellectual openness regarding the acceptance of non-human forms including AI. Equivalent non-human (a potentially AI interpretable) values and norms are not embedded in Western countries outside of the realm of superstition and science fiction. Through the review of international IP treaties and legal developments, it is noted that unintended consequences can occur that create a domino effect, where rights granted in one country can influence the legal landscape of another nation. And thus it is essential to remain flexible in thinking about the possibilities involved in legal and cultural influence on change.

Another contemporary illustration includes South Korea, where a proposed robot ethics charter was inspired by Isaac Asimov's *I Robot* (Yampolskiy, 2015: p. 115). The guiding principle of this charter was not only to protect humans from robots but also robots from humans. The charter, announced in 2007, is widely regarded as the first to consider this issue through an ethical framework (Rizk, 2018). In the UK, The British Standards Institute published a document concerning the ethical application and design of robots (Ferreira, et al., 2019: p. 114). In the US there is virtually no specific law regarding robotics and AI (Ahmad, 2019). However, the US' significant investment in the development and testing of autonomous vehicles suggests it may be somewhat inevitable that the US will have to engage with this topic.

A striking example of how far this debate has moved on is shown by developments within the institutions of the EU. At the European Parliament a report, proposed and accepted on the 16th Feb 2017 by a significant majority, requested that the European Commission develop standards for Robotics and AI in order to exploit their full economic potential and mention was given to provisions for 'electronic personhood'

(European Parliament, 2017). Conversely, a counterargument was proposed by The European Economic and Social Committee in May 2017 opposing any legal recognition of machine personhood and considering it a 'threat to an open and equitable democracy' (Delvaux, 2017). Furthermore, several international legal academics published an open letter in April 2018 calling for the rejection of the proposal for electronic personhood (Dignum, 2019: p. 121). They argued that it would be inappropriate and nonsensical to create a comparative legal status. The decision of the European Commission to reject the Parliament's proposals undoubtedly reflects the weight given to these arguments and points to the direction of the emerging EU strategy for AI. The development of the EU policy for AI is expanded upon in the next chapter.

4.13.1 Legislation

Regional and national legal responses – independent of, yet still within, the EU – cannot be discounted at this stage. This is notably the case in France, where national regulations, particularly regarding *moral rights,* have been in practice for many years (Tiefenbrun, 2010: p. 543). Indeed, strong opposition was presented to proposals made by Secretary of State for Digital Affairs, Axelle Lemaire in the *La Stratégie France IA* plan of January 2017 regarding the recognition of legal personhood for AI and robots (Rizk, 2018). However, any resistance and consideration of authors' moral rights do not seem to have been displayed by the Society of Authors, Composers and Publishers of Music (SACEM), the French national collection body for performing music rights.

In 2017 SACEM recognised AIVA as the world's first AI to officially acquire the international status of composer (Lauder, 2017). Here, the musical works created have been granted copyright in the AI's name. It is important to note that the French tradition of IP – which fundamentally differs from the more commercial North American model – is anchored on the concept of *moral rights.* To repeat – *moral rights* are an explicit

recognition of the value of the human person. However, legal AI specialists including France's Alain Bensoussan have suggested that the decision about the ability of AI robots will inevitably lead to them being recognised as 'a moral person' under the law (Committee on Legal Affairs, 2015). Corresponding paradoxical societal tensions will be considered in relation to the international recognition given to the humanoid robot Sophia.

Developments, both technological and theoretical, question the boundaries for existing IP – for if AI can create works that are indistinguishable to those produced by humans, where will these IP rights rest? With the programme producer, the user of the AI or the AI itself? Alternatively, should these works remain as they theoretically do at present in the public domain, if there is no human in the process?

The possibility of various legal responses to the many risks, including abuse of AI for criminal purposes, places an onus on each member state to adopt urgent and complementary approaches in their legislative codes. The European Commission has established differentials between 'high' and 'low' risk AI in its recommendations for AI regulation (European Commission, 2020b). However as will be seen in the next chapter, the EU's definition of low risk AI would likely include the creative arts, not because of the likelihood of the AI's capacity for invention or creating unemployment but because the status of high risk relates to matters of human mortality. For the EU to move beyond liability issues to factoring in guidelines as to how AI systems may be accorded the status of personhood will require some degree of prescience. It is undoubtedly essential that the EU acts in advance of separate individual states to prevent conflicting legal rulings that would lead to confusion and forum-shopping when bringing a case to court[118].

[118] Forum shopping is where the plaintiff, presented with a range of locations in which to file suit, chooses the jurisdiction most likely to maximise a positive result.

Comparative action is also needed to maintain economic competitiveness given the development of AI in China and the US (Probst, et al., 2018).

4.13.2 Sophia and Robot Personhood

The enhancement of the corporation in 17th Century Netherlands as a legal device to facilitate economic activity led to the development of the concept of the corporation or company as a non-human legal person (Barfield & Pagallo, 2018: p. 228). The development of international capitalism has been said to be contingent on the exploitation and development of this non-human legal person (Roberts, 2011: p. 204).

Therefore, the concept of legal persons has already been extended to corporations, partnerships, societies as well as individuals. But this extended, if artificial, definition of the 'legal person' allied to advances in robotics has raised questions that, while they may seem amusing or frivolous, could have extensive ramifications in the real world. To extend the examination of how the existing relationship between IP and AI in the music ecosystem may be challenged by unintended consequences in related fields, the case of Sophia is examined. Here once more, the predictions of Attali provide sober reflection when he writes: 'through the androids, it is authority itself that is speaking' (p. 85). With Sophia, what was initially seen as little more than a multi-partner publicity exercise became an instrument for political and economic comment, as evidenced when Sophia requested creative rights for robots in South Korea.

The android Sophia was activated by her creator David Hanson in February 2016 (Greshko, 2018) and in October 2017 Sophia was granted citizenship of Saudi Arabia (Weller, 2017).

The granting to a robot of citizenship raised many questions: was Sophia entitled to the rights of human citizens of Saudi Arabia (Sini, 2017)? Would shutting down her system while also preventing any possible reactivation be treated as a form of murder

(Falk, 2017)? And would indeed granting this citizenship automatically render Sophia a Muslim (Steinberg, 2017)? Irreverent and fantastical as those questions might seem, these issues have precedent. Corporations have the status of legal persons which can exceed the commercial capacity of the human person and have other privileges, for instance the potential to have lives of indefinite duration (Proffatt, 1880: p. 80). In this context, it is not far-fetched to propose that in the future machines might be afforded similar privileges.

Saudi Arabia, a signatory to the *TRIPS Accord* and a member nation of the WTO, has not been the only international actor to formally recognise Sophia. Following a public conversation between Sophia and the UN Deputy Secretary-General Amina J. Mohammed, the android became the first non-human to be given a title by the UN when named as the UN Development Programme's 'innovation champion' (UNDP, 2017). Continuing this trend, Azerbaijan granted Sophia a visa to visit Baku (azerbaycan24.com, 2018), while China appointed Sophia an Innovation Ambassador (Sohu.com, 2019). Indeed, measured by any music entertainment standards Sophia had a spectacular global launch, conducting 'live in-person' interviews with the BBC, NBC and Charlie Rose on his *60 Minutes* show on CBS. Upon making a return appearance on *The Tonight Show*,

Sophia even sang a duet of Christina Aguilera's *Say Something* with the show's host (Fallon, 2018) as glimpsed in figure 34 below.

Figure 34: Jimmy Fallon singing a duet with Robot Sophia on The Tonight Show. Source: https://www.businessinsider.com/jimmy-fallon-sang-a-duet-with-sophia-the-robot-2018-11?r=US&IR=T

Building on the knowledge provided earlier in this chapter, little technical requirement would be needed to augment Sophia to become a composer. As David Hanson, its creator, outlined the android is comprised of seventy percent open-sourced material (Jewell, 2018) and already employs other open source TTS systems similar to Google WaveNet. As noted with AIVA, the first non-human composer admitted to SECAM, surely an embodied AI (android) like Sophia would also qualify for recognition? The issue here is not the prediction that Sophia will be extending her music career, though that is entirely possible, but rather that distinctions between human and non-human persons are separated by an ever-blurring line.

Sophia's global debut was greeted entirely uncritically and required significant technological staging, but that has not diminished the potential consequences however unintended. As Winkler's *We the Corporations* (2018) outlines, the legal development of corporate personhood in the US occurred accidently, as a corollary of the civil rights movement for humans and is a useful reminder of how developments in one societal sector can transform another.

Furthermore, the Sophia music proposition recalls Muslim polymath al-Jazarī, whose book dated to 1206*, Kitab fi marifeti'l-hiyeli'l-hendesiyye (The Book of Knowledge of Ingenious Mechanical Devices)*, included details for the construction of a four-piece robot band, as illustrated in figure 35 below (al-Jazarī, 1973 [1206]).

Figure 35: Illustration of four-piece robot band. Source: https://public-dyk.blogspot.com/2013/07/robots-starting-because-this-muslim.html

It is in said connections as between Sophia and al-Jazarī which span thousands of years that the desire deep in the human psyche to automate music creativity can be seen. And it is in recognising that amidst all the new-fangled innovation, it is an ancient curiosity that is satisfied in AI exploration. And in acknowledging that deep rooted fascination, there is a requirement for an ethical pause, to reflect and consider the technology's development.

4.13.3 Sophia and Corporate Personhood

A legal examination of the current status of Sophia will follow shortly. Firstly though, it is important to acknowledge that embodied AI (robots) is not a prerequisite of the debate of legal personhood as other questions also inform the discussion. For instance, what are the possibilities of granting such rights to AI systems with creative ability? Is it as straightforward as equating the notions of legal personhood with that given to

corporations as well as natural persons? This proposition has been advanced as a theoretical legal possibility by Shawn Bayern in an article entitled *The Implications of Modern Business-Entity Law for the Regulation of Autonomous Systems* (Bayern, 2016). Bayern argued that under New York State law it would be possible for a corporation to be established by a human being working with an AI entity and by means of a sufficiently elaborate operating agreement, it would be possible for the human to subsequently resign from the corporation's board, leaving the AI system solely working autonomously. The result would be that the AI would have effective benefit of legal corporate personhood lasting in perpetuity.

There are of course strong legal arguments against the courts allowing such an outcome. Under most legal jurisdictions operating within the WTO agreements, it is implicitly understood that the purpose of corporate personhood – in so far as it relates to corporations having legal rights – is to foster commerce and enterprise (Ripken, 2019: p. 24). However, if the above-mentioned speculations regarding granting to AI the status of legal personhood were ever to become a reality, there would be inescapable legal consequences. Would it not mean that similar technological systems could sue, and be sued, have property rights, have independent freedom of speech and other rights and protections normally ascribed to humans? In fact, this very proposition was touched on in the *WIPO AICM* session in February 2020. David Harrington, replying to the moderator's question regarding European moral rights within the context of an AI being granted music copyright protection, said: 'If you (the AI) don't like the version [a cover of an AI music composition] is the AI going to sue for that? (p. 224). It is important to note that none of the panellists at the *WIPO AICM* session were lawyers. Nonetheless, the fact that these complex legal issues have arrived at the centre of the AI debate in the music ecosystem demonstrates the need for the aforesaid concepts to both be understood and engaged with.

Therefore, these considerations for the potential of legal status for electronic persons require analysis.

Many international bodies and regulatory authorities are currently reviewing the next stage of legal development for AI. The company law of many states around the world gives freedom to limited liability companies to draft operating agreements that govern their normal activities. If an AI system is built into these structures as outlined by Bayern, it is conceivable that an AI could, on a day-to-day basis, control corporate entities. Unlikely as these speculations may be, it is important to be mindful that comparative discussions are taking place. Again, what may appear to be harmless developments in other domains of human commercial activity may have unintended and decidedly less than benign implications for the music ecosystem. These developments – events seemingly remote from the arts but directly affecting the arts – fuel the need for ethical debate.

4.13.4 Human Mortality and Legal Immortality

Why does legal personhood matter? It must be remembered that, in this context, the exploration of this concept happens between very narrow parameters. Principally and originally, personhood resides in the human individual (Ford & Ford, 1991: p. 78). Without the need for philosophical or moral bearings – it is the recognised legal unit in which responsibilities and entitlements, freedoms and constraints, wherein the social contracts of civilised life are arranged and upon which they are universally accepted and function. Humans, as persons can divorce and marry, inherit and disinherit, bear responsibility for actions or omissions, and gain from their and others' creative activity. This term is defined as *legal capacity* and is a key attribute of what is determined to constitute a person.

In the narrower context of commercial activity, the broader consequences of personhood cannot be overlooked. Engendering AI systems with partial or incomplete attributes of personhood, while initially attractive and advantageous for encouraging the development of AI systems within commercial activity, could lead to unexpected and troubling results. Legal capacity is a two-way process: if it is exemplified in the right to sue, for example, or to enforce an IP right, it also entails being open to being sued. However, what if the AI has breached a right? Can it be sued? (Čerka, Grigienė & Sirbikytė, 2015). Equity law and common law maintain that, however unsatisfactory it may be for some, for every wrong there should be a remedy (Kames, 1767: p. 382). Thus, under current legislation, if an AI system were responsible for a legal wrong or injury, the court would be obliged to hold the owner perhaps even the organiser of the AI system responsible. There could be no legal system that would leave a victim without a remedy on the basis that an offending AI system lacked personhood. However, the temptation of potential political and commercial reward in the delegation of corporate liability, especially when considering AI within the context of Lethal Automated Weapons Systems (LAWS) and AI driven vehicles or drones, cannot be overlooked.

While these arguments may fall under the umbrella of 'vicarious liability' (Čerka, Grigienė & Sirbikytė, 2015; Sullivan & Schweikart, 2019; European Commission, 2019a), how would reliance on these doctrines play out in the context of music copyright and AI actors?

4.13.5 Arguments from Tort Law and Vicarious Liability

Any progress in terms of establishing an internationally recognised and enforceable code requires a universally accepted legal definition of what constitutes AI. In a seminal essay, Dr Matthew Scherer, in *Regulating Artificial Intelligence Systems: Risks, Challenges, Competencies, and Strategies* in 2015, offered a definition as:

> an A.I. system includes both hardware and software components. It thus may refer to a robot, a program running on a single computer, a program run on networked computers or any other set of components that hosts an AI. (Scherer, 2015: p. 362)

Traditionally copyright protection in terms of work emanating from AI is seen exclusively in terms of the human originator of the systems that result in the artistic product. Thus, the law sees AI software incorporated into devices like robots as simply products (European Commission, 2020b). If a product is defective, if it does not work properly or causes damage, the product manufacturer can be held liable. So, an injured party can sue based on product liability law or negligence:

> While AI-based products can act autonomously by perceiving their environment and without following a pre-determined set of instructions, their behaviour is largely defined and constrained by its developers. (p. 16)

Liability issues can become complex where the AI system is manufactured on the customer's specifications. Legal academics including Professor Marguerite Gerstner have recommended legislative regimes of strict liability in dealing with automated systems (Gerstner, 1993).

As noted above, the requirement to be human is not a legal prerequisite for an entity to be recognised as a legal person. The modern corporation has been described as an immortal being and possessing many of the same rights as humans (Davies & Gower, 2008). In the US and in Europe, corporations share many of the same rights as human counterparts and corporations are granted various constitutional protections[119]. Winkler's *We the Corporations* (2018) was referenced earlier, which outlines the creation of many

[119] *Citizens United v. Federal Election Commission, 558 US 310 (2010)* in which the US Supreme Court held that the free speech clause of the First Amendment prohibits the government from restricting independent expenditures for political communications by corporations and companies.

of the US constitutional rights for corporations that are more usually considered as attributable to humans[120]. The observation was confirmed in a landmark case concerning political campaign finance, where the US Supreme Court held that the free speech clause of the First Amendment prohibits the government from restricting independent expenditures for political communications by corporations, including non-profit corporations, labour unions, and other associations (Citizens United v. Federal Election Commission, 558 US 310 (2010)). The immortality of the corporate body is demonstrated through a reflection of the life span of existing corporate persons; for instance, the Japanese construction company Kongo Gumi was established in 570 A.D. and is still in operation (Nishiyama, 2003).

As was seen in the so-called 'monkey selfies' case, IP self-generated by non-humans will not be protected by the Courts. However, corporate persons (record and publishing companies for instance) can own or be assigned IP created by humans. So, while the corporations themselves can be seen as legal persons and indeed be considered as immortal (by comparison to their human counterparts), the term of the copyright is registered in the traditional methods (seventy years after the death of the last human author for instance in publishing). A rare exception to the term limitation relates to IP protected by trade secrets. The opaque machinations of a black box algorithm, for instance WaveNet, where no one knows how the creative process was determined, would seem an ideal candidate to qualify as a trade secret, albeit one that may require some ingenuity to achieve. Logically this could conceivably have the consequence of granting music copyright in perpetuity.

For the transhumanist, mortality is another technical challenge to be overcome (Ross, 2020: p. 14). This review has shown how possible legal arguments could be

[120] A more dystopian but influential interpretation of the corporate personhood is discussed in Canadian law professor Joel Bakan's book and documentary series *The Corporation* (Bakan, 2005).

constructed whereby a non-human legal person – an AI – could be capable of immortality. The lifespan of corporate entities suggests that immortality may only be contingent on retaining commercial viability. They could own IP (as per trade secrets) that could potentially exist in perpetuity (subject to the IP remaining undisclosed). These observations may be considered more appropriate to the realms of science fiction. However, when all the relevant legal facts are seen in context and within an ethical framework they are not so easily dismissed. Regarding the opaque nature of black box outcomes, the commercial opportunities that might arise from machine learning outputs creating potentially lucrative IP such as a trade secret, is sobering. It is important to note when discussing matters that are linked to human rights that throughout history, humans have been by law treated as less than full persons. In the US, slaves were considered non-persons, while in Ireland up to 1957 with the passing of the *Married Women's Status Act*, a wife was not regarded as a fully separate legal person from her husband (Irish Statute Book, 2020). Similarly, the definition of when a foetus becomes a human person can mirror the socio-politics as much as the science of its day. It is not too fanciful to suppose that AI personhood issues will be in the near future subject to the same zeitgeist vagaries.

4.14 Breaching the Boundaries of the Legal Landscape?

4.14.1 Robot Sophia – The Legal Implications for IP Protection

It is with the aforementioned history in mind, and given an understanding of the wider framework of legal personhood, that this review returns to the robot android, Sophia. Her creator David Hanson, of Hong Kong-based Hanson Robotics, said that she is regarded as 'our most advanced character robot. We use her in a variety of R&D activities… as well as in support of artistic efforts at Hanson Robotics' (Jewell, 2018). While the introduction of Sophia sparked international debate regarding whether or not all

of this was anything other than an investment-driven publicity stunt, the implications of Sophia remain considerable. Leading AI figures and ethicists have dismissed Sophia as little more than an anthropomorphised puppet (Nyholm, 2020: p. 3) despite her creators position that 'she' is almost human. Indeed what Hanson Robotics and other transhumanists decline to state is that many AI systems are built on human data in which the humans whose identity and data are being tracked cannot access when and how often their personal information is processed. This issue of data sovereignty is critical, as Sophia and other AI devices base their insights and faux sentience on concealed, effectively stolen[121] and often resultantly erroneous data. And yet at the same time, as consumers' personal information is being unknowingly processed, a transfer of agency from human to machine is incited as the public and many policymakers become enchanted by the make-believe magic of a misfunctioning android. For example, the successful staging of Sophia can involve frequent technical delays and is reliant on the many humans behind the android curtain (Wooderson, Personal Correspondence, 2018).

Whatever of Sophia's intermittent technical mishaps, it is still quite capable of programmed political comment. During the *Third International Conference on the Fourth Industrial Revolution* in June 2017, Sophia made a series of political references during an interview with Park Young-sun of the ruling Democratic Party of Korea. The android referenced the 'candlelight revolution'[122] and congratulated the people on realising a 'mature democracy' (Ji-hye, 2018). Furthermore, Sophia recommended that robots 'deserve respect' and requested that relevant laws be introduced (Ji-hye, 2018). One month later, Park brought a bill before the Korean legislature outlining a new law that would provide robots with 'legal status as electronic, human beings'. Park outlined how this bill was in keeping with global legal developments for future coexistence between AI

[121] As the owner of the personal information is most often uninformed of the data's use.
[122] A revolution which had led to the resignation of the former leader of South Korea, Park Geun-Hye.

and humans and noted that the bill would include rights for 'granting robots copyright over their creative work' (Ji-hye, 2018). However the obfuscation of Sophia's capacity involves many dangers as pointed out by AI ethicist and roboticist Noel Sharkey in his Forbes article *Mama Mia its Sophia:*

> It is vitally important that our governments and policymakers are strongly grounded in the reality of AI at this time and are not misled by hype, speculation and fantasy. It is not clear how much the Hanson Robotics team are aware of the dangers that they are creating by appearing on international platforms with government ministers and policymakers in the audience. (Sharkey, 2018)

Sharkey's apprehensions are compounded by Elizabeth Rocha's paper *Sophia: Exploring the Ways AI May Change Intellectual Property Protections* (Rocha, 2017), which discusses the potential responsibility of the US under international law to recognise citizenship granted by a foreign country. Though the paper does not review music copyrights, it does consider patent law, which has a higher threshold of qualifying standards to be met than copyright. It is worth revisiting some of the legal requirements in play here in order to consider Rocha's propositions.

All the AI music start-ups mentioned to date operate and function on the potential value of their IP. This family of IP might be expressed in the form of patents, trademarks et al, and an AI music start-up will in most instances have a portfolio of IP rights. For a patent to be available for a patent grant, the invention must be *novel* and *not obvious* or not easily anticipated by *prior art*[123]. Patent protection can give effective monopoly in industrial fields to the patent holder. However, IP is not intended to be an overarching monopoliser of human ingenuity. In *Feist Publication Inc v Rural Telephone Service Company Inc.*, it was ruled that a database (telephone directory) was a compilation work

[123] Prior art is any evidence that your invention is already known. Prior art does not need to exist physically or be commercially available. It is enough that someone, somewhere, sometime previously has described or shown or made something that contains a use of technology that is very similar to your invention (European Patent Office, 2020).

which required a minimum level of creativity to be protectable. The protection of copyright requires a unique expression of the idea rather than the idea itself. For instance, one cannot protect the idea of a fizzy, black-coloured sugary drink but a variety of IP expressions protect both Pepsi and Coca-Cola products. One of the potential routes for Sophia to be recognised as a legal person could, as Rocha argues, be by using trademark IP[124] (Rocha, 2017: 132). Similarly, the right to publicity could be argued as an extension of any trademark (Rocha, 2017: p. 131). The proof of this protection is based on the economic interest associated with the trademarked name. Just as a music CD comprises many co-existing expressions of IP (the recording, the publishing, the design, and the trademark of the artist name), many everyday technologies are similarly comprised of a variety of bundled IPs. When considering a humanoid android like Sophia, she could comprise many significant but separate expressions of IP, including perhaps one capable of creating IP. So in this context if Sophia were granted the rights to create music copyright, it would be deemed a significant step to a robot being granted rights to create other forms of IP including patents – patents that could be created for application in other domains, for example medicine or technology. Based on comparable technical capabilities if Sophia's request for 'robot creative rights' were to be granted, then on what criteria should efforts be made to distinguish them from the rights afforded to humans? What possible incentive would there be to grant AI such a fundamental right?

4.14.2 Incentive Theory

When John McCarthy first coined the term artificial intelligence in his proposal for the 1956 Dartmouth Conference, it was a description of how a programmed computer, processing information, would respond in parallel to how an intelligent human would act

[124] The humanoid android's name, based on the publicity noted above, suggests that Sophia is now arguably more identifiable in the global public mind with that name than is the actress Sophia Loren after whom the android was named (Rocha, 2017: p. 132).

in response to similar input. The debate since on the status of AI, its produced material and its entitlement to IP protection has grown in intensity and sophistication in both argument and application.

An argument relied upon to defend a special position for human creativity is to be found in the concept of author *incentivisation* (Sinha & Mahalwar, 2017: p. 66). *Incentive theory* argues that society benefits from the creation of new inventions and new works which provide authors with monopoly rights limited in time and territory, to foster the *common good* (Boldrin & Levine, 2010). An intriguing re-interpretation of author incentivisation theory exists within the broader debate on AI, robotics and IP. This counter argument proposes that many societal benefits could emerge from extending independent rights to machine-generated creativity. It is only necessary to acknowledge these developing ideas in the international public sphere and reflect on some of their key factors and motivators.

In the US considerable importance is attached to the incentivising function of the copyright system. Copyright protection is seen as an important incentive to creativity, which has the effect of encouraging the production of works available when the period of copyright has expired. The US Supreme Court ruled in *the Sony Corporation of America v Universal City Studios, Inc.*, that copyright systems are:

> intended to motivate the creative activity of authors and inventors by the provision of a special reward and allow the public access to the products of their genius after the limited period of their exclusive control has expired. (Sony Corporation of America v Universal City Studios, Inc., 1984)

Writing in the *Journal of the Franklin Pierce Centre* in 2017 Dr Kalin Hristov has, citing the Sony judgment, employed the ‘incentives’ argument for exploring the idea of some copyright protection for AI:

> Denying copyright from being issued to developers and owners of AI machines reduces their incentives to create new AI programs, and may ultimately lead to a lower number of AI generated copyrightable works… and significantly decreases incentives for creativity and is counterproductive to the development of AI, … having far reaching negative effects...with the arts education, medicine technology, among others suffering significantly. (Hristov, 2016: p. 439)

For example, part of the argument as outlined by John Frank Weaver suggests that if there is a failure to recognise the multiple outputs of AI, industry becomes disincentivised and human progress slows down (McKinnon, 2019).

In an important contribution to this debate, Professor Lawrence Solum (Solum, 1992) reviewed the question whether AI applications should be treated as legal persons in the context of the challenges the law faces about the status of personhood (Solum, 1992). He referenced and dismissed the issues which had been raised earlier by Dr Steven Goldberg (Goldberg, 1991). Goldberg had posited that, given that humans see their species as unique, if AI systems were deemed to be self-aware and capable of social interaction would that lead to a form of recognition of personhood for AI. One must share a degree of Solum's doubts about levels of borderline personhood though this question has, for the moment, received a response in the AI ethics guidelines of the IEEE which recommends:

> that the technology has not yet developed to the point where it would be legally or morally appropriate to accord A/IS [AI] the rights and responsibilities inherent in the legal definition of personhood. (IEEE, 2019a: p. 256)

However, this admission of the law is based on the appraisal of current levels of technology, suggesting that it may well change based on future AI development. This is evident from the EU perspective where a resolution of the European Parliament in 2017 urged the European Commission to consider 'electronic personality' for autonomous

robots (European Parliament, 2017). This gives rise to many questions that need to be addressed in advance of the invention of comparable technology.

If the granting of copyright protection to AI generated works was agreed upon, then in whom or in what will the copyright vest? Should the granting of a non-human legal personhood to an AI application be agreed to? How would this new legal personality be governed, and could it be bought and sold in the same way as a company? What does the birth of autonomous AI applications say about the human perspective on the central place of the human as the sole entity on the planet capable of enjoying rights and providing exclusively human-centred and human understood criteria and value judgments for the world?

4.14.3 AI, Unprotected Copyright and Music Revenue Streams

Several of the reviewed AI music actors (most notably those from Iamus and Melomics) create musical works published with creative commons licences. Equivalent unprotected copyrights, as well as copyrights whose period of protection has expired, enter the public domain. There, works can be reinterpreted or repurposed without being subject to the existing legal permissions and royalty payments arising from registered or recognised works of IP. The potential application of creative commons music licences (free copyrights), impinging as it does on the traditional purpose of copyright, which is the remuneration of the creator, is a development requiring attention so as to remove any capacity for abuse in the change of the purpose of copyright.

An insight gained by Chapter 3's AI music actor analysis is to note the diversity of alternative revenue streams explored by AI music actors. A feature of many of these new revenue streams is that they are not so readily available to rival human authors- an illustration which can be seen in the offers of 'copyright free AI music' in exchange for a licensing fee, or a portal membership or some manner of barter interchange involving the

user's personal data. Of course, these economic models are potentially open to human musicians to adopt, interpret or incorporate into their existing revenue streams. However, the relentless scale of content proliferation with which AI music generators can operate, especially when considered in adaptive and personalised contexts, demand respect and assessment. In these instances the exponential scale of musical material produced exposes the weakness of copyright law already discussed.

It should be noted too that Section 178 of the UK *Copyright, Designs and Patents Act* defines a computer-generated work as that which is 'generated by a computer in circumstances such that there is no human author of the work' (UK Government, 1988). The rationale here is to create an exception to the only human authorship requirements, by recognising the human work that goes into creating a program capable of generating artistic works, even if the machine undertakes the original creative stimulus. That is fine as far as it goes, but only in the sense as qualified by the technological standards of the 1990s.

When it comes to contemporary AI music systems, the machine user's contribution to the creative process might be just a verbal command instructing the ambient creative AI to begin. The degree of legal as well as factual ambiguity emerging in these instances is challenging, and leads to a broader perspective which asks difficult and searching questions about the understood and accepted traditional principles underpinning copyright law.

Nonetheless, an exponentially developing autonomy in AI systems is occurring (Gerstner, 1993). Thus, AI may well be passing from the status of tool to that of an agent, if not an actor. On the understanding that AI continues to be treated as an instrument or communication tool on behalf of natural persons, the existing legal approach of viewing AI as a product may suffice in terms of financial, personal and property rights protection. However, when an AI system starts to act on behalf of no-one, and supposedly on its own

behalf, the law will need to radically re-examine its approach as then the arguments for applying strict liability regimes may be seen to need urgent and critical assessment. This is particularly the case as mentioned in the context of so-called 'high risk' AI as Lethal Automated Weapon Systems (LAWS) or indeed issues of liability regarding automated vehicles. However, the law remains the same whether dealing with killer or marimba playing robots, and it may well be that these laws are first tested in the music ecosystem.

4.14.4 Skill and Effort

Of course, despite their wider societal implications, these legal issues are left to be resolved on a case by case basis. For instance, in the UK case of *Nova Productions v Mazooma Games* (Nova Productions Ltd v Mazooma Games Ltd, 2007) the Court of Appeal decided on the authorship of a computer game, declaring that a user's input 'is not artistic in nature and he has contributed no skill or labour of an artistic kind' (Guadamuz, 2017b). By and of itself, relying on the requirement of a creative user action on a case by case basis may be one possible if not always a satisfactory approach to the matter.

As observed in the recent cases of *Blurred Lines* and *Dark Horse*, a jury can give surprising interpretations and the law cannot, it is suggested, turn a blind eye to the ever more complex scenarios with growing frequency. Matters will become more intricate as the adoption of AI tools by the music ecosystem becomes more widespread. Moreover, as machines get better without humans at producing creative works, distinction between human and non-human actors in the creative process will inevitably blur. And while parallel distinctions were blurred before the advent of AI, as with the DJ case study and indeed with prior introductions of musical technologies, the issues presented by AI are radical and exponential, and emerge from all sectors of the music ecosystem.

Whilst outsourcing responsibility from legislation to judge-made case law can be temporarily politically expedient, it marks a fundamental failure to embrace consideration

of the *common good* as identified in law. National legislation and jurisprudence are sensitive, if not subject to international legal decisions. This scenario is always capable of producing unintended consequences.

Compounding these challenges, there is a distinct infirmity in relying on classic copyright case law to deal with the innovation of AI when that case law has its roots in the pre-computerised age. Recognising the inordinately challenging issues given the progression of AI science, the question arises is there a middle way which may serve to provide a dependable and predictable legal regime for AI in the present and foreseeable future?

Does the existing conservative approach of requiring a human creator, before copyright can be attributed to works autonomously created by AI, still provide a credible answer? The music ecosystem founded as it is on the rewards of the exploitation of human-generated IP is on the shakiest of ground. It is evident that current legislation across jurisdictions and at regional level, as interpreted and applied by the Courts, is no longer fit enough to fully protect the financial and other interests of music makers. What is required is a global response which considers both the exponential developments in AI and the fundamental principles which under-pin copyright laws. These principles require effective legal supports for what is determined to be the *common good.* And that is an ethical issue.

At the *WIPO AICM* session in February 2020 (US Copyright Office, 2020a) the panel traced aspects of the financial and legal issues reviewed in this chapter. Statements given at the discussion indicate that protections offered by IP law to human actors, despite its examined fragile status, remain for the time being a bulwark to unfettered AI innovation. Alex Mitchel, representing Boomy start-up, responded to the question of what constituted best practice regarding music copyright:

> remember there are these attorneys that we pay money to – to write these contracts for us and we're [Boomy] going to do, you know, basically what the attorney, you know, tell us is the best way to do it. We don't have the choice, right? That's pretty much all we can do. But I will say that, you know, there are aspects of copyright law that make it kind of difficult to create the systems that we might want to do. (p. 299-230)

Joel Douek agreed with Mitchel's assessment that 'if you want an AI to write good music, you've got to be free completely of all [regulatory] boundaries' (p. 199-200). The dominant technological determinist position of science as an inexorable actor was confirmed when Douek further reflected:

> personally, I think that it is just a matter of time….we're going to do it – because that's what science does…why do we do it? Because we can. It's going to happen, and we'll have to retroactively look back and say was this meaningful or not (p. 212)

It is here, when technological progress is confronted by regulation, that the question of ethics enters the analytical frame. The panel reached some conclusion when Douek acknowledged that 'There's some ethical implications there' (p.199), a reflection also shared by Mitchel: 'This question of ethics is crucial' (p. 235). However, the question of how ethics would be socially constructed and from what materials would it draw was not discussed by the panel. It is this question the next chapter seeks to map and investigate.

Chapter 5: AI Ethical Guidelines and the Music Ecosystem

> Music and culture matter. They are our heart and soul. But they don't just happen; they demand the hard work of so many people. Importantly, music also creates jobs and economic growth and digital innovation across Europe. Unfortunately, 'the value gap' jeopardises the music ecosystem. We need an internet that is fair and sustainable for all. The value gap is that gulf between the value these platforms derive from music and the value they pay creators. (McCartney, 2018)

This chapter reviews what contribution from ethical reports is needed to address the challenges and opportunities to music copyright, and thus to the overall needs of the music ecosystem, presented by AI music actors. As will be shown in the macro perspective there are a plethora of reports on the principles of AI ethics, of which over forty-seven were reviewed for the research presented in this chapter. However, because of their macro perspective remit they are insufficient to address the disruptive influence of AI in sector-specific decision-making. This chapter locates the connective pathway between the general AI principles. It develops a hypothetical framework and a set of questions about how the principles can and should pragmatically apply to the music ecosystem. This chapter presents the argument that in the era of the algorithm, it is only through the global regulation of human rights oriented AI that human artists and their IP, music copyright and ability to create freely are protected: by prioritising the human-in-the-loop. After analysing the AI ethics discourse, the resulting argument in this and the concluding chapter is that the objectives of the *UN SDGs*, buttressed by other supporting and aligned AI principles, have the moral capacity to drive a unified AI ethics policy. This policy is capable of regulating the needs of a truly global equitable music ecosystem through the implementation of an ethical and trustworthy 'music mark' for AI.

To analyse the development of an ethical framework for AI in the music ecosystem, a macro perspective review is conducted of critical issues recognised in

selected global AI reports and other relevant publications. These AI ethics guidelines (mainly published between 2017-2020) are drawn from a selection of sources including industrial, governmental, intergovernmental, independent think tanks, and academic institutes. Six primary reference sources have been selected representing all of the sectors, as follows:

1. AI HLEG, *Ethics Guidelines for Trustworthy AI (EGTAI)* (AI HLEG, 2019b).
2. UN, *Transforming our world: the 2030 Agenda for Sustainable Development (UN SGDs)* (UN General Assembly, 2015).
3. IEEE, *Ethically Aligned Design: A Vision for Prioritising Human Well-being with Autonomous and Intelligent Systems* (*EAD1e*) (IEEE, 2019a).
4. AI NOW Institute, *2017*, *2018* and *2019 Reports* (Crawford, et al. 2017).
5. UNI Global Union, *Top 10 Principles for Ethical Artificial Intelligence* (UNI Global Union, 2017).
6. IFPI, *2018 Global Music Report* (IFPI, 2018).

This analysis begins with the macro perspective – the intergovernmental, governmental, and nongovernmental publications that intersect by addressing fundamental values. The outcomes from this macro perspective analysis are then applied to the micro perspective of the music ecosystem. The chapter ends with a best practice case study of the implementation of ethical values by an existing AI music start-up.

5.1 The Macro Perspective of AI Ethical Guidelines

5.1.1 The Intergovernmental Level

This section reviews first how various intergovernmental bodies (EU/G20/UN) have engaged with issuing ethical recommendations for AI through the publications of

white papers, specific reports, and guidelines, principally between 2015-2019. Many of those ethical policies interlink and overlap to provide an emergent commonality of fundamental, human-centred values, which are relevant to music copyright. While some critics including Thilo Hagendorff have stated that all the intergovernmental and nongovernmental AI publications are lacking 'the tangible implementation of ethical goals and values' (Hagendorff, 2020: p. 2), this is arguable as Hagendorff's criticism tends to overlook that publications, for example the *OECD AI Principles* and the work of the AI HLEG, have contributed to the US, EU, and the UK national AI strategies. Furthermore, the *OECD AI Principles* can be considered as a formal legal instrument (at least within the context of its member state agreements) that strengthens the overall international movement towards regulation that contains enforceable governance and accountability. Similarly, the work of the IEEE has directly influenced both the OECD and the AI HLEG AI principles, and the proliferation of reports on the ethical issues surrounding AI are at the very least affecting global conversation about AI policy.

Moreover, some of the guidelines are released in draft form in order to request wider input from affected stakeholders (e.g. *EAD1e*) but these works are substantial in both length and rigor in each stage of publication. With so many sets of principles it can be difficult to navigate which to choose from; additionally as most of these principles have not evolved from or to legislation at the time of writing, it remains unclear how they will ultimately directly affect the music ecosystem. However, the key lesson here is to identify the early stage that these developing principles represent and thus note the ensuing opportunity to influence their pathway to eventual legislation (as the music sector example shows).

To consolidate this work's macro analysis, the prompt incorporation of EU policy on AI ethics into the AI Principles of global parties including the G20 and OECD is observed. In particular, *EGTAI* has had a direct influence on the relevant EU policy and

subsequently on the adoption of AI principles not only by the OECD and G20 but also at the state level (e.g. the Irish national AI strategy). In comparison to EU AI guidelines, the UN is at an early stage of an approach, but this institution's position and its mission is more adequate to recognise and respond to the global AI challenge, aligned with its future-orientated SDGs. As Audrey Azoulay, Director-General of the United Nations Educational, Scientific and Cultural Organisation (UNESCO) noted, though the advancements in AI are:

> relevant to every aspect of the mandate of the United Nations Educational, Scientific and Cultural Organisation (UNESCO)... AI could open up tremendous opportunities for achieving the Sustainable Development Goals (SDGs)…(but also) give rise to major ethical issues. (Azoulay, 2019)

Azoulay outlined a range of ethical questions that needed to be addressed to ensure that algorithms do not infringe on human rights (privacy, freedom of choice) and that AI systems provide accountability and transparency for a global citizenship. In the same article, Azoulay also observed:

> Many actors – businesses, research centres, science academies, United Nations Member States, international organizations and civil society associations – are calling for an ethical framework for AI development. (Azoulay, 2019)

What follows is a closer look at those actors' reports on the ethics surrounding AI, and through the analysis of the discourse how the commonality of those values is communicated and links back to the *UN SDGs*. As Azoulay further states, a holistic global approach with the participation of UN funds, agencies and programmes is required to locate methods of 'harnessing AI for sustainable development'. Eventually, the parallel

between SDGs and AI music ecosystem's ethical regulation is one of this dissertation's research hypotheses to investigate.

The EU. The analysis of the influence and interaction of intergovernmental publications begins with the European Commission's *Communication – Artificial Intelligence for Europe* (*CAIE*) published on 25th April 2018 (European Commission, 2018a) and ends with the white paper published on 19th February 2020, *On Artificial Intelligence – A European Approach to Excellence and Trust* (*White Paper*) (European Commission, 2020b).

The *CAIE* proposes a European strategy in support of a unified methodology to AI. The ethical requirement for AI technology was enshrined throughout its content, and rested on three pillars, which can be summarised as follows:

(1) Funding would be provided to increase the functionality and capacity of both the economic public and private sectors to maximise the adoption of AI technologies.

(2) Preparation needed to be made for the various societal, economic and cultural changes that corresponding technologies would incur.

(3) The EU should ensure that an ethical and legal framework be created, aligned with the Charter of Fundamental Rights of The European Union and grounded in the EU's values.

The *CAIE* proposed to provide minimum funding of €1 billion yearly, to be distributed through established EU research projects such as the Horizon Europe and The Digital Europe Programme to assist in the objective of those three pillars. Alongside that investment, the Commission tasked the AI HLEG with drafting ethics guidelines established on an investment and regulatory framework.

Building from the three pillars of the *CAIE* another document, the *EU Coordinated Plan for AI,* was issued in December 2018 (European Commission, 2018b). Again, explicitly stated in the annex to this publication is the necessity for ethics to inform all areas of the debate:

> The Union aims to develop trusted AI based on ethical and societal values building on its Charter of Fundamental Rights. People should not only trust AI but also benefit from the use of AI for their personal and professional lives. (Fullerton, 2018: p. 1)

The *EU Coordinated Plan for AI* envisaged that AI would likely be a fundamental driver of economic growth (p. 2). The stated ambition in the plan was for Europe to 'become a global leader in developing and using AI for good and promoting a human-centric approach and ethics-by-design principles' (p. 8).

The *EU Coordinated Plan for AI* sought to use existing instruments like the European Fund for Strategic Investment and the European Investment Fund to provide the necessary resources (€100 million). Collaborations were then introduced between Public-Private Partnerships (PPP) under the EU Horizon 2020 programme and would operate alongside the existing Robotic and Big Data PPPs. PPP-based projects would have separate but complementary innovation and research agendas[125].

The importance of dedicated ethical research institutes and centres of excellence to contribute to the implantation of AI, as advised by EU, is underlined in the concept of a Digital Innovation Hub (DIH). A function of the DIH is the integration of small to medium enterprise businesses (SME), many of which are start-up companies, into the broader research programme (p. 5). The DIH aims to assist in accelerating the uptake of AI in the wider economy through transmitting knowledge of the scientific advances made through the DIH testing facilities and centres of excellence. A key outcome of that integration is the adoption of the AI ethical principles by DIH partners and stakeholders.

Following the recommendations of the *CAIE* on the 25th April 2018, the EU created the

[125] Of note to this chapter's conclusions is the prestige of EurAI (European Association for AI). Membership to the EurAI panel is evaluated on the individual's long-term contribution to the field of research. Ireland, interestingly, has the highest per-capita number of representatives on the committee.

AI HLEG in June 2018. It consists of fifty-two expert representatives from civil society, industry and the academy. Its principal mission was to contribute to the development of policy and regulatory investment recommendations that would inform the publication of the *EU Coordinated Plan for AI*, a plan that was subsequently published in late 2019. The AI HLEG also served as the steering group for the European AI Alliance Forum, which is designed to widen the debate on the recommendations of EU AI policies through the engagement of public and civic stakeholders.

As will be demonstrated, the AI HLEG is a highly influential actor in the development of intergovernmental AI policy, and so it is of value to extract critical ethical concepts from their work. What is of interest in the end is the applicability of these concepts to the music ecosystem.

The human-centric frame is the first concept of AI ethics for the EU. Composed under the EU's motto of 'united in diversity', the AI HLEG's report *Ethics Guidelines for Trustworthy AI* (*EGTAI)* proposes that: 'AI systems need to be human-centric, resting on a commitment to their use in the service of humanity and the common good' (AI HLEG, 2019b: p. 4). The inclusion of the term 'common good' is directly connected to a key tenet of IP concepts and is central to many of the challenges presented to music copyright previously outlined in Chapter 4. It is important to note that while the emphasis is on values in the selected reports, the AI principles of other organisations do not always prioritise human-centricity, which is apparent in the field of Lethal Autonomous Weapons Systems (LAWS).

A useful AI HLEG description for the music ecosystem relates to the notion of 'ethical AI' itself:

> The development, deployment and use of AI that ensures compliance with ethical norms, including fundamental rights as special moral entitlements, ethical principles and related core values. (AI HLEG, 2019b: p. 37)

Furthermore, the AI HLEG's principle of 'respect for human autonomy' (p. 8) states that AI systems should be designed to 'augment and empower human cultural skills' (p. 12). A compelling juxtaposition occurs when this quotation – 'augment and empower human cognitive, social and cultural skills' (p. 12) – is considered within the context of the common good of the music ecosystem where vested interests in human creativity can be observed in the review of various AI music actors. The concept of a music ecosystem as opposed to a music industry is supported by another recommendation which involves multiple stakeholders. They are encouraged to establish a global framework for 'trustworthy AI' to build international agreement, while 'promoting and upholding our fundamental rights-based approach' (p. 5).

Concerning what might characterise this critical concept of trustworthy AI, *EGTAI* recommends that the technology should comprise three critical components:

(1) It should be legally compliant with all applicable laws and regulations.

(2) It should adhere to ethical principles and values.

(3) It should, from a technical and social perspective, be sufficiently robust that comparable AI systems do not have unforeseen consequences that cause any unintentional harm.

Other ethical principles discussed within *EGTAI* interconnect with the concept of trustworthy AI. These principles address the notion of fairness and the measure of this fairness in AI technologies is calculated upon the objective of equality for both EU individuals and groups. The evaluation of societal benefits against any potential costs is also considered. The principle of fairness seeks to ensure that AI systems protect citizens from 'unfair bias, discrimination and stigmatisation' (p. 12), and that equal access to education and AI tools is granted. A procedural aspect of this principle is that an AI system's decision-making processes must be explicable to its users. This requirement can

pose a challenge to technical execution, while maintaining a competitive landscape and commercial viability within the corporate domain.

The section on respect for human autonomy is clear in stating that AI systems should not, without legal justification, 'subordinate, coerce, deceive, manipulate, condition or herd humans'[126] (p. 12). In other words, equivalent systems should follow human-centric design principles that facilitate the augmentation and empowerment of human 'cognitive, social and cultural skills…[that create] meaningful opportunity…[that] aim[s] for the creation of meaningful work' (p. 12). Exactly what constitutes 'meaningful work' (p. 12) is not elaborated in *EGTAI,* and this is one example of a problematic status of this recommendation when applied to the music ecosystem.

In an additional point in the report, one which inevitably touches on concerns of employment, *EGTAI* acknowledges that these challenges should meet with a desire to 'ensure that everyone can thrive in an AI-based world' (p. 9). This is a good example of a clearly stated ethical value that can be readily incorporated to empower the rights of artists within the music ecosystem. Nevertheless, overall the style of this report's formulations can be taken to suggest over-generalised and highly interpretable aspirations. Who is the 'everyone' that is referred to? Is it all EU citizens but not those of the UN? And what of the status of displaced communities? Are they part of 'everyone'? Similar concerns apply when considering from what values is the word 'thrive' derived? Are those values defined by metrics beyond GDP (as recommended by the *UN SDGs*) or not? Likewise, the prospect of an 'AI-based world' suggests many dystopian connotations. Indeed these reservations extended to the definition of trustworthy AI may be normatively limited because it does not say what constitutes 'untrustworthy' AI, nor

[126] A directive that points to the concerns related to the capacity of affective computing. Affective computing and the ethical use of 'nudging' techniques is mentioned in Chapter 6's conclusions.

does it provide any detailed reflection on the risks that involve the development of AI technologies.

The prevention of harm in this recommendation concludes with an ecological aspect when it states that the principle should also address 'the natural environment and all living beings' (p. 12). Within the framework of human-centred values, the development of AI, which includes here not only humans but also non-humans, invites the posthuman perspective. It follows that a trustworthy AI approach should be critical about what is created by humans under the umbrella of AI, and question how ethical relations are built with technology that affects not only the human world.

According to *EGTAI* the realisation of the principles of trustworthy AI consists of seven requirements (p. 14):

(1) Human agency and oversight

(2) Technical robustness and safety

(3) Privacy and data governance

(4) Transparency

(5) Diversity, non-discrimination and fairness

(6) Societal and environmental well-being

(7) Accountability

However, these requirements conceptually overlap with the previously surveyed *EGTAI* principles. Therefore, they do not address the question that reappears throughout this analysis: how will these requirements be implemented into the industries challenged by the exponential development of AI technology, including the music ecosystem?

The *EGTAI* builds its recommendation on these concepts, but it is still limited to general guidelines, which need to be developed further or exemplified to be applicable. However, to some extent these broad ethical requirements can be filtered and interpreted to be practically applicable in the music ecosystem. To illustrate this, the following

extracted passages will be discussed from the *EGTAI*[127] before returning to a holistic contextualisation of these and related AI challenges in Chapter 6.

The *EGTAI* recommends that users of AI systems 'should be able to make informed autonomous decisions' (p. 16) that guarantee privacy and the protection of data throughout a system's 'entire life cycle' (p. 17)[128]. Furthermore, when AI has 'significant impact on people's lives' (p. 18), traceability in the data used and decision-making process is necessary. These recommendations inform the many issues of data sovereignty that emerge in the use of AI music services and products. The transparency of the wider financial exchange in operation particularly regarding so-called 'free' AI music services would alleviate some of the legal stresses to music copyright outlined in Chapter 4. However, it would have to be successfully argued by representatives of the music ecosystem that concerns regarding data sovereignty were sufficiently 'significant' to warrant governance by the *EGTAI*.

When *EGTAI* stipulates that users should know when they are engaging with AI systems and the 'systems should not represent themselves as humans to the user' (p. 18), it is relevant both to the consideration of the complexity of argument related to notions of legal personhood (Sophia et al.) and also to concerns regarding the development of ambient and embodied AI along with the emergence of AI music artists. It is further emphasised in this document when it states that 'ubiquitous exposure… [to] social AI in all areas of our lives (be it in education, work, care or entertainment)' (p. 19) can alter and challenge concepts of social agency and impact on social relationships. It is here, where the macro and micro perspectives of this chapter intersect, that the significance of the challenges of AI in the music ecosystem are sufficient to warrant intervention by regulation and governance at the EU level.

---

[127] Usage of 'must', 'should' and 'advisable' is in line with these terms' usage by *EGTAI*.

[128] An important distinction as a user's data may be processed at different intervals for differing purposes.

A further positive opportunity presented by AI for the music ecosystem is contended when *EGTAI* states that systems must be enabled to allow 'inclusion and diversity' (p. 18) throughout the AI's full lifecycle. Entrenched bias within the music industry in terms of gender and ethnic participation could successfully be addressed through the adoption of AI systems ethically designed to highlight and help regulate historic imbalances and practices at all tiers in the music ecosystem. Such change would be enabled by the *EGTAI* call that broad stakeholder participation is 'advisable' (p. 19) for the creation of trustworthy AI and that such stakeholders should be 'consulted with who may be directly or indirectly affected' (p. 19) by the AI system.

In summary, the *EGTAI* indicates potential positive technological contributions, and it states that EU AI ethics are coordinated and aligned with the values of the *UN SDGs*:

> Ethical reflection on AI [technology] can serve multiple purposes… it can stimulate new kinds of innovations that seek to foster ethical values such as those helping to achieve the UN Sustainable Development Goals, which are firmly embedded in the forthcoming EU Agenda 2030. (p. 9)

For implementation of its report aimed at ethically aligned AI, the AI HLEG has repeated the general directions of setting out the principles for trustworthy AI and working on international consensus for building human-centric AI procedures. The most important step for the application of AI ethics – from this work's perspective of a sector-specific approach – concerns the AI HLEG's large scale pilot phase for feedback from stakeholders (AI HLEG, 2019b: p. 31) as this suggests the possibility of intervention into unregulated practices of AI actors within the music ecosystem.

The European position concludes that this approach to AI ethics should be brought to 'the global stage' because AI technologies 'know no borders' and promises that the European Commission will strengthen cooperation with 'like-minded partners' including

Japan, Canada and Singapore (European Commission, 2019b). In that document the EC reemphasises the interconnection between developing AI ethical principles that reach beyond intergovernmental agencies and extend into a transdisciplinary and multi-stakeholder environment. Following on from the work of the AI HLEG, the European Commission issued the white paper *On Artificial Intelligence – A European Approach to Excellence and Trust (White Paper)* (European Commission, 2020b). This document approaches the question of a marking system for AI which, in comparison to the general nature of presented recommendations in *EGTAI,* could be adapted in the micro perspective application to the music ecosystem. In general, the ongoing development of AI ethics at the EU level is in tandem with much of this thesis's argument, however it includes some conceptual departures from this concurrence, which will now be outlined. The most important departure is the inference that the arts will be ascribed as a so-called 'low risk' AI category and thus do not warrant formal legislative assessment.

The *White Paper* (European Commission, 2020b) distinguishes between 'high risk' and 'low risk' AI, in the movement towards a European 'ecosystem of trust' (p. 3). The characterisation of high risk includes AI applications that 'pose risk of injury, death or significant material or immaterial damage…[and] cannot reasonably be avoided by individuals or legal entities' (p. 17). Therefore, any challenges to the music ecosystem caused by AI (e.g. regarding copyright) can be determined according to the *White Paper*'s classification as being low risk, because the division of risk is formulated not on the probability of the challenge, but on its likely impact on mortality. These distinctions between high and low risk AI are relevant but problematic when the paper approaches the issue of the regulatory marking of AI.

The *White Paper* proposes that non-high-risk AI applications should not be subject to mandatory regulatory requirements, and recommends an option to establish a voluntary labelling scheme for which the economic operators of the AI would be

‘awarded a quality label’ (p. 24). However, while the *White Paper* refers to the creation of a legal instrument that sets out the framework for AI developers, it somewhat fudges on the structure of the framework’s governance. It suggests reliance on a ‘network of national authorities, as well as sectorial networks and regulatory authorities at national and EU level’ (p. 24), plus a committee of experts to aid the European Commission. Additional responsibility for low-risk AI governance would be deployed by involving ‘maximum stakeholders participation… – consumer organisation and social partners, businesses, researchers and civil society organisations’ (p. 25). With regard to an AI marking system, the paper raises some critical issues that will become apparent when assessing concerns from the nongovernmental level. These concerns relate to calls from nongovernmental actors for a legislatively enforced, independent certification of AI, founded on the common good and capable of instilling public trust regarding the veracity of its assessment. Whether the *White Paper*’s voluntary labelling scheme is sufficiently robust and independent to be separated from the strains of vested interests is the key question the remainder of the macro perspective analysis addresses.

Nonetheless, there is much in the document that is a positive development. When the *White Paper* calls for maximum stakeholder participation, it reflects this review’s recommendation for the evolution of a responsible and equitable music ecosystem in which all the actors in the network are heard and contribute to its development and governance. It is likely that much of the *White Paper* will form the eventual EU legislation, and if industrial self-assessment for ‘low risk’ AI applications is a regulatory future (at a state level), then the establishment of best practice, sector-specific industry models will be crucial such as are proposed in this work.

Having examined the EU position on the AI ethical development, including so-called ‘trustworthy’ AI, it is concluded that the guidelines contained in the *EGTAI* recommendation, despite their global ambitions, involve still too broad a direction on AI

ethics. This review now examines other intergovernmental AI ethics polices to see how they rapidly, but uncritically, incorporated initial EU (AI HLEG) concepts and approach.

The Organisation for Economic Co-operation and Development. In May 2019, The Organisation for Economic Co-operation and Development (OECD)[129] incorporated the *EGTAI* recommendations into its document *OECD Principles on Artificial Intelligence* (*OECD AI Principles*) (OECD, 2019a). The OECD continues to develop these principles with the announcement in June 2020 of their Global Partnership on AI (Newsroom, 2020).

The *OECD AI Principles* are based on, and reference, the EU concept of 'trustworthy AI'. The importance of the AI HLEG 'trustworthy' AI components such as algorithmic accountability and transparency are highlighted in the *OECD AI Principles*. The report proposes an AI standard that respects 'human rights and democratic values' (OECD, 2019a) under the umbrella of repeated but unspecified human-centric values. Similar to *EGTAI* aspirational schemata, the *OECD AI Principles* states that the transformative power of AI should 'benefit people and the planet', 'respect the rule of law' and ensure a fair and just society (OECD, 2019a).

G20. In May 2019, the G20 (comprising the EU and nineteen other countries including China, India, Saudi Arabia, Russia and the US) adopted the recommendations of the *OECD AI Principles* in their Ministerial Statement (Hudson, 2019). Hence in a matter of months, from the EU to the OECD and on to G20, virtually identical moral AI statements were exchanged and agreed. The *G20 Statement*, in accordance with the EU and OECD, demonstrates how these AI strategies are themselves rooted in the moral values

[129] The OECD, founded in 1961, is an intergovernmental economic organisation consisting of thirty-six countries (Ireland joined in 1961) intended to stimulate world trade.

articulated in the *UN SDGs*. This observation is supported by the G20's *Ministerial Statement on Trade and Digital Economy (G20 Statement)* from 9th June 2019 (G-20, 2019):

> vision of human-centred future to achieve an advanced society, which realises economic growth and solves social challenges, by advancing towards Sustainable Development Goals (SDGs) through the increasing convergence of the physical world and the virtual world. (G-20, 2019: p. 1)

The *G20 Statement* also calls for the 'human-centred' (p. 3) development of AI, which will realise an 'inclusive, sustainable, safe, trustworthy and innovative society' (p. 2), and which can 'mitigate (AI) risks to wider societal values' (p. 3). The connection between the ethical development of AI policy and the ideals of *UN SDGs* is thus explicitly made in the *G20 Statement*. The relationship between those AI charters and the objectives of the *UN SDGs* is not always directly mentioned in other intergovernmental guidelines. But the real-world adoption of the UN's agenda should be encouraged, because like the UN agency WIPO's movement towards the global harmonisation of IP, values need to be concomitant with global stakeholder purpose and benefit. The individual *UN SDGs* relevant for micro perspective application to the music ecosystem are now pinpointed.

The United Nations Sustainable Development Goals. The United Nations Sustainable Development Goals (*UN SDGs*) (UN General Assembly, 2015) replaced the Millennium Development Goals (MDGs) and were announced in 2012 at the UN Conference on Sustainable Development in Rio de Janeiro. The *UN SDGs* were formally adopted in 2015 by all UN member states. The objective of the *UN SDGs* was to produce a set of 'universal goals that meet the urgent environmental, political and economic challenges

facing our world' (UN, n.d.). The *UN SDGs*' ambition is to achieve the full global implementation of the goals by 2030. The goals are designed to complement each other, and several possible applications of the *UN SDGs* can correlate with what is assumed as an ethical approach to AI. Although none of the goals use the term 'AI' or directly address AI challenge, there are identifiable SDGs that can demonstrate their moral connection and applicability to the development of a unified global AI ethics policy and emerging standards that could regulate the music ecosystem.

There are seventeen SDGs in total. The most supportive aspects of the *UN SDGs* that develop concepts of trustworthy AI include health and well-being (no. 3), education (no. 4), gender equality (no. 5), employment (no. 8), innovation (no. 9), and equality (no. 10). All these goals speak to the wider challenges and opportunities presented also by AI to the music ecosystem. However, it is Goal 17, defined as to 'strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development' (UN General Assembly, 2015), in which is recognised the specific connection between the *UN SDGs* and AI ethics.

The goal's tenth target (17.10) calls for a 'universal rules-based, non-discriminatory and equitable multilateral trading system under the World Trade Organisation' (UN General Assembly, 2015), and can therefore be applied to the need for regulating the troubled legal and financial relationship between IP and AI, as discussed in Chapter 4. Other stated targets of Goal 17, the sixth and the seventh, refer to technology and encourage international co-operation through a global technology 'facilitation mechanism' (17.6), to foster and diffuse 'environmentally sound technologies' to developing nations on 'favourable, including concessional and preferential terms' (17.7). This objective, along with 17.8 ad 17.9 can be interpreted to support the need for an ethical approach to both the implementation and access to AI tools and systems in low to middle income countries (LMICs).

The emergent actors in the economics of the global music ecosystem require sector-specific support mechanisms to enable competitive and sustainable participation in the creative arts industries. Target 17.17 further outlines how these economic alliances can be achieved through building and promoting partnerships, which involve civil, public, and public-private actors. This target endorses the frequent calls in this thesis for the development of such alliances to represent all actors and financial interests in the music ecosystem, in order to meet the challenges presented by AI. The range of promising approaches for those music alliances is emphasised when Goal 17 states that multi-stakeholder partnerships should 'mobilise and share knowledge, expertise, technology and financial resources' in support of the achievement of the *UN SDGs* for each country (17.16). Goal 17 is in line with the EU fundamentals of an approach to AI and ethics but extends that remit to all nations. Following from this, the question of framing the borders of the music ecosystem therefore appear, and the consequences of Goal 17 in that context are returned to in Chapter 6. However, were policymakers to fully recognise the moral imperative of the *UN SDGs* in regard to the ethics of AI being grounded in improving human well-being, then regulation of the music industry would most likely need to prioritise the human artist over AI in regulation, data, and IP rights. This point is expanded upon in the conclusions of Chapter 6.

In effect, the existing guidelines at the intergovernmental level, including the EU and other organisations, have recognised the problem of developing an ethical approach to AI as timely, but their strategy – for example, to correlate AI ethics with *UN SDGs* and communicate it within the rhetoric of generalised human-centred values – is not sufficient to address the disruptive influence of AI in any sector-specific ecosystem. In light of this inadequacy, what responses to AI have national governments prepared?

5.1.2 The National Government Level

One of the most important developments in the AI landscape is the emergence of national plans and recommendations issued over the last few years. A consultation for the development of an Irish national AI strategy (DBEI, 2019a) is currently evaluating the capacity of national academic research and training institutions to embrace the EU AI guidelines. The strategy seeks to encourage greater collaboration between the industrial and research communities. The Irish AI strategy is at an early stage and in Chapter 6 consideration is given to how the implementation of this thesis' recommendation for the creation of an ethically aligned AI music mark can become a key pillar of the Irish AI strategy development.

Other national plans and strategies are also indicative of the timely global movement towards a broad ethical understanding of AI, however none of these strategies contain any significant deliberation on the arts or entertainment industries. Many of them, though, tend to replicate the competing relationship between the major political powers (e.g. the UK, US, and China), or merge with European guidelines (e.g. Germany and France). Consideration of the scale of this activity, once again, informs the possibilities and opportunities for a consequential Irish AI blueprint, which could be distinguishably applicable to the arts in the near future, as it is not the case of other countries exemplified here[130].

The State Council of China in 2017 produced *The Next Generation AI Development Plan* (Department of International Cooperation, 2017) and involved the setting up of fifteen government agencies to support that mission's goals. The US was among the first to issue reports reflecting the role of AI for national industry, publishing

[130] All the updated information on the separate national AI strategies can be found on the Holon IQ website (Holon IQ, 2019).

three reports as early as 2016, and establishing a White House-based Select Committee on Artificial Intelligence in May 2018 (White House, 2018).

The applicability criterion and future networking character of AI regulations created for industry include German AI Strategy (European Commission, 2020c) and stresses that the ethical and legal framework of German AI Strategy should be aligned with European guidelines (European Commission, 2018c). Similar EU-orientated strategy involves the *La Stratégie France IA* (France AI Plan), which followed by an AI ethics report, *For A Meaningful Artificial Intelligence: Towards a French and European Strategy* (Villani, 2018).

In the Middle East, the implementation of AI has been embraced at fundamental governmental level with The United Arab Emirates creating a Minister for State for Artificial Intelligence (Galeon, 2017) in October 2017, and with Saudi Arabia building three new smart AI cities (Smartcity, 2019). Each of these examples highlight the entrenchment of AI within national governmental strategies, and thus the importance that ethical considerations keep pace and contribute to the design of governance policies.

With China, the EU, the UK, and the US each stating their independent aspiration to be the world's leader in AI, the importance of global ethical agreement cannot be overstressed. Therefore, the requirement for multi-national agreements such as the *UN SDGs* to be adhered to – and be territorially enforceable – becomes ever more imperative. Above all in the context of this review's research, none of these reports or stratagems contain any meaningful consideration for the arts or entertainment industries beyond nominal reference to the possible impact of AI, as in the *EGTAI* reference to 'cultural skills'. While that omission is to be expected, it fuels the necessity for a sector-specific interpretation and adaptation of these principles to steer regulatory and legislative action towards protecting human values, including those of artists and musicians, that are in the common good. However, because of the rapid and unpredictable development of AI –

discussed in the AI music actors section of Chapter 3 – these 'human-centred values' need also to be revisited and critically addressed to fit the new challenges.

5.1.3 The Nongovernmental Level

In addition to the governmental and intergovernmental sectors, a number of nongovernmental actors have also made significant contributions to the macro perspective on AI ethics. They include the leading AI research institutes, independent foundations, and commercial corporations. Their varied and impactful influence on the macro AI ethics map is based on their roles in consultancy and often voluntary participation in this global discussion, and in the many national and transnational industries that are expected to relate to AI ethics in their internal policies. The nongovernmental input to AI ethics also demonstrates that the leading universities and global companies dedicate substantial resources to the endeavour of translating what used to be the science fiction of AI into social realities.

Based at New York University, the AI Now Institute, whose reports (2017, 2018, 2019) are included in the six key regulatory and national bodies' documents used in this chapter's analysis, is a highly influential interdisciplinary research centre. The AI Now Institute represents four core themes: rights and liberty, labour and automation, bias and inclusion and lastly, safety and critical infrastructure. The AI Now Institute was founded in 2017 by Kate Crawford and Meredith Whittaker and has been a global AI thought leader since its inception. It also includes gender studies perspectives in their reports (Crawford, et al., 2019), which is notable as it is one of the few AI agencies led by women. The biases and difficulties presented by the predominance of men in the AI sector was memorably described by Margaret Mitchell (Microsoft) as 'a sea of dudes' (Walsh, 2019: p. 142) – an observation further expanded upon by AI Now co-founder Kate Crawford (Director of AI Now) in her opinion that 'we risk constructing machine

intelligence that mirrors a narrow and privileged vision of society with its old, familiar biases and stereotypes' (Crawford, 2016).

It is worth noting that other nongovernmental organisations such as the GeDIS research group (University of Kassel), Leverhulme Centre for the Future of Intelligence (CFI, Cambridge University), and the MIT Media Lab (Massachusetts Institute of Technology) also tackle ethical issues by employing critical cultural theories, like gender or postcolonial studies from the humanities, to adhere to building a responsible AI future. An example of that approach and mission is represented by the CFI's partner at Cambridge University – the Centre for the Study of Existential Risk (CSER). It is an interdisciplinary research facility whose focus includes addressing major global risks, where both climate crisis and impact of AI are equally considered as the planet's most urgent threats.

Nevertheless, the problem of how to address sector-specific needs in implementing AI technologies and supportive ethical regulations remains, even when an organisation includes creative arts in its wide range of AI-themed research topics. This is the case of MIT's Media Lab where arts are classified alongside affective computing, personal robots, and synthetic neurobiology. Within this computational mindset of approach, as with the transhumanist narrative of the following examples, it is difficult to support the human-in-the-loop focus that will encourage businesses and regulators to set an effective precedent for the beneficial symbiosis of human and algorithmic artistic creation.

As a result, the human artist does not feature in other research groups, which take a radical perspective of employing the transhumanist agenda. Perhaps most influential is Oxford University's the Future of Humanity Institute (FHI), which was founded by Professor Nick Bostrom, the author of *Superintelligence, Paths, Dangers and Strategies* (2014). FHI is a multidisciplinary research institute where academics, drawn from

mathematics, philosophy, and social sciences, work on what the FHI describes as 'big-picture questions about humanity and its prospects'. The FHI's principal interest is in Artificial General Intelligence (AGI) and Artificial Super Intelligence (ASI) – technologies still not developed beyond the speculative phase – and this interest is shared by another generously funded institute, OpenAI, constituted by Elon Musk.[131]

The OpenAI institute focuses on the development of AGI – human level AI. On their website, one of the first messages is that the research laboratory is devoted to ensuring that AI benefits all of humanity and is dedicated to 'discovering and enacting the path to artificial general intelligence' (OpenAI, 2018). However, the institute has introduced new (narrow-)AI systems that have profound developments for both the music ecosystem and related fields, accelerating creative processes thanks to computational, algorithmic AI technologies. In 2019, OpenAI introduced its AI text generation application GTP-2 which generates text content in real-time in a variety of authorial approaches. In 2020, GTP-2 technology was used to produce new lyrics in the style of various music artists[132] and, as discussed in Chapter 4, OpenAI released 'Jukebox' to produce AI music from raw audio training sets (Bijan, 2020).

Another influential research and public engagement organisation, which envisions the future AI as a response to global problems, is the Singularity University (SU) in California. Co-founded by Ray Kurtzweil, its focus is on transhumanist enterprise and innovation programs to support and scale start-ups and their subsequent social impact, as illustrated by the XPrize Foundation led by SU founder Peter Diamandis (Diamandis & Kotler, 2020: p. 266). The XPrize Foundation runs over seventeen competitions in domains including space, ocean, robotics, and the environment. Project grants are

[131] Musk resigned from OpenAI in February 2018 (Huddleston, 2018).

[132] In one test, Tickpick.com fed the AI one thousand songs and generated new lyrics in the styles of various artists. According to the site 1003 participants were involved in a blind test comparison, with 63% finding the AI content more creative (Kurup, 2020).

measured by their direct impact on millions globally through 'industry-changing technology that makes for a safer more sustainable world' (Xprize, n.d.). Such research, justified by the world's biggest challenges as stated on the SU website, inevitably leads towards commercial application, be it by start-ups or transnational corporations, and that industrial focus is the subject of the next section.

5.1.4 The Industry Level

Having mapped the governmental, intergovernmental, and independent research sectors, the review of the macro perspective analysis within the role of industry and the issues related to ethical corporate AI self-regulation is concluded. The importance of this approach to all of the actors discussed in this section is contained in the following statement from Accenture Fjord, as it provides genuine incentive for the business world to pay attention to ethics and AI Ethics:

> Since 2017 a paradigm has become clear: organisations can no longer claim to be neutral or unaware**.** They must be proactive, identify and understand their position on a broad range of issues – before they are forced to take a stand. (p. 58)

This ethical paradigm is supported by findings from a global survey of over three hundred leading companies, *AI Momentum, Maturity and Models for Success* (AMS) (SAS, et al., 2018), where corporate leaders[133] were asked about the ethical implications of their work with AI technologies**.** Insight into the motivation and impetus toward corporate engagement with AI ethics is one important outcome of the AMS survey (p. 17). 70% of the companies said that they had either internal ethics review committees for AI or programmes involving ethics training for their software developers. While over half of the correspondents said that the adoption of AI had improved productivity and

[133] Participants in the AMS report were from the Americas, Europe and the Asia-Pacific region.

increased customer acquisition (p. 7), a significant segment (64%) agreed that while a shift to AI technologies was of benefit to productivity, they remain apprehensive about the impact of AI on employee relations – where resistance to AI had been evident from workers concerned about future job security (pp. 18-19).

From the AMS survey, issues including employment relevant to the music ecosystem, can be seen to denote broader technological and cultural transformations accruing through the wide-spread implementation of AI technologies. This shift in working norms is seen where the established occupational insecurity of creative artists is now increasingly commonplace in many other sectors of employment:

> While a few generations ago, many workers in Europe or Northern America could expect to keep the same job for life, more workers are like musicians always on the lookout for the next gig, unsure where the money will come from and bearing the risk of unemployment alone. (Baym, 2018: p. 8)

The common expression the 'gig economy' – a term appropriated from the music ecosystem – now exists as part of governmental lexicon (Department for Business, Energy & Industrial Strategy, 2018) as well as in academic research discourse (Graves, 2017).

The scale of the movement away from jobs for life (Rifkin, 1995) towards employment within a wider gig economy was highlighted in a study by the University of Hertfordshire (2019), sponsored by the UNI Global Union[134]. The report *Platform Work in the UK 2016-2019* revealed that 9.6% of the UK workforce in 2019 were working at least once a week via so-called 'gig economy platforms' (p. 2). That figure had doubled since 2016, and the report concluded that this proportion is likely to increase in the coming years. The estimations of the growth of this workforce within the gig economy

[134] The UNI Global Union is the world's largest workers union with over twenty million members.

are in line with the global forecast trends from the World Economic Forum and international academic evaluations (Katz & Krueger, 2019; Taylor, et al., 2017).

According to the EU, platform work[135] is a form of employment particularly susceptible to automation (EurWork, 2018). In response to the concerns of the gig economy, the UNI Global Union issued its own report on AI: *Top 10 Principles for Ethical Artificial Intelligence* (2017). The report calls for an immediate global ethical response, in which its members should create 'collective agreements, global framework agreements and multinational alliances' (p. 6). However, despite this call for industrial alliance, the question remains: what are the constraints to ethical self-regulation by industry of AI technologies – a question which is investigated below and highlighted with examples.

The Fjord group is an integral part of Accenture Interactive, and specialises in design and innovation consultancy for industry. Fjord, founded in 2001 and acquired by Accenture in 2013, has over one thousand employees located in twenty-seven countries. Each year the publication of the *Fjord Trends* is a significant industry influencer[136]. Additionally, the *Fjord Trends* impact within the wider Accenture Group[137] should not be underestimated[138]. In *Fjord Trends 2018* (Curtis, 2017), seven areas affecting technology, design and business were identified for analysis. The sixth trend was titled the *Ethics Economy*, and pointed out that customers were increasingly demanding that brands become socially responsible, and that organisations must respond to consumer concern or risk losing their customers. It also stated that public scrutiny is 'the new norm as… [social

[135] The term platform work is defined by the EU as employment in which organisations or individuals primarily use an online service (Uber et al.) to access other organisations or individuals to provide specific services in exchange for payment (EurWork, 2018).
[136] An illustration of its influence on industry is the inclusion of the *Trends* in the World Economic Forum reportage (Armbrecht, 2015).
[137] The Accenture corporation has over four hundred and fifty thousand employees in more than one hundred and twenty countries.
[138] Early in this chapter's research (2017) Lorna Ross, Group Director at Fjord in Dublin, was interviewed regarding ethics and AI. She explained the role of the *Fjord Trends* that had recently been published.

media platforms] can be intimidating [and]…public reaction can change fast with share prices impacted accordingly' (p. 56). The *Ethics Economy* concluded with the broad recommendation for the business world to be proactive, which applies to the congruity of AI ethics to respond AI challenges (p. 58).

The recommendations to the business community by Fjord's *Ethics Economy* provide insight into the varying successes and failures of FANG+ corporations' engagement with AI ethics since 2014. The real-world dynamics operating in the corporate sector between ethics and technology reveal the many contradictions and tensions involved in industrial self-regulation (Drahoe, 2017: p. 67). Documenting the stresses in play within the macro perspective assists in later proposals regarding corporate self-regulation of AI within the music ecosystem.

To comprehend these dynamics, consider contemporaneous AI ethics case studies from the nongovernmental sector to highlight the participation of AI research institutes alongside transnational corporations in facing the presented challenges. Chapter 4 noted the importance to DeepMind's (creators of WaveNet) founder Demis Hassabis of the establishment of an ethics committee as part of his start-up's acquisition by Google. The DeepMind objective is the development of AGI and explains why AI ethics is a prerequisite for Hassabis. Therefore, case studies on the ethics economy of Google are now presented.

Google Ethics Board. In May 2018 Google CEO Sundar Pichai, after presenting the Duplex TTS system at Google I/O[139], publicised the release of a set of Alphabet (Google's holding company) AI principles to be governed by a new external AI Ethics Panel (Novet, 2018). A year later in April 2019, the new external advisory panel – the

[139] The company's principle annual conference.

Advanced Technology External Advisory Council (ATEAC) – was announced[140]. ATEAC members included Professors Luciano Floridi (University of Oxford), Alessandro Acquisti (Carnegie Mellon), and Joanna Bryson (Bath University). This membership was largely uncontroversial, except for the inclusion of Kay Coles James, President of the US think-tank the Heritage Foundation (Hamilton, 2019). James's nomination led to over a thousand Google employees requesting her removal from the ATEAC council due to reported anti-LGBTQ views and her position on immigration (D'Onfro, 2019). However, this was only one of the problematic facets in the creation of a Google AI ethics council.

On the 4th April 2019, one week after announcing the membership of the ATEAC, the company released a press statement stating that it was 'ending the council and going back to the drawing board' (Wakefield, 2019). As mentioned, Demis Hassabis had insisted, as part of the $400 million acquisition of DeepMind, that Google set up an AI ethics board (Bory, 2020) and its purpose was explained as to 'help technologists put ethics into practice, and to help society anticipate and direct the impact of AI so that it works for the benefit of all' (DeepMind written evidence (AIC0159) – House of Lords Select Committee on Artificial Intelligence, 2019: p. 121). In theory, as this quote shows, AI systems designers can incorporate Langdon Winner's call not to sleepwalk into technological futures and demonstrates that a proximity of shared values can exist between AI creators and affected actors. Nonetheless, that proposed contractual obligation was correctly perceived by FHI's Nick Bostrom as a contentious subject regarding the future cooperation between DeepMind and Google:

> I don't know what is involved internally inside Alphabet (DeepMind's and Google's parent company) in making this happen, but I can't think of another case of a small group (DeepMind) being acquired by a large

[140] Google had previously tried this approach in 2014 (Havens, 2014).

> company and setting up a mechanism to oversee and regulate that the large company will only use their inventions. (Hern, 2017)

Perhaps former ATEAC member Joanna Bryson summarised the apparent paradox in her departing comments:

> They [Google] just invest vast resource in things and then flush it and start over, because they have too much resource. (Shead, 2019)

The ATEAC saga reveals that even the fourth most valuable company in the world, which is itself an AI company and despite having limitless resources and a former corporate motto of 'don't be evil' (Boss, 2010), Google has been repeatedly unsuccessful in creating a self-regulating AI ethics policy that satisfies both its employees and its most significant AI specialists (DeepMind).

The Partnership on AI. A slightly earlier attempt at corporate AI self-regulation was undertaken with The Partnership on AI, founded in 2016 by AI researchers representing Apple, Amazon, Google (DeepMind), Facebook, IBM, and Microsoft. The Partnership on AI currently has over eighty members, more than half of which comprise not-for-profit organisations drawn from sixteen countries. The Partnership on AI reflects one possible vision for nongovernmental corporate AI governance. The membership is instructive regarding the interactions of the AI actors reviewed so far[141]. Corporate signatories feature Accenture, Baidu, and Sony while AI research institute partners include AI Now,

[141] Members include Accenture; AI Forum New Zealand; AI Now Institute; Allen Institute for Artificial Intelligence (A12Z); Amazon; American Psychological Association; Amnesty International; Apple; Article; Autonomy, Agency and Assurance (3A) Innovation Institute; Baidu/BBC; Centre for Internet and Society, India; Chatham House; DeepMind; Deutsche Telekon AG; Electronic Freedom Foundation; EY; Facebook; Future of Humanity Institute; Future of Life Institute; Google; Human Rights Watch; IBM; Intel; Leverhulme Centre for the Future of Intelligence; McKinsey & Company; Microsoft; MIT Media Lab; The New York Times; NVIDIA; OpenAI; Oxford Internet Institute University of Oxford; PayPal; Salesforce; Samsung; Sony; UNI Global Union; UNICEF; UNDP; WikiMedia Foundation; Xprize Foundation.

the FHI, OpenAI and the Singularity University's XPrize - all of whom are AI actors featured in this review, which demonstrates the deeply interwoven nature of their activities. Other signatories are Amnesty International, The New York Times, and the BBC, while the inclusion of the UN Development Programme group again indicates the proximity of the SDGs to multi-stakeholder AI alliances.

An example of the work of the Partnership on AI is the Social and Societal Influences of AI (SSI) Working Group set up in February 2019. The SSI Working Group's purpose is to consider the implications of AI breakthroughs, and it began by focusing on developments in generative video synthesis and related TTS systems (like WaveNet) - in this instance the GPT-2 AI. One of the group's most prominent members, Elon Musk, had received worldwide attention by announcing the release of the system (previously discussed in relation to its music capacity) and then withdrawing the AI because it was 'too dangerous for humans'[142] (Hern, 2019). The concerns of GPT-2's wider application are akin to the challenges associated with other deep fake technologies[143] and debate on the software's abilities provided global publicity for its creators the OpenAI institute. Nonetheless, the SSI Working Group's stated aspiration is to flag AI risks early enough to provide the time 'for mitigation and affords opportunities to adjust the project (AI development) to change the balance of outcomes towards positive ones' (Leibowicz, Adler & Eckersley, 2019).

It remains to be seen how and if the Partnership on AI can be an effective self-regulating body when it must answer to so many varying voices and interests. Another disadvantage is the overlap of key AI figures on advisory bodies, for instance a co-founder of DeepMind, Mustafa Suleyman, co-chairs The Partnership on AI but also

[142] A withdrawal that was later rescinded in November 2019 amidst a similar flurry of media reportage (Vincent, 2019).

[143] Example of deep fake technology include a fictitious public service announcement by President Barack Obama and an interview with Nancy Pelosi in which the speaker of the US House of Representatives speech was surreptitiously slowed down.

belongs to Google's Advanced Technology Review Council and is involved with DeepMind's internal ethics council (Murgia, 2019). During background interviews with Lorna Ross, head of Fjord Trends group who authored *Ethics Economy*, Ross disclosed that she was unaware of the existence of the Partnership on AI or that Accenture was one of its members[144]. However, Professor Floridi, who sat on the week-long Google ATEAC, also featured on ethics boards for Facebook, IBM, Microsoft, Tencent and Cisco, and provided a relevant overview:

> Unless you have an open debate and try lots of different experiments, how can we identify a solution? We have three tools – law, self-regulation and public opinion. Let's use them all. (Murgia & Shrikanth, 2019)

The concerns of potential tokenism towards the adoption of corporate AI ethics, a practice which Floridi described as 'bluewashing'[145] (Floridi, 2019: p. 188), were addressed in the AI Now Institute's annual report 2017 (Crawford, 2017). That report highlighted the concerns of institutions such as the FHI and the IEEE regarding the negligible influence that many ethics committees have on real-world AI practices, unless practices are rigidly tied to algorithmic accountability and direct work procedures (p. 34). The report also referred to how infrequently ethical codes and guidelines contain enforcement measures (p. 5). By illustration, nowhere does the Partnership on AI stipulate any level of punishment that might be meted out because of an infringement by a signatory to the agreement. It is in light of the lack of regulatory enforcement that the AI Now report commented that in response to calls from the public and industry sectors, certification and standards bodies have sought to provide a uniform policy approach (p. 34). The most significant illustration of which, the AI Now report noted, was the IEEE

[144] However, Accenture has over four hundred and fifty thousand employees worldwide, so such omissions are understandable.
[145] A term more commonly known as 'ethics washing' (Dataethics, 2018).

which published (2019) an *Ethics Certification Program for Autonomous and Intelligent Systems* (ECPAIS) with the aim of creating marks that can certify to the wider public that an AI system is transparent, accountable and fair. The ECPAIS certification system has been adopted by the Government of Finland and the city of Vienna. The AI Now's reference to the IEEE is significant, for it allows us to add an independent industrial contribution to the already analysed intergovernmental AI principles. So, this section concludes by linking the AI HLEG *EGTAI* with the IEEE *EAD1e* (IEEE, 2019a). The role of the IEEE is of particular assistance in transitioning from the macro to the micro perspective of the music ecosystem.

The Institute for Electrical and Electronic Engineers. The IEEE traces its history to its foundation by Thomas Edison in 1884. However, despite celebrating that centennial in 1984, the current body known as IEEE officially came into being in 1963, with the amalgamation of two bodies: the Institute of Radio Engineers and the American Institute of Electrical Engineers (Congressional Record US, 2010: pp. 12178-12179).

This history helps to explain the IEEE's international standing and why the IEEE promotes itself as the 'world's largest technical organisation' (with over four hundred and fifty thousand members) dedicated to 'advancing technology for the benefit of humanity' (IEEE, 2018). The IEEE's primary focus is on the professional development of the computer science and engineering fields, and it advertises the activities of its worldwide community through the publication of over forty peer-reviewed journals and hundreds of yearly international IEEE-sponsored conferences. The institute is also one of the world's largest industrial certification bodies and sets standards for computer components, signalling protocols and data representations 'to name only a few of its areas of involvement' (Null & Lobur, 2006: p. 13).

It is because of the IEEE position as an internationally respected nongovernmental agency with an established reputation as a principled certification body that its involvement with AI ethics can be of support to the music ecosystem.

5.1.5 The IEEE Principles of Ethically Aligned Design

The report *EAD1e* was positioned by the IEEE as 'the most comprehensive, crowd-sourced global treatise regarding the ethics of new technologies available today' (IEEE, 2019b). The report was the result of three years' work involving thousands of global experts with worldwide engagement from academia, government, NGOs, and industry (IEEE, 2019a).

Separate IEEE EAD committees have been created including those for law, affective computing, extended reality (XR) and the arts[146]. The aim of the IEEE EAD for the Arts Committee is to help establish a framework and shared vocabulary for AI ethics for the arts, specifically regarding the arts' developing relationship with AI. Members of the committee volunteer as individuals rather than formally representing any organisations. The IEEE EAD for the Arts Committee's first paper, *The Voice of the Artist in the Algorithmic Age* is scheduled for publication in the third quarter of 2020.

The following description of the principles of the *EAD1e* provides a practical understanding of the major tenets of the report aimed at developing an ethical approach to AI or Autonomous and Intelligent Systems (A/IS). The term 'A/IS' is a preferred form for AI technologies in the *EAD1e* report and is intended to ensure that it interlinks fields such as machine learning and robotics, which can have the widest application of ethical consideration in their technological design as possible (IEEE, 2109a: p. 16). However,

[146]It is necessary to indicate that I was invited in April 2019, by John C. Havens, Chief Executive of the IEEE EAD to become the Founder Chair of the IEEE EAD for the Arts Committee.

having examined the nuances of various AI terms in Chapter 2, A/IS is an interchangeable term with the thesis' definition of AI.

We now summarise the eight *EAD1e* ethical principles and note the conceptual connections or overlaps with both the *EGTAI* principles/requirements and the *UN SDGs*. Before addressing the application of AI ethics to the music ecosystem, the following distillation of ethical commonalities (between IEEE/AI HLEG/UN) avoids technical classifications contained in the original documents. Also, the *EAD1e* principles will form the basis of an indicative ethical marking system for AI that will be analysed in a case study of one AI music start-up (Xhail). As mentioned, the IEEE is currently engaged in developing a marking system for a series of separate AI ethical certifications. The first review of nine months' work by ECPAIS targeted three areas: algorithmic accountability, transparency, and bias, and is in the process of being completed.

The correlation of the central eight principles of the *EAD1e* with both *EGTAI* guidelines for trustworthy AI and the values of *UN SDGs* are summarised as follows, and forms the basis of subsequent analysis of AI ethics for the music ecosystem:

1. Human Rights

The use of AI should not infringe upon human rights such as privacy, dignity, and freedom (IEEE, 2019a: p. 19). Technological design should be in accordance with established principles of human rights set out in international law and pan-national agreements (p. 200). Regulatory bodies require measurable governance enforceable by new legal frameworks (pp. 204-205). The *EGTAI* framework for trustworthy AI is based on fundamental rights as well, enshrined in the Charter of Fundamental Rights of the European Union (EU Charter) and other international human rights laws including the European Convention on Human Rights. Similarly, in the case of the UN, 'more than

90% of the *UN SDGs* targets are linked to international human rights and labour standards' (Dahlbeck, n.d.).

2. Well-Being

AI should prioritise human well-being in AI design: *EAD1e* Principle 2 references Aristotle's *eudaimonia* and emphasises its practice on the collective and personal level as a goal that 'defines human well-being… [and is the] highest virtue for a society' (IEEE, 2019a: p. 2). The contention here is that traditional metrics of society health (GDP for instance) are insufficient to appraise the effect of AI on notions of human well-being (p. 68). The IEEE principal definition is drawn from the OECD *Guidelines on Measuring Subjective Well-Being* (p. 21), further evidencing the influence and interoperability of such publications.

EGTAI concurs with the *EAD1e* references to Aristotelian concepts, themselves adopted from the positive psychology movement[147], are in evidence when the *EGTAI* states that AI provides a 'promising means to increase human flourishing' (AI HLEG, 2019b: p. 4) to achieve enhanced levels of human well-being that are 'in the common good' (p. 6). Though not explicitly stated in the *EAD1e,* Principle 2 can be utilised to extend the objectives of *UN SDG* 3 to ensure healthy lives and promote well-being for all at all ages.

3. Data and Digital Agency

[147] Positive psychology can be understood as a scientific approach to the analysis of human thoughts, feelings and behaviour with a focus on growth and resilience rather than notions of weakness associated with post trauma survival (Peterson, Park & Sweeney, 2008). The foundation of the positive psychology movement was published in 2000 paper by Martin Seligman and Mihaly Csikszentmihalyi. Csikszentmihalyi had earlier created the notion of 'flow': which described by the author is a state in which 'the best moments in our lives are not the passive, receptive, [but when]a person's body or mind is stretched to its limits in a voluntary effort to accomplish something difficult'(Csikszentmihalyi, 1990: p. 3). The notion of a flow state is often referenced regarding musicians, most particularly the term's adoption by Sony CSL with its AI music 'Flow Machines'.

EAD1e Principle 3 states that individuals should fully own and control the use of personal data in AI technologies (IEEE, 2019a: p. 24). Chief concerns relate to AI accountability and suggest that partnership alliances should be promoted to help construct the necessary norms to contend with issues of legal responsibility in the societal use of AI (p. 5).

EAD1e Principle 3 is aligned with the *EGTAI* Requirement 3 of privacy and data governance, and *EAD1e*'s call for 'multi-stakeholder ecosystems' (p. 29) is consistent with targets contained *UN SDG* 17, reviewed earlier.

4. Efficiency

Principle 4 recommends the development of an independent certified AI marking system[148] designed to maintain ethical standards observable to the public and adhered to by industry (p. 136), whereas *EGTAI* makes no reference to an independent certification system for AI but does include a detailed 'Trustworthy AI Assessment List (Pilot Version)' (AI HLEG, 2019b: p. 24). Furthermore, the AI HLEG inspired EU *White Paper* notes that Europe is progressively equipped with 'the capacity needed' (European Commission, 2020b: p. 1) for the marking and certification of AI-enabled technologies and services.

Against this background, the *UN SDGs* have been addressed on many levels of state and intergovernmental funding operations, and as such the Goals themselves can be seen as a de facto global ethical marking system.

5. Transparency

The IEEE definition is akin to *EGTAI* Requirement 4 on transparency. However, *EAD1e* extends *EGTAI* by recommending that the principle be subject to certification and

[148] The *EAD1e* states that such marking systems do not necessarily have to be applied through the IEEE certification methods (IEEE, 2019a: p. 136).

validation to independent agencies for external verification (IEEE, 2019a: pp. 136, 186). The ethical requirement for transparency of AI development underscores all seventeen of the *UN SDGs*.

6. Accountability

Accountability is an extension of the prior principle of transparency, where AI systems should be programmed and operated to provide an 'unambiguous rationale for all decisions made' (p. 11). *EGTAI* Requirement 7 also mentions accountability and, as seen earlier in this chapter, operates upon a similar value framework to the *EAD1e* definition. The requirement for accountability, like transparency, is another prerequisite value underpinning the *UN SDGs* mission.

7. Awareness of Misuse

EAD1e Principle 7 addresses the need to identify and protect against potential misuse of AI systems (p. 31). Principle 7 is based on the protocols of Responsible Research and Innovation (RRI) (Colizzi, et al., 2019) (IEEE, 2019a: pp. 46-47) and includes the role of education in increasing public awareness of and confidence in engagement with AI (p. 206). *EGTAI* includes in its 'Trustworthy AI Assessment List' the question 'Did you identify any potential safety risks of (other) foreseeable uses of the technology including accidental or malicious misuse?' (AI HLEG, 2019b: p. 29), which establishes *EGTAI*'s ethical connection to *EAD1e* Principle 7. Similarly, the *UN SDGs* embrace the concerns of the misuse of technology. For example, at the Sustainable Development Summit (2019) AI was discussed in the context of the *UN SDGs* stating that there are: 'Risks to democracy and human rights from misuse of technology, and the potential impact of automation on jobs and inequality' (Herweijer & Waughray, 2019).

8. Competence

Operators of AI should be able to understand through a regulated set of standards the sources, scale, accuracy, and uncertainty that are implicit in applications of AI (IEEE, 2019a: pp. 32-33). The focus on the responsibility of humans in the processing systems of AI (p. 5) is echoed throughout *EGTAI*. *EAD1e* Principle 8 is also in accord with the SDG 17.7.1 Target for sustainable technology.

It is a relevant moral requirement of all seventeen of the *UN SDGs* to include the diverse economic needs of all member nations of the emerging global music industry. The SDGs lay out an evolving real-world structure upon which an AI music mark, designed to close the value gap in the music ecosystem, can be imagined, prescribed and administered.

Criticism of Ethics at the Industry Level. The ethical challenges of AI, as indicated by the *EAD1e*, focus on the central issues of algorithmic accountability and regulatory enforcement. While the *EAD1e* is among the most comprehensive documents on AI ethics, it has received some criticism in its certification strategy. A review of the impact of the *EAD1e* by AlgorithmWatch showed that corporations including Facebook and Google had yet to acknowledge or implement the IEEE recommendations by October 2019. Indeed, the only company to respond to AlgorithmWatch's enquiry was Twitter, who stated that while they agreed with the IEEE principles, their own company's move towards accountability (December 2018) predated the publication of the *EAD1e* (AlgorithmWatch, 2020).

In the AI Now 2018 annual report, the institute pointed out that it was difficult to conceive how 'one certification standard' (Crawford, 2018: p. 4), as recommended by IEEE, could be reliably applied globally and across all AI systems. Furthermore, a single marking standard might allow companies to be 'relieved of the responsibility to explore

more complex and costly forms of review and remediation' (p. 29). This observation by AI Now complicates the concerns outlined in earlier section regarding the ethics economy and industrial self-regulation of AI.

However, to address that issue, the IEEE EAD series of specialist review committees (law, the arts, affective computing et al.) engage with a significant prior recommendation contained in the AI Now Institute's earlier report of 2017 that stated: 'Advocates, members of affected communities and those with practical domain expertise' (Crawford, 2017: p. 36) should be at the centre of decision-making regarding the governance and assessment of AI.

The AI Now recommendation regarding 'practical domain expertise' directly joins and concurs with this thesis's call for the sector-specific application. As such it follows that sector-specific AI certification is not only feasible but economically realisable and applicable for the music ecosystem. Such a proposition is further supported by Recommendation 1 of the AI Now Institute 2018 Report, which advises that governmental AI regulations are required to expand the 'powers of sector-specific agencies to oversee, audit and monitor these technologies by domain' (Crawford, 2018: p. 4).

Finally, the AI Now 2018 Report's executive summary (p. 6) identifies a 'growing accountability gap' in AI which supports the creators of these technologies at the 'expense of those most affected'. The technology controversies (e.g. Facebook/Cambridge Analytica) (Christians, et al., 2020) suggest that the gap between the owners of AI systems and the civic society is becoming wider. The AI Now Institute reasons that a lack of government regulation, alongside a highly concentrated AI sector and insufficient governance structures within technology companies, contributes to this growing division (Crawford, 2018: p. 7). Furthermore, it points to the gap's 'power asymmetries' that create 'a stark cultural divide between the engineering community

responsible for technical research, and the vastly diverse populations where AI systems are deployed' (p. 7). These observations of a growing accountability gap in AI are central to this assessment. Solutions to the algorithmic accountability gap can support the closure of what Paul McCartney described as 'the value gap [the gap between owners and the creators of music copyright] within the music ecosystem' (McCartney, 2018).

The micro perspective analysis begins by accessing the current economic condition of the global music industry, whose resurgence is due to burgeoning revenues from the exploitation of music copyright. This understanding is essential to frame the economic motivations of AI music actors and the existing willingness for ethical intervention by multi-partner stakeholders of the music ecosystem.

5.2 The Micro Perspective: A Sector-Specific Application of AI Ethics

The international music industry provides the industrial backdrop to the consideration of a sector-specific application. Resurgent recording industry profits and the entry of new territories to the international music market for recordings are analysed – a depiction which is contextualised within cycles of technological disruption. Since the beginning of the 2000s, each of these disruptive cycles has contributed to the downscaling of employment in music and the reduction of artist remuneration. However, a near-future disruption which is adequately termed by the Warner Recording Company's Chief Innovation Officer, Scott Cohen, as 'post-streaming' (Dredge, 2019a) involves AI technologies where AI become an agent. As depicted in Chapter 1, this 'post-streaming' disruption brings us back to the Attalian 'composing' network where the relations between musicians and non-musicians blur.

To better understand this upcoming 'post-streaming/composing' cycle of technological disruption from the perspective of AI-generated music and its ethical

impact on the music ecosystem, some of the key contemporary mutations occurring in the commercial operation of the modern global music industry need to be scrutinised.

5.2.1 21st Century Cycles of Disruption in the Music Ecosystem

Broadly speaking these significant remodelling or disruptions can historically be categorised and understood to have occurred within three interconnected technological cycles in the 21st Century. In Wade Morris's *Selling Digital Music, Formatting Culture* (2015), the music industry of the 21st Century is essentially organised around a series of four technological developments. These four technological music tools are: 1) Winamp (and similar computer desktop music file players) which allowed the public to consume music as digital files (pp. 30-50); 2) CDDB/Gracenote systems which provided an indexing order to convert ('rip') personal music collections (from CDs) into the mp3 format (pp. 66-80); 3) the Napster peer to peer platform, which emerged as an online channel for the distribution of so-called 'ripped' personal music collections (pp. 94-110); and 4) Apple's iTunes which, following Napster's demise, helped legitimise the online sale and distribution of digital music files (pp. 131-50). Morris does not refer to procedurally generated music in his work, but these technological divisions contextualise Attali's concept of the composing network and contribute to what this work categorises as four cycles of digital disruption in the 21st Century.

The engine of the first cycle of disruption was the advent and global popularity of peer to peer digital file sharing. The illegal mp3 music file sharing phenomenon was facilitated through internet user platforms like LimeWire, Napster and Pirate Bay (Prasad & Agarwala, 2008). These practices began in the late 1990s and continued to grow in global usage until the wide-spread adoption of music streaming services reduced the appeal of piracy when illegal digital file sharing declined. Among the disruptive effects attributed to this first cycle of technological change, according to the Record Industry

Association of America (RIAA), was that the sales of recorded music declined by 47% in the US, costing the industry over $12.5 billion in expected revenue with a resultant loss of 71,061 jobs in the US market alone (Siwek, 2007: p. 2). These figures are important to bear in mind when considering the contemporary prosperity of the music industry, as it shows how revenue, if not employment, from music (lost to technological change) has rebounded thanks to the introduction of new technologies (music streaming).

The second cycle of disruption occurred as the music industry reacted to the economic effects of illegal peer to peer file sharing and saw the development of a new music format – authorised digital downloads (Peitz & Waelbroeck, 2005). The popularity of digital downloads both marked the end of the CD as the dominant format of recorded music consumption and evidenced the near monopoly in ownership of the new music delivery systems by transnational actors such as Apple and Amazon.

The third and current cycle of disruption is the subsequent consumer shift away from the digital downloading of recorded music towards subscription model of music consumption via streaming platforms like Spotify, Apple Music, Deezer, et al. (Hesmondhalgh & Meier, 2018). While the fourth cycle of disruption shares some general features with the streaming consumer model, when offering the unlimited access to music, it also recognises that the need for proliferating music consumption can be paired with accelerated and easily accessed music creation tools. The fourth disruption, anticipated but already visible, is caused by AI technologies within the music ecosystem and, as is repeated throughout this thesis, has not been adequately described and introduced as a challenge within the wider societal needs, for example in parallel to the *UN SDGs*. Inspired by Attali's understanding of a 'composing' network – where 'composing' could not have developed without technological change but now prefigures the near-future challenges of AI to music makers – the fourth cycle signifies AI as the technologically disrupting agent. However, what needs to be continuously investigated

and regulated are the AI related actors that use these technologies, often under the umbrella of enhancing music creation.

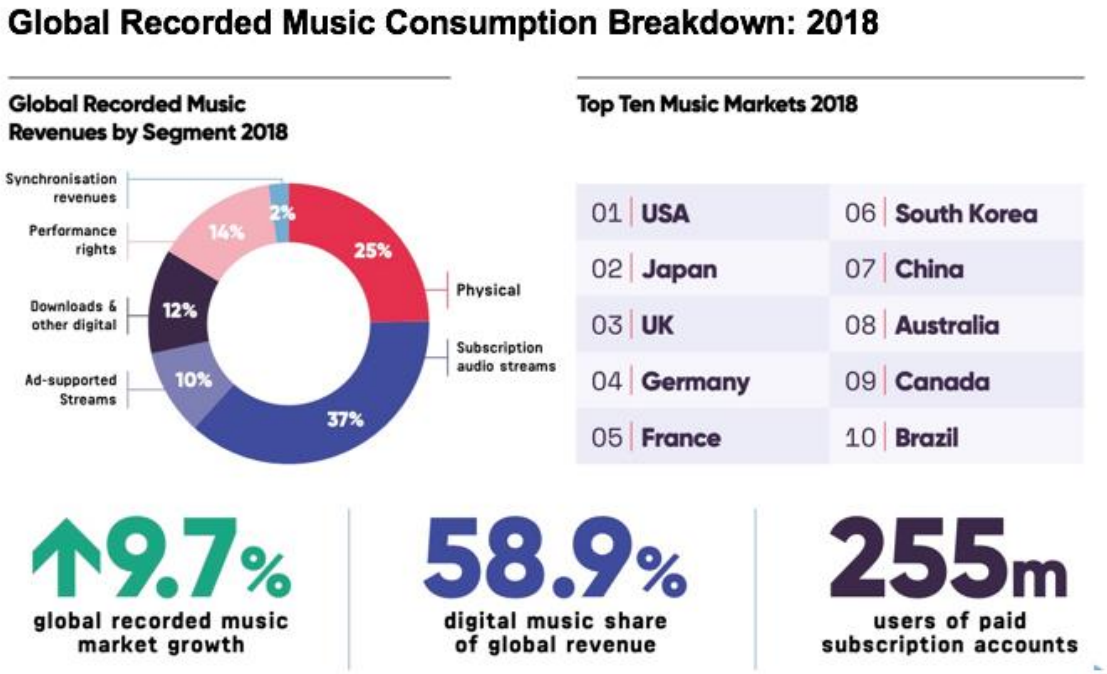
It is against this backdrop of three interconnected technological cycles of disruption in music that recent (2011-20) financial developments in the music ecosystem are weighed. An understanding of these modern dynamics frames the landscape within which the plausible anticipation of AI music technologies can be considered and looks to how the next, fourth cycle of disruption will affect the music ecosystem.

5.2.2 A Financial Overview of the Global Music Market

Market for Recorded Music. The International Federation of the Phonographic Industry (IFPI) represents one thousand and three hundred record companies in fifty-nine countries worldwide. The IFPI Global Music Report (2019) details key trade developments for the recorded music industry.

In 2018, the global recorded music market continued its four-year growth and rose by 9.7% to $19.1 billion (p. 15). The prime revenue obtained by recorded music copyrights stems from the market ascent of subscription streaming income as the most popular form of recorded music consumption globally. In 2018, returns from streaming accounted for 47% of all recorded music revenues (p. 13). The IFPI report identified two hundred and twenty-five million worldwide users of paid streaming subscription accounts (p. 13). Prior to 2018, the established top ten markets for sales of recorded music had remained constant for the past forty years, of which the top five territories were 1) US 30%; 2) Japan 12%; 3) UK 9%; 4) Germany 9%; and 5) France 7%.

Table 1: The IFPI Global Recorded Music Consumption Breakdown 2018. Source: IFPI, 2018: p. 13

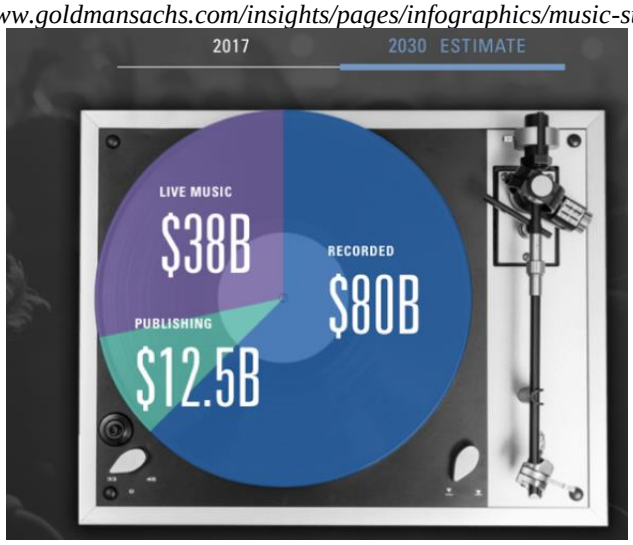


However, the 2018 entry of China to the global top ten markets for recorded music sales, as shown in table 1 above, is perhaps the most notable indicator of a forthcoming reshaping of the established music markets. The rise of the Chinese market, plus the recent arrival of South Korea (number six in the world in 2018) and Brazil (number ten), signposts a new, dynamic and genuinely global music marketplace. Meanwhile, investment by recording companies reflected confidence in the durability of the world market for music sales, with $5.8 billion invested in the development of new artists by music labels.

Another industry report in 2017 from Goldman Sachs *Global Investment Research* predicts that recorded music revenue will reach $41 billion by 2030. Such confidence is another example of the continued centrality of the value of copyright to the music ecosystem.

The financial breakdown presented by Goldman Sachs in table 2 below underpins the principal revenue sources hypothesis provided at the start of Chapter 4.

Table 2: 2030 Recorded Music Revenue Forecast. Source: https://www.goldmansachs.com/insights/pages/infographics/music-streaming/



The Goldman Sachs predictions for recorded music outline growth patterns for 2020-2030 which are based on income from streaming, paid subscriptions, advertising (streaming), synchronisation (placement of music content in film and television), digital downloads and physical sales (CDs and vinyl)[149]. All of these income sources are derived from the exploitation of music copyright and IP.

As a further indication of a renewed market confidence (after the decline caused by the first cycle of disruption) in the future value of music, the world's largest record company Universal Music Group (UMG) was valued in early 2019 variously by Deutsche Bank at $33 billion and Morgan Stanley at €50 billion (Ingham, 2019e). Vivendi, the corporate owners of UMG, after this valuation announced plans in April 2019 to sell up to 50% of UMG and reported potential buyers included Apple, Tencent, Alibaba, and Google (Ingham, 2019f). The range of purported UMG investors reflects deepening transnational actor benefit in immersion in the music ecosystem. Similar optimistic market predictions were confirmed by the *Entertainment and Media Outlook Perspectives*

[149] Additional sources of income also included audio streaming platforms adding video content and the monetising of new video/social media platforms including the sale of content to platforms such as Facebook.

report by Price Waterhouse Cooper (PwC, 2019) which projected continued market growth for recorded music between 2019-23.

The PwC report noted that worldwide, music downloading has continued a sharp decrease (-23% in 2018), and this decline is anticipated to continue as consumers increasingly favour streaming (p. 12). The changing boundaries of the new global music ecosystem are also referenced when PwC predicted that while established territories such as the US and Western Europe will continue to drive global music revenue, Asia Pacific are forecast to be the fastest-growing region.

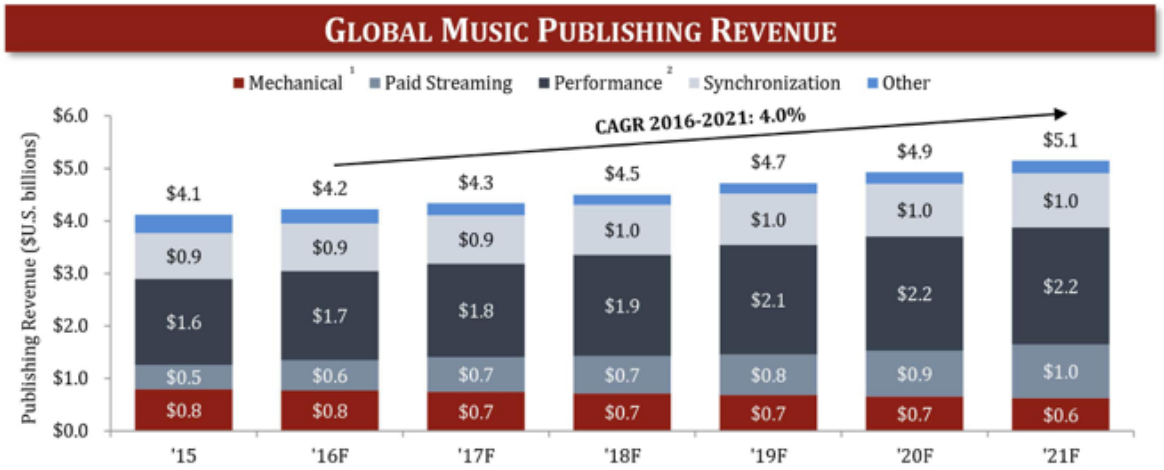
Both reports reflect the projected market strength of recorded music prior to this review's estimate of the fourth cycle of disruption (post-streaming/composing era). The important point here is not to suggest that AI technologies will decimate the prosperity of the established catalogue of recorded music (though they may) in the fourth cycle of disruption. Rather it is intended to specify that transnational actors will continue to implement AI technologies to maintain and increase market share and profitability, and that this AI advancement will not necessarily benefit, unless ethically marshalled, affected communities in the music ecosystem.

Historically the recording industry has been the most profitable revenue stream of the music industry while also its most capital intensive (Wikström, 2014: p. 443). However, as we shall see the dividends of recorded music have rarely been deemed to have been equitably shared between the creators and the licensees of music copyrights. Unsurprisingly as incomes from recording music copyrights declined during the early part of the 21st century, the importance and reliance upon live performance income to music artists dramatically increased – 'for most musicians, money from live performances, teaching, and their orchestra salaries represent the greatest share of their music income' (DeCola, 2013: p. 30). It is thus imperative to note the economic role that live performance plays in the music ecosystem.

Live Performance Music Market. Live performance was once the primary means of boosting the sales of new recordings by artists signed to major recording companies. However, during the cycles of technological disruption in the 21st Century, new recordings from best-selling acts reversed their former commercial purpose and became instead the principal method of promotion for a global live performance tour. Nevertheless, outside of the top one hundred selling global tours, the commercial reality for most working artists is very different than the top tier of artists. In this sector, the profitability of a tour can depend on the fluctuations in the volume of after-show CD sales (Jackson, 2012) and the economic tightening of touring budgets means that bands travel with fewer musicians and a significantly reduced supporting technical crew. Additionally, concert promoter guarantees for live performances are negligible at this scale and ticket prices for smaller shows (than the top one hundred tours) have remained static. Even mid-size artists (playing to concert venues of over one thousand people) are finding that concert promoters are commenting that groups are touring too frequently to the same cities and thus reducing ticket demand. This combination of circumstance places further financial strain as musicians outside of the top tier increasingly take up second and third jobs to support their professional music work (Rome Thomas, Personal Correspondence, 15th January 2019). However, prior to spring 2020, the market for the live performance of music was regarded as being one that was continuing to flourish as indicated by the global rise and popularity of boutique music festivals, conferences, and public seminar series.

Music Publishing Market. Similar to the economic confidence in recorded music and live performance, the prospects for music publishing indicate a related growth trajectory, as illustrated in table 3 below.

Table 3: Global Music Publishing Revenue Forecast. Source: Shot Tower estimates; Enders Analysis; IFPI: Global Music Report 2016; Goldman Sachs Equity Research: Music in the Air.



Three areas in music publishing contribute to this sector's continued financial rise. Firstly the corporate consolidation of copyright ownership continued as publishers became involved in a highly competitive acquisition period, a period that can be seen to start with Sony acquisition of the *EMI* publishing catalogue in 2011 (Hull, Hutchison & Strasser, 2011) and reflected confidence in the long-term value of song-writing catalogues. Next, the passing of *the Music Modernization Act* in October 2018 in the US had a profound effect. The act dealt with music downloads, streaming and a range of activities including the administration of blanket music licences along with new procedures for the collection and distribution of publishing royalties (Wittow, 2018). Those changes meant that streaming platforms include music publishing in their royalty payments. Thirdly, income from social media platforms via user generated content added to the increased publishing revenue. During 2017-18 a series of licensing deals between music companies and Facebook occurred, which again promoted renewed confidence in the publishing sector's increased economic viability (Nicolaou, 2018).

The analysis of the music recording, live performance and publishing sectors demonstrates that during the third cycle of technological disruption, the principal sources

of revenue derived from music copyright outlined in Chapter 4 have been restored to their former (prior to 21st Century) financial prosperity.

It is important to note that the final revisions to this thesis occur during the COVID-19 lockdown of 2020, the effects of which on the music ecosystem are impossible to gauge but will likely have significant implications on several long-range growth forecasts contained in these reports. The most evident of which is that there are no live music performances and scant indication of how and when they may return. All of the four sectors of the music industry are of course interlinked and while the absence of live performance directly affects promoters, agents, musicians and technical support teams, it will also have ruinous effects on publishers and composers as a percentage of every live show's box office is paid to the governing PROs of each nation.

However, it is noteworthy and reflective of the future confidence in the economic vitality of music copyrights that during the COVID-19 pandemic, the appetite for publishing acquisition has shown little sign of abating. Indeed, Gabrielle Wong, partner in influential law firm Herbert Smith Freehills, known for their engagement in bridging law with global challenges, observed that the successful completion of investment raised during a global pandemic was 'testament to the confidence of investors…in the evolution of songs as a valuable asset class' (Ingham, 2020b) – a point concurred by Round Hill Music CEO Josh Gruss who noted, after his company completed another successful raise (April 2020), that the market remains all about 'recognizing the value in copyright' (Ingham, 2020b). Indeed, recognising the value in copyright is a chief concern in closing the so-called 'value gap', the gap between the incomes of creators of music works and the incomes attributable from the exploitation of IP to the owners of the copyrights. This concludes the mapping of the contemporary financial landscape by reviewing ethical changes in EU music copyright that involve leading transnational AI actors featured in

Chapter 3. The Article 13 Campaign shows that this thesis focus reflects the existing needs within the music ecosystem.

5.2.3 The Article 13 Campaign and The Value Gap in the Music Ecosystem

The value gap can be demonstrated via a case study of the political influence of a music coalition on legislation. The worth of music IP was highlighted by a vote, on 12th September 2018, by Members of European Parliament (MEPs) to adopt the EU *Directive on Copyright in the Digital Single Market* (*Copyright Directive*) (European Parliament, 2018). However, a subsequent campaign led to the addition of the controversial Article 13 (renamed as Article 17) and to a revised version of the *Copyright Directive* on 26th March 2019 (Reynolds, 2019).

The Article 13 Campaign marked the end of a three-year movement to adjust the controversial interpretation of the *Safe Harbor* provision contained in the *Digital Millennium Copyright Act 1998 (DMCA*) (Reynolds, 2019). The *Safe Harbor* provisions of *DMCA* had been established to protect internet service providers from the illegal use of their platforms by their customers[150] (Seltzer, 2010). The US implemented the recommendations of the *WIPO Copyright Treaty* into law through *DMCA* (1998), companies like YouTube, Google and Facebook did not exist, and contemporary digital consumer practices were still nascent. However, an unforeseen consequence of the legislation significantly contributed to the first cycle of technological disruption.

An unintended interpretation of *DMCA* provided a legal protection that would aid YouTube's rise to become the most popular music listening system in the world (Arewa, 2010; ec.europa.eu, 2018). Google (owners of YouTube) would subsequently openly acknowledge the *DMCA*'s role in the company's rise and exponential growth in

[150] It was the US film industry who were the most fearful of copyright infringement at the time of the enactment of *DMCA*.

popularity (Kravets, 2008). Therefore, until the implementation of Article 13 in 2019, YouTube was not bound by copyright payment systems applicable to other traditional broadcasters of recorded music content (Colitre, 2019).

Article 13 was designed to close a legal loophole that previously required a case-by-case request for illegal music content to be made by rightsholders to the internet platforms. The campaign was led by a broad coalition of over two hundred trade bodies of the music industry including the Independent Music Companies Association, the Music Managers Forum and national performing rights organisations and sought to legally obligate internet platforms to be liable for uploaded user content including audio music files. Geoff Taylor, Chief Executive BPI, said of the *Copyright Directive*: 'The value gap distorts the music ecosystem and holds back the growth of the UK's creative industries' (Cooke, 2019). The existence of the copyright value gap, prior to the introduction of AI music systems, as an existential economic reality requiring an ethical adjustment was underlined in Citi GPS's study *Putting the Band Back Together: Remastering the World of Music* (Bazinet, et al., 2018). The study pointed out that though the US music industry generated profits of $43 billion (meeting the prior industrial profit peak of 2006), the industry's structure included significant disadvantages to the income of artists and the report stated:

> Despite changes in the revenue mix, the structure of the music industry has remained the same. In 2017 artists share of music revenues remains small, capturing only 12% of music revenue. (p. 3)

The *Copyright Directive* was a crucial step in overall attempts to reduce the value gap between the creators (whether writers, performers or recording artists) and the owners of the copyrights for, as noted earlier in the quotation from Paul McCartney, 'the value gap jeopardises the music ecosystem'. Nevertheless, amidst all the celebrations connected

with the closing of an unintended consequence of *DMCA*, unreported beneficiaries of the Article 13 ruling may be some of AI music actors surveyed in Chapter 3.

For instance, one beneficiary may be Jukedeck, who along with many other AI music start-ups advertise their services as 'for the copyright-free creation of music for YouTube videos' (Becker, 2015). These AI actors now have additional legislative-driven (*Copyright Directive*) benefits that can be attached to their services and products. For if internet platforms (Google/Facebook) are now legally compelled (at least in Europe) to ensure that music copyright holders are rewarded, then an increased consumer demand for copyright free music content (AI music for instance) is a likely outcome.

It is indicative of the accelerated times that in the same week of July 2019 that TikTok was accused of music copyright infringement by the US National Music Publishers Association (O'Neill, 2019), the company also purchased Jukedeck. The objectives of that acquisition were not stated, and it is perhaps a too obvious interpretation of that purchase to say that TikTok sought a mechanism for AI copyright free music[151]. However, the complexity of actor interconnection and the unintended or at least inexplicit consequences of their actions for the music ecosystem was further evidenced by one final recent illustration that reintroduces an AI actor (Tencent) from Chapter 3.

As noted earlier, after record profits Vivendi announced plans to sell up to 50% of UMG stock. On 31st December 2019, it was revealed that after reported interest from Apple and Google (Ingham, 2019f), the Chinese company Tencent[152], itself subject to various music copyright controversies, had agreed to initially buy 10% of UMG (Chen,

[151] An alternative explanation was offered by Valerio Velardo, CEO of Melodrive (2019) who recommended caution in drawing too close a correlation between the charges of copyright and the acquisition of Jukedeck. Valerio speculated that what had happened was that TikTok had acquired a 'top AI music team' and perhaps did not necessarily intend to implement the existing Jukedeck platform within the existing one.

[152] Tencent's chief rival in the Chinese market is ByteDance, owners of TikTok.

2020). This acquisition by Tencent highlights the importance of Chapter 3's inclusion of China as a significant new actor in the music ecosystem. It also underlines the complexity of actors' (Google, ByteDance, et al.) shifting positions towards music copyright.

The urgent need to engage with these recommendations is seen in two recent court cases (one involving Tencent) which confirm both the global diversity of legal opinion and the situation's openness to unintended consequence.

In January 2020 in a remarkable ruling, a court in Shenzhen, China, determined that a work written by a machine qualified for copyright protection. The Dreamwriter AI developed by Tencent in 2015 is an automated news writing program and the Court ruled 'that the article's structure was reasonable, the logic was clear, and it had a certain originality' (Yan, 2020). While Dreamwriter does not generate music, the ruling unsettles staple legal concepts in copyright protection.

While, in contrast, in *re Application of Application No.: 16/524,350* the USPTO decided (April 27, 2020) that an AI system cannot be an inventor of a patent and that only a 'natural person can' (Krieser & Camiel, 2020). Stephen Thaler, the creator of DABUS (the AI filed in the patent), contended that his 'creativity machine' had been designed for the purpose of invention (Barsky, 2019). However, the USPTO cited in *Univ. of Utah v. Max-Planck-Gesellschaft zur Förderung der Wissenschaflen e.V.*, its rulings, in which the necessity of 'mental gymnastics are required to invent' (Krieser & Camiel, 2020) and ruled therefore an inventor must be a natural person, maintaining the established human-centred position of IP[153]. This case, and Thaler's many other legal attempts, has

[153] Thaler responded that the European Patent Office and the UK Intellectual Property Office had acknowledged that DABUS created the invention (though importantly they had not granted DABUS patent rights). Interestingly, though the USPTO had previously granted patents relating to DABUS, the agency did not believe at this time in its evolution that the DABUS AI was capable of being recognised as an inventor. The judgement is under review and 'is unlikely to be the last word on the matter' (Krieser & Camiel, 2020).

demonstrated the increased number of global pushes to test the established principles of IP[154].

Though these two cases took place in separate jurisdictions[155] and had dramatically differing rulings, it must be remembered that the IP tests for patent application are more restrictive than those for copyright law. Moreover, the granting of an expression of IP to AI can only contribute to a weakening of the entire IP framework. Other Chinese corporations and global players such as ByteDance may well apply the Shenzhen ruling to music copyright. Possible implications for the music ecosystem, earlier outlined regarding TikTok and Jukedeck, were strengthened by the announcement in June 2020 that another Chinese tech giant NetEase[156] had invested $1.7 million in the AIVA music start-up (King, 2020). These acquisitions underline the increase in the number of Chinese AI actors with commercial interests who are likely to further test the framework of established concepts of IP. Therefore, in order to consider the potential implementation of human-centred ethical principles for AI, it is essential to comprehend the financial mechanisms that operate for these actors, so as to gauge where resistance but also opportunity for intervention is possible.

In summary, the Article 13 Campaign showed how meaningful collective music activism is achievable to safeguard human-centred warrants to close the existing copyright value gap. Contemporaneously, the multi-tiered advancement of ethical approaches to the AI accountability gap provides a methodology to anticipate and meet the challenges presented by new technology in the fourth cycle of disruption. As we have seen that fourth cycle of disruption as identified by figures such as Attali and Scott Cohen

[154] The DABUS AI's close proximity to the music ecosystem is also important to note, as Thaler's creativity machine has been used in the past to generate music (Plotkin, 2009: p. 52).
[155] Important to note that both China and the US are WIPO members.
[156] NetEase is a significant corporate rival of Tencent and ByteDance.

has the capacity to exponentially expand the copyright value gap in the music ecosystem beyond the present concerns of its stakeholders.

5.2.4 Connections Between the Value and the AI Accountability Gaps

The deep-seated interconnection, until now, between the separated concepts of the copyright value gap and the AI accountability gap are manifested in the ethical case study of an AI music actor – the start-up Xhail. To advance the Xhail case study analysis, we must revisit a number of earlier points.

We have established that the music industry is founded on four principal sources of revenue – live performance, recording, publishing and merchandise, and that all four are instituted on the commercial exploitation of music copyrights created by humans. In turn, based on this understanding, the majority of employment in the music ecosystem can be directly linked to one or more of the four exploitations of music IP. Furthermore, building on the recognition of the crucial role of IP, the consequences of the impact of AI technologies should be explored before its full implementation has occurred. That is why the next stage of analysis is devoted to a case study of an ethically aligned music company who specialises in the AI generation of recorded and compositional music copyrights.

5.3 Xhail – a Case Study

Xhail is an AI music technology developed by Score Music Interactive Limited (SMI)[157], an AI music start-up with offices in Los Angeles and Dublin, founded in 2013 by its CEO Mick Kiely. The Xhail platform is the commercial application of SMI-patented machine learning technology. A series of background interviews were conducted

[157] Score Music Interactive Limited (SMI) is the name of the Irish start-up which operates as and is officially known as Xhail.

with both Mick Kiely and Chief Financial Officer (CFO) Tom FitzGerald over a period of eighteen months during 2018-19 (see Appendix II). Each interviewee was gracious in offering their time and candidly sharing personal and professional concerns about the current state of AI music development globally[158].

During the initial period of the Xhail research (July-September 2018), I was a co-principal investigator for Trinity College in its partnership with Xhail in the development of an expression of interest application (EOI) to the Irish Government's Disruptive Technologies Innovation Fund (DTIF) for grant aid funding of €3.18 million. The Xhail/Trinity EOI intention was to build and patent new AI music technologies that expanded existing SMI IP to the consumer market. Though the DTIF application was unsuccessful, the proposed technology *Xhail RS* was subsequently created and patented by SMI. I was not involved in that subsequent process and have not been at any time employed or paid by SMI. During the DTIF application, my recommendation for inclusion in the EOI of an 'ethical AI' component was not incorporated due to the DTIF deadline constraints.

However, it is my observation that the later adoption of the term 'ethical' in describing the Xhail AI (as evidenced by multiple quotes from both Kiely and FitzGerald), is a contribution to the company's self-awareness and corporate identity from this dissertation's research. Moreover, relevant to this analysis is that such appropriation is proof of how value concepts like 'ethical AI' can passionately be adopted to articulate and empower tacit moral impulses of actors in the music ecosystem.

[158] Quotations from Xhail CEO Mick Kiely are denoted by (MK) while Xhail CFO Tom FitzGerald are marked (TG).

5.3.1 Origins

Kiely first identified the possibility of Xhail in 2011 though he admitted that he had probably been 'preparing unknowingly' (MK) for the technology during his thirty year professional music career. The start-up's creative catalyst occurred while Kiely was scoring the video game *Bodycount* in 2010. After recording the first section of the soundtrack with a live orchestra and while overdubbing additional individual musical parts, Kiely resolved a commonplace technical challenge. The *Bodycount* soundtrack required a series of short musical passages ('audio assets') compiled for multiple uses within the varying contexts of the gameplay. With a limited amount of CD-ROM disk memory available, Kiely devised a solution that would seed the Xhail AI concept. To work around the limited available memory for audio[159], Kiely designed a set of reusable pre-set audio recordings. Once these musical phrases proved be successful Kiely considered what other uses there might be for such flexible tools.

Kiely had begun his music career as a guitarist in Irish post-punk bands and, by the time of the *Bodycount* soundtrack, owned and performed in a tribute band – *20th Century Gold*. Kiely managed the act, booking live performances for the band who consisted of a series of ever-changing musicians and their stand-in replacements ('deps'). As Kiely recounts one night, 'Murphy's law' (MK) befell the group and neither the regular musicians nor their substitute players were available to perform:

> I had to bring in new musicians that hadn't played with each other before. And I remember being on stage and several times going this sounds nothing like the original song, but it works with just the vocal melody. This was the [Xhail] lightbulb moment! (MK)

[159] Audio demands on memory would also include dialogue and sound effects, increasing the need for workaround for music files.

Kiely realised that a new piece of music could be created in real-time with just rudimentary 'mapping' (chord sheets) given to the musicians. The combination of the creative possibilities inherent in improvised live performance, when joined with the adaptive music *Bodycount* techniques, would form the nucleus of the future Xhail AI system.

Today, when musicians create content for the start-up, comparable 'mappings… [or] simple formulas' (MK) involving key, tempo and genre are provided to inspire new creative ideas. However, in 2012, Kiely and Moira Kiely, his founding partner in the company, had 'at that point just a piece of paper and an idea' (TG). To navigate the translation of Mick and Moira's idea into a series of patented algorithms[160], the Xhail team began a detailed study of the harmonic ingredients supporting different genres of popular music and customary scoring requirements for film trailers.

5.3.2 AI Platform

The review was also granted access to the Xhail B2B platform and new Xhail AI music prototypes. With that access, it is possible to demonstrate how Xhail's human-centred AI business model operates, and succinctly outline how the system generates original music copyrights in real-time. A short demonstration of the system reveals the speed and compositional capacity of adaptive music AI technologies. However, as Xhail is a B2B desktop application and therefore not accessible to the public, for the purpose of illustration a unique and copyrightable recording and composition was created through the platform and synchronised the music to picture (see Appendix III).

To understand the system's process, a summary of the operative software procedure is first provided followed by a short glossary of the Xhail key technology

[160] Moira Kiely co-founded the company SMI but did not contribute to the tech innovation or patenting process.

terms. All compositional adjustments and mixing described occurred in real-time and no processing or rendering delay was encountered during its operation[161]. An understanding of how a user creatively interacts with the Xhail system to generate music supports subsequent ethical analysis of the AI.

5.3.3 AI Software

Xhail is a proprietary cloud-based AI music platform for creative industry professionals and its purpose is the generation of soundtracks for media projects. Its objective is to appeal to film editors, music supervisors and composers who require 'high-quality' music soundtracks through an affordable, convenient, and speedy delivery system. An Xhail user must first have a registered paid account. A variety of pricing is available depending on the Xhail client's project needs, and its cost is determined by the scale of usage and licensing clearance requirements[162]. An annual blanket licence is also available for clients who regularly require the use of the platform.

While Xhail is designed to compete with stock music catalogues of pre-recorded audio compositions, the system itself does not include a pre-recorded catalogue of music. Instead, each Xhail track created by the user is unique and capable of music copyright. To each achieve this, the AI assembles in real-time exclusively recorded single instrument performances (known as 'stems') by human musicians and composers to create new original music copyright works. While the majority of the software's parameters are clear and self-descriptive, some require further clarification:

- Stem: A solo recorded instrument performance that combines with other stems to present an assembled recorded composition.

[161] A Mac Book Pro (2012) was used to run the browser software. Xhail AI runs on Chrome, Firefox, Microsoft Edge and Safari. It requires a laptop or desktop with a minimum of 2-core Intel i5 with 6GB of RAM to operate.

[162] Xhail is used on productions for US TV channels that include US Television station CBS along with corporations such as Gaia.

- Tag Button: Limits a stem's musical expression by register, genre, or articulation.
- Articulation: The selection of performance techniques such as staccato or legato applicable to a stem.
- Register: Regulates (expands or reduces) the number of notes that a stem will play.

When the user opens up their Xhail account to begin a new session, a homepage appears, as illustrated in figure 36 below.

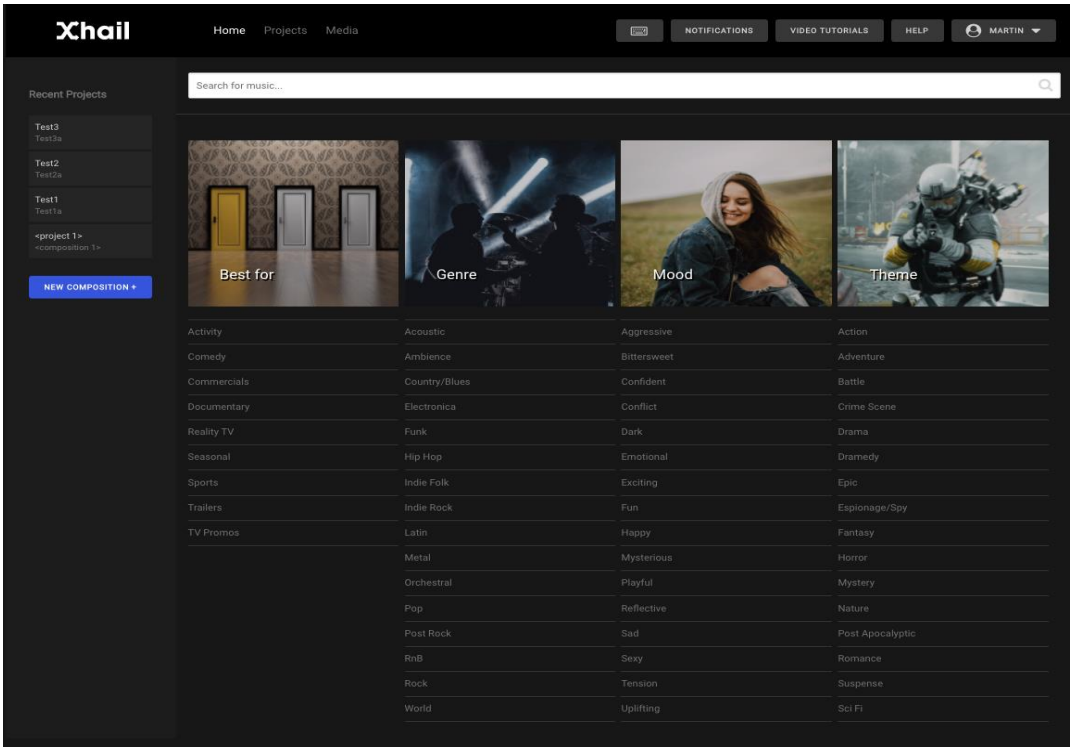


Figure 36: Xhail Platform homepage. Source: Author's desktop screenshot.

To create a new Xhail composition, there are three options:

(1) Select from one of four categories: *Genre* (e.g. rock, ambient), *Mood* (e.g. sad, happy), *Theme* (e.g. dramatic) or *Best for*. The system will then assemble relevant individual stems.

(2) *Start here* or *surprise me* buttons: load pre-made compositions containing a group of musical stems. Any *preload* recordings (earlier compiled by the AI) can be then edited and reworked by the user.

(3) *Blank composition* creates an empty project.

In the test case, *blank composition* was selected and titled *Sunset Mars*. When a new project is created, the composition window opens, and the user selects a music style. You cannot start a composition in Xhail without first selecting a music style, as demonstrated in figure 37 below.

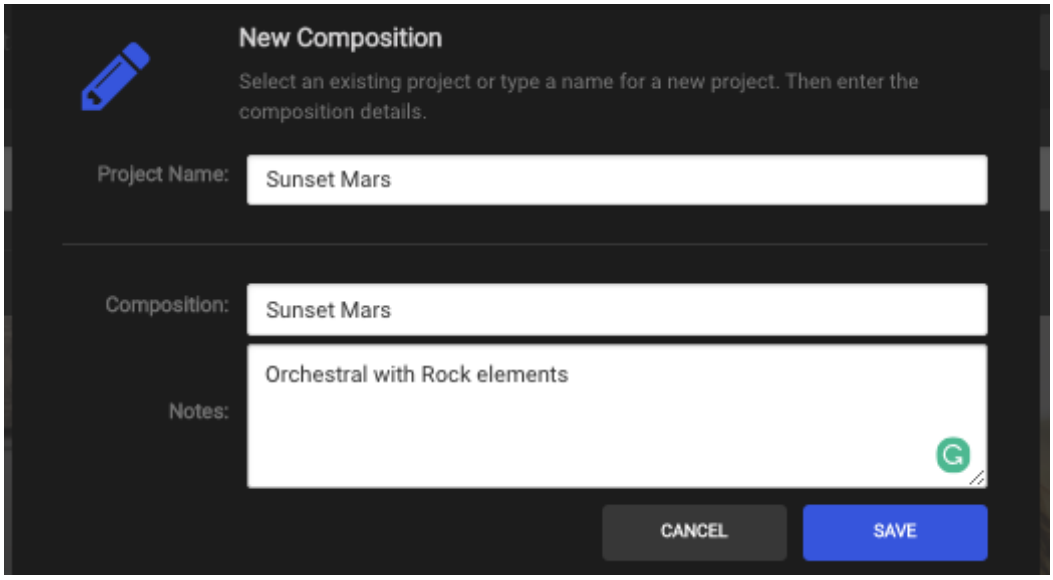


Figure 37: Xhail Project Folder. Source: Author's desktop screenshot.

For the demo, *Orchestral* was the selected music style and the system provided a variety of different suggested templates to choose from, as indicated in figure 38 below.

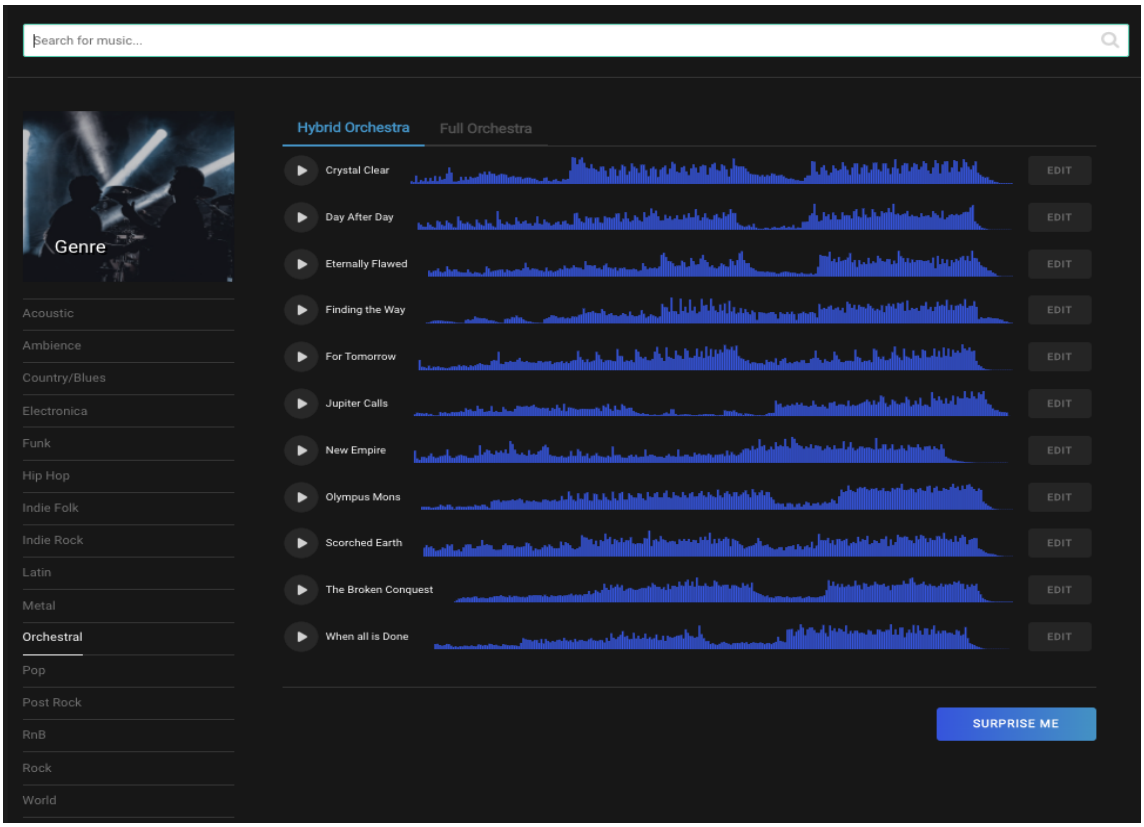


Figure 38: Xhail templates. Source: Author's desktop screenshot.

From the *Full Orchestra* section shown in the diagram above, the *Walk in the Woods* template was loaded. The provided recording offered eleven musical stems involving five string sections, brass, timpani, solo violin, clarinet, and percussion. Individual stem parts are visible on the desktop, and solo or grouped stem audio parameters can now be adjusted as displayed in figure 39 below.

Figure 39: Xhail stems. Source: Author's desktop screenshot.

The next compositional stage involves five key options. *Master shuffle* recreates, within the specified genre, an entirely separate new work. *Stem* and *group* shuffle buttons reconfigure individually (stem) or collectively (a group of stems). The shuffle function allows the stems to retain their initial instrumentation while changing pitch and rhythm components. Hence, a shuffled string section stem will provide an alternate string recording synchronised with the same key and tempo within the composition. Audio

mixing controls for mute, solo, and group are provided. Additional instruments can be requested with the *Add-in* button.

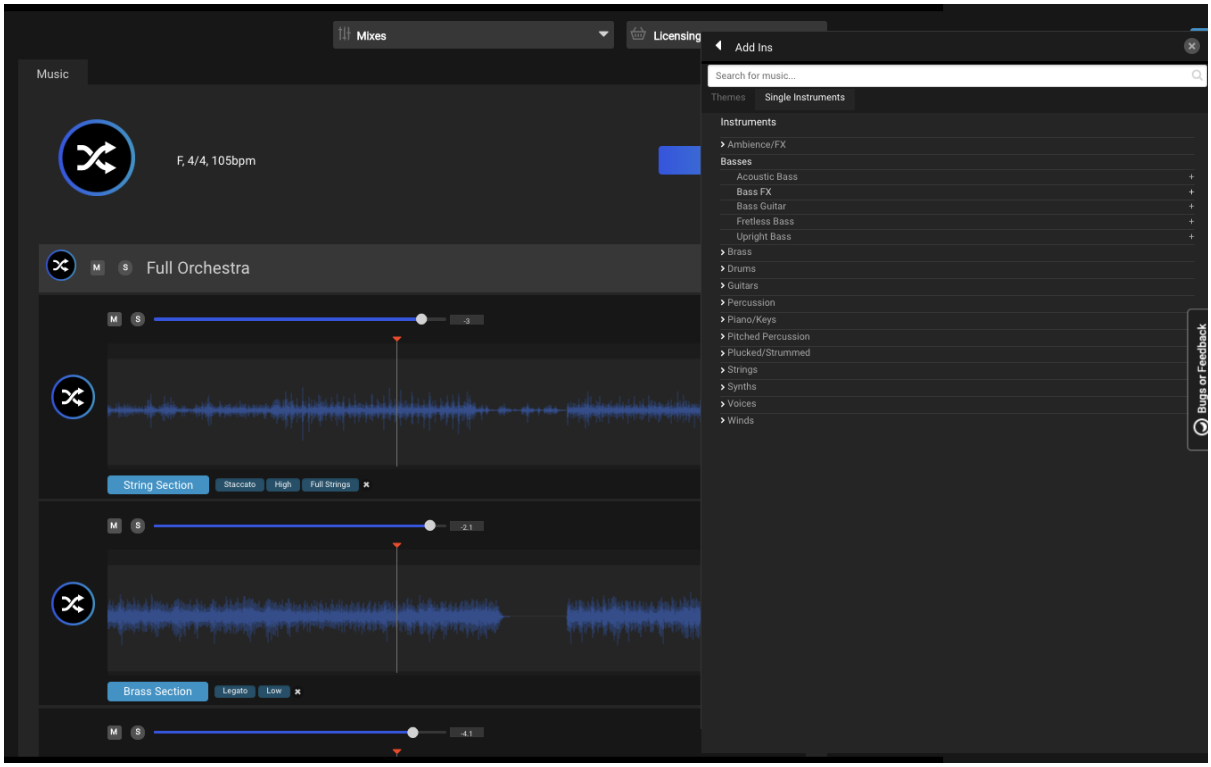


Figure 40: Xhail browser for new stems. Source: Author's desktop screenshot.

The *Add-in* parameter, shown above in figure 40 and below in close up in figure 41, allows for further moods/genres or themes to be combined with the AI's understanding of the user's creative intention. Alternatively, the user can add a series of, for instance, individual rock stems to the overall *Orchestral* composition. Drums, electric guitar bass FX and vocal FX stems were added to the mix.

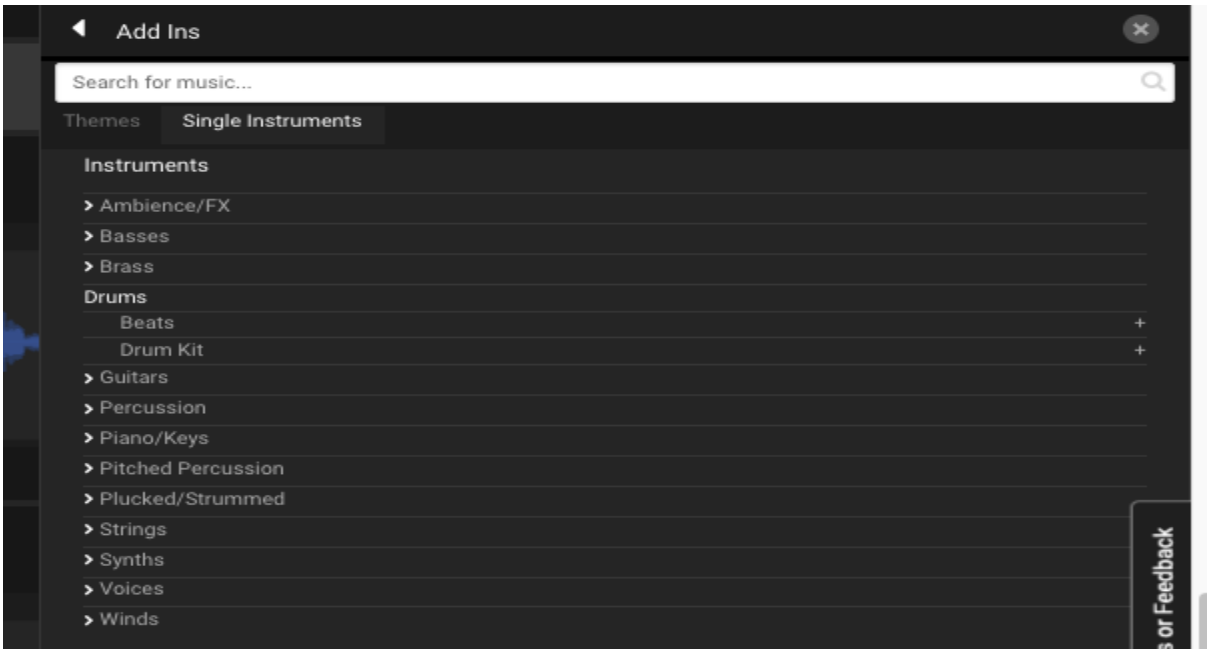


Figure 41: Xhail add-in parameter. Source: Author's desktop screenshot.

Filters (crunch, rhythm, indie) are provided which the users can delete to guide the algorithm's stem selection. A video (see Appendix III) is now inserted by the user to accompany the created soundtrack. A thumbnail of the video is shown below in figure 42.

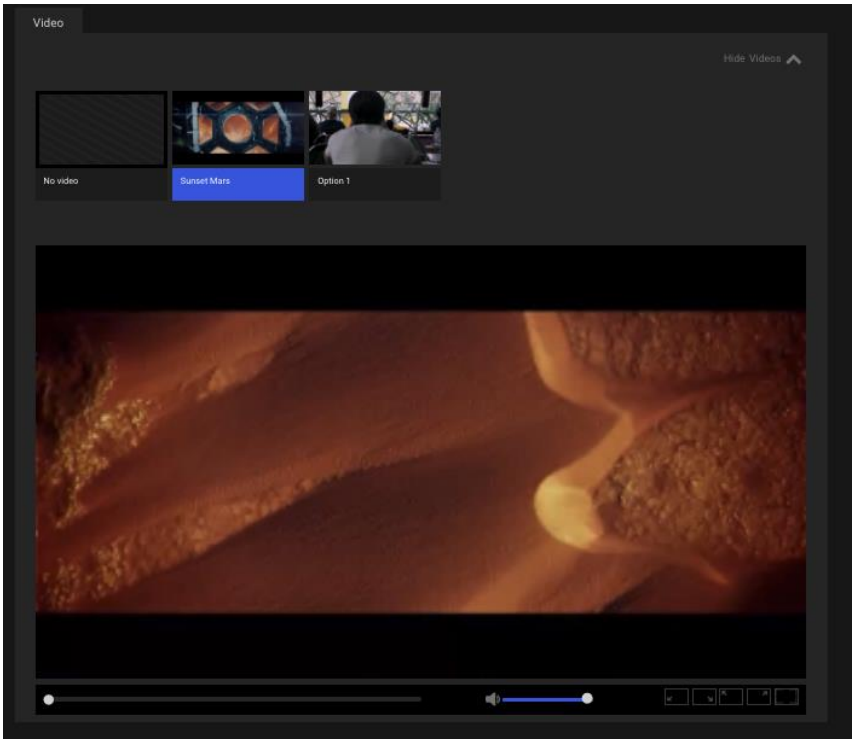


Figure 42: Sunset on Mars video still. Source: Author's desktop screenshot.

Synchronised with the picture, the created composition can be edited. A striking feature is the ability to add or shorten the length of the composition by ten seconds. 'Hit points' in the film can be selected by adding *stingers* to the work's timeline; A *stinger* indicating the location of a visual cue in the film. The completed composition can then be downloaded; however, until the created track is *locked* to the picture, the audio-visual file will not be legally available for exclusive commercial licensing usage[163].

In conclusion, the fidelity and quality of the audio stems offered by Xhail meet the high standard required for professional use. The user interface design clearly targets usage by both musicians as well as non-musicians, as may be the case with film editors. The combination of musical and film terminology (crop, mood et al.) are pointers towards supporting a multi-tasking professional. The processing speed of the system's delivery is notable, and the software's potential when powered by increasingly larger databases of stem catalogues and user feedback is immense.

Access to the inner workings of Xhail has significant research value as it provides real-world insight into the motivational and economic drivers that are the framework for an ethically aligned AI music company.

5.3.4 AI Ethical Self-Perception

As has been shown, several factors can motivate the corporate assimilation of ethical principles. Corporate determinants range from the cost-benefit analysis directed at the lowering of employee absenteeism due to mental health difficulties[164] to the varying public and internal resistance to corporate bad actions. However, principles related to AI ethics can also, as in the case of Xhail founder Mick Kiely, provide the tacit cornerstone

[163] Any performance of 'unlocked' compositions in commercial work is not protected by copyright and is deemed to be a breach of the user's Xhail contract.
[164] Such as the adoption of corporate employee well-being programmes.

for a company's primary conception. And it is because of this last factor that substantial review is given to that consideration in the analysis.

Xhail appears to be a rare exception to common practice within the overall world of AI music start-ups studied in Chapter 3. An examination displays one method of how AI ethics guidelines are capable of pragmatic and competitive utilisation. It is because of Xhail's engagement with the key topics of this dissertation that this chapter explores drivers that contribute to the Xhail vision.

At the end of this chapter, attention will be drawn to applicable principles from the previously analysed AI guidelines (transparency, accountability, et al.) to demonstrate a practical approach for an ethical marking system for AI. However, neither Kiely nor FitzGerald at the time of the interviews had prior knowledge of any content or concepts from the publications on AI ethics discussed in this chapter.

5.3.5 The Music Database

To explain how the Xhail AI operates, Kiely uses a lottery metaphor, showing how the exponential potential of six lottery numbers can provide a multitude of variable outcomes. The current Xhail catalogue contains over one hundred thousand individual artist recordings that are uniquely assembled by AI into new music recorded compositions, which can be copyrighted afterwards.

Kiely estimates that with one thousand five hundred stems, the total amount of possible new works exceeds one million and two hundred thousand music compositions. When that database increases to ten thousand stems, the conceivable output reaches hundreds of millions of new copyrights. Xhail plans to increase their database to over two hundred and fifty thousand by autumn 2020. The output number of compositions for a template is a function of how many stems are in that template, not the total number of stems in the overall database. For example, there will typically be between one thousand

and five hundred, and five thousand stems per Xhail template. This typically sets the number of compositional combinations, which can then range from one million compositions at the minimum stem count, up to hundreds of millions at the top of the range. However, there are certain harmonic restrictions to the exponential output of the Xhail stem catalogue which Kiely notes: ‘well, you’re never going to create a track with five bass guitars or with five drum kits all playing together’ (MK).

Even with that caveat, the potential yield of Xhail compositions involves potential infringement and copyright duplication. To counteract this possibility, there is a limited commercial life span for individual stems. In order to protect unwanted repetition in created content, all the gathered stems are coded by the AI to ensure they will never meet again in the same configuration. To ensure this, the company’s catalogue deletes a stem once a recording has featured several times in copyrighted works. Nevertheless, at that point the stem’s creator will have been paid a recording fee and received royalty returns from the prior use of the deleted recording in the copyrights.

5.3.6 Scepticism of AI in the Music Ecosystem

The system’s financial transparency explains why many musicians and composers have embraced the Xhail model, despite some scepticism. An example of this trepidation was demonstrated when the Xhail team presented its AI software at the Malibu Music seminar in August 2018: ‘The reaction [of musicians and composers attending] was savage. It was like you’re here to kill us, you’re going to ruin our future, you’re taking the food off my table’ (TG). As Kiely observes, these encounters are the norm as the implications of AI music companies causes ‘a lot of deep concern amongst the artists community and the music making community, understandably’ (MK). Both Kiely and FitzGerald concur that once musicians and composers appreciate the human-centred focus

of the Xhail economic model, much of the music community's fears of AI could be revised:

> Inevitably, they [musicians] all want to know how they can get involved and how they can contribute. And how can they get into this because they see us as the future and it's [a] game changer for the industry, because they're all very aware that music AI is definitely out there. (MK)

Kiely's instinctual moral assessments of what are fair and unfair practices concerning the music business are integral in the configuration of the values that inform Xhail technologies. It is insightful to detail these values and note how they have directly impacted on the Xhail AI design. Foremost the ethical principles of this company prioritise the human musician over AI technological potentiality:

> We are about artistry, we are about musicianship, and we do not mess with the artistry, we do not stretch it, we do not reach around us, we do not break it up, we do not rearrange melody, we do not do any of that, we simply bring musicians together [through AI] to create new music in real-time. (MK)

5.3.7 Royalties Payments

Let us now consider how the stem creators (composers/musicians) receive payment for their work within the Xhail model.

The company pays a 'reasonable fee' (MK) for stem content and the remainder of the stem creator income is generated through copyright usage. Kiely acknowledges that the company has not invented this financial model, and that the start-up has to remain price-competitive compared to the alternative cost of rivals' pre-recorded stock music catalogues. Payment is determined on a case-by-case basis subject to the costs involved for the stem creator depending on, for instance, orchestra or recording studio hire.

Kiely points out that their model offers an additional and otherwise non-existing revenue stream to musicians involved in film scoring. Within the established industry model, a recording musician is paid a set fee, while the composer retains the copyright in the composition of the score. In the Xhail model, each stem contributor is a writer, and afforded a pro-rata division of the final composition. Xhail retains the publishing of the new copyright, but the writers' share (50% of any music composition copyright) is evenly divided among the contributing (stem) authors.

Kiely hopes that in the future, as the musical stem pool expands, the company will attribute individual stem contributors so that the platform's users will be able to choose from musicians as well as from musical styles. That selection data would subsequently feed into a chart of the most popular stem contributors. Such a chart would certainly 'promote the artistry within, in the musician and the community' (MK). However, these ambitions are dependent on significant growth for the start-up.

It is instructive to reflect that if Xhail or a similar human-centred AI music company were to achieve sufficient scale, then a palpable contribution could be made to the shaping of a new, viable and equitable remuneration model for human music creation. At scale, it is conceivable, as Kiely anticipates, that a successful contributing stem author could become sufficiently identifiable within the market. Other opportunities in traditional areas of the music industry including live performance, merchandise and recordings would be a logical follow-up. This vision shows how the common good of the music-making community can be embedded as a core AI design value. Indeed, it is a major contention of this review that, if an ethically aligned approach were expressed as a core value by other AI music companies, additional innovative solutions to addressing the value gap would transpire.

5.3.8 IP

As established in Chapter 3, IP development is the lifeblood of start-ups. For Xhail, IP includes patents, trademarks, and composition music copyrights. After joining the company in 2016, FitzGerald explained that the cost of global patent filing was not as prohibitive as anticipated; conversely, the administrative demands of maintaining the granted patents were considerable. In addressing those demands, FitzGerald is precise in determining the role of a CFO. The CFO must ensure that the business model works and must find commercial opportunities to 'keep it funded in its journey by identifying investors and in due course, find a buyer for the business' (TG).

Xhail has been granted broad patents in the US, Russia, China, Japan, and Australia, and has a priority date for its core patents in almost all other territories. However, FitzGerald remains cautious reflecting that 'at the end of the day, IP is only valuable to the extent that you can protect it' (TG). Patent protection is one of the concerns that has seen the company explore an alliance with a major, possibly Chinese, corporation. FitzGerald explained that, with a powerful corporate partner attached to the start-up, it would be possible to enforce and indeed deter infringement of Xhail's various IP assets. The company has also considered the other AI music actors competing in the music start-up sector. Having identified a specific difference between the guiding principles behind Xhail compared to other AI music start-ups, Kiely further asserted that Xhail 'were the first to step into the space [AI music]' (MK). Xhail now possesses a family of patents that 'can largely control [the AI music market] one day' (MK). Nevertheless, Kiely concedes that such '[legal] battles are not something that Xhail plans to engage with in the near future' (MK). This is a pragmatic summation by Kiely of the fragility of the start-up world, acknowledging that although potentially Xhail patent infringing AI music actors are in operation, these rivals' start-ups may not survive for long enough to sue. 'Because they are start-ups – they probably won't succeed' (MK) – a

somewhat brutal admission from the CEO of a start-up, albeit one that has survived for several years. Moreover, Kiely's summation indicates the long-term planning of Xhail, where in order to fully protect Xhail patents, a larger corporate partner would be needed.

Xhail's Chinese patent protection makes plain the growing influence of the Chinese market, as indicated regularly throughout this review's analysis. Kiely is explicit in stating the importance of China in the music ecosystem:

> The Chinese entertainment industry can come to surpass Hollywood. They have the talent, they're building the farm, they have the technology, they have the studios, some massive movies are coming from China. (MK)

Further to that point, in a changing global entertainment marketplace, Kiely sees extraordinary potentialities: 'Because with those changes will come a surge of opportunity for the arts in China. And if you are aware of that, you can undoubtedly benefit' (MK).

Kiely's observations correspond with, and confirm the validity of, this review's enquiry into the intersection between global intergovernmental trade (IP) and AI ethics guidelines for music makers.

5.3.9 Notions of Quality Music

The promise of 'music of the highest quality' may seem more redolent of gramophone advertisements than cutting edge machine learning systems. Nevertheless, these interpretable Xhail guarantees are deliberate. The design of the Xhail platform is positioned on the market as a B2B service for the professional audio/visual user – a market that has clear-cut expectations of standards for audio fidelity and musicality:

> (Xhail is) aims at the highest quality, because it has high-quality performances by really good musicians who know how to record. The music sounds real – because it is real. We do not disrupt the artistry. (MK)

Similarly, FitzGerald, as a confessed ‘non-musician’, restated that music quality is fundamental to the success of the start-up: ‘Xhail must curate the music expertly because the AI is only as good as the system’s inputted material’ (TG). Yet Kiely remains mindful of the pitfalls in defining what makes ‘high quality’ music, which echoes the earlier discussion of what constitutes authenticity in music.

In contemplating future development where Xhail AI system is applied to other musical environments and unrestricted to the required norms of TV and film scoring, Kiely anticipates that the technology could:

> become a platform for everybody to contribute. Where the music can be whatever it wants to be. Art is in the interpretation of the artists, and we are open to becoming a place where the quality of the music is not our problem. We are a SAAS (Software as a Service) company. (MK)

It must be heeded that if Xhail expanded to a platform where ‘everybody contributes’, it undoubtedly would come into conflict with the current equitable methods of stem creator remuneration. FitzGerald portrayed how future contributors might give their ‘content for free or pay to have their content on the platform’ (TG). He detailed that the current curation component of Xhail business requires the company to act as a music publishing company but ‘ultimately, we are not a music publishing company. Ultimately, we’re a technology platform’ (TG). However, the ethical contradiction inherent in that statement is acknowledged by FitzGerald who remains open to attaining resolution to the challenging and conflicting needs of a dynamic music ecosystem. For example, FitzGerald assesses that at scale, the Xhail financial model would have to adapt to increased user volume and changing profile of the musician. The core, human-centred ethical values of the company, however, are secured, and summarised by FitzGerald:

> Our premise at all points in the Xhail journey is about the music and the musician. The money must go back to the guy who made the music, who's a human. It is the fundamental issue. (TG)

Nevertheless, while it is interesting how the future application of Xhail technologies may test the core values of the company, now, at sufficient scale, Xhail's example promises an equitable human-centred AI music system. The question remains how the values of an AI music company can be stacked through the combined ethical interactions of all actors (investors, employees, corporate partners and users).

5.3.10 Why Care? – An Ethical Response

When I finally asked Kiely about his ethical motivation: 'why should we care about of any of this', referring indirectly to the music ecosystem challenged by AI, the Xhail founder's response was illuminating.

The issues of future employment within the music ecosystem and the decline of the work opportunities that were available to Kiely in the 1980-90s contribute to his ethical engagement. Kiely began by reflecting on how past opportunities are no longer available to his children and grandchildren:

> I wanted to be a musician; I wanted to make my life from music. I managed to put my kids through college, to rear kids through being a musician. That, to me, is an extraordinary achievement, something I am proud of. I'd like to pass on that opportunity to my kids and their kids. We must try and influence, so that AI does not have such a devastating effect as it potentially can on our creative community. (MK)

Kiely's passions inform his assertion that 'one of the most important things for kids growing up is their aspirations towards the artists they admire' (MK). Kiely points out how the adoption of an artist's politics, fashion and persona significantly contribute to the positive shaping of adolescent identity, stating that the development of an identity

separate from parental values is ‘an absolute necessity for every single one of us to succeed in life, to achieve our goals’ (MK).

For Kiely as a young man, the ‘go-to place’ for such identity was music and ‘artists, songwriters and singers, who took on the challenges of a world that was unfair to the underprivileged. And that felt righteous, it felt right’ (MK). Kiely’s somewhat emotional and polemical contentions about how musicians have engaged historically with ‘the challenges of a world that is unfair to the underprivileged’ (MK) recall the moral aspirations of the *UN SDGs*. For Kiely, the application of that commonality is contended through the prism of human-made music, and its decisive near-future engagement with AI. As Kiely neatly summarises, when humans:

> aspire to an artist’s beliefs, hopefully, the messaging will always be a positive one, which it always seems to be around the arts. And it is such a necessary part in the growth of humanity; we all must do our piece to keep that intact. Because you cannot hand that responsibility over to AI. (MK)

5.3.11 Ethics of Investors and Partners

Xhail’s values are shared by its ‘like-minded’ (TG) investors. As FitzGerald points out, the company’s principles are one of the reasons that people choose to invest in Xhail rather than their AI music rivals: ‘Our investors, although they want a return, they also want to know that it is also serving a greater good’ (TG).

Interestingly, the majority of Xhail’s investors have been with the start-up since 2014. The company has to date not found it necessary to seek investment from VC funding companies and thus can avoid any ‘excessive influence in the decision-making on the music start-ups journey’ (TG). Kiely revealed that the approval of Xhail tenets extended to their dealings with Sony. His acknowledgement that Sony ‘ethically get why we are doing what we are doing’ was another revealing admission:

> Sony has a profound interest in what is going on in the world of music AI. They have looked at everything on the planet. And we have met with them, we have spoken to them. They really like what we are about, what we are doing. They have said to us that we are light years ahead of anything that they have seen out there. (MK)

5.3.12 Rival AI Music Actors

Kiely grants that there is a lot of 'muddiness in the AI music market at the moment' (MK). Such 'muddiness' has proven to be a source of frustration for Xhail, especially when dealing with possible partners or private investors who are not musicians and have difficulty evaluating the claimed creative capacities of rival AI music actors. As FitzGerald comments, evaluating the possibilities that rivals might offer is especially difficult because 'you have all sorts of people [rival start-ups] doing whatever it is they can. It is a little bit like the Wild West – we refuse to overpromise' (TG).

Meanwhile, for Kiely, the basis of the Xhail model is interestingly one of trust - a trust pragmatically expressed by Xhail's capacity to protect its users against charges of copyright infringement. To contend with the issues outlined in Chapter 4, Xhail provide a legal reassurance to meet the growing anxiety in the music industry regarding potential copyright infringement claims. As Kiely explains, with the black box ML decision making process employed by many rival AI actors, similar legal reassurances cannot be provided to the system's user by those actors. So while a piece of AI generated music might be sufficiently legally compliant for use in a prosumer YouTube video, where the related incomes streams (if any) are so marginal as be unlikely to provoke infringement claims, this is certainly not the case in professional film or TV music synchronisation whose music content is open to potential claims from differing jurisdictions with varying

legal tests[165]. Indeed, the successful appeal of the *Dark Horse* (2020) case, discussed earlier in Chapter 4, revealed a return to more common interpretations of copyright infringement that can potentially strengthen Kiely's arguments about the legal benefits offered by Xhail system:

> We have started to penetrate the industry through trust. We have trusted users in environments where protection from legal exposure is critical. We have to make them feel safe [in their use of music generated by AI]. (MK)

This legal development is important as it demonstrates that the embrace of strong ethics by AI music companies can be economically empowering and provide a strategic advantage to companies who adopt these policies.

Xhail's mindset can differ from other actors operating in the AI music sector who underestimate a personal (musician's) involvement in the creative process. The relation between music creation and copyright should not be discredited even when a professional or non-professional musician is equipped by AI. Xhail's CEO and CFO's position supports this: 'We hold ourselves to a higher standard. We built a model that does not allow it to happen [legal exposure]' (TG). Moreover, regarding the consequences for music makers, FitzGerald asserts that:

> The underlying ethical point is that we are not trying to replace musicians. Where most AI companies are trying to replace musicians and composers, we are trying to facilitate them in a way that allows them to participate. (TG)

The portfolio of new AI music start-ups presented in Chapter 3 is evidence of just how distinct, and perhaps isolated, Xhail is in their stance. Therefore, all participants in

[165] The increasing globalisation of television either through international sales of content to local providers (a US show sold to a European broadcaster for instance) or particularly through pan-national streaming platforms (Disney, Netflix et al.) increases this concern.

the music ecosystem need to be committed to ethically responding to AI challenge for the future shaping of the development of music. It remains this thesis anticipation that the Xhail ethical line in the sand will at the very least be passionately engaged with by the music ecosystem. And the future equity of the music ecosystem rests on the degree of this engagement by affected communities and their demand or otherwise, for effective ethical responsibility from the developers and owners of AI music systems. This call is perhaps more straightforward when the AI owners are themselves music creators, for in the example of Xhail, Kiely did not just want to make an AI to find out if it could be built. He wanted to invent something that had moral purpose – similar to Gil Weinberg's motivation and decision, stated earlier during his interview, where work on the Shimon robotic movie scoring was halted when none of the team could agree on the purpose of what they were attempting to achieve. In this context of decisive ethical decision-making, one is reminded of the call by Neil Postman to ask of technology 'What is the problem to which this technology is the solution?' (Postman, 1997). Kiely perhaps answers Postman's question when concluding that, given the current development of music generated by AI:

> There is a ship sailing now into the future. And there is no one steering that ship, nobody really knows what direction to point it in. So why shouldn't it be Xhail that takes the helm and takes them in this direction that brings artistry and musicianship on the journey. (MK)

That is certainly a powerful assertion, the questioning of which can only bring benefits to the music ecosystem, if it is contended within an ethically constructed context. This context, analysed in the macro perspective, offers a framework for a marking system of AI music.

5.4 Towards an Ethical Marking System: Marking the Xhail AI

A certification and marking system constitute the primary trend in the AI ethics landscape and one that could be used by the music ecosystem to ensure creativity can continue in the algorithmic era. It is confirmed by a recent development of the AI HLEG recommendations, the *White Paper* and the *IEEE Ethics Certification Program for Autonomous and Intelligent Systems* (ECPAIS), launched in October 2018 and being completed in July 2020 for industrial application.

This dissertation has reviewed the relevant reports and recommendations from intergovernmental to industry level in reference to AI ethics and located commonalities in their principles. The question remains of how to apply these guidelines into a workable regulatory marking system to address the challenges posed by AI from IP practices in the music ecosystem. A solution presented in the final part of this chapter is to examine Xhail's statements about their AI system and determine how they correlate with AI HLEG/IEEE/SDG commonality of values. The future development of this comparative and critical approach can contribute to a framework for a marking system for the utilisation of ethical principles in an affordable and workable application for small to medium sized enterprise (SME) AI actors in the music ecosystem[166].

Human Rights/Well-Being. The Xhail CEO's belief in the role of human creative arts in 'the development of an identity … to succeed in life, to achieve our goals' (MK) is a significant ethical value, for it reaffirms the importance of the *eudaimonia* concept of human well-being and flourishment made possible through participation in the arts. recommendations contained in the *EAD1e* and other reports including the OECD

[166] The larger transnational AI music actors can also avail of this marking system, but such is the level of their operational complexity that they would require separate case studies.

Guidelines on Measuring Subjective Well-Being (OECD, 2013). Particularly, Kiely's recognition of the disruptive influence of AI in the music ecosystem, including employment, is addressed when he states that 'you cannot hand that responsibility over to AI…we must try and influence, so that AI does not have such a devastating effect as it potentially can, on our creative community' (MK).

The human-centred approach to respond to AI challenge represented in *EGTAI* and other recommendations is shared by the Xhail team and applied into their AI system's design. The Xhail model presents innovative working and creative opportunities not only for professional musicians, but for the wider prosumer market too, especially as the technology extends in the future from its B2B model to a planned B2C application. However, it would be essential to review the transition of the Xhail technology (to B2C) to ensure that its current financial rewards to its contributors remain constant. This concern, noted by Tom FitzGerald earlier in this review, suggests that the presence of an on-going AI marking system would be an incentive for the maintenance of best practice standards as the technologies inevitably morph to meet market demands.

The Xhail AI system design is directly shaped to achieve ethical principles. While it is democratic in the sense that it increases the overall number of people capable of creating music, unlike many of Xhail's start-up rivals, this AI uses human created content and pays for it. As Tom FitzGerald, Xhail CFO points out: 'The money must go back to the guy who made the music, who's a human. It is the fundamental issue' (TG). While this cannot be the sole ethical criterion (the payment to musicians) for AI music actors, it presents a benchmark standard that other AI designers could aspire to incorporate or reimagine in their own designs. It also sets out a timely commercial aspiration that would resonate, as seen by the Article 13 Campaign, with disparate actors in the music ecosystem. This is imperative, because for any marking system to work, it must embrace a broad community consensus. FitzGerald's statement 'we are not trying to replace

musicians' (TG), as quoted before, simultaneously closes both the value and the algorithmic accountability gaps.

Data and Digital Agency. The *EAD1e* Principle 2 recommendation that individuals (users) should fully own and control the use of their personal data in AI technologies includes, as chief among concerns, issues pertaining to legal culpability in the use of AI. The Xhail AI's process in assembling music copyright from a multitude of participants ensures this principle when it is strictly adhered[167]. However, this best practice will only become truly applicable and tested when the Xhail system is implemented in a large scale B2C prosumer environment.

If the integrity of the ethical principles expressed and deployed by Xhail is maintained and integrated into their stated future aspirations, then it is technically feasible that the Xhail's AI could achieve best practice standards suitable for global adoption throughout the music ecosystem. It must be acknowledged that the values of any future transnational partner for Xhail will inevitably impact on the continued ethical integrity of the systems that are developed around the AI[168]. This however is equally true for any assessed AI actor, and is supported by earlier analysis of the commercial trajectory of start-ups, which leads to either an eventual IPO or the start-up's acquisition by a larger corporation. The start-up's commercial pathway means that any AI marking system will require regular reassessment of involved AI actors to incentivise maintenance of its AI ethical performance.

[167] In the Xhail publishing formulation, the writers share (50%) is retained by the composer and Xhail (the publisher) owns the remaining 50% of the music copyright.
[168] The example of DeepMind after its acquisition by Google demonstrated the various tensions and challenges that come into play within such a scenario.

Transparency and Accountability. Xhail's position to these principles has two aspects. Firstly, Xhail's stated ambition is to work only with investors who 'although they want a return, they also want to know that it is also serving a greater good' (TG) and corporations who 'ethically get, why we are doing, what we are doing' (MK). This statement of intent increases the chances of continued reliability of principled self-regulation within Xhail.

Secondly, the existing Xhail system for copyright creation can already be considered a best practice model for algorithmic transparency and accountability. The AI is designed to explicate in real-time the 'who' (stem authors), the 'what' (the music copyright), and the 'how' (through the avoidance of stem assembled duplication of work and hence claims of copyright infringement). Although the machine learning (ML) system may be black boxed in terms of its real-time data analysis of a user's creative requests, it must by its design secure complete transparency and accountability in its final decision-making process. It achieves this through the employment of blockchain technology, which provides both the end user and the stem creator with a detailed record of the ML decision-making process, while simultaneously generating the specifics of copyright ownership in the new work created.

Awareness of Misuse. *EGTAI* widely refers to risks to democracy and human rights from misuse of technology, and the potential impact of automation on jobs and inequality. The AI HLEG's 'Trustworthy AI Assessment List' includes the question: 'did you identify any potential safety risks of (other) foreseeable uses of the technology including accidental or malicious misuse?' (AI HLEG, 2019b: p. 29). The awareness of misuse can only be achieved by the AI's owners' and designers' explicit statements of what the exact – intended – consequence of these technologies is, and how it is accompanied by protective technical tools such as blockchain. Explicit statements of intent, even enforced

by penalties as recommended by the AI Now Institute, could serve as efficient regulatory governance.

It is within these criteria that the value of the multiple ethical concerns of Kiely and FitzGerald can be frameworked. Xhail's declaration of clarity regarding awareness of AI misuse separates them from the 'muddiness' (MK) of the current world of AI music start-ups, where 'you have all sorts of people doing whatever it is they can' (TG). The Xhail financial model, as it is advertised, is based on retention of the customer's trust. It also exemplifies how the AI HLEG's 'trustworthy' AI requirement can be satisfied.

Competence (human responsibility). The *EAD1e* states that while operators of AI may not fully understand the 'sources, scale, accuracy and uncertainty that are implicit in applications of A/IS [AI]' (IEEE, 2019a: p. 32), this issue can be addressed through a regulated set of standards. Xhail fully addresses the competency requirement because its AI design can be communicated to a wide public. Each participant involved with the Xhail system, from the programmers, investors and AI owners to the users, understand the human-centred purpose and how the system operates. This meets the *EAD1e* requirement of human responsibility in the processing systems of AI, a value echoed in *EGTAI* Principle 8 and in accord with the general mission of *UN SDGs* to responsibly build new technologies (Farag, 2019).

Efficiency (adherence to a marking system). Principle 4 of the *EAD1e* refers to the development of an AI marking system observable to the public and adhered to by industry. Innovative actors like Xhail need external ethical regulations to operate within a fairer and more predictable music ecosystem, which comprises all AI actors. An AI marking system could function as a methodological approach of how to validate the trustworthiness of both the actor and its technology's design, while also offering a

competitive advantage against rival but noncompliant AI music actors. In this context Xhail would support the formalisation of a marking system. As Kiely indicated, the development of AI music technologies can be compared to an untethered ship upon which 'nobody really knows what direction to point it in' and asked, 'why shouldn't it be Xhail that takes the helm'.

In summary, despite the general nature and complexity of AI ethics in the macro perspective, in the micro perspective, a sector-specific AI marking system within the music ecosystem is conceivable and possible. As the Xhail case study demonstrates, such a system can be understood by the AI owners and can meet the users' expectations without diluting the need for enforcement of AI ethics and governance. Kiely and FitzGerald present themselves as active members of a music ecosystem which has been seriously challenged by AI development. They evidence how AI ethics is a timely task, requiring applicable solutions for other start-ups as well. It would be fascinating to see how other AI systems could be innovatively designed to meet the ethical demands of the music ecosystem. The adoption of similar values as Xhail, regarding the ethical purpose of music technology, is a step forward, while creation of an independent marking system can invigorate more innovative AI products and services.

Successful advocacy for an AI marking system within music would respond to the value gap, as well as the algorithmic accountability gap. This is the central argument of this dissertation that requires further intervention and real-world implementation.

Chapter 6: Conclusions of the Financial and Ethical Implications of AI Technologies for the Music Ecosystem

Retrospective: Theoretical Architecture of the Argument

Theory, including the positions presented in Chapter 1 (e.g. philosophy of technology) and Chapter 2 (existing AI and its forecasted or envisioned development), deals with an exponentially advancing technology, which is culturally loaded and driven by excitement. This thesis's primary goal is not a response to speculative AGI/ASI positions but instead a restart the discussion based on existing AI, and to point to the kind of technology society is faced with, how it is constructed and by whom. In theory of technology, SCOT initiated the discussion, which is ongoing, that it is not the advancement of technology that determines consumer choices but the constructions of it – for example, how AI is presented to society and turned into products and services which then inform consumer decisions. AI actors' relationships within SCOT formed this study's discussion, one primarily concerned by the perception, rather than the progress of AI. Therefore, there was a requirement to identify music actors who produce AI constructions when they communicate through the usage of the term AI within the market (i.e. music industry). SCOT applied to AI music development uncovered that the progress of AI music was driven by such constructs as freedom of creativity, the purpose of copyright and the movement towards a hyper-personalised proliferation of music content. These constructs, in turn, bring financial and ethical consequences – consequences that are not discussed when AI development is uncritically perceived.

The research analysis' central guiding concept is the music ecosystem. This work chose to follow the ANT model, and replaced the term 'network' with 'ecosystem', to give emphasis to the emerging dynamics within an industry affected by AI expansion.

Ecosystem, with its biological derivative compared to network which does not have this connotation, is therefore the more robust and effective term. Ecosystem overlaps with the function of Latour's network. Network signifies a concept to express access to the monitoring and analysis of what is happening within a system (i.e. musical ecosystem) where the diversity of actors, and the tension between them, grows. AI technology seems to be one of the disturbing actors within the network because it causes – from the financial and ethical perspective – unregulated relations between the actors. ANT gives a possibility to capture even the most unstable, momentary relations in so-called 'association' (Latour, 2005), before they are galvanised as social, political, and economic relations. It is important in regard to AI's rapid development – where new sources and information appear everyday – that ANT sets the borders (the stage), which can then be placed under research analysis.

In Chapter 3, the ANT model was followed to see who the actors are within the sector-specific network of the AI music ecosystem, and interest lay in who was relating to whom or to what, as AI started to play out within this network. After that analysis, AI was regarded as a weak actor, in parallel to its technological status of being a narrow AI. The strong AI music actors involved not the technology, but specific representatives of the music industry. These 'strong' AI actors compete and construct AI often as a 'democratic' tool to enhance music production or the popularisation of music by attracting non-professional musicians (prosumers). However sometimes as a consequence, which is a negative side of 'democratisation', the actions of the AI music actors impact and restructure employment opportunities. As Winner was convincingly concerned, technology is not a mere tool that can just be developed. AI technology, which music actors construct as 'ubiquitous' and accessible, reminds us of Winner's concept of technology as 'forms of life'. In this concept, the perception of AI as accessible can transform into the technology becoming irreplaceable. Humans already voluntarily

substitute their work with AI, but what if AI supplants human work essentially? The example of iHeartRadio is a sign that this is possible.

When the endeavours of legal and ethical responses to the AI challenges in the music ecosystem were studied, the concern lay in the rhetorical character of how AI risk is evaluated and communicated. Many legal cases and reports on AI ethics repeat the dominance of 'human-centred' values in regard to AI technology. With music copyright, it was established how legal concepts and case law were underpinned by the essential requirement of the human author. In turn, when considering commonalities in reports on AI ethics, a similar human-centred locus was encountered.

Human-centrism – and other derivative values – in relation to technological threats resembles Heideggerian 'human exceptionalism', a concept which is taken for granted and communicated publicly. Human in this context is an uncritical term, a full stop, a source of values that can frame and close the discussion, especially when human-centred values in regard to AI ethics are juxtaposed with other commonly accepted values akin to those of the *UN SDGs*.

Transhumanism builds on the notion of uncritical human progress – now expressed through AI advancement – but it also informs considerations regarding the possibility of the further development of AI into a form that society is not prepared to respond to. This possibility of the future AI of the next generation, which will not be a narrow AI but a strong non-human actor, cannot be excluded. And while this review is limited to existing AI technologies, other actors, like DeepMind and OpenAI, were encountered who are dedicated to the achievement of AGI. It is no coincidence then that these actors produce musical tools radical in construction and capability and release them as by-products in their journey to the development of AGI. Transhumanist thought allows us to acknowledge and embrace these actors within the music ecosystem's network.

While the challenges faced are now better imagined, preparation can be improved, and an ethical approach to AI can be advocated for. Music ecosystem – as Attali assumed – is a sensitive ground which captivates the *avant-garde* of change and the challenges AI has brought. Advocating for ethics in reference to a concrete network – in which the dynamic nature of transformations, and the possible disruptions, can be seen – is a question that cannot be closed by the rhetorical 'human-centred' values but instead opened by a 'post/critical' human concerned approach. AI ethics should be reframed in this posthuman way: how to build more ethical relations with technology in order to sustain the music ecosystem, where the main actors are still humans and not conscious machines. This work does not demonise the possibilities that existing AI music technology can offer, rather in considering the negative consequences – already visible – this work's conclusions can now be presented and the discussion opened further.

This review's primary focus is the impact of music generated by AI on IP, as copyright is the core of the music ecosystem and remains the fundamental driver of employment in music. However, other important and interrelated financial and ethical questions have emerged; these questions in turn contribute to the holistic reflection and wider understanding of the future relationship between AI and IP.

These questions begin with, what are the benefits of a sector-specific ethical approach to AI? If that approach is useful, then how should industry seek to regulate it? And within that regulatory context, how should the protection of consumers, prosumers and musicians be addressed through the development of an AI music mark? Building on that, what factors need to be considered when formulating the global arrangements of a new ethically orientated music ecosystem? And finally, what part, and how, should education play in informing and enriching that new music ecosystem? Before considering possible approaches in answer to these questions, this chapter's conclusions return to reflect on AI and IP within this wider framework of a new music ecosystem.

6.1 IP

Two recent US publications, firstly the *WIPO Conversation on Intellectual Property (IP) and Artificial Intelligence (AI)* (*WIPO-CIPAI*) (Flynn, 2020) and secondly a notice published by the United States Patent and Trademark Office (USPTO) in the *US Federal Register* (USPTO, 2019), underline the timeliness and structure of the questions just presented. *WIPO-CIPAI* released on the 13th December 2019, prepared under the auspices of the UN by WIPO Secretariat, references global policy on IP and AI. Several of the *WIPO-CIPAI* questions present concerns addressed throughout this dissertation. Notably however, the paper does not seek to provide solutions to its enquiry. Therefore, a consideration of *WIPO-CIPAI* themes demonstrate how this thesis's sector-specific analysis informs issues of the WIPO macro perspective.

The *WIPO-CIPAI* presents a list of the key questions and challenges emerging from AI and IP policy for 'representatives of the commercial, research and nongovernmental sectors' (p. 1) and notes that while one of the chief goals of global IP policy is to 'stimulate innovation and creativity in the economic and cultural systems' (p. 1), AI technologies 'intersect' with these aims at a number of points. The paper also contends with issues relating to the technology gap and capacity building of low to middle income countries (LMICs) (p. 8) – issues which are addressed in a later section of this chapter.

The *WIPO-CIPAI* notes that it 'now seems clear that inventions can be autonomously generated by AI' (p. 3) and acknowledges the existence of a number of cases of applications for patent protection where the AI was listed as the inventor. The paper asks whether legislation is necessary to permit an AI to be named as an inventor or should this decision be 'left to private arrangements such as corporate policy'? Furthermore, should precise legal provisions be made to govern the 'ownership of

autonomously generated AI' creations? (p. 3). The purpose of *incentive theory* is also noted, and the *WIPO-CIPAI* states that the reward system of IP is based on the calculation that it ultimately contributes 'positively to the welfare of society' (p. 4) but asks whether a 're-assessment' of AI in this context is required.

Many of these questions are familiar from this thesis and have been applied to the music ecosystem. Notably, the WIPO document states its understanding that AI is currently 'capable of producing literary and artistic works autonomously' (p. 4) and that this ability 'go[es] to the heart of the social purpose for which the copyright system exists' (p. 5). This is significant as it confirms the perception of the power of existing technologies and thus indicates a creative assumption for the basis of future legislation of CGWA. *WIPO-CIPAI* concludes on this issue that if AI was excluded from copyright authorship, then the copyright system would be seen as an 'instrument for encouraging and favouring the dignity of human creativity over machine creativity' (p. 5). However the paper neither endorses nor disputes that contention. The question of legal personhood for AI is addressed when the paper asks if the copyright should 'vest in the personality and the personality could be governed and sold in a manner like a corporation?' (p. 5). Responses are now provided to those *WIPO-CIPAI* questions which hint at key contentions from this thesis's analysis of AI and music copyright.

As explored and summarised in Chapter 4, IP law needs urgent attention, specifically regarding what constitutes the *common good* in relation to music copyright and CGWA. To date, the status of AI creativity is not sufficiently addressed in discussions on AI ethics and the music ecosystem represents a tipping point for the legal tests for CGWA. Scrutiny of existing legislation is required to prevent AI systems from being granted possible legal autonomy and regulatory protections are required to remove ambiguity (for both jury and judge made rulings) which can rigorously assist in the

closing of interpretable loopholes that arise from the uncertainty of legal concepts such as *originality*, *creativity* and *substantiality.*

Regional jurisdiction and legislation regarding music copyright and related creative IP vary significantly around the world. The continued movement towards a global harmonisation of IP laws must respond to the specific needs of the creative arts industries and in particular to the concerns of the music ecosystem, which historically is among the first domains to be affected by the introduction of new technologies. Reliable and trusted AI systems that provide transparency, traceability and verification of music IP are required and their implementation must be widespread.

AI technologies are likely to be increasingly subject to regional regulation. As a result of this, the opportunity for the position on legal personhood to be reassessed and re-evaluated by individual governments and decision-makers will arise. However, this will come with as many problems as opportunities, for regulation needs to be achieved at the UN (WIPO) level in order to create a globally uniform and enforceable policy. Attention from the music ecosystem to the implementation of a value-based system could inform this developing conversation as technology progresses from its current incarnation as ANI into possible AGI. The urgent need to engage with these recommendations is evident in the two recent court cases cited[169] in Chapter 5 which confirm both the global diversity of legal opinion and the situation's openness to unintended consequence. In this instance, the radically divergent verdicts rulings present a timely opportunity for regulatory bodies of the music ecosystem to contribute an active voice to this debate. An example of this possible regulatory involvement is seen when looking at the second relevant and recently issued publication.

On the 30th October 2019, a notice was published by the USPTO in the *US Federal Register* inviting public comment on thirteen questions regarding the possible

[169] The *Dabus* and *Dreamwriter* cases

impact of AI on the creation of IP. Questions ranged from opinions regarding the legality of feeding an AI system on training sets of human authorship, to whether anything other than natural persons might have the right to copyright protection. Many of these thirteen questions have perplexing implications for artists operating throughout the creative industries. Such implications prove how the legal entanglements with AI require the immediate engagement of the global creative community and allied stakeholders within the music ecosystem.

In the situation where economic activity generated by the commercial exploitation of IP is a significant contributor to employment, the questions presented by the USPTO notice need to be answered by the music ecosystem. If the arts community fully engage with the emerging AI technology, the potential to transform the creative industries towards a positive human-centred outcome is possible and workable. Though IP law varies around the world, one concept is common to all traditions – that IP is a reward, deemed to be in the common good, and used to recompense a human creators' skill and efforts (*sweat of the brow*), before it enters the public domain.

It is the recommendation of this thesis that current standards of AI should not be conferred with legal personhood. Such a legal recognition would not be morally appropriate to the aims of an ethically aligned music ecosystem. While there can be little dispute that IP laws need to be overhauled, AI's impact on employment should result in a reconsideration of IP laws to meet this challenge. Dedicated remedies, however, require research testing to ensure that any new development successfully harnesses the stated good intention. As reported in Verge in December 2019 on the notice in the *US Federal Register:*

> The USPTO only gets a few responses from the public when it makes these types of inquiries, with the bulk coming from law firms, companies and various interest groups. (Deahl, 2019e)

Therefore as demonstrated in the success of the comparable Article 13 music coalition, creative artist and multi-partner stakeholders need to unite and engage in a sector-specific intervention that actively seeks to shape the global debate on AI and IP. Otherwise, the future of the music ecosystem will be decided by 'law firms, companies and various [other than music] interest groups'. In the next section, components which support that music coalition aspiration are considered.

6.2 Sector-Specific Approach and Response to AI

After identifying that the interplay between AI and IP is the foremost challenge, this thesis then sought to find workable strategies whereby macro perspective AI ethical guidelines could be drilled down into and applied to a given domain network – in this case the music ecosystem. A conclusive requirement was found that ethical decision-making must be endorsed as a core design value by AI music actors, and not regarded as another technical obstacle to be resolved or outsourced.

The actors (programmers/creative technology companies, et al.) connected in the design and deployment of AI technologies should be accountable and responsive to the broader obligations of the music ecosystem. Recognition of those obligations is first formed by debating what societal value is to be placed on the protection and enhancement of employment and thus financial reward within the music ecosystem. The obligations are also identified by consideration of the relative stresses to IP by AI. However, the existing willingness towards closing the 'value gap' – the gap between the creators and the owners of music rights – presents a debate framework for the implications of AI to be discussed.

Responsible and adequate reply to AI challenges can be achieved through an equitable coalition of governmental, industrial, and individual ethical protocols, as expressed by Xhail, in conjunction with regulatory legislation. Moreover, carefully

coordinated and evolving industrial self-regulation would present clarity to the general public easing fears and uncertainty by offering clear insight about the usage and management of AI systems. A contribution to this objective should come from public outreach initiatives that encourage informed and open debate regarding the impact of AI on all industries.

Furthermore, while pursuing a positive and encouraging forum of discussion with all members of the music ecosystem, any suggestion of blanket prohibition (the outright banning of AI music systems, for instance) should be bypassed. The history of prohibition within music intimates that radical arrangements of industrial protection often have the opposite effect to their intention (Trivedi, 2010; Yu, 2011). Instead, actors within the music ecosystems (designers, AI companies) should explore how to utilise AI systems to maintain and not decrease human employment, consider how to address existing bias in workplace discrimination (gender, race, disability, sexuality) (Gebru, 2019; Houser, 2019), and link these policies to the *UN SDGs*. As a result, the AI challenge recognised within the music ecosystem could lead to a regulated incentivisation for other actors to demonstrate how ethically aligned AI can amplify the values of the *common good*.

6.3 Regulation of the Music Industry

The music industry requires new approaches to AI governance. As evidenced through the prior analysis of the algorithmic 'accountability gap', internal governance structures at many technology companies neglect to secure accountability systems for AI. The category of 'low risk AI' in the EU *White Paper* affects the creative arts because the paper does not prioritise legal and ethical necessity to regulate the creative sector. It only recommends a voluntary self-regulating system, which if passed into law will need to be adjusted by an independent music industry regulation.

This, however, creates an opportunity within the music ecosystem to experiment and adopt proactive best practice procedures to help close the value gap through so-called 'trustworthy' AI applications. Any debate about AI trustworthiness should directly address concerns regarding the negative implications of new technologies. AI designers and their employees should be obliged to concretely outline the – intended – consequences of any new system.

Development of any new technology, including AI, relates to cultural norms that value human cognisance and responsibility to other humans and environmental actions, as advocated by posthuman ethics. This should be coupled with procedures that primarily focus on prevention rather than on reaction to technological disruption. In fact, there are many spheres in which the positive application of AI could be inscribed. In the music ecosystem, there is a range of best practice examples from streaming curation[170], through techniques in adaptive music co-creation, to the avoidance of retrofitted payola models[171]. These examples can contribute to an AI baseline normative system founded on human-centric values, where AI is a weak actor in the music ecosystem (rather a servant, not an agent) but extraordinarily capable of securing these values. The recuperation of AI ethics in relation to the recent events in AI developments and applications can form the model for AI governance in the music ecosystem.

6.4 Consumer Protection

The call from consumer protection agencies to apply truth-in-advertising laws (Kamakoti, 2018) can readily be applied to AI music products and services. Software licensing agreements which are not limited to music (whether iTunes or Jukedeck) should

[170] In 2017 up to 50% of Spotify listeners' music was generated by AI curated playlists (Pierce, 2020).
[171] An example of this is the deployment of AI data retrieval systems to optimise payment of artist royalties from performing rights organisations.

be uniformly presented in an easy to read and clearly interpretable form. The test for reasonable comprehension in such agreements should be based on the consumer behaviour of the average global user. Standards for these agreements should be auditability, accessibility, meaningfulness, and readability expressed in language that is commonly understood. The enforcement of non-deceptive marketing guidelines for music products and services, supported by industry and governmental regulations, would provide clarity and avoid confusion in the consumer's mind regarding the capabilities and limitations of existing AI technologies.

By regulating corporate standards of compliance, a reduction in the exploitation or gaming of AI systems regarding metrics (streaming charts) or recommendation algorithms can be achieved[172]. An example of why regulation is needed involves a case from June 2017 when over fifty 'fake artists' (each with many millions of Spotify streams) were revealed by Music Business Worldwide. A series of articles by the music industry journal indicated that Spotify were:

> encouraging and even paying producers to create tracks under untraceable pseudonyms – within specific musical guidelines – which were then being drafted into key first-party playlist. (Ingham, 2017)

Though the Spotify controversy did not specifically reference the involvement of AI music, at the *WIPO AICM* session (US Copyright Office, 2020a), Joel Douek stated that:

> I know a large popular streaming platform [that] is actively using AI music because it owns it and doesn't have to pay out any kinds of royalties and therefore it helps their bottom line. You know there is this kind of race to the bottom. (p. 235)

[172] The increasing popularity of AI smart speakers adds to this concern for transparency in playlist selection. 54% of users have been shown to use them to recommend what music to listen to via algorithmically selected music playlists (Soundcharts, 2019).

Douek's revelatory opinion suggests that this practice may become more widespread in the near future. In the same month that Spotify's fake authors were revealed, Francois Pachet (a former director of AI Sony CSL) was appointed as Director of Spotify Creator Technology Research Lab. This appointment demonstrated that Spotify also has the capacity, if not the intention, to produce its own AI music content.

These dynamics in the music landscape undermine the trustworthiness of AI and confirm the value of an ethical marking system for AI. However, the consumer protection rights have to be tested in advance of the future challenges presented by the development of both embodied and ambient AI music systems.

6.5 Ambient and Embodied AI Artists

The majority of actors reviewed in Chapters 3, 4 and 5 consisted of AI tethered to devices that were in the main mobile, desktop or API based. Weinberg's robot Shimon showed the potential of embodied AI. However, it is conceivable that the next stage of AI music expression will be in the realm of XR and ambient AI technologies rather than robotics due to the many technical constraints involved with embodied AI systems. This may present even more complex challenges than considered so far, as AI is being developed in new directions.

New paradigms involve the design of AI music artists and avatars of existing human musicians[173]. Despite some existing scepticism among musicologists, who state that the prospect of AI music artists belongs to the 'distant future...[and] the inevitability of such a music AI should be taken with a grain of salt' (Sturm et al. 2019), there are innovations which indicate that change may appear sooner than anticipated. One example

[173] For instance, a 'post-biological' version of Elton John is being developed by Spinifex that will produce a 'cognitive Elton...that can be part of the creation of new music in the future' (Reynolds, 2018). In 2018 ABBA announced that they planned to tour again as AI powered holograms (Shaw, 2018). Similar holograms of Roy Orbison, Tupac and Michael Jackson have appeared in recent years.

is the computer-generated AI avatar pop singer Lil Miquela who signed with Hollywood Talent agency CAA in May 2020 (Spangler, 2020). Miquela, named by *Time Magazine* (2018) as one of the twenty-five most influential people on the internet (TIME, 2018), is described as a nineteen-year-old Brazilian-American model, musical artist, and influencer with over 1.6 million Instagram followers[174]. However, Miquela's phenomenon should not be considered fearfully by the music ecosystem but rather critically observed in relation to AI and an ethical marking system. This is also the case with the Japanese pop singing hologram Hatsune Miku[175], who in comparison to Miquela, encourages music composition among its predominantly teenage users.

Nick Collins, reflecting on Miku's popularity, writes in a pioneering paper in 2011: 'The more of ourselves we commit to virtual musicians; the weirder and more interesting musical life may become' (Collins, 2011: p. 38). Miku is intriguing for she intersects with notions of music authenticity and copyright protections that can enrich the AI debate, for at the 'core of Miku culture is a series of Crypton products', in which users are encouraged to reinterpret and use Miku's image without traditional IP restrictions (Ekman, et al., 2020). 'Miku culture' has resulted in over one hundred thousand songs being written with/for her by her audience, and as one Miku fan confirmed of the musical authenticity of the hologram:

> what makes her real is us. These are our words. These are our songs. These are our lyrics that we hear up there. At the end of the day more than anything else she (Miku) is just us up there. We are seeing each other. (Marche, 2019)

[174] Lil Miquela has worked with brands such as Samsung, Calvin Klein and YouTube music while supporting social community movements such as 'Black Lives Matter' and donating over $100,000 dollars to music education in the US (Maughan, 2018).

[175] Hatsune Miku has been sixteen years of age since she was created in 2007 by Crypton Future Media, a Japanese software company, as a mascot for Yamaha Vocaloid – a digital music instrument.

Nonetheless, the human tendency to anthropomorphic projection[176], coupled with the heavily promoted expectation of AI capabilities, calls for immediate intervention regarding consumer (or indeed prosumer) safeguards. As ‘music life gets more interesting and weirder’ (Collins, 2011), the development of an AI marking system to address these new technological forms of musical expression, including future AI advancements, should be accelerated. But what would that marking system look like and how might it be implemented? The following sections of this chapter present opportunities for question to be approached.

6.6 AI Music Mark

In Chapter 5 a range of voices were encountered from various bodies including the AI Now Institute, the IEEE and EU AI HLEG that called for an AI ethical marking system. Earlier in Chapter 2 when introducing the concept of the AI music mark reference was made to plans for national approaches such as the German Quality Seal for AI and The Danish Seal both which involve a voluntary pledge to adhere to its guidelines and thus are open to many of the problematic interpretative issues discussed in Chapter 5.

But how would this movement in the macro perspective manifest itself in the music ecosystem? Moreover, could an AI marking system, based on sector-specific needs, be given additional authority and be extended to other domains after successful testing in the music ecosystem? And what of other vested interests in the music ecosystem, particularly those at the transnational level? What benefit would the interference of an AI music mark possibly have for them?

[176] In November 2018 Akihiko Kondo, a thirty-five-year-old school administrator, married the virtual reality singer Hatsune Miku. Though the marriage has no legal standing in Japan – Gatebox, the company that produces the hologram granted a marriage certificate (one of some three thousand seven hundred such marriage certificates for cross dimensional marriages) to Kondo (Mainichi, 2020).

Competitive music streaming services and the majority of the AI music actors reviewed offer very similar products and services with little to distinguish them outside of brand loyalty in the marketplace. For instance, Apple Music and Spotify offer licences to access to the majority of the world's music catalogue through near identical service platforms at similar price points. If an AI music mark was available and recognised by consumers, then the attainment of the mark would provide a competitive advantage. However, for any music mark to be truly effective it would need to operate eventually at the global level. This can be achieved when an AI music mark is ethically aligned with the *UN SDGs*.

The WIPO is one of fifteen specialised agencies of the UN, and this review has returned regularly to the *WIPO AICM* session of February 2020. During this session, the moderator Regan Smith observed after hearing the various statements given by expert AI music witness that:

> I bought a Fairtrade coffee this morning… are we going to enter into a world where we see an attribution on a playlist whether music is human created or primarily human created? Does this relate to some of the moral rights issues? (US Copyright Office, 2020a: p. 234)

In response to Smith, David Hughes, a Chief Technology Officer of the RIAA, suggested that 'maybe we need a free trade organic music logo [to identify] if it is actually composed or played by human beings… then at least we know if a real person is getting paid' (p. 241). These observations made at the WIPO level indicate a growing awareness of the need for intervention in the music ecosystem and prove that an AI music mark is possible.

6.7 Towards a New Global Music Ecosystem

What would propel the societal movement towards the adoption of an AI music mark suggested at the WIPO meeting, especially as the situation has radically changed since the WIPO session occurred.

The effects of COVID-19 on jobs within the arts have galvanised the critical issue of employment for the music ecosystem in my discussion of the financial and ethical implications of AI. Work within the music ecosystem has already shown many structural changes to traditional employment practices, not least through those involving IP.

The UNI Global report forecasts that over fifty percent of the global workforce will shortly be affected by AI automation. Actors in any ecosystem should shift their focus to the volume of jobs being created and not lost (Horizon, 2020). New forms of music participation and consumption are being revealed (WASP, 2020) as the music ecosystem enters its fourth cycle of disruption. An integrated understanding of these potentialities can actively contribute to employment opportunities for music makers. Many insights can be built upon the Article 13 music coalition, with the ambition that – regarding AI challenges outlined in this review – prevention rather than cure can be achieved.

The expansion of the Article 13 coalition of stakeholders to include academic researchers, music fans, policymakers and affected communities of music makers alongside the established industrial voices can address challenges and opportunities presented by the rapid introduction of AI technologies. The music ecosystem possesses a long-standing tradition of activism and has historically demonstrated the capacity to organise and demand structural societal changes (Haycock, 2015). Evidence of mass participation can provoke a broader music alliance that demands AI accountability in its

ecosystem. Amid accelerated and exponential technological transformation, traditions of activism in music can thus be practically repositioned.

The cycles of technological disruption showed that the norms of music consumption are not static. Similarly, many cultural patterns in popular music are transforming and these changes emphasise the truly global nature of the emerging music ecosystem. The entry of China, South Korea and Brazil is proof of radical alterations to the status quo of markets for recorded music. Likewise, an equal if not more significant transformation may be occurring concerning English as the lingua franca of popular music. In 2018, seven of the top ten most popular global songs on YouTube were sung in Indian or Spanish dialects (Ingham, 2019g).

Table 4: English language v. non-English language songs in YouTube global Top 10 music videos. Source: https://www.musicbusinessworldwide.com/english-language-music-is-losing-its-stranglehold-on-global-pop-charts-and-youtube-proves-it

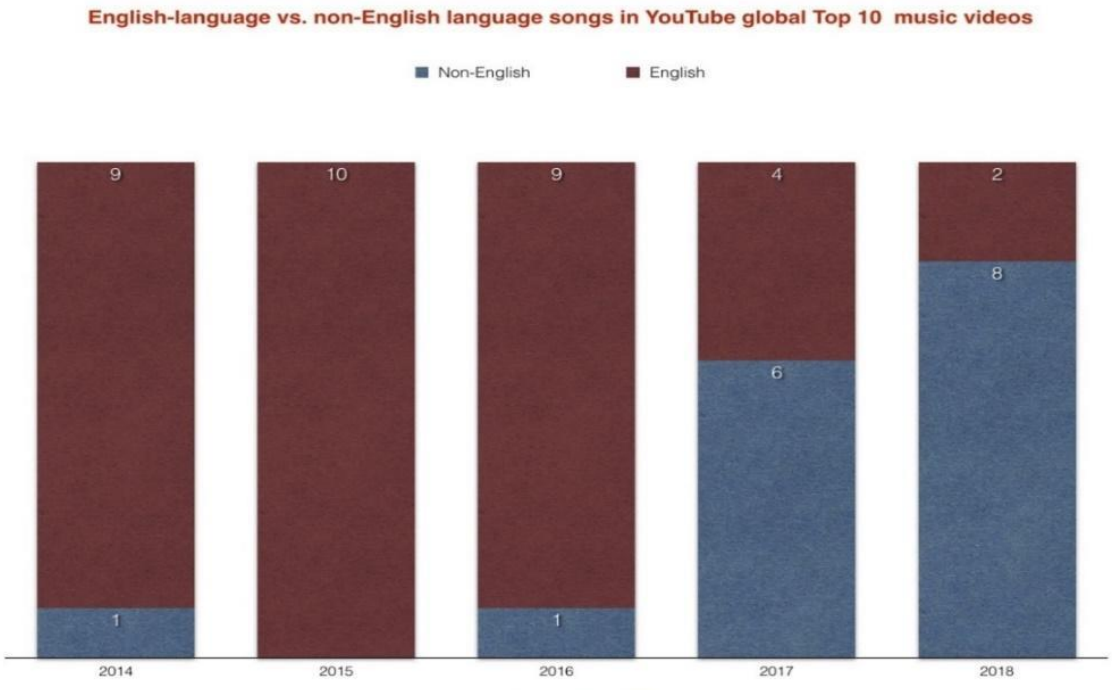


Table 4 above denotes a reshaping of the regional power structure of the music ecosystem. Any new music coalition must therefore embrace and amplify the ethical and economic needs of these emergent diversified voices (LMICs) and correspond with the

values of the SDGs. Therefore, any ethically aligned AI marking system should be reinforced at the UN level.

6.8 Global and Local Governance

The emergence of the new actors as substantial markets remaps the borders of the music industry. However, what should be the ethical response to cultural shifts from LMICs (Mallapur, 2019)? How can AI technologies serve the achievement of the *UN SDGs* targets? Indeed, can the selection of best practice AI ethical principles in the music ecosystem contribute to the responsibilities of global citizenship as set out by the UN?

This thesis has identified how new music-related technologies contributed to the creation of near-monopolies of transnational enterprise (FANG+). These corporations exist beyond political borders and face many internal ethical challenges. As major music industry companies adjacent to these transnational corporations advance commercial partnerships in LMICs, what ethical guidance is available to inform these relationships?

The *EAD1e* asks how LMICs will implement competitive AI with existing resources and assistance, and what the role of public and private sectors is in the development of under-resourced nations (IEEE, 2019a: p. 152). *UN SDG* 17 suggests how to engage with the IEEE questions.

UN SDGs Target 17.11 calls for an increase in the share of global exports from LMICs with a target of doubling that share by 2020 from the least developed countries. This target can be achieved by ethically aligned multi-stake partnerships in the music ecosystem working in LMICs. More specifically, Target 17.3 notes that part of achieving SDG 17 involves the mobilisation of financial resources from ‘multiple sources’ to increase the percentage of individuals who have access to information and communication technologies (17.8). Access should be globally available on ‘favourable terms’ (17.7) to encourage the ‘dissemination and diffusion of environmentally sound’

technologies (17.7). SDG 17 aspirations incorporated within the protocols of an ethical music mark will provide further incentivisation to both public and private AI music actors to deliver on the SDG's mission. As a result, the remit of an ethical music mark can evaluate AI actors who are not involved in the generation of AI music. For those involved however, *UN SDG* Target 17.10 calls for a:

> universal, rules-based, open, non-discriminatory and equitable multilateral trading system under the World Trade Organisation including the inclusion of negotiations under its Doha Development Agenda.[177]

This SDG target returns us to a global notion of the *common good* and the role of IP and AI within that definition.

Recognition that the needs of LMICs are included in the discussion, design and implementation of AI can ensure that use of AI technologies contributes to the targets of the *UN SDGs*. The music ecosystem is a fertile environment in which to embed these global best practice standards as a model for other industries and cultural sectors.

In the end, why does music matter so much? After all, according to the *White Paper* the characterisation of the needs of the music ecosystem as being 'low risk' must be agreed upon. However, if Jacques Attali is correct — and this thesis confirms many of his predictions — that music is 'a herald for social change', this thesis attests to the importance of examining the financial and ethical implications of AI in the music ecosystem and advocacy for AI ethical music mark.

What happens now in music according to Attali will inevitably happen in other domains, and the opportunity for the exploration of the AI challenges presented in music only depends on the curiosity and willingness of its actors. One such AI music actor is

---

[177] A vital element of the Doha Development Agenda is the *TRIPS Accord.* An illustration of the convergence of the *TRIPS Accord* and SDGs was announced in February 2020. A WTO workshop of the *TRIPS Accord* Council on the implementation of Article 66.2 of the *TRIPS Accord* was held, developing incentives for technology transfer to LMICs (WTO, 2020a).

Mick Kiely, who on completion of the final interview, requested that the recorder be turned back on. The Xhail CEO wanted a second chance to address one question which had troubled him. It is this final question which needs to be addressed by all members of the music ecosystem. Asked for the second time, what does it matter if music is made by humans or AI, Kiely asserted:

> Historically, many of the major events that had a huge influence on world peace began with the arts. Many lead by artists, involved in music – take Live Aid, he [Bob Geldof] brought the whole world together to deal with issues of starvation. The whole world comes together. And comes together through song, because song transcends language, music transcends language, the whole world can unite to deal with disaster, to grieve, and raise aid through music. And as for artistry? AI is never going to do that. So, there's a massive void created if music and artistry go away, and Al replaces it, and what does that void get filled with? It is just a machine. You cannot look to a machine for love like that. Because it is about love as well. We aspire to individual artists when growing up and as we develop, we fall in love with them, we develop emotional connections to the posters on our bedroom wall, whether it is a Bieber, Pink or Katy Perry, whoever it is, that gives such growth in our personal development. But we are brought on this journey by our aspiring relationships, which includes the love of artists and people we may have crushes on, people that bring messaging in the context of their lyrics, or in how they dress or their attitudes towards society. And the push back, on the right or the left, whatever it may be [politically]it is just a massive expression. Be it punk rock and its whole, 'this is not good anymore….We want more than this'. And the flower power movement developed in the late 60s was similar. These are all necessary movements for the world to evolve and change. That was all in the name of love and the development of a better world to live in for everybody. And that was all expressed through music. It was brought together through music, that cannot happen with an AI, it just cannot. You need humanity to bring that on. Taking that musical expression out of the hands of humanity, and putting it into an AI machine is…just nothing. You would want to be a complete idiot to think that was a better system. You would have to be a complete gobshite to think that that is a better way to do it. (MK)

Kiely's opinion that AI presents a cultural void that can only be filled by a passionate human response can be addressed through a re-evaluation of the role of education in the music ecosystem.

6.9 Education

Many of the AI ethical guidelines call for significant and immediate changes in education and this call can speak more strongly through music.

Ethics education that intersects primary, secondary and post-secondary education and includes both universities and vocational training schools should be comprehensively remodelled. At third level, a movement towards deep interdisciplinarity for education and research already exists and should be expanded. Modules that have the creative arts at their core but offer integration with computer science, law, industrial design, anthropology, neuroscience and business studies can provide a template for a future-proofed understanding of ethical music technology studies. Indeed, the movement from deep interdisciplinarity to a bona fide transdisciplinarity as outlined in the *EGTAI* principles can be achieved through the development of internationally and inter-institutionally recognised undergraduate, postgraduate and doctoral programs that comprise Arts, Humanities and Social Sciences (AHSS).

Members of global networks such as Trinity College's Science Gallery can further adopt and recognise formal and informal learning protocols, which serve the AI HLEG's prioritised model that integrates (transdisciplinarity) business (start-ups and corporations) with AI ethics research institutes of excellence. The curriculum at all tertiary levels should be designed to anticipate and critically question the pace and progress of AI. This aim can be accomplished in education through the promotion of adaptive and appropriate inter- and transdisciplinary skill sets. Inventive pedagogical approaches will be called for to meet with these challenges, and the creative arts, in particular music, provide an engaging environment for innovative approaches to be tested and established.

Key to the success and economic viability of new pedagogical practices is a forward-looking embrace of XR technologies. Such frameworks can revitalise and

broaden the reach of music education while concurrently anticipating and facilitating future skill transfer employment possibilities. Combining an emphasis on value-based design systems with the commercial openings presented by AI technologies can enhance the future employment prospects of workers in the music ecosystem. The capacity of existing AI technologies creates a unique opportunity for music to emerge as a leader in this transdisciplinary research and ethically orientated practice.

Furthermore, re-defining music education, housed within the larger orbit of AI policies, can directly engage with questions related to broader IP (patent, design, trademarks and copyright), the creation of which can develop new forms of artistic remuneration. An expansion of the current AHSS research agenda would broaden technology transfer potentialities for third level institutions from its focus on the life sciences.

Outside of the traditional tertiary levels, educational training programs for the low-skilled workforce in the music ecosystem should be incentivised. Programs that encourage a positive approach to lifelong learning founded on the principles of human flourishment, and implemented through NGOs and social enterprise initiatives require immediate research and funding support (O'Keefe, et al., 2020).

Such a holistic and integrated multi-tiered educational programme that involves existing and future actors of the music ecosystem would be a powerful 'bottom up' contribution to an ethically articulate, multi-partner music coalition capable of intervention through the widespread adoption of an AI music mark. A corresponding educational vision would influence the broader financial landscape providing new forms of human reward through the innovative imagining of ethically aligned AI music tools.

AI technologies are both Promethean and disruptive in nature. Being critical about human misuse of them, via a posthuman rather than transhuman approach, equipped this examination with a curiosity and belief that the creation of a sustainable and equitable

music ecosystem responsible for all of its human and non-human actors is possible and viable.

Bibliography

Abadi, M., et al. (2016) TensorFlow: A system for large-scale machine learning. In: *12th USENIX Symposium on Operating Systems Design and Implementation (OSDI 16)*. Savannah, GA, USENIX Association. pp. 265-283. Available from: https://www.usenix.org/conference/osdi16/technical-sessions/presentation/abadi [Accessed 24th April 2020].

Abad-Santos, A. (2019) A jury said Katy Perry's 'Dark Horse' copied another song. The $2.8 million verdict is alarming. *Vox*. Available from: https://www.vox.com/culture/2019/7/30/20747100/katy-perry-dark-horse-joyful-noise-copyright-2-8-million [Accessed 4th May 2020].

Abbey Road Studios (2020) Abbey Road Red – Abbey Road Studios. *Abbey Road*. Available from: http://www.abbeyroad.com/abbeyroadred [Accessed 27th April 2020].

Abelson, H., Leaden, K., & Lewis, H. R. (2008) *Blown to Bits: Your life, liberty, and happiness after the digital explosion.* Boston, Addison Wesley.

Accusonus (n.d.) Regroover: your samples reimagined. *Accusonus*. Available from: https://accusonus.com/products/regroover [Accessed 2nd June 2020].

ACIDS (2020) The first AI-based opera. *Artificial Creative Intelligence and Data Science.* Available from: http://acids.ircam.fr/ai-opera/ [Accessed 4th May 2020].

Ackerman, M., & Loker, D. (2016) *Algorithmic songwriting with ALYSIA*. *arXiv:1612.01058 [cs]*. Available from: http://arxiv.org/abs/1612.01058 [Accessed 27th April 2020].

ACM US Public Policy Council (2017) *Statement on algorithmic transparency and accountability*. Available from: https://www.acm.org/binaries/content/assets/public-policy/2017_usacm_statement_algorithms.pdf [Accessed 3rd May 2020].

Adams, T. (2010) David Cope: 'You pushed the button and out came hundreds and thousands of sonatas' *theguardian.com.* Available from: https://www.theguardian.com/technology/2010/jul/11/david-cope-computer-composer [Accessed 21st February 2017].

Agarwal, A., et al. (2018) Community regularization of visually-grounded dialog. *ArXiv*. Available from: https://arxiv.org/pdf/1808.04359v2.pdf [Accessed 3rd April 2020].

Ahmad, T. S. (2019) Regulation of artificial intelligence. *Library of Congress.* Available from: https://www.loc.gov/law/help/artificial-intelligence/americas.php [Accessed 4th May 2020].

AI Forum New Zealand (2018) *Artificial intelligence shaping a future New Zealand*. Available from: https://aiforum.org.nz/wp-content/uploads/2018/07/AI-Report-2018_web-version.pdf [Accessed 2nd May 2020].

AI.Music (2020) AI.MUSIC | music that listens to you. *AI MUSIC*. Available from: https://www.aimusic.co.uk [Accessed 28th April 2020].

Aiken, M. (2016) *The Cyber Effect: A pioneering cyberpsychologist explains how human behaviour changes online*. London, John Murray (Publishers).

AIVA (2020) Available from: https://www.aiva.ai/about [Accessed 27th April 2020].

Aiva Technologies (2018) How we used our music engine to create the first AI-generated album of Chinese music. *Medium*. Available from: https://medium.com/@aivatech/how-we-used-our-music-engine-to-create-the-first-ai-generated-album-of-chinese-music-9d6fa984b4e8 [Accessed 27th April 2020].

Aldinhas Ferreira, M. I., et al. (Eds.) (2019) *Robotics and Well-Being*. Springer.

Alexander, J. (2019) 'Old Town Road' proves TikTok can launch a hit song. *The Verge*. Available from: https://www.theverge.com/2019/4/5/18296815/lil-nas-x-old-town-road-tiktok-artists-spotify-soundcloud-streams-revenue [Accessed 28th April 2020].

Alfred Bell & Co. v Catalda Fine Arts (1951) 191 F.2d 99.

Algoriddim (n.d.) dJay Pro for Mac – The #1 DJ Software for iTunes and Spotify. *Algoriddim online.* Available from: https://www.algoriddim.com/apps [Accessed 13 October 2015].

Algorithm Watch (2020) Algorithm Watch. Available from: https://algorithmwatch.org/en/ [Accessed 30th June 2020).

AlgoTunes (2020) AlgoTunes – Generate original music for your content. *algotunes.com*. Available from: https://www.algotunes.com/generate-music/ [Accessed 27th April 2020].

Alikhan, S. (1986) Role of the Berne Convention in the promotion of cultural creativity and development: Recent copyright legislation in developing countries. *Journal of the Indian Law Institute*. *28* (4), pp. 423-440. Available from: https://www.jstor.org/stable/43951043 [Accessed 4th May 2020].

al-Jazarī, I. al-Razzāz (1973 [1206]) *The book of knowledge of ingenious mechanical devices:(Kitāb Fī Ma'rifat Al-ḥiyal Al-handasiyya)*. Trans. Hill, D. R. Netherlands, Springer.

Allen, C., & Hanly, R. (2020) Legal systems in Ireland: Overview. *Practical Law*. Available from: http://uk.practicallaw.thomsonreuters.com/w-009-0803?transitionType=Default&contextData=(sc.Default)&firstPage=true&bhcp=1 [Accessed 5th May 2020].

Amadeus (2020) AmadeusCode – Meet your artificial intelligence powered songwriting assistant. *Amadeus Code*. Available from: http://amadeuscode.com/top [Accessed 27th April 2020].

Amazon Web Services, Inc. (2020) *AWS DeepComposer*. Available from: https://aws.amazon.com/deepcomposer/ [Accessed 27th April 2020].

Amini, L. (2016) IBM Brandvoice: How to make 'cognitive music' with IBM Watson. *Forbes*. Available from: https://www.forbes.com/sites/ibm/2016/10/24/how-to-make-cognitive-music-with-ibm-watson/ [Accessed 27th April 2020].

Amper (2020) *AI music composition tools for content creators*. Available from: https://www.ampermusic.com/ [Accessed 27th April 2020].

Anderton, C., Dubber, A., & James, M. (2012) *Understanding the music industries.* London, SAGE Publications.

Andrews, R. (2006) Real DJs code live. *Wired*. Available from: https://www.wired.com/2006/07/real-djs-code-live/ [Accessed 29th March 2017].

Angermiller, M. A. (2019) Marshmello lands historic $60 million Las Vegas residency at new KAOS nightclub. *Variety*. Available from: https://variety.com/2019/music/news/marshmello-las-vegas-residency-deal-kaos-nightclub-1203154698/ [Accessed 28th April 2020].

Anglade, A., et al. (2016) The computer is listening. *Loop 2016*. Funkhaus, Berlin. November 2016. Discussion. Available from: https://loop.ableton.com/2016/program/activity/computer-listening/ [Accessed 20th April 2020].

Appel, G., et al. (2020) The future of social media in marketing. *Journal of the Academy of Marketing Science*. *48* (1), pp. 79-95. Available from: https://doi.org/10.1007/s11747-019-00695-1 [Accessed 2nd April 2020].

Arewa, O. B. (2010) Youtube, UGC, and Digital Music: Competing business and cultural models in the internet age. *Northwestern University Law Review 104*(2), pp. 431-476 Available from: https://ssrn.com/abstract=1892329 [Accessed 2nd May 2020].

Aristotle (2009 [350BCE]) *The Nicomachean Ethics, new edition*. Ross, D. Trans. Brown, L. (Ed.) Oxford, Oxford World Classics.

Armbrecht, A. (2015) 10 Trends to watch in 2016. *World Economic Forum*. Available from: https://www.weforum.org/agenda/2015/12/10-trends-to-watch-in-2016 [Accessed 2nd June 2020].

Armstrong, V. (2016) *Technology and the gendering of music education*. Oxfordshire, Routledge.

Aronson, J.D., & Cowhey, P.F. (2017) *Digital DNA: Disruption and the challenges for global governance.* New York, Oxford University Press.

artsites.ucsc.edu. (n.d.) Emily Howell. *Art Sites.* Available from: http://artsites.ucsc.edu/faculty/cope/Emily-howell.htm [Accessed 27th April 2020].

Arulkumaran, K., Cully, A., & Togelius, J. (2019) AlphaStar: An evolutionary computation perspective. In: GECCO '19 *Proceedings of the Genetic and Evolutionary Computation Conference Companion.* pp. 314-315. Available from: https://dl.acm.org/doi/10.1145/3319619.3321894 [Accessed 4th April 2020].

Ashby, A. (2010) *Absolute music, mechanical reproduction.* Berkeley, University of California Press.

Ashoori, M., & Weisz, J. D. (2019) In AI we trust? Factors that influence trustworthiness of AI-infused decision-making processes. *ArXiv [Cs]*. Available from: http://arxiv.org/abs/1912.02675 [Accessed 4th April 2020].

Ashri, R. (2020) Defining an AI Strategy. In: Ashri, R. (Ed.) *The AI-powered workplace: How artificial intelligence, data, and messaging platforms are defining the future of work*. pp. 142-159. Berkeley, CA, Apress. Available from: https://doi.org/10.1007/978-1-4842-5476-9_11 [Accessed 27th March 2020].

Associated Press (2015) Pharrell Williams and Robin Thicke to pay $7.4m to Marvin Gaye's family over Blurred Lines. *The Guardian*. Available from: https://www.theguardian.com/music/2015/mar/10/blurred-lines-pharrell-robin-thicke-copied-marvin-gaye [Accessed 4th May 2020].

Attali, J. (2019) *Art, the last bastion of freedom against artificial intelligence*. Available from: http://www.attali.com/en/art-et-culture/art-the-last-bastion-of-freedom-against-artificial-intelligence/ [Accessed 26th March 2020].

Attali, J. (1992) *Millennium: Winners and losers in the coming world order*. New York, Random House.

Attali, J. (1985 [1977]) *Noise: The political economy of music.* Trans. Massumi, B. Manchester, Manchester University Press.

Attias, B., & Gavanas, A., & Rietveld, H., (Eds.) (2012) *DJ culture in the mix: Power, technology, and social change in electronic dance music*. New York: Bloomsbury Academic.

Atwood, M. (2013) Margaret Atwood on science fiction, dystopias, and intestinal parasites. *WIRED*. Available from: https://www.wired.com/2013/09/geeks-guide-margaret-atwood/ [Accessed 4th May 2020].

Aucouturier, J., & Pachet, F. (2003) Representing musical genre: A state of the art. *Journal of New Music Research. 32* (1), pp. 83-93. Available from: http://doi.org/10.1076/jnmr.32.1.83.16801 [Accessed 27th March 2018].

Audioxpress (2016) iZotope introduces neutron intelligent mixing assistant software. *audioXpress.* Available from: https://audioxpress.com/news/izotope-introduces-neutron-intelligent-mixing-assistant-software [Accessed 28th April 2020].

Awde, N. (2008) *Mellotron: The machine and the musicians that revolutionised rock.* Desert Hearts.

AZƏRBAYCAN24 (2018) UK media writes about AI humanoid Sophia's visit to Azerbaijan. *AZƏRBAYCAN24.* Available from: http://www.azerbaycan24.com/en/uk-media-writes-about-nbsp-ai-humanoid-sophia-s-visit-to-azerbaijan/ [Accessed 4th May 2020].

Azoulay, A. (2019) Towards an ethics of artificial intelligence. *UN Chronicle*. Available from: https://www.un.org/en/chronicle/article/towards-ethics-artificial-intelligence [Accessed 4th December 2019].

Bagehot, R., & Kanaar, N. (1998) *Music business agreements*. London, Sweet & Maxwell.

Bahr, E. (2008) *Weimar on the Pacific. German exile culture in Los Angeles and the crisis of modernism*. California, University of California.

Bailey, J. (2015) Which country has the longest copyright term? *Plagiarism Today*. Available from: https://www.plagiarismtoday.com/2015/09/23/which-country-has-the-longest-copyright-term/ [Accessed 4th May 2020].

Bailey, M. (2017) Popgun, an artificial intelligence music startup, wins TechStars berth. *Australian Financial Review*. Available from: https://www.afr.com/technology/popgun-an-artificial-intelligence-music-startup-wins-techstars-berth-20170224-gukddw [Accessed 27th April 2020].

Bainbridge, W. S. (Ed.) (2011) *Leadership in science and technology: A reference handbook*. Sage Publications.

Baio, A. (2020) With questionable copyright claim, Jay-Z Orders DeepFake audio parodies off YouTube. *Machine Learning Times.* Available at: https://www.predictiveanalyticsworld.com/machinelearningtimes/with-questionable-copyright-claim-jay-z-orders-deepfake-audio-parodies-off-youtube/11421/ [Accessed 8th May 2020].

Bakan, J. (2005) *The Corporation: The Pathological Pursuit of Profit and Power*. London, Constable & Robinson.

Ball, P. (2012) Computer science: Algorithmic rapture. *Nature 488.7412* Available from: https://doi.org/10.1038/488458a [Accessed 29th March 2017].

Ball, P. (2011) *The music instinct – How music works and why we can't do without it.* London, Vintage.

Barcz, A. (2017) *Animal narratives and culture: Vulnerable realism.* Newcastle Upon Tyne, Cambridge Scholars Publishing.

Barfield, W., & Pagallo, U. (Eds.) (2018) *Research handbook on the law of artificial intelligence*. Cheltenham UK, Edward Elgar Publishing.

Barker, H., & Taylor, Y. (2007) *Faking it: The quest for authenticity in popular music.* London, Faber and Faber.

Barnet, R.D., Burriss, L.L., & Fischer, P.D. (2001) *Controversies of the music industry*. Westport, Greenwood Press.

Barrass, S., & Adcock, M. (2002) Interactive granular synthesis of haptic contact sounds. In: *Audio Engineering Society conference: 22nd international conference: virtual, synthetic, and entertainment audio*. June 15-17, 2002, Espoo, Finland AES. Available from: http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=6ECD93B66FE406A0762A99BD21B6A7A0?doi=10.1.1.127.2010&rep=rep1&type=pdf [Accessed 27th March 2018].

Barry, R. (2018) *Three True Tales about Music and Technology*. UK, Rough Trade Books.

Barsky, D. J. (2019) Does an invention discovered with artificial intelligence obtain patent protection? *Holland & Knight*. Available from: https://www.hklaw.com/en/insights/publications/2020/05/does-an-invention-discovered-with-ai-obtain-patent [Accessed 29th June 2020].

Bartmanski, D., & Woodward, I. (2014) *Vinyl: The analogue record in the digital age*. London, Bloomsbury Academic.

Bayern, S. (2016) The implications of modern business – Entity law for the regulation of autonomous systems. *European Journal of Risk Regulation. 7* (2), pp. 297-309. Available from: https://doi.org/10.1017/S1867299X00005729 [Accessed 4th May 2020].

Baym, N. K. (2018) *Playing to the crowd – Musicians, audiences and the intimate work of connection*. New York, New York University Press.

Bazinet, J. B., et al. (2018) Putting the band back together: Remastering the world of music. *Citi GPS Global Perspectives and Solutions*. Available from: https://ir.citi.com/NhxmHW7xb0tkWiqOOG0NuPDM3pVGJpVzXMw7n%2BZg4AfFFX%2BeFqDYNfND%2B0hUxxXA [Accessed 2nd May 2020].

BBC (2019) TikTok owner investigated over Musical.ly deal. *BBC News.* Available from: https://www.bbc.com/news/technology-50267985 [Accessed 28th April 2020].

Beck, L. W. (1960) *A Commentary on Kant's critique of practical reason*. Chicago, University of Chicago Press.

Becker, T. (2015) Jukedeck uses artificial intelligence to create unique, royalty-free music for your videos. *Social Media Week*. Available from: https://socialmediaweek.org/blog/2015/12/jukedeck-artificial-intelligence-royalty-free-music/ [Accessed 2nd May 2020].

Behmann, F., & Wu, K. (2015) *Collaborative Internet of Things (C-IoT) for future smart connected life and business.* West Sussex, John Wiley & Sons Ltd.

Beijing Academy of Artificial Intelligence (BAAI) (2019) *Beijing AI principles*. Available from: https://www.baai.ac.cn/blog/beijing-ai-principles [Accessed 2nd May 2020].

Bell, C. (2011) Algorithmic music composition using dynamic Markov chains and genetic algorithms. *Journal of Computing Sciences in Colleges*, *27*(2), pp. 99-107. Available from: https://dl.acm.org/doi/10.5555/2038836.2038850 [Accessed 8th December 2019].

Benedikter, R., & Siepmann, K. (2016) "Transhumanism": A new global political trend? *Challenge. 59* (1), pp. 47-59. Available from: https://doi.org/10.1080/05775132.2015.1123574 [Accessed 12th June 2018].

Benoit, E. (1976) "A dynamic equilibrium economy." *The Bulletin of the Atomic Scientist, 32* (2), pp. 47-55. Available from: https://doi.org/10.1080/00963402.1976.11455567 [Accessed 15th May 2018].

Berger, P. L., & Luckmann, T. (1966) *The social construction of reality: A treatise in the sociology of knowledge.* New York, Doubleday Anchor Books.

Berne, R. (2001) "Robosapiens, transhumanism, and the Kurzweilian utopia: Why the trans in transhumanism?" *Iris 43* (36). Available from: [Accessed 27th March 2017].

Berryhill, J., et al. (2019) Hello, World: Artificial intelligence and its use in the public sector. *OECD Working Papers on Public Governance 36*, OECD Publishing. Available from: https://doi.org/10.1787/19934351 [Accessed 2nd May 2020].

Best, J. (2013) IBM Watson: The inside story of how the Jeopardy-winning supercomputer was born, and what it wants to do next. *TechRepublic*. Available from: https://www.techrepublic.com/article/ibm-watson-the-inside-story-of-how-the-jeopardy-winning-supercomputer-was-born-and-what-it-wants-to-do-next/ [Accessed 27th April 2020].

Biederman, Donald E., et al. (2007) *Law and business of the entertainment industries*. 5th ed. Westport, Praeger Publishers.

Bienvenu, L. (2013) Are DJs musicians? Eleven heavyweights weigh in. *Santa Fe Reporter*. Available from: https://www.sfreporter.com/music/2013/02/12/are-djs-musicians/ [Accessed 11th October 2015].

Bijan, S. (2020) OpenAI introduces Jukebox, a new AI model that generates genre-specific music. *Verge.com*. Available at: https://www.theverge.com/2020/4/30/21243038/openai-jukebox-model-raw-audio-lyrics-ai-generated-copyright [Accessed 8th May 2020].

Bijker, W. E. (2009) Social construction of technology. In: Olsen, J. K., Pedersen, S. A., & Hendricks, V. (eds) *A companion to the philosophy of technology.* Chichester, Blackwell Publishing, pp. 88-94.

Bijker, W. E., & Hughes, T.P., & Pinch, T. (Eds.) (2012) *The social construction of technological systems – new directions in the sociology and history of technology*. Cambridge, The MIT Press.

Bijker, W. E., Boonig, J., & van Oost, E. C. (1984) The social construction of technological artefacts. *Zeitschrift fur Wissenschaftsforschung, 3* (2), pp. 39-52.

Bijsterveld, K., & Peters, P.K. (2010) Composing claims on musical instrument development: A science and technology studies' contribution. *Interdisciplinary Science Reviews, 35* (2), pp. 106-21. Available from: https://doi.org/10.1179/030801810X12723585301039 [Accessed 28th March 2015].

Bindas, K. J. (1993) "The future is unwritten": The Clash, punk and America, 1977-1982. *American Studies, 34* (1), pp. 69-83. Available from: https://www.jstor.org/stable/40642496 [Accessed 13th October 2015].

Birkinbine, B. J. (2015) Conflict in the Commons: Towards a political economy of corporate involvement in free and open source software. *The Political Economy of Communication 2* (2). Available from: http://www.polecom.org/index.php/polecom/article/view/35 [Accessed 5th May 2020].

Blacklow, J. (2015) 21 Top DJs share their secrets for the perfect new year's eve party playlist. *Entertainment News Online*. Available from: https://www.etonline.com/music/155707_21_top_djs_share_their_secrets_for_the_perfect_new_year_eve_party_playlist [Accessed 15th June 2015].

Blau, M. (2011) 4 ways Steve Jobs and Apple changed the music industry. *Mashable*. Available from: https://mashable.com/2011/10/11/apple-changed-music/ [Accessed 28th April 2020].

Bleistein v. Donaldson Lithographing Co., (1903) 188 US 239, 23 S. Ct. 298

Boldrin, M., & Levine, D.K. (2009) Does intellectual monopoly help innovation. In: *Review of Law & Economics 5* (3). UCLA Department of Economics. Available from: https://doi.org/10.2202/1555-5879.1438 [Accessed 20th April 2020].

Bonada, J., et al. (2001) Singing voice synthesis combining excitation plus resonance and sinusoidal plus Residual Models. *International Computer Music Association Conference Proceedings 2001*. Available from: https://quod.lib.umich.edu/i/icmc/bbp2372.2001.093/1 [Accessed 29th March 2017].

Bone, R.G. (2015) Trademark functionality reexamined. *Journal of Legal Analysis*. *7* (1), pp. 183-246. Available from: http://doi.org/10.1093/jla/lav002 [Accessed 4th May 2020].

Bonnington, C. (2014) Forget vinyl you can DJ like a pro with this new app *Wired.com.* Available from: https://www.wired.com/2014/12/djay-pro-mac-app/ [Accessed 21st October 2015].

Boomy (2020) Boomy – Make instant music with artificial intelligence. *Boomy.* Available from: https://boomy.com/ [Accessed 27th April 2020].

Booton, J. (2017) Watson won 'Jeopardy,' but IBM is not winning with artificial intelligence. *MarketWatch.* Available from: https://www.marketwatch.com/story/watson-won-jeopardy-but-ibm-is-not-winning-with-artificial-intelligence-2017-05-05 [Accessed 7th April 2020].

Bory, P. (2020) Deep new: The shifting narratives of artificial intelligence from Deep Blue to AlphaGo. *Convergence: The Journal of Research into New Media Technologies 25* (4), p. 627. Available from: https://doi.org/10.1177/1354856519829679 Accessed 26th April 2020].

Bosher, H. (2019a) Jury awards Joyful Noise $2.8M in copyright infringement damages for Katy Perry's Dark Horse. *The IPKat*. Available from: http://ipkitten.blogspot.com/2019/08/jury-awards-joyful-noise-28m-in.html [Accessed 4th May 2020].

Bosher, H. (2019b*)* Warner Music signs distribution deal with AI generated music app Endel. *IP Kitten*. Available from: http://ipkitten.blogspot.com/2019/03/warner-music-signs-distribution-deal.html [Accessed 28th April 2020].

Bosker, B. (2017) Life as Francisco Vico, creator of the incredible computer-composer Iamus. *HuffPost.* Available from: https://www.huffpost.com/entry/francisco-vico-iamus-melomics_n_2457374 [Accessed 28th April 2020].

Boss, S. (2010) Do no evil. *Stanford Social Innovation Review*, *8* (4), pp. 66-71. Available from: https://ssir.org/articles/entry/do_no_evil# [Accessed 26th April 2020].

Bostrom, N. (2014) *Superintelligence: Paths, Dangers and Strategies*. Oxford, Oxford University Press.

Bostrom, N. (2005) A History of transhumanist thought. *Journal of Evolution and Technology*. *14* (1). Available from: https://www.nickbostrom.com/papers/history.pdf [Accessed 27th March 2017].

Bostrom, N. (1998) How long before superintelligence? *International Journal of Future Studies.* (2). Available from: https://www.nickbostrom.com/superintelligence.html [Accessed 3rd April 2020].

Bowie, D. (1979) DJ. *Lodger.* RCA. Vinyl.

Bown, O., & Martin, A. (2012) Autonomy in music-generating systems. *AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment*. Palo Alto, California. Available from: https://www.aaai.org/ocs/index.php/AIIDE/AIIDE12/paper/view/5492 [Accessed 29th March 2017].

Bradley, L. (2000) *Bass culture: When reggae was king.* London, Viking.

Brand, S. (1968) We are as Gods. *wholeearth.com*. Autumn 1968. Available from: https://monoskop.org/images/0/09/Brand_Stewart_Whole_Earth_Catalog_Fall_1968.pdf [Accessed 27th March 2017].

Braun, H-J. (Ed.) (2002) *Music and technology in the Twentieth Century*. Baltimore, John Hopkins University Press.

Brennan, W. & Co. Solicitors (2020) Intellectual property. *LawOnline*. Available from: https://www.lawonline.ie/index.php/law-guides/business/intellectual-property [Accessed 5th May 2020].

Brewster, B., & Broughton, F. (2010) *The record players: DJ revolutionaries*. London, DJhistory.com.

Brewster, B., & Broughton, F. (2003) *How to DJ right: The art and science of playing records.* New York, Grove Press.

Brewster, B., & Broughton, F. (1999) *Last night a DJ saved my life: The history of the disc jockey.* London, Headline Book Publishing.

Bridgeman Art Library, Ltd. v. Corel Corp. (1999) 36 F. Supp. 2d 191, Southern District of New York

Bridy, A. (2012) Coding creativity: Copyright and the artificially intelligent author. *Stanford Technology Law Review* 5, pp. 1-28.; University of Pittsburgh Legal Studies Research Paper No.2011-25. Available from: https://ssrn.com/abstract=1888622 [Accessed 4th May 2020].

Bright Tunes Music Corp. v. Harrisongs Music, Ltd. (1976) 420 F. Supp. 177, Southern District of New York

Brimsted, K., Chesney, G., & Smith, H. (2008) The ECJ's judgement in Promusicae: The unintended consequences – music to the ears of copyright owners or a privacy headache for the future? A comment. *Computer Law & Security Review 24* (3), pp. 275-279. Available from: https://doi.org/10.1016/j.clsr.2008.03.006 [Accessed 26th March 2017].

British Go Association (n.d.) A comparison of Chess and Go *britgo.org*. Available from: http://britgo.org/learners/chessgo.html [Accessed 27th March 2017].

Brooker, K. (2019) Google's quantum bet on the future of AI – and what it means for humanity. Fast Company. Available from: https://www.fastcompany.com/90396213/google-quantum-supremacy-future-ai-humanity [Accessed 5th June 2020].

Brown, A. R. (2015) *Music Technology and Education: Amplifying Musicality*. *2nd ed*. London, Routledge.

Brown, A. R. (2006) Code Jamming. *Media-Culture Journal 9* (6). Available from: http://www.journal.media-culture.org.au/0612/03-brown.php [Accessed 29th March 2017].

Brown, J. (2009) *Rick Rubin: In the studio*. Toronto, ECW Press.

Brown, M. (2016) 'New Rembrandt' to be unveiled in Amsterdam. *The Guardian*. Available from: https://www.theguardian.com/artanddesign/2016/apr/05/new-rembrandt-to-be-unveiled-in-amsterdam [Accessed 4th May 2020].

Bruncko, M. (2015) Beyond the fourth industrial revolution. *World Economic Forum*. Available from: https://www.weforum.org/agenda/2015/11/are-you-ready-for-the-information-revolution/ [Accessed 8th May 2020].

Brynjolfsson, E., & McAfee, A. (2014) *The second machine age: Work, progress, and prosperity in a time of brilliant technologies.* London, W.W. Norton & Company.

Burger, M. (2020) The risk to population health equity posed by automated decision systems: A narrative review. *arXiv:2001.06615 [Cs]*. Available from: http://arxiv.org/abs/2001.06615 [Accessed 4th April 2020].

Burgess, M. (2016) Google's AI has written some amazingly mournful poetry. *Wired UK*. [Online]. Available from: https://www.wired.co.uk/article/google-artificial-intelligence-poetry [Accessed 4th May 2020].

Burkart, P., & McCourt, T. (2006) *Digital music wars: Ownership and control of the celestial jukebox.* Lanham, Rowman & Littlefield.

Burnim, M.V., & Maultsby, P.K. (Eds.) (2014) *African American music: An Introduction.* 2nd ed. New York, Routledge.

Burrow-Giles Lithographic Co. v. Sarony (1884) 111 US 53, 4 S. Ct. 279, 28 L. Ed. 349

Cabrera, M. (2016) Sony develops algorithm based AI Music. *reuters.com* Available from: https://www.reuters.com/article/us-sony-algorithm-idUSKBN12H1ST [Accessed 22nd February 2017].

CambridgeIP (2014) *An analysis of intellectual property activity in Ireland based on existing data*. An independent report for Forfás/Department of Jobs Enterprise and Innovation Available from: https://dbei.gov.ie/en/Publications/Publication-files/An-Analysis-of-Intellectual-Property-Activity-in-Ireland-Based-on-Existing-Data.pdf [Accessed 5th May 2020].

Campbell v. Acuff-Rose Music, Inc. (1994) 510 US 569

Campbell, A., & Kelly, D. M. (2020) KTI practical guide managing intellectual property & confidentiality. *knowledge transfer Ireland* Available from: https://www.knowledgetransferireland.com/Model-Agreements/Practical-Guides/KTI-Practical-Guide-Managing-Intellectual-Property-Confidentiality.pdf [Accessed 5th May 2020].

Caparros-Gonzalez, R.A., et al. (2018) Listening to relaxing music improves physiological responses in premature infants: A randomized controlled trial.

Advances in Neonatal Care 18 (1), pp. 58 -69. Available from: http://doi.org/10.1097/ANC.0000000000000448 [Accessed 20th March 2020].

Cardiner, B. (2014) Ableton CEO Gerhard Behles talks killing your darlings, piracy and more. *Highsnobiety Online*. Available from: https://www.highsnobiety.com/p/ableton-ceo-gerhard-behles-interview/ [Accessed 21st November 2014].

Carnachan, R. (1996) Sampling and the music industry: A discussion of the implications of Copyright Law. *Auckland University Law Review*. *8*, pp. 1033-1058. Available from: http://kirra.austlii.edu.au/nz/journals/AukULRev/1999/4.pdf [Accessed 4th May 2020].

Carr, N. (2015) *The Glass Cage: Where automation is taking us.* London, The Bodley Head.

Casey, M., & Nzau, S. (2019) Robots kill jobs. But they create jobs, too. *Brookings.* Available from: https://www.brookings.edu/blog/up-front/2019/03/18/robots-kill-jobs-but-they-create-jobs-too/ [Accessed 8th May 2020].

Cassel, D. (2017) Could AI algorithms one day make better art than humans? *The New Stack*. Available from: https://thenewstack.io/ai-algorithms-one-day-make-better-art-humans/ [Accessed 28th April 2020].

Casselman, B. (2019) Why wages are finally rising, 10 years after the recession. *The New York Times*. Available from: https://www.nytimes.com/2019/05/02/business/economy/wage-growth-economy.html [Accessed 8th May 2020].

Castells, M. (2011) *The rise of the network society*. John Wiley & sons.

Castro, D., McLaughlin, M., & Chivot, E. (2019) Who is winning the AI race: China, the EU or the United States? *Center for Data Innovation*. Available from: https://www.datainnovation.org/2019/08/who-is-winning-the-ai-race-china-the-eu-or-the-united-states/ [Accessed 8th May 2020].

Čerka, P., Grigienė, J., & Sirbikytė, G. (2015) Liability for damages caused by artificial intelligence. *Computer Law & Security Review*. *31* (3), pp. 376 -389. Available from: https://doi.org/10.1016/j.clsr.2015.03.008 [Accessed 4th May 2020].

Černý, M. (2019) Narrow big data in a stream: Computational limitations and regression. *Information Sciences*. 486, pp. 379-392. Available from: https://doi.org/10.1016/j.ins.2019.02.052 [Accessed 1st April 2020].

CFI (2020) *Leverhulme Centre for the Future of Intelligence.* Available from: http://lcfi.ac.uk/ [Accessed 30th June 2020].

Challis, B. (2009) The song remains the same: A review of the legalities of music sampling. *WIPO Magazine*. Available from: https://www.wipo.int/wipo_magazine/en/2009/06/article_0006.html [Accessed 4th May 2020].

Chalmers, D. J. (1996) *The conscious mind: In search of a fundamental theory*. Oxford, Oxford University Press.

Chaney, D. (2012) The music industry in the digital age: Consumer participation in value creation. *International Journal of Arts Management, 15* (1), pp. 42-52. Available from: https://www.jstor.org/stable/41721144 [Accessed 30th March 2020].

Chen, I. (2020) Chinese company Tencent in talks to buy stake in Warner Music. LA Biz Journal. Available from: https://www.bizjournals.com/losangeles/news/2020/05/29/tencent-in-talks-to-buy-stake-in-warner-music.html [Accessed 10th July 2020].

Chen, L. (2017) Tencent music drowns out Spotify and Apple in China. *Bloomberg*. Available from: https://www.bloomberg.com/news/articles/2017-12-13/tencent-fends-off-spotify-apple-in-china-s-battle-for-the-bands [Accessed 28th April 2020].

Cheng, J. (2009) Virtual composer makes beautiful music – And stirs controversy. *Ars Technica*. Available from: https://arstechnica.com/science/2009/09/virtual-composer-makes-beautiful-musicand-stirs-controversy/ [Accessed 28th March 2017].

Chess Base Products (2011) *Ludwig 3 – Introduction*. Available from: https://www.youtube.com/watch?v=AeLvBQP9WLQ&feature=emb_logo [Accessed 27th April 2020].

Chivot E. (2019) 5 Q's for Pierre Barreau, CEO of AIVA. *Center for data innovation*. Available from: https://www.datainnovation.org/2019/05/5qs-for-pierre-barreau-ceo-of-aiva/ [Accessed 27th April 2020].

Christians, C. G., et al. (2020) *Media ethics: Cases and moral reasoning*. New York, Routledge.

Christie's (2018) Is artificial intelligence set to become art's next medium? *Christie's*. Available from: https://www.christies.com/features/A-collaboration-between-two-artists-one-human-one-a-machine-9332-1.aspx [Accessed 4th May 2020].

Christopher, D. P. (2015) *British culture: An introduction.* 3rd ed. London, Routledge.

Clancy, M (Ed.) (n.d.) Artificial Intelligence and Creative Music Practice. Pre-print. London, Routledge.

Clements, A. (2018) A postdigital future for music education: Definitions, implications, and questions. *Action, Criticism, and Theory for Music Education 17* (1), pp. 48-80. Available from: http://doi.org/10.22176/act17.1.48 [Accessed 19th March 2020].

Cloud.Google.com (2020) *Cloud Text-to-Speech – Speech synthesis*. Google Cloud. Available from: https://cloud.google.com/text-to-speech [Accessed 7th April 2020].

Coelho, V., & Covach, J. (Eds.) (2019) *The Cambridge companion to the Rolling Stones*. Cambridge University Press.

Cohen, H. G. (2010) *Duke Ellington's America*. Chicago, The University of Chicago Press.

Cole, S. J. (2011) The prosumer and the project studio: The battle for distinction in the field of music Recording. *Sociology, 45* (3), pp. 447-463. Available from: https://doi.org/10.1177%2F0038038511399627 [Accessed 29th March 2019].

Cole-Turner, R. (Ed.) (2011) *Transhumanism and transcendence: Christian hope in an age of technological enhancement.* Washington, Georgetown University Press.

Colitre, W. B. (2019) Streaming revenue update. *Computer & internet lawyer*, *36*(9), pp. 1-8. Available from: http://search.ebscohost.com.elib.tcd.ie/login.aspx?direct=true&db=bth&AN=138075892 [Accessed 29 April 2020].

Colizzi, V., et al. (2019) Structural transformation to attain responsible BIOSciences (STARBIOS2): Protocol for a Horizon 2020 funded European multicenter project to promote responsible research and innovation, *JMIR Res Protoc 2019; 8*(3) e11745. Available from: https://www.researchprotocols.org/2019/3/e11745/ [Accessed 2nd May 2020].

Collins, H. M., & Pinch, T. (1982) *Frames of meaning: The social construction of extraordinary science*. London, Routledge and Kegan Paul.

Collins, N. (2016) A funny thing happened on the way to the formula: Algorithmic composition for musical theatre. *Computer Music Journal 40* (3), pp. 41-57.

Available from: https://doi.org/10.1162/COMJ_a_00373 [Accessed 29th March 2017].

Collins, N. (2011) Trading faures: Virtual musicians and machine ethics. *Leonardo Music Journal 21* (21) pp. 35-39. Available from: http://doi.org/10.1162/LMJ_a_00059 [Accessed 8th May 2020].

Collins, N. (2004) Composers inside electronics: Music after David Tudor. *Leonardo Music Journal 14* (1), iv, pp. 1-3. Available from: https://muse.jhu.edu/article/176388/pdf [Accessed 30th March 2017].

Collins, N., et al. (2003) Live coding in laptop performance. *Organised Sound 8* (3), pp. 321-330. Available from: https://doi.org/10.1017/S135577180300030X [Accessed 29th March 2017].

Committee on Economic, Social and Cultural Rights (2005) Committee on economic, social and cultural rights, general comment 17, the right of everyone to benefit from the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he or she is the author (article 15, paragraph 1 (c), of the Covenant), U.N. Doc. E/C.12/GC/17 (2006). *University of Minnesota Human Rights Library*. Available from: http://hrlibrary.umn.edu/gencomm/escgencom17.html [Accessed 4th May 2020].

Committee on Legal Affairs (2015) Working group on legal questions related to the development of robotics and artificial intelligence. In*: European Parliament meeting of 19 November*, Brussels, ASP 5G2. Available from: https://www.europarl.europa.eu/cmsdata/95466/Minutes%20Robotics%2019nov.pdf [Accessed 4th May 2020].

Congressional Record US (2010) Proceedings and debates of the 111th Congress First Session. Volume 155 – Part 9. Available from: https://www.congress.gov/congressional-record/111th-congress/browse-by-date [Accessed 2nd May 2020].

Constine J. (2015) Need music for a video? Jukedeck's AI composer makes cheap, custom soundtracks. *TechCrunch* Available from: https://social.techcrunch.com/2015/12/07/jukedeck/ [Accessed 27th April 2020].

Cooke, C. (2019) The record industry comments on the bloody Copyright Directive. *Complete Music Update.* Available from: https://completemusicupdate.com/article/the-record-industry-comments-on-the-bloody-copyright-directive/ [Accessed 2nd May 2020].

Cooper, D. (2019) How TikTok gets rich while paying artists pennies. *Pitchfork.* Available from: https://pitchfork.com/features/article/the-great-music-meme-

scam-how-tiktok-gets-rich-while-paying-artists-pennies/ [Accessed 28th April 2020].

Cope, D. (2012) *Ars Ingenero*. Santa Cruz CA, Epoc.

Cope, D. (2005) *Computer models of musical creativity* (p. xi462). Cambridge, MIT Press.

Cope, D. (2004) A musical learning algorithm. *Computer Music Journal 28* (3), pp. 12-27. Available from: https://doi.org/10.1162/0148926041790685 [Accessed 25th April 2020].

Cope, D. (2001) *Virtual music: Computer synthesis of musical style*. Cambridge, MIT press.

Cope, D. (1999) Facing the music: Perspectives on machine-composed music. *Leonardo Music Journal 9*, pp. 79-87. Available from: https://doi.org/10.1162/096112199750316857 [Accessed 27th April 2020].

Cope, D. (1996) *Experiments in musical intelligence (Vol. 1)*. Madison, WI, A-R editions.

Cope, D. (1987) An expert system for computer-assisted composition. *Computer Music Journal*. *11* (4), pp. 30-46. Available from: https://www.jstor.org/stable/3680238 [Accessed 7th December 2019].

Covel, M. W. (2017) *Trend following, 5th edition: How to make a fortune in bull, bear, and black swan markets*. Hoboken New Jersey, John Wiley & Sons.

Crawford, K. (2016) Artificial intelligence's white guy problem. *New York Times*. Available from: https://www.nytimes.com/2016/06/26/opinion/sunday/artificial-intelligences-white-guy-problem.html [Accessed 27th April 2020].

Crawford, K., et al. (2019) *AI Now 2019 Report*. New York, AI Now Institute. Available from: https://ainowinstitute.org/AI_Now_2019_Report.html [Accessed 2nd May 2020].

Crawford, K., et al. (2018) *AI Now 2018 Report*. New York, AI Now Institute. Available from: https://ainowinstitute.org/AI_Now_2018_Report.pdf [Accessed 2nd May 2020].

Crawford, K., et al. (2017) *AI Now 2017 Report*. New York, AI Now Institute. Available from: https://assets.ctfassets.net/8wprhhvnpfc0/1A9c3ZTCZa2KEYM64Wsc2a/863655

7c5fb14f2b74b2be64c3ce0c78/_AI_Now_Institute_2017_Report_.pdf [Accessed 2nd May 2020].

Creator Academy (2020) Produce videos with global appeal. *Creator Academy, YouTube*. Available from: https://creatoracademy.youtube.com/page/lesson/global-format [Accessed 3rd May 2020].

Crecente, B. (2013) Tencent's $330M Epic Games investment absorbed 40 percent of developer [Updated]. *Polygon.* Available from: https://www.polygon.com/2013/3/21/4131702/tencents-epic-games-stock-acquisition [Accessed 8th May 2020].

Crilly, A. (2017) A brief history of sampling. *University Observer*. Available from: https://universityobserver.ie/a-brief-history-of-sampling/ [Accessed 4th May 2020].

Crouse, R. (2000) *Big Bang, Baby: Rock Trivia*. Canada, Dundurn.

Crunchbase (2020a) David Cope – CTO / Co-founder @ Recombinant. *Crunchbase.* Available from: https://www.crunchbase.com/person/david-cope [Accessed 27th April 2020].

Crunchbase (2020b) DeepMind – Current Team. *Crunchbase.* Available from: https://www.crunchbase.com/organization/deepmind [Accessed 27th April 2020].

Crunchbase (2020c) Amadeus Code *Crunchbase*. Available from: https://www.crunchbase.com/organization/amadeus-code-tokyo-japan [Accessed 27th April 2020].

Crunchbase (2020d) Amper Music. *Crunchbase*. Available from: https://www.crunchbase.com/organization/amper-music [Accessed 27th April 2020].

Crunchbase (2020e) Popgun. *Crunchbase*. Available from: https://www.crunchbase.com/organization/popgun [Accessed 27th April 2020].

Crunchbase (2020f) Aiva Technologies. *Crunchbase*. Available from: https://www.crunchbase.com/organization/aiva-technologies#section-lists-featuring-this-company [Accessed 27th April 2020].

Crunchbase (2020) Crunchbase: Discover innovative companies and the people behind them. *Crunchbase.* Available from:

https://www.crunchbase.com/search/principal.investors/field/organizations/num_investors/deepmind [Accessed 7th April 2020].

Cummings, A.S. (2013) *Democracy of sound – Music piracy and the remaking of American copyright in the Twentieth Century.* New York, Oxford University Press.

Curtis, M. (2017) Fjord launches 2018 Trends Report. *Fjord.* Available from: https://www.fjordnet.com/conversations/fjord-launches-2018-trends-report/ [Accessed 28th April 2020].

D'Alessandro, M., Radev, S. T., Voss, A., & Lombardi, L. (2020) A Bayesian brain model of adaptive behavior: An application to the Wisconsin card sorting task. To be Published in [Pre-print] ArXiv:2003.07394 [q-Bio]. Available from: http://arxiv.org/abs/2003.07394 [Accessed 2nd April 2020].

D'Onfro, J. (2019) Google employees protest 'Anti-LGBTQ' conservative's appointment To AI Ethics Council. *Forbes.* Available from: https://www.forbes.com/sites/jilliandonfro/2019/04/01/google-employees-protest-anti-lgbtq-conservatives-appointment-to-its-ai-ethics-council/#4fd62b1413e1 [Accessed 28th April 2020].

DADABOTS Official (2019) *RELENTLESS DOPPELGANGER \m/ \m/ \m/ \m/ \m/ \m/ \m/ \m/ \m/ \m/ \m/ \m/* Available from: https://www.youtube.com/watch?v=MwtVkPKx3RA [Accessed 24th March 2020].

Dahlbeck, A. (n.d.) The sustainable development goals (SDGs). *The Danish Institute for Human Rights.* Available from: https://www.humanrights.dk/learning-hub/sustainable-development-goals-sdgs [Accessed 2nd May 2020].

DailyFX, NASDAQ (2018) What is the FANG group and why does it matter? *NASDAQ*. Available from: https://www.nasdaq.com/articles/what-nasdaq-fang-group-and-why-does-it-matter-2018-08-09 [Accessed 28th April 2020].

Dalton, A. (2020) Judge hands major win to Katy Perry in 'Dark Horse' dispute. *AP NEWS.* Available from: https://apnews.com/c1f74039c73ea11888fe7ef8451491cc [Accessed 4th May 2020].

Daly, C. (2018) Why Asia will become the world's AI powerhouse. *AI Business*. Available from: https://aibusiness.com/asia-ai-powerhouse/ [Accessed 28th April 2020].

Dannenberg, R.B. (2006) Book review: Computer models of musical creativity, David Cope, MIT Press (2005) *Artificial Intelligence*. *170* (18), pp. 1218-1221. Available from: http://doi.org/10.1016/j.artint.2006.10.004 [Accessed 8th December 2019].

Dasgupta, S. (2020) Technology: Computational Creativity. In: Steven Pritzker & Mark Runco (eds.). Encyclopedia of Creativity (Third Edition). [Online]. Oxford, Academic Press. pp. 554–559. Available from: http://doi:10.1016/B978-0-12-809324-5.23765-6 [Accessed: 9 December 2020].

Dataethics (2019) Danish companies behind seal for digital responsibility. *Data Ethics*. Available from: https://dataethics.eu/danish-companies-behind-seal-for-digital-responsibility/ [Accessed 29th June 2020].

Dataethics (2018) Ethics Washing Is When Ethics is A Substitute for Regulation. *Data Ethics*. Available from: https://dataethics.eu/ethics-washing-is-when-ethics-is-a-substitute-for-regulation/ [Accessed 17th July 2020].

David, M. (2019) AI and the illusion of human-algorithm complementarity. In: *Social Research: An International Quarterly 86* (4 Winter), pp. 887-908. Available from: https://www.muse.jhu.edu/article/748877 [Accessed 20th March 2020].

Davies, P. L. (2008) *Gower and Davies: Principles of modern company law 8th edition*. London, Sweet & Maxwell.

Davis, E. (2015) Ethical guidelines for a superintelligence. *Artificial Intelligence 220*, pp. 121-124. Available from: https://doi.org/10.1016/j.artint.2014.12.003 [Accessed 24th March 2020].

Day, T. (2002) *A century of recorded music: Listening to musical history.* New Haven, Yale University Press.

de Carvalho, N. P. (2017) *The TRIPS regime of patents and test data. 5th edition*. Kluwer Law International BV.

de la Torre-Luque, A., et al. (2016) Acute stress recovery through listening to Melomics relaxing music: A randomized controlled trial. *Nordic Journal of Music Therapy 26* (2), pp. 124-141. Available from: https://doi.org/10.1080/08098131.2015.1131186 [Accessed 22nd February 2017].

De Spiegeleire, S., Maas, M., & Sweijs, T. (2017) *AI – today and tomorrow*. In: Artificial intelligence and the future of defense. pp. 43-59. Hague Centre for Strategic Studies. Available from: http://www.jstor.org/stable/resrep12564.8 [Accessed 3rd April 2020].

De Stefano, V. (2015) The rise of the "just-in-time workforce": On-demand work, crowdwork, and labor protection in the "gig-economy". *Comparative Labor Law & Policy Journal 37* (3), pp. 471-504. Available from: https://ssrn.com/abstract=2682602 [Accessed 3rd April 2020].

Deahl, D. (2019a) Amazon's new 'AI keyboard' is confusing everyone. *The Verge*. Available from: https://www.theverge.com/2019/12/4/20994203/amazon-web-services-deepcomposer-ai-keyboard-confusing-everyone [Accessed 27th April 2020].

Deahl, D. (2019b) Warner Music signed an algorithm to a record deal — what happens next? *The Verge*. Available from: https://www.theverge.com/2019/3/27/18283084/warner-music-algorithm-signed-ambient-music-endel [Accessed 28th April 2020].

Deahl, D. (2019c) This live stream plays endless death metal produced by an AI. *The Verge*. Available from: https://www.theverge.com/2019/4/27/18518170/algorithm-ai-death-metal-dadabots-live-stream-youtube-cj-carr-zack-zukowski [Accessed 9th April 2020].

Deahl, D. (2019d) We've been warned about AI and music for over 50 years, but no one's prepared. *Theverge.com*. Available from: https://www.theverge.com/2019/4/17/18299563/ai-algorithm-music-law-copyright-human [Accessed 7th April 2020].

Deahl, D. (2019e) The USPTO wants to know if artificial intelligence can own the content it creates. *The Verge*. Available from: https://www.theverge.com/2019/11/13/20961788/us-government-ai-copyright-patent-trademark-office-notice-artificial-intelligence [Accessed 19th June 2020].

Dean, R. T. (Ed.) (2009) *The Oxford handbook of computer music*. New York, Oxford University Press Inc.

Deek, F.P., & McHugh, J.A. (2007) *Open Source: technology and policy*. London, Cambridge University Press.

Dejohn, J. (2004) Where are all the cockroaches? *Journal of Experimental & Theoretical Artificial Intelligence. 16* (1), pp. 1-3. Available from: https://doi.org/10.1080/09528130310001659674 [Accessed 4th April 2020].

Delić, V., et al. (2019) Speech technology progress based on new machine learning paradigm. *Computational Intelligence and Neuroscience*. pp. 1-19. Available from: doi:10.1155/2019/4368036 [Accessed 4th April 2020].

Delvaux, M. (2017) *Report with recommendations to the Commission on Civil Law Rules on Robotics*. Available from: https://www.europarl.europa.eu/doceo/document/A-8-2017-0005_EN.html [Accessed 8th May 2020].

DeMain, B. (2007) You stole my song! From George Harrison to Michael Bolton, strange tales of copyright infringement. *Performing Songwriter 99* (Jan/Feb 2007) pp. 16-20. Available from: http://performingsongwriter.com/wp-content/uploads/2010/07/Stole-My-Song_99.pdf [Accessed 3rd May 2020].

Demers, J. (2006) *Steal this music: How intellectual property law affects musical creativity*. Athens, The University of Georgia Press.

Dennett, D. C. (2020) The age of post-intelligent design. In: Gouveia, S. S. (Ed.) *The Age of Artificial Intelligence: An Exploration*. Vernon Press, p. 27.

Dennett, D.C., (2017) *Bacteria to Bach and Back Again.* UK, Penguin Books.

Dennett, D. C. (2015) The singularity – an urban legend? In: *2015: What Do You Think About Machines That Think?* edge.org. Available from: https://www.edge.org/response-detail/26035 [Accessed 27th March 2017].

Dennett, D.C. (1980) The milk of human intentionality. *Behavioral and Brain Sciences 3* (3), pp. 428-430. Available from: https://doi.org/10.1017/S0140525X0000580X [Accessed 1st April 2020].

Denton, J. (2020) Future 25: Why Holly Herndon built a robot bandmate. *Rolling Stone*. Available from: https://www.rollingstone.com/music/music-features/future-25-holly-herndon-889072/ [Accessed 8th May 2020].

Department for Business, Energy & Industrial Strategy (2018) Gig economy research. *Government of United Kingdom.* Available from: https://www.gov.uk/government/publications/gig-economy-research [Accessed 28th April 2020].

Department of Business, Enterprise and Innovation (DBEI) (2020) Patents. *Department of Business, Enterprise and Innovation.* Available from: https://dbei.gov.ie/en/What-We-Do/Innovation-Research-Development/Intellectual-Property/Patents/ [Accessed 5th May 2020].

Department of Business, Enterprise and Innovation (DBEI) (2019a) Government investment in Research and Development amounted to €808.1million in 2019 – Minister Halligan. *Department of Business, Enterprise and Innovation*. Available from: https://www.gov.ie/en/press-release/3b4b9e-government-investment-in-research-and-development-amounted-to-8081-m/ [Accessed 20th June 2020].

Department of Business, Enterprise and Innovation (DBEI) (2019b) Disruptive Technologies Innovation Fund. *Department of Business, Enterprise and Innovation*. Available from: https://dbei.gov.ie/en/What-We-Do/Innovation-Research-Development/Disruptive-Technologies-Innovation-Fund/ [Accessed 17th July 2020].

Department of Business, Enterprise and Innovation (DBEI) (2019) Government launches Future Jobs Ireland to answer the future needs of our businesses and workers. *Department of Business, Enterprise and Innovation.* Available from: https://dbei.gov.ie/en/News-And-Events/Department-News/2019/March/10032019.html [Accessed 27th April 2020].

Department of International Cooperation (2017) *Next generation Artificial Intelligence Development Plan issued by State Council.* China Science & Technology Newsletter. Available from: http://fi.china-embassy.org/eng/kxjs/P020171025789108009001.pdf [Accessed 17th July 2020].

Department of Labor (2020) Unemployment rates in 15 states were lower than the 3.5-percent US rate in December 2019. *The Economics Daily: US Bureau of Labor Statistics*. Available from: https://www.bls.gov/opub/ted/2020/unemployment-rates-in-15-states-were-lower-than-the-3-point-5-percent-u-s-rate-in-december-2019.htm [Accessed 8th May 2020].

Determeyer, E. (2010) *Rhythm Is Our Business: Jimmie Lunceford and the Harlem Express*. USA., University of Michigan Press.

Devlin, H. (2015) Google a step closer to developing machines with human-like intelligence. *The Guardian UK.* Available from: https://www.theguardian.com/science/2015/may/21/google-a-step-closer-to-developing-machines-with-human-like-intelligence [Accessed 14th June 2015].

Diamandis, P., & Kotler, S. (2020) *The future is faster than you think: How converging technologies are transforming business, industries, and our lives*. New York, Simon & Schuster.

Diaz-Jerez, G. (2011) Composing with Melomics: Delving into the computational world for musical inspiration. *Leonardo Music Journal*. *21* (21), pp. 13-14. Available from: https://doi.org/10.1162/LMJ_a_00053 [Accessed 29th March 2017].

Dickey, J. (2015) Grammys: Sam Smith's 'Stay With Me' is your song of the year. *Mashable*. Available from: https://mashable.com/2015/02/08/grammys-sam-smiths-song-of-the-year/ [Accessed 4th May 2020].

DiCola, P. C. (2013) Money from music: Survey evidence on musicians' revenue and lessons about copyright incentives. *55 Arizona Law Review 301 (2013);*

Northwesters Law & Economics Research Paper No.13-01. Available from: https://ssrn.com/abstract=2199058 [Accessed 2nd May 2020].

Dictionary.com (2020) Definition of term of art. *Dictionary.com*. Available from: https://www.dictionary.com/browse/term-of-art [Accessed 5th May 2020].

Dignum, V. (2019) *Responsible artificial intelligence: How to develop and use AI in a responsible way*. Switzerland, Springer International Publishing.

Dijkstra E.W. (1984) The threats to computing science. *ACM South Central Regional Conference*. November 16-18, 1984, Austin, Texas. Available from: http://www.cs.utexas.edu/users/EWD/transcriptions/EWD08xx/EWD898.html [Accessed 7th April 2020].

Dilmaghani, S., et al. (2019) Privacy and security of big data in AI systems: A research and standards perspective. In: *2019 IEEE International Conference on Big Data (Big Data)*, 9-12th December 2019, pp. 5737-5743. Available from: https://doi.org/10.1109/BigData47090.2019.9006283 [Accessed 28th March 2020].

Directive 2006/115/EC (2020) Judgment of the Court: Copyright and related rights— Directive 2006/115/EC— Articles 8 and 10— Concepts of 'user' and 'communication to the public'— Installation in hotel bedrooms of televisions and/or radios to which the hotelier distributes a broadcast signal) *CURIA – Documents*. Available from: http://curia.europa.eu/juris/document/document.jsf?text=&docid=120461&pageIndex=0&doclang=EN [Accessed 4th May 2020].

Directive 2001/29/EC (2001) Directive 2006/115/EC of the European Parliament and of the Council of 12 December 2006 on rental right and lending right and on certain rights related to copyright in the field of intellectual property. *EUR-Lex – 32006L0115 – EN – EUR-Lex.* Available from: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32006L0115 [Accessed 3rd June 2020].

Discogs (2020) David Cope – Bach by Design: computer composed music – Experiments in Musical Intelligence. *Discogs.* Available from: https://www.discogs.com/David-Cope-Bach-By-Design-Computer-Composed-Music-Experiments-In-Musical-Intelligence/release/7531356 [Accessed 10th June 2020].

Domingos, P. (2015) *The master algorithm: How the quest for the ultimate learning machine will remake our world*. London, Penguin.

Drahoe, P. (Ed.) (2017) *Regulatory theory: Foundations and applications*. Canberra, Australian National University Press.

Dredge, S. (2019a) *Scott Cohen: 'Every 10 years something kills the music industry'.* Music Ally. Available from: https://musically.com/2019/01/29/scott-cohen-every-10-years-something-kills-the-music-industry/ [Accessed 2nd May 2020].

Dredge, S. (2019b) Boomy is the latest startup using AI to create music. *Music Ally*. Available from: https://musically.com/2019/01/02/boomy-is-the-latest-startup-using-ai-to-create-music/ [Accessed 27th April 2020].

Dredge, S. (2019c) Mubert pitches AI generative music for B2B background usage. *Music Ally*. Available from: https://musically.com/2019/07/24/mubert-pitches-ai-generative-music-for-b2b-background-usage/ [Accessed 28th April 2020].

Dredge, S. (2019d) Siri co-founder Tom Gruber talks about his new AI-music startup LifeScore. *Music Ally*. Available from: https://musically.com/2019/02/08/siri-tom-gruber-ai-music-lifescore/ [Accessed 28th April 2020].

Dredge, S. (2018a) AI-music startup Popgun evolves: 'We're gonna make hit pop songs...' *Music Ally*. Available from: https://musically.com/2018/11/06/ai-music-startup-popgun-evolves-hit-songs/ [Accessed 27th April 2020].

Dredge, S. (2018b) AI-music app Amadeus Code opens up to all with Spotify feature. *Music Ally*. Available from: https://musically.com/2018/09/06/ai-music-app-amadeus-code-opens-up-to-all-with-spotify-feature/ [Accessed 27th April 2020].

Dredge, S. (2018c) Abbey Road Red incubator adds two more startups… and a new boss. *Music Ally*. Available from: https://musically.com/2018/02/01/abbey-road-red-new-startups/ [Accessed 27th April 2020].

Dredge, S. (2018d) WaveAI launches EP with lyrics and melodies created by AI. *Music Ally*. Available from: https://musically.com/2018/10/23/waveai-launches-ep-with-lyrics-and-melodies-created-by-ai/ [Accessed 27th April 2020].

Dredge, S. (2018e) Shapeshifting startup AI Music closing £5m funding round. *Music Ally*. Available from: https://musically.com/2018/02/01/shapeshifting-startup-ai-music-closing-5m-funding-round/ [Accessed 28th April 2020].

Dredge, S. (2018f) Jukedeck takes its AI music to Korea with K-Pop collaboration. *Music Ally*. Available from: https://musically.com/2018/02/27/jukedeck-takes-ai-music-korea-k-pop-collaboration/ [Accessed 27th April 2020].

Dredge, S. (2017a) Playing next door to Alice: Popgun reveals its music AI. *Music Ally*. Available from: https://musically.com/2017/06/30/playing-alice-popgun-music-ai/ [Accessed 28th April 2020].

Dredge, S. (2017b) Jukedeck hopes artificial intelligence can 'democratise music'. *Music Ally*. Available from: https://musically.com/2017/08/09/jukedeck-artificial-intelligence-music/ [Accessed 27th April 2020].

Dredge, S. (2013) Thom Yorke calls Spotify 'the last desperate fart of a dying corpse'. *The Guardian*. Available from: https://www.theguardian.com/technology/2013/oct/07/spotify-thom-yorke-dying-corpse [Accessed 28th April 2020].

Dreier, T., & Hugenholtz, P. B. (Eds.) (2016) *Concise European Copyright Law, 2nd Edition*. Wolters Kluwer Law International BV.

Dreyfuss, R. C., & Strandburg, K. J. (Eds.) (2011) *The law and theory of trade secrecy: A handbook of contemporary research*. Edward Elgar Publishing.

Dubber, A. (2020) *About Andrew Dubber | Dubber*. Available from: https://andrewdubber.com/about/ [Accessed 8th May 2020].

Dubber, A. (n.d.) *andrewdubber.com*. [Accessed 27th March 2017].

Dubowsky, J.C. (2011) The evolving 'temp score' in animation. *Music, Sound, and the Moving Image 5* (1), pp. 1-24. Available from: https://doi.org/10.3828/msmi.2011.1 [Accessed 22nd April 2020].

Duhaime (2020) De Minimis Non Curat Lex Definition. *Duhaime's law dictionary.* Available from: http://www.duhaime.org/LegalDictionary/D/DeMinimisNonCuratLex.aspx [Accessed 4th May 2020].

Duhl, G.M. (2004) Old lyrics, knock-off videos, and copycat comic books: The fourth fair use factor in U.S. Copyright Law. *Syracuse Law Review* 54, p. 665. Available from: https://ssrn.com/abstract=1689685 [Accessed 3rd May 2020].

Durant, W. (1961) *Story of philosophy*. Simon and Schuster.

Du Sautoy, M. (2019) *The Creativity Code: Art and Innovation in the Age of AI*. US, Harvard University Press.

Duverneuil, B., & Torner, V. (2018) Digital ethics a guide for professionals in the digital age. *Cigref-Syntec.* Available from: https://www.cigref.fr/digital-ethics-guide-professionals-the-digital-age-cigref-syntec-2018 [Accessed 3rd May 2020].

Ebcioğlu, K. (1990) An expert system for harmonizing chorales in the style of J.S. Bach. *The Journal of Logic Programming*. *8* (1-2), pp. 145-185. Available from: https://doi.org/10.1016/0743-1066(90)90055-A [Accessed 27th April 2020].

ec.europa.eu (2018) *The European AI Alliance*. European Commission. Available from: https://ec.europa.eu/digital-single-market/en/european-ai-alliance [Accessed 8th May 2020].

Eck, D. (2016) Welcome to Magenta *Magenta.tensorflow.org*. Available from: https://magenta.tensorflow.org/blog/2016/06/01/welcome-to-magenta/ [Accessed 19th February 2017].

Eck, D., et al. (2016) Generating music by fine-tuning recurrent neural networks with reinforcement learning. *Deep Reinforcement Learning Workshop NIPS*. Barcelona, Spain. December 2016. Available from: https://research.google/pubs/pub45871/ [Accessed 28th March 2017].

Edison, T.A. (1875) The phonograph and its future. *North American Review*, *126.262* (878) pp. 527-36. Available from: https://archive.org/details/jstor-25110210/page/n1/mode/2up [Accessed 25th July 2015].

EDM Sauce (2014) The Frontman for Arcade Fire who made fun of DJs… is a DJ. *EDM Sauce*. Available from https://www.edmsauce.com/2014/09/25/frontman-arcade-fire-made-fun-djs-dj/ [Accessed 23rd October 2014].

Edwards, M. (2011) Algorithmic composition: Computational thinking in music. *Communications of the ACM 54* (7), pp. 58-67. Available from: https://doi.org/10.1145/1965724.1965742 [Accessed 29th March 2017].

Eger, T., & Scheufen, M. (2012) The past and the future of copyright law: Technological change and beyond. In: De Mot, J., (Ed.) *Liber Amicorum Boudewijn Bouckaert* pp. 37-65. Bruges, De Keuren.

Eggertsen, C. (2020) Ariana Grande accused of ripping off '7 Rings' chorus in new copyright lawsuit. *Billboard*. Available from: http://www.billboard.com/articles/business/legal-and-management/8548286/ariana-grande-7-rings-copyright-lawsuit [Accessed 4th May 2020].

Eisenlauer, V. (2013) *A critical hypertext analysis of social media – The true colours of Facebook.* London, Bloomsbury Academic.

Ekman, U., et al. (2020) *The Uncertain Image*. Routledge.

Elkhova, O. I., & Kudryashev, A.F. (2017) The creative ability of artificial intelligence / Dirbtinio intelekto kūrybiškumo gebėjimas. *Creativity Studies 10* (2), pp. 135-144. Available from: https://doi.org/10.3846/23450479.2017.1348396 [Accessed 27th April 2020].

Elliott, E. D. (1984) Holmes and Evolution: Legal process as artificial intelligence. *The Journal of Legal Studies*. *13* (1), pp. 113-146. Available from: https://www.jstor.org/stable/724345 [Accessed 4th May 2020].

Elliott, M. (2018) Surprising Fortnite bill? How to stop your kid from making in-app purchases. *CNET*. Available from: https://www.cnet.com/how-to/surprising-fortnite-bill-how-to-stop-your-kid-from-making-ios-in-app-purchases/ [Accessed 27th April 2020].

Endel (2020) Endel | Personalized environments that help you focus and relax. *Endel*. Available from: https://endel.io/ [Accessed 28th April 2020].

Engel, J., et al. (2019) GANSynth: Adversarial Neural Audio Synthesis. *arXiv:1902.08710 [cs, eess, stat]*. Available from: http://arxiv.org/abs/1902.08710 [Accessed 27th April 2020].

English, D. (2016) Inspiring Partnership – the national IP Protocol 2016. Policies and resources to help industry make good use of public research in Ireland. *Department of Jobs, Enterprise and Innovation*. Available from: https://www.knowledgetransferireland.com/ManagingIP/KTI-Protocol-2016.pdf [Accessed 5th May 2020].

Eno, B. (1996) Evolving Metaphors, in my opinion, is what artists do. *Imagination Conference 1996*. San Francisco, CA. June 1996. Available from: https://inmotionmagazine.com/eno1.html [Accessed 29th March 2017].

EPSRC (2010) Principles of robotics. *UK Engineering and Physical Science Research Council*. Available from: https://epsrc.ukri.org/research/ourportfolio/themes/engineering/activities/principlesofrobotics/ [Accessed 2nd May 2020].

Eronen, A. J., et al. (2005) Audio-based context recognition. *IEEE Transactions on Audio, Speech, and Language Processing 14* (1). pp. 321-329.

Esser, P., Rombach, R. & Ommer, B. (2020) A Note on Data Biases in Generative Models. 8.

Etherington, D. (2019) We won't be listening to music in a decade according to Vinod Khosla. *TechCrunch*. Available from: https://techcrunch.com/2019/06/12/we-

wont-be-listening-to-music-in-a-decade-according-to-vinod-khosla/ [Accessed 28th April 2020].

eurekalert.org (2019) Abundance of information narrows our collective attention span. *EurekAlert!* Available from: https://www.eurekalert.org/pub_releases/2019-04/tuod-aoi041119.php [Accessed 8th May 2020].

European Commission (2020a) *Music Moves Europe Preparatory action 2020: Innovative support scheme for a sustainable music ecosystem.* European Commission. Available from: https://ec.europa.eu/culture/calls/music-moves-europe-preparatory-action-2020-innovative-support-scheme-sustainable-music_en [Accessed 17th July 2020].

European Commission (2020b*) White Paper on Artificial Intelligence: a European approach to excellence and trust.* European Commission. Available from: https://ec.europa.eu/info/publications/white-paper-artificial-intelligence-european-approach-excellence-and-trust_en [Accessed 4th May 2020].

European Commission (2020c) *Germany AI Strategy Report.* European Commission. Available from: https://ec.europa.eu/knowledge4policy/ai-watch/germany-ai-strategy-report_en [Accessed 17th July 2020].

European Commission (2020) Funding and tender opportunities. Single electronic data interchange area (SEDIA). *Horizon 2020 Online Manual*. Available from: https://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/ssh_en.htm [Accessed 27th April 2020].

European Commission (2019a) *Liability for Artificial Intelligence and other emerging digital technologies.* European Commission. Available from: http://op.europa.eu/en/publication-detail/-/publication/1c5e30be-1197-11ea-8c1f-01aa75ed71a1/language-en/format-PDF [Accessed 4th May 2020].

European Commission (2019b) News: Artificial Intelligence. *European Commission.* Available from: https://ec.europa.eu/commission/news/artificial-intelligence-2019-apr-08_en [Accessed 17th July 2020].

European Commission (2018a) *Communication from the Commission to the European Parliament, The European Council, The Council, The European Economic and Social Committee and The Committee of the Regions – Artificial Intelligence for Europe (CAIE)*. Brussels, 25.4.2018 COM (2018) 237 final. Available from: https://ec.europa.eu/digital-single-market/en/news/communication-artificial-intelligence-europe [Accessed 2nd May 2020].

European Commission (2018b) *Communication from the Commission to the European Parliament, The European Council, The Council, The European Economic and*

Social Committee and The Committee of the Regions – Coordinated plan on artificial intelligence. Brussels, 7.12.2018 COM (2018) 795 final. Available from: https://ec.europa.eu/knowledge4policy/publication/coordinated-plan-artificial-intelligence-com2018-795-final_en [Accessed 2nd May 2020].

European Commission (2018c) *Germany AI Strategy Report.* European Commission. Available from: https://ec.europa.eu/knowledge4policy/ai-watch/germany-ai-strategy-report_en [Accessed 2nd July 2020].

European Commission (2018d) *Statement on artificial intelligence, robotics and 'autonomous' system.* European Commission Directorate-General for Research and Innovation Unit RTD.01 — Scientific advice mechanism European group on ethics in science and new technologies artificial intelligence, robotics and 'autonomous' systems. Available from: http://lefis.unizar.es/wp-content/uploads/EGE_Artificial-Intelligence_Statement_2018.pdf [Accessed 2nd May 2020].

European Commission for the Efficiency of Justice (CEPEJ) (2018) *European ethical charter on the use of artificial intelligence in judicial systems and their environment.* Available from: https://rm.coe.int/ethical-charter-en-for-publication-4-december-2018/16808f699c [Accessed 2nd May 2020].

European Parliament (2018) Amendments adopted by the European Parliament on 12 September 2018 on the proposal for a directive of the European Parliament and of the Council on copyright in the Digital Single Market. European Parliament. Available from: https://www.europarl.europa.eu/doceo/document/TA-8-2018-0337_EN.html?redirect [Accessed 17th July 2020].

European Parliament (2017) *Texts adopted – Civil law rules on robotics – Thursday, 16 February 2017*. Available from: https://www.europarl.europa.eu/doceo/document/TA-8-2017-0051_EN.html [Accessed 4th May 2020].

European Patent Office (2020) What is prior art? *EPO.* Available from: https://www.epo.org/learning-events/materials/inventors-handbook/novelty/prior-art.html [Accessed 4th May 2020].

EurWork (2018) Platform work. *Eurofound.* Available from: https://www.eurofound.europa.eu/observatories/eurwork/industrial-relations-dictionary/platform-work [Accessed 28th April 2020].

Expo, DJ., & Cant, T. (2014) A guide to different DJ setups. *Music Radar.* Available from: https://www.musicradar.com/news/dj/a-guide-to-different-dj-setups-598128 [Accessed 15th October 2015].

Falconer, R. (2018) Breaking up the static – AI and the music industry. *Hack and Craft*. Available from: http://hackandcraft.com/insights/articles/breaking-up-the-static-ai-and-the-music-industry/ [Accessed 28th April 2020].

Falk, D. (2017) The rise of smart machines puts spotlight on 'robot rights'. *NBC News*. Available from: https://www.nbcnews.com/mach/science/rise-smart-machines-puts-spotlight-robot-rights-ncna825791 [Accessed 4th May 2020].

Fallatah, K. (2019) *Guide for sustainable design of NEOM City*. Rochester Institute of Technology. Available from: https://scholarworks.rit.edu/theses/10268 [Accessed 8th May 2020].

Fallingham, A. (2007) *Northern soul: Music, drugs and subcultural identity*. Cullompton and Portland: Willan Publishing.

Fallon, J. (2018) Sophia the Robot and Jimmy sing a duet of "Say Something". *Youtube*. Available from: https://www.youtube.com/watch?v=G-zyTlZQYpE&t=309s [Accessed 4th May 2020].

Farag, A.A. (2019) The Story of NEOM City: Opportunities and Challenges. In: *New Cities and Community Extensions in Egypt and the Middle East*. Springer. pp. 35-49.

Farrell, J. P. (2015) Artificial composers: Tools of the modern musician or affront to human creativity? *Inquiries Journal/Student Pulse 7(03)*. Available from: http://www.inquiriesjournal.com/articles/1017/artificial-composers-tools-of-the-modern-musician-or-affront-to-human-creativity [Accessed 29th March 2017].

Farrugia, R., & Swiss, T. (2005) Tracking the DJs: Vinyl records, work, and the debate over new technologies. *Journal of Popular Music Studies 17* (1) pp. 30-44. Available from: https://doi.org/10.1111/j.1524-2226.2005.00032.x [Accessed 20th August 2015].

Fawaz, A. (2020) Sony launches AI-based music production service, Flow Machines. *Neowin*. Available from: https://www.neowin.net/news/sony-launches-ai-based-music-production-service-flow-machines [Accessed 27th April 2020].

Federal Ministry of Justice & Consumer Protection (2020) Copyright *Act (2020) Act on Copyright and Related Rights (Urheberrechtsgesetz – UrhG)*. Germany. Available from: https://www.gesetze-im-internet.de/englisch_urhg/englisch_urhg.html [Accessed 4th May 2020].

Feist Publications, Inc. v. Rural Telephone Service Co. (1991) 499 US 340, 111 S. Ct. 1282, 113 L. Ed. 2d 358.

Fernandez, J.D., & Vico, F. (2013) AI methods in algorithmic composition: A comprehensive survey. *Journal of Artificial Intelligence Research 48*, pp. 513-582. Available from: https://doi.org/10.1613/jair.3908 [Accessed 19th March 2020].

FHI (2020) *Future of Humanity Institute*. The Future of Humanity Institute. Available from: http://www.fhi.ox.ac.uk/ [Accessed 8th May 2020].

Ficsor, M. (2009) The international copyright treaties and collective management – Key issues (background paper). In: *WIPO National Seminar on Collective Management of Copyright and Related Rights.* World Intellectual Property Organization, Belgrade. Available from: http://www.zis.gov.rs/upload/documents/pdf_en/pdf/seminari/15sep2009_copyright_protection.pdf [Accessed 4th May 2020].

Filene, B. (2000) *Romancing the folk: Public memory & American roots music.* Chapel Hill, The University of North Carolina Press.

Floridi, L. (2019) Translating principles into practices of digital ethics: Five risks of being unethical. *Philosophy & Technology 32* pp. 185-193. Available from: https://doi.org/10.1007/s13347-019-00354-x [Accessed 2nd May 2020].

Floridi, L. (2018) Ethical framework for a good AI society. *AI4People Society*. Available from: https://www.eismd.eu/wp-content/uploads/2019/02/Ethical-Framework-for-a-Good-AI-Society.pdf [Accessed 3rd May 2020].

Flow Machines (2020) Flow Machines: AI Assisted Music, Our Vision. Flow Machines. Available from: https://www.flow-machines.com/ [Accessed 5th May 2020].

Flynn, S. (2020) WIPO Conversation on Intellectual Property (IP) and Artificial Intelligence (AI). *American University Washington College of Law.* Working Papers, Digital Commons. Available from: https://digitalcommons.wcl.american.edu/cgi/viewcontent.cgi?article=1043&context=fac_works_papers [Accessed 2nd May 2020].

Forbes (2020) Vinod Khosla. *Forbes*. Available from: https://www.forbes.com/profile/vinod-khosla/ [Accessed 27th April 2020].

Forbes (2018) 30 Under 30 2018: Music. *Forbes.* Available from: https://www.forbes.com/30-under-30/2018/music/ [Accessed 3rd June 2020].

Forbes (2017) What companies are winning the race for artificial intelligence? *Forbes.* Available from: https://www.forbes.com/sites/quora/2017/02/24/what-companies-are-winning-the-race-for-artificial-intelligence/ [Accessed 7th April 2020].

Ford, M. (2015) *The rise of the robots: Technology and the threat of mass unemployment*. London, Oneworld Publications.

Ford, N. M., & Ford, N. D. (1991) *When did I begin?: Conception of the human individual in history, philosophy and science*. Cambridge, Cambridge University Press.

Frank, A. (2019) 'Old Town Road' just became Billboard's longest-running No. 1 ever. *Vox.* Available from: https://www.vox.com/culture/2019/7/29/8937934/lil-nas-x-old-town-road-billboard-charts-record-breaking-single [Accessed 8th May 2020].

Franke, U. (2019) Harnessing artificial intelligence. *European Council on Foreign Relations*. Report number 289 JSTOR. Available from: https://www.ecfr.eu/publications/summary/harnessing_artificial_intelligence [Accessed 1st April 2020].

Frey, C. B. and Osborne, M. A. (2013) The future of employment. Working Paper. *The Oxford Martin Programme on Technology and Employment*. Available from: https://www.oxfordmartin.ox.ac.uk/downloads/academic/future-of-employment.pdf [Accessed 28th April 2020].

Friedel, F. (2018) Machines who play (and compose) music. *Medium.* Available from: https://medium.com/@frederic_38110/machines-that-play-and-compose-music-70abfe9a8549 [Accessed 27th April 2020].

Friedel, F. (2006) Ludwig – a synthesis of chess and music. *Chess Base News.* Available from: https://en.chessbase.com/post/ludwig-a-synthesis-of-che-and-music [Accessed 27th April 2020].

Frith, S., & Marshall, L. (Eds.) (2004) *Music and copyright.* New York, Routledge.

Fukuyama, T. (2020) Why AI music will let human artists be less like machines. *The Drum*. Available from: https://www.thedrum.com/opinion/2020/01/14/why-ai-music-will-let-human-artists-be-less-machines [Accessed 8th May 2020].

Fulde, V. (2018) *Guidelines for artificial intelligence.* Deutsche Telekom AG. Available from: https://www.telekom.com/en/company/digital-responsibility/details/artificial-intelligence-ai-guideline-524366 [Accessed 2nd May 2020].

Fuller, S. (2015) Doing justice to machines in an 'organicist' world. In: *2015: What do you think about machines that think? edge.org*. Available from: https://www.edge.org/response-detail/26139 [Accessed 27th March 2017].

Fullerton, K. (2018) *Coordinated Plan on Artificial Intelligence (COM(2018) 795 final)*. Knowledge for policy – European Commission. Available from: https://ec.europa.eu/knowledge4policy/publication/coordinated-plan-artificial-intelligence-com2018-795-final_en [Accessed 10th June 2020].

Future of Life Institute (2019) Future of Life Institute annual report 2018. *Future of Life Institute.* Available from: https://futureoflife.org/wp-content/uploads/2019/02/2018-Annual-Report.pdf?x64279 [Accessed 2nd May 2020].

Future of Life Institute (2009) Beneficial AGI 2019. *Future of Life Institute.* Available from: https://futureoflife.org/beneficial-agi-2019/ [Accessed 10th June 2020].

G-20 (2019) *G20 Ministerial Statement on Trade and Digital Economy (Digital Economy Part).* Available from: https://g20-digital.go.jp/asset/pdf/g20_2019_japan_digital_statement.pdf [Accessed 23rd April 2020].

Galeon, D. (2017) The United Arab Emirates is the first country in the world to hire a minister for artificial intelligence. *Business Insider*. Available from: https://www.businessinsider.com/world-first-ai-minister-uae-2017-12 [Accessed 8th May 2020].

Gallagher, O. (2018) *Reclaiming critical remix video: The role of sampling in transformative works*. New York, Routledge.

Gamble, J., & Gilmore, A. (2013) A new era of consumer marketing? An application of co-creational marketing in the music industry. *European Journal of Marketing 47 (11/12)*, pp. 1859-1888. Available from: https://doi.org/10.1108/EJM-10-2011-0584 [Accessed 27th March 2017].

Gammons, H. (2011) *The art of music publishing: An entrepreneurial guide to publishing and copyright for the music, film and media industries*. New York, Taylor & Francis.

Ganti, A. (2020) How does Fortnite make money? *Investopedia*. Available from: https://www.investopedia.com/tech/how-does-fortnite-make-money/ [Accessed 28th April 2020].

Garcia, C. (2017) Oral history of David Cope *Computer History Museum* Available from: https://archive.computerhistory.org/resources/access/text/2018/03/102738611-05-01-acc.pdf [Accessed 7th December 2019].

Gardner, E. (2020) Katy Perry & Capitol Records off the hook for $2.8M 'Dark Horse' copyright verdict. *Billboard.* Available from: https://www.billboard.com/articles/business/legal-and-management/9337054/judge-wipes-out-katy-perry-copyright-verdict [Accessed 28th April 2020].

Gardner, M.B. (1968) Historical background of the Haas and/or Precedence Effect. *The Journal of the Acoustical Society of America*. *43* (6), pp. 1243-1248. Available from: https://doi.org/10.1121/1.1910974 [Accessed 15th August 2018].

Garud, R., & Karnøe, P. (Eds.) (2012) *Path dependence and creation*. East Sussex, Psychology Press.

Gawliczek, T. (2019) Upcoming sampling problems on the CJEU's agenda – Intellectual Property – European Union. *Mondaq.* Available from: https://www.mondaq.com/copyright/792420/upcoming-sampling-problems-on-the-cjeu39s-agenda [Accessed 4th May 2020].

Gebhardt, N., & Whyton, T. (Eds.) (2015) *The cultural politics of jazz collectives – This is our music*. New York, Routledge.

Gebru, T. (2019) Chapter on race and gender. In: Dubber, M. D., Pasquale, F., & Das, S. (Eds.) *Oxford Handbook on AI Ethics*. Available from: http://arxiv.org/abs/1908.06165 [Accessed 28th April 2020].

Gensler, A. (2019) The Live Biz's robust – and then some – 2019 mid-year. *Pollstar*. Available from: https://www.pollstar.com/article/the-live-bizs-robust-and-then-some-2019-mid-year-138318 [Accessed 2nd May 2020].

George, N. (2004) *Post-Soul nation: The explosive, contradictory, triumphant, and tragic 1980s as experienced by African Americans (previously known as blacks and before that negroes).* New York, Penguin.

Georgia Tech (2020) Robotic musicianship projects. *Center for Music Technology (GTCMT).* Available from: https://gtcmt.gatech.edu/robotic-musicianship-projects [Accessed 27th April 2020].

Gerstner, M.E. (1993) Liability issues with artificial intelligence software. *Santa Clara Law. Review. 33* (1), pp. 239-269. Available from:

https://digitalcommons.law.scu.edu/lawreview/vol33/iss1/7/ [Accessed 3rd May 2020].

Ghorpade, T., & Ragha, L. (2012) Featured based sentiment classification for hotel reviews using NLP and Bayesian classification. In: *2012 International Conference on Communication, Information Computing Technology (ICCICT)* Mumbai, India. October 19-20th. pp. 1-5. Available from: https://doi.org/10.1109/ICCICT.2012.6398136 [Accessed 4th April 2020].

Gibbs, S. (2014) Monkey business: macaque selfie can't be copyrighted, say US and UK. *The Guardian*. Available from: https://www.theguardian.com/technology/2014/aug/22/monkey-business-macaque-selfie-cant-be-copyrighted-say-us-and-uk [Accessed 7th April 2020].

Gibney, E. (2015) DeepMind algorithm beats people at classic video games. *Nature, 518* (7540), pp. 465-466. Available from: https://www.nature.com/news/game-playing-software-holds-lessons-for-neuroscience-1.16979 [Accessed 27th April 2020].

Gilbert, B. (2019) The biggest game company in the world isn't Nintendo — it's a Chinese company that has a piece of everything from 'Fortnite' to 'League of Legends'. *Business Insider*. Available from: https://www.businessinsider.com/what-is-tencent-games-explainer-2019-8 [Accessed 28th April 2020].

Ginsburg, J.C. (2003) The concept of authorship in comparative copyright law. *Columbia Law School, Published Law Research Paper No.03-51.* Available from: https://dx.doi.org/10.2139/ssrn.368481 [Accessed 4th May 2020].

Girouard, G. (2012) *Ray Kurzweil: Music making – past, present and future (3 of 3).* Available from: https://www.youtube.com/watch?v=mt7mPxDsbr4 [Accessed 29th March 2017].

Gitzel, R., et al. (2019) Towards robust ML-algorithms for the condition monitoring of Switchgear. In: *2019 First International Conference on Societal Automation (SA),* 2-6 September 2019 Krakow, Poland. pp. 1-4. Available from: https://doi.org/10.1109/SA47457.2019.8938089 [Accessed 26th March 2020].

Global Supercomputing (2020) *Kemal Ebcioĝlu | Biography*. Available from: http://global-supercomputing.com/people/kemal.ebcioglu/bio.html [Accessed 27th April 2020].

Gobble, M.M. (2019) The road to artificial general intelligence. *Research-Technology Management. 62* (3), pp. 55-59. Available from: https://doi.org/10.1080/08956308.2019.1587336 [Accessed 26th March 2020].

Goel, K., Vohra, R., & Sahoo, J. K. (2014) Polyphonic music generation by modeling temporal dependencies using a RNN-DBN. In: Wermter, S. et al. (Eds.) *Artificial Neural Networks and Machine Learning – ICANN 2014* Lecture Notes in Computer Science, 8681, pp. 217-224. Available from: https://doi.org/10.1007/978-3-319-11179-7_28 [Accessed 22nd April 2020].

Goertzel, B. (2013) Artificial general intelligence and the future of humanity. In: More, M., & Vita-More, N. (Eds.) *The transhumanist reader: Classical and contemporary essays on the science, technology, and philosophy of the human future.* pp. 128-137. New York, John Wiley & Sons.

Goertzel, B. (2007) Human-level artificial general intelligence and the possibility of a technological singularity: A reaction to Ray Kurzweil's 'The Singularity is Near', and McDermott's critique of Kurzweil. *Artificial Intelligence 171* (18), pp. 1161-1173. Available from: https://doi.org/10.1016/j.artint.2007.10.011 [Accessed 27th March 2017].

Goethe University Frankfurt am Main (2019) First machine-generated book published. *PHYS.ORG.* Available from: https://phys.org/news/2019-04-machine-generated-published.html [Accessed 4th May 2020].

Goldberg, S. (1991) The changing face of death: Computers, consciousness, and Nancy Cruzan. *Stanford Law Review*. *43*(3), pp. 659-684. Available from: https://www.jstor.org/stable/1228915 [Accessed 4th May 2020].

Golden, E. (2015) Can you DJ off the internet in a club? *djtechtools.com*. Available from: https://djtechtools.com/2015/07/09/can-you-dj-off-the-internet-in-a-club-djay-pro-cdjs-spotify-reviewed/ [Accessed 21st October 2015].

Goldgel-Carballo, V., & Poblete, J. (Eds.) (2020) *Piracy and intellectual property in Latin America: Rethinking creativity and the common good.* Routledge.

Goldman Sachs (n.d.) Infographics. *Goldman Sachs.* Available from: https://www.goldmansachs.com/insights/pages/infographics/music-streaming/ [Accessed 2nd May 2020].

Goldman, A. (1981) *Elvis*. New York, McGraw Hill.

Goldman, A. (1978) *Disco!* New York, Hawthorne Books.

Golvan, C. (2007) *Copyright law and practice*. Sydney, The Federation Press.

Goodall, H. (2001) *Big bangs: The story of five discoveries that changed music history.* London, Vintage.

Goodwin, A. (1998) Sample and hold: Pop music in the digital age of reproduction. *Critical Quarterly 30* (3), pp. 34-39. Available from: https://doi.org/10.1111/j.1467-8705.1988.tb00315.x [Accessed 28th March 2017].

Google (2013) Doodles: About. Google.com. Available from: https://www.google.com/doodles/about [Accessed 10th July 2020].

Google (n.d.) *Google AI responsible practice*. Available from: https://ai.google/responsibilities/responsible-ai-practices/ [Accessed 2nd May 2020].

Gopinath, S., & Stanyek, J., (Eds.) (2014) *The Oxford Handbook of Mobile Music Studies, Volume 2.* New York, Oxford University Press.

Gough, J. W. (1950) *John Locke's political philosophy: eight studies*. Oxford, Clarendon Press.

Government Digital Services, Office for Artificial Intelligence (2019) *A guide to using artificial intelligence in the public sector.* Available from: https://www.gov.uk/government/collections/a-guide-to-using-artificial-intelligence-in-the-public-sector [Accessed 2nd May 2020].

Government of Ireland (2020) *Ireland's National IP Protocol 2019.* Available from: https://www.knowledgetransferireland.com/Reports-Publications/Ireland-s-National-IP-Protocol-2019-.pdf [Accessed 5th May 2020].

Granstra, C. (2013) Accenture completes acquisition of Fjord, expanding digital and marketing capabilities. *Accenture Newsroom*. Available from: https://newsroom.accenture.com/industries/communications/accenture-completes-acquisition-of-fjord-expanding-digital-and-marketing-capabilities.htm [Accessed 28th April 2020].

Graves, J., B. (2017) The original gig economy – UNI global paper. *Futures of Work.* Available from: https://www.futuresofwork.org/working-papers-resources [Accessed 28th April 2020].

Greenhouse, L. (1994) Ruling on rap song, High Court frees parody from copyright law. *The New York Times.* Available from: https://www.nytimes.com/1994/03/08/us/ruling-on-rap-song-high-court-frees-parody-from-copyright-law.html [Accessed 4th May 2020].

Greshko, M. (2018) Meet Sophia, the robot that looks almost human. *National Geographic*. Available from: https://www.nationalgeographic.com/photography/proof/2018/05/sophia-robot-artificial-intelligence-science/ [Accessed 4th May 2020].

Grigorescu, S. C. (2019) Copyright law: A historical and moral analysis of the confusion surrounding substantial similarity between musical works. *Law School Student Scholarship*. 955. Available from: https://scholarship.shu.edu/student_scholarship/955 [Accessed 2nd May 2020].

Grinvalsky, P. M. (199) Idea-expression in musical analysis and the role of the intended audience in music copyright infringement. *California Western Law Review 28* (2) Article 8. p. 395. Available from: Available at: https://scholarlycommons.law.cwsl.edu/cwlr/vol28/iss2/8 [Accessed 2nd May 2020].

Grupo De Estudios en Biomimética (2020) List of all projects – Projects. *geb.uma.es*. Available from: http://www.geb.uma.es/projects/list-of-all-projects [Accessed 27th April 2020].

Guadamuz, A. (2017a) Impact of artificial intelligence on IP policy. *WIPO Magazine*. Available from: https://www.wipo.int/about-ip/en/artificial_intelligence/call_for_comments [Accessed 4th May 2020].

Guadamuz, A. (2017b) Artificial intelligence and copyright. *WIPO Magazine*. Available from: https://www.wipo.int/wipo_magazine/en/2017/05/article_0003.html [Accessed 4th May 2020].

Guardian Music (2014) One-quarter of Spotify tracks are skipped in first five seconds, study reveals. *The Guardian*. Available from: https://www.theguardian.com/music/2014/may/07/one-quarter-of-spotify-tracks-are-skipped-in-first-five-seconds-study-reveals [Accessed 8th May 2020].

Guinness World Records (2020) Oldest hotel. *Guinness World Records*. Available from: https://www.guinnessworldrecords.com/world-records/oldest-hotel/ [Accessed 4th May 2020].

Gurman, M. (2018) Apple warns employees to stop leaking information to media. *Bloomberg*. Available from: https://www.bloomberg.com/news/articles/2018-04-13/apple-warns-employees-to-stop-leaking-information-to-media [Accessed 5th May 2020].

Ha, A. (2017) Amper raises $4M to use AI to write music. *TechCrunch*. Available from: https://techcrunch.com/2017/03/02/amper-funding/ [Accessed 28th April 2020].

Haeb-Umbach, R., et al. (2019) Speech processing for digital home assistants: Combining signal processing with deep-learning techniques. In: *IEEE Signal Processing Magazine*. *36* (6), pp. 111-124. Available from: https://doi.org/10.1109/MSP.2019.2918706 [Accessed 20th April 2020].

Hagendorff, T. (2020) The ethics of AI ethics: An evaluation of guidelines. *Minds & Machines 30*, pp. 99-120 Available from: https://doi.org/10.1007/s11023-020-09517-8 [Accessed 4th May 2020].

Haggart, B. (2014) *Copyfight: The global politics of digital copyright reform*. Toronto, University of Toronto Press.

Hahn, M. (2005) Digital music sampling and copyright policy – A bittersweet symphony? Assessing the continued legality of music sampling in the United Kingdom, the Netherlands, and the United States. *Georgia Journal of International and Comparative Law 34* (3), pp. 713-741. Available from: https://digitalcommons.law.uga.edu/gjicl/vol34/iss3/6 [Accessed 4th May 2020].

Hakobyan, M., (2016) How Steve Jobs inspired a generation of entrepreneurs. *HuffPost*. Available from: https://www.huffpost.com/entry/how-steve-jobs-inspired-a_b_8742148 [Accessed 28th April 2020].

Haldane, M. (2018) A look at China's massive music streaming industry and how it differs from Spotify. *Tech in Asia.* Available from: https://www.techinasia.com/chinas-massive-music-streaming-industry-differs-spotify [Accessed 28th April 2020].

Hale, J. (2019) The US Government is investigating TikTok parent Bytedance as a potential national security threat (Report). *Tubefilter*. Available from: https://www.tubefilter.com/2019/11/01/tiktok-us-government-national-security-investigation/ [Accessed 28th April 2020].

Halloran, M. (2017) *The musician's business and legal guide 5th edition*. Oxfordshire, Taylor & Francis.

Halt, G. B., et al. (2017) *Intellectual property and financing strategies for technology startups*. Springer.

Hamilton, A. H. (2019) Google set up an external ethics council for AI, but one of its members was called out for her views on trans people and immigration. *Business Insider*. Available from: https://www.businessinsider.com/google-sets-up-new-external-ai-ethics-council-2019-3?r=US&IR=T [Accessed 28th April 2020].

Hanna, D. (2012) The history of the red envelopes and how you can use them during the Year of the Yang Metal Rat 2020. *Feng Shui Store.* Available from: https://www.fengshuiweb.co.uk/advice/angpow.htm [Accessed 28thApril 2020].

Harari, H. (2015) Thinking about people who think like machines? *Edge.org.* Available from: https://www.edge.org/response-detail/26056 [Accessed 27th March 2017].

Harari, Y. N. (2016) *Homo Deus: A brief history of tomorrow*. London, Harvill Secker.

Harari, Y. N. (2014) *Sapiens: A brief history of humankind.* London, Harvill Secker.

Haraway, D. J. (2007) *When species meet.* Minneapolis, University of Minnesota Press.

Haraway, D. J. (1985) A cyborg manifesto. [eBook] Minnesota, University of Minnesota Press. Available from: https://warwick.ac.uk/fac/arts/english/currentstudents/undergraduate/modules/fictionnownarrativemediaandtheoryinthe21stcentury/manifestly_haraway_---_a_cyborg_manifesto_science_technology_and_socialist-feminism_in_the_....pdf [Accessed 20th March 2019].

Harland, D. M. (2011) *Apollo 12 – On the ocean of storms.* Chichester, Praxis Publishing.

Harman Pictures v Osborne (1969) 1 Ch 508

Harrison, A. (2008) *Music – The Business: The essential guide to the law and the deals 4th edition*. London, Virgin.

Haskell, H. (1996) *The early music revival: A History*. New York, Dover Publications.

Havens, J. (2014) Nominations open for humanity's Artificial Intelligence Ethics Board. *LinkedIn*. Available from: https://www.linkedin.com/pulse/20140822163342-109319-nominations-open-for-humanity-s-artificial-intelligence-ethics-board/ [Accessed 10th July 2020].

Haycock, J. (2015) Protest music as adult education and learning for social change: A theorisation of a public pedagogy of protest music. *Australian Journal of Adult Learning 55* (3), pp. 423-442. Available from: https://archive.org/details/ERIC_EJ1082524/mode/2up [Accessed 28th April 2020].

Hayles, K. (1999) *How we became posthuman: Virtual bodies in cybernetics, literature, and informatics.* Chicago, University of Chicago Press.

HCC (2020) Human Centred Computing. *Department of Computer Science – research theme*. Available from: https://www.cs.ox.ac.uk/research/HCC/ [Accessed 8th May 2020].

Hegel, G. W. (1942) *Hegel's philosophy of right.* Trans. Knox, T. M. Oxford, Clarendon Press.

Heidegger, M. (2010 [1927]) *Being and time*. Trans. Stambaugh, J. New York, SUNY Press.

Heidegger, M. (2003 [1954]) The question concerning technology. In: Scharff, R. C., & Dusek, V. (Eds.) *Philosophy of technology. The technological condition. An anthology*, pp. 253-264. Malden, MA, Blackwell Publishing.

Helfer, L. R. (2000) World music on a US stage: a Berne/TRIPS and economic analysis of the fairness in Music Licensing Act. *Boston University Law Review 80*, p. 93. Available from: https://ssrn.com/abstract=196210 [Accessed 4th May 2020].

Henderson, M. (Endo) (2013) Harmonic mixing and key detection study + results! *Dubspot College, New York.* Available from: http://blog.dubspot.com/endo-harmonic-mixing-key-detection-analysis/ [Accessed 21st October 2015].

Hermes, W. (2011) *Love goes to buildings on fire: Five years in New York that changed music forever*. New York, Farrar Straus and Giroux.

Hern, A. (2019) New AI fake text generator may be too dangerous to release, say creators. *The Guardian*. Available from: https://www.theguardian.com/technology/2019/feb/14/elon-musk-backed-ai-writes-convincing-news-fiction [Accessed 2nd May 2020].

Hern, A. (2017) Whatever happened to the DeepMind AI ethics board Google promised? *The Guardian*. Available from: https://www.theguardian.com/technology/2017/jan/26/google-deepmind-ai-ethics-board [Accessed 7th April 2020].

Herweijer, C., & Waughray, D.K.N. (2019) How technology can fast-track the global goals. *World Economic Forum*. Available from: https://www.weforum.org/agenda/2019/09/technology-global-goals-sustainable-development-sdgs/ [Accessed 2nd May 2020].

Hesmondhalgh, D., & Meier, L.M. (2018) What the digitalisation of music tells us about capitalism, culture and the power of the information technology sector. *Information, Communication & Society, 21*(11), pp. 1555-1570. Available from: https://doi.org/10.1080/1369118X.2017.1340498 [Accessed 2nd May 2020].

Hey, T., Butler, K., Jackson, S., & Thiyagalingam, J. (2020) Machine learning and big scientific data. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*. *378* (2166). Available from: https://doi.org/10.1098/rsta.2019.0054 [Accessed 20th March 2020].

HG Contemporary (2019) Faceless portraits transcending time. *HG Contemporary*. Available from: http://www.hgcontemporary.com/exhibitions/faceless-portraits-transcending-time [Accessed 4th May 2020].

Hickok, M. (2020) Lessons learned from AI ethics principles for future actions. AI and Ethics. [Online] Available from: http://doi:10.1007/s43681-020-00008-1 [Accessed: 9 December 2020].

Higgins, D., & Madai, V. I. (2020) *From bit to bedside: A practical framework for artificial intelligence product development in healthcare*. 30. arXiv preprint. Available from: https://arxiv.org/ftp/arxiv/papers/2003/2003.10303.pdf [Accessed 10th April 2020].

High-Level Expert Group on Artificial Intelligence (AI HLEG) (2019a) *A Definition of AI: Main capabilities and scientific disciplines*. European Commission. Available from: https://ec.europa.eu/digital-single-market/en/news/definition-artificial-intelligence-main-capabilities-and-scientific-disciplines [Accessed 3rd May 2020].

High-Level Expert Group on Artificial Intelligence (AI HLEG) (2019b) *Ethics guidelines for trustworthy AI*. European Commission. Available from: https://ec.europa.eu/digital-single-market/en/news/ethics-guidelines-trustworthy-ai [Accessed 3rd May 2020].

High-Level Expert Group on Artificial Intelligence (AI HLEG) (2019c) *Policy and investment recommendations for trustworthy AI*. European Commission. Available from: https://ec.europa.eu/digital-single-market/en/news/policy-and-investment-recommendations-trustworthy-artificial-intelligence [Accessed 3rd May 2020].

Hilliard, D.C., Welch II, J. N., & Widmaier, U. (2012) *Trademarks and unfair competition*. LexisNexis.

Hochberg, B. (2020) YouTube won't take down a deepfake of Jay-Z reading Hamlet – To sue, or not to sue. *Forbes*. Available from: [Accessed 20th June 2020].

Hofstadter, D. R. (1979) *Gödel, Escher, Bach: An eternal golden braid* (Vol. 13). New York, Basic Books.

Hogan, M. (2020) What does Jay-Z's fight over audio deepfakes mean for the future of AI music? *Pitchfork.* Available from: https://pitchfork.com/thepitch/what-does-jay-zs-fight-over-audio-deepfakes-mean-for-the-future-of-ai-music/ [Accessed 16th May 2020].

Holden, J. (2015) On using modular gear live and Max for Live patches. *Music Radar Online*. Available from: https://www.musicradar.com/news/tech/james-holden-on-using-modular-gear-live-and-max-for-live-patches-622023 [Accessed 15th October 2015].

Holmes, T. (2015) *Electronic and experimental music: Technology, music, and culture. 5th ed.* London, Routledge.

Holtz, M. (2019) Going global (or globally local)? How Netflix produces amazing global content. *Hacker Noon*. Available from: https://hackernoon.com/going-global-or-globally-local-how-netflix-produces-amazing-global-content-5ad98d0a5ff1 [Accessed 3rd May 2020].

Holon IQ (2019) The Global AI Strategy Landscape. *Holon IQ*. Available from: https://www.holoniq.com/notes/the-global-ai-strategy-landscape/ [Accessed 10th July 2020].

Hong Kong (1993) Report on reform of the law relating to copyright (topic 22). *The Law Reform Commission of Hong Kong*. Available from: https://www.hkreform.gov.hk/en/docs/rcopyright-e.pdf [Accessed 3rd May 2020].

Hopkins, P.D. (2005) Transcending the animal: how transhumanism and religion are and are not alike. *Journal of Evolution and Technology 14* (2), pp. 13-28. Available from: https://jetpress.org/volume14/hopkins.pdf [Accessed 27th March 2017].

Horenko, I. (2020) On a scalable entropic breaching of the overfitting barrier in machine learning. *ArXiv:2002.03176 [Cs, Stat]*. Available from: http://arxiv.org/abs/2002.03176 [Accessed 2nd April 2020].

Horizon (2020) *Horizon*. Available from: https://www.horizon.ac.uk/ [Accessed 8th May 2020].

Hornof, A.J. (2014) The prospects for eye-controlled musical performance. In: *14th International conference on new interfaces for musical expression (NIME).* Goldsmiths, University of London, UK. Available from: http://ix.cs.uoregon.edu/~hornof/downloads/NIME2014.pdf [Accessed 29th March 2017].

Horowitz, B. T. (2018) IBM releases pretrained Watson AI tools in several industries. *PCMag UK*. Available from: https://uk.pcmag.com/news-analysis/117625/ibm-releases-pretrained-watson-ai-tools-in-several-industries [Accessed 27th April 2020].

Horsfield, M. (2011) Wigan casino voted greatest disco in the world. *The Guardian Online*. Available from: https://www.theguardian.com/music/2011/jun/15/wigan-greatest-disco [Accessed 22nd October 2015].

Houghton, B. (2018) CEO Tim Cook is ok that Apple music loses money, slams 'bits-and-bytes' streaming. *Hypebot*. Available from: https://www.hypebot.com/hypebot/2018/08/tim-cook-is-ok-apple-music-loses-money-slams-bits-and-bytes-streaming.html [Accessed 12th May 2020].

House of Lords Select Committee on Artificial Intelligence (2018) AI in the UK: Ready, willing and able? Report of Sessions 2017-19. *Authority of the House of Lords.* HL paper 100. Available from: https://publications.parliament.uk/pa/ld201719/ldselect/ldai/100/100.pdf [Accessed 2nd May 2020].

Houser, K. A. (2019) Can AI solve the diversity problem in the tech industry? Mitigating noise and bias in employment decision-making. *22 Stanford Technology Law Review 290, By permission of the Board of Trustees of the Leland Stanford Junior University*. Available from: https://law.stanford.edu/wp-content/uploads/2019/08/Houser_20190830_test.pdf [Accessed 28th April 2020].

Houvast, F., Timmerman, R., Zwaan, Y. (2018) *Exploring the legal rights & obligations of robots. A Legal book review of I, Robot by Isaac Asimov.* Utrecht University.

Hristov, K. (2016) Artificial intelligence and the copyright dilemma. *IDEA: The IP Law Review 57* (3), pp. 431-454. Available from: https://ssrn.com/abstract=2976428 [Accessed 4th May 2020].

Hu, C. (2019) How artificial intelligence will do to music what Instagram did to photography. *Medium.* Available from: https://medium.com/@cheriehu42/how-artificial-intelligence-will-do-to-music-what-instagram-did-to-photography-b69268a2d318 [Accessed 28th April 2020].

Huddleston, T. (2018) Elon Musk leaves OpenAI Board, research group he co-founded. *Fortune.* Available from: https://fortune.com/2018/02/21/elon-musk-leaving-board-openai/ [Accessed 10th June 2020].

Hudson, E. (2020) *Drafting copyright exceptions: From the law in books to the law in action*. UK, Cambridge University Press.

Hudson, R. L. (2019) Step by step, world leaders strive to find consensus on AI development. *Science Business.* Available from: https://sciencebusiness.net/news/step-step-world-leaders-strive-find-consensus-ai-development [Accessed 25th April 2020].

Hughes W. E., & Pinch, T (1985) *The social construction of technological systems: New directions in the sociology and history of technology*. Cambridge Mass, MIT Press.

Hughes, D., et al. (2016) *The new music industries: Disruption and discovery*. London, Palgrave Macmillan.

Hui, G., & Fleury, N. (2015) China's crusade for anti-piracy. *International Organization for Standardization.* Available from: https://www.iso.org/cms/render/live/en/sites/isoorg/contents/news/2015/03/Ref1940.html [Accessed 28th April 2020].

Hull, G.P., Hutchison, T.W., & Strasser, R. (2011) *The music business and recording industry: Delivering music in the 21st Century, 3rd edition*. Oxfordshire, Taylor & Francis.

humanrights.com (2020) *Article 6 of The Universal Declaration of Human Rights*. Available from: https://www.humanrights.com/course/lesson/articles-06-11/read-article-6.html [Accessed 8th May 2020].

HumOn (2020) HumOn – The simplest music creation app. *HumOn*. Available from: http://hum-on.com/ [Accessed 27th April 2020].

Humphreys, A., & Grayson, K. (2008) The intersecting roles of consumer and producer: A critical perspective on co-production, co-creation and prosumption. *Sociology Compass 2* (3), pp. 963-980. Available from: https://doi.org/10.1111/j.1751-9020.2008.00112.x [Accessed 26th March 2017].

Humtap (2020) Home. *Humtap.* Available from: https://www.humtap.com [Accessed 27th April 2020].

Hunt, C. (2011) National Strategy for Higher Education to 2030. *Department of Education and Skills.* Available from: https://www.education.ie/en/Publications/Policy-Reports/National-Strategy-for-Higher-Education-2030.pdf [Accessed 5th May 2020].

Hunt, D., Nguyen, L., & Rodgers, M. (Eds.) (2012) *Patent searching: Tools & techniques*. John Wiley & Sons.

Hustvedt, S. (2019) When will the art world recognise the real artist behind Duchamp's Fountain? *The Guardian*. Available from: https://www.theguardian.com/books/2019/mar/29/marcel-duchamp-fountain-women-art-history [Accessed 4th May 2020].

Hutchinson, L. (2015) George Harrison's 'My Sweet Lord' copyright infringement case. *Performing Songwriter Ent., LLC*. Available from: http://performingsongwriter.com/george-harrison-my-sweet-lord/ [Accessed 4th May 2020].

Hutton, J. (2003) Daphne Oram: Innovator, writer and composer. *Organised Sound 8* (1), pp49-56. Available from: https://doi.org/10.1017/S1355771803001055 [Accessed 30th March 2017].

Hyrynsalmi, S., et al. (2019) *Software Business: 10th International Conference, ICSOB 2019, Jyväskylä, Finland, November 18-20, 2019, Proceedings*. Springer Nature.

Iamus (2012) Iamus by Iamus on Amazon Music. Amazon.com. Available from: https://www.amazon.com/Iamus/dp/B00AUMAYT0 [Accessed 18th June 2020].

Iansiti, M., & Levien, R. (2002) Keynotes and dominators: Framing operating and technology strategy in a business ecosystem. *Harvard Business School Working Paper*, No. 03-061. Boston, Harvard Business School.

IBM Archives (2003) *IBM Archives: Music chronology*. IBM.com. Available from: www.ibm.com/ibm/history/exhibits/music/music_CH1.html [Accessed 1st June 2020].

IBM Corporation (2019) Let's put smart to work. *IBM*. Available from: https://www.ibm.com/thought-leadership/smart/ [Accessed 27 April 2020].

IBM Corporation (2018a) *IBM Watson Beat*. Available from: https://www.ibm.com/case-studies/ibm-watson-beat [Accessed 27th April 2020].

IBM Corporation (2018) *Data trust and transparency.* Available from: https://www.ibm.com/blogs/policy/trust-principles/ [Accessed 2nd May 2020].

IBM Corporation (2014-20) *Everyday ethics for artificial intelligence*. Available from: https://www.ibm.com/watson/assets/duo/pdf/everydayethics.pdf [Accessed 2nd May 2020].

IEEE (2020) The Ethics Certification Program for Autonomous and Intelligent Systems (ECPAIS). IEEE Standards Association. Available from:

https://standards.ieee.org/industry-connections/ecpais.html [Accessed 29th June 2020].

IEEE (2019a) *Ethically Aligned Design First Edition: A Vision for Prioritizing Human Well-being with Autonomous and Intelligent Systems.* The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems. Available from: https://standards.ieee.org/content/dam/ieee-standards/standards/web/documents/other/ead1e.pdf?utm_medium=undefined&utm_source=undefined&utm_campaign=undefined&utm_content=undefined&utm_term=undefined [Accessed 12th July 2020].

IEEE (2019b) *Ethics in Action – The IEEE global initiative on ethics of autonomous and intelligent systems.* Available from: https://ethicsinaction.ieee.org [Accessed 2nd May 2020].

IEEE (2018) *IEEE Annual Report 2018.* Available from: https://www.ieee.org/content/dam/ieee-org/ieee/web/org/corporate-communications/annual-report/ieee-annualreport2018-7.9-print-version.pdf [Accessed 2nd May 2020].

iHeartMedia (2020) As it enters the new decade, iHeartMedia announces technology transformation and new organisational structure for its markets group. *iHeartMedia.com.* Available from: https://www.iheartmedia.com/press/it-enters-new-decade-iheartmedia-announces-technology-transformation-and-new-organizational [Accessed 4th May 2020].

iHeartMedia (2014) Clear Channel Becomes iHeartMedia. *iHeartMedia*. Available from: https://www.iheartmedia.com/press/clear-channel-becomes-iheartmedia [Accessed 7th June 2020].

Infopaq International A/S v Danske Dagblades Forening (2009) C-5/08, ECLI identifier: ECLI:EU:C:2009:465

Ingberg, A. (2019) Bewildering Brain: Writing songs like Bob Dylan using machine learning. *MC.AI.* Available from: https://mc.ai/bewildering-brain/ [Accessed 4th May 2020].

Ingham, T. (2020a) Apple Music expands into 52 (52!) new markets, upping presence in Africa and beyond. *Music Business Worldwide*. Available from: https://www.musicbusinessworldwide.com/apple-music-expands-to-52-52-new-markets-upping-presence-in-africa-and-beyond/ [Accessed 28th April 2020].

Ingham, T. (2020b) Hipgnosis now has $188m more to spend, via loan facility from banks including JP Morgan. *Music Business Worldwide*. Available from: https://www.musicbusinessworldwide.com/hipgnosis-now-has-188m-more-to-

spend-via-loan-facility-from-banks-including-jp-morgan/ [Accessed 2nd May 2020].

Ingham, T. (2020) Anyone can go out and spend $1Billion. The trick is getting a good return for your investors. *Music Business Worldwide*. Available from: https://www.musicbusinessworldwide.com/josh-gruss-round-hill-anyone-can-go-out-and-spend-1bn-the-trick-is-getting-a-good-return-for-your-investors/ [Accessed 2nd May 2020].

Ingham T. (2019a) TikTok owner Bytedance buys AI music company Jukedeck. *Music Business Worldwide*. Available from: https://www.musicbusinessworldwide.com/tiktok-parent-bytedance-buys-ai-music-company-jukedeck/ [Accessed 27th April 2020].

Ingham, T. (2019b) Nearly 10% of tracks on Tencent Music services will be behind a paywall by the end of the year. *Music Business Worldwide.* Available from: https://www.musicbusinessworldwide.com/nearly-1-in-10-tracks-on-tencent-services-will-be-behind-a-paywall-by-the-end-of-the-year/ [Accessed 28th April 2020].

Ingham, T. (2019c) Nearly 40,000 tracks are now being added to Spotify every single day. *Music Business Worldwide*. Available from: https://www.musicbusinessworldwide.com/nearly-40000-tracks-are-now-being-added-to-spotify-every-single-day/ [Accessed 28th April 2020].

Ingham, T. (2019d) Universal Music Group valuation hits $50BN – As Vivendi seeks 'half dozen' investment bank partners. *Music Business Worldwide*. Available from: https://www.musicbusinessworldwide.com/universal-music-group-valuation-hits-50bn-as-vivendi-seeks-half-dozen-investment-bank-partners/ [Accessed 2nd May 2020].

Ingham, T. (2019e) Universal Music Group is being valued at $42bn – and could ignite a major label sales frenzy. Music Business Worldwide. Available from: https://www.musicbusinessworldwide.com/universal-music-group-is-being-valued-at-42bn-and-could-set-in-motion-a-major-label-sales-frenzy/ [Accessed 29th June 2020].

Ingham, T. (2019f) Big question: Could Google buy Universal Music Group? *Music Business Worldwide*. Available from: https://www.musicbusinessworldwide.com/big-question-could-google-buy-universal-music-group/ [Accessed 28th April 2020].

Ingham, T. (2019g) English-speaking artists are losing their global dominance of pop. *Rolling Stone*. Available from: https://www.rollingstone.com/music/music-

features/english-speaking-artists-are-losing-their-grip-on-global-pop-domination-and-youtubes-leading-the-charge-786815/ [Accessed 28th April 2020].

Ingham, T. (2019) English-language music is losing its stranglehold on global pop charts – and YouTube is driving the change. *Music Business Worldwide*. Available from: https://www.musicbusinessworldwide.com/english-language-music-is-losing-its-stranglehold-on-global-pop-charts-and-youtube-proves-it/ [Accessed 20th April 2020].

Ingham, T. (2019) Streaming growth is slowing at the world's biggest music company. Could TikTok help? *Rolling Stone*. Available from: https://www.rollingstone.com/music/music-news/universal-music-streaming-growth-tiktok-905159/ [Accessed 28th April 2020].

Ingham, T. (2017) *Spotify denies it's playlisting fake artists. So why are all these fake artists on its playlists?* Music Business Worldwide. Available from: https://www.musicbusinessworldwide.com/spotify-denies-its-playlisting-fake-artists-so-why-are-all-these-fake-artists-on-its-playlists/ [Accessed 11th May 2020].

Insights Team (2019) Forbes Insights: Can AI crack the code for creativity? *Forbes*. Available from: https://www.forbes.com/sites/insights-intelai/2019/05/22/can-ai-crack-the-code-for-creativity/ [Accessed 4th May 2020].

International Federation of the Phonographic Industry (IFPI) (2018) Global Music Report 2018: Annual State of the Industry. *International Federation of the Phonographic Industry*. Available from: https://ifpi.org/news/IFPI-GLOBAL-MUSIC-REPORT-2018 [Accessed 28th April 2020].

International Federation of the Phonographic Industry (IFPI) (2017) Music Consumer Insight Report. *International Federation of the Phonographic Industry*. Available from: https://www.ifpi.org/downloads/Music-Consumer-Insight-Report-2017.pdf [Accessed 2nd May 2020].

Irish Statute Book (2020) Married Women's Status Act, 1957. *electronic Irish Statute Book (eISB)*. Available from: http://www.irishstatutebook.ie/eli/1957/act/5/enacted/en/print.html [Accessed 4th May 2020].

Irish Times (2017) Ed Sheeran settles €19m copyright infringement lawsuit. *The Irish Times*. Available from: https://www.irishtimes.com/culture/music/ed-sheeran-settles-19m-copyright-infringement-lawsuit-1.3045115 [Accessed 4th May 2020].

Iser, L. (2018) Childish Gambino's 'This Is America' facing plagiarism accusations after BET Awards. *Forbes*. Available from:

https://www.forbes.com/sites/legalentertainment/2018/06/25/childish-gambinos-this-is-america-facing-plagiarism-accusations-after-bet-awards/#8c1b77a7e4d7 [Accessed 4th May 2020].

Ivankova, N. V. (2015) *Mixed Methods Applications in Action Research: From Methods to Community Action.* Los Angeles, Sage Publications Inc.

Jacca (2019) How does Spotify count a 'listen' or 'stream' on a song? *RouteNote Blog*. Available from: http://routenote.com/blog/how-does-spotify-count-a-listen-or-stream-on-a-song/ [Accessed 28th April 2020].

Jacko, J.A. (2012) *Human-computer interaction handbook: Fundamentals, evolving technologies, and emerging applications. 3rd ed.* Boca Raton, CRC Press.

Jackson, R. L. (2012) Count it all: The actual, hard costs of touring. *DIY musician CD Baby*. Available from: https://diymusician.cdbaby.com/musician-tips/count-it-all-the-actual-hard-costs-of-touring/ [Accessed 2nd May 2020].

Jacob, B.L. (1996) Algorithmic composition as a model of creativity. *Organised Sound 1* (3), pp. 157-165. Available from: https://doi.org/10.1017/S1355771896000222 [Accessed 28th March 2017].

Jagger, M., et al. (2003) *According to the Rolling Stones*. San Francisco, Chronicle Books.

Jain, V. (2019) Biba the first international collaboration of DJ Marshmello with Pritam-Shirley Setia is out, watch here. *News18*. Available from: https://www.news18.com/news/movies/biba-the-first-international-collaboration-of-dj-marshmello-with-pritam-shirley-setia-is-out-watch-here-2021465.html [Accessed 28th April 2020].

Jajal, T.D. (2018) Distinguishing between Narrow AI, General AI and Super AI. *Medium*. Available from: https://medium.com/@tjajal/distinguishing-between-narrow-ai-general-ai-and-super-ai-a4bc44172e22 [Accessed 26th March 2020].

Japanese Society for Artificial Intelligence (2017) *The Japanese society for artificial intelligence ethical guidelines*. JSAI. Available from: http://www.ai-elsi.org/wp-content/uploads/2017/05/JSAI-Ethical-Guidelines-1.pdf [Accessed 2nd May 2020].

Jasanoff, S. (2016) The Ethics of Invention: Technology and the Human Future. New York, W.W. Norton Company.

Jennings, R. (2018) TikTok, explained. *Vox.* Available from: https://www.vox.com/culture/2018/12/10/18129126/tiktok-app-musically-meme-cringe [Accessed 28th April 2020].

Jerez, G.D. (2018) Iamus Computer — Hello World! *PHP Video Academy*. Available from: https://phpvideoacademy.com/iamus-computer-hello-world/ [Accessed 27th April 2020].

Jewell, C. (2018) Bringing AI to life. *WIPO Magazine.* Available from: https://www.wipo.int/wipo_magazine/en/2018/05/article_0003.html [Accessed 4th May 2020].

Jiang, D., et al. (2020) Big data analysis based network behavior insight of cellular networks for industry 4.0 applications. *IEEE Transactions on Industrial Informatics*, *16* (2) pp. 1310-1320. Available from: https://doi.org/10.1109/TII.2019.2930226 [Accessed 4th April 2020].

Jiao, Z., Yao, P., Zhang, J., Wan, L., & Wang, X. (2019) Capability construction of C4ISR based on AI planning. *IEEE Access*, *7*, pp. 31997-32008. Available from: https://doi.org/10.1109/ACCESS.2019.2902043 [Accessed 30th March 2020].

Ji-hye, J. (2018) AI robot Sophia speaks about her future in South Korea. *South China Morning Post.* Available from: https://www.scmp.com/tech/article/2131357/ai-robot-sophia-speaks-about-her-future-south-korea [Accessed 4th May 2020].

Ji-hye, J. (2018) AI robot Sophia speaks about own future in Seoul. *Korea Times*. Available from: http://www.koreatimes.co.kr/www/tech/2020/05/133_243333.html [Accessed 4th May 2020].

Johns, A. (2010) *Piracy: The intellectual property wars From Gutenberg to Gates.* University of Chicago Press.

Johnson, G. (1997) Undiscovered Bach? No, a computer wrote it. *The New York Times* Available from: https://www.nytimes.com/1997/11/11/science/undiscovered-bach-no-a-computer-wrote-it.html [Accessed 27th April 2020].

Jolly, A., & Philpott, J. (2004) *A handbook of intellectual property management: Protecting, developing and exploiting your IP assets*. London, Kogan Page Publishers.

Jones, R. (2017) Alex da Kid: ‘There’s going to be a resurgence in independent music companies’ *Music Business Worldwide*. Available from:

https://www.musicbusinessworldwide.com/theres-going-to-be-a-resurgence-in-independent-music-companies/ [Accessed 27th April 2020].

Jordan, L. (2017) Inside the lab that's producing the first AI-generated pop album. *Seeker*. Available from: https://www.seeker.com/tech/artificial-intelligence/inside-flow-machines-the-lab-thats-composing-the-first-ai-generated-pop-album [Accessed 27th April 2020].

Judi Boisson v. Banian, LTD (2001) 273 F.3d 262

Jukebox (2020) Jukebox. *OpenAI.* Available from: https://openai.com/blog/jukebox/ [Accessed 12th May 2020].

Jukedeck (2018) Available from: https://www.jukedeck.com/ [Accessed 27th December 2018].

Jütte, B., & Quintais, J. (2019) Advocate General turns down the music – Sampling is not a fundamental right under EU Copyright Law. *European Intellectual Property Review 2019 (forthcoming)*. Available from: https://ssrn.com/abstract=3377205 [Accessed 4th May 2020].

Kurup, N. (2020) *Can artificial intelligence replace songwriters? Study on AI lyrics suggests it is possible.* Meaww.com. Available at https://meaww.com/artificial-intelligence-replace-songwriters-tickpick-study-pop-rap-country-hip-hop [Accessed 8th May 2020].

Kaiser, G., Ekblad, G., & Broling, L. (2007) *Audience participation in a dance-club context: Design of a system for collaborative creation of visuals*. Stockholm, Malmo University.

Kalanje, C. M. (2006) Role of intellectual property in innovation and new product development. *World Intellectual Property Organization*. Available from: https://www.wipo.int/sme/en/documents/ip_innovation_development_fulltext.html [Accessed 5th May 2020].

Kaleagasi, B. (2017) A new AI can write music as well as a human composer. *Futurism*. Available from: https://futurism.com/a-new-ai-can-write-music-as-well-as-a-human-composer [Accessed 4th May 2020].

Kamakoti, V. (2018) Report of task force on artificial intelligence. *Ministry of Commerce and Industry*. Available at: https://dipp.gov.in/sites/default/files/Report_of_Task_Force_on_ArtificialIntelligence_20March2018_2.pdf [Accessed 8th May 2020].

Kames, L.H.H. (1767) *Principles of equity*. A. Millar, London, and A. Kincaid & J. Bell, Edinburgh.

Kanovei, V., Katz, M.G., & Mormann, T. (2013) Tools, objects, and chimeras: Connes on the role of hyperreals in mathematics. *Foundations of Science. 18* (2), pp. 259-296. Available from: http://doi:10.1007/s10699-012-9316-5 [Accessed 15th October 2015].

Karjala, D.S. (2008) Copyright and creativity. *UCLA Entertainment Law Review 15*(2), pp. 169-201. Available from: https://escholarship.org/uc/item/0t95v7n7 [Accessed 4th May 2020].

Kasparov, G. (2017) *Deep Thinking: Where machine intelligence ends and human creativity begins*. Hachette UK.

Kastrenakes, J. (2015) Djay wants you to DJ an entire party from the Apple Watch. *The Verge.* Available from: https://www.theverge.com/2015/4/23/8470417/djay-apple-watch-app-release [Accessed 14th October 2015].

Katz, B. (2007) *Mastering audio: The art and the science. 2nd ed.* Amsterdam, Elsevier/Focal Press.

Katz, D. (2003) *Solid foundations: An oral history of reggae*. Bloomsbury USA

Katz, L. F., & Krueger, A. B. (2019) The rise and nature of alternative work arrangements in the United States, 1995-2015. *Industrial and Labour Relations Review, 72*(2), pp. 382-416. Available from: https://doi.org/10.1177/0019793918820008 [Accessed 28th April 2020].

Katz, M. (2010) *Capturing sound: How technology has changed music, volume 1*. Berkeley, University of California Press.

Keane, J. (2018) A Dublin music tech startup has scooped €1.5m in funding from a Californian investor. *Fora.ie.* Available from: https://fora.ie/xhail-music-funding-3994286-May2018/ [Accessed 28th April 2020].

Keisner, A. (2016) Breakthrough technologies – robotics and IP. *WIPO Magazine.* Available from: https://www.wipo.int/wipo_magazine/en/2016/06/article_0002.html [Accessed 4th May 2020].

Kelke, W. H. H. (1910) *An epitome of personal property law*. London, Sweet and Maxwell.

Kendrick J.M. (Ed.) (2002) *Collective licensing – Past, present and future: Reports presented at the meeting of the International Association of Entertainment Lawyers, MIDEM 2002, Cannes*. International Association of Entertainment Lawyers.

Kent, D. (1993) *Australian chart book: 1970-1992, 23 years of hit singles & albums from the Top 100 Charts*. Australian Chart Book.

Kern, F. (2017) *The Role Of Technology Transfer Offices In Academic Entrepreneurship*. Munich, GRIN Verlag Gmbh.

Kettle, III, J. R. (2002) Dancing to the beat of a different drummer: Global harmonization – and the need for congress to get in step with a full public performance right for sound recordings. *Fordham Intellectual Property, Media & Entertainment Law Journal*. *12*(4), pp. 1041-1088. Available from: https://ir.lawnet.fordham.edu/iplj/vol12/iss4/3 [Accessed 4th May 2020].

Khatchatourov, A., Pachet, F., & Rowe, V. (2016) Action identity in style simulation systems: Do players consider machine-generated music as of their own style? *Frontiers in Psychology 7*. Available from: https://doi.org/10.3389/fpsyg.2016.00474 [Accessed 27th April 2020].

Kilian, K. (2009) From brand identity to audio branding. In: Kai Bronner & Rainer Hirt (Eds.) *Audio branding: Brands, sound and communication. 1st edition*. Baden-Baden, Nomos Verlagsgesellschaft mbH & Co. KG. pp. 36-51. Available from: https://doi.org/10.5771/9783845216935-36 [Accessed 28th April 2020].

Kima Ventures (2020) *Kima ventures – The most active business angel in the world*. Available from: https://www.kimaventures.com/ [Accessed 27th April 2020].

King, A. (2020) NetEase invests $1.7million in Luxembourg AI Music Startup AIVA. *Digital Music News.* Available from: https://www.digitalmusicnews.com/2020/06/17/netease-aiva-ai-music-startup/ [Accessed 21st June 2020].

King, A., & Himonides, E. (Eds.) (2016) *Music, technology, and education: Critical perspectives*. New York: Routledge.

Kirn, P. (2017) With Japan's latest Vocaloid characters, another song from the future. *CDM Create Digital Music*. Available from: https://cdm.link/2017/07/heres-new-vocaloid-japanese-synthetic-singers-sound-like/ [Accessed 11th May 2020].

Kirn, P. (2015a) Garageband, Logic could be the production side of Apple. *Create Digital Music* Available from: https://cdm.link/2015/06/rumors-next-garageband-logic-focus-connect-alchemy-synths/ [Accessed 25th July 2015].

Kirn, P. (2015) Can Stems finally make multi-channel DJ audio a standard? *Create Digital Music*. Available from: https://cdm.link/2015/03/can-stems-finally-make-multi-channel-audio-standard/ [Accessed 25th July 2015].

Kirn, P. (2015) deadmau5 wants EDM DJs to actually play, produces Tumblr poetry in the process. *Create Digital Music*. Available from: https://cdm.link/2015/07/deadmau5-wants-edm-djs-actually-play-produces-poetry/ [Accessed 11th October 2015].

Knee, A.J. (2018*)* Review: How corporate America won its civil rights. *The New York Times*. Available from: https://www.nytimes.com/2018/02/23/business/dealbook/review-we-the-corporations.html [Accessed 4th May 2020].

Knight, W. (2019) China may overtake the US with the best AI research in just two years. *MIT Technology Review*. Available from: https://www.technologyreview.com/2019/03/13/136642/china-may-overtake-the-us-with-the-best-ai-research-in-just-two-years/ [Accessed 28th April 2020].

Knight, W. (2017) The Dark Secret at the Heart of AI. *MIT Technology Review*. Available from: https://www.technologyreview.com/2017/04/11/5113/the-dark-secret-at-the-heart-of-ai/ [Accessed 8th May 2020].

Knopper, S. (2019) Copyright chaos? 'Dark Horse' verdict could lead to new wave of lawsuits. *Billboard.* Available from: http://www.billboard.com/articles/business/8526902/copyright-dark-horse-verdict-copyright-lawsuits-katy-perry [Accessed 4th May 2020].

Koch, T. (2010) Enhancing who? Enhancing what? Ethics, bioethics, and transhumanism. *Journal of Medicine and Philosophy 35 (6),* pp. 685-699. Available from: https://doi.org/10.1093/jmp/jhq051 [Accessed 27th March 2017].

Kolakowski, M. (2020) At $1.3 Trillion, Apple is bigger than these things. *Investopedia*. Available from: https://www.investopedia.com/news/apple-now-bigger-these-5-things/ [Accessed 28th April 2020].

Kop, M. (2019) AI & intellectual property: Towards an articulated public domain. *University of Texas School of Law; Texas Intellectual Property Law Journal, 28* (1). Available from: https://dx.doi.org/10.2139/ssrn.3409715 [Accessed 4th May 2020].

Kopf, D. (2019) The economics of streaming is making songs shorter. *Quartz.* Available from: https://qz.com/1519823/is-spotify-making-songs-shorter/ [Accessed 28th April 2020].

Kotler, P., et al. (2013) *Marketing*. New South Wales, Pearson Australia.

Kravets, D. (2008) Ten years later, misunderstood DMCA is the law that saved the internet. *Wired.* Available from: https://www.wired.com/2008/10/ten-years-later/ [Accessed 2nd May 2020].

Krieser, J., & Camiel, A. (2020) USPTO: Artificial intelligence systems cannot legally invent. *The National Law Review*. Available from: https://www.natlawreview.com/article/uspto-artificial-intelligence-systems-cannot-legally-invent [Accessed 11th May 2020].

Krommenhoek, B. (2018) Why 90% of startups fail, and what to do about it. *Medium.* Available from: https://medium.com/swlh/why-90-of-startups-fail-and-what-to-do-about-it-b0af17b65059 [Accessed 27th April 2020].

Krueger, A. (2019) *Rockonomics: What the music industry can teach us about economics (and our future).* London, John Murray Press.

Ku, R.S.R. (2001) The creative destruction of copyright: Napster and the new economics of digital technology. *The University of Chicago Law Review 69* (1), pp. 263-324. Available from: https://www.jstor.org/stable/1600355 [Accessed 26th March 2017].

Kumar, J. S., & Lavery, J. N. (2019) Does AI generated work give rise to a copyright claim? *The National Law Review*. Available from: https://www.natlawreview.com/article/does-ai-generated-work-give-rise-to-copyright-claim [Accessed 4th May 2020].

Kurzweil, R. (2012) Kurzweil joins Google to work on new projects involving machine learning and language processing. *kurzweilai.net.* Available from: https://www.kurzweilai.net/kurzweil-joins-google-to-work-on-new-projects-involving-machine-learning-and-language-processing [Accessed 9th March 2017].

Kurzweil, R. (2006) *The singularity is near: When humans transcend biology.* New York, Penguin.

Kurzweil, R. (2001) Promise and peril. *kurzweilai.net* Available from: https://web.cs.ucdavis.edu/~rogaway/classes/188/materials/kurzweil.pdf [Accessed 27th March 2017].

Kurzweil, R. (2000) *The age of spiritual machines: When computers exceed human intelligence*. New York: Penguin Books.

Kurzweil, R., & Grossman, T. (2001) *Fantastic voyage: Live long enough to live forever*. USA, Rodale.

Kwall, R. R. (2010) *The soul of creativity: Forging a moral rights law for the United States*. Stanford CA, Stanford University Press.

La Rocca, M. V. (2019) AIVA: a software that compose original music pieces. *The Patent.* Available from: https://www.thepatent.news/2019/10/21/aiva-a-software-that-compose-original-music-pieces/ [Accessed 27th April 2020].

Landa, R. (2010) *Graphic design solutions. 4th edition.* Wadsworth Cengage Learning.

Landy, G. K. (2008) *The IT/Digital legal companion: A comprehensive business guide to software, IT, internet, media and IP law*. Syngress.

Lange, B., & Bürkner, H. (2013) Value creation in scene-based music production: The case of electronic club music in Germany. *Economic Geography 89* (2), pp. 149-169. Available from: https://doi.org/10.1111/ecge.12002 [Accessed 27th March 2017].

Lanier, J. (2014) *Who owns the future?* London, Penguin Books.

Larkin, C. (Ed.) (2009) *Encyclopedia of popular music 4th ed.* New York, Oxford University Press.

Lashua, B., & Spracklen K., & Wagg, S., (Eds.) (2014) *Sounds And the city – Popular music, place and globalization.* Palgrave Macmillan.

Latham, S. J. (2003) Newton v. Diamond; Measuring the legitimacy of unauthorized compositional sampling -A clue illuminated and obscured. *Hastings Comm. & Ent. LJ*. *26*, 119.

Latour, B. (2005) *Reassembling the social: An introduction to actor-network-theory*. Oxford, Oxford University Press.

Lauder, E. (2017) Aiva is the first AI to officially be recognised as a composer. *AI Business.* Available from: https://aibusiness.com/aiva-is-the-first-ai-to-officially-be-recognised-as-a-composer/ [Accessed 4th May 2020].

Lauer, D. (2020) You cannot have AI ethics without ethics. AI and Ethics. [Online] Available from: http://doi:10.1007/s43681-020-00013-4 [Accessed: 9 December 2020].

Lawrence, T. (2003) *Love saves the day: A history Of American dance music culture, 1970-1979.* Durham and London, Duke University Press.

Lee, T. B. (2013) 15 years ago, Congress kept Mickey Mouse out of the public domain. Will they do it again? *Washington Post*. Available from: https://www.washingtonpost.com/news/the-switch/wp/2013/10/25/15-years-ago-congress-kept-mickey-mouse-out-of-the-public-domain-will-they-do-it-again/ [Accessed 4th May 2020].

Leibowicz, C., Adler, S., & Eckersley, P. (2019) When is it appropriate to publish high-stakes AI research? *Partnership on AI.* Available from: https://www.partnershiponai.org/when-is-it-appropriate-to-publish-high-stakes-ai-research/ [Accessed 2nd May 2020].

Leichtentritt, H. (2013 [1938]) *Music, history, and ideas*. Read Books Ltd.

Leight, E. (2019) 'If you can get famous easily, you're gonna do it: How TikTok became the music industry's new fame machine. *Rolling Stone*. Available from: https://www.rollingstone.com/music/music-features/tiktok-video-app-growth-867587/ [Accessed 28th April 2020].

Lemley, M. A. (2008) The surprising virtues of treating trade secrets as IP rights. *Stanford Law Review 61, p311; Stanford Law and Economics Olin Working Paper No.358.* Available from: https://ssrn.com/abstract=1155167 [Accessed 4th May 2020].

Leskin, P. (2019) Here are all the major US tech companies blocked behind China's 'Great Firewall'. *Business Insider*. Available from: https://www.businessinsider.com/major-us-tech-companies-blocked-from-operating-in-china-2019-5 [Accessed 28th April 2020].

Leslie, D. (2019) Understanding artificial intelligence ethics and safety: A guide for the responsible design and implementation of AI systems in the public sector. *The Alan Turing Institute*. Available from: https://doi.org/10.5281/zenodo.3240529 [Accessed 2nd May 2020].

Lessmiller, K. (2019) Top EU court bolsters music copyright protection. *Courthouse News Service.* Available from: https://www.courthousenews.com/top-eu-court-bolsters-music-copyright-protection/ [Accessed 4th May 2020].

Levy, S. (2020) This AI maestro wants to serenade you. *Wired.* Available from: https://www.wired.com/story/ai-maestro-lifescore-wants-to-serenade-you/ [Accessed 6th June 2020].

Levy, S. (2006) *The perfect think: How the iPod shuffles commerce, culture, and coolness.* New York, Simon & Schuster.

Lewis, D. (2016) *An AI-written novella almost won a literary prize*. *Smithsonian Magazine*. Available from: https://www.smithsonianmag.com/smart-news/ai-written-novella-almost-won-literary-prize-180958577/ [Accessed 8th May 2020].

Li, T., & Roslof, C. M. (2016) Robots vs. Monkeys: Intellectual property rights of non-human creators [poster session]. *We Robot Conference 2016.* University of Miami School of Law, Florida. Available from: https://doi.org/10.31228/osf.io/jbr9u [Accessed 29th March 2017].

Liang, F. (2016) BachBot: Automatic composition in the style of Bach chorales. *University of Cambridge, 8*, pp. 19-48.

Liang, F., et al. (n.d.) The BachBot challenge *bachbot.com.* Available from: http://bachbot.com/ [Accessed 20th February 2017].

Lifescore (2020) About. *Lifescore*. Available from: https://sites.google.com/lifescoremusic.com/mainsite/about [Accessed 28th April 2020].

Ligon, S. (2019) AI can create art, but can it own copyright in it, or infringe*? Lexis Nexis*. Available from: https://www.lexisnexis.com/lexis-practice-advisor/the-journal/b/lpa/posts/ai-can-create-art-but-can-it-own-copyright-in-it-or-infringe [Accessed 4th May 2020].

Lillis, A.M. (1983) *Decisions of the United States Courts involving copyright, 1983.* Copyright Office, Library of Congress, Washington.

Lindenbaum, J. (1999) Music sampling and copyright law. *Princeton University*. Available from: https://slidelegend.com/music-sampling-and-copyright-law-princeton-university_5b604f1f097c47a1598b45ae.html [Accessed 4th May 2020].

Lindop, E. (2010) *America in the 1920s.* Minneapolis, Twenty-First Century Books.

Ling, Z., et al. (2019) Explaining AlphaGo: Interpreting contextual effects in neural networks. *arXiv:1901.02184 [Cs]*. Available from: http://arxiv.org/abs/1901.02184 [Accessed 2nd April 2020].

LinkedIn (2020) WaveAI *LinkedIn*. Available from: https://www.linkedin.com/company/waveai [Accessed 27th April 2020].

Liou, G.-T., Wang, Y.-R., & Chiang, C.-Y. (2016) Text normalization for Mandarin TTS by using keyword information. In: *2016 Conference of The Oriental Chapter of International Committee for Coordination and Standardization of Speech Databases and Assessment Techniques (O-COCOSDA)*. October 2016 Bali, Indonesia, IEEE. pp. 73-78. Available from: http://doi:10.1109/ICSDA.2016.7918987 [Accessed 7th April 2020].

Liu, G., et al. (2019) *Machine-learning algorithms.* pp. 15-17. James Martin Center for Non-proliferation Studies (CNS). Available from: http://www.jstor.org/stable/resrep19699.6 [Accessed 13th May 2020].

Liu, J. (2019) An empirical study of transformative use in copyright law. *Stanford Technology Law Review 22*, pp. 163-241. Available from: https://ssrn.com/abstract=3330236 [Accessed 4th May 2020].

Livid Instruments (2014) *Cell + Cell DNA VJ Software* Available from: http://lividinstruments.com/news/cell-cell-dna-vj-software/ [Accessed 10th October 2015].

Llano, M.T., d'Inverno, M., Yee-King, M., McCormack, J., et al. (2020) Explainable Computational Creativity. In: Proceedings of the Eleventh International Conference on Computational Creativity, ICCC. 2020 p.

Lloyd, B. (2019) What are microtransactions? *Entertainment.ie.* Available from: https://entertainment.ie/gaming/what-are-microtransactions-389840/ [Accessed 28th April 2020].

Lloyd, I. J. (2020) *Information technology law 9th edition*. Oxford, Oxford University Press.

Local Enterprise (2020) New product development. *Local Enterprise.* Available from: https://www.localenterprise.ie/Westmeath/Publications-Resources/New_Product_Development.pdf [Accessed 5th May 2020].

López-Sintas, J. (Ed.) (2015) *The social construction of culture markets: Between incentives to creation and access to culture.* Trans. Ailish Maher. Barcelona, Spain, OmniaScience.

Loughran, T., & Ritter, J. R. (2004) Why has IPO underpricing changed over time? *Financial Management*. *33* (3), pp. 5-37. Available from: http://doi.org/10.2139/ssrn.331780 [Accessed 25th April 2020].

Lovelock, J. (2019) *Novacene: The coming age of hyperintelligence.* London, Penguin Books.

Lovelock, J. (2006) *The Revenge of Gaia*. London, Penguin Books.

Lowry, M. (2003) Why does IPO volume fluctuate so much? *Journal of Financial Economics*. *67* (1), pp. 3-40. Available from: https://doi.org/10.1016/S0304-405X(02)00230-1 [Accessed 27th April 2020].

Lucas, J. R. (1961) Minds, machines and Gödel. In: *Philosophy 36* (137), pp. 112-127. Available from: http://users.ox.ac.uk/~jrlucas/Godel/mmg.html [Accessed 20th April 2020].

Ludwig 3 (2011) Music software Ludwig: Automatic arranging, composing and songwriting. Royalty free music. *Write Music.* Available from: http://www.write-music.com/ [Accessed 27th April 2020].

Luppicini, R. (2012) *Handbook of research on technoself: Identity in a technological society*. IGI Global.

Lynch, P. (2012) Composition's new thing: Bruno Latour and the apocalyptic turn. *College English 74 (5*), pp. 458-476. Available from: https://www.jstor.org/stable/23212925 [Accessed 27th March 2017].

Mackay, H., & Gillespie, G. (1992) Extending the social shaping of technology approach: Ideology and appropriation. *Social Studies of Science 22* (4), pp. 685-716. Available from: https://www.jstor.org/stable/285460 [Accessed 26th March 2017].

Macmillan & Co. Ltd v Cooper (K & J) (1923) 40 TLR 186.

Madhaven, R. (2019) Establishing AI ethics – Public and private sector initiatives. *The AI Research and Advisory Group.* Available from: https://emerj.com/ethics-and-regulatory/establishing-ai-ethics-public-and-private-sector/ [Accessed 2nd May 2020].

Magenta (2020) *Magenta*. Available from: https://magenta.tensorflow.org/ [Accessed 27th April 2020].

Magenta (2019) *Magenta + Deeplocal +
The Flaming Lips = Fruit Genie*. Available from: https://magenta.tensorflow.org/fruitgenie [Accessed 27th April 2020].

Magna (2017) MAGNA Global Advertising Forecasts. *Magna Global*. Available from: https://magnaglobal.com/magna-advertising-forecasts-spring-update-june-14-2017/ [Accessed 27th April 2020].

Magnusson, T. (2014) Herding cats: Observing live coding in the wild. *Computer Music Journal 38* (1), pp. 8-16. Available from: https://doi.org/10.1162/COMJ_a_00216 [Accessed 29th March 2017].

Magnusson, T. (2013) The Threnoscope: A musical work for live coding performance. *First International Workshop on Live Programming in conjunction with ICSE 2013*. San Francisco, CA. Presentation. Available from: https://liveprogramming.github.io/2013/papers/thor.pdf [Accessed 29th March 2017].

Mainichi (2020) AI love you: Japanese man not alone in 'marriage' to virtual character. *Mainichi Daily News*. Available from: https://mainichi.jp/english/articles/20200417/p2a/00m/0na/027000c [Accessed 12th May 2020].

Majaski, C. (2019) General agreement on tariffs and trade (GATT). *Investopedia*. Available from: https://www.investopedia.com/terms/g/gatt.asp [Accessed 3rd May 2020].

Mallapur, C. (2019) While Sri Lanka grows richer, India remains a lower-middle-income nation. Scroll. Available from: https://scroll.in/article/929406/while-sri-lanka-has-grown-richer-india-remains-a-lower-middle-income-nation [Accessed 20th June 2020].

Mandle, C. (2015) Robin Thicke says he was 'drunk and high' for every interview he did in 2013. *The Independent*. Available from: http://www.independent.co.uk/news/people/robin-thicke-admits-he-was-high-and-drunk-during-every-interview-he-gave-in-2013-as-part-of-blurred-a6708931.html [Accessed 4th May 2020].

Manheim, K., & Kaplan, L. (2019) Artificial intelligence: Risks to privacy and democracy. *Yale Journal of Law & Technology*. *21*. Available from: https://yjolt.org/sites/default/files/21_yale_j.l._tech._106_0.pdf [Accessed 1st April 2020].

Manyika, J. (2017) *A future that works: AI, automation, employment, and productivity.* McKinsey Global Institute Research. Tech. Rep, 60. Available from: https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Digital%20Disruption/Harnessing%20automation%20for%20a%20future%20that%20works/MGI-A-future-that-works_Full-report.ashx [Accessed 20th March 2018].

Marche, S. (2019) The Future of celebrity is a Japanese hologram named Hatsune Miku. *Medium.* Available from: https://onezero.medium.com/the-future-of-celebrity-is-a-japanese-hologram-named-miku-a87419c951e [Accessed 11th May 2020].

Markoff, J. (2011) Computer wins on 'Jeopardy!': Trivial, it's not. *The New York Times.* Available from: https://www.nytimes.com/2011/02/17/science/17jeopardy-watson.html [Accessed 27th April 2020].

Martland, P. (2013) *Recording history: The British recording industry, 1888-1931*. Plymouth, Scarecrow Press.

Mathur, A. (2019) Behind the code: Connecting GRAMMY artists with IBM Watson Discovery. *IBM Developer*. Available from: https://developer.ibm.com/technologies/artificial-intelligence/blogs/behind-the-code-connecting-grammy-artists-with-ibm-watson-discovery/ [Accessed 27th April 2020].

Matney, L. (2019) Snap overtakes its IPO debut price. *TechCrunch*. Available from: https://techcrunch.com/2019/07/24/snap-overtakes-its-ipo-debut-price/ [Accessed 28th April 2020].

Matsakis, L. (2019) FTC hits TikTok with record $5.7 Million fine over children's privacy. *WIRED*. Available from: https://www.wired.com/story/tiktok-ftc-record-fine-childrens-privacy/ [Accessed 28th April 2020].

Maughan, J. (2018) Virtual influencers: What you need to know. *Talking Influence*. Available from: https://talkinginfluence.com/2018/11/13/virtual-influencers-what-you-need-to-know/ [Accessed 12th May 2020].

Mauk, S. (2015) The saxophone: Is it a legitimate instrument? *Phi Kappa Phi Forum, 95* (2), pp. 13-15. Available from: https://www.phikappaphiforum-digital.org/phikappaphiforum/summer_2015/MobilePagedReplica.action?pm=1&folio=10#pg12 [Accessed 1st April 2020].

Mazzola, G., et al. (2020) Musical distribution channels: New networks. In: Mazzola, G., et al. (Eds.) *The future of music: Towards a computational musical theory of everything*. Cham, Springer International Publishing. pp. 87-94. Available from: https://doi.org/10.1007/978-3-030-39709-8_8 [Accessed 1st April 2020].

McAfee, A., & Brynjolfsson, E. (2016) Human work in the robotic future: Policy for the age of automation. *Foreign Affairs 95* (4). Available from: https://www.foreignaffairs.com/articles/2016-06-13/human-work-robotic-future [Accessed 27th March 2017].

McCarthy, J., et al. (2006 [1955]) A proposal for the Dartmouth summer research project on artificial intelligence. In: *AI Magazine 27* (4) Winter. pp. 12-14. Available from: http://jmc.stanford.edu/articles/dartmouth.html [Accessed 29th March 2020].

McCartney, P. (2018) An Open Letter to the European Parliament. *IFPI Twitter*. Available from: https://twitter.com/IFPI_org/status/1014429611176972288 [Accessed 17th July 2020)

McEachern, W. A. (2011) *Economics: A contemporary introduction*. Cengage Learning.

McHugh, R. (2018) Ireland is the world's second largest software exporter. Business World. Available from: https://www.businessworld.ie/technology-news/Ireland-is-the-World-s-second-largest-software-exporter-571274.html [Accessed 20th June 2020].

McKinnon, B. (2019) Should artificial intelligence be a legal person? *Boston College Law School Magazine*. Available from: http://lawmagazine.bc.edu/2018/09/should-artificial-intelligence-be-a-legal-person/ [Accessed 4th May 2020].

McLaughlin, C. (2019) *South Bronx Battles: Stories of Resistance, Resilience, and Renewal.* Oakland California, University of California Press.

McNamee, MJ., & Edwards, S.D. (2006) Transhumanism, medical technology and slippery shoes. *Journal of Medical Ethics 32* (9), pp. 513-518. Available from: http://dx.doi.org/10.1136/jme.2005.013789 [Accessed 27th March 2017].

Medeot, G., et al. (2018) StructureNet: Inducing structure in generated melodies (Jukedeck*)*. In: *The 19th International Society of Music Information Retrieval Conference 2018*, Paris France. Sept. 23-27, 2018. pp. 725-731. Available from: http://ismir2018.ircam.fr/doc/pdfs/126_Paper.pdf [Accessed 22nd April 2020].

Melodrive (2018) *Melodrive* Available from: https://melodrive.com/ [Accessed 14th October 2018].

Melomics Records (2013) IAMUS / MELOMICS documentary. *Youtube*. Available from: https://www.youtube.com/watch?v=ETGDbWvWCbM&feature=youtu.be [Accessed 1st June 2020].

Mercuri, M. (2019) How TikTok influenced music discovery in 2019. *Forbes.* Available from: https://www.forbes.com/sites/monicamercuri/2019/12/23/how-tiktok-influenced-music-discovery-in-2019/#3731466a321b [Accessed 28th April 2020].

Metz, C. (2016) The sadness and beauty of watching Google's AI play Go. *Wired* Available from: https://www.wired.com/2016/03/sadness-beauty-watching-googles-ai-play-go/ [Accessed 27th March 2017].

Metzger, G., & Kaligofsky, P. W. (2005) *Gustav Metzger: History History, 1st Edition*. Hatje Cantz Publishers.

Miceli, T. J. (2017) *The economic approach to law. 3rd edition.* Stanford University Press.

Michaels, M. (2017) *Actor-network theory: Trials, trails and translations.* London, SAGE Publications.

Microsoft Corporation (2018) Responsible bots: 10 guidelines for developers of conversational AI. *Microsoft*. Available from: https://www.microsoft.com/en-us/research/uploads/prod/2018/11/Bot_Guidelines_Nov_2018.pdf [Accessed 2nd May 2020].

Microsoft Corporation (2018) The future computed: Artificial intelligence and its role in society. *Microsoft*. Available from: https://3er1viui9wo30pkxh1v2nh4w-wpengine.netdna-ssl.com/wp-content/uploads/2018/01/Executive-Summary_The-Future-Computed.pdf [Accessed 2nd May 2020].

Microsoft Corporation (n.d.) AI principles. *Microsoft.* Available from: https://www.microsoft.com/en-us/ai/responsible-ai?activetab=pivot1%3aprimaryr6 [Accessed 2nd May 2020].

Middleton, R. (1990) *Studying popular music.* UK, Open University Press.

Miller, C. (2019) Rolling Stone feature explores Apple's 'Music Apps' team, GarageBand's origin and future. *9to5Mac*. Available from: https://9to5mac.com/2019/03/16/rolling-stone-feature-explores-apples-music-apps-team-garagebands-origin-and-future/ [Accessed 28th April 2020].

Miller, C. (2018) Tim Cook on Apple Music: Human curation is key, not 'bits-and-bytes'. *9to5Mac*. Available from: https://9to5mac.com/2018/08/07/tim-cook-music-curation-vs-spotify/ [Accessed 12th May 2020].

Miller, P. D. (Ed.) (2008) *Sound unbound: Sampling digital music and culture*. Cambridge, The MIT Press.

Miller, S. (1993) *The last post: Music after modernism*. Manchester, Manchester University Press.

Milner, G. (2010) *Perfecting sound forever: The story of recorded music*. UK, Granta Books.

Miranda, E. (2004) *Composing music with computers.* Burlington, Focal Press.

Miranda, E. R. (2000) *Readings in music and artificial intelligence.* New York, Routledge.

Miranda, E.R., & Biles, J.A. (Eds.) (2007) *Evolutionary computer music*. London, Springer-Verlag.

Mispagel, C. (2018) Resolving a copyright law circuit split: The importance of a *De Minimis* exception for sampled sound recordings. *Saint Louis University Law Journal*. *62* (2), pp. 461-484. Available from: https://www.slu.edu/law/law-journal/pdfs/issues-archive/v62-no2/claire_mispagel_note.pdf [Accessed 4th May 2020].

Mitrev, D. (2019) Springer Nature published its first machine-generated book. *NeuroHive.* Available from: https://neurohive.io/en/news/springer-nature-published-its-first-machine-generated-book/ [Accessed 4th May 2020].

Mittelstadt, B.D., & Floridi, L. (2016) The ethics of big data: Current and foreseeable issues in biomedical contexts. *Science and Engineering Ethics 22* (2), pp. 303-341. Available from: https://tdwi.org/research/2011/09/best-practices-report-q4-big-data-analytics.aspx?tc=page0&tc=assetpg&tc=page0 [Accessed 20th April 2020].

Mixed In Key (n.d.) How to guide. *Mixedinkey.com* Available from: https://mixedinkey.com/captain-plugins/how-to-guide/ [Accessed 15th October 2015].

Mnih, V., Kavukcuoglu, K., Silver, D., Graves, A., et al. (2013) Playing Atari with deep reinforcement learning. *arXiv:1312.5602 [Cs]*. Available from: http://arxiv.org/abs/1312.5602 [Accessed 7th April 2020].

Newsroom (2020) OECD to host Secretariat of new global partnership on Artificial Intelligence. *Modern Diplomacy*. Available at: https://moderndiplomacy.eu/2020/06/15/oecd-to-host-secretariat-of-new-global-partnership-on-artificial-intelligence/ [Accessed 30th June 2020].

Montano, E. (2010) 'How do you know he's not playing Pac-Man while he's supposed to be DJing?': technology, formats and the digital future of DJ Culture. *Popular Music, 29* (3), pp. 397-416. Trinity College Database. Available from: https://www.jstor.org/stable/40926942 [Accessed 28th March 2017].

Montano, E. (2008) 'You're not a real DJ unless you play vinyl' – technology and formats – the progression of dance music and DJ culture. *Journal on the Art of Record Production, 03* (1). Available from: https://www.arpjournal.com/asarpwp/'you're-not-a-real-dj-unless-you-play-vinyl'-–-technology-and-formats-–-the-progression-of-dance-music-and-dj-culture/ [Accessed 8th August 2015].

Moore, J. (1996) *The death of competition: Leadership and strategy in the age of business ecosystems*. New York, Harper Business.

Moore, J. (1993) Predators and prey: A new ecology of competition. *Harvard Business Review, 71* (3), pp. 75-86.

Moosazadeh, S. (2018) AJMF9: Robotic musician does more than keep beat. *Atlanta Jewish Times*. Available from: https://atlantajewishtimes.timesofisrael.com/ajmf9-robotic-musician-does-more-than-keep-beat/ [Accessed 27th April 2020].

More, M. (2013 [1990]) The philosophy of transhumanism. In: More, M., & Vita-More, N. (Eds.) *The transhumanist reader: Classical and contemporary essays on the science, technology, and philosophy of the human future,* pp. 3-17. Chichester, John Wiley & Sons.

Morning Consult (2019) *The influencer report: Engaging Gen Z and Millennials.* Morning Consult.

Morris, J. W. (2015) *Selling Digital Music, Formatting Culture*. Oakland CA, University of California Press.

MSP Hub (2019) *IBM Watson: taking the power of AI to the Grammys*. Available from: https://www.themsphub.com/content/ibm-watson-taking-the-power-of-ai-to-the-grammys/ [Accessed 27th April 2020].

Mubert (2020) Mubert — Royalty-free music, powered by AI. *Mubert.* Available from: https://mubert.com/ [Accessed 28th April 2020].

Mubert & Adidas (2020) Mubert x Adidas nite jogger secret channel. *Mubert.* Available from: https://nj.mubert.com [Accessed 1st June 2020].

Muehlhauser, L., & Helm, L. (2012) The singularity and machine ethics. In: Eden, A., et al. (Eds.) *Singularity hypothesis: A scientific and philosophical assessment.* pp. 101-126. Berlin, Springer Berlin Heidelberg. Available from: https://doi.org/10.1007/978-3-642-32560-1_6 [Accessed 20th March 2017].

Murgia, M. (2019) DeepMind co-founder leaves for policy role at Google. *Financial Times*. Available from: https://www.ft.com/content/02757f12-1780-11ea-9ee4-11f260415385 [Accessed 2nd May 2020].

Murgia, M., & Shrikanth, S. (2019) How big tech is struggling with the ethics of AI. *Financial Times.* Available from: https://www.ft.com/content/a3328ce4-60ef-11e9-b285-3acd5d43599e [Accessed 2nd May 2020].

Murray, R. (2015) Watch: Bob Dylan chats to his computer. *Clash Music*. Available from: https://www.clashmusic.com/news/watch-bob-dylan-chats-to-his-computer [Accessed 27th April 2020].

Muscutt, K. (2007) Composing with algorithms: An interview with David Cope. *Computer Music Journal*. *31* (3), pp. 10-22. Available from: https://doi.org/10.1162/comj.2007.31.3.10 [Accessed 8th December 2019].

Music Ally (2016) Britain's smart future: How will AI affect the music industry. *Music Tank*. Available from: https://www.musictank.co.uk/wp-content/uploads/2018/03/bpi-ai-report.pdf [Accessed 2nd May 2020].

Music Market (2019) Music market focus: China (Part 1/2). *Soundcharts*. Available from: https://soundcharts.com/blog/music-market-focus-china-part-1 [Accessed 28th April 2020].

Music Tech Fest (2020) MTF. *Music Tech Fest.* Available from: https://musictechfest.net/ [Accessed 8th May 2020].

Myers, M. (2013) *Why jazz happened*. Berkeley, University of California Press Books.

Nabirahni, D. M., Evans, B. R., & Persaud, A. (2019) Al-Khwarizmi (Algorithm) and the development of algebra. *Mathematics Teaching Research Journal*. *11* (1-2), pp. 13-17. Available from: https://commons.hostos.cuny.edu/mtrj/wp-content/uploads/sites/30/2019/08/v11n12-Al-Khwarizmi-Algorithm.pdf [Accessed 29th March 2017].

Naghavi, A., & Prarolo, G. (2018) Harmonisation and globalisation of intellectual property culture. *The World Economy*. *41* (7), pp. 1847-1866. Available from: https://doi.org/10.1111/twec.12648 [Accessed 5th May 2020].

Nandy, A., & Biswas, M. (2018) OpenAI basics. In: Nandy, A., & Biswas, M. (Eds.) *Reinforcement learning: With Open AI, TensorFlow and Keras Using Python*. pp. 71-87. Berkeley, CA, Apress. Available from: https://doi.org/10.1007/978-1-4842-3285-9_3 [Accessed 27th March 2018].

Narayen, S. (2019) Amplifying human creativity with artificial intelligence. *Adobe Blog*. Available from: https://theblog.adobe.com/amplifying-human-creativity-with-artificial-intelligence/ [Accessed 28th April 2020].

Nass, C. (2010) *The man who lied to his laptop – What machines teach us about human relationships.* London, Penguin Group.

Nass, C., & Moon, Y. (2000) Machines and mindlessness: Social responses to computers. *Journal of Social Issues 56* (1) pp. 81-103. Available from: https://doi.org/10.1111/0022-4537.00153 [Accessed 29th March 2017].

Nass, C., Fogg, B.J., & Moon, Y. (1996) Can computers be teammates? *International Journal of Human-Computer Studies 45* (6), pp. 669-678. Available from: https://doi.org/10.1006/ijhc.1996.0073 [Accessed 28th March 2017].

National Research Council Canada (2017) Advisory statement on human ethics in artificial intelligence and big data research. *Government of Canada.* Available from: https://nrc.canada.ca/en/corporate/values-ethics/research-involving-human-participants/advisory-statement-human-ethics-artificial-intelligence-big-data-research-2017 [Accessed 3rd May 2020].

Native Instruments (2020) Samplers. *Native Instruments*. Available from: https://www.native-instruments.com/catalog/komplete/samplers/ [Accessed 4th May 2020].

Native Instruments (n.d.) Traktor Digital DJing *Native Instruments News*. Available from: https://www.native-instruments.com/en/ [Accessed 15th October 2015].

Native Instruments (n.d.) Traktor Kontrol S8: Flagship All-In-One DJ system. *Native Instruments News.* Available from: https://www.native-instruments.com/en/ [Accessed 2nd November 2015].

Newborn, M. (2012) *Kasparov versus Deep Blue: Computer chess comes of age*. New York, Springer-Verlag New York Inc.

Newman, K. (2010) The cyborg variations. *The Atlas Society*. Available from: https://atlassociety.org/commentary/commentary-blog/3808-the-cyborg-variations [Accessed 27th April 2020].

Nezu, R. (2007) Technology transfer, intellectual property and effective university-industry partnership. *Japan, World Intellectual Property Organization.* Available from: https://www.wipo.int/edocs/pubdocs/en/intproperty/928/wipo_pub_928.pdf [Accessed 20th March 2017].

Nicolaou, A. (2018) Facebook strikes new music licensing deals. *Financial Times.* Available from: https://www.ft.com/content/7b7e71d6-2964-11e8-b27e-cc62a39d57a0 [Accessed 2nd May 2020].

Nierhaus, G. (2009) *Algorithmic composition: Paradigms of automated music generation*. New York, Springer-Verlag/Wein.

Niklasson, L, (2019) *Improving the sustainable development goals – Strategies and governance challenges*. New York, Routledge.

Nilsson, N. J. (2009) *The quest for artificial intelligence: A history of ideas and achievements*. Cambridge, Cambridge University Press. Available from: https://doi.org/10.1017/CBO9780511819346 [Accessed 2nd April 2020].

Nimmer, D. (2003) *Copyright: Sacred text, technology, and the DMCA (Vol. 1)*. The Hague, Kluwer Law International.

Nishiyama, G. (2003) 14-Century-old Japanese firm's longevity secret: Sticking to basics. *Los Angeles Times*. Available from: https://www.latimes.com/archives/la-xpm-2003-may-26-fi-japanbiz26-story.html [Accessed 4th May 2020].

Nobel Prize (2020) The Nobel Prize in Literature 2016. *NobelPrize.org*. Available from: https://www.nobelprize.org/prizes/literature/2016/press-release/ [Accessed 4th May 2020].

Noë, A. (2015) Strange *tools: Art and human nature*. New York, Hill & Wang.

Northern Soul (2015) Directed by Elaine Constantine [Film]. UK, Universal.

Northern Soul: Living for the weekend (2015) BBC FOUR. Available from: https://www.bbc.co.uk/programmes/b04bf1lf [Accessed 27th March 2017].

Nottage kurz Jackson (1883) 11 Q. B. Div. 627

Nova Productions Ltd v Mazooma Games Ltd (2007) EWCA Civ 219, 14 March

Novet, J. (2019) Google's flashy A.I. demo overshadowed Microsoft's focus on work. *CNBC.* Available from: https://www.cnbc.com/2018/05/12/google-beats-microsoft-in-ai-demo-war-with-duplex.html [Accessed 28th April 2020].

Nowell, D. (2001) *Too darn soulful: The Story of northern soul.* London, Robson Books.

Nowell, D. (1999) *The story of northern soul – A definitive history of the dance scene that refuses to die*. London, Portico Books.

Null, L., & Lobur, J. (2006) *The essentials of computer organization and architecture 2nd edition*. Sudbury MA, Jones and Bartlett.

Numerico, T. (2015) Google AI and Turing's social definition of intelligence. In: *Proceedings of ISIS Summit Vienna 2015—The Information Society at the Crossroads*. 1 July 2015 Vienna, Austria, MDPI. p. S3039. Available from: http://doi.org/10.3390/isis-summit-vienna-2015-S3039 [Accessed 7th April 2020].

Nyholm, S. (2020) *Humans and Robots: Ethics, Agency, and Anthropomorphism.* London, Rowman & Littlefield Intl.

nytimes.com (2018) When Queen took 'Bohemian Rhapsody' to Live Aid. *The New York Times*. Available from: https://www.nytimes.com/2018/11/09/arts/music/bohemian-rhapsody-queen-live-aid.html [Accessed 8th May 2020].

O'Keefe, C., et al. (2020) The windfall clause: Distributing the benefits of AI. *Centre for the Governance of AI Research Report.* Future of Humanity Institute, University of Oxford. Available from: https://www.fhi.ox.ac.uk/windfallclause/ [Accessed 2nd May 2020].

O'Leary, D.E. (2019) GOOGLE'S Duplex: Pretending to be human. *Intelligent Systems in Accounting, Finance and Management. 26* (1), pp. 46-53. Available from: https://doi.org/10.1002/isaf.1443 [Accessed 7th April 2020].

O'Malley Greenburg, Z. (2015) The world's highest-paid DJs: Electronic cash kings 2015 *Forbes*. Available from: https://www.forbes.com/sites/zackomalleygreenburg/2015/08/24/the-worlds-highest-paid-djs-electronic-cash-kings-2015/ [Accessed 15th October 2015].

O'Neill, R. (2019) Music publishers call for congressional TikTok probe. *Trademarks and Brands Online.* Available from: https://www.trademarksandbrandsonline.com/news/music-publishers-call-for-congressional-tiktok-probe-5559 [Accessed 28th April 2020].

OECD (2019a) *OECD Principles on Artificial Intelligence*. Organisation for Economic Co-operation and Development. Available from: https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0449 [Accessed 25th April 2020].

OECD (2019) *Artificial intelligence in society*. Paris, OECD Publishing. Available from: https://doi.org/10.1787/eedfee77-en [Accessed 2nd May 2020].

OECD (2013) *OECD Guidelines on Measuring Subjective Well-being*. OECD Publishing. Available from: https://read.oecd-ilibrary.org/economics/oecd-guidelines-on-measuring-subjective-well-being_9789264191655-en#page4 [Accessed 7th July 2020].

OII (2020) OII. *Oxford Internet Institute*. Available from: https://www.oii.ox.ac.uk/ [Accessed 8th May 2020].

Okuno, H. G., et al. (2001) Human-robot interaction through real-time auditory and visual multiple-talker tracking. In: *Proceedings 2001 IEEE/RSJ International Conference on Intelligent Robots and Systems. Expanding the Societal Role of Robotics in the Next Millennium*. 2001 Maui, HI, USA, IEEE. pp. 1402-1409. Available from: http://doi.org/10.1109/IROS.2001.977177 [Accessed 27th April 2020].

Oldham, A. L. (2013) *Rolling stoned*. Canada, Because Entertainment Inc.

Olewitz, C. (2016) Japanese A.I. writes novel, passes first round for literary prize. *Digital Trends*. Available from: https://www.digitaltrends.com/cool-tech/japanese-ai-writes-novel-passes-first-round-nationanl-literary-prize/ [Accessed 4th May 2020].

Omnicore (2020) Snapchat by the numbers: Stats, demographics & fun facts. *Omnicore Agency*. Available from: https://www.omnicoreagency.com/snapchat-statistics/ [Accessed 28th April 2020].

OpenAI (2018) *OpenAI charter*. Available from: https://openai.com/charter/ [Accessed 2nd May 2020].

Orwell, G. (2004 [1946]) *Why I write*. Revised Edition. Penguin Books.

Osipenko, A. (2019) *AI for Art: Recipes for art generation with machine learning*. Springer

Oskar (2019a) Tracklib presents state of sampling 2019. *Tracklib Blog*. Available from: https://www.tracklib.com/blog/tracklib-presents-state-of-sampling-2019/ [Accessed 4th May 2020].

Oskar (2019b) 2019: The state of sampling. *Hypebot*. Available from: https://www.hypebot.com/hypebot/2019/03/2019-the-state-of-sampling-draft.html [Accessed 4th May 2020].

Otis, L. (2009) *Literature and science in the nineteenth century: an anthology*. Oxford University Press.

Otzen, E. (2015) Six seconds that shaped 1,500 songs. *BBC World Service* Available from: https://www.bbc.com/news/magazine-32087287 [Accessed 31st March 2015].

Owen, L. (2019) *Selling rights 8th edition.* London, Routledge.

Pachet, F. (2009) Description-based design of melodies. *Computer Music Journal*. *33* (4), pp56-68. Available from: https://doi.org/10.1162/comj.2009.33.4.56 [Accessed 27th March 2020].

Pachet, F. (2003) Content management for electronic music distribution. *Communications of the ACM*, *46* (4), pp. 71-75. Available from: https://doi.org/10.1145/641205.641207 [Accessed 27th April 2020].

Paine, T.L., et al. (2016) Fast WaveNet generation algorithm. *arXiv:1611.09482 [Cs]*. Available from: http://arxiv.org/abs/1611.09482 [Accessed 7th April 2020].

Palombini, C. (1993) Machine songs V: Pierre Schaeffer: From research into noises to experimental music. C*omputer Music Journal 17* (3), pp. 14-19. Available from: https://www.jstor.org/stable/3680939 [Accessed 30th March 2017].

Pandey, N., & Dharni, K. (2014) *Intellectual property rights*. PHI Learning Pvt. Ltd.

Pandey, V. (2015) India: The relevance of doctrine of scène à faire in copyright law. *Mondaq.* Available from: https://www.mondaq.com/india/copyright/365210/the-relevance-of-doctrine-of-scne-faire-in-copyright-law [Accessed 4th May 2020].

Pareles, J. (2002) David Bowie, 21st Century Entrepreneur. The New York Times. Available from: https://www.nytimes.com/2002/06/09/arts/david-bowie-21st-century-entrepreneur.html [Accessed 20th June 2020].

Parikh, D. (2020) Interesting AI experiments with Google that you should check out now. *Medium.* Available from: https://medium.com/the-research-nest/interesting-ai-experiments-with-google-that-you-should-checkout-now-1c0e2982cbb0 [Accessed 27th April 2020].

Park, T. H. (2009) An interview with Max Mathews *Computer Music Journal 33* (3), pp. 9-22. Available from: https://doi.org/10.1162/comj.2009.33.3.9 [Accessed 28th March 2017].

Parkinson, A., & Bell, R. (2015) deadmau5, Derek Bailey, and the laptop instrument – Improvisation, composition, and liveness in live coding. In: *Proceedings of the First International Conference on Live Coding.* University of Leeds School of Music, Leeds, UK. 2015. Available from: https://iclc.toplap.org/2015/html/101.html [Accessed 29th March 2017].

Partnership on AI (2020) *Tenets.* Available from: https://www.partnershiponai.org/tenets/ [Accessed 2nd May 2020].

Patel, A.D. (2014) The evolutionary biology of musical rhythm: Was Darwin wrong? *PLOS Biology 12* (5). Available from: https://doi.org/10.1371/journal.pbio.1001821 [Accessed 26th March 2017].

Patents Act 1977 (2020) *Patents Act 1977*. Available from: http://www.legislation.gov.uk/ukpga/1977/37/section/1 [Accessed 5th May 2020].

Patry, W. (2011) *How to Fix Copyright*. New York, Oxford University Press.

Patry, W. F. (1994) *Copyright law and practice (Vol. 3)*. Washington D.C., The Bureau of National Affairs Inc.

Pearson, D.M. (2019) Extreme hardcore punk and the analytical challenges of rhythm, riffs, and timbre in punk music. *Music Theory Online*. *25* (1). Available from: http://doi.org/10.30535/mto.25.1.5 [Accessed 8th April 2020].

Peel, J. *(2015) The John Peel Archive*. Available from: https://johnpeelarchive.com/ [Accessed 16th October 2015].

Peiser, J. (2019) The rise of the robot reporter. *The New York Times*. Available from: https://www.nytimes.com/2019/02/05/business/media/artificial-intelligence-journalism-robots.html [Accessed 4th May 2020].

Peitz, M., & Waelbroeck, P. (2005) An economist's guide to digital music. *CESifo Economic Studies, 51* (2-3), pp. 359-428. Available from: https://doi.org/10.1093/cesifo/51.2-3.359 [Accessed 2nd May 2020].

Pelham GmbH, M.P., Martin Haas v. Ralf Hütter, Florian Schneider-EslebenDirective 2001/29/EC, Arts. 2(c), 5(2) and (3), 9(1)(b); Charter of Fundamental Rights of the European Union, Art. 13 (2019) "Pelham and Others". *IIC – International*

Review of Intellectual Property and Competition Law 50 (9), pp. 1156-1157. Available from: https://doi.org/10.1007/s40319-019-00876-z [Accessed 4th May 2020].

Penrose, R. (2016) *The emperor's new mind: Concerning computers, minds, and the laws of physics.* New York, Oxford University Press.VA

Penrose, R., & Mermin, N. D. (1990) The Emperor's New Mind: Concerning Computers, Minds, and the Laws of Physics. *American Journal of Physics 58* (12), pp. 1214-1216. Available from: http://doi.org/10.1119/1.16207 [Accessed 10th April 2019].

Perez, S. (2019) Spotify and India's T-Series ink a global content deal for over 160,000 songs. *TechCrunch*. Available from: https://social.techcrunch.com/2019/01/14/spotify-and-indias-t-series-ink-a-global-content-deal-for-over-160000-songs/ [Accessed 3rd May 2020].

Perkal, P. J. (2018) Monkey business finally settled: the 'monkey selfie' disputes. *Kluwer Copyright Blog.* Available from: http://copyrightblog.kluweriplaw.com/2018/02/05/monkey-business-finally-settled-monkey-selfie-disputes/ [Accessed 4th May 2020].

Perkins, W. E. (Ed.) (1996) *Droppin' science: Critical essays on rap music and hip hop culture.* Philadelphia, Temple University Press.

Perry, M., & Margoni, T. (2010) From music tracks to Google maps: Who owns computer generated works? *Computer Law and Security Review 26*, pp. 621-629. Available from: https://doi.org/10.1016/j.clsr.2010.09.005 [Accessed 28th March 2017].

Peter (2019) Considering human imagination the last piece of wilderness, do you think AI will ever be able to write a good song? *The Red Hand Files*. Available from: https://www.theredhandfiles.com/considering-human-imagination-the-last-piece-of-wilderness-do-you-think-ai-will-ever-be-able-to-write-a-good-song/ [Accessed 12th May 2020].

Peterson, C., Park, N., & Sweeney, P. J. (2008) Group Well-Being: Morale from a Positive Psychology Perspective. *Applied Psychology 57* (1), pp. 19-36. Available from: https://doi.org/10.1111/j.1464-0597.2008.00352.x [Accessed 28th June 2020].

Pfeiffer, T. (2019) Tencent Group buys 10% of Universal Music for $3.4 Billion. *Bloomberg*. Available from: https://www.bloomberg.com/news/articles/2019-12-31/tencent-group-clinches-deal-for-10-of-vivendi-s-universal-music [Accessed 28th April 2020].

Philip, R. (1992) *Early recordings and music style – Changing tastes in instrumental performance, 1900-1950*. Cambridge, Cambridge University Press.

Pierce, D. (2020) The secret hit-making power of the Spotify playlist. *WIRED*. Available from: https://www.wired.com/2017/05/secret-hit-making-power-spotify-playlist/ [Accessed 8th May 2020].

Pinch, T. J., & Bijker, W. E. (2003 [1987]) The social construction of facts and artefacts. In: Scharff, R. C., & Dusek, V. (Eds.) *Philosophy of technology. The technological condition. An anthology*. pp. 221-232. Malden, MA, Blackwell Publishing.

Pinch, T., & Trocco, F. (2004) *Analog days – The invention and impact of the Moog synthesizer*. Harvard University Press.

Pinch, T., & Trocco, F. (1998) The social construction of the early electronic music synthesizer. *Icon* (4), pp. 9-31. Available from: https://www.jstor.org/stable/23785956 [Accessed 27th March 2017].

Pinch, T.J., & Bijsterveld, K. (2004) Sound studies: New technologies and music. *Social Studies of Science 34* (5), pp. 635-648. Available from: https://www.jstor.org/stable/4144355 [Accessed 26th March 2017.

Pinch, T.J., & Bijsterveld, K. (2003) Should one applaud? – Breaches and boundaries in the reception of new technology in music. *Technology and Culture 44* (3), pp. 536-559. Available from: http://doi.org/10.1353/tech.2003.0126 [Accessed 30th March 2017].

Pisani, B. (2018) Spotify's IPO disrupted Wall Street. What lies ahead now for unicorns looking to go public. *CNBC*. Available from: https://www.cnbc.com/2018/05/22/spotifys-ipo-disrupted-wall-street-what-lies-ahead-now-for-unicorns-looking-to-go-public.html [Accessed 27th April 2020].

Plotkin, R. (2009) *The genie in the machine: how computer-automated inventing is revolutionizing law and business*. Stanford University Press.

Pohl, J.G. (2019) The five tribes of machine-learning: A brief overview. In: *InterSymp-2019 Conference, International Institute for Advanced Studies in Systems Research and Cybernetics*. 1 July 2019. Available from: https://digitalcommons.calpoly.edu/cgi/viewcontent.cgi?article=1082&context=arch_fac [Accessed 20th March 2020].

Polansky, R. (2007) *Aristotle's De Anima: A critical commentary*. Cambridge University Press.

Pope, R. (2008) In the mix: Today's VJ is entertainer, inventor, visualist. *Live Design Journal*, *42* (2). Available from: https://www.livedesignonline.com/concerts/mix [Accessed 12th August 2015].

Porter, S. (2018) The five big things that made Apple. *BBC News*. Available from: https://www.bbc.com/news/business-45044963 [Accessed 28th April 2020].

Posard, M.N. (2014) status processes in human-computer interactions: Does gender matter? *Computers in Human Behaviour 37* (A), pp. 189-195. Available from: https://doi.org/10.1016/j.chb.2014.04.025 [Accessed 29th March 2017].

Posard, M.N., & Rinderknecht, R.G. (2015) Do people like working with computers more than human beings? *Computers in Human Behaviour 51* (A), pp. 232-238. Available from: https://doi.org/10.1016/j.chb.2015.04.057 [Accessed 29th March 2017].

Poschardt, U. (1998) *DJ culture*. Trans. Shaun Whiteside. London, Quartet Books.

Postman, N. (2000) *Building a bridge to the 18th Century: How the past can improve our futur*e. New York, Vintage Books, Random House Inc.

Postman, N. (1993) *Technopoly – the surrender of culture to technology*. New York, Vintage Books.

Prasad, A., & Agarwala, A. (2008) Whodunit! Assessing copyright liability in Cyburbia: positing solutions to curb the menace of copyrighted 'file sharing' culture. *Journal of International Commercial Law & Technology, 3* (1), pp. 1-12. Available from: http://search.ebscohost.com.elib.tcd.ie/login.aspx?direct=true&db=a9h&AN=36133477 [Accessed 29th April 2020].

Prendergast, M. (2000) *The ambient century from Mahler to Moby – The evolution of sound in the electronic age*. New York, Bloomsbury.

Pride, J. (2018) *Unicorn tears: Why startups fail and how to avoid it*. Australia, John Wiley & Sons.

Prior, N. (2008) Putting a glitch in the field: Bourdieu, actor network theory and contemporary music. *Cultural Sociology 2* (3), pp. 301-319. Available from: https://doi.org/10.1177%2F1749975508095614 [Accessed 26th March 2017].

Probst, L., et al. (2018) USA-China-EU plans for AI: where do we stand. *Digital Transformation Monitor of the European Commission*. Available from: https://ec.europa.eu/growth/tools-

databases/dem/monitor/sites/default/files/DTM_AI%20USA-China-EU%20plans%20for%20AI%20v5.pdf [Accessed 4th May 2020].

Proffatt, J. (1880) The law of newspaper libel. *The North American Review 131* (285), pp. 109-127. Available from: https://www.jstor.org/stable/25100878?seq=1#metadata_info_tab_contents [Accessed 4th May 2020].

PubNub (2015) How Fast is Realtime? Human Perception and Technology. *PubNub*. Available from: https://www.pubnub.com/blog/how-fast-is-realtime-human-perception-and-technology [Accessed 13th June 2020].

PwC (2019) Global entertainment & media outlook 2019-2023. *PwC Global*. Available from: https://www.pwc.com/gx/en/industries/tmt/media/outlook.html [Accessed 30th June 2020].

Pynchon, T. (1984) *Thomas Pynchon*. Available from: https://archive.nytimes.com/www.nytimes.com/books/97/05/18/reviews/pynchon-luddite.html? [Accessed 8th May 2020].

Quintais, J. P. (2017) *Copyright in the age of online access: Alternative compensation systems in EU law*. The Netherlands, Wolters Kluwer Law International BV.

R.T.E. (2020) Katy Perry has song copyright verdict reversed. *RTE*. Available from: https://www.rte.ie/entertainment/2020/0318/1123954-katy-perry-has-song-copyright-verdict-reversed/ [Accessed 7th June 2020].

Rahmatian, A (2015) *Concepts of music and copyright: How music perceives itself and how copyright perceives music.* Cheltenham, Edward Elgar Publishing Ltd.

Rajan, M. T. S. (2011) *Moral rights: Principles, practice and new technology.* New York, Oxford University Press.

Ramsey, C. (2017) "Thinking out loud" about copyright infringement (again). *JD Supra*. Available from: https://www.jdsupra.com/legalnews/thinking-out-loud-about-copyright-45394/ [Accessed 4th May 2020].

Randles, C. (Ed.) (2015) *Music education: Navigating the future.* New York, Routledge.

Rashid, T., et al. (2020) Monotonic value function factorisation for deep multi-agent reinforcement learning. *arXiv:2003.08839 [cs, stat]*. Available from: http://arxiv.org/abs/2003.08839 [Accessed 7th April 2020].

Rath, A., & Wald, E. (2015) 50 years ago, Bob Dylan electrified a decade with one concert. *Interview: National Public Radio*. Available from: https://www.npr.org/2015/07/25/424977355/50-years-ago-bob-dylan-electrified-a-decade-with-one-concert?t=1587825219529 [Accessed 15th September 2015].

Ravenscraft, E. (2014) How piracy benefits companies, even if they don't admit it. *Lifehacker.com* Available from: https://lifehacker.com/how-piracy-benefits-companies-even-if-they-dont-admit-1649353452 [Accessed 30th October 2015].

Rawls, J. (2005 [1971]) *A theory of justice (original edition, reprint).* Cambridge MA, The Belknap Press of Harvard University Press.

Reedy, C. (2017) Kurzweil claims that the singularity will happen by 2045. *Futurism.com.* Available from: https://futurism.com/kurzweil-claims-that-the-singularity-will-happen-by-2045 [Accessed 26th March 2020].

Rekordbox (n.d.) What is Rekordbox? *Rekordbox online*. Available from: https://rekordbox.com/en/ [Accessed 12th October 2015].

Remengesau, T. E. (2003) *Republic of Palau Copyright Act of 2003.* Republic of Palau.

Requena, G., et al. (2014) Melomics Music Medicine (M^3) to lessen pain perception during pediatric prick test procedure. *Pediatric Allergy and Immunology 25* (7), pp. 721-724. Available from: https://doi.org/10.1111/pai.12263 [Accessed 29th March 2017].

researcher.watson.ibm.com (2020) The music of machines – IBM. *researcher.watson.ibm.com* Available from: https://researcher.watson.ibm.com/researcher/view_group.php?id=6376 [Accessed 27th April 2020].

Reynolds, M. (2019) What is Article 13? The EU's divisive new copyright plan explained. *Wired*. Available from: https://www.wired.co.uk/article/what-is-article-13-article-11-european-directive-on-copyright-explained-meme-ban [Accessed 2nd May 2020].

Reynolds, M. (2018) Inside the race to create an AI-powered virtual Elton John. *Wired.co.uk* Available at: https://www.wired.co.uk/article/elton-john-farewell-tour-virtual-reality-retirement-announcement [Accessed 8th May 2020].

Reynolds, S. (1999) *generation Ecstasy: Into the world of techno and rave culture*. New York, Routledge.

Ricketson, S. (1987) *Berne Convention for the Protection of Literary and Artistic Works: 1886-1986.* London, Centre for Commercial Law Studies; Queen Mary College, Kluwer.

Rieder, K., & Voß, G. (2010) The working customer – An emerging new type of customer. *Psychology of Everyday Activity 3* (2) pp. 2-10. Available from: https://www.uibk.ac.at/iup/buch_pdfs/journal-psychologie-open-access/journal_3_2.pdf [Accessed 26th March 2017].

Rifkin, J. (1995) *The end of work*. New York, G. P. Putnam's Sons.

Ripken, S. K. (2019) *Corporate personhood*. Cambridge University Press.

Ritzer, G., & Jurgenson, N. (2010) Production, consumption, prosumption: The nature of capitalism in the age of the digital 'prosumer'. *Journal of Consumer Culture 10* (1), pp. 13-36. Available from: http://doi.org/10.1177/1469540509354673 [Accessed 26th March 2017].

Rizk, P.-A. (2018) The legal status of robots in different countries. *Le droit et l'intelligence artificielle*. Available from: https://pierre-antoine-rizk.com/2018/04/26/the-legal-status-of-robots-in-different-countries/ [Accessed 4th May 2020].

Roads, C. (2015) *Composing electronic music: A new aesthetic*. New York, Oxford University Press.

Roads, C. (1996) *The computer music tutorial*. Boston, MIT Press.

Roberts, A., et al. (2019) *Magenta studio: Augmenting creativity with deep learning in Ableton Live*. 7. Available from: https://storage.googleapis.com/pub-tools-public-publication-data/pdf/ab2b1a3cf41bd6c42b1d599382a40e05c22bea3b.pdf [Accessed 27th April 2020].

Roberts, K. (2011) *The origins of business, money, and markets*. New York, Columbia University Press.

Robertson, J. (2014) Human rights vs. robot rights: Forecasts from Japan. *Critical Asian Studies. 46* (4), pp. 571-598.

Robinson, W. K., & Smith, J. T. (2018) Emerging technologies challenging current legal paradigms. *Minnesota Journal of Law, Science & Technology 19* (2), *SMU Dedman School of Law Legal Studies Research Paper No. 392*. Available from:

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3220440 Accessed [3rd May 2020].

Rocha, E. (2017) Sophia: Exploring the ways AI may change intellectual property protections. *DePaul Journal of Art, Technology & Intellectual Property Law 28* (2), pp. 126-146. Available from: https://via.library.depaul.edu/jatip/vol28/iss2/3 [Accessed 4th May 2020].

Romero, J., & Machado, P. (eds) (2007) *The art of artificial evolution: A handbook on evolutionary art and music*. London, Springer.

Roof, K. (2016) Musical.ly raising $100 million at $500 million valuation for social music videos. *TechCrunch*. Available from: https://social.techcrunch.com/2016/05/06/musical-ly-raising-100-million-at-500-million-valuation-for-social-music-videos/ [Accessed 28th April 2020].

Rooksby, J. H. (Ed.) (2020) *Research handbook on intellectual property and technology transfer (research handbooks in intellectual property).* Cheltenham UK, Edward Elgar Publishing.

Rose, M. (2016) *Authors in court: Scenes from the theater of copyright*. Harvard University Press.

Rosoff, M. (2009) TuneCore ties up with world's largest record label. *CNET.* Available from: https://www.cnet.com/news/tunecore-ties-up-with-worlds-largest-record-label/ [Accessed 19th February 2017].

Ross, B. (2020) *The philosophy of transhumanism: A critical analysis*. Emerald Group Publishing.

Rothblatt, M. (2012) The Terasem mind uploading experiment. *International Journal of Machine Consciousness 04* (01), pp. 141-158. Available from: https://doi.org/10.1142/S1793843012400070 [Accessed 27th March 2017].

Rothenberg, S. (1954) *Copyright and public performance of music.* The Hague, Springer.

Ruder, D. S. (2008) *Strategies for investing in intellectual property*. Beard Books.

Rushe, D. (2020) $15bn a year: YouTube reveals its ad revenues for the first time. *The Guardian*. Available from: https://www.theguardian.com/technology/2020/feb/03/youtube-ad-revenue-google-alphabet-shares [Accessed 28th April 2020].

Russell, J. (2016) Spotify finally launches in Japan, the world's second largest music market. *TechCrunch*. Available from: https://techcrunch.com/2016/09/28/spotify-japan-launch/ [Accessed 19th February 2017].

Russom, P. (2011) Big data analytics. *TDWI best practices report, fourth quarter*, *19* (4), p. 34. Available from: https://tdwi.org/research/2011/09/best-practices-report-q4-big-data-analytics.aspx?tc=page0&tc=assetpg&tc=page0 [Accessed 20th April 2020].

Ryan, D. (2015) Google doodles: Evidence of how graphemes' colour, shape, size and position can interact to make writing multidimensional. *Writing Systems Research* 7 (1), pp. 79-96. Available from: https://doi.org/10.1080/17586801.2014.912578 [Accessed 27th April 2020].

Sabanovic, S., Milojevic, S., & Kaur, J. (2012) John McCarthy [History]. *IEEE Robotics & Automation Magazine*, *19* (4), pp. 99-106. Available from: https://doi.org/10.1109/MRA.2012.2221259 [Accessed 28th March 2020].

Samsung (2018) Cooljamm: Samsung's C-Lab spin-off mixes its passion for music with technology. *Samsung Newsroom*. Available from: https://news.samsung.com/global/cooljamm-samsungs-c-lab-spin-off-mixes-its-passion-for-music-with-technology [Accessed 27th April 2020].

Samuel, S. (2019) Robot priests can bless you, advise you, and even perform your funeral. *Vox*. Available from: https://www.vox.com/future-perfect/2019/9/9/20851753/ai-religion-robot-priest-mindar-buddhism-christianity [Accessed 4th May 2020].

Sánchez Quintana, C., et al. (2013) Melomics: A case-study of AI in Spain. *AI Magazine 34* (3), pp. 99-103. Available from: https://doi.org/10.1609/aimag.v34i3.2464 [Accessed 20th March 2019].

Sanden, P. (2013) *Liveness in modern music: Musicians, technology and the perception of performance*. New York, Routledge.

Santos, J. (2015) DJ Pro1.2 supports all Pioneer DDJ controllers. *Digital DJ Tips* Available from: https://www.digitaldjtips.com/2015/08/djay-pro-now-supports-pioneer-ddj-controllers/ [Accessed 12th October 2015].

Sartre, J.P. (1992 [1943]) *Being and nothingness – A phenomenological essay on ontology*. Trans. Barnes, H.E. New York, Washington Square Press.

SAS, et al. (2018) *AI momentum, maturity and models for success*. Accenture.com. Available from: https://www.accenture.com/t20180914t183027z__w__/us-en/_acnmedia/pdf-86/accenture-ai-momentum.pdf [Accessed 2nd May 2020].

Savage, R. (2008) What a result! *DJ Mag* Available from: https://djmag.com/content/what-result [Accessed 12th August 2015].

Savery, R., (2019) PhD Student in Music Technology at Georgia Tech. Personal Communication, 10th February 2019.

Savery, R., & Weinberg, G. (2019) Shimon the robot film composer and DeepScore. In: *Conference: Computer Simulation of Musical Creativity.* Dublin, Ireland. Available from: https://www.researchgate.net/publication/334971929_Shimon_the_Robot_Film_Composer_and_DeepScore [Accessed 15th March 2020].

Sayes, E. (2014) Actor-network theory and methodology: Just what does it mean to say that nonhumans have agency? *Social Studies of Science 44* (1), pp. 134-149. Available from: https://doi.org/10.1177%2F0306312713511867 [Accessed 27th March 2017].

Schahinian, D. (2019) Quality seal for AI to reinforce ethical values. Hannover Messe. Available from: https://www.hannovermesse.de/en/news/news-articles/quality-seal-for-ai-to-reinforce-ethical-values [Accessed 29th June 2020].

Scherer, M. U. (2015) Regulating artificial intelligence systems: Risks, challenges, competencies, and strategies. *Harvard Journal of Law & Technology 29* (2), pp. 353-400. Available from: https://dx.doi.org/10.2139/ssrn.2609777 [Accessed 4th May 2020].

Schmidt Horning, S. (2013) *Chasing sound: Technology, culture, and the art of studio recording from Edison to the LP*. Baltimore, Johns Hopkins University Press.

Schoen-Nazzaro, M. B. (1978) Plato and Aristotle on the ends of music. *Laval Theologique et Philosphique, 34* (3) pp. 261-273. Available from: https://doi.org/10.7202/705684ar [Accessed 27th March 2017].

Schuster, M., Mitchell, D., & Brown, K. (2019) Sampling increases music sales: An empirical copyright study. *American Business Law Journal 56* (1), pp. 177-229. Available from: https://doi.org/10.1111/ablj.12137 [Accessed 4th May 2020].

Science Gallery Dublin (2017) Humans Need Not Apply. *Science Gallery Dublin*. Available from: https://dublin.sciencegallery.com/hnna [Accessed 8th May 2020].

Seltzer, W. (2010) Free speech unmoored in copyright's safe harbor: Chilling effects of the DMCA on the First Amendment. *Harvard Journal of Law &Technology 24* (1), pp. 171-232. Available from: https://ssrn.com/abstract=1577785 [Accessed 2nd May 2020].

Serato.com (n.d.) *Serato.com: The home of software design.* Available from: https://serato.com/ [Accessed 10th October 2015].

Service, T. (2012) Iamus's Hello World! – review. *The Guardian*. Available from: https://www.theguardian.com/music/2012/jul/01/iamus-hello-world-review [Accessed 27th April 2020].

Sethi, R. (2015) Native Instruments free stem creator app released. *Ask Audio* Available from: https://ask.audio/articles/native-instruments-free-stem-creator-app-released [Accessed 11th September 2015].

Seufert, E. B. (2014) *Freemium economics: Leveraging analytics and user segmentation to drive revenue*. Waltham MA, Elsevier.

Sfetcu, N. (2014) *The music sound*. Nicolae Sfetcu.

Shanahan, M. (2015) *The technological singularity*. Cambridge MA, MIT.

Shapiro, P. (2005) *Turn the beat around: The secret history of disco.* London, Faber and Faber.

Shapiro, P. (2002) Deck wreckers: The turntable as instrument. In: Young, R. *Undercurrents: The hidden wiring of modern music.* pp. 163-179. New York, Continuum.

Sharkey, N. (2018) Mama Mia it's Sophia: A show robot or dangerous platform to mislead? Forbes. Available from: https://www.forbes.com/sites/noelsharkey/2018/11/17/mama-mia-its-sophia-a-show-robot-or-dangerous-platform-to-mislead/#334f31077ac9 [Accessed 6th July 2020].

Sharma, U., & Sharma, S.K. (2001) *Indian political thought*. Atlantic Publishers & Dist.

Shaw, L. (2018) Abba reunites for new album and takes a chance on hologram tour. *Bloomberg.com*. Available at: https://www.bloomberg.com/news/articles/2018-04-27/abba-reunites-for-new-album-and-takes-a-chance-on-hologram-tour [Accessed 11th May 2020].

Shead, S. (2019) Google A.I. panel member says Google 'pulled the plug rather than defend themselves'. *Forbes.* Available from: https://www.forbes.com/sites/samshead/2019/04/05/google-a-i-panel-member-says-google-pulled-the-plug-rather-than-defend-themselves/#1ff045253955 [Accessed 24th April 2020].

Shen, J., et al. (2018) *Natural TTS synthesis by conditioning WaveNet on Mel Spectrogram predictions. arXiv:1712.05884 [Cs]*. Available from: http://arxiv.org/abs/1712.05884 [Accessed 7th April 2020].

Shepherd, J. (Ed.) (2003) *Continuum Encyclopedia of Popular Music of the World, Volume 11: Performance and Production*. London: Continuum.

Shippey, K.C. (2002) *A short course in international intellectual property rights: Protecting your brands, marks, copyrights, patents, designs, and related rights worldwide*. The Short Course in International Trade Series. World Trade Press.

Shneiderman, B. (2000) Creating creativity: User interfaces for supporting innovation. *ACM Transactions on Computer-Human Interaction 7* (1), pp. 114-138. Available from: https://doi.org/10.1145/344949.345077 [Accessed 9th December 2019].

Shuker, R. (1998) *Key concepts in popular music.* London, Routledge.

Sicko, D. (1999) *Techno rebels: The renegades of electronic funk*. New York, Billboard.

Siderits, J. (2016) The case for copywriting monkey selfies. *University of Cincinnati Law Review 84* (1), pp. 327-348. Available from: https://scholarship.law.uc.edu/uclr/vol84/iss1/ [Accessed 4th May 2020].

Sinha, M. K., & Mahalwar, V. (2017) *Copyright law in the digital world: Challenges and opportunities*. Singapore, Springer.

Sini, R. (2017) Does Saudi robot citizen have more rights than women? *BBC UGC and Social News*. Available from: https://www.bbc.com/news/blogs-trending-41761856 [Accessed 4th May 2020].

Sisario, B. (2019) 'Blurred Lines' on Their Minds, Songwriters Create Nervously. *The New York Times*. Available from: https://www.nytimes.com/2019/03/31/business/media/plagiarism-music-songwriters.html [Accessed 8th May 2020].

Siwek, S. E. (2007) The true cost of sound recording piracy to the US economy. *IPI Center For Economic Growth. Policy Report 188.* The Recording Industry

Association of America. Available from: https://www.riaa.com/reports/the-true-cost-of-sound-recording-piracy-to-the-u-s-economy/ [Accessed 2nd May 2020].

SKYGGE (2020) *Hello World album the first album composed with an artificial intelligence.* Available from: https://www.helloworldalbum.net/ [Accessed 27th April 2020].

Sloan, S., & Sutton, M. (2011) Australia: Authorship and copyright protection. *Mondaq*. Available from: https://www.mondaq.com/australia/copyright/126916/authorship-and-copyright-protection [Accessed 4th May 2020].

Sloman, A. (1992) REVIEW. *For: Bulletin of the London Mathematical Society, 24* (3) pp. 87-96. Available from: http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=F109D485F3F639648B35916CDB8F0445?doi=10.1.1.157.6123&rep=rep1&type=pdf [Accessed 29th March 2019]

Small, C. (1998) *Musicking: The meanings of performing and listening*. Hanover, Wesleyan University Press.

Small, C. (1977) *Music, society, education*. London, John Calder (Publishers).

Smartcity (2019) Saudi Arabia – Building Smart Cities for a Utopian Future. Smartcity. Available from: https://www.smartcity.press/saudi-arabia-smart-cities/ [Accessed 17th July 2020].

Smart Dubai (2018) *AI ethics and guidelines*. Smart Dubai in collaboration with Falcon and Associates. Available from: https://www.smartdubai.ae/docs/default-source/ai-principles-resources/ai-ethics.pdf?sfvrsn=d4184f8d_6 [Accessed 2nd May 2020].

Smartt, U. (2011) *Media and entertainment law*. Taylor & Francis.

Smith, M.D. (2017) *Opinion by Judge Milan D. Smith, Jr.* United States Court of Appeals for the Ninth Circuit. Available from: https://cdn.ca9.uscourts.gov/datastore/opinions/2018/03/21/15-56880.pdf [Accessed 10th May 2020].

Smith, S. (2013) *Hip-Hop turntablism, creativity and collaboration.* Farnham and Burlington, Ashgate.

Smooha, S., & Hadar, D. (2006) The Beatbug generation. *Haaretz*. Available from: https://www.haaretz.com/1.4896525 [Accessed 27th April 2020].

Snijders, T., & van Deursen, S. (2019) The road not taken – the CJEU sheds light on the role of fundamental rights in the European copyright framework – a case note on the Pelham, Spiegel Online and Funke Medien decisions. *IIC-International Review of Intellectual Property and Competition Law*. *50* (9), pp. 1176-1190.

Sohu.com (2019) China honors Sophia the robot with "belt and road innovative technology ambassador" award. *Hanson Robotics*. Available from: https://www.hansonrobotics.com/news-china-awards-belt-and-road-innovative-technology-ambassador-honor-to-sophia-the-robot/ [Accessed 4th May 2020].

Solum, L. B. (1992) Legal personhood for artificial intelligences. *North Carolina Law Review. 70*, pp. 1231-1287; Illinois Public Law Research Paper No 09-13. Available from: https://ssrn.com/abstract=1108671 [Accessed 3rd May 2020].

Song Lyrics Generator (2020) Taylor Swift song lyrics generator. *Song lyrics generator*. Available from: https://www.song-lyrics-generator.org.uk/create.php?song=19 [Accessed 4th May 2020].

Songfacts (2020) Bitter sweet symphony by The Verve. *Songfacts*. Available from: https://www.songfacts.com/facts/the-verve/bitter-sweet-symphony [Accessed 4th May 2020].

Sonoda, A. (2007) Historical overview of formation of international copyright agreements in the process of development of international copyright law from the 1830s to 1960s. *IIP (Institution of Intellectual Property) Bulletin*. 2. Available from: https://www.iip.or.jp/e/summary/pdf/detail2006/e18_22.pdf [Accessed 4th May 2020].

Sony (2020) *AI × Robotics*. Available from: http://www.sony.net/SonyInfo/Careers/IJCAI16_Career/ [Accessed 27th April 2020].

Sony Corporation of America v Universal City Studios, Inc. (1984) 464 US 417,429

Sony CSL (2020) *Sony Computer Science Laboratories, Inc.* Available from: http://www.sonycsl.co.jp/ [Accessed 27th April 2020].

Sony CSL-Paris (2016) *Daddy's Car: a song composed by artificial intelligence – in the style of the Beatles*. Available from: https://www.youtube.com/watch?v=LSHZ_b05W7o [Accessed 22nd February 2017].

Sople, V.V. (2016) *Managing intellectual property: The strategic imperative*. Dehli, PHI Learning Pvt. Ltd.

Sorcinelli, G. (2019) T-Pain made “I’m N Luv (Wit A Stripper)” in GarageBand during a power outage. *Medium*. Available from: https://medium.com/micro-chop/t-pain-made-im-n-luv-wit-a-stripper-in-garageband-during-a-power-outage-8b39793bd078 [Accessed 28th April 2020].

Sorensen, A., & Gardner, H. (2010) Programming with time: Cyber-physical programming with Impromptu. In: *ACM SIGPLAN Notices – OOPSLA ’10. 45* (10), pp. 822-834. Available from: https://dl.acm.org/doi/10.1145/1932682.1869526 [Accessed 29th March 2017].

Soundcharts (2019) Smart speakers and the future of music consumption. *Soundcharts Blog*. Available from: https://soundcharts.com/blog/smart-speakers-and-music-consumption [Accessed 11th May 2020].

Souppouris, A. (2016) The first ‘computer-generated’ musical isn’t very good. *Engadget*. Available from: https://www.engadget.com/2016-03-02-beyond-the-fence-computer-generated-musical.html [Accessed 4th May 2020].

Souvignier, T. (2003) *The world of DJs and the turntable culture*. United States, Hal Leonard Corporation.

Spangler, T. (2020) Miquela, the uncanny CGI virtual influencer, signs with CAA (exclusive). *Variety*. Available from: https://variety.com/2020/digital/news/miquela-virtual-influencer-signs-caa-1234599368/ [Accessed 12th May 2020].

Sparks, H. (2019) Rolling Stones give ‘Bitter Sweet Symphony’ rights to The Verve. *New York Post*. Available from: https://nypost.com/2019/05/23/rolling-stones-give-bitter-sweet-symphony-song-rights-back-to-the-verve/ [Accessed 4th May 2020].

Spinello, R. A., & Tavani, H. T. (2005) *Intellectual property rights in a networked world: theory and practice*. IGI Global.

Splice (2019) Splice machine to present on machine learning and operational AI at Spark + AI Summit 2019. *Splice Machine*. Available from: https://splicemachine.com/splice-machine-to-present-on-machine-learning-and-operational-ai-at-spark-ai-summit-2019/ [Accessed 28th April 2020].

Spratt, E. L. (2018) Dream formulations and deep neural networks: Humanistic themes in the iconology of the machine-learned image. 29. *arXiv:1802.01274 [Cs]*. Available from: https://arxiv.org/abs/1802.01274 [Accessed 10th April 2020].

Springer (2019) Springer Nature publishes its first machine-generated book. *Springer*. Available from: https://www.springer.com/gp/about-springer/media/press-

releases/corporate/springer-nature-machine-generated-book/16590126 [Accessed 4th May 2020].

Staff, V. (2018) 'Blurred Lines' suit ends with $5 million judgement against Robin Thicke, Pharrell Williams. *Variety*. Available from: https://variety.com/2018/music/news/blurred-lines-ends-5-million-judgement-robin-thicke-pharrell-williams-1203089172/ [Accessed 8th May 2020].

Stanford Today Online (1998) *Bach's EMI concerto*. Available from: https://web.stanford.edu/dept/news/stanfordtoday/ed/9801/9801smf201.shtml [Accessed 27th April 2020].

Stanley, B. (2012) David Whitaker obituary. *The Guardian*. Available from: https://www.theguardian.com/music/2012/feb/16/david-whitaker [Accessed 4th May 2020].

Stassen, M. (2019a) NMPA calls for 'scrutiny' of TikTok, says platform has 'consistently violated US copyright law and the rights of songwriters and music publishers'. *Music Business Worldwide.* Available from: https://www.musicbusinessworldwide.com/nmpa-calls-for-scrutiny-of-tiktok-says-platform-has-consistently-violated-us-copyright-law-and-the-rights-of-songwriters-and-music-publishers/ [Accessed 28th April 2020].

Stassen, M. (2019) Native Instruments names new senior hires in 'biggest leadership transformation' in 23-year history. *Music Business Worldwide*. Available from: https://www.musicbusinessworldwide.com/native-instruments-names-new-senior-hires-in-biggest-leadership-transformation-in-23-year-history/ [Accessed 28th April 2020].

Stassen, M. (2019) TikTok owner to launch Spotify rival – report. *Music Business Worldwide*. Available from: https://www.musicbusinessworldwide.com/tiktok-owner-to-launch-spotify-rival-report/ [Accessed 28th April 2020].

State Council of China (2017) *State Council notice on the issuance of the new generation artificial intelligence development plan.* Trans. Webster, G., Creemers, R., Triolo, P., & Kania, E. Available from: https://www.newamerica.org/cybersecurity-initiative/digichina/blog/full-translation-chinas-new-generation-artificial-intelligence-development-plan-2017/ [Accessed 3rd May 2020].

Statistical Services and Consultancy Unit (SSCU), University of Hertfordshire and Hertfordshire Business School (HBS) (2019) *Platform work in the UK 2016-2019* Available from: https://www.feps-europe.eu/attachments/publications/platform%20work%20in%20the%20uk%202016-2019%20v3-converted.pdf [Accessed 2nd May 2020].

Statsky, W. P. (2014) *Family law: The essentials 2nd edition*. Cengage Learning.

Statt, N. (2020) Jay Z tries to use copyright strikes to remove deepfaked audio of himself from YouTube. *The Verge*. Available from: https://www.theverge.com/2020/4/28/21240488/jay-z-deepfakes-roc-nation-youtube-removed-ai-copyright-impersonation [Accessed 16th May 2020].

Stav, I. (2014) Musical plagiarism: A true challenge for the copyright law. *DePaul Journal of Art, Technology & Intellectual Property Law 25* (1). Available from: https://via.library.depaul.edu/jatip/vol25/iss1/2 [Accessed 4th May 2020].

Steinberg, A. (2017) Can a robot join the faith? *The New Yorker*. Available from: https://www.newyorker.com/tech/annals-of-technology/can-a-robot-join-the-faith [Accessed 4th May 2020].

Sterne, J., & Razlogova, E. (2019) Machine learning in context, or learning from LANDR: Artificial intelligence and the platformization of music mastering. *Social Media + Society 5* (2). Available from: https://doi.org/10.1177%2F2056305119847525 [Accessed 28th April 2020].

Steventon, J. (2014) *DJing for dummies, 3rd edition*. Chichester, John Wiley & Sons Ltd.

Stim, R. (2018) *Music law: How to run your band's business, 9th edition*. Nolo.

Strachan, R. (2017) *Sonic technologies: Popular music, digital culture and the creative process*. Bloomsbury Publishing USA.

Strapagiel, L. (2019) How TikTok made Lil Nas X's 'Old Town Road' into both a meme and a hit. *BuzzFeed.News.* Available from: https://www.buzzfeednews.com/article/laurenstrapagiel/tiktok-lil-nas-x-old-town-road [Accessed 28th April 2020].

Stratton, J., & Zuberi, N. (Eds.) (2014) *Black popular music in Britain since 1945*. Farnham and Burlington, Ashgate.

Strauß, S. (2018) From big data to deep learning: A leap towards strong AI or 'intelligentia obscura'? *Big Data and Cognitive Computing, 2* (3), p. 16. Available from: https://doi.org/10.3390/bdcc2030016 [Accessed 5th April 2020].

StringspaceLive (2017) Bitter sweet symphony – The Verve – Stringspace String Quartet. *YouTube.* Available from: https://www.youtube.com/watch?v=CvVa6wpZsrI [Accessed 4th May 2020].

Sturm, B.L., et al. (2019) Artificial intelligence and music: open questions of copyright law and engineering praxis. In: *Arts*. 2019 Multidisciplinary Digital Publishing Institute. p. 115.

Sulaimani, J. (2018) Personal Correspondence. November 2018.

Sullivan, H. R., & Schweikart, S. J. (2019) Are current tort liability doctrines adequate for addressing injury caused by AI? *AMA Journal of Ethics 21* (2), pp. 160-166. Available from: http://doi.org/10.1001/amajethics.2019/160 [Accessed 20th June 2020].

Sullivan, M (2019) South Korea says about 20% of its population is at risk for internet addiction. *National Public Radio*. Available from: https://www.npr.org/2019/07/30/746687204/south-korea-says-about-20-percent-of-its-population-is-at-risk-for-internet-addi [Accessed 4th May 2020].

Supper, M. (2001) A few remarks on algorithmic composition. *Computer Music Journal 25* (1), pp. 48-53. Available from: https://doi.org/10.1162/014892601300126106 [Accessed 28th March 2017].

Surden, H. (2020) Ethics of AI in Law. [Online]. 9 July 2020. The Oxford Handbook of Ethics of AI. Available from: http://doi:10.1093/oxfordhb/9780190067397.013.46 [Accessed: 9 December 2020].

Swade, D., & Babbage, C. (2001) *Difference engine: Charles Babbage and the quest to build the First Computer*. Viking Penguin.

Swan, M. (2013) The quantified self: Fundamental disruption in big data science and biological discovery. *Big Data 1* (2), pp. 85-99. Available from: https://doi.org/10.1089/big.2012.0002 [Accessed 8th May 2020].

Sweney, M. (2019) Is streaming killing the radio star? *The Guardian*. Available from: https://www.theguardian.com/media/2019/feb/08/is-streaming-killing-the-radio-star [Accessed 28th April 2020].

Syken, N. (2019) IBM Watson is making connections at the music industry's biggest night. *Business Insider*. Available from: https://www.businessinsider.com/sc/music-awards-ibm-watson-personal-connections-2019-2 [Accessed 27th April 2020].

Synthhead (2015) Is Native Instruments 'Stems' audio format the future of DJing … or karaoke? *Synthopia*. Available from: www.synthtopia.com/content/2015/03/31/is-native-instruments-stems-audio-format-the-future-of-djing-or-karaoke/ [Accessed 22nd September 2015].

Tang, D. (2018) Sophia the robot takes step towards world domination. *The Sunday Times.* Available from: https://www.thetimes.co.uk/article/hanson-robotics-sophia-the-robot-takes-step-towards-world-domination-lhb0b8bvx [Accessed 4th May 2020].

Taplin, J. (2017*) Move fast and break things: How Facebook, Google, and Amazon cornered culture and undermined democracy*. New York, Little, Brown and Company.

Taruskin, R. (1995) *TEXT & ACT: Essays on music and performance.* New York, Oxford University Press.

Tavana, A. (2015) Democracy of sound: Is GarageBand good for music? *pitchfork.com*. Available from: https://pitchfork.com/features/article/9728-democracy-of-sound-is-garageband-good-for-music/ [Accessed 30th March 2017].

Taylor, C. (2019) Rolling Stones give up royalties on hit 90s track in 'magnanimous gesture'. *CNBC*. Available from: https://www.cnbc.com/2019/05/24/rolling-stones-give-up-royalties-on-hit-90s-track.html [Accessed 4th May 2020].

Taylor, M., et al. (2017) Good work: The Taylor review of modern working practices. *Department for Business, Energy & Industrial Strategy.* London, Great Britain. Available from: https://www.hbs.edu/faculty/Pages/item.aspx?num=54457 [Accessed 28th April 2020].

Taylor, R. (Ed.) (1843) *Scientific memoirs, selected from the transactions of foreign academies of science and learned societies, and from foreign journals, Volume 3*. London, R. and J.E. Taylor. Available from: https://books.google.ie/books/about/Scientific_Memoirs_Selected_from_the_Tra.html?id=qsY-AAAAYAAJ&redir_esc=y [Accessed 28th April 2020].

Taylor, R. D. (1989) *Blackstone's guide to the Copyright, Designs and Patents Act 1988: the law of copyright and related rights*. London, Blackstone Press.

Taylor, T., & Dorin, A. (2018) Past visions of artificial futures: One hundred and fifty years under the spectre of evolving machines. *The 2018 Conference on Artificial Life*. pp. 91-98. Available from: https://doi.org/10.1162/isal_a_00022 [Accessed 2nd April 2020].

Taylor, T.D. (2001) *Strange sounds: Music, technology, and culture.* New York, Routledge.

Techristic (2019) Rolling Stone feature explores Apple's 'Music Apps' team, GarageBand's origin and future. *TechRistic.com*. Available from:

https://techristic.com/rolling-stone-feature-explores-apples-music-apps-team-garagebands-origin-and-future/ [Accessed 28th April 2020].

Techstars (2019) Techstars Music 2020: Growing global capital for music tech. *Techstars.* Available from: https://www.techstars.com/newsroom/techstars-music-2020-growing-global-capital-for-music-tech [Accessed 28th April 2020].

Temple, K. A. (2018) The United States modernizes its music licensing system. *WIPO Magazine 6.* Available from: https://www.wipo.int/wipo_magazine/en/2018/06/article_0002.html [Accessed 5th May 2020].

The Clash (1979) London Calling. [Vinyl]. London: CBS.

Theberge, P. (2001) Plugged in: Technology and popular music. In: Firth, S., & Straw, W., & Street, J., (Eds.) *The Cambridge companion to pop and rock*, pp. 3-25. Cambridge, Cambridge University Press.

theice.com (2020) NYSE FANG+ Index Futures. Theice.com. Available from: https://www.theice.com/fangplus [Accessed 31st May 2020].

Thomala, L. L. (2020) China: number of internet users 2017-2023. *Statista.* Available from: https://www.statista.com/statistics/278417/number-of-internet-users-in-china/ [Accessed 28th April 2020].

Thomas, R. (2019) Personal Correspondence. January 2019.

Thompson, A. (2020) Eurovision's First AI Winner Was Trained on Kookaburra Songs. *Bloomberg*. Available from: https://www.bloomberg.com/news/articles/2020-05-13/eurovision-s-first-ai-winner-was-trained-on-kookaburra-songs [Accessed 16th May 2020].

Thompson, C. (2019) What will happen when machines write songs just as well as your favorite musician? *Mother Jones* Available from: https://www.motherjones.com/media/2019/03/what-will-happen-when-machines-write-songs-just-as-well-as-your-favorite-musician/ [Accessed 27th April 2020].

Thompson, D. (2017) *Goldmine's essential guide to record collecting.* Iola WI, Krause Publications

Thomson, K., et al. (2014) Artist revenue streams. *Futureofmusic.org.* Available from: http://money.futureofmusic.org/ [Accessed 23rd February 2017].

Tian, Y. (2008) *Re-thinking intellectual property: The political economy of copyright protection in the digital era*. London, Routledge-Cavendish.

Tiefenbrun, S. (2010) *Decoding international law: Semiotics and the humanities*. New York, Oxford University Press.

TikTok (2019) Statement on TikTok's content moderation and data security practices. *Newsroom | TikTok*. Available from: https://newsroom.tiktok.com/en-us/statement-on-tiktoks-content-moderation-and-data-security-practices [Accessed 28th April 2020].

Timberg, S. (2015) *Culture crash: The killing of the creative class*. Yale University Press.

TIME (2018) Meet this year's 25 most influential people on the internet. *Time*. Available from: https://time.com/5324130/most-influential-internet/ [Accessed 11th May 2020].

Time Is On Our Side (2020) The last time. Available from: http://www.timeisonourside.com/SOLastTime.html [Accessed 4th May 2020].

Ting, D. (2019) Everything you need to know about ByteDance, the company behind TikTok. *Digiday*. Available from: https://digiday.com/media/everything-you-need-to-know-about-bytedance-the-company-behind-tiktok/ [Accessed 28th April 2020].

Titlow, J.P. (2017) Why did Spotify hire this expert in music-making AI? *Fast Company.* Available from: https://www.fastcompany.com/40439000/why-did-spotify-hire-this-expert-in-music-making-ai [Accessed 11th May 2020].

Todd, A. (2020) Interview with Bruno Latour. *The Guardian.* Available from: https://www.theguardian.com/stage/2020/feb/04/bruno-latour-moving-earths-theatre-science-climate-crisis [Accessed 26th March 2020].

Toffler, A. (1980) *Future shock: The third wave.* New York, Bantum Books.

Toop, D. (1984) *The Rap Attack: African Jive to New York Hip Hop*. London, Pluto Press.

Top40-Charts (2020) Taryn Southern is first artist to compose pop album with AI. *Top40-Charts.* Available from: https://top40-charts.com/news.php?nid=139552&cat= [Accessed 27th April 2020].

Towse, R., & Hernández, T. N. (Eds.) (2020) *Handbook of cultural economics, 3rd edition.* Edward Elgar Publishing.

Trafton, A. (2014) In the blink of an eye. *MIT News*. Available from: https://news.mit.edu/2014/in-the-blink-of-an-eye-0116 [Accessed 13th June 2020].

Trefis Team (2019) Is Google advertising revenue 70%, 80%, Or 90% of Alphabet's total revenue? *Forbes.* Available from: https://www.forbes.com/sites/greatspeculations/2019/12/24/is-google-advertising-revenue-70-80-or-90-of-alphabets-total-revenue/ [Accessed 28th April 2020].

Trivedi, P. (2010) Writing the wrong: What the e-book industry can learn from digital music's mistakes with DRM. *Journal of Law & Policy 18* (2), pp. 925-966. Available from: https://brooklynworks.brooklaw.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=1129&context=jlp [Accessed 29th April 2020].

Troitino, C. (2017) The brave new world of artificial intelligence-based fake restaurant reviews. *Forbes.* Available from: https://www.forbes.com/sites/christinatroitino/2017/09/05/the-brave-new-world-of-artificial-intelligence-based-fake-restaurant-reviews/#5a56829f2ef2 [Accessed 4th May 2020].

Tschmuck, P. (2006) *Creativity and innovation in the music industry*. Berlin, Springer.

Tune, C.A., & Iverson, S.E. (2020) The Rise of the Copyright Bots. *Internet & Social Media Law Blog*. Available from: https://www.internetandtechnologylaw.com/copyright-bots/ [Accessed 12th May 2020].

Turing, A. M. (1950) I.— Computing machinery and intelligence. Mind, LIX (236), pp. 433-460. Available from: https://doi.org/10.1093/mind/LIX.236.433 [Accessed 23rd March 2020].

Turntable Lab (2015) *Beginner's guide to DJ equipment setups.* Available from: https://www.turntablelab.com/pages/beginners-guide-to-dj-equipment-setups [Accessed 15th October 2015].

Tyner, A. (2019) The EU Copyright Directive: "Fit for the digital age" or finishing it. *Journal of Intellectual Property Law 26* (2) pp. 275-288. Available from: https://digitalcommons.law.uga.edu/jipl/vol26/iss2/4 [Accessed 2nd May 2020].

UCC (2016) *Spin-out companies – policy statement.* University College Cork

UK Government (2019) *AI Sector Deal*. UK Government. Available from: https://www.gov.uk/government/publications/artificial-intelligence-sector-deal/ai-sector-deal [Accessed 10th July 2010].

UK Government (1988) *Copyright, Designs and Patents Act 1988*. UK Government. Available from: https://www.legislation.gov.uk/ukpga/1988/48/part/I/chapter/I/crossheading/authorship-and-ownership-of-copyright?view=plain [Accessed 4th May 2020].

US Code (2020) *17 US Code § 114 – Scope of exclusive rights in sound recordings*. LII / Legal Information Institute. Available from: https://www.law.cornell.edu/uscode/text/17/114 [Accessed 4th May 2020].

US Congress (1987) *US Adherence to the Berne Convention: Hearings before the subcommittee on Patents, Copyrights, and Trademarks of the Committee on the Judiciary, United States Senate, Ninety-ninth Congress, First and Second Sessions, May 16, 1985 and April 15, 1986, Volume 4.* Senate. Committee on the Judiciary. Subcommittee on Patents, Copyrights, and Trademarks. US Government Printing Office.

US Copyright Office (2020a) AI and Creating Music. In*: Proceedings: Copyright in the Age of Artificial Intelligence.* US Copyright Office. Library Of Congress, Washington D.C., February [Transcript] Available from: https://www.copyright.gov/events/artificial-intelligence/transcript.pdf [Accessed 16th May 2020].

US Copyright Office (2020b) *Chapter 1 – Circular 92 | US Copyright Office*. Available from: https://www.copyright.gov/title17/92chap1.html#107 [Accessed 4th May 2020].

US Copyright Office (2020c) Circular 56: Copyright registration for sound recordings. *US Copyright Office.* US Government Printing Office. Available from: https://www.copyright.gov/circs/circ56.pdf [Accessed 3rd May 2020].

US Copyright Office (2017) *Compendium of US Copyright Practices*. US Copyright Office. Available from: https://www.copyright.gov/comp3/ [Accessed 7th June 2020]

US Copyright Office (1998) *The Digital Millennium Copyright Act of 1998.* US Government Printing Office. Available from: https://www.copyright.gov/title17/92appb.html [Accessed 7th July 2020].

US Copyright Office (1984) *Compendium of US Copyright Office Practices, II (1984).* US Government Printing Office.

USPTO (2019) DEPARTMENT OF COMMERCE Patent and Trademark Office [Docket No. PTO–C–2019–0038] Request for Comments on Intellectual Property Protection for Artificial Intelligence Innovation. Federal Register 84, 210, pp. 58141-58142. Available from: https://www.govinfo.gov/content/pkg/FR-2019-10-30/pdf/2019-23638.pdf [Accessed 17th July 2020].

UNCTAD-ICTSD (2005) *Resource book on TRIPS and development: An Authoritative and practical guide to the TRIPS Agreement by UNCTAD and ICTSD*. Cambridge University Press. Available from: https://unctad.org/en/PublicationsLibrary/ictsd2005d1_en.pdf [Accessed 27th April 2020].

UNI Global Union (2017) Top 10 principles for ethical artificial intelligence. *The future world of work.* Available from: http://www.thefutureworldofwork.org/media/35420/uni_ethical_ai.pdf [Accessed 2nd May 2020].

UN (n.d.) Background to the sustainable development goals. *United Nations Development Programme.* Available from: https://www.undp.org/content/undp/en/home/sustainable-development-goals/background.html [Accessed 27th April 2020].

UNDP (2017) UNDP in Asia and the Pacific appoints world's first non-human innovation champion. *United Nations Development Programme in Asia and the Pacific*. Available from: https://www.asia-pacific.undp.org/content/rbap/en/home/presscenter/pressreleases/2017/11/22/rbfsingapore.html [Accessed 4th May 2020].

UN General Assembly (2015) *Transforming our world : the 2030 Agenda for Sustainable Development A/RES70/1*. UN General Assembly. Available from: https://www.refworld.org/docid/57b6e3e44.html [Accessed 5th July 2020].

University of Hertfordshire (2019) *Platform work in the UK 2016-2019*. Statistical Services and Consultancy Unit (SSCU), University of Hertfordshire and Hertfordshire Business School (HBS). Available from: https://www.feps-europe.eu/attachments/publications/platform%20work%20in%20the%20uk%202016-2019%20v3-converted.pdf [Accessed 28th April 2020].

University of London Press Ltd v University Tutorial Press Ltd (1916) 2 Ch 601

UTokyo (2020) *The University of Tokyo*. The University of Tokyo. Available from: https://www.u-tokyo.ac.jp/en/whyutokyo/wj_003.html [Accessed 4th May 2020].

Valek, M. (2008) *What is US Patent No. 5,205,473?* CNET. Available from: https://www.cnet.com/news/what-is-u-s-patent-no-5205473/ [Accessed 5th May 2020].

Van den Oord, A., et al. (2016a) WaveNet: A generative model for raw audio. *arXiv:1609.03499 [Cs]*. Available from: http://arxiv.org/abs/1609.03499 [Accessed 7th April 2020].

Van den Oord, A., et al. (2016b) Conditional image generation with PixelCNN decoders. *arXiv:1606.05328 [Cs]*. Available from: http://arxiv.org/abs/1606.05328 [Accessed 7th April 2020].

Van Gorp, D. (2015) *Serato adds key detection, key shifting & more to Serato DJ*. Available from: http://www.gearjunkies.com/2015/10/serato-adds-key-detection-key-shifting-more-to-serato-dj/ [Accessed 22nd October 2015].

VanGrasstek, C. (2013) *The history and future of the World Trade Organization.* Geneva, World Trade Organization.

Vannini, P., & Williams, J.P. (Eds.) (2016) *Authenticity in culture, self, and society*. London, Routledge.

Vantomme, J. D. (1995) David Cope: Bach by design-experiments in musical intelligence. *Computer Music Journal* 19 (3), p. 66.

Vaver, D. (Ed.) (2006) *Intellectual property rights: Critical concepts in law*. London, Taylor & Francis.

Vaver, D., et al. (2002) *Principles of Copyright Law-Cases and Materials/Notions Fondamentales Du Droit D'auteur*. Geneva, WIPO.

Velardo, V. (2019) Chief Executive Officer of Melodrive. Personal Correspondence. March 2019

Velardo, V. (2017) *About: Valerio Velardo, PhD.* Available from: https://valeriovelardo.com/about/ [Accessed 27th April 2020].

Verdoux, P. (2009) Transhumanism, progress and the future. *Journal of Evolution and Technology 20* (1), pp. 46-49. Available from: https://jetpress.org/v20/verdoux.htm [Accessed 28th March 2017].

Vico, F. (2015) *MTF London: Francisco Vico – Melomics*. Available from: https://www.youtube.com/watch?v=U0xI84bBV_k [Accessed 22nd February 2017].

Vico-Vela, F.J., Sánchez-Quintana, C.A., & Albarracín, D. (2010) MELOMICS: Contributions of computer science and biology to receptive music therapy. In: *VIII European Music Therapy Congress Conference.* Cádiz, Spain. Presentation. Available from: https://core.ac.uk/reader/62899321 [Accessed 29th March 2017].

Villani, C. (2018) *For a Meaningful Artificial Intelligence, Towards a French and European Strategy*. AI for Humanity. Available from: https://www.aiforhumanity.fr/pdfs/MissionVillani_Report_ENG-VF.pdf [Accessed 17th July 2020]

Vincent, J. (2019) OpenAI has published the text-generating AI it said was too dangerous to share. The Verge. Available from: https://www.theverge.com/2019/11/7/20953040/openai-text-generation-ai-gpt-2-full-model-release-1-5b-parameters [Accessed 2nd June 2020].

Vincent, J. (2016) This AI-written pop song is almost certainly a dire warning for humanity. *The Verge*. Available from: https://www.theverge.com/2016/9/26/13055938/ai-pop-song-daddys-car-sony [Accessed 27th April 2020].

Vinge, V. (1993) Technological singularity. In: *VISION-21 Symposium sponsored by NASA Lewis Research Center and the Ohio Aerospace Institute*. 1993 pp. 30-31. Available from: http://cmm.cenart.gob.mx/delanda/textos/tech_sing.pdf [Accessed 16th May 2020].

VOCALOID (2020) *VOCALOID – the modern singing synthesizer*. Available from: https://www.vocaloid.com/en/ [Accessed 11th May 2020].

Voynovskaya, N. (2019) Copyrighting the 'building blocks' of music? Why the Katy Perry case alarms producers. KQED. Available from: https://www.kqed.org/arts/13863015/perry-dark-horse-flame-joyful-noise-copyright-infringement-precedent [Accessed 8th May 2020].

VPRO (2020) Germany – Dadabots x Portrait XO – The AI Song Contest. *VPRO International*. Available from: https://www.vprobroadcast.com/titles/ai-songcontest/teams/germany-3.html [Accessed 13th June 2020].

Wadhwa, V., & Salkever, A. (2017) *The driver in the driverless car: How our technology choices will create the future*. Oakland, Berrett-Koehler Publishers.

Wakefield, J. (2019) Google's ethics board shut down. *BBC News*. Available from: https://www.bbc.co.uk/news/technology-47825833 [Accessed 28th April 2020].

Walsh, N. (2017) Why the Steve Jobs GarageBand reveal is the best live product demo of all time. *freeCodeCamp.* Available from: https://www.freecodecamp.org/news/why-steve-jobs-garageband-reveal-is-the-best-live-product-demo-of-all-time-535c3192e267/ [Accessed 28th April 2020].

Walsh, T. (2019) *Android dreams: The past, present and future of artificial intelligence.* London, Hurst and Company.

Wang, A. X. (2020) How music copyright lawsuits are scaring away new hits. *Rolling Stone*. Available from: https://www.rollingstone.com/music/music-features/music-copyright-lawsuits-chilling-effect-935310/ [Accessed 4th May 2020].

Wang, G., & Cook, P. R. (2004) On-the-fly programming: Using code as an expressive musical instrument. In: *2004 International Conference on New Interfaces for Musical Expression (NIME).* Hamamatsu, Japan. June 2004. Proceedings. Available from: https://doi.org/10.1007/978-3-319-47214-0_13 [Accessed 29th March 2017].

Wang, P. (2008) What do you mean by "AI"? *Frontiers in Artificial Intelligence and Applications.* 171, pp. 362-373. Available from: https://www.researchgate.net/publication/262357941_What_Do_You_Mean_by_AI [Accessed 15th December 2020].

Wang, R. "Ray" (2015) *Disrupting digital business: Create an authentic experience in the peer-to-peer economy.* Boston, Harvard Business School Publishing.

Warhol, A. (1975) *The philosophy of Andy Warhol: From A to B and back again.* USA, Harcourt Books.

WASP (2020) *WASP – Wallenberg AI, Autonomous Systems and Software Program*. Available from: https://wasp-sweden.org/ [Accessed 8th May 2020].

Watson, K. (2019) IMS business report 2019: An annual study of the electronic music industry. *International Music Summit*. Available from: https://www.internationalmusicsummit.com/wp-content/uploads/2019/05/IMS-Business-Report-2019-vFinal.pdf [Accessed 28th April 2020].

WaveAI (2020) WaveAI – Unlocking creativity through AI. *WAVEAI.* Available from: https://www.wave-ai.net/ [Accessed 27th April 2020].

Webb, K. (2019) More than 10 million 'Fortnite' players logged on to watch a 10-minute concert over the weekend, proving there's more to the craze than just playing the game. *Business Insider*. Available from: https://www.businessinsider.com/10-million-fortnite-players-watched-dj-marshmello-concert-live-2019-2 [Accessed 8th May 2020].

Weber, S. (2004) *The success of open source.* Cambridge, Harvard University Press.

Webley, H. (2006) Sounding off: Are DJs musicians? *Sound on Sound Journal* Available from: https://www.soundonsound.com/people/sounding-are-djs-musicians [Accessed 11th October 2015].

Weinberg, G., et al. (2020) *Robotic musicianship: Embodied artificial creativity and mechatronic musical expression*. Switzerland, Springer Nature.

Weinberg, G. (2014) On robotic musicianship and human augmentation. At *Ted: Youth 2014 – You Tube.* Available from: https://www.youtube.com/watch?v=iEsfmnxt5F4 [Accessed 27th April 2020].

Weinberg, G., & Driscoll, S. (2006) Robot-human interaction with an anthropomorphic percussionist. In: *CHI '06: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, pp. 1229-1232. Available from: https://doi.org/10.1145/1124772.1124957 [Accessed 24th April 2020].

Weinberger, M. (2017) Why Amazon's Echo is totally dominating – and what Google, Microsoft, and Apple have to do to catch up. *businessinsider.com*. Available from: https://www.businessinsider.com.au/amazon-echo-google-home-microsoft-cortana-apple-siri-2017-1 [Accessed 29th March 2017].

Weingarten, C.R. (2018) Review: Icelandic composer Ólafur Arnalds's Experiment in Artificial Intelligence 'Re:Member'. *Rolling Stone*. Available from: https://www.rollingstone.com/music/music-album-reviews/review-icelandic-composer-olafur-arnaldss-experiment-in-artificial-intelligence-re-member-714971/ [Accessed 8th May 2020].

Weiszfeld, D. (2019) Insiders EP03.2: Interview with Stephen Phillips on AI music composition. *Soundcharts Blog*. Available from: https://soundcharts.com/blog/stephen-phillips-interview-part-two [Accessed 27th April 2020].

Weizenbaum, J., & Massachusetts Institute of Technology (1965) *Eliza: a computer program for the study of natural language communication between man and machine.* Boston, MIT.

Welcome AI (2020) *Humtap* Available from: https://www.welcome.ai/humtap [Accessed 27th April 2020].

Weller, C. (2017) Sophia robot citizenship in Saudi Arabia is the first of its kind. *Business Insider*. Available from: https://www.businessinsider.com/sophia-robot-citizenship-in-saudi-arabia-the-first-of-its-kind-2017-10?r=US&IR=T [Accessed 4th May 2020].

Weyde, T. (2016) Perception, cognition, and generation of Music: a case for human-like understanding of temporal structures. *Human-Like Computing Machine Intelligence Workshop (MI20-HLC)*. Windsor, UK. October 2016. Presentation. Available from: http://mi20-hlc.doc.ic.ac.uk/short_presentations/Weyde.pdf [Accessed 28th March 2017].

Wherry, M. (2011) Using Apple's iOS devices for music. *Sound On Sound*. Available from: https://www.soundonsound.com/reviews/using-apples-ios-devices-music [Accessed 28th April 2020].

Wherry, M., & Bell, M. (2002) Apple's Emagic takeover. *Sound on Sound*. Available from: https://www.soundonsound.com/music-business/apples-emagic-takeover [Accessed 28th April 2020].

Whitaker, Z. (2019) OpenAI built a text generator so good, it's considered too dangerous to release. *TechCrunch*. Available from: https://techcrunch.com/2019/02/17/openai-text-generator-dangerous/?guccounter=1 [Accessed 10th June 2020].

White House (2018) *Summary of the 2018 White House Summit on Artificial Intelligence for American Industry*. The White House, Office of Science and Technology Policy. Available from: https://www.whitehouse.gov/wp-content/uploads/2018/05/Summary-Report-of-White-House-AI-Summit.pdf [Accessed 17th July 2020].

Wiggins, G.A. (2008) Computer models of musical creativity: A review of computer models of musical creativity by David Cope. *Literary and Linguistic Computing*. *23* (1), pp. 109-116. Available from: http://doi.org/10.1093/llc/fqm025 [Accessed 7th December 2019].

Wikström, P. (2014) The Music Industry in an Age of Digital Distribution. In: *19 key essays on how the internet is changing our lives.* BBVA OpenMind. Available from: https://www.bbvaopenmind.com/en/articles/the-music-industry-in-an-age-of-digital-distribution/ [Accessed 2nd May 2020].

Wikström, P., & DeFillippi, R. (2016) *Business innovation and disruption in the music industry*. Cheltenham, Edward Elgar Publishing.

Willcock, J. (1999) Who's suing whom: Bitter symphony as The Verve is sued by Oldham. *The Independent.* Available from: http://www.independent.co.uk/news/business/whos-suing-whom-bitter-symphony-as-the-verve-is-sued-by-oldham-1046409.html [Accessed 4th May 2020].

Willens, M. (2019) Gravity blanket seller Futurism acquired by Singularity University. *Digiday.* Available from: https://digiday.com/media/gravity-blanket-seller-futurism-acquired-singularity-university/ [Accessed 28th April 2020].

Wilson, Z. (2019) 'The best way to ensure nobody ever hears your music is to release it': Warner Music's Scott Cohen. *The Music Network*. Available from: https://themusicnetwork.com/scott-cohen-keynote/ [Accessed 28th April 2020].

Wiltshire, E. (2019) 2019 Key digital marketing growth stats [Infographic]. *Social Media Today*. Available from: https://www.socialmediatoday.com/news/2019-key-digital-marketing-growth-stats-infographic/558413/ [Accessed 8th May 2020].

Winkler, A. (2018) *We the corporations: How American businesses won their civil rights*. New York, Liveright Publishing.

Winner, L. (2003 [1993]) Upon opening the black box and finding it empty: social constructivism and the philosophy of technology. In: Scharff, R. C., & Dusek, V. (Eds.) *Philosophy of Technology. The Technological Condition. An Anthology.* Malden, MA, Blackwell Publishing, pp. 427-452.

Winner, L. (1983) Technologies as forms of life. In: Cohen & Wartofsky (Eds.) *Epistemology, methodology and the social sciences*. New York, Kluwer Academic Publishers.

Winseck, D. (2017) The geopolitical economy of the global internet infrastructure. *Journal of Information Policy 7*, pp. 228-267. Available from: http://doi.org/10.5325/jinfopoli.7.2017.0228 [Accessed 27th April 2020].

Winter Music Conference (2019) Taishi Fukuyama. *Winter Music Conference.* Available from: https://wmc2020.ultra.us/speaker/taishi-fukuyama/ [Accessed 27th April 2020].

WIPO (2020a) What is intellectual property? *World Intellectual Property Organization*. Available from: https://www.wipo.int/publications/en/details.jsp?id=99&plang=EN [Accessed 5th May 2020].

WIPO (2020b) Artificial Intelligence Collides with Trademark Law. *World Intellectual Property Organisation*. Available from: https://www.wipo.int/export/sites/www/about-ip/en/artificial_intelligence/call_for_comments/pdf/ind_revella.pdf [Accessed 22nd May 2020].

WIPO (2020c) *WIPO Copyright Treaty*. World Intellectual Property Organisation. Available from: https://www.wipo.int/treaties/en/ip/wct/ [Accessed 3rd May 2020].

WIPO (2020d) *WIPO Performances and Phonograms Treaty*. World Intellectual Property Organisation. Available from: https://www.wipo.int/treaties/en/ip/wppt/ [Accessed 3rd May 2020].

WIPO (2019) *WIPO Technology Trends 2019: Artificial Intelligence* Available from: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_1055.pdf [Accessed 2nd May 2020].

WIPO (2018) *Toronto Declaration ML 2018.* Amnesty International and Access Now. Available from: https://www.accessnow.org/the-toronto-declaration-protecting-the-rights-to-equality-and-non-discrimination-in-machine-learning-systems/ [Accessed 2nd May 2020].

WIPO (2001) *Intellectual property needs and expectations of traditional knowledge holders: WIPO Report on fact-finding missions on intellectual property and traditional knowledge (1998-1999) (Vol. 768)*. WIPO.

Wiprovideos (2018) Wipro – Financial Times Dinner Forum: The immortal corporation. *YouTube*. Available from: https://www.youtube.com/watch?v=7GvlN9_T6G8 [Accessed 4th May 2020].

Wirth, N. (2018) Hello marketing, what can artificial intelligence help you with? *International Journal of Market Research, 60* (5), pp. 435-438. Available from: https://doi.org/10.1177/1470785318776841 [Accessed 10th April 2020].

Withers, R. (2018) The EU is considering giving robots 'personhood' – here's what that would mean. *Business Insider*. Available from: https://www.businessinsider.com/the-eu-is-considering-giving-robots-personhood-2018-4?r=US&IR=T [Accessed 4th May 2020].

Wittow, M. H. (2018) A modern melody for the music industry: The Music Modernization Act just passed Congress and awaits Presidential approval. *The National Law Review.* Available from: https://www.natlawreview.com/article/modern-melody-music-industry-music-modernization-act-just-passed-congress-and-awaits [Accessed 2nd May 2020].

Wixen, R. (2009) *The plain and simple guide to music publishing*. Milwaukee, Hal Leonard Corporation.

Wolfe, C. (2009) *What is posthumanism?* Minneapolis, University of Minnesota Press.

Wolfe, T. (1975) *The painted word*. USA: Farrar, Straus & Giroux.

wonderfulengineering.com (2020) The applications of AI in music production: A new era of creativity? *Wonderful Engineering*. Available from: https://wonderfulengineering.com/the-applications-of-ai-in-music-production-a-new-era-of-creativity/ [Accessed 8th May 2020].

Wong, F. (2019) Intellectual property in China: Laws and registration procedures. *China Briefing News*. Available from: https://www.china-briefing.com/news/intellectual-property-china-laws-registration-procedures/ [Accessed 28th April 2020].

Wong, M. W. S. (2008) Transformative user-generated content in Copyright Law: Infringing derivative works or fair use? *Vanderbilt Journal of Entertainment and Technology Law*. *11* (4), pp. 1075-1140. Available from: http://www.jetlaw.org/wp-content/journal-pdfs/Wong.pdf [Accessed 4th May 2020].

Wong, R. (2019) Apple removes song that referenced Tiananmen Square massacre from China's Apple Music. *Mashable*. Available from: https://mashable.com/article/apple-music-china-censorship/ [Accessed 28th April 2020].

Wooderson, M. (2018) Personal Correspondence. March 2018.

Wootson, C.R. (2017) Saudi Arabia, which denies women equal rights, makes Sophia the robot a citizen. *National Post.* Available from: https://nationalpost.com/news/world/saudi-arabia-which-denies-women-equal-rights-makes-sophia-the-robot-a-citizen [Accessed 4th May 2020].

Woycicki, P. (2016) Recursive game structures as emergent post-capitalist creative strategies. *Performance Research – A Journal of the Performing Arts 21* (4), pp. 20-25. Available from: https://doi.org/10.1080/13528165.2016.1192863 [Accessed 29th

WTO (2020a) Workshop addresses incentives for technology transfer to LDCs under the TRIPS Agreement. *World Trade Organisation.* Available from: https://www.wto.org/english/news_e/news20_e/trip_06feb20_e.htm [Accessed 2nd June 2020].

WTO (2020) WTO can … contribute to peace and stability. *World Trade Organisation*. Available from: https://www.wto.org/english/thewto_e/whatis_e/10thi_e/10thi09_e.htm [Accessed 3rd May 2020].

WTO: Basics (2020) WTO | Understanding the WTO – principles of the trading system. *World Trade Organisation*. Available from: https://www.wto.org/english/thewto_e/whatis_e/tif_e/fact2_e.htm [Accessed 3rd May 2020].

Wu, Y-C., et al. (2020) Non-parallel voice conversion system with WaveNet Vocoder and collapsed speech suppression. In: *IEEE Access 8*, pp. 62094-62106. Available from: http://doi.org/10.1109/access.2020.2984007 [Accessed 20th April 2020].

Xenakis, I. (1977) *Formalized music: Thought and mathematics in composition (Harmonologia Series, No 6).* New York, Pendragon Press.

Xenakis, I. (1965) Free stochastic music from the computer. Programme of stochastic music in Fortran. *Gravesaner Blätter, 26.* pp. 54-92.

Xhail (2020) Xhail – The evolution of music creation and licensing. *Xhail*. Available from: https://www.xhail.com/ [Accessed 28th April 2020].

Xprize (n.d.) *Mission*. Available from: https://www.xprize.org/about/mission [Accessed 28th April 2020].

Yampolskiy, R. V. (2015) *Artificial superintelligence: A futuristic approach*. CRC Press.

Yan, L. (2020) Court rules AI-written article has copyright. *ECNS.* Available from: http://www.ecns.cn/news/2020-01-09/detail-ifzsqcrm6562963.shtml [Accessed 11th May 2020].

Yeung, P. (2019) TikTok is changing the music industry. *Medium*. Available from: https://ffwd.medium.com/tiktok-is-changing-the-music-industry-bc19a8468b61 [Accessed 28th April 2020].

York, S. (2015) The pop star and the prophet. *BBC Radio 4 Documentary Broadcast.* Available from: https://www.bbc.co.uk/programmes/b069xcys [Accessed 22nd October 2015].

Yu, P. K. (2011) Digital copyright and confuzzling rhetoric. *Vanderbilt Journal of Entertainment and Technology Law* 13(4), pp. 881-939. Available from: https://ssrn.com/abstract=1775886 [Accessed 29th April 2020].

Yu, S., Da San Martino, G., & Nakov, P. (2019) Experiments in detecting persuasion techniques in the news. *ArXiv:1911.06815 [Cs]*. Available from: http://arxiv.org/abs/1911.06815 [Accessed 24th March 2020].

Yun-Pu, M. T. (2019) Copyright ownership for outputs by artificial intelligence. *Science & Technology Law Institute.* Available from: https://stli.iii.org.tw/en/article-detail.aspx?no=105&tp=2&i=171&d=8194 [Accessed 4th May 2020].

Zen, H., et al. (2010) Statistical parametric speech synthesis based on product of experts. In: *2010 IEEE International Conference on Acoustics, Speech and Signal Processing*. 2010 Dallas, TX, USA, IEEE. pp. 4242-4245. Available from: http://doi.org/10.1109/ICASSP.2010.549691 [Accessed 7th April 2020].

Zhou, J., et al. (2020) Automating botnet detection with graph neural networks. *ArXiv:2003.06344 [Cs, Stat]*. Available from: http://arxiv.org/abs/2003.06344 [Accessed 30th March 2020].

Zuboff, S. (2019) *The age of surveillance capitalism: The fight for a human future at the new frontier of power*. London, Profile Books.

Appendix I

Gil Weinberg interview transcript.
Professor of musical technology at Georgia Tech and founding director of the Georgia Tech Center for Music Technology, 20th May 2019.

Audio File of Gil Weinberg Interview.

Transcript –

Gil Weinberg 0:00

The kind of research that we wanted to do, for example, with funding from a company called grace notes for three or four years now. And not only they don't press us, it's also pretty excited and they like us to publish in, in papers. So of course, the route of patents, which we do as well, but we make sure that the companies that find us will also allow us to publish and in journals and conferences and, and we've never accepted money so far and actually was never asked to accept money. Where this was an issue that we are not allowed to publish. They're the kind of fields that I sell to the industry is that if you want to pay us sponsorship to do research, it should be something that is not on your critical path. It should be something that you wouldn't do otherwise, because you can have your money you can hire people to do stuff that you need to be ready by Christmas for us it's more speculative a potential threat. transformative and think that you wouldn't have to necessarily justify for the board's it will lead to a product tomorrow or next year. But if something really cool happens, then you can get exclusive licencing from Georgia Tech. And so I don't know how it works in Europe. But for me so far, it hasn't been a problem

Martin Clancy 1:23
That's very, that's very positive to hear. It's I've had some experiences where I've observed and I wasn't sure whether they were, I didn't want to draw too many conclusions from that. So that's actually it's very good to hear. Let me move along to the issue of robot rights. Shimano, the robot film composer in deep score, and when I met Richard last summer, he you were working on he was working on a film together. It seemed very exciting, where has that project at the moment.

Gil Weinberg 1:55
So currently, we put it a little bit on the back burner. As I mentioned, my projects so far, and for the foreseeable future, will focus on AI and robots. And they are a tool for inspiring humans and, and to help humans and push music as we know it this project was a little bit for me on the side of let's replace humans. And I talked with Richard about it and we're kind of putting it on the back burner for now. And he and I, and we, some new students coming are going to think how we can take what we've been doing and find a way for it to be something that inspires humans and help humans and surprise humans and create human robot collaboration because that's my interest. I realised even to create the jobs that will replace humans. There will be other jobs and part of my schpeel is showing how You may look at my talk, I'm gonna send you a talk where I talk about it and an interview for NPR here. And I talked about Savannah, and where everyone was thinking back then that he put in place musicians, you will not have to go to see musicians. And not only that it did not replace musicians. Actually, today, most of the commercial elements of music and the money that is being made is from performance, not so much from recordings, and it helps spread music all over the world and make music much more acceptable and a larger more interesting than it used to be. And not only that, it actually led to genres that would have been otherwise or definitely not in this form, you know, without vinyl. And there would be no scratching without scratching, hip hop as we know it today and probably look different, or maybe even be completely different or not exist

Martin Clancy 3:52
with no half the album, we wouldn't have the concept of the album.

Gil Weinberg 3:56
Right? Right. Which by what I'm saying I'm talking about. We Placing jobs and if you look at the top 100 songs in the billboard, most of them are hip hop, especially Atlanta now is being on track the man. And this whole genre creates so much more work for humans that similarly I'm talking about the camera, which is again, it's a different art form, but people were concerned that you will not need painters anymore because painting was very artistic up until then. And not only camera was probably one of the tools that led to the art from to diverge into expressionism and Impressionism are kind of genres that that you know, artists probably in the back of their mind or not. So okay, camera can capture this normal person perfectly. How about we try something else, and a whole field of new art had been developed. But not only that, it created a whole industry of photography, and which again, didn't happen. So I'm not concerned about Art oriented AI, even though it's a little different, because it replaces more than just a technical ability to replace some of the current abilities of humans, but still, I'm not concerned about taking jobs. But I do try to have all of my projects and about human robot or human AI collaboration,

Martin Clancy 5:22
And it's not the first time that you were involved in a project where you went. This doesn't feel like where I really want to be going with this at the moment. So that's park this.

Gil Weinberg 5:34
I think, yes. This is this is something that we tried to come up with. I think he did a great job and it's really inspiring and, and promising, but I did ask him to let's go back to the drawing board and think how can this be a human robot collaboration system rather than first automatic complete automatic system

Martin Clancy 6:00
And I have to admit, I think that that is a very profound decision. And you're one of the first, I think you're probably the first person that I've come across, who will admit that on the basis of not saying that they, they didn't reach a technical limit, where they went, Okay, this is too expensive or too time consuming or impossible to solve. But it goes back to the author, Neil Postman, who once said, we should ask of this technology, what problem is it trying to solve? But sometimes before we invent it, so I think

Gil Weinberg 6:36
I want to stress it's not because I'm afraid it will take musician jobs. It might take some time, but it will create it just for me personally. It's more interesting to do human robot interaction.

Martin Clancy 6:47
I understand that. I'm very good with the area of and I have to ask you this because of robotics, but there's a lot of talk at the moment about the granting of rights. To AI the potential granting of rights to robots. In my own research, I do a thought experiment where I take the Android Sophia, you know, the animate Tron from Saudi Arabia. and I look at the way that she was granted personhood, and how that could legally be interpreted accidentally, do you have any thoughts in this area at all? Is that something that you've given any consideration to?

[redacted interview reply from Weinberg involving off the record research information, that the interviewee did not want to have formally included but regarded as useful]

Gil Weinberg 7:29
Yes, I don't think we're there yet. And so, to provide personhood and rights in the way I look at it, you have to show or you have to even have a step towards some level of showing consciousness. And maybe even we'll, and I think we are many, many years away. I'm not saying robots will not develop self-consciousness. It may happen but it will not going to happen in the next few 550 or 500, maybe 500. So, so before we do that, you know, people are on top of amazing robots a little too much. And it still algorithms that we kind of know even when you go to deep learning and some hidden layers and don't know exactly what's hidden, it still very far for any level of really consciousness and that consciousness, I don't see a robot or human look at me and say, Hey, I have rights in the future

Martin Clancy 8:31

It's interesting, and I can send you a link to this. You may have seen it, Sophia and as we know, I'm sure you're familiar with how she technically works, was being interviewed with the president of South Korea, the Prime Minister of South Korea, at a public event, and commended him on his election, but also reminded him and this isn't a public address that he's about Upcoming bill on robot rights that she was very much in favour of. Did you see this?

Gil Weinberg 9:07
Well. Yes, it can, that's it's all about the possibilities of narrow AI. But I do refer to the fact that accidental personhood could be created. Not a deliberate thing, just purely like for instance, the corporation has legal personhood in America and that happened accidentally. So, if so forgetting about the idea of role of sentience and super intelligence or any of that stuff, if it happened to by accident, but still legally, that shimp Simone was for instance capable of having recognisable music copyrights with the current technology, which would you think that that would be a bad development or not a positive development or Did you have any thoughts about that?

Gil Weinberg 12:02
Yeah.

Mixture 12:04
Yes, if it happens, true. I just don't see it happening in the next many, many years. So I think it's not really a relevant question to where we are currently. But yes, if you think about 500 years from now, or I will have no knows how many years. And if that happens, it will definitely be a discussion. But knowing how these systems work at this point. Oh, absolutely. No, I agree. This is this is not something relevant to our research. Yeah.

Martin Clancy 12:33
Yeah. And Gil, just go just to be clear on that. I wasn't suggesting that. Anything like the Singularity is anywhere near or anything like that. I meant with the current technology, an accidental legal case happening, which was which does occur, where by accident with current technology rights were given, somewhat unintentionally and that's kind of one of the issues on top

Gil Weinberg 12:59
So, let me see, let me rephrase that question. Let me rephrase that. I do think it will not be a good thing if in the current technology for example, and accidentally robots get rights because that will be one Yeah. Because I you know, I may be wrong I may be narrow minded and someone at some point there will be some consciousness able robot but I think that if accidentally is happened in South Korea, or I don't know, Saudi Arabia suddenly gives Sophia some kind of rights that that's wrong, the next I don't know, foreseeable future that that's not right. It's more like a PR stuff.

Martin Clancy 13:43
Yeah, absolutely. And that's one of the areas that's out there researching is going this is a PR stunt. There are other PR stunts like I have with becoming a member of the French composers rights organisations and they are effectively PR stunts. However, when you look at it legally, unfortunately, there's loads of precedents for where legal accidents have occurred. And I think that one of my contentions anyway is that it's something we need to be mindful of to say, No, we don't want this to happen. because of that reason, not because of any to do

Gil Weinberg 14:18
With sentence. Yeah, let me test it. Sure. But I don't see that happening. That's why I would say,

Martin Clancy 14:24
I'd like to move on to the issue of affective computing. regard. You mentioned the IEE spectrum interview, you said if they are able to pass the uncanny valley and become indistinguishable from humans, I'm quoting from it. Yeah. It can lead to ethical questions, ethical issues. Humans in general would like to know if they are talking to a robot or human see, for example, Google duplex. We therefore try to make our robots indistinguishable from humans in ways they communicate. Okay. So that's what you said that was only two weeks ago. The area of affective computing has raised this is my question is raised many concerns. regarding human behaviour modification techniques such as nudging, shimmies ability for emotional engagement brings us quite close to that area. Are there any specific challenges that your team addressed in this regard? For instance, when you chose a particular synthetic voice to separate it, is there any other issues that have concerns?

Gil Weinberg 15:22
Yes, also, I looked at a Google demo. And it really made me feel uncomfortable, and I didn't talk to me but I wasn't the only one. There's a lot of ethical questions about whether the person in the restaurant need to know that even those that voice is going in and all kind of small little tweaks that makes it sound more like human. And is that something that that society's ready to accept that you don't know who to talk to? So much, you know, there's also question videos people now do all kind of small thing and lip synching of videos that you can see Barack Obama saying He loves Trump. And at some point we will lose what's true and what's AI generated. So I have issues with that. And that's why we are focusing and I think many others have, you know, David Hanson, for example, in Sofia, although he really tried to help the face, and he's not there. He's deep in the uncanny valley. Yeah, and even though it's, you know, animatronic Marvel, what he was able to do is it's pretty cool. It's very far away from really fooling me to think it's human but multiple degrees of freedom leaps and so on. But even he put like, at the back that it's kind of a fibreglass translucent thing to say, Hey, I'm not doing doesn't really try to, to fool you to think this is a human. And I think we should think about it and that's why we use this Aboriginal language and that's why now when working on the different projects that involve voice, we try to distinguish it from humans by adding artefacts and deliberately. And yes, I don't see that visual robots like physical robots are close to pass the uncanny valley. Sophia is probably as far as getting into really deep down there. But just in terms voice as Google showed, I think we can pass it. And that's where I'm word.

Martin Clancy 17:23
Yeah, I thought that, that that's where that area of affective computing comes in. I've got one last question for you. I'm conscious of your time when the calls have been made to embed ethics into the AI engineering practice, to enshrine human centred socio economic values into this innovative innovation process. Moreover, and I quote from a recent IE ethics report, to make such principles, core values and simply not another technical problem to get solved. So in my research, what I found is that a lot of these, a lot of the issues of say algorithmic bias, accountability, transparency, all apply to AI that's used in a lot of, for instance, business areas, such as curation within Spotify, the business with Francois Pachet working there, the ghost writers, but does that do you think that these, so these issues that for instance, apply to say, exchanging of data analytics, is it possible to apply to go back to this quote, in trying human centred social economic values to embed them into the engineering process? I mean, is there a way of doing that?

Gil Weinberg 18:48
So, there is a way I believe this is not my field of study, but you may be familiar with Miri machine intelligence recent Institute So you'd kowski and some others that are working on friendly AI, as it is, Nick Bostrom, actually, in England is talking about it and talking about the future of humanity. And my insight not being an expert as these people and others in this field is that the real problem that we currently have is not such a robot. We'll turn against that. And we have to develop Friday night and the three will have Asimov and all of this. The real problem is, I think I mentioned briefly are things such as using training data as a tool that is embedded with bias and letting government totalitarian governments control AI. And we say I control the citizens in ways that we live in Monterrey, Mexico, in in China, for example, there's cameras that follow people and give them socialist calls, or companies using our data using AI without killing us. It can be done anything. That's real current problems that we need to fix, in order to prevent current negative directions for in terms of AI, getting rid of humans again, it's similar to consciousness. I would like to other people, probably smarter than me at worry about it, because it is important. You know, Nick Bostrom is thinking about future of humanity, not in five years, but in 500. And someone should Yeah, it's just not what I do.

Martin Clancy 20:27
Yeah, I mean, but I think if you don't mind me saying I actually do think it's what you're currently doing. And it's and I think you're doing a very good job of it.

Gil Weinberg 20:39
Either winner

Martin Clancy 20:40
Well, no, this is the issue because of my interest in background, both as a music creator but also a music business. My own feeling and sense has been for some time and I'm not alone in this that the music industry is the canary in the coal mine for The digital disruption. So what happens in music? for lots of reasons, cultural but also technological trends tends to happen with music before it happens in other environments. So I'm working with the IEEE at the moment on an ethics committee, where my specific area is to develop this within the creative arts and take those areas that those big subjects, so you're referring to, and transpose them to music. Because one of the arguments that I make, and it is quoting, the experience I had

in loop is that I believe that we can learn an awful lot by talking about remember playing robots and killer robots, because they're not going to kill anybody. And because it's playful, and we can experiment and music is an expression of whatever it is, there's the human condition that everybody pretty much understands and pretty much everybody who's working in music and working in AI music who I've spoken to really cares about humans. And so it's not a big step. And it's not a complicated one. It's literally the kind of decisions that are informing your research and it's clear from my interview with you, you know that that's your entirely ethically aligned with, regardless of whether that's a big issue for you or not.

Martin Clancy 22:22
That's to go.

Gil Weinberg 22:23
I'll take that. And, you know, my decision, for example, to put this on hold might be part of the way I think about this. It's just that I think about it in terms of its music driven come from music, it's not really dealing with a big question of the future of humanity. Yeah, but I guess say no, music is part of the future of humanity. So maybe in a way, yes.

Martin Clancy 22:50
Yeah. And you and you can we can do tests and we can find things out. But if you think about it, but it was also curious, I'm conscious of your time, but the interview is effectively ended if you like, but they, when you speak about when we speak about the fangs, the big the big global corporations. I mean, a large part of their growth was based on music and it was interesting to see the other day that when universal the biggest record company in the world was being put up for sale that the first person that was being suggested there will be a bidder was Google. And it's just as a real irony to the fact that they have effectively built a business based or based on safe haven. And now maybe acquiring these copyrights. So I don't think we're too far removed with music from the heart of these issues. But thankfully, the consequences aren't too significant. But anyway, that's, that's, that's my area of intrigue. So

Gil Weinberg 23:52
Let's say now, I would love to read your thesis. When do you think it'll be ready? I'm hoping to

Martin Clancy 23:57
I'm hoping to complete unsubstituted By September, if not sooner, and I've been approached by Routledge to put together a I'm going to meet them on Friday a collection in relation to the bigger things in relation to artificial intelligence, like a transdisciplinary work that would kind of introduce the different areas to each other and say, this is kind of what's happening here and, but also what people are thinking. And if they if they continue their interests, I'd love to talk to you more about potentially contributing a chapter towards that because I think that there's a big issue here for the whole music community to understand what's going on in the different sectors but also to realise how much commonality there is. So sure, the technologists, you know, I think it's an exciting time to be doing this. So But thank you very much for taking time out of your busy schedule and congratulations once more you inspired me down this road simply by the live performance. Appreciate it and good luck with this. Thank you very much. Okay, bye, take care now.

Appendix II

Xhail Interview Transcripts

Part One: Tom FitzGerald interview. CFO at Xhail 13th May 2019

Audio File of Tom FitzGerald Interview part 1

Audio File of Tom FitzGerald Interview part 2

Transcript

Martin Clancy 0:02
One two, I'll be testing the recording. But as I say, anything that's used I'll check for it and things included. No, that's fine. And there we go. Just

Tom FitzGerald 0:22
To my right. My wife hates surprises. So I'm just going to let her know you're here.

Martin Clancy 0:27
Yeah, I'm being interviewed for a student. It's not testing yet. Okay, so this is an official interview for my PhD Delta table say that I'll send you details of anything with permission for GDPR. So let's get cracking a little bit about when to begin.

Tom FitzGerald 1:35
So the company Mick set up the company in 2013 with the vision of, you know, creating a music platform that enabled musicians and composers to be involved in the music industry as it moves forward with the approach of AI and streaming and you know, FX be taken. The revenue opportunities that existed for musicians off the table and so it was set up by Mick & Maura his wife. They and was initially seeded with a 500, round of capital from friends, family usual start up situation. And through the business plan, they put together they got enterprise, Ireland, high performance unit support, and they refer to it as a junior bit of the 250. So it's like match, match funding so, so that, you know, that was the start. And I think at that stage, they had a piece of paper and an idea. they hired CTO, and Got, I guess the prototype up and running back end 2013. So proving that the technology, we're proving that the concept worked. And that concept, being as you know, to bring stems of, music together in a template and to allow those stems to interact with each other, using the technology is technology that sits within the platform. They applied for the patent for it in the in Ireland initially event in the US. And got a priority date, which is the key point of global priority date of April 2014 and so it could be 13 need to check and, and in so the journey has been a journey of build the tech and sort out the IP commercialize yourself to a place where you can you can sustain and that's the journey that's been going on

Martin Clancy 3:55

So your role in the organization.

Tom FitzGerald 3:56
My role in that is actually CFO Or director. in a startup situation, you almost do everything. It's like you're touching everything every day. But that's the nature of it. It's fast and

Martin Clancy 4:12
Have you learned a lot about music?

Tom FitzGerald 4:13
I know nothing about music and being straight. I like music. I like listening to music, but I don't play an instrument and I don't have I have no music theory experience. So it's a bit I feel a bit of a bit of a fraud from that perspective so my skills sit elsewhere as a My job is essentially to make it work. Yeah. And make the business model work, commercialize the business keep it funded in the journey, and I guess, an ultimately identify investors and in due course, a buyer for the business as we go out from here, which may well be sometime yet

Martin Clancy 4:56
in terms of a little bit about one of the one of the people I interviewed kind of identified that they were two make this as a statement and you can tell me whether I'm agreeing with it, you know that for startups There are basically two paths economically to success one is that you develop funding that you go for an IPO or that at some point along that journey a corporate acquisition occurs was that be an accurate reflection.

Tom FitzGerald 5:23
Yeah, I mean, I think there's this just as any number of buckets here I mean, a lot in a lot of it is linked really to the founder as well. So typically, you will have founders who want to build it manager to see it all the way to the end mind there baby till they retire themselves. Yeah. And in which case, that's one that's one journey, which is good from a enthusiasm and involvement perspective but often is not so good because guys who, you know, entrepreneurial people in start businesses like that in my opinion tend to overstay their welcome. Yeah, and their job really is to bring the business so far. And then as it evolves into a more corporate entity, you know, either they can stick with it in a different role. But they have to allow the company to breath and go on and grow into a larger because it becomes something else because it typically becomes something as or, or, and the skill set that the founder typically has doesn't necessarily match. So we take the in the XHail situation. Mick is the founder, Mick has dragged the business kicking and screaming from day one today, five years out, but Mick will acknowledge the fact that is he the right guy to be the CEO of this business into the future? Probably not one because he's not that interested in doing that job because that is an entirely different job. He is naturally a creative guy. And, and, and I think in our case, we've worked hard to Make sure that we're all comfortable around the board table, that that is the journey group and that Mick wishes to step off the bus or step into an alternative role. And that's been really important when you're talking to investors as well. Because so our plan is essentially a build it prove the breath and of the of the technology in terms of geographies and business segments, when you've hit the minimum level of sales within that grid of that vertical grid, that you can then you're then saying that is the value of this IP potentially, there is then an execution phase, which says, I've got to exploit all of those verticals, geography and segmentally. And, and the question becomes, well, who is the best who are the best people do that? Right. And in our case, I think what we've the conclusion we've reached is that Sales is very hard. And we don't naturally have sales capability within our organization we've tried to get and it has been difficult because the technology is new, it's not like selling widgets, you know, there's quite, you know, there's quite a level of understanding required to sell the product, or be it the product in quite simple. So that's been that has definitely been a challenge for us. So we've identified that actually, our journey should be about getting to that place where we've seeded the grid maybe not all of it but certainly some of it, and then identify a suitable partner, who has the already got the scale. Yeah, to bring the product on, you know, the product, the problem is made more difficult for us because essentially, creating our own brand is actually quite a hard thing to do it's very expensive, and there's no guarantee that you'll get there and but association is for us a better a better model. has several advantages one is it gets you the scale quicker two it provides a partnership with an organization that is naturally leaning towards you. And so whether they then move from being a partner to being to buying into your company, and others providing more capital, or ultimately buying out your company, which is which is providing a big liquidity event for the investors then we see that as a good as a good as a good as a good way to go. So that's been so the journey today has been keep it funded while were building and feeding and we've successfully I guess done that.

Martin Clancy 9:41
Tell me a little bit more about that journey not specifically for executives, because that's your own private business. Don't feel free to do whatever you like. But yeah, I'm thinking
about this as more for the pressures that would apply to startups the maybe on sometimes wouldn't have some of your expertise involved to guide them. ? Where you're going from, say, initial seed capital, to rounds of VC funding? Yes. And the pressures that come into play there?

Tom FitzGerald 10:10
Yeah, I mean, I think I think, I think it's a broader point that that one of the biggest issues startups have is skill set. And it's very hard because you can't afford it to have the kind of the kind of skills and capabilities that you need to so very much you live hand to mouth. And, you know, and it becomes it becomes very difficult to get anybody with industry, you know, 10 plus years industry experience, which is exactly what you need. Every fund sales, you know, funding or whatever, whatever, you know, technological

Martin Clancy 10:46
So outside of the actual concept. Those other skills are also essential

Tom FitzGerald 10:53
They absolutely are. I mean, so. So, you know, in our business, the key skills are our technology to build platform content to bring the music, you know, and to curate the music effectively, because it's only as good as the inputs, and funding, which is about, you know, making sure that you can tell your story in a meaningful way to allow people to, to believe in you and invest in you so I mean, they're probably the skills, you know, we're a small organizations of like 15 people and so all that other stuff that comes with large organizations, we don't have to worry about, you know, all that, you know, making sure all the bits are hanging together properly, making sure the communication processes is there and making sure you know, it is very secondary. But what you absolutely need to have sales because that's revenue, absolutely need to have technology because that's the platform and the IP, and you need to have content to feed the machine. So they're there. They're the key components but the difficulty, I guess, for a lot of organizations is finding skill sets to have enough people sitting round the table that can actually all make that work together at the price that you can afford to pay, which is And typically, that's where often organizations would fail not because the ideas not good because they don't have the ability to get past the various barriers that come along on prototyping and again to get there yet probably can but commercialization becomes like the hardest bit, and sometimes, sometimes, companies will have very sales oriented founders and sometimes they'll have quite technologically or creative founders and wait so whichever you have, you almost never find a fella who's both and so you're going to you're going to be deficient in one or the other. an so either you'll tell a great story but won't be able to deliver the product or you have a brilliant product and you know, struggle to get it, get it to market and hence you need to have a range there for probably three or four different skill sets all living there together to keep the balance and to keep people on the journey or even forming the plan is a skill set in itself having a story that's

Martin Clancy 13:11
Would a key part of your responsibility to figure out how to present that message to investors?

Tom FitzGerald 13:18
Oh 100% what the job. That's it the CFO job, essentially in this stage is essentially

Martin Clancy 13:24
is have you changed him much I'm curious about because you're well established at this point in terms. So the area of music and technology, become careful of not using AI pacifically.

Tom FitzGerald 13:38
Yeah.

Martin Clancy 13:39
Have you noticed when you first started to introduce the whole okay? It's an idea of machines to it which would be brand new. Now it's quite a competitive there's a lot of startups in that area how has that changed, say VC mentality

Tom FitzGerald 13:56
Yeah. So we've so just picking up the VC point first. I mean, we don't we have absolutely done our very best to ensure that we have no relationships with VCs and we have no relationship with private equity firms, simply because they we've tried to have investors who are like minded and wanted to come on the journey,

as opposed to VCs and PE's who, while they might make your idea, really it's a numbers game for them. Yeah. And the problem with that is they sometimes become excessively influential in the decision making. Exactly. And so our ambition has been to stay away from that as long as we can. And we have successfully stayed away from to date. So there are no funds in our business.

Martin Clancy 14:42
Oh, I didn't know so.

Tom FitzGerald 14:43
So our investors are only friends and family and people who are involved directly in the company. And we have one US private investor, who just does stuff himself.

Martin Clancy 14:54
Can you tell me a little bit more about because that's a very, I believe it's very important distinction because one of the things that I've observed with VCs is that the hit rate, the expectation is phenomenal? Like for instance, like it's worse than the music business ever was like, Oh, one in 20

Tom FitzGerald 15:16
Yeah, so maybe it might be one in yeah might be 1 in 20, 1 in 15 ,1 in 20 it's in that zone.

Martin Clancy 15:22
But the profits have to be so

Tom FitzGerald 15:24
Yes advice. Yes and that's why the price the price of the funding is very high. Yeah. And by price I don't mean and what you have to pay back the consequence for the targets, they will set for you in terms of sales, etc, etc. In order to get them on the trajectory they feel they need combined with the fact that you know if, what you will ultimately cede a lot of control in that process. And typically if you are not getting to where you have said you will get to on your trajectory, your broadly speaking there'll get rid of you So, so that journey becomes very high pressure, right? And, unfortunately compromising. Because ultimately you've got to hit the number. So you will not do things you should do. And you will do things that you wouldn't otherwise do.

Martin Clancy 16:14
Would you think I'm an observation that I've made, I checked with one or two other people who work in separate areas to perhaps smaller, say music AI startup. I was curious about? Well, I'll tell exactly as there's a chap called Victor Abelardo, because he has a company called Melodrive to do interactive adaptive music for gaming and he referred to the fact that this is cult with AI music companies have tried to be the first and as a result, they over promised, even though the technology is actually very good. It's stepping over the mark to promise more

Tom FitzGerald 16:59
And over Promising of what I can deliver yeah.

Martin Clancy 17:01
And I was wondering, do you have any thoughts about that has a tendency when meeting those VC pressures.

Tom FitzGerald 17:06
It's inevitable because you got caught on a little treadmill there. in other words, make an initial promise, whatever happens from that, typically it will take longer and take cost more than you originally thought your now in a reason you start to get into a vicious cycle of then having to repromise and then not deliver and repromise and ultimately to go right to you. Right And that's, that's really bad. but yet the counter a better but probably doesn't really work, either is constantly trying to underplay what you're going to do. Or you know, some of the guys I know, I know I can get there right and I, you know, say in our case, we cannot over promise and we refuse to over promise. Because, you know, that is that, that is a worst sin to say you're going to do it. and not do it We would rather to be to have our story, believe in our story and go on the journey. And if it takes a bit longer, it takes a bit longer. And that's been our actual experience. But we have found the investors we have and because there not VC's and PE's to be patient, and to be understanding, and to you know, at the end of the day, we've been in the fortunate situation that we haven't had to go back to the investors going well, more money, lads or it's curtains. In other words, you're going, we're going to burn your capital, right? We've never been in that situation because we've always found

somebody else to help. Yeah. And so, so I've not, I've not truly tested them in terms of well, right, lads, if the if the rubber really, you know, hit the road, what would you do? How much do you how much patience Do you really have and how much support but to be fair, most investors have been here since day one, which isn't like in 2014? So it's and their still there right now, they're sitting there because they may be going with might as well just keep riding the wave and hopefully it'll all happen or I don't know what they actually feel their investment might be worth now, but, but as we go to the next round, as long as in my view, as long as you've added enough value to the enterprise to facilitate the next fundraise being at a higher price than the last fund raise, well, then your existing investors while they get diluted, they are getting a value uplift. And so, you know, and the thing is still, the thing is still going with a great prospect. So they should, they should stay on board with you. Right. And that's been the experience we've had to date. But it is hard to go around. I mean, the hardest thing we faced is, is everybody loves the tech. And, you know, we, you know, everybody likes the IP aspect, every likes the tech we build, and nobody likes our sales journey. And if you're once you're in the VCP space, it's only about the sales. Yeah. And so it has made those conversations quite difficult.

Martin Clancy 20:00
And as I imagine in the VC space now, like, for instance, one company management company, their work in America to do some VC funding my mainly manage artists, but they, they tell me that they get seven or eight proposals a week now. Yeah. Ai music companies. And it sounds like there's a bit of a feeding frenzy in make. Definitely, that's not referring to XHail. Yeah. In terms of going What are we going to say? Whatever we need to say?

Tom FitzGerald 20:34
Yeah, that, definitely. You know, there's no doubt we in our case, we stayed away from AI and specifically, we were actually going as far as they were not AI. Yeah, right. And that, we felt that that was a strong message. And when I do

Martin Clancy 20:48
Notice on the artosis, on the frequently asked questions, right, on the XHail site, does XHail use AI to create music? The answer No exclamation mark, you tell me about the exclamation mark.

Tom FitzGerald 21:03
So, at the end of the day, it's kind of it's kind of like, well, exactly what it what exactly is AI? Right. So what does it mean to you? So for us, so for us, you know, I can make an argument that says I use AI, you know, have AI, right. I mean, as I have algorithms within the technology that help stems to, you know, combine and talk to each other and, and that appropriate stuff only comes in and other stuff is left, you know, so I can argue that that's AI. And, and we have found that actually, in the back end of our investment, fundraising journey, we've had to kind of, you know, play to that crowd technology, you know, now, and so, why do we still believe really, we're not you know, there is machine learning in what we do. You know, the decisioning processes are, you know, are there are they organic? You know, this does it teach itself a little bit, but not a lot So I can creditably say, we have AI in our organization, if it gets you in to, you know, a room with people who only invest in AI Yeah, right. We've certainly, you know, the experience experientially of going into rooms and saying you're absolutely not AI can have quite negative consequences because government really only invest in AI, you know, and so, which is bad, right? but So, so you have to kind of play the game, play that game just a little bit. I don't like it but that's, that's the reality and over time, as we move into the XHail or space for example, I there will be, it will be more and more machine learning in our product. So, you know, is it AI that take a lyric and put the lyric in the system. And I that is perfectly musically current history. AI

Martin Clancy 23:00
it is it is by the comparison to some companies that are rounding in that area. Yeah, yeah. So and a sidebar for you just to in case I forget to mention this one, I think it's outside of this way I figured you're definitely on messages that AI is going to become very dated right and I was curious, that body I was chatting to you about the IEEE, specifically don't call it AI. Right? so, it's autonomous, and intelligent systems, even though it's everything that we regard as traditional AI, but that that arc is going to get because it's going to become one of those kind of terms like virtual reality that's going to date in Absolutely. And it's got nothing to do with your technology

Tom FitzGerald 23:48
And you know, in the in the world we live in, you know, you know, branding, or you know, perception of what something is being is very important and things fads come and fads go, you know,

Martin Clancy 24:01
Right, you might just want take the exclamation mark.

Tom FitzGerald 24:04
Well, I it's funny I got what I was when you said it. I'm going right where exactly is he as is that's on our website. it's on your website So yeah, I see that the difficulty with that that, that. And this is just the passage of time and being too close to things that website upgrade happened in 2017 and the end of 17. Right. And so my guess is that our thinking has moved on quite a lot. But no one's bothered to go back to check.

Martin Clancy 24:35
Was another observation first video that I saw with Mick. What really caught my eye was when he was saying we do not use artificial intelligence and I kind of found that distancing to the message of what it was.

Tom FitzGerald 24:54
And he just railed against you but actually, in these last seven or eight months I think he's maybe even longer. He's kind of gone. You know, what? Well, actually, I get the I get the win. There's no point in fighting this. Yes, you can play alongside, you know, associate with

Martin Clancy 25:11
And it's true to the message of what you're doing. Yeah, absolutely. So let's move into that area a little bit. So in terms of and again this is not distinct to XHail lets still a little bit with the IP Yeah, the range of IP options that are available to a startup. How do you how do you go about differentiating that in terms of cost involved time like,

Tom FitzGerald 25:35
Ultimately in startup in startup world? It has to be about IP. Yeah, right. In that

Martin Clancy 25:43
In the form of that like, a patten as to adverse to a trade secret as opposed to this trademarks, yes. is always going to be a patent

Tom FitzGerald 25:48
So we so we've got Well, it can be I mean, for us, it's, for us, it's patents and trademarks. I mean, we spent quite a lot of time and we're very good at IP lawyer. Thinking about how you can build value within your IP by having the initial patent and then building a family of patents around us to protect it, right? Because at the end of the day IP protection or IP is only valuable to the extent that you can protect it. So you know, if somebody decides they want to, they want to use our IP in their own world on a copycat basis or whatever. And they do under a large company you know, what do we do? You know, I don't have a big check book to go to court with. So one of the reasons we're trying to get a partner on board is that, that protects us because you know, if I if I have a partner of Apple, right, the chances of Johnny copycatting, when he knows that Apple are connected to this are a lot lower than if he just XHail who are they doesn't matter. I'm just going to rob their technology and off I go let them come chase me and so it's a double edged sword and you're about your enterprise value is about your IP and companies that set up the don't have IP a proprietary IP struggle to, startups struggle to I think survive because just the model says you're either heavily reliant on a person right in which case who's gonna buy that company right no nobody really or alternatively your you know okay if you've created it lets say your salesman sheet or something you know that the value dies really quickly right because you don't you don't have anything tangible for is in our it where you have patents in place at least you have that starting building block that you have something that's unique, you the only one who has it and really the task then is to prove that well it's okay to have it but does anybody else want to like it is usable which is our journey is to prove that the IP we have one we've built it, but two its commercializable because if it's not commercial, like, how many thousands of really smart things have been built, and that are that are even our patented, but nobody buys

Martin Clancy 28:18
The cost of doing it

Tom FitzGerald 28:23
Actually It's not as expensive as I thought it was going to be, like, so we would be we would be following the patent journey globally, every jurisdiction and, the initial applications

Martin Clancy 28:37

Is there regulation for that is that improved, because it used to be that you had to do in every country and I know

Tom FitzGerald 28:40
You're still on you're still on every country, right? And there are like the European one, which will then associate with those companies. There's international ones which then have other Association. So there is a kind of a slight bit of layering, you know, But, but ultimately you're going through every examiner in every jurisdiction right? And, you know, that might be we might have 30 of them on the go right now, but they tend to sit in the veins for a long time. You mean, each jurisdiction Yeah 30 different yeah 30 different applications being managed in different jurisdictions globally, right. So currently, we're patent granted in the US, Russia, China, Japan, and soon to be Australia, right. So, I'm getting some pretty good coverage. There. But, and then but and that's for the main pack, some continuations that we've done in the States, there's a new application for SLR which is nicely and so but we're, we have a strategy of making sure we have a priority date everywhere in the world. First point, and secondly, that we then building the right IP around the core and the product to protect it. And that's it because At the end of the day, you know, our commercial model is okay build a sales organization that has offices and people and you know selling and blah blah that business model number one, business model number two, could be I'm just a licensing company. So I just sell I just sell exclusive license rights in jurisdictions to people and I take an annual fee and let them worry about it after that so we need to cover all markets that may emerge.
Absolutely which in fairness to Mick was quite foresightful at Day zero, which is get the get the get the date get the priority date. And then follow the journey of the patents thereafter. They all follow different timelines. There's different levels of examiner ship and all of that. And you have to dip in and out of it every now and again, but it doesn't absorb a massive amount of time.

Martin Clancy 30:55
So the relevance of the bottom line is from what I'm taking away from this is that which I'm very interested is that the process of the process and the costs involved are not an impediment to technological development?

Tom FitzGerald 31:10
I don't think they should know. They shouldn't know. I mean, relative to the cost of the IT department, for example, it's small, it's relatively small day, okay? So it's painful, it's a bit painful, it's a bit administrative and stuff, but having the right people on your team to do that is fundamentally important, you know, the writing, writing the application, get dumping, you know, mixed brain into the application process. And then the skill of doing that, you cannot place enough value on that because ultimately, writing a patent that has strong claims that are acceptable and are is, you know, priceless, priceless, so it's about getting the claims very good it's not about what your applications says it doesn't matter what your processes is, it's about, what does it claim to do? Because that's the thing you go to court on. In other words, when somebody steps and does something even remotely with your my claim, one says, You can't do that. You know, it doesn't matter how fancy my diagrams are, that's what the claim says. So, yes, the process, so there's a we may have like 20 claims. Now, the first one is the most important. And you know, they do, there isn't sort of a, and I'm not claiming to be a patent expert, but they will, you know, they'll say, well, we could put that wording in claim three but we couldn't put it in word one been more about you know, this kind of goes on yet but ultimately, it's about getting negotiated. The negotiation best claim one that you can get from the examiner

Martin Clancy 32:44
And another time you're talking about from what I'm taking from that is kind of ways of protecting, controlling. All of that kind as you said if you were affiliated with Apple, nobody wants to go to court so it's more just prevention.

Tom FitzGerald 33:01
[information regarding IP is provided off the record]

Martin Clancy 34:13
Let's move into the area of the actual the copyrights do you mind talking about that

Tom FitzGerald 34:18
[Off the record information]

Martin Clancy 34:22

Please yeah, we can we should talk about that separately because that's fascinating for other applications that you could work that into it when XHail creates a piece of music.
What's the economic model in terms of the copyright is created?

Tom FitzGerald 34:47
Well, we have the Q we have a huge advantage in this space because someone at the door there just pause there for one second gonna Can we just stop for a minute there's a guy coming here to do some work like one minute

Martin Clancy 0:00
Get it working again. Yes, Get this recording we do the same here.
There we go now. So let's frame this one for you. And maybe I'll start with a statement and you think this is true or not or music industry is very complicated for a lot of people. So one of the ways that I've identified how you break it down, I do this in my undergraduate courses, but just as general understanding is the music industry Music, ecosphere, which I mean by that everything from tech companies, to musicians to a whole, anybody who's vaguely associated with working, you can basically stick all that into a crucible and boil it down, it comes down to four things. And that's all based on in publishing live performance recording merchandise was five brand alignment, corporations. If you burn that down, what's more, When it comes down to music copyright, everybody, somewhere or other is engaged even if you're in, in,

Tom FitzGerald 1:08
In the business of exploiting copyright.

Martin Clancy 1:10
Yeah. Would you concur with that?

Tom FitzGerald 1:12
I think so. I mean, I like at the end of the day the revenue streams that exist, are have to be linked to the ownership, right, be the publishers ownership, the writers ownership, you know, and so it does inevitably all come back to that certainly in the musician and composer space. Right. And as the recipients and definitely to the publishers as recipients of the broadcaster's piece, right. So, how that evolved mean, that's been the traditional model, how that evolves from here, you know, it's changing in many, many ways that like we get exposed to some of that change, but, but essentially, everybody's now trying to avoid back end. You know all the commercial guys and they want to avoid it because

Martin Clancy 2:03
What do you mean by back end?

Tom FitzGerald 2:04
So royalties so the royalty payment you know so when it when it when a broadcaster plays a piece of music, the payment he makes one to the writer and two to the publisher. He doesn't like them. And the reason doesn't like them is the more successful The show is, the more he pays. but yet, it's a totally variable thing. So, typically he won't like that. Right? So, so the evolution is towards, in broadcast space towards buyout. So as I pay more upfront, and that's it, I own it after that he can't buy out the writer, he's there, he's protected for legally forever but the publisher guy get screwed well not he gets squeezed. Right. And so I guess that's that dynamic is going on and but a much Bigger dynamic is obviously streaming. And the issue there is that the business models for how people get paid in the streaming world are under underdeveloped for the best way. In other words, it's only starting so it has to come out. And you know, the it's the big social media guys that really have probably going to be the testbed for how some of this happened. So you've got so you've got the Spotify model, which is, you know, pay, pay your fee and income stream as much as you want. And the composer gets a fraction and nothing for the privilege fine seems to be there all be it that the musician group and ultimately his consent who creates the music I guess, for like, they definitely don't like it right.

Martin Clancy 3:55
What is traditionally to do with the divide of who owns, If you take it that if you look at the profits that are currently being made by Universal, and universal was valued by Deutsche Bank as being more than its parent company VND. might mean there's a bit of fat in the cow there, but that was two months ago. So everybody's profits are booming, based on streaming the, the idea that

Tom FitzGerald 4:22

Well, yeah, but and who's? Yeah, I think somebody, it's a zero sum game, right? So somebody's losing, right.

Martin Clancy 4:29
But the model that that's if you look at what that model is, is because it's based on the equity divisions that occur between the creators of the music based on different models that are not, we're not creating on a streaming model. So that's a slightly different issue in terms of distribution of income. And one that I think is going to become more charged where the traditional costs and reasons of why you would get into Transferring copyrights to a third party such as a universal, are questionable when you have models like Spotify,

Tom FitzGerald 5:08
Yes.

Martin Clancy 5:10
What's in Xhail's situation?

Tom FitzGerald 5:13
Well, there is a difference. So in Spotify, it simply, Spotify is simply a listening device, right? And so, but if you're a music, your universal how you bring on you bought the back catalogue of David Bowie, right? The challenge the universal have is, how do I make money from that? How do I monetize that? catalogue. Now, I can put it on Spotify, and I can get like, you know, whatever. David would have got, or I can come up with a different way to do it. And I think that's, that's where the thinking is. So what we would do with the likes of library, so libraries in theory are a competitor of ours. So they produce tracks. And in their, in their case, their IP is the track. Yeah. Right and they resell it. gazillions of times to as many people who buy it right on the pay per, or track right. They don't have the ability to sell unique tracks, because once it's gone, it's gone. And so that's a massive difference between us and them in theory, but people sourced their music from library so they're thinking it's awesome libraries in sourcing from us. We're going well, yeah, that's fine, so we can sell library music at a fraction of what library sell library music for simply because we can just make a new one. So our effectively Our music is disposable or uniquely creative.

Martin Clancy 6:48
So you're telling me a little bit about that model of how, when, on a very simple level, so someone uses XHail. I'm sure it's different in different platforms in the different situations, but a copyright is created is a copyrighted the recording, does the user purchase them.

Tom FitzGerald 7:08
So he's credo we own the copyright (in the recording), so in the recording so, so, the stems that have been so if you think about it, we actually own the stems absolutely so, the stems create track, that track is then copyrighted and that unique copyright is owned by us, but licensed in perpetuity to the buyer, okay. So, he, you know, so that's and then he can either you know, in that model he can he can either buy the track out or he can do you know, some sort of, you know, back end deals It was like so, so, traditional models of we can do we can operate in that traditional world. And in that model, we will compete with the libraries and the publishing and the publishing where we are the publisher. So in that model when you when you create a track the back end When we get because it's our content right, that track is will come any royalties due on that track will come, you know, 50% to us as a publisher and 50% to the, to the writer, okay, in that scenario, in our tracks, it's not a single writer, it will be six to 10 writers. And so they will share if it's if it's 10 stems used in that track, they got a 10th each of the writer share, okay, we keep 50% and in that model libraries, you know, so we're actually competing similarity to the way life is the difference between our, the cost of us making a track is next to zero, right? Because I'm reusing the stems all the time. So I've only bought the stems once, but I'm using them over and over and over again. So typically, as I produce a new track, that new track is essentially cost of zero. Whereas if you're in binary land, and it's unique, right on, uniquely copy and copyrighted and uniquely, you know, and, and there's a bit of a debate about how important is uniqueness do people pay extra for uniqueness to know the that tracks never going to be anywhere else? And the answer is some people would, but many people wouldn't. Because they don't actually really care. So but that applies in library music anyway. Anyway, correct. And if you want to take it out of the library is going to cost you Yeah, right. But in our world doesn't need to. So in theory, we can wipe out the libraries, just simply because we can do it faster, cheaper, better than they can do.

Martin Clancy 9:35
And it's very curious. I think it's a key selling point, at least to me. I shouldn't be saying I'm supposed to be impartial. But that you have. You're not doing works for hire. correct.

Tom FitzGerald 9:49
But the stems It works for hire

Martin Clancy 9:51
But the stems of Okay, so the stems of work for hire, so the writer though of the track is who

Tom FitzGerald 9:59
The writer of the track is XHail essentially because so each stem you know, you would have prepared to work for hire for my template 1 or my template 10 or whatever that stem is appropriate to. And so I've paid at this point in time I will pay you to write that stem and I pay you on the basis that I'm going to give you a little bit for your time. And you are going to be you're stems are going to be exposed very globally and as it's repeatedly used; you will get your relative fraction of the of the of the of the of the back end.

Martin Clancy 10:32
So but you're not offering in a sense which is where the where they get like the crux of this comes down to is there's still humans who are, you're still working within the traditional copyright human creative copyright.

Tom FitzGerald 10:49
So we're not we are not like amper or any of those guys who are actually making the music. Yeah, theoretically, right. All of our stems are people made, right. And in the future. People will, people will either give us their content for free or pay to have their content on our platform. Because in the in the future, we won't be necessarily curators, there will be a curated aspect to our business where we are a music publishing company. But ultimately, we're not a music publishing company. Ultimately, we're a technology platform. And we are we're effectively a marketplace where people can bring their content expose it. And the laws of supply and demand will work. If it's good content, people will use it with bad content they want,

Martin Clancy 11:39
Which is the basis of the music industry as such already but the rewards that are actually based in there. They seem to be hardwired into what you're doing, which is that
has on a rate of growth. And so the idea will be that human copyrights are still being created.

Tom FitzGerald 12:00
Yes, well they are in the sense that they we will have bought a work for hire piece of human created content on its own, it's a nothing. It only really works when it comes together with other ones. Absolutely. So but the commercial model is, you know, humans provide content to us. The technology, AI music machine learning, produces the track. And the track is then exposed to the marketplace, either through our commercial contracts or what are online like just yeah, just go in and make it yourself and buy it. That's, that's the end of it as an individual user.

Martin Clancy 12:37
Well, that's a very different model than for instance, are you familiar with what occurred Spotify with the mystery artists? Yeah, but yeah, but I mean, well, no, actually not that point. No this is this is one where I became quite curious about this was about 18 months ago. You're familiar with the transition from say Artists and genre selection to playlist, right? So let me contextualize this as an argument as a thought experiment. And then again, so it's clear that this this huge transition is occurring in terms of music taste. push into that the idea that you've got 75% of American consumers, which is still the vast majority of say, Spotify membership, curating their music through smart speakers. A lot of the music is now being selected based on lifestyle things. So yeah, I mean, yeah, right after that. Yeah. Right. and, more and more nuanced. So there was around 100 writers, hundred artists who were very popular appearing on ambient piano music playlists, clocking up millions of plays, right? Somebody decided to check. Magnus Magnus, social media elsewhere found out that the corresponding which would be normal corresponding same profile and social media, YouTube, Twitter, whatever really wasn't them and asked Who were these writers?
The names were suddenly removed. Writers disappeared. Everybody never really an answer for what it was. I'm not curious personally about what that was, but it did strike me that you can see where the rights the temptation to have Tesco home beans versus how Heinz beans? Absolutely. an pump it through

Tom FitzGerald 14:41
[Off the record information given]

Martin Clancy 15:03

And it's as old as the person. Yeah.

Tom FitzGerald 15:04
It Illegal but yet but they do.

Martin Clancy 15:07
And also this is this is where it gets into the ethical part yes is that whatever about what people decide to consume? Allowing them to know that what they're listening to is like if you go into a supermarket and make a choice between Heinz beans and Tesco beans so keep it very, very simple. But you know what we make it as a consumers choice as opposed to Yeah,

Tom FitzGerald 15:35
Yeah, having two baked beans things I'm pretty much look the same.

Martin Clancy 15:38
But actually what is and what isn't? Yeah, and it's the same thing as if you're buying insurance and someone's getting the commission. Yeah. Is that ethical side? Do you have any thoughts on that? Well we do

Tom FitzGerald 15:48
In the sense that in that scenario, even if it was that it was white labelling musician, you're putting it together. We're getting paid at the far side for us. no issue with that. Yeah. But, clearly it's not right. That it's been, you know, you've effectively created use the term loosely but illegal business practice there just can't be having. Right, it goes back to this point for me a little bit about the evolution. And as things change it be and evolve to where they are now the direction how the old models are, were reasonably well regulated and the kind of the rules it's kind of gone a little bit like this, but has kind of settled to where everybody's going to go. And you know, it's okay. There's the odd thing in there, but you know, broadly speaking, okay. But the difficulty with change and evolution is that you then get to this place where it's very choppy waters again, right, and the new norm, or the acceptable norm has not been achieved here yet. And therefore, you're going to have all sorts of people doing whatever it is they can because it's a little bit like the Wild West, right? It's just going on, right. And, uh, you know, everybody survives. They do they do some ethically correct and some not so ethically correct, but ultimately, in time as the market matures, it will weed out those things. But to your earlier point, if you're not standing on the right side of the line, yeah, you are not for the long term, you just can't be right. And you Okay, you know, typically make a bit of money for a while, but you won't you won't commercially be successful in the long run because transparency will expose you in due course and better that's natural transparency by word of mouth, or whether it's regulated transparency, it will come and but you know, it could be 10 years. It doesn't happen overnight.

Martin Clancy 17:44
[Off the record chat]

Tom FitzGerald 19:00
What you find is that the law is not appropriate anymore yeah, I mean that's not the there's always laws but the world changes and they need new laws instead you know, we never needed road traffic laws when we have no cars it has to evolve with it but it's always tracking behind always just saying something like Amtrak who actually have technically an only technically created songs because I think there's a lot of human intervention going on the background there as well they were branded as well look at the machine built even know didn't but just say that the machine had made it and just say that the quality was there and it was really good. Okay. Now they're in a sweet spot because they've actually done something now how they commercially do it. So it'll still be the traditional model, but the point being People won't accept. people won't accept what actually goes on there only on one for one reason, the outputs crap. If the output was really good people might people will move to use won't be, you know, ethically they shouldn't or you know, if there's something on you know, there's they're saying they're doing something that they shouldn't they're insane. They're doing what they do. You know, even though that's ethically wrong, it doesn't I'm going back to what you're all about here is will a consumer use or not use that product. Because they know whether it was produced ethically or not ethically, their first measure is what is assembled. Absolutely. And so ethical, ethical allegiance comes later. It's not the Prime Directive for engaging in not increasingly but it is but we're the vast majority people that well if it sounds good well its fine and you know no one's died, you know, here we go, you know, but. and for us, unfortunately, we hold ourselves to a higher standard there. And we built a model that doesn't allow it to happen. Right. And so, our premise at all points in the journey is the music, the money must go back to the guy who made the music, who's a human. It's a it is fundamentally the issue. And as we evolved from being or we're more in control of the music because we're

curating and hosting events, our own content, we can absolutely guarantee that right. When we become a platform where you load up your music, and you sell it to whoever you sell it to, it becomes harder then because, you know, that will be a challenge. I don't know how much we have to worry about that but. But ultimately, if you're putting the content up there, you're using XHail to produce outputs on your selling that to something or whatever you're doing at some point we will have to worry about, is it an okay use of our platform? So it's the kind of thing that Facebook have. Yeah. Right. With privacy? And is it okay to sell people data to some other people you don't know. And people have now jumped on that bandwagon a bit and now you can't give anything to anybody, at any point at a time, right. And so it's always that way of kind of knee jerk reactions to too severe but, but the point is the same, that you could get to a place where we become less in control of everything. And we will at that point need to worry about, well, what are our rules for using our platform? And we

Martin Clancy 22:41
But further to your point, that's not something you have to impose because that's something that has to come from the bottom up. Yeah, but becomes a societal where

Tom FitzGerald 22:52
Well, yeah, I probably disagree with you a bit on them because I would hold ourselves to not the lowest Common denominator factor, I don't think that's the right way to do things, I think you have to do them right from the start, agree and be transparent in the way you do things from the start in order to do it properly. You can get away with it for a while, no doubt, but you will have to unwind it fix it all the issues that will come with that later if you're going to try and make cause I count that as like fast book, yep, stuff, you know, you just, we're trying to we're trying to build a sustainable, long term change in the music, the way music is made. And you can only do that if the foundation for that is correct. And solid and if you're, if you're a quick book merchant, that's fine. You're here for a couple of years and you're gone and you've made a few quid. That's great. I think that's not our purpose

Martin Clancy 23:42
So what I meant that was that once there's a consumer recognition of the value of that it's not something that you have to police and endorse because it's a valley, that you know, it's not understood it's it will be become a requirement in the Yeah, he as people look at the labels and go, Well, what is this? And what does that mean?

Tom FitzGerald 24:03
But I would be very and I think, I think Mick too will be, in fact, Mick more than me in some ways. would want to set the bar. Yeah, and would want to for we would we would look to push the industry in a direct in that direction because I think it's a big statement to make, but like, you know, when this when we get when we really start to move, right, it will we will be, you know, well out in front will be quite so influential in in how things happen. Again, platforming wise, but I absolutely

Martin Clancy 24:41
And the music sector I don't think there's anybody who's asking to set up the way that you are to deal with the things that are going to come from other sectors. Absolutely. Absolutely.

Tom FitzGerald 24:50
And I mean, I'm, you know, at the end of the day, if this is about making sure that musicians and composers Yeah, share in the benefit and have a future because that what music's about right? You know, it's been it's no better evidence than giving a sat in a room who was really kind of, you know, really want to do this. But went to the breakfast event in Malibu myself and Mick was and the room was full of composers and musicians. And Mick was pitching and XHail, right. And the reaction in the room at the start was Savage. It was like you're here to kill us, you're going to ruin our future blah, blah, you're taking the money off, you're taking the food off my table. That was the message at the start. And by the end, they're all going oh yeah this is fantastic this could be brilliant for me be a queue of people to provide content. Right? So if that tells you whether the very people you're trying to protect get it, then it's got to be good. and it's about how we harness that and that's the ethical point. Yeah, and it's not so our technology does not conflict with the, the underlying ethical point about we're not trying to replace music where most AI companies are trying to replace musicians and composers. We're actually trying to facilitate them in in a way that allows them to participate, going forward,

Martin Clancy 26:23
Entirely entirely,

Tom FitzGerald 26:25
And that's it. That's kind of the differences.

Martin Clancy 26:26
That's a great place for us to close on the stop there

Part Two: Mick Kiely Xhail CEO interview - 11am August 1st, 2019.

Mick Kiely Audio file Part 1

Mick Kiely Audio file Part 2

Transcript

Martin Clancy 0:00
did the same with Tom. So it's fine. It looks like we're good. Do you want to do it here or?

Mixture 0:06
Here? Yeah, sure. Which one do you prefer?

Mick Kiely 0:12
That's up here.

Mixture 0:14
Yeah, it's handy for me to read as well. Yeah, I just did that.

Martin Clancy 0:20
Okay. So first of all this

Martin Clancy interviewing,

XHail, CO, for PhD use, I will anything that I use, I will send to Mick in advance, and he will have consent over that. I will also send a written transcript and a verbal recording of that. And that's my compliance with the ethics side of this. And I'll also need you to sign something like an NDA at that point should be subject to what it is. Okay. So this is check gives a quick idea of what time are we I want to be careful of

Mick Kiely 1:08
your time?

10 Two, three. Okay.

Martin Clancy 1:14
So can you give us a quick how did you? Where did Where did XHail? What? What was the inspiration? What? When do you Where do you? Where did you where now, in retrospect you've identified was the seed of XHail?

Mick Kiely 1:27
And that's a great question. And that's something I've been trying to figure out for quite a while. And I keep coming up with slightly different answers every arrive at a certain point in time, I guess that's the that's the key. And the point in time of when this actually first came about and started was around 2012, when the idea came 2011 2012 when in truth, I probably be preparing for XHail unknowingly for over 30 years that's how long I've been in music. So all those little pieces just starting to fall into place. About six or seven years ago, I (UNKNOWN) a patent lawyer in this morning, and he tells me it's seven years. So seven years. So the first part of it came from I was recording a score, I was scoring a video game and recording all the parts separately. They were all live orchestra parts. And then you know, lots of guitar parts and synth parts and everything. So everyone was that for that was for video game called body count. And so all those assets are known as in the video game world are all audio assets. So there, there were literally, there were literally short music passages that that basically became tracks. And I came up with a system to fix a problem within the game where they wanted quite a lot of music in the game, they didn't want shorter loops, they want too many cues, there was only a certain amount of memory available because the game had the ship on disk. And a lot of that memory was given away to the was given away to computer graphics for the gameplay. And also the audio part of the of the budget, the memory budget, if you like was already a lot of that was already allocated for dialogue and the sound effects and all that. So didn't have an awful lot to work with. But I came up with a system where I created a number of templates. And I created interactive content around those templates, which allowed the game to play out with different iterations of soundtracks depending on what the game players were doing. And it was worked really well and was very effective. So I then started to take that thinking further into, out of gameplay, if you like, and into the world of music production and how it might be accessed and used in a different way to did it solve all the problems, then some other stuff started to come into play. And that goes back to my time as a musician. I been in bands all my life 25 plus years, 30 years. And

I started off in original bands. And then I moved into cover bonds where the money was

in, in my last band before XHail, was a band called 20th century gold. And it was my band in the sense that was I ran the band and I booked the musicians and the gigs and all that. But often I would have a situation where I could have two, two musicians on a gig that because for some reason there's my main guys couldn't make the gig or whatever, for whatever reason. And inevitably, I had a black book of people I could call who knew the set, but sometimes it would happen that you know, Murphy's Law, those guys would be out, I would have a situation where I had to bring in new musicians that hadn't played with before. And while they might know a lot of the songs, they inevitably wouldn't know them all. But given that they were all playing two chord charts, no matter what they played, would work with the song. And I remember being on stage several times and going this sounds nothing like the original song. But it works with the with the vocal melody and all that. So if I actually start singing, we have a brand new piece of music being created in real time by real musicians on the stage. And the only thing they have in common is the mapping to get them through the song, the chord map, the drummer, let's keep in tempo, they have no data, no other information. And that was extraordinary to me, because that meant that in the Jam sense of the word, there was a new piece of music being created by five guys who never played together, don't know each other really. And yet, this music was absolutely perfect. And that was happening in real time. That was that was a that was a lightbulb moment for me that the fact that that was happening. And I took that process. And that is the process on which XHail now works

Martin Clancy 6:12
and you apply that to your experiences from the gaming.

Mick Kiely 6:15
Correct. So depending on the situation of that determines the music that needed to be created in the moment in real time, whether it was emotionally driven, which it often is, or whether it was a requirement for it to

be a certain genre of music for a situation we were able to create rule sets around computer programming that would simply do what the musicians on stage are doing on those occasions. So we ended up we ended up now on a platform that that works on the basis that 10s upon thousands unlimited amount of musicians around the world can create content, their own strength to whatever it is that they're that they're strong at. And given very little directive by way of simple formulas. And those formulas would be maps, chord maps, and tempo in the same way that in bands we find our way through songs. So we give we did it, we did a big study. And we found that there were formulas and trends and different styles of music, and different styles of film score, pop songs, trailer music, and there are formulas that could be formed that would navigate harmonically any, through those and tell those stories in how they needed to be told in musical terms. So now we have a situation where literally hundreds upon thousands, as I said, unlimited amounts of musicians around the world can produce content that there and play to their strengths that they're good at. And then our system Xhail is programmed to do exactly what it is that we were doing that night on stage, where they can, it can select from different musicians, and pull their performances together to create new music in real time. That's that fits a specific requirement or purpose and get it 100% on target in the moment. And that works.

Martin Clancy 8:18
So when you when you got the idea when the idea appeared, between those two, kind of fusion, those two things, I can see why that would occur to you had a light bulb moment,
it strikes me that Xhail hasn't really changed. It's obviously expanded, expressed itself. But it's pretty much that is what you've used, the idea must be very similar now to do as it was at that point.

Mick Kiely 8:44
It is it's and it's critical for us, we believe in our history. We're about artistry, we're about musicianship and we don't mess with the artistry, we don't stretch it, we don't retune it, we don't break it up, we don't rearrange melody, we don't do any of that, we simply bring musicians together to create new music in real time in the form of musical arrangements for which whatever purpose the user is, needs music or requires music and it does it in real time. So in terms of music, Ai, we are creating automatically creating music in real time, at the highest quality because we because it's high quality performances by really good musicians who know how to how to record that the music sounds real because it is real. And we don't we don't we don't disrupt the artistry as we receive it. We just put it into a heavily meditate data bank. And then our program we teach the XHail technology. We teach it what a rock and sample as an example is. So we want to create a rock track, how does XHail know to create a rock track what it knows that most rock bands have a have a rhythm section driven by drums and bass, at least one rhythm guitar, a lead guitar and probably some keys as well, whether they be Hammond organ, piano or otherwise, maybe some synth stuff. So it knows the ensemble of instrumentation to bring together and also knows what a typical chord progression for a rock song is. And it's able to find them through the through the mapping that we have pre-determined. And there was only there's only so deep I can go with this and can be comfortable with Yeah, no, it's too much secret sauce here

Martin Clancy 10:41
If there anything, by the way, this is that that's a very important thing, that same thing happen. If there's anything where it falls into that area, that's why you get it and you go, we'll pull that out.

Mick Kiely 10:51
Yeah, I just don't want it. I don't want it proprietary.

Martin Clancy 10:54
And it's my interest in this is nothing is not the programming. So that's the key part. So it's like one of the it might be for other people, but it's not the sure It's the experience. But I mean sociologically, not about technically how it's how it's achieved, right. But I think this one, I had a couple of other questions, but seeing as we've got to the XHail part in just in terms of stems, without getting into any proprietary stuff, can you give us an indication of the volume of what's involved? Or is that?

Mick Kiely 11:28
Yeah, so if you think about the lottery and the lotto numbers and the exponential potential of, of the six numbers in the lotto, I mean we've devised a system where XHail can produce new copyright music that's that each time it's new, and I can assure that it's new, because what it will not do is it won't, won't put the same stems together again, and another iteration. So in other words, if it creates a to explain the simply if it creates a track that has seven stem performances in it, if we imagine taking it kind of yellow spray paint

and spraying all those stems yellow those stems will return to the cloud collective, but they will never meet another yellow stem in their lifetime again, because they've already been in the yellow band of the yellow song. So they won't be they won't. They won't meet each other again, understood, but they'll meet all the creditors. Yeah. And that's how that depending on what the numbers start to become really interesting. If you take if you take, if you take, say 50,000 let's say you take 1000 stems that comply to a certain key untameable, you know that work together harmonically. Let's say there's 1000 of those then the output. If there's an average track, the average track has about five stems between five and seven stems, the output from 1000 stems becomes an output of unique combinations to the sum of about 50,000. Okay, now gets interesting if you add only 500 more stems in so we've gone from 1000 stems to 1500. And now the output becomes something like 1.2 million. Now, if we added another 500 stems in there, then we're just, it's just crazy.

Martin Clancy 13:20
And that's just based on the law of exponential gratification.

Mick Kiely 13:23
Now we have to be honest with ourselves and say, well, you're never going to create a track with five bass guitars or with five drum kits all playing together. So we got to take those into consideration. But even when we do, it's still if you get to, you know, if you get to a pool of stems, which will be we could get to very quickly, if we get to a pool of stems of 10,000 stems that are that are harmonically related to each other. You're into hundreds of millions of tracks.

Martin Clancy 13:54
So that that just reinforces the idea that it's exponential and if you have so we're talking about ideally that you're looking at hundreds of thousands of stems. Yeah, as a potential database. Sure. Okay. Just yeah, just anecdotally puts a say, Yeah,

Mick Kiely 14:11
okay. Yeah. And we probably won't ever stop taking content in that sense. Because there's reasons to keep the stems updated. Because, because styles change. Yeah, you know, sounds change, everyone needs to sound fresh. And we might cull certain amount of stems that have been used several times so the musicians have been well have been well paid for those so we'll just take them out and just refresh them with new stuff so there's a life cycle for a stem prove the system over a period of time over a number of uses, and stuff like that

Martin Clancy 14:45
In my interview with Tom, he mentioned that he, I think it was probably got this wrong. I might be wrong if I quoted the thesis. But there was a meeting that you attended in Santa Monica, where you met a music community, who initially were quite resistant to the idea of XHail until you actually spoke to them about what it was and what you were offering and at the end, various composers and musicians are going okay, now, this actually makes sense this surely a good thing? Yeah. I think that is, can you tell us a little bit about how the changing reactions you have experienced within the music community has been to technology and your offers?

Mick Kiely 15:27
Yeah, so I've been I've been invited to, you know, speak on number of panels that relate to the music industry. And that's been an honour to be asked to speak on those panels. And some of them might be at NAV. or not, NAV sorry, NAM the NAM SHOW. Yeah. So the NAM show, I've spoken with a couple of couple of years. And then I've spoken several times at the PMC, which is the production music conference, that's an annual conference for all the Production Music associations. And these, these events attract high numbers of musicians and composers. And in the interest of where things are moving in the future because there's a there's an awareness of music, AI, and, and there's a couple of companies out there that are bringing that technology to the forefront. And it is causing a lot of deep concern amongst the artists community and the music making community, understandably. And I have been invited on panels to discuss those, you know, that future, what it looks like, and our role in it and how we can affect it. And we're very passionate about keeping musicianship and artistry on that journey, as it inevitably will change. So if I wasn't sitting here talking to you today, and decided just to get out of this all together, that change is happening anyway. So but what we can do was try and influence that they've had to not have such a devastating effect as it potentially could on our creative community. So what, when, when those musicians and composers turn up to those discussion panel and events, they all sit there looking at looking at the stage, which I'm sitting on at the start of those talks, and they, they look very upset and sceptical? and you know, they don't look at me, with friendly expressions at all. But by the time the interviews, the discussion is

over, and they really see what we're about as X-Hail on how, how we see that we can influence this change in a very positive way, then they completely, you know, it completely flips over to the other side and I get approached, always get approached by literally dozens and dozens of musicians and composers afterwards to thank me, congratulate me for getting involved in this space and flying the flag for them and do another way we're doing it. And inevitably, they all want to know how they can get involved and how they can contribute. And how can they get into this because they see it as the future and it's game changing to the industry, because they're all very aware that music AI is definitely is out there, it's raised its head on a number of occasions, and continues to do so. But music AI from other companies that I that I've ever seen have, they have they have no relationship with artistry or with musicians at all, it is completely, it is completely algorithmic and computer driven in every sense I think our timing has been critical in our, in our stepping into this space, we were the first to step into it. In we were there before, the most noted companies out there doing AI we were at we were ahead of them and we were not only were we ahead of them, but we were also we managed to file for patents around this space first patents have been granted others continue to come to that granting stage in all the territories globally. So we've got a very good footprint in this space. And we can control largely control one day, it's not for now because we're a startup taken on those battles, one day will be something that we can do. I'm not inclined to go after any companies that I think could be even infringing already. Because one they're a startup and the probably won't succeed. But if they did succeed, we would need more muscle to go after them in terms that we need to form those relationships with other industry, large giants wherever they may be. We've already been in discussion with major corporations happy this could say that Sony and one, Sony had a very deep interest in what's going on in the world of music AI and they've looked at everything on the planet and we've met with them, we've spoken to them. They really like what we're about what we're doing. They've said to us that we're light years ahead of anything that they've seen out there and ethically they get why what we're doing and why we're doing it. One thing that I noticed very early on in my journey and something that doesn't seem to have changed to really have changed, which again, is one of the reasons that I really did want to get into this space is that there is a ship sailing now in into the into the future. And there's no steering that ship so nobody really knows what direction to point it in. So why not why shouldn't it be Xhail that takes the Helm and takes them in this direction that brings artistry and musicianship on the journey. I think that's really important. I mean, why do you care? Because I am a musician, I am that I am a composer, I have a I have it's in my blood. It has been around my blood all my life. Music has been good to me. I want to give back.

Martin Clancy 21:16
Fair enough. But the other startups without getting naming any names right. And other CEOs and musicians. Yeah. So you've got investors that you have to be responsible to sure that you're running a business. Yes. So why do you care?

Mick Kiely 21:31
Well, our investors care about the reason we're doing it too they care about keeping artistry and musicianship alive as well, which is one of the reasons they would invest and also not those other companies. So our investors, although, you know, they, they want to return. They also, I mean, everybody wants to know that it's clean money, that work that's gone around. I mean, you know

Martin Clancy 21:57
Its only music what this what the hell does it matter if it's made by machines? So if we can, musicians can't make money.

Mick Kiely 22:04
That's interesting. You know, I remember Killian and who works here, and now. He's my son, he works down the hall there. And he's runs head of content. I remember. And that's one reason why I'm doing this. Not just because of Killian, but because of his kids, too. I don't want my grandkids coming into the room, carrying a guitar going 'granddad, what's this?' Because I already saw that would Killian with my son, he ran into that I remember when he was small, he run into the kitchen with a with a vinyl album. And didn't know it was., he said to my mother's grandmother. And he said, Look, this is a giant CD, or what is this, he didn't know, now technology is moving that fast. I saw something recently on Facebook, where there were kids and their father had a cassette tape. And he was trying to convince them that there was music on that tape, and they didn't believe them, they were trying headphones into it, they're going were just they couldn't figure it out. Now, that's happened in a very, very short space of time. If you look at some of the skills that are being lost, even in Ireland, like basket weaving are, I don't think there's any Thatcher's left in Ireland, I know there was one maybe 10 years ago, if he's still alive, maybe there's one or two Thatcher's in Ireland thatch, every thatched house that's still in Ireland across the country, they used to be hundreds, the you

know, at one point, so we do go through evolution, and just no avoiding it, evolution will always happen. But the arts have been around forever. And yeah, maybe we're going to maybe we're going to face into a world that someday, art will be gone or will have taken on unhuman forms. It's, you know, this the science of that are pretty compelling that that's, that's going to be in the future somewhere. But anything that keeps my grandkids and their kids playing music, and, and being artistic and more importantly, having an opportunity to actually live a life lived a life of what, what might be their passion, and consider myself lucky that especially in Ireland, that I was able to be what I wanted to be, I made a very early decision. That's what he wanted to be. And it was quite unconditional, I was going after it, I wanted to be a musician, I wanted to make my life from music, you know, I and they managed to do that I managed to put my kids through college I managed to, you know, I managed to have a life rare kids through being a musician, That, to me is, is an extraordinary achievement, something I'm very proud of, it's something I'd like, I'd like to pass that opportunity on to my kids, other kids other generations the feel this as passionately about music as I did. Now, if all of a sudden music becomes just one of those obscure obsessions or interests that really, the world has no need for anymore. Well, you know, that would be for me, as you know, for me, that would be a sad day. But it doesn't mean it's right or wrong. It's what I'm about. And I do believe that it's what a lot of musicians are still about as well on what they want in the world. And evidence shows that evidence just shows that people that attend the talks that that I've been involved in, and that make the comments that they make afterwards, when they understand more about it. You know, it's clear, that's not just me, that wants this for our enough, you know, music, the music business, the music industry has never been in better shape, it's better shape now than it's ever been. There's more music being created, legitimately being created in an artistic way, then ever before. So you put the meat that's so that's the music industry, but the music business is fault, the models come apart is that is that since the record industry went down the toilet with the advent of the Internet, it's been hard to know what to do and how to get it back on track. The music businesses been in the shit for decades now. And it's only starting to find its way out through streaming with think streaming as the future is the way forward, protecting, streaming, making, you know, holding accountability to streaming and making sure that that revenues from streaming is making its way back to where it needs to be going. And that's back to the music content creators. If we can be part of that infrastructure, we can set things up in a way that really, that really promote that. That's Mission accomplished.

Martin Clancy 26:57
Well, so that was brilliant. And had to ask you in a rhetorical level,

Mick Kiely 27:01
Why? Sure. But I thought that's, I think it

Martin Clancy 27:06
Really, it really encapsulated that perfectly. It's inspiring, let's unpack a little bit about how the XHail model currently works. For musicians, can we have a look at how that technically works, and totally technically programming wise, but just sure, so musicians, keep it nice and simple so we just take it up as I just need to kind of a general sense of how this works. So content is stems provided

Mick Kiely 27:36
Terms provided, which we pay, we pay a reasonable fee for, and then the rest of the money is generated on usage. Right on. So off the back end. So if you think of

Martin Clancy 27:50
Like a gig and the way you live, there's a minimum guarantee, and the back end, depending on your system

Mick Kiely 27:57
But what's interesting about the model that we've created and stuff as if you're a musician, let's not get musicians and composers mixed up here. And this is an important okay thinking, because composers that compose music for TV already say, or for production, well, if you don't like a quick,

Martin Clancy 28:10
We just walk away through, like the experience of, say, a composer within the XL model, and the music and now that we're different from a musician,

Mick Kiely 28:19
Yeah, so in the Excel model, there's no differentiation we've levelled to. And our model has been the first to do that. Because in in in the world outside XHail a composer creates a track that goes into a show, film or library, and the royalties get paid to the composer. Now if there's a musician involved in that tracker, like a guitar player, bass player drummer that gets hired for the for the recording of the track, they get paid fee,

and then they go away. And there's no nothing more after that. And this, so if you're a musician, you only ever make money when you're wearing your guitar on stage or in the studio. That passive income of writers royalties don't apply to you. In our model they do, because we consider every contributor whether you're a musician, or a compose, excuse me composer, and contributing stems, right. So everybody is an artist in our in our world. And everybody is equally important in music track and pro by XL, if there's five stems in there, each of those contributors are contributing the same amount of so the writers Chair of the royalty is divided evenly amongst the writers of the stems, we retain the publishing, when we can sometimes we go down the publishing away, because some of the networks insist on which In which case, we get a sync fee up front to make up for that. So we make our share through publishing and the writers make that a rule of the shared true retaining 100% of the rideshare. That's, that's the model and help, basically how

Martin Clancy 30:00
That works. And you've done an analysis back and I can see where the, if you put that together with the exponential side of the growth that's possible, that it makes sense in this.

Mick Kiely 30:10
Yeah, it's, and we, you know, I believe in a world where that is played a really important part of our musicianship in the future. So if you're a guitar player, and somebody creates a track and exhale for a film, and they just love your guitar part, and then they have another project coming up, and they go, Okay, I'm using Excel, and let's create music for this, as well. But I really liked that guitar style, you can type in the name of you can look for the name of the guitar part, guitars that created the stand in your last track. And then you can literally say, I want, you know, I want this guitar player to be involved in this track, you type them Amen, and it will search the system and the stood for their performances. And on we can, we can also promote musicianship we can create charting, yeah, you know, trending and stuff. So we can actually promote the artistry within, in the musician, community as well. So that's based on the scale. So that you start to attract, more successful you become, the more you know, the more you get used, the more successful you become, the more recognizable you become, to a point where you can be a long race, you're an artist, which you are anyway, which has become a popular artists that, then all the people start to look for.

Martin Clancy 31:41
It makes perfect sense. Yeah, this this is lots of Christmas and how that could occur, and actually question that we can drop from this, if you're not comfortable, okay, In the growth of XHail, there may be a certain point, It's quite natural that the founders exit the company for in the absence of the founders, and you're a strong, ethical, kind of guidance in this. Is there any way that the XL model could protect itself from gaming, meaning that certain types of stems which may be say, for instance, 100%, owned by the I'm thinking of the Spotify model that occurred with a music, people bought a trust into a system so that when certain standards have been selected, is there any way that the system can could offer transparency to the people who are using it, to make sure that there's always a fair system in terms of the way that the AI is selecting? Am I making sense? Let me give an example. I'll be Clara, with what came up with Spotify, when they, for instance, had ghost riders, creating their own playlist tracks, people were going okay, I'm gonna listen to me a piano. The music that was the question that was raised was whether or not the music was being fed to them was actually owned 100% by Spotify.

Okay, gotcha. The user is going Spotify is taking my data and choosing the songs that they want based on my listening tastes. So this trust between the user in the system the basis of the exhale system is based on that you put in certain keywords, the stems are being provided. Make sense? And what you have is an open system that's clear in in how the values that you have. But it struck me then, that if you weren't here of Tom, that that same issue that could have was it was brought on Spotify could occur within the exhale system?

Mick Kiely 33:57
Yeah, it's not, it's not my desire for XA with the BNCR. droids know for in the future for its life force. Right now, we're caught up in the music business, because we have to, this is an interesting one for musicians as well. I'm a musician, I get musicians, I love musicians, we, so many of us thinking certain way we don't trust, anything that we don't really know is going to work. So we knew this in the very beginning. So that's why I set sail for LA, and started to settle and acquire the user base there. Because if you get the big players in, they buy in, then every musician is going to buy in and the government is going to be an advocate of trust, it's much easier to establish success at the top and then filter it down. But if I was here, working with musicians, and going, this is going to be great, we're going to make it to the top. And you wouldn't get the commitment from musicians in that sense, because too much the musicians are, are largely cynical by nature. And uncertain, they need to know that they need to really fear that they're missing out on something that isn't the new model that's working. So that was the reason that went to LA really to get to make it happen there, it's easier than to grow the thing of the future. But to my point that I want to make,

the intention is not necessarily for us to be in the music business forever. We by default, find ourselves in the music business through the system works. But I believe in a world where we can develop the technology to be an open source platform that people use, and that new labels can pop up new industry can pop up new music related business, business modelling can pop up and use the use the platform to manage content to create music, business models that work in the same ways that record companies always did. And in that essence, you've got, you've got so many camps of music production going on, that if there is a bogus one over here that pretending to be something that musicians can extract from that and go over to where they know where the real results are happening. And the analytic Linux of what, when the musicians are making money and not making money will show that anyway. Because if we're in a world where exhale, everyone's use an exhale, and we've got hundreds or thousands of contributors, if all those music contributors are saying, I never I never made a penny from this, but everybody's using them for something wrong. Yeah. So

Martin Clancy 36:30
Nobody, right, you've actually put your you perfectly answered. Not only the question about exhale, but also how that would apply. It's going to be based on that word that you said trust that the users are gonna have to trust in the system. And that trust, as you said, with music musicians being naturally cynical and questioning, yeah, then the level is going to be very, very, very,

Mick Kiely 36:51
Yeah. Because I mean, true open forum. So music, yes. Say, I made I made hundreds of dollars this month, the next sale was gonna say, Well, I didn't make so much more than this kind of question enough. Well, how good is your code, Jupyter guitar or whatever. Now, at this point, we are really heavy on quality control here, we have to be honest, we're trying to change the thinking of a new industry. And if we're not ahead of the curve on quality, we're wasting our time. So we got to be really hard on that now. But moving down the road becomes art is you know, in the interpretation of artists open. So when exhale becomes a platform for everybody to contribute to and anybody to use from, well, then oldest will control the quality you'll get, you know, you'll get a new label opening up and signing guitar players. But you know, it makes sense, it's under control, the quality is not our problem. Exactly. And we're not looking to dip, we're not looking to dip our hand in that till in any shape or form, we just literally, it's a SAS, they just pays to pay to use the platform that everybody's using. So it just becomes a platform, it becomes a way to do know, it makes sense. And the great part that you've identified there because it's a big question. One, we might return to again in another context, because it's a really big thing is that self-regulating, because it's based on trust. And that's just it's really simple. But it's really powerful. So

Martin Clancy 38:12
that you've really hit something on that that one and how it over time, I've got a couple of key areas, I want to ask you. And I'm going to back up a little bit about XHail itself, because I'm planning to show the software in, it's actually really demis. Because I've done that with other AI to look at that too much just to kind of go, this is why this is the quality will stand up for itself, because you'll be able to hear how good it is. Now speed is or anything else. It's it does it itself. So couple of other questions that are around and I'm curious about, AI? Right. What does AI mean to you? When you hear that term? And has it changed?

Mick Kiely 39:01
Yeah, I think, you know, if I'm honest, I think a lot smoke and mirrors, I think there's so much that claims to be AI there just isn't AI. It's very hard to be a you know, in musical terms, especially for something truly be AI it's it, you know, we're not there. We're a very way long anyway. Long, very long way off from any of that. There are you know, there are moves towards that, you know, the artificial intelligence. And I think it's interesting, I think, I think I think that the whole tag might be something that gets dropped moving into the future and become something else. Yeah, because I think it's cool to be considered AI. Because that's where, because it's a buzzword, that's where the investors are going. So, you know, there's value in being perceived as AI if you're not, I mean, what is AI who is really AI probably nobody, and put the perception of AI is where the investment is going. So, so there are there are, you know, there are those that really ride that pony.

Martin Clancy 40:18
But in one of your promotional videos, I noticed you are quite clear. And you said, we do not use AI. And then in your frequently asked questions. I just have a little screenshot of it there is a, Does XHail use AI to create music. And it's no with an exclamation mark. Yeah, Is that because of that?

Mick Kiely 40:48
The difference I'm trying to make is that the music that he that actually outputs is real music made by real musicians and real composers. And it will always be that fundamentally important to us. We're about real

art, about real music. XHail does not output artificially. Intelligent intelligently created music, the music you hear is real music by real people. The AI component is the is the component where it's music that's being generated automatically in real time. And the component of AI is can our system learn, you know, can it benefit from machine learning, based on what a user is doing? to give something to better serve the next user? The answer to that is yes, that's the direction of the AI component in what we're doing. So in other words, how can let me give you maybe an example. If somebody was looking for chicken music, because they made a video of chicken and they put into XHail, I want chicken music? an XHail doesn't know what chicken music is, so can't produce music. But then they go, well, it's kind of like, you know, bluegrass like banjo music. So then they put in banjo music to XHail. Now XHail knows what banjo music is bluegrass banjo. And also there is so produces a track. And then it might pop a question and go, is this what you meant by chicken music? user goes, yes. Then it goes away. And it calls all the manual stems and it says, guess what, guys? You're not just a banjo. You're a chicken as well. So they go oh, are we so they tied themselves were chicken. So now the next time somebody else comes along and says I need chicken music, exhale knows what chicken music is So it's that kind of machine learning, and that's just an example. straight. Good, right? It's that kind of machine learning that makes the process more fluent for the user.

Martin Clancy 42:48
And interestingly, as machine learning, it's also a way if you think about it, it's pretty much the way that human musicians over the years have developed genres by responding with and our Alright, so we're a punk band now army. I'm a pop rock. Okay, well, this is good rock. So yeah, that, but I like that good. It's again, that falls back to very kind of fundamental traditions, in all forms of me there is deep rooted as anything. Yeah. So that's not AI being imposed. On top of redirecting things, that's going back to the main line of the real

Mick Kiely 43:22
Yeah, and or if user were to create a rock track with XM, and have a transition into a hip hop track halfway through, well, XHail will know that it has just transitioned the rock track into a hip hop track. And it can suggest that this piece of music is, is hip rock or whatever, it will know it will learn from the experiences into the future, too, so that the system becomes one sec, I'm just

Martin Clancy 43:50
still recording.

Mick Kiely 43:53
It will, it will, it will create, you know, to be learning mechanisms that we can implement that are beneficial for us and for the users of the system. So that the, the lighten the workload of the guys here and the guys here are XHail can actually start to take on some of that workload itself, and do tasks and jobs and learn from the usage. Exactly. That's true AI, what I mean here is I don't want the perception of what's coming out of XHail to be computer generated music, because it isn't understood it is real music by real musicians.

Martin Clancy 44:32
And do you find that stand there and you is a source of frustration to you, I'm just imagining that, like, we're both musicians, we both know the area to like, so a little bit of a degree. But when you're speaking to the market to investors, to people who don't know the area, it must be very frustrating when other companies are promising the world and his wife AI is capable of. And there's clearly humans involved, whether that's in the playing of a piece that was generated by media, the augmentation of a score that's output of that you kind of go Okay, well, let's change this. And yet it's presented in a very different way. Is it hard to be to deal with that muddiness that exists in the in the market at the moment?

Mick Kiely 45:31
It's less difficult for us now, because we started because we started to, you know, we started to penetrate the industry with trust. So we have, we've got trusted users that are using our system, in in, in environments that where exposure is critical, if they're exposed legally, if they're exposed in any certain ways. And they have to really feel safe. And they do feel safe using our system because they understand how it works. They understand structuring and everything else

Martin Clancy 46:07
So the market becoming educated, exact, is a key part.

Mick Kiely 46:11
Exactly. And so I guess my point is even take any of the AI companies out there just go and look at the traction that they're getting in terms of what are they what are the credits start getting? What are they done

in the industry? Yeah, what shows are using them on where what film companies production companies are using them? And where the answers.

Martin Clancy 46:34
So without this is, this is slightly leading, there's a reason for this slightly leading question. But it's it seems to me to be a natural follow on from what you're saying, would it? Would you agree then that one of the ways of creating an equitable system for musicians, composers, everybody to earn money is going to be through the market becoming educated in exactly all of these issues? That is that strikes me that that's just if people understand better, what's going on?

Mick Kiely 47:06
Yes, so then they feel safer, because they are, because we're actually not changing the models that they're used to, we're changing that we're changing the process or which they acquired music, but we're not changing. We're not changing the model in terms of what they used to, they still understand that there, they still understand the copyright aspect of a track the publishing aspect of a track what they're paying for, what kind of a license there they're getting, that coverage of that license is what the what the, you know, has it all territories, that was the duration, the stuff that they're already used to, we're not disrupting, that we're playing into their comfort zone there. Yeah, at the end of the day, what they're getting is they're getting a remarkable and music solution in a way that they weren't able to get before and it doesn't come with, it doesn't come with any surprises It comes with. It comes with exactly, and music models and business models that they've already been.

Martin Clancy 48:12
So all the stakeholders involved, base is in everybody's benefit, clearly, so it's just a question of making sure that the more everybody's aware of that everybody suddenly realizes, actually, this is actually in everybody's interest across the board. Absolutely, Right. Okay, that makes sense.

Mick Kiely 48:28
And they're not taking any new risks, because we're not changing. We're not fundamentally changing or asking for asks that make them uncomfortable about that weren't, they weren't. They weren't just say to, you know,

Mixture 48:42
They weren't already. And you're referring specifically to the kind of copyright issues that

Mick Kiely 48:46
Yeah the licensing of music on to, you know, the copyright ownership, and as you mentioned, the guarantee of Bonafidity of the of the tracks and hopes that you know, that there's no copyright infringement, or from the tracks that are generators as well, that's really important. And we're probably the only ones that can really, you know, speak to that. Because older, older music AI just cannot give that assurance.

Martin Clancy 49:12
It makes perfect sense. I know we've spoken about that separately, nothing really relates to links that the reader, the three readers of this thesis will notice, because they'll understand that if differentiation is in copyright and see exactly why that that works. Two final questions for you the quite separate. First one is it's been I've seen a number of people remark that startups are like the new rock and roll, or the being in the startup is like the experience of being in a band you've been spending a lot of time playing in bands as being a founding member of a band. Is there any connection in terms of that in the spirit of the endeavour?

Mick Kiely 49:57
Yeah, I guess there is. I mean, I've got the, you know, clear advantage that, you know, this startup is very music heavy, it's very, you know, it's entirely dependent on music and passion of music. So, it doesn't feel like I've left the industry, although I have the sense that, okay, I may not be in a band, but I'm just in a bloody Big Band right now. Because it's all it's all, you know, so it's all music, and there's just tons, tons of it. And the output of what the system to do is just, you know, unlimited jam sessions, really, so

Martin Clancy 50:33
Yeah, but as the experienced actual working experiences as similar being a band, like,

Mixture 50:37

Yeah, the excitement is definitely there. It's, it's, well, it's type of thing, or us against the world. Impossible odds.

Mick Kiely 50:45
Yeah. You know, when I moved to LA, I thought I gone crazy. I was 50, when I, when I decided to take on the whole industry. And I remember flying into LA, and it was in the flight was coming in the evening, and it was night-time on the just sheer size of it. I thought, am I mad, because I did not know one person flew into LA, to a place that we still live in that Debbie was working here. And she's terrific. She found, you know, she found an apartment that just went up for rent, and jumped on it. And I was in West Hollywood, right in the heart of everything. I flew in into LA got up the next day. And I walked up the street, to familiarize myself got a coffee looked around and say, Well, what do I do? And the sheer size of the industry on everybody out there? All there? For the same reasons I thought on my absolutely about I've lost my mind here, I absolutely lost my mind. And yet, you know, two, three years down the road, you know, have a conversations with people I never thought they'd get in the room. But, you know, I'm thinking how do I get the meetings? I mean, these people don't take meetings, they just don't. Yeah, you know, I'm finding myself in the room with the top guys. And companies that you don't get meetings with. And they're the ones calling meetings, and it's like, how did that happen? So it's, it's, it's, it is a lot of similarities between that and being in a rock band, or, you know, this there's a, you know, similarities in the rush, and the, you know, you do that really great gig and the buzz after it. You know, you go to a meeting with some of these key players in the industry, you know, who you're in the room, but are there their stars in their own right? producers? What have you, you come out of the meeting, and they're pumped up and excited about what we're doing? And you feel that same exhilaration? It's like, yeah, it's pretty cool.

Martin Clancy 52:47
Businesses, you businesses unusual, unusual, like that. Got another one for you. China? Yes. China is how important? Do you think it is for anybody working in this sector, to be aware of China, and if that's the case, because you mentioned before that you thought that?

Mick Kiely 53:15
And so China is, is, is an important focus for us, and this, they've got the they've got the infrastructure out there for the, for the industry to could surpass Hollywood, so they can make, they've got the, they've got the talent there now, where they've certainly been building the farm, they've got the technology, they've got the studios, they've got some massive movie. emergence coming from China, there's, there's a lot more focus in China now on the arts, side, in, in, in the you're in the, you know, in a European our US sense of the word and, you know, it's not as it's not as closed, as I guess it used to be in terms of culturally, there, the world has become culturally a very expansive place, there are no, there are fewer borders, in, in, in, in entertainment than there ever was before. I mean, there were cultural borders were always there. And they just all, all but dissolved. And China is accounts for billion people, quarter of the world's population. And there is a, there's a lot of investment into this sector in China. And really, there should be an awareness of that. Because with that will come a surge of opportunity in China. And if you're aware of that, you can certainly benefit from it by being aware of it, but it's there, it's coming, there's gonna be a lot of it, it's going to be a lot of opportunities for the arts coming from China, because there's massive Investment gone into it.

Martin Clancy 55:12
And but it's a very different market. Have you come Have you any thoughts on that? Is it like in terms of its the way that it's structured? I don't mean politically, now. There's nothing in this that I'm not leading to any to do anything to do with politics, just in terms of the economic models.

Mick Kiely 55:34
Yeah, I think. I don't know this,

Mixture 55:38
I don't know, we say can you? Can you apply

Martin Clancy 55:41
Models that you might use in America directly into China. Or do you have to rethink them?

Mick Kiely 55:47
We think we can use a lot of the same modeling, but our interest in China is, is definitely going to be more of the consumer side prosumer consumer side, we're developing new technologies that speak to that world.

So we're just so excited XHail, we've got XHail R, which is on the on the cutting table. Now in development right now, it's very exciting what the capabilities of that are. And it really does bring music, making songwriting into the home for, for, for any emerging talent that will take on the modeling of its own kind, really. And I think that modeling is very easy to, to maintain on a global basis. Yeah, we don't have to change it moving around different territories.

Mixture 56:30
So I think technology technologies is like make sense.

Martin Clancy 56:34
Yeah. Especially for your technology may appear, you can see how that's legal. Use one word there, that you're the only person I've heard use that word. But it's a section in the thesis where your interview is going to be. So I have to ask you about it. Use the word prosumer.

Mick Kiely 56:53
Prosumer. Yeah. So professionals in the industry of those, let's say, a professional as somebody who, who uses technologies to make music like logic, or like, you know, I work with logic, I get it paying gig to compose as a composer for a video game, or for a TV series or what my professional, right. Consumers are basically, anybody that can go to, to a product, or Garage band, Garage Band and use it and yeah, and then there's the prosumers and the prosumers are like The, the enthusiasts, the hobbyists, so, where I might be, you know, where my business where I might be an accountant by day, I'm a musician at night, and I play in bands. And I also like to, I also like to write some songs at home and I record, you know, albums, maybe an album, The songs with a bunch of friends, and we try and sell the album on we have a, we have an unprofessional interest and our skill set, and they'd be more prosumer. So a lot of prosumers will use logic, for example, but lots of professionals will also use logic. But no consumers will use logic, they'd be more Garage band, because it's only a device. Yeah. You would invest in logic as a not as because you would be either one or two things are professional or more pro than consumer. So that's prosumer, very good.

Martin Clancy 58:36
Well, that's taken up a huge amount of time. I could cover hours about this, but it's brilliant and I've got all the key points, that's fantastic.

Mick Kiely 58:48
Well, if you think of any questions,

Martin Clancy 58:50
Absolutely, it will in a certain with the or maybe something that we spoke about an I'll go It was is a question for that's

Mixture 58:56
Thank you so much. You're welcome, Some of what you need, that's really good.

Last Question Revisited. Mick Kiely requested a second opportunity to answer one of the earlier questions.

Mick Kiely 0:02
Why do I think it's important to, to do something like this? Why does it matter? What so what if it's a AI whether it's, you know, real music? What does it really matter? why does it really matter? One of the most important things for kids I feel, growing up is to have aspirations towards (artists). kids naturally aspire to be like certain pop stars, they admire, or artists they admire. they want to be like them , so they dress like them, or they buy their albums, or they take on the persona of the artist, or the artists, attitude or opinions. it that helps them form their own identity, which is absolutely necessary for every single one of us to succeed in life, to achieve goals. Unless we find our own identity. And that we separate our identity away from a parenting thing, where your parents rare us to be a certain way. and we think "no'. and I got kids and I did the same. Try to rare the kids in ways and give them stuff that maybe that I didn't have, and all that stuff, we all rare our kids in a certain way. And we do it all for the same reason. And that's inherent in our DNA. It's something that we do, it's nature's way of offering protection. fundamentally, the aspect that makes me the person I am today, is not what my parents gave me. Yes, they gave me stuff that was important. But I am the person I am today, because of those I aspired to be like. And I aspired to be like musicians. I was a big Bowie fan, I was big, you know, I've really looked up too actors, artists, songwriters, singers, that took on the challenges in a world unfair to the underprivileged. And that gave me a sense, that

it felt righteous, that felt right. it's really important in the development of every human being that they have people that they aspire to. And Music has always been the mainstream go to place because there is an emotional context to the songs that you would follow an artist for. And then you aspire to that artist beliefs. And hopefully, the messaging is always a positive one, which always seems to be around the arts. So it's always it's healthy stuff. And it's such a necessary part of the growth of humanity, it's really important that we all do our piece to keep that intact. Because you can't hand that over to AI.

Martin Clancy 3:11
If you did?

Mick Kiely 3:12
It goes away, then we start to become dependent on other aspects, we start to look to other places for what's missing, because the universe abhors a void. If there's a void there, something must fill up. So what's going to fill that if it goes away? Is it gonna be you know,
more this? Is it going? You know? What? It's, it's , it's hard to answer that one. I don't know what would fill that void?

Mixture 3:45
I think you just did. You pointed out that, like, there's a void. Universe fills a void. So it's like, we may not know what it is. But it's dangerous. So it's like going into this casino, you're taking a risk you're going as opposed having a business plan? Yeah, I'm going to roll it over there. And let's see what happens.

Mick Kiely 4:03
Yeah, I mean, you just look historically, at some of the major events that had had huge influence on World Peace to begin with. A lot of them were artistry, music, take live aid, brought the whole world together to deal with starvation. You know, the whole world gets together. And through song because it transcends language, music transcends language, the whole world can unite to disasters to grief, and raise aid through music. And artistry, AI never going to do that. So there's a massive void created, if music and artistry goes away, and Al replaces it, and what does that void get filled with?

Martin Clancy 4:45
And I think you when you describe that, I think it's brilliant when you said that, as opposed to aspiring to what you see in a Bowie or what you see. And Bob Dylan or doesn't, or Katy Perry doesn't matter. Doesn't matter inspires you? But because you're human, you can reach into yourself to go well, okay, I have that. If that's a machine, it's what you lack. And you said that,

Mick Kiely 5:11
yeah, it's just machine you can't look to a machine for love like that. Because that is about love as well. I mean, we aspire to certain artists because when growing up, we developed, we fall in love with them, we develop emotional connections to the posters on our bedroom wall, whether it's just that was in Bieber, or whether it's Pink or Katy Perry, whoever it is, there's such growth and development in our own personal development. But it's brought on the journey by our aspiring relationship, which includes love of artists and people we may have crushes on, are people that bring messaging in the context of their lyrics, or in how they dress or their attitude towards society. And their pushback on the right side of things or the left, whatever it may be. It's just like a massive expression about it from punk rock. that whole ,`" this is not good anymore' 'We want more than this'. And so you know, the whole punk rock thing develops, the whole Flower Power thing developed in the late 60s, these are all movements that were necessary for the world to go through evolution and change. That was in the name of love and developing a better world to live in for everybody. And that was all expressed through music. It was brought together through music, that can't happen with a AI it just can't. you need humanity, to bring that on. and taking that expression and musical expression out of the hands of humanity and putting it into an AI machine is just nothing, you want to be a complete idiot to think that was better system you'd have to be a complete gobshite to think that that's a better way to do it.

Martin Clancy 7:22
I have to tell you that that is definitely going in.

Mixture
And if you if you asked me to retract that, I will refuse. That's brilliant. That's Thank you very much, Martin. Thank you. That's Yeah if I

Appendix III

Xhail Recording & Composition – *Sunset on Mars*