

BA Creative Music Production

Professional Project

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**AI and Music Digital Streaming Platforms: The Effectiveness of Implementing an
Ethical Identifier to Highlight AI Compositions**

April 26th 2024

Dr Brian Carty

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Abstract

This research paper investigates the possible efficacy of implementing an ethical badge to identify Artificial Intelligence compositions on digital music streaming platforms. The concept was explored by interviewing music industry experts and conducting two separate experiments involving the general public. AI's relationship with the music industry is developing rapidly, and an ethical solution is needed to put musicians ahead of AI. Laws alone cannot provide this because they are ununified globally and slow to change to implement the necessary protections. Placing an emphasis on this area should be justified to protect the career path of musicianship in the future.

The objective of this thesis was to form an answer to the research question: Can integrating an ethical identifier that highlights AI compositions on digital music streaming platforms positively impact the music ecosystem? The different methodologies utilised in the research process aided in concluding an answer to this question. Interviewing experts actively working to traverse this problem offered interesting insights from researchers, musician copyright managers and artist perspectives. As examination in this area is still in the early development stages, it will provide a firm basis for others to advance this research.

The research also employed two listening experiments and a survey questionnaire to gather feedback on participant's perceptions of AI-composed works compared to human works. The experiment aimed to highlight the diminishing likelihood of distinguishing AI and human works and demonstrate a form of skill and luck required when using AI-powered composition software. The songs in experiment A were created far more equally to ensure difficulty distinguishing between the two works. In contrast, the AI-generated piece in experiment B was noticeably sub-par due to changes in compositional technique. The study participants encompassed a broad demographic to highlight that this is a problem for everyone.

Overall, both the interviews and the experiments provided valuable insight to allow an answer to the research question to be formed. Most participants in experiment A incorrectly identified the AI composition as human because this experiment was more challenging, while correctly identifying it in experiment B. This highlights both the increasingly indistinguishable nature of AI and human compositions, while also demonstrating that tracks generated by AI can be sub-par and inconsistent in terms of quality. These compositions require an element of skill and luck in the creation process when using AI music generation software. Along with the interviews, the results gathered from the surveys provided enough

detail on how an ethical identifier can exist on digital streaming platforms. While the majority of participants were in favour of placing a badge to identify AI works on streaming platforms, the interviews conducted presented a more realistic approach. They concluded it is too difficult to place an ethical identifier composition created with AI due to too many variables where AI can be involved in the creative process.

To conclude, this research paper was a positive step in implementing ethical practices regarding AI in the music industry. Although an ethical identifier precisely placed on AI compositions may not be feasible, similar solutions may be the way forward. Creating an ethical badge that sets standards that entities in the music industry must adhere to receive this badge is a possible route. Further research in this area will aid in finding a solution to this rapidly growing problem.

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Introduction

Generative Artificial Intelligence (AI) and the music industry have never been more intertwined than they are at present. Since its introduction into the music ecosystem¹, AI has provided new and innovative tools for musicians and producers alike to experiment with. It has also opened the music industry to a new world of ethics, legality, and copyright issues. Many of these problems centre around digital streaming platforms (DSPs) such as Spotify, and the content these platforms host. At the time of writing, there are no identifiers for consumers to know if AI has exclusively produced a particular song.

This project examined how effective an ethical identifier like Dr Martin Clancy's *'AI Music Mark'* would be for labelling AI-generated music on streaming platforms. Ethics, in this case, concerns both the musician and the consumer. An ethical identifier placed on AI works will allow musicians to differentiate their music from AI-generated music. It will also identify a piece of music AI has composed for the consumer. This will signal that a human musician will not receive royalties from streams of that particular song. As copyright laws are not unified globally, a worldwide legal solution is not viable; therefore, an ethical solution like the one mentioned is now being proposed by The United Nations as the way forward to solve this problem.

The European Union has referred to Artificial Intelligence as “systems that display intelligent behaviour by analysing their environment and taking actions – with some degree of autonomy – to achieve specific goals” (Rossi 1). In recent years, AI has been a transformative force in the creative sector, specifically the music industry. AI-powered algorithms and generative models have created unique musical pieces, blurring the lines between human and machine creativity. Hence, this creates a problem where musicians must now compete with AI-generated music for an already minuscule and unsustainable revenue pool offered by DSPs.

Digital streaming platforms have been keen on implementing AI-driven consumer features, such as algorithmic playlisting based on listening patterns and personal DJ tools

¹ In this research project, the music ecosystem refers to the diverse network of entities involved in the creation, distribution, promotion, and consumption of music, including artists, record labels, streaming platforms, and fans.

(Henkin). Following suit with the creators of these platforms, some users have begun implementing AI in their practices, using it as a low-effort method for financial gain. The users do this by uploading music generated entirely by AI to these platforms and illegally purchase streams to generate income from each song (Hoover). Situations like this have accelerated the discussion around the regulation of AI in the music industry in an effort to prevent artists from experiencing further financial losses as a result.

This project aims to explore how effective the implementation of an ethical identifier can be in highlighting AI-composed works and protecting human-composed works on DSPs. Through facilitating two experiments, data analysis and conducting interviews, these methods attempted to answer the research question: Can integrating an ethical identifier that highlights AI compositions on digital music streaming platforms positively impact the music ecosystem? This gave insight into how an ethical solution could benefit the DSPs moving forward instead of a slow-to-implement, lawful solution, as each country has its own legislation.

Literature Review

Introduction

Artificial Intelligence (AI) is currently at the forefront of an era of rapid technological advancement. It is reshaping all areas of society and industry, including the music industry. Generative AI is currently the tool most prominently used within the music industry. This literature review attempted to understand how streaming platforms can implement an ethical identifier for AI compositions to create a more sustainable sector for musicians. To clarify how this could work in practice, the following themes were analysed:

1. Generative Artificial Intelligence
2. The Digital Streaming Platform Model
3. Artificial Intelligence and Copyright
4. Creating an Ethical Solution for Artificial Intelligence

These topics gave a broader understanding of AI in the music industry, narrowing down to the current issue of identifying AI music on digital streaming platforms and how an ethical solution can help as opposed to a lawful one.

Generative Artificial Intelligence

To understand how AI impacts the music industry, one must first understand what generative AI is. This type of technology can produce content such as imagery, text, audio and synthetic data² (Lawton). Generative AI first originated in the early 1930s with the creation of a mechanical brain by Georges Artsrouni (Daumas 283). This machine acted as a mechanical translator between languages. The release of OpenAI's DALL-E³ software in 2021 marked an explosion of AI technology usage among the general public. Generative AI works by the user presenting it with a prompt (input) and producing the content (output) for the relative field it is working in. These AI models are trained using large datasets and machine learning⁴ to create these outputs.

² Information that is artificially generated instead of being produced by real world events (Yasir).

³ Software which turns text prompts into artificially generated images.

⁴ The use of data sets and algorithms to mimic the way humans learn, improving accuracy over time (Tucci).

The application of generative AI translates to music creation by fostering creativity and innovation. According to Bernard Marr, one exciting aspect of AI technology is the “democratising impact it has on creativity” (Marr). Generative AI, through various tools, aids in composition creation through inspiration, melody, harmonic and rhythmic writing. The types of tools using Generative AI in the music industry range from solely consumer-based to professional products. An article from Andreesen Horowitz categorises the different tools, as shown in Figure 1 (Acharya).

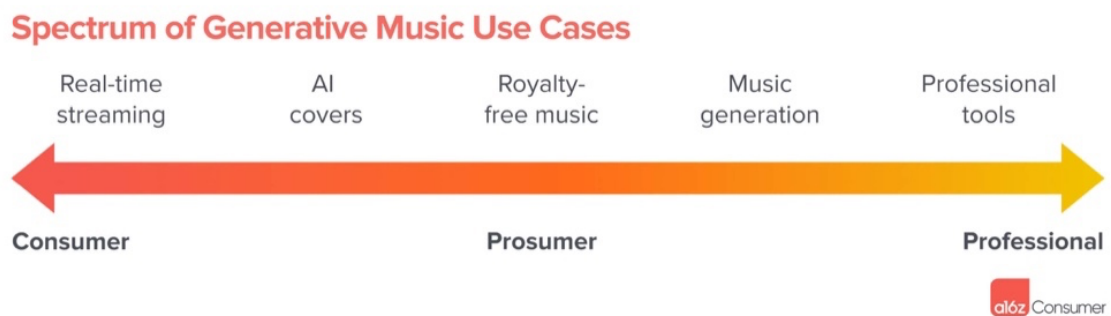


Figure 1: Scale of different use cases for generative AI

At the time of writing, Artificial Intelligence Virtual Artist, better known as AIVA, is one of these high-quality professional music tools. It is a composition tool that uses deep learning algorithms to analyse a vast music database, enabling it to generate original music pieces in various genres (Sound Tech Insider). This software was chosen for two AI composition-based experiments which are subsequently detailed in this paper. AI covers, music generation, and professional tools are arguably the most popular uses of Artificial Intelligence at present within the music industry. The creation of AI covers went viral in 2023, with technology becoming available to the public to make highly accurate imitations. The model used in most covers is ‘*Differential Source-Channel Voice Conversion*’⁵. It must be noted that many of these algorithms are trained on copyrighted material to create voice imitations, which fall into a grey area involving fair use⁶ in the United States.

A prime example of this trend is the song ‘Heart On My Sleeve’ by ghostwriter977 (Refer to Appendix A), which shocked the internet with how high quality an AI cover can be. The song was also submitted for consideration for the Grammy Awards (Shanfeld). It did not meet general distribution⁷ requirements because Universal Music sent takedown notices to

⁵ A process of converting one voice to another using an algorithm to produce high quality (Liu et al.).

⁶ Any copying of copyright material done for a limited and transformative purpose in The United States (Stim).

⁷ The broad release of a recording via brick-and-mortar stores, third party online retailers and/or streaming services (Shanfeld).

digital streaming platforms, meaning it failed to qualify for a nomination. Although the original song was taken off streaming platforms in this case, this is just one instance of AI representation on digital streaming platforms.

Digital Streaming Platform Model

The Digital Streaming platform model can be divided into four categories, as outlined in an article from CMU Library (Cooke).

Download Stores

They are considered to be the earliest conception of online streaming. Users purchase each song/album individually from online stores such as iTunes, which were highly popular in the 2000s and early 2010s, as mentioned by Cooke.

Premium Streaming Services

Users pay a subscription fee to platforms like Spotify to access an extensive music catalogue on demand.

Free Streaming Services

The user can avail of a free music streaming service from sites like Spotify. Still, it is generally paid for by listening to ads, and the functionality is limited, incentivising the user to upgrade to the premium version.

User-generated Content platforms

This is music used by social media content creators⁸ in their videos. Most social media platforms, such as Instagram, have built-in audio clip libraries, allowing users to include background music.

Although DSPs exist in several forms, artists' revenue from each type remains minuscule. Compared to the physical copy sales structure artists relied on before streaming, it is now much more difficult for a musician to make a living from streaming revenue alone (Hesmondhalgh). As stated by Hesmondhalgh, revenue from the music industry has only begun to increase again since 2014 after a fourteen-year decline. This growth contradicts what musicians receive in revenue from sales, as this has decreased significantly compared to when they relied on physical sales. The DSPs operate a pay-per-stream model, paying a fraction of a cent per stream. Figure 2 shows the streaming rates for the most widely used

⁸ In this case, any user on a platform who produces content.

DSPs (Yonata). It must be noted that these numbers are averages and vary slightly due to several factors.

Platform	Pay per stream	Streams to get \$1,000
Tidal	\$0.013	76,924
Apple Music	\$0.01	100,000
Amazon Music	\$0.004	250,000
Spotify	\$0.0032	312,500
Youtube Music	\$0.008	125,000
Pandora	\$0.0013	769,231
Deezer	\$0.0064	156,250
Qobuz	\$0.043	23,255

Figure 2: List of pay out rates for various streaming services

As a result of miniscule payments per stream, artists now have to rely on merchandising and touring as a primary source of income (Bassett). In an article which examines streaming revenues, Katherine Bassett explains “Artists are paid less per stream than ever before, and the sale of one T-shirt can generate the same level of revenue as tens of thousands of streams”. Coupled with this problem, musicians now find themselves competing with AI for streams. People use Generative AI to create music rapidly, upload it to DSPs, and use click farms⁹ to boost stream numbers and receive royalties (Hoover). This means people can generate a source of income without any creative input or a human hearing the song. A quote from Amanda Hoover encapsulates this problem perfectly: “If a song is created by artificial intelligence and listened to by a bot, was it even heard at all?” (Hoover). This is part of a broader problem that the music industry faces with copyright law and AI.

Artificial Intelligence and Copyright

Although many countries globally may share similarities in their copyright laws because they are signatories of The Berne Convention¹⁰, they remain ununified. The Berne Convention provides minimum standards to its signatory countries, some of which include (WIPO):

- Automatic copyright protected upon the creation of a work
- Minimum term of copyright of life plus 50 years after death
- Exclusive rights

⁹ A network of devices that play a specific song on repeat to artificially increase streaming numbers (Trajcheva).

¹⁰ An international agreement that helps protect the rights of creators and their works.

- National Treatment¹¹
- No formal registration for copyright

This is where many commonalities end, as each country has its nuances, which presents problems when trying to create a unified regulation for an area such as AI.

At the time of writing, the European Union is the only body to draft a regulatory framework for artificial intelligence, which will come into effect in 2024. The draft AI act aims to regulate AI through a risk-based approach, with a technology-neutral definition and a classification system for different AI systems (Madiega). The document categorises AI systems into four separate categories, as shown in Figure 3.

Pyramid of risks

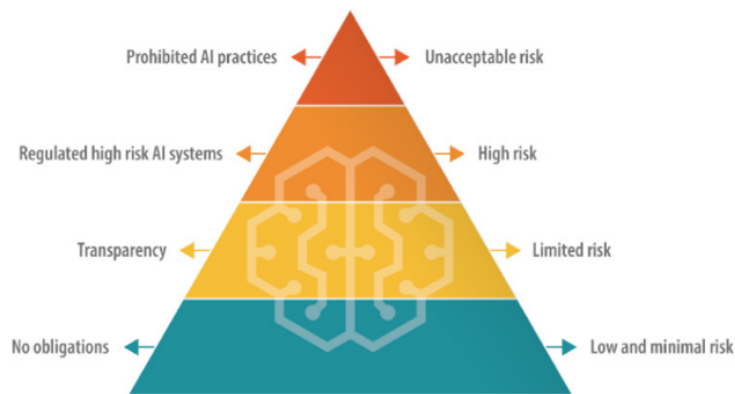


Figure 3: EU Pyramid of risk for generative AI

The case of Generative AI falls into the '*Limited risk*' category, with the obligations centred on transparency. These obligations include:

- Disclosing the content generated by AI
- Preventing the model from generating illegal content
- Publishing summaries of copyrighted data for training

Although, in theory, this is a positive step forward, it does not necessarily combat the copyright issues surrounding AI covers. In the United States, copyrighted material can still be used technically under fair use. This act also only applies to EU member states and not countries worldwide. The rate at which AI technology is developing constantly eclipses the rate at which laws and regulation pertaining to AI are implemented. It also does not help that a unified global response regarding the law is unachievable due to the nuances of each country's legal framework. UNESCO¹² has acknowledged this problem and aims to find a

¹¹ Authors from member countries are entitled to the same rights and privileges as the nationals of the country where the work is used or protected (LII).

¹² The United Nations Educational, Scientific and Cultural Organisation.

solution. During a conference in 2021 detailing both the positive and negative impacts AI can have on society, it was recommended that the answer be an ethical solution based on international law (UNESCO 1). These ethical standards for AI technology will play a key role in creating AI normalities across the globe.

Creating an Ethical Solution for Artificial Intelligence

An ethical solution regarding AI for the music industry involves defining the characteristics and principles that uphold ethical standards in the application of artificial intelligence within this specific domain. At the time of writing this, arguably, the most robust ethical solution is AI song marking which is being posed by Dr Martin Clancy in the form of the '*AI Music Mark*' (Clancy 22). This aims to be a globally recognised and enforced ethical checkmark which signifies the certification of AI music products and services. Theoretically, the mark would be a publicly recognised logo similar to the Fair Trade Movement logo that would be used to identify AI compositions on streaming platforms. For this concept to be successful, it would have to be done via a national approach with the support of a certification partner to provide impartiality, such as the IEEE¹³, which is currently developing an ethics certification program for Autonomous and Intelligent Systems (David et al.).

The German and Danish technology sectors have already trialled this marking concept. The German Seal of Approval is a voluntary AI seal used in Germany (Engenhardt et al.). The seal aims to ensure a human-centred use of AI. The identifier ensures that the service and product development provided by the companies under the German Seal of Approval adhere to ethical principles. The focus is on the quality criteria of ethics, impartiality, transparency, security, and data protection. On the other hand, The D-Seal in Denmark allows IT companies to convey digital trust by showing their customers and partners that they are digitally accountable (Olsen). The receiving company must meet data ethics requirements if working with AI to receive this checkmark.

An emphasis should be placed on bringing an ethical solution to digital streaming platforms because the quality of generative AI music is rapidly advancing. It will also allow artists to differentiate their works from AI and consumers to know what they are truly listening to. AI creations are now dominating several genres. Andreesen Horowitz details several music streaming platforms such as Endel, whose catalogue is built entirely on

¹³ A professional association that focuses on advancing technology in various fields, particularly those related to electrical engineering, electronics, computer science, and telecommunications (IEEE).

generative AI music. According to the article, these streaming platforms aim to “generate never-ending playlists to help you get into a certain mood or headspace”. The app’s focus is on ambient and soundscape instrumentals, shying away from vocals, as at the time of writing this, the technology is not sophisticated enough to produce convincing generative AI vocalisations. According to an interview with David Hughes in Dr Martin Clancy’s book about the music ecosystem and AI, Hughes states:

We already see production, relaxation, and meditation music created by AI. AI has already taken over these three genres. It starts with the most straightforward stuff. With the lowest bar. If you are a composer trying to compete with AI in this area at this point, it might be a waste of your time. So now it is going to start to spread across genres.... I love country music, but I love it primarily because of the lyrics. However, as I said, it would be some time before an AI can write Tammy Wynette’s ‘D-I-V-O-R-C-E.’ At least not until two computers are fighting over the custody of their AI child, so some parts of the music industry seem safe—at least for now.

(Clancy 104)

Although this quote holds meaning, it is a flawed argument. As many musicians write about fictitious scenarios and from life experience, to say generative AI cannot write convincing country lyrics if trained on the correct data sets is naïve. However, it is concerning that AI dominates compositionally straightforward genres such as relaxation music.

The fact that music streaming platforms can be solely based on generative AI music is a sign that technology can compete with human composition in terms of quality. Distinguishing between music composed by humans and music composed by AI is becoming an increasingly difficult task. In a study conducted by Tidio on AI and creative artforms, the participants found music the most complex category to differentiate between what was a human or AI creation (Rajnerowicz). According to the study, a song composed by AI trained with machine learning on Beatles songs and played by real musicians convinced 61.6% of people it was composed by a human. Although this AI composition was played by musicians, staggering percentage of people who believed it was human-composed backs up the claim that people increasingly struggle to differentiate between AI and human-composed music.

Conclusion

Each area discussed in the literature review depicts the music industry's current problem regarding generative AI. Generative AI has advanced substantially, from the creation of the mechanical brain, to the recent progress exemplified by OpenAI, which has been transformative. This technology, rooted deep in machine learning, has found its application in all forms of music composition, fostering creativity and attempting to democratise the artistic process. Various generative AI tools, ranging from consumer-based to professional-grade, have emerged in the music industry, with notable examples like AIVA showcasing the capabilities of AI-composed music. However, the rise of AI-generated music, particularly in the form of covers, has raised ethical and legal concerns. The exploitation of AI to generate streams using fraudulent means such as click farms, poses challenges to artists and the integrity of the music ecosystem.

From examining the digital streaming platform model, it is evident that artist revenue remains minimal, exacerbated by the influx of AI-generated content competing for attention. The pay-per-stream model employed by these platforms and the ease of creating AI-composed music raises questions about the financial future impacts on musicians regarding streaming platforms. They may need to rely even more on touring and merchandising if their share of revenue from DSPs decreases further. Addressing the complexities of AI and copyright law reveals the lack of global unification. While the European Union has taken steps with the draft AI act, its limited scope and the varying nuances in copyright laws worldwide create a fragmented landscape. UNESCO's recognition of the need for ethical standards in AI aligns with efforts to find an international ethical solution instead of a legal one.

Dr Martin Clancy's '*AI Music Mark*' presents a promising avenue. Like the Fair Trade Movement, this global certification could serve as a standard for ethical AI music products on music streaming platforms. Trials in adjacent industries in Germany and Denmark with similar concepts demonstrate the feasibility of such an approach, emphasising human-centred AI use. As generative AI advances, distinguishing between human and AI compositions will become increasingly challenging. The growing prevalence of AI-generated music on streaming platforms highlights the need for an ethical solution. Although there is a need for a solution akin to an identifier, there has to be some form of incentive for these streaming platforms. These platforms are ultimately profit-driven businesses, so if a solution costs a significant amount, they may refuse to adopt it until it becomes a legal requirement. The referenced works further back this claim by providing sufficient evidence regarding each

theme. Through a literature review in each of these areas, it is clear that generative AI is an emerging area of the music industry that will only grow over time.

Methodology

Introduction

The primary goal of this project was to evaluate whether an ethical identifier such as Dr Martin Clancy's '*AI Music Mark*' would be effective in labelling AI-produced works on music streaming platforms. To amplify this pressing issue, two experiments are detailed below comparing AI-generated music against human-composed music. Survey questionnaires accompanied these experiments to gather participant feedback. Several interviews were conducted with key members involved with both AI and the music industry, along with these experiments. These methods were utilised to answer the research question: Can integrating an ethical identifier that highlights AI compositions on digital music streaming platforms positively impact the music ecosystem? All the evidence was empirical, using quantitative and qualitative data research methods. These findings were gathered from a subject group participating in the project. Quantitative and qualitative data were collected through a survey questionnaire. The data gathered from the interviews was open-ended qualitative data.

Method 1

The first piece of methodology implemented in this project took inspiration from the study conducted by Tidio regarding human and AI-composed works detailed in the literature review. These experiments investigated how participants perceive and evaluate music composed by humans versus music generated by AI under specific constraints. There were constraints to create a quality control aspect, so each piece of music was produced to the same standard. The following was considered:

Varying Level of Difficulty

Two experiments were conducted to highlight the current level at which AI-composed music is being produced. In the first experiment, it was much more difficult to tell what entity composed what piece compared to the second one, which was arguably more straightforward for the participant. This was to highlight the inconsistent nature and quality of AI-composed works at present.

Participants

The surveys focused on gathering participants with varying degrees of musical knowledge. This reiterated that AI-generated and human-composed music can vary in complexity to distinguish for all types of people. The study aimed to have a sample size of at least 100

people between the two surveys. This allowed for statistical significance. The surveys incorporated participants from all backgrounds and asked for information on their demographics. Participants accessed the survey online and were primarily students from the Institute of Art, Design and Technology Dún Laoghaire. There was also an emphasis on obtaining responses from younger and older demographics to examine whether the perception of AI-composed works differs for each cohort.

Musical Constraints

Two pieces of music were prepared for listeners for each experiment, one by a human composer and the other by AIVA, an online generative AI music tool. At the time of writing, this tool was renowned for AI music generation. Each composer had to adhere to the following constraints. These restraints were:

- No lead vocals are allowed
- Similar duration
- Genres: Meditation and Lo-Fi music
- Similar tempo and key

Vocals were excluded from this experiment because, at the time of writing, generative AI could not produce a convincing result without human input through techniques like *'Differential Source-Channel Voice Conversion'*, mentioned in the literature review. The aim was to have the songs have a similar duration to eliminate time-related biases. Ambient and Lo-Fi music genres fit the experiments perfectly, as human and AI composers can produce a comprehensive track. A similar key and tempo ensured that each piece was not vastly different. The human composer also had a time constraint of 4 hours to complete the composition. The online tool can instantly generate the music, so a time limit was unnecessary. It must also be noted that each track was mastered to -14LUFS to eliminate any loudness bias¹⁴. These constraints helped create an unbiased experiment. It must be noted that, in the second experiment, the composition process varied slightly. The AI-composed piece was trained using the human piece of music as a dataset to replicate a track of a similar nature.

¹⁴ Often, the louder a song is, the better it may be received.

The Experiment

All experiment participants had to actively listen¹⁵ to each piece of music, following instructions. These instructions were sent out with the experiment to achieve the most accurate results. These instructions included:

- *Listen in a quiet space with headphones*
- *Listen to each music piece at the same volume*
- *Listen to each music piece once*

The instructions further eliminated any possible bias. The participants then answered a survey regarding what they had just listened to, which will be detailed in the following section.

Method 2

The second methodology utilised in this project was a survey and a questionnaire to collect data from the aforementioned experiments. The experiment participants were presented with a series of questions regarding the test. These surveys employed the use of two different question types:

- Multiple Choice
- Open-ended

The open-ended questions provided qualitative data, allowing the subject group participants to express their opinions on the music examined in the experiments. The quantitative data was produced from the multiple-choice questions. Some example questions from the survey included:

- *How often do you listen to music? Please tick the appropriate box.*
- *Who is the composer of this music piece, Human or AI? Please tick the appropriate box.*
- *Why do you think this particular piece of music was composed by a human or AI?*
- *Do you believe there is a place for generative AI in the music industry? Please detail your reasons below.*

Both types of questions aided in forming an answer to the research question, and the open-ended questions provided the rational reasoning the subjects of the experiment used in their decision-making process. The open-ended questions regarding music listening habits enabled

¹⁵ Involves focusing your full attention on the music and immersing yourself in the experience with an intentional and engaged mindset, rather than having music play in the background while doing other activities.

the data to be gathered on this topic for each participant. This allowed different cohorts of listeners to be identified.

Method 3

The final methodology utilised in this project was conducting semi-structured¹⁶ interviews with key personnel in the music ecosystem. The primary goal of these interviews was to gather open-ended qualitative data to aid in forming an answer to the research question. This approach was chosen as it allowed the thesis to probe deeper into the interviewee's responses instead of opting for thematic analysis. The interviews enabled an in-depth exploration of the participant's perspective on the topic.

A purposeful sampling strategy was used to identify and select critical individuals for these interviews. This included experts in musicology, technology, AI ethics, or all of the above. An emphasis was placed on recruiting people who played pivotal roles during the study. For example, as mentioned previously, Dr Martin Clancy has posed an ethical solution for streaming platforms in the *'AI Music Mark'*, making him a suitable candidate to interview. Although a pilot test was not utilised for these interviews as the questions varied depending on the interview because each had different discussion points, the questions were sent to the participants beforehand, so they had sufficient time to prepare answers.

Ethics

Before the questionnaires and interviews, the participants were provided with detailed information about the study's purpose and procedures. Informed consent was obtained from each participant, ensuring they understood the voluntary nature of their participation. All data collected was treated confidentially. Participants in the experiment and survey remained anonymous for this study. All data collected was securely stored.

Conclusion

This project attempted to find an answer to the research question utilising the methods detailed above. An ethical solution is exemplified by Dr Martin Clancy's *'AI Music Mark'* in safeguarding the future of the music ecosystem, with a particular focus on music streaming platforms. There should be an emphasis on the urgency required, which the imminent

¹⁶ A data collection method that relies on asking questions within a predetermined thematic framework, but the questions are not set in an order (George).

challenges of integrating artificial intelligence into music creation pose. To address this, a multifaceted approach was adopted, employing experimental, survey-based, and interview methodologies, all geared toward answering the overarching research question: Can integrating an ethical identifier that highlights AI compositions on digital music streaming platforms positively impact the music ecosystem?

The experimental component of the research involved a comparative study between AI-generated music and human-composed music, guided by constraints to ensure a standardised evaluation. Through a systematic approach encompassing participant selection, musical rules, and a controlled listening environment, this methodology aimed to prove that the gap between distinguishing AI-generated and human-composed music is growing thin, but the results AI is currently producing are inconsistent in quality. The surveys were crucial in gathering quantitative and qualitative data from the experiment's participants. They aimed to explore the participants' perceptions and the rationale behind their choices using open-ended and multiple-choice questions. This approach allowed for a comprehensive understanding of how individuals perceive human and AI-composed music, providing valuable insights into the impact of ethical considerations in AI-generated music.

Additionally, conducting interviews added depth to the research, incorporating the perspectives of key stakeholders in the music ecosystem, particularly those engaged in musicology, technology, and ethical considerations related to AI. Conducting semi-structured interviews with individuals like Dr Martin Clancy ensured that comprehensive data was gathered. The open-ended qualitative data from these interviews enriched the study by offering expert opinions and nuanced viewpoints that would not be captured through the experiment survey dynamic alone. The triangulation of empirical evidence from experiments, surveys, and interviews provided a comprehensive approach to forming an answer to the research question. Integrating ethical solutions in the music digital streaming landscape is a complex and evolving challenge, and the findings from this research intended to contribute meaningful insights that can inform the development and implementation of an ethical framework for DSPs.

Analysis

Introduction

Through the implementation of the different methodologies detailed in the previous chapter, several different perspectives were gathered to answer the research question: Can integrating an ethical identifier that highlights AI compositions on digital music streaming platforms positively impact the music ecosystem? The following cohorts of people were interviewed or surveyed:

- A researcher involved in both music and AI
- Someone who works in the management of copyright for music
- Artists involved in using AI
- The public

Utilising people from these areas allowed an evaluation of whether an ethical identifier such as Dr Martin Clancy's '*AI Music Mark*' would effectively label AI-produced works on music streaming platforms. The findings of the aforementioned groups will be analysed in detail below.

A Researcher's Perspective

The researcher interviewed for this project was Dr Martin Clancy, who has a PhD on the music ecosystem's relationship with Artificial Intelligence, the creator of the '*AI Music Mark*' concept and the founder of start-up AI:OK¹⁷. This interview had the following goals:

- Understand Clancy's perspective on AI's place in the music industry
- Is there a need for an ethical identifier in the music industry, and what are its benefits?
- How does this solution fit in both the law and regulatory bodies?
- What does the future of AI look like in the music industry?

Throughout the interview, all of these topics were covered in detail. For the complete set of sample questions used as a guide throughout the interview, refer to Appendix B1; the interview recording can be found in Appendix C1.

As an innovator in the space, Clancy had a positive perspective when talking about AI's current place in the music industry. While researching his PhD, he made many connections to 'Transformer'¹⁸, a deep learning architecture detailed in the 'Attention Is All

¹⁷ A company dedicated to creating a mark which identifies music created with responsible AI (AIOK).

¹⁸ A computational architecture used for tasks such as natural language and audio processing (Vaswani et al.).

You Need' research paper (Vaswani et al.). This paper details the fundamentals of how transformers work, and it has since been adopted for use in Large Language Models (LLMs),¹⁹ which is the basis of systems such as Chat GPT. Towards the end of his research, this supervised machine learning process began working with raw audio. He stated that “the only thing going for it at the time was it was a bit crap”. This was about the low fidelity of the music produced. However, due to the nature of the technology, it was likely to advance rapidly due to historical data. Clancy mentioned it was important that “the fact it was writing songs on a granular level” was a starting point to allow this rapid advance to happen. Overall, the researcher thought ChatGPT was the catalyst that changed everything in the mainstream to lead to an explosion in AI technology, and it will only advance further as time progresses.

The original concept of Clancy's *'AI Music Mark'* has developed into a concept that is now broader than just marking AI compositions. According to Martin, the ethical mark now known as AI:OK is “the music industry version of the DDEX²⁰”. DDEX was formed to create metadata standards, while AI:OK's focus is on ethical standards for using AI in the music industry. This stamp currently does not mean anything, but Martin stated that all the major music labels “Currently have a little box called AIOK on their metadata standards”. He also mentioned the record labels “are willing to come to the party”, which seems promising in protecting artists' rights.

In terms of this new ethical solution that can co-exist with laws, he thought an AI system might be the solution to work through all these complexities. Everyone Clancy has encountered working in the field of AI and music has been chiefly musicians attempting to do the right thing, but they do not know what the right thing is. He stated, “Even if they were given a series of guidelines from high up in the music industry, how that specifically would work with what that system they're doing, that's kind of tricky.” The researcher thinks building an AI to adjudicate on these guidelines on a case-by-case basis will allow for “self-certification”, which will provide the means for widespread adoption, avoiding the geopolitical bounds of varying laws in the global market. He hopes it “could improve a company's ethical impact in terms of the AI systems they are using”, which is the basis of AI:OK.

The researcher seemed quite hopeful about the future but did not know what might happen. AI is such a sensitive topic that he feels an ethical solution, as opposed to a lawful

¹⁹ A type of artificial intelligence program that can recognise and generate text along with other tasks. These LLMs are trained on huge data sets, hence the name “Large” (Kerner).

²⁰ Digital Data Exchange which sets international data standards for companies globally (DDEX).

one, is the way forward. He thinks different “decrees might need to be passed for different industries to allow things to happen”, making this issue a “flexible” one and declaring it challenging to be a lawful solution. Clancy thought the “prohibition” of AI would not be feasible or valuable; instead, people should use their expertise to shape the future positively. Setting these information goals pre-interview and exploring them in depth throughout the course of the interview allowed for a comprehensive understanding of AI and the music ecosystem from Dr Martin Clancy’s perspective, which appeared more favourable than the copyright specialist’s.

A Copyright Perspective

Seán Donegan, the Chief Commercial Officer (CCO) for the Irish Music Rights Organisation (IMRO), was interviewed to get insight into the current situation with copyright and the music industry. Several goals were set out to get the most accurate information to aid this research before this interview, which were:

- Donegan’s perspective on AI in the music industry
- Has AI impacted music’s licensing/copyright protection process in a positive or negative light?
- The legal implications of AI on the music industry
- Does he think an ethical checkmark on streaming platforms is the solution?

Each of these topics were covered in detail throughout the interview. The sample questions used as a guide throughout the interview can be found in Appendix B2, and the interview recording can be found in Appendix C2.

Donegan had a somewhat dystopian view of the current state of AI in the music industry compared to Martin. The interviewee thought AI generative music tools were becoming quite good, lowering the barrier to entry for people to get involved in the music industry. However, on the commercial side, he was not as optimistic. Donegan was concerned that more businesses were opting to use royalty-free music composed by generative AI to bypass the need to pay for an IMRO license²¹. This, of course, leads to less royalty payments for songwriters. When asked about consumers being able to distinguish the difference between human and AI compositions, Donegan stated it is something people will continue to “struggle” with. However, in five or six years, “They probably will not care”.

²¹ A license Irish businesses must pay to play copyright music in the public domain (IMRO).

This is a startling contrast compared to Clancy's faith in the music industry and the public wanting to put artists first.

Regarding AI impacting music licensing, Donegan thought the area AI would help best was audio recognition in businesses in the hospitality sector. It would allow IMRO to pay out a particular business's IMRO license fee more accurately as they will have the exact songs played akin to music logs radio stations, use instead of what currently happens, which is the distribution of royalties to the top performing artists on the charts. They also work with a Spanish company, BMAT, an AI audio recognition service. According to the interviewee, IMRO has participated in a trial with BMAT where they have "given them a list of say 300 Irish composers and we're saying okay, you scan all the radio play in Australia for these 300,000 tracks and give me a report saying the exact time, station, duration of when that track was performed". This allows the Australian society to send IMRO the correct overseas royalties to each artist.

Concerning legality, Donegan implied that IMRO would offer something extra to protect the copyrights of musicians in the years to come. IMRO only deal with copyrighting human-composed works, so he thought this stance might have to be explicitly declared further. He suggested creating a tick box stating, "This is not an AI generated work. I fully control all the rights in this work". The interviewee was concerned AI works could flood the system, diluting the revenue pool for human songwriters. In the Irish Copyright and Related Rights Act 2000, he also stated that a loophole allows AI companies to data mine copyrighted material in Ireland without obtaining the required license. He felt this was something that needed to be reviewed.

Finally, when it came to the topic of an ethical checkmark, Seán Donegan was not keen on the idea. A mock of how this AI checkmark was shown (Refer to Appendix D) to visualise the concept. He thought it would help IMRO and Spotify identify tracks as Artificial Intelligence. However, regarding public perception of an ethical checkmark, he stated, "I'm not sure as to the benefit it would have ultimately from a consumer point of view". This ties back to his view that the public will ultimately not care whether or not Artificial Intelligence creates the music. He also thought it would be difficult to classify a song as AI, depending on how much involvement it had. His issue lies with white noise tracks taking away revenue from artists, and something like a "guaranteed Irish Mark" may work better. The topics addressed in this interview gave an excellent indication of Donegan's views on AI in the music industry. The artist interviewed for this thesis also shared some of these views.

An Artist's Perspective

The final interview was conducted with Irish composer Sebastian Adams during the research process. Along with his abstract composition process, Adams is part of Irish experimental ensemble Kirkos and manages Dublin's Unit 44 DIY music space. Arguably, his most notable work is '*STOLEN MUSIC*', Adam's capstone project at IRCAM Paris. As many topics concern the future of artists in this thesis, it was necessary to interview a forward-thinking individual with experience with both AI and copyright. This interview set out to explore the following:

- Adam's current composition process and how it involves AI and copyright material
- Sebastian's view on copyright
- Whether an AI ethical checkmark will be beneficial for artists
- How advanced he sees AI becoming in the future in terms of the music industry

All of these topics were covered in detail throughout the interview. For the sample questions used as a guide throughout the interview, refer to Appendix B3; the recording can be found in Appendix C3.

In Adam's current composition process, AI is not a significant factor on the frontend but is in the backend of many systems he has in place to help create his pieces. His composition style is interesting. All of the projects the artist works on start by using copyrighted material in some form. According to Adams, his process is as follows:

I often will collect material, and then I build software that processes it so that I can, I don't have to spend a lot of time shaping the material, it's more like shaping the outline of the concept and then improvising with the material rather than fine tuning the fixed audio files or things like that.

Adams creates many of these systems using Max MSP²² batch downloading items such as his YouTube history and using tagging processes to organise the content. All of these processes use AI in some way, and although he does use some AI tools, such as Deezer's '*Spleeter*'²³, he does not consider AI a prominent part of his process.

However, his complex use of copyright material allows him to have a forward-thinking topic on copyright. Due to several experiences, Adams considers himself

²² Max MSP is a visual coding language that allows users to build interactive audio programs without any experience in command-line coding (amandaghassaei).

²³ An audio stem separation tool (DeezerResearch).

“sceptical” of copyright. His *‘STOLEN MUSIC’* catalysed him to begin basing all of his work on copyrighted material. The interviewee explained the premise of the project as:

There was this whole course who were really focused on working towards this final concert where everyone had like one piece to kind of show that show who they were and in a way almost like make their career in France or whatever. At least that's how it seemed internally and I thought it would be cool in that context to just steal everything from my colleagues. So that was kind of where I started with that and then it grew legs and you know now I mean I suppose I've developed some ways of Dealing with material that I didn't write, but I mean it kind of makes sense as a starting point for most of my work at the moment.

With this heavy use of copyrighted material, Adams still does not think copyrighted material should be allowed to be used freely by everyone. He thinks artists need to think more “critically” about how it can protect their work being used in authorised circumstances. The musician perceives significant threats stemming from companies seeking to profit from the appropriation and control of intellectual property. Although his art takes a proactive stance in wanting to abolish copyright, in reality, this in a real world scenario is not practical. It would cause a lot more harm to artists as opposed to helping them.

In terms of an ethical checkmark that identifies AI compositions on streaming platforms, such as Dr Martin Clancy’s *‘AI Music Mark’*, he thought at present there should be something to identify this cohort of music. The artist felt they should know what they are listening to for the consumer's sake. Adams stated, “People using the platform are going to expect that the music they're listening to is written by humans, and Clearly, that's important to a lot of people”. He compared it to the labelling of organic foods and explained that consumers should not be tricked into listening to music they thought was produced by a human when, in reality, it was composed by AI. Although a valid comparison, compositions can have a varying level of AI input which is difficult to identify and is not as clear as organic foods.

Finally, Sebastian Adams was still determining the future of AI and the music ecosystem. He mentioned there will be an increase of people “unknowingly using AI”, and the industry may face some form of reckoning in the coming years. He thought it would come down to how the general public felt about AI when faced with a “Much bigger volume and much more kind of obvious kind of wave of AI music”. If AI also becomes sophisticated enough, he felt the human race would have to accept that AI would need rights of “Different

kinds, and a copyright would be one of them”. This is an insightful point to make and will become a stronger argument in the future. His views are closely related to the participants of this project's two experiments.

Public Perception of AI Music

In parallel to conducting interviews, members of the public participated in the two experiments detailed in the methodology section of this thesis. These experiments had two main goals:

- To highlight the increasing difficulty in distinguishing AI and human-created works.
- To highlight there is a level of skill and luck required to use AI music generation software.

Experiment A

The first experiment sent out to participants consisted of two pieces of music in the meditation music genre and a survey which examined the listeners' response to these compositions. Both pieces followed the constraints mentioned in the methodology section, sharing the same key, tempo and duration. This experiment was intended to be the more difficult of the two experiments regarding identifying what entity created each work. The human piece was created after the AI-composed work was selected to ensure a fair difficulty level for the experiment. This was a starting point for the type of human composition to be created for the experiment. It was also due to the inconsistency in AI composition quality, as it took many more attempts to create a convincing composition than anticipated. The survey results highlight the participants' struggle in this identification. To understand the experiment's results sufficiently, 'Piece 1' (Refer to Appendix E1) was the human composition and 'Piece 2' (Refer to Appendix E2) was the AI composition.

There were eighty participants in experiment A, with a varying demographic. 65% of the participants were male, and 68.8% were in the 18-24 age category. However, only 42.5% of participants had formal music education, but everyone listened to music at least once a week, with the majority listening daily. As shown in Figure 4, only 27.5% of people identified Piece 1 correctly as a human composition. Another 18.3% could not confidently distinguish the two pieces. To add to this lack of confidence, the results from the bar chart in

Figure 5 can be seen below. Only 10% of participants were extremely confident in their selections, and this whole cohort of people had incorrectly identified the AI piece.

Which piece do you think was composed by a human?

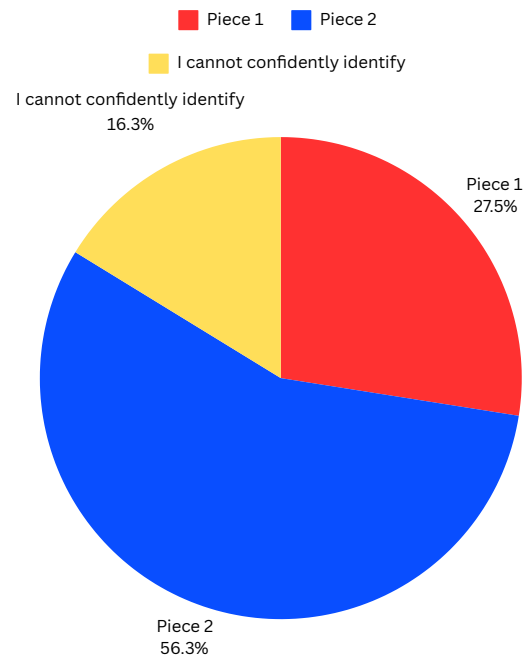


Figure 4: Pie chart of result from a question in experiment A

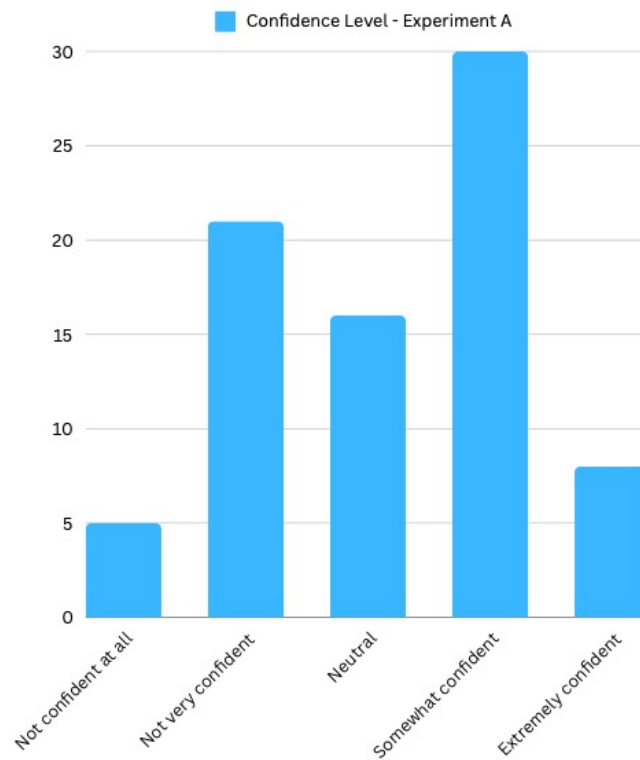


Figure 5: Bar chart of result from a question in experiment A

Some of the reasons participants believed Piece 1 was composed by AI as opposed to a human were:

- Felt more ‘generic’
- Less variation
- Sounded ‘robotic’

In terms of Piece 2, the actual AI-composed piece, some of the reasons people thought it was human were:

- It was more emotional
- It sounded ‘more human’
- Sections of dissonance sound intentional, and AI would not be capable of this.

These points are insightful as they are spoken in the sense that AI cannot produce these characteristics when, in reality, they are describing the piece composed by the AI. As much meditation music relies on a small pool of instruments and similar tropes, people’s first instinct was to class it as generic and robotic.

Almost all participants faced challenges when identifying the two pieces. Some of the challenges they felt they faced included:

- The songs were similar, and the elements used to identify each track were interchangeable
- Both sounded natural progression and chordwise
- Both in the ambient/meditative genre

These challenges highlight the critical point the experiment set out to prove: an increasing difficulty in identifying AI music compared to human-composed works. As mentioned in the literature review, AI is becoming the dominant force in certain genres, and the fact that less than half of surveyed participants could correctly identify who composed each piece, is significant. The full results of experiment A can be viewed in Appendix F.

Experiment B

This was the second experiment sent out to participants. Akin to the first survey, it contained two pieces of music, but this time, it was in the instrumental lo-fi hip-hop genre and utilised a different composition method. Although the same AIVA software was used for music generation, human composition was first created this time. The AI was then trained on this human-composed track to create its own composition similar to the human track. The

resulting AI track lacked the quality level compared to the human track. This production method was intentionally chosen to highlight that, at present, some form of skill and luck is required to create an indistinguishable AI composition. The results of this experiment showcase the ease with which tracks were identified compared to the first experiment. To understand the experiment's results sufficiently, 'Piece 1' was the AI composition (Refer to Appendix G1) and 'Piece 2' was the human composition (Refer to Appendix G2).

For the second experiment, there were thirty-six respondents. Similar to the first survey, it shared a majority in gender and age groups, with 55.6% of participants being male and 69.4% being from the 18-24 age category. However, this time, there was a lower percentage of people who had formal music education, with it only sitting at 38.9%. This adds an interesting layer to the survey as many people with no formal music education could still identify the AI composition correctly. All participants in experiment B listened to music daily. As seen in Figure 6 below, two-thirds of participants correctly identified Piece 1 as an AI-composed work, with only 5.6% unable to confidently distinguish between the two. This is a much greater success rate compared to the first experiment, with just over a quarter of people incorrectly identified piece 2 as the AI work. This was unexpected due to the low quality of the AI composition, but it could be due to the low number of people with formal music education who took the survey.

Which piece do you think was composed by AI?

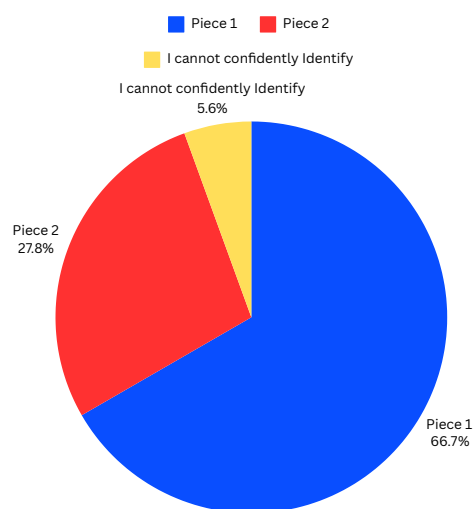


Figure 6: Pie chart of result from a question in experiment B

The confidence levels of participants' answers for this experiment can be viewed in Figure 7 and were quite similar to experiment A. The significant difference here is that everyone who was extremely confident in their answers had identified the AI composition.

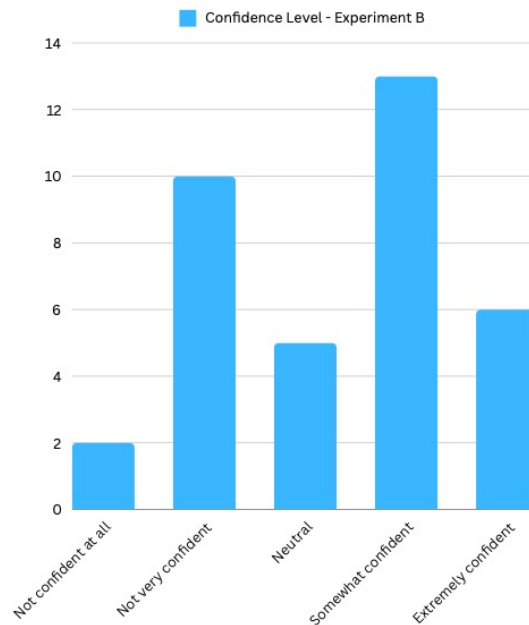


Figure 7: Bar chart of result from a question in experiment B

People felt Piece 1 because the AI composition was more defined than experiment A's. Some of the reasons included:

- It was boring with basic, blocky chords and had little rhythmic variation compared to Piece 2
- It was simple
- It sounded like a beginner's first attempt at a composition

These themes repeat throughout the majority of correct answers, making a much more clear-cut reasoning compared to the first experiment. This decisive reasoning was also why people thought Piece 2 was the human composition. Some of these reasons include:

- Sample choice seemed to be human decision-making
- More personality and emotion
- It sounded much more like a complete professional piece
- The drums and chops are not something AI is capable of yet

Again, these themes were present in the majority of survey responses. One response in particular stated that the pieces were different genres. This is worth noting as the AI created its composition through training itself on the data of the human composed piece.

Few participants noted any challenge distinguishing each piece compared to the first experiment. This, of course, lines up with the results, with two-thirds correctly identifying each piece. Many of the people surveyed noted there was a “gulf in quality” or automatically felt AI-created Piece 1. This highlights that a level of skill and luck is required to create a piece of music with AI software that makes it indistinguishable from human composition. Based on this experiment, it can be posited that AI music generation software - especially that which bases its compositions off human -created data - cannot currently replicate complex, human-generated musical compositions.. The full results of experiment B can be viewed in Appendix H.

Participants View on Artificial Intelligence

At the end of experiment A, several questions were asked regarding Artificial Intelligence’s place in the music industry to obtain a public view of the topics discussed in the interviews. These questions were:

- *Do you believe there is a place for Artificial Intelligence in the music industry?*
- *Do you think it is important to be able to identify music that has been composed by AI on music streaming platforms such as Spotify? If you answered yes to this question, please state why.*

Regarding the first question, participant responses were split. People thought AI belongs in the music industry for the following reasons:

- Educational Purposes
- To bolster creativity with different tools, etc
- Cost reduction/Streamline specific processes

These are all valid arguments, particularly the last one. AI may become a go-to option if someone needs to get an audio component quickly and cheaply without worrying too much about quality. On the other hand, there were several reasons why people believed AI does not have a place in the music industry, some of which included:

- AI lacks a human ‘touch’ and does not do anything spectacular currently
- It will deprive musicians of jobs
- AI can be trained off human works, which is viewed as theft

These points are genuine concerns and show that a value is still placed on human generated work over artificially created work.

Regarding whether or not an identifier should be present on streaming platforms to highlight a composition as AI, 72.5% of participants agreed this should be the case. This is

encouraging in the development of something akin to the aforementioned '*AI Music Mark*'. The consensus gathered from the survey was that people want to know what they are listening to and that human musicians should be fairly credited for their work. The point was also raised similar to Seán Donegan from IMRO, where it would be difficult to govern what songs the badge should be placed on as AI involvement can vary. Labelling a track as AI may not be deemed fair if a composer has only used a AI as a extremely element of their production process.

Conclusion

In conclusion, the methods implemented to gather information for the analysis section have worked effectively. They have contributed significant information to form an answer to this thesis' research question. The interviews provided compelling insights from researchers, copyright specialists and artists. Each had their own opinions on the current landscape of AI's relationship with the music industry. Although some of these opinions may not have aligned with the views of this paper, they offered plenty of material to consider when detailing the possible drawbacks of implementing an ethical identifier for AI compositions. The two experiments highlighted the ever-increasing quality of AI compositions and the inconsistencies of track generation.

Dr Martin Clancy presented a hopeful outlook on AI's place in the music industry, feeling it would bolster creativity. He is confident that an ethical identifier should be implemented in some form, possibly through metadata, instead of laws being put in place. He thought marking particular AI tracks on streaming services would be too difficult as many would fall into a grey area. Seán Donegan shared similar views to Clancy regarding AI lowering the entry barrier to the music industry and encouraging creativity but was not particularly in favour of any ethics mark. However, he thought data mining laws needed to be examined as they could potentially leave vulnerabilities for AI companies to scrape copyrighted material without repercussions.

From an artist's perspective, Sebastian Adams offered an activist approach through his composition projects involving copyrighted material. His main concern was with artists not understanding how copyright protects them and large companies unfairly exploiting musician's intellectual property to gain money and power. In terms of a marking system for AI tracks on streaming platforms, he thought it was a positive idea to present so the public is not tricked into listening to compositions which they think are human-composed but are AI.

In comparison, most survey participants agreed with this view and placed value in knowing what they were listening to. Experiment A highlighted the decreasing gap in the ability to distinguish the difference between AI and human compositions, with only 27.5% of participants correctly identifying the AI composition. In experiment B, the results showcased the inconsistencies of AI music generation, with two-thirds of participants identifying the AI track correctly due to the noticeable difference in quality compared to the human composed track.

Discussion

Introduction

The outcomes of this research have provided insight into how Artificial Intelligence's relationship with the music ecosystem is moving forward. When compared and contrasted, the information obtained from each interview presented insight from three different perspectives. These views, paired with the data gathered from the experiments, help formulate an answer to the research question: Can integrating an ethical identifier that highlights AI compositions on digital music streaming platforms positively impact the music ecosystem? This chapter discusses the findings of these interviews and experiments and provides a detailed reflection on them. It will also discuss how the data gathered compares to material referenced in the literature review and detail the research's limitations.

Interpretation of Results

Overall, the information gathered from the interviews and experiments has aided in formulating an answer to the research question. Each interviewee had a different perspective on the topic and this allowed for an open-minded evaluation. Both Dr Martin Clancy and Seán Donegan presented ideas on why it may be challenging to implement a checkmark to identify AI compositions on streaming platforms. At the same time, Sebastian Adams found it a valuable concept to show consumers what they are listening to. However, the amount AI can be involved in a project ranges from being an insignificant part, such as a reverb²⁴ design tool, to creating an entire composition. This creates a grey area when labelling AI tracks. It becomes challenging to categorise a song as AI if it has only had a minor involvement in the process.

Donegan had a more fatalist, dystopian view of the idea, stating that in the future, people would not care what they were listening to or how it was made. Although this is a valid point of view, it does not correlate with survey participants' opinions, with over 70% favouring some form of ethical identifier on streaming platforms. This demonstrates that people care about what they listen to and aligns with Adams' view of labelling tracks on streaming platforms. Clancy's outlook was more optimistic, stating there is a definite need for an ethical identifier that creates standards the music industry must follow to obtain it. He believed it to be vital in protecting the rights of the human creator. With the rate at which AI

²⁴ Short for reverberation, in this context it is an audio effect to add atmosphere and space to a sound (Sones).

technology is advancing, and laws are too complex to change globally, it will only become increasingly difficult to protect these rights.

In a workshop held by IMRO on Artificial Intelligence, guest speakers from Complete Music Update (CMU) presented the point that AI-generated content will begin to overflow society (Taylor). This could culminate in the reckoning Sebastian Adams mentioned, where humans must decide how much they value human art. As these tools are widely accessible to the public, more people are using them for creative purposes. This will lead to the creation of many sub-par AI compositions, such as the AI piece from experiment B which could flood a user's social media experience. The CMU speaker dubbed this phenomenon the 'AI Winter', where a stark increase in low-value AI content will be produced.

Regarding the two experiments, the results highlighted the increasing difficulty in distinguishing AI and human compositions. However, skill and luck are also required to produce satisfactory results. In experiment A, only 27.5% correctly identified Piece 2 as AI. This percentile could easily decrease in the future as technology improves. Participants fared much better with experiment B, as two-thirds of participants identified the AI composition correctly. This was due to the sub-par quality of the AI composition. It proves that skill and luck are required to prompt software such as AIVA to create satisfactory results correctly. Forty compositions were produced for experiment A before settling on a composition to meet the standard required. This highlights the nature of the lottery process.

When the track from experiment B was trained off the human composition, it could not effectively break down the elements and re-create them. If the AI were trained off it, any composition trialled that did not include a simple rhythm or identifiable instruments would produce sub-par results. For example, a trial song that was trained off Jamie XX's 'The Rest is Noise' (Refer to Appendix I) seemingly interprets synth patches and song dynamics as filter sweeps. This ruins the flow and structure of the resulting AI-generated composition. Overall, each track produced had some form of imperfection. Receiving the composition used in experiment A with little imperfections may have due to the lottery nature of the composition generation process.

Significance of Findings

The information gathered from the interviews and experiments indicates that an ethical solution, such as a mark, could be a positive step key music industry stakeholders will take in regulating AI within the music industry. However, this badge may not necessarily be shown beside AI compositions on streaming platforms. These key stakeholders are willing to adopt change, which should benefit artists. For example, Seán Donegan, CCO of Ireland's music copyright organisation, may not have been keen on the idea of Dr Martin Clancy's '*AI Music Mark*', but acknowledged there was a need for something to be implemented to protect the rights of musicians. On the other hand, Martin Clancy was quite passionate that an ethical badge obtained through upholding standards when using AI, such as AI:OK, could be the way forward. Major labels and streaming services also seem to agree with the solution, as they already implement it into their metadata. This form of ethical badge may work as a long-term option, as Sebastian Adams thought marking individual songs with a system like the '*AI Music Mark*' would only be helpful in the short term.

With regard to the experiments, it was significant that some form of ethical mark is required as most people could not identify the AI composition in experiment A. Many people also stated they wanted to know the creative origins of what they were listening to. This is where an ethical checkmark such as AI:OK could act as a pledge to convey digital trust by companies to put human musicians first. A badge identifying AI songs may be challenging to implement due to the reasons stated in the previous section. It would be hard to gauge AI involvement in a composition and set a threshold that every song above it is classified as an AI composition.

Comparison with Previous Studies

This research project built on previous work by the sources cited in the literature review. This paper is a real-world litmus test for the '*AI Music Mark*' documented in Dr Martin Clancy's PhD paper. Conducting interviews with industry professionals and attending a talk on Artificial Intelligence gave a good indication of how the concept could work in real-world practice. The concerns raised about the ability to mark each composition due to varying degrees of AI involvement are valid. An ethical identifier setting ethical standards for entities in the music industry that can be acknowledged by the consumer, such as the D-Seal mentioned in the literature review rather than a badge placed on each AI composition, will work better in practice.

This research also improved on the experiment carried out by Tidio, which is detailed in the literature review. As AI technology has advanced substantially since that experiment took place, a new perspective was obtained on the topic. The experiment backed up the claims from Tidio, stating that people struggled to tell the difference between AI and human compositions. The improved technology demonstrated that the gap between AI and human compositions is shrinking. However, it also showed that luck and skill are still factors that produce adequate results. This was present in how many attempts it took to get a composition fit for experiment A, and in the sub-par quality of the AI, composition used in experiment B.

Limitations and Implications

Several areas of this project encountered limitations throughout the research, which served as valuable learnings for future research. Artificial intelligence is an evolving area in the music industry, with a small pool of industry professionals available to interview, particularly musicians. During this research, most musicians considered for an interview refused to use AI in their creative process or were heavily involved in using AI but unavailable for an interview. However, the benefit of it being a small community meant that the people willing to discuss the topic were very forthcoming. It also forced the research to explore unconventional methods to conduct a substantial investigation, which would not have happened without a small pool of interview candidates.

The almost lottery-like nature of the AIVA software was something that was not anticipated at the beginning of the research. The high inconsistency rate in composition generation was unexpected but presented positive outcomes simultaneously. The time spent to produce a usable track for the first experiment was a juxtaposition to how long it took the AI to produce one of these tracks. From this trial of the AIVA, it seems the software focuses on the speed and quantity of compositions generated, not the quality of the tracks. This proves quite promising for musicians, as AI still has difficulty consistently producing high-quality work. Sebastian Adams likened this point to the human composition process, which is an ironically accurate comparison.

Another aspect of the music generation software problem is the rapid advancement of the software. Towards the end of this research project, several new services offering AI composition generation were released, such as Udio which is producing high quality songs with vocals (Refer to Appendix J). The software is progressively advancing, which may have made the compositions showcased in the experiments of a higher quality. However, the

experiments did show that at AI's current skill level, it can comfortably pass its compositions as human compositions. This highlights the urgent need for some form of ethical identifier to be adopted by companies in the music industry to protect musicians in the future.

Finally, as the experiments were conducted on a small scale, having a broader range of participants may have offered more value to the research. Although the experiments produced satisfactory results, this may have been different with a broader range of participants with varying degrees of musical knowledge. However, it lays the foundation for an expanded experiment in future research as it highlights the issue of AI music getting closer in quality to human-composed music. In the future, a broader pool of participants and using different AI composition software when conducting the same experiment may yield different results.

Conclusion

The findings discussed from the interviews, experiments, and talk can be deemed significant in finding an answer to the research question posed at the beginning of this thesis. The information gathered from the interviews showed that an ethical checkmark placed on AI-composed works on streaming platforms, may be too difficult to implement due to AI's varying involvement in the production process. Instead, a more straightforward route forward is an ethical identifier such as AI:OK, which entities could obtain by complying with ethical standards when using AI. This can convey digital trust to consumers, such as D-Seal in Denmark, discussed in the literature review.

The results of the two experiments revealed how advanced AI composition is becoming, and most participants struggled to identify AI composition in experiment A. Alternatively, generating both AI compositions utilised in the experiments highlighted the inconsistent quality of the tracks produced. The results also indicated that most participants would like to see some form of identification with AI music on streaming platforms as they care about what they listen to and where their music comes from. The project used the reviewed literature to good effect, but the interviews and experiments did come with challenges that should be solved in future research.

Conclusion

Introduction

This research aimed to find an answer to the research question: Can integrating an ethical identifier that highlights AI compositions on digital music streaming platforms positively impact the music ecosystem? Conducting interviews and experiments aided in forming an answer to this question but also provided insight into how this research can be explored further. This section acts as a summary of the entire research paper.

Summary of Findings

The findings of this study contributed to several different conclusions. The most apparent one is that people find it increasingly challenging to differentiate AI and human compositions. This will only become more difficult as the technology improves and the AI becomes more consistent in quality with its compositions. Globally, laws are too different to implement a solely legal solution. Therefore, the best option is an ethical checkmark that holds companies to a set of standards around AI. There are too many intricacies for something such as '*AI Music Mark*' to exist to identify AI compositions on streaming platforms. Many tracks will eventually utilise AI tools in some form, so implementing a marking system to tag songs is not feasible as it would be impossible to identify the involvement of AI in a song. An ethical mark such as AI:OK makes the most sense globally, where it will act like the D-Seal to convey trust and sustainable practices to consumers in the music industry. This option also provides sufficient protection for musicians from AI.

Implication of Findings

The critical artefact this research has highlighted is the need for further research and development in this field. Due to the rapid advancement of AI technology, a solution needs to be implemented relatively soon to protect musicians. This compels an ethical badge such as AI:OK to become a priority as government policy and laws are too slow to keep up with technological advancements. AI compositions will become increasingly difficult to identify, and the general public may no longer realise what they are listening to. This was proven in the experiments with the sheer lack of participants being able to identify the AI composition in experiment A.

Regarding public opinion, Seán Donegan's view that people will eventually not care that AI has created the songs they are listening to is ill-informed. Nearly all participants in

experiment A gave their views on why human creativity should be highlighted and prioritised, and they wanted to know the creators of the music they consume. Even though this experiment was small-scale and had only eighty participants, the fact that the themes of putting human creativity first resonated so frequently throughout the responses proves people will still care. This is backed up further by both Dr Martin Clancy and Sebastian Adams, who opposed this viewpoint.

Limitations and Future Research

Throughout this research, the main limitation encountered was how effective implementing an ethical badge for AI compositions on streaming platforms would be in practice. There are too many variables involved in creating a song that AI could play a part in. It is simply too difficult to identify if AI has been involved in the process and then determine how significant of a role it played in the completed process. It becomes even more challenging to draw parameters on what counts as a track that should be labelled with an AI badge. Instead, the priority should be placed on implementing a badge that holds entities to ethical standards surrounding the use of AI, such as AI:OK, which was previously discussed.

Another emerging problem is the data mining regulations worldwide. There are loopholes in Irish law and in other countries globally where AI companies can legally scalp copyright material to train their machines. This could compromise the music industry as it could allow AI advancement to exceed expectations. This could lead to super sophisticated AI systems before regulation comes into play. In this instance, Sebastian Adams' claim of AI possibly deserving the right to receive copyright applies. If mishandled, this could be detrimental to the music industry and may further condemn musicianship as a career path.

Conclusions

This has further progressed the conversation around Artificial Intelligence in the music industry. An identifier on streaming platforms is not feasible due to the sheer amount of variables involved in creating a track. It has highlighted the need for an ethical badge that upholds a set of standards that companies in the music industry must abide by. This will help protect the future of musicians. This solution cannot rely on legal solutions as they are not unified globally and are slow to change. The results from experiment A document how people struggle to identify a composition as AI. This will only continue to become increasingly tricky, and measures must be implemented to combat this. Taking these steps

will protect artists from suffering further financially as AI creates more sophisticated and popular works.

Recommendations

Several recommendations can be offered to aid in future exploration of this topic. Simply put, they are:

1. Utilise different software in the experiment and see if different results are achieved.
2. Retrieve more artist's opinions as they are the stakeholders it will affect the most.
3. Do not just focus on a solution for streaming platforms but for a solution across the entirety of the music industry.

These recommendations will allow the research into the topic to progress further.

Conclusion

To conclude, an answer to the research question was successfully obtained through an in-depth analysis of the data gathered through detailed methodologies. Although implementing an ethical checkmark to identify AI compositions on streaming platforms was deemed unachievable due to the number of variables involved, it highlighted possible solutions at a surface level. If companies adhered to a set of standards surrounding AI, such as an ethical badge setting these stands like AI:OK, this would protect musician from AI. This protection is needed so the career of a musician won't suffer further financially. This concept should be researched further and urgently due to the ever-evolving nature of AI technology.

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Appendices

Appendix A

A link to the song 'Heart On My Sleeve' by ghostwriter977 (ghostwriter977)

<https://iadt->

[my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/EsPnGKA6JhpMhzQi232lwEcBjJmjNJQiaw-nzMSxJolPsA?e=w3z8oy](https://iadt-my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/EsPnGKA6JhpMhzQi232lwEcBjJmjNJQiaw-nzMSxJolPsA?e=w3z8oy)

Appendix B

A list of interview questions used for each interview.

B1 – Martin Clancy Interview Questions

<https://iadt->

[my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/EhIJKXJOV0NIp8Cuk_Ghju0B1Y1iqOn0ZQZfzvUkef1LQQ?e=ONwOY9](https://iadt-my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/EhIJKXJOV0NIp8Cuk_Ghju0B1Y1iqOn0ZQZfzvUkef1LQQ?e=ONwOY9)

B2 – Seán Donegan Interview Questions

<https://iadt->

[my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/ErDVjQ9HpGlJi3CnsZBb_QQB-XGpf-n2ix64XicvtgkPHA?e=MgtRi9](https://iadt-my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/ErDVjQ9HpGlJi3CnsZBb_QQB-XGpf-n2ix64XicvtgkPHA?e=MgtRi9)

B3 Sebastian Adams Interview Questions

<https://iadt->

[my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/EsjhPPDFjYpGLY2Elfau3TcBsD9Kj9v6VvD2Nsy_pqCJgA?e=1VaAvI](https://iadt-my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/EsjhPPDFjYpGLY2Elfau3TcBsD9Kj9v6VvD2Nsy_pqCJgA?e=1VaAvI)

Appendix C

The recordings/transcripts for each interview.

C1 – An interview with Martin Clancy

<https://iadt->

[my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/Euz1Nmsr89IPgcSkPPuXleUBBFFxpM8VOfcotkir_XibMg?e=mnQ6zw](https://iadt-my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/Euz1Nmsr89IPgcSkPPuXleUBBFFxpM8VOfcotkir_XibMg?e=mnQ6zw)

C2 – An interview with Seán Donegan

<https://iadt->

[my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/EvH_d93JZXxFvJGxl061a5QB4hN8G1eWMaGfIe483SDoWw?e=f83hVM](https://iadt-my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/EvH_d93JZXxFvJGxl061a5QB4hN8G1eWMaGfIe483SDoWw?e=f83hVM)

C3 – An interview with Sebastian Adams

<https://iadt->

[my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/EhBVasxew4FEIcH3QbBD_zEBqNn4bMAMAIW4Kb_BB2NKtg?e=iFX3L](https://iadt-my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/EhBVasxew4FEIcH3QbBD_zEBqNn4bMAMAIW4Kb_BB2NKtg?e=iFX3L)

Please Note there were off the record discussions in both the interview with Seán Donegan and Martin Clancy which have been cut removed each artefact.

Appendix D

The mock-up of how an ethical checkmark could look placed upon AI compositions on Spotify.

<https://sway.cloud.microsoft/IcOZbHHKOQ8BWnE?ref=Link&loc=mysways>

Appendix E

Compositions from experiment A

E1 – Human Composed Piece

<https://iadt->

[my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/E17ZjHzUd0pHly_8yOdtXEwBIUaUawRna1Q6Id8rwC909A?e=4Pcn3Z](https://iadt-my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/E17ZjHzUd0pHly_8yOdtXEwBIUaUawRna1Q6Id8rwC909A?e=4Pcn3Z)

E2 – AI Composed Piece

https://iadt-my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/Ejh-

[1uTvg9VKqXZRqoJsreAByXOs01pcsv6EyzoOUW-fYA?e=QCPcNZ](https://iadt-my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/Ejh-1uTvg9VKqXZRqoJsreAByXOs01pcsv6EyzoOUW-fYA?e=QCPcNZ)

Appendix F

The full spreadsheet of results from experiment A.

https://iadt-my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/EIbRxveDnxAmsr-fq8UOi0B0nc5pl3hSyxgknFxnCOoA?e=Uue61b

Appendix G

Compositions from experiment B

G1 – AI Composed Piece

<https://iadt->

[my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/EnB0n_yvxWpIIIERa87zf0EBFKtrtd1e_O16VFFc1WtC9g?e=RAtWE4](https://iadt-my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/EnB0n_yvxWpIIIERa87zf0EBFKtrtd1e_O16VFFc1WtC9g?e=RAtWE4)

G2 – Human Composed Piece

<https://iadt->

[my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/EsEtiuOlCAdEuuF_Xq7mszABqVLZU1I2lukchPT2yN9Few?e=vrDSsi](https://iadt-my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/EsEtiuOlCAdEuuF_Xq7mszABqVLZU1I2lukchPT2yN9Few?e=vrDSsi)

Appendix H

The full spreadsheet of results from experiment B.

<https://iadt->

[my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/EidHoQ599MdDpUN23vepLxIBpA4npS13WEec87jLmWBnPQ?e=pVeACz](https://iadt-my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/EidHoQ599MdDpUN23vepLxIBpA4npS13WEec87jLmWBnPQ?e=pVeACz)

Appendix I

AI composition trained off Jamie XX's 'The Rest is Noise'.

<https://iadt->

[my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/EvjM_W09e05EmC9WOQXfsqwBEuZm8Tmup9he5ZRxdRDIyA?e=koApCA](https://iadt-my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/EvjM_W09e05EmC9WOQXfsqwBEuZm8Tmup9he5ZRxdRDIyA?e=koApCA)

Appendix J

Example AI composition created using Udio AI music generation software (Lynn).

<https://iadt->

[my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/Et9NnIcD119KvjOT2a2B968BSycCuhUKTvF-XxevKlsL0w?e=vN9cyM](https://iadt-my.sharepoint.com/:f:/g/personal/n00200219_iadt_ie/Et9NnIcD119KvjOT2a2B968BSycCuhUKTvF-XxevKlsL0w?e=vN9cyM)