The Day the Music Died? Generative Artificial Intelligence and its Effect on the Music Industry

A Research Paper submitted to the Department of Engineering and Society

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

Paul Wesley Stepler

Spring 2024

On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

Advisor

Pedro A. P. Francisco, Department of Engineering and Society

Introduction

Listening to music is one of the most shared human experiences. Among many other things, we listen to music while we work, while we study, and while we exercise. Many people will pay money—sometimes considerable amounts of it—to go see their favorite artists perform live. Most people would likely agree that music has a net positive effect on society. It provides an outlet to express emotions, helps motivate us to be productive, and in many cases, brings people together.

Recently, however, a new variable has entered the music scene. In the last year or so, generative artificial intelligence (generative AI) has taken society by storm, seeping into countless facets of life, including but certainly not limited to the music industry. In the grand scheme of things, generative AI is still very new and not yet fully embedded in our lives and routines. But there are conversations taking place regarding what will happen if—or perhaps when—it ultimately does. These conversations cover a wide range of topics, including job security for software developers, academic integrity, and the future of music. Recently there have been all kinds of AI generated songs popping up across the internet, and while many of them are mostly light-hearted and fun, they do raise legitimate concerns about what will happen if they continue to spring up.

One such concern deals with copyright issues. In April 2023, "Universal Music Group—the music company representing superstars including Sting, The Weeknd, Nicki Minaj and Ariana Grande…sent urgent letters…to streaming platforms, including Spotify and Apple Music, asking them to block artificial intelligence platforms from training on melodies and lyrics of their

copywritten songs" (Yurkevich 2023). Generative AI operates by consuming vast amounts of data and then in turn learns how to generate content based on the data it has already analyzed.

AI's use of copyrighted material brings up unique and new problems that must be addressed. A second concern centers on the livelihood of those within the music industry. While this does not pertain to the giants of the industry—people like Taylor Swift and Post Malone who, even in 2020 at the height of the pandemic, still raked in millions—it is much more of a concern for those who do not have fame and fortune to fall back on (Christman 2021). There are countless producers, songwriters, and lesser-known artists in the industry who depend on their profession to get by. If generative AI continues to gain traction in the industry, there is a risk that people will lose their jobs.

These concerns can be encapsulated in the question: what effects might the rise of generative AI have on the music industry? How might it impact the industry as a whole and, perhaps more importantly, how could it impact those whose livelihood depends on their profession within the industry? What actions do we need to take to avoid what Don McLean famously sang about: "the day the music died"? (Don McLean, 1971). To effectively explore these questions, I will frame and support my arguments with the evidence acquired through the analysis and review of a wide variety of sources.

Methodology

Regarding my methodology for this research, I will consider these questions through the lens of actor-network theory, which provides a very helpful way to frame this question. The music industry is not comprised just of the artists themselves; it is a complicated network of people who all work together to deliver a finished product. Through this framework, one can

better understand how the incorporation of generative AI in the music industry impacts and affects all the different actors, because the impacts are not the same across the board by any means. Through the lens of actor-network theory, and through the review of literature on this topic, I will seek to answer questions regarding the influence of generative AI in the music industry.

Background and Significance

As we enter into this conversation, it would be beneficial to have a little more background on the actors involved with AI, the nuts and bolts of AI, and how it actually works. AI brings with it a rather large actor-network. There are the developers who create AI, the developers who code with AI, everyday people who encounter AI in various forms, and the companies who stand to make a massive profit off these AI models, to name a few. It is one of those things that almost everybody interacts with almost daily, on some level or another.

As for how AI actually works at a very high level, the heart and soul of AI is data. Without data, there is no artificial intelligence. “AI works by combining large amounts of data with fast, iterative processing and intelligent algorithms, allowing the software to learn automatically from patterns or features in the data” (SAS Institute n.d.). A very basic example of this is training an AI model to recognize a dog. To do so, you would feed the model a bunch of pictures of dogs, so that when the model receives a picture of a dog that has not been explicitly labeled as such, it will theoretically be able to recognize it.

There are three main kinds of AI that are good to know about: Machine learning, neural networks, and deep learning. Machine learning utilizes things like neural networks and statistics to discover hidden insights within data and datasets, while not being programmed to look for

anything in particular or reach any specific conclusions. Neural networks are a subset of machine learning and are comprised of interconnected units—think neurons in the human brain— "that process information by responding to external inputs, relaying information between each unit". This process requires analyzing the data to discover the connections and meaning from what was previously undefined data. Finally, deep learning utilizes massive neural networks "with many layers of processing units, taking advantage of advances in computing power and improved training techniques to learn complex patterns in large amounts of data" (SAS Institute n.d.).

Each of these three types of artificial intelligence are foundational to generative AI, the kind of AI this paper focuses on. The term generative AI "refers to deep-learning models that can take raw data – say, all of Wikipedia or the collected works of Rembrandt – and 'learn' to generate statistically probable outputs when prompted" (Martineau 2023). In layman's terms, this means generative AI can look at all kinds of different works online—articles, poetry, prose, you name it—and, when prompted, can generate a "new" work based on all the data it has consumed related to the prompt it has received. ChatGPT, GitHub Copilot, and Google Gemini are some examples of current popular generative AI models.

It would also be helpful to have a high-level understanding of how the music industry functions. Within the music industry are various sub-industries, each with their own specific focus: recording, digital music distribution, licensing, artist management, and audience and fan attention are a few of them (Soundcharts Blog n.d.). Within these and other areas are countless different actors who belong to the overarching music network. Artists, songwriters, managers, band members, producers, venue managers, record managers, and plenty of others, all have a stake in what the music industry does and how it operates.

Within the music industry, a few conversations have cropped up regarding how generative AI could be used. It is generally agreed that generative AI will inevitably influence the music industry, with some even saying the use of generative AI signifies "the dawn of a whole new music business" (Kimbrell 2023). Another common opinion is that AI can be a helpful tool in a musician's creative process. Gideon Kimbrell, in an article in *Rolling Stone*, points out that artists can **"**use AI to overcome writer's block, ensure that style and content tone is unique in the final stages of editing, and fill skillset gaps (e.g., musicians making album art, songwriters generating vocals, etc.)" (Kimbrell 2023).

Another topic of conversation centers around the inherent humanity of music, and how we ought to be cautious with how much power AI is given. Jessica Powell, chief executive of the start-up Audioshake, points this out, making the point that "Taylor Swift is far more than a Taylor Swift song" (Hunter-Tilney 2023). These questions raise some compelling points that are worth considering. Inherently, humans desire connection with one another, and music serves as a unique medium in which this can occur. When a variable such as Generative AI enters the equation, it destabilizes that connection. This may have lasting consequences for the music industry writ large.

The discussions around AI's impact in the music industry is but one example of the critical juncture we are approaching with AI more broadly. It certainly has a more pressing relevance to some than others, but AI in music will impact massive swathes of people—from the top artists on Spotify and Apple Music to those who simply stream music on a Spotify or Apple Music account. It is a critical part of the broader conversation around AI, and serves as an

intriguing catalyst for this conversation, given the broad spectrum of ways it could impact the industry.

Literature Review and Discussion

The first argument centers on the copyright issues AI could cause. There are two primary types of copyright issues that could arise: AI using copyrighted material to generate music, and artists taking work from other artists that was generated using AI. Regarding the first type, there have already been problems with AI infringing on copyright. One of the first stories about AI-generated music that garnered significant attention was its ability to create songs in the style—or even with the voice of—artists without their consent. In April 2023, "a TikTok user released the song 'Heart on My Sleeve', a song that used generative artificial intelligence to create a track in the style of rappers Drake and The Weeknd. The song got 15 million views on TikTok and 600,000 streams on Spotify before it was removed from platforms" (Berry 2023). Songs like this prompted the Universal Music Group in April to send letters to Spotify and Apple Music, among other streaming platforms, urgently asking them to not allow artificial intelligence to use melodies and lyrics of copywritten songs hosted on their platforms as training data. (Yurkevich 2023). Without any sort of regulation, it will become increasingly difficult to determine what is the authentic work of an artist, and what is a copy of it.

Regarding the second kind of copyright issue, on March 16th, 2023, the United States Copyright Office (USCO) "took a firm stance that AI output cannot be copyrightable" (Kimbrell 2023). In the statement of policy, the USCO claims "it is well-established that copyright can protect only material that is the product of human creativity. Most fundamentally, the term 'author', which is used in both the Constitution and the Copyright Act, excludes non-humans". It

is worth noting that “Individuals who use AI technology in creating a work may claim copyright protection for their own contributions to that work”, but anything included that was AI-generated is fair game (USCO 88 FR 16190). This could lead to the same piece of AI generated music appearing in several works by different artists—and while based on the above policy from the USCO this is perfectly legal, it could still lead to disputes among these artists. If nothing else, it has the potential to simply make music less interesting. Part of what makes music great is that it is an expression of an artists’ original ideas, emotions, and creativity. If that starts to get replaced with recycled pieces of AI-generated content, a piece of musical magic will be lost.

The second argument we will consider focuses on the inherent humanity of music and music composition. Melissa Avdeeff, from the School of Media and Performing Arts at Coventry University, in her article, “Artificial Intelligence and Popular Music: SKYGGE, Flow Machines, and the Audio Uncanny Valley”, discusses in-depth the concept of AI’s role in music production. In this article, her use of the term “AIPM (artificial intelligence popular music)” is analogous to what this paper refers to as “generative AI”. Of particular interest to the questions posed in this paper is her idea of the Audio Uncanny Valley. Avdeef writes, “Because of the way in which AIPM is generated, there is great potential for unfamiliar, novel, and at times uncanny, sounds to be created…Human ears, and aesthetic expectations do not influence AIPM generations, but rather they are formed from probabilities, code, and constraints” (Avdeef 2019). At the end of the day, generative AI can only be as “creative” as the limitations in its source code allow it to be. One of the beauties of being human is to experience a sudden burst of creativity, finally getting past whatever block has been holding him back for who knows how long. AI has no such experience—it simply compiles, executes, and repeats in a dull, dry, disinteresting loop.

In refutation to this idea, however, some may argue that, while there are other spheres in which AI cannot harness true creativity, music is not one of them, given the very structured and consistent nature of music theory itself. Avdeef herself writes, “it should be noted that there has long been an intimate connection between music and algorithms, as many musical formats are also bound to particular sets of rules, or algorithms” (Avdeef 2019). There is no denying music theory is by nature mathematical and algorithmic—seemingly a field in which something like generative AI would thrive. But the actual music that artists write is so much more than just music theory. Jessica Powell, while arguing that concerns of an AI takeover in the music industry are overblown, points this out. “What is the story behind a song”, she writes, “Who is performing it? What is their larger social or cultural context? How are they interacting with their fans? Taylor Swift is far more than a Taylor Swift song.” (Hunter-Tilney 2023). Her overall point here is people should not be worried about AI taking over music because of all the other external factors that make music special. But every factor she mentions—the story behind a song, the performer, the context, and fan interaction—all have to do with the person who wrote the music. So, implicit in these claims is a claim that the human element of music is what brings people in.

In light of this idea, let us further investigate Powell’s claims about Taylor Swift. To say Taylor Swift is more than a Taylor Swift song is maybe the understatement of the century. Unless one has been living under a rock for the last year and a half or so, he has probably heard about “The Eras Tour”, Swift’s most recent—and by far most successful—concert tour. It is not only her most successful tour, though, it is the most successful tour of all time by a wide margin. The Eras Tour was the number one tour both in North America and worldwide, and it brought in a ridiculous 1.04 billion in revenue (Sherman 2023). That alone is remarkable, but when you take a

deeper dive into the numbers and compare them to those of other top-grossing concert tours, it becomes even more staggering.

The second highest-grossing tour of all time, according to Wikipedia, was Elton John's "Farewell Yellow Brick Road", which grossed a little over 939 million. That is still a massive number and, at first glance, puts him not too far behind Swift. But these numbers are not the whole story. It took John just under five years and 330 shows to reach that number—Swift hit one billion on December 8, 2023. Meaning it only took her a little under eight months, and sixty of her 152 total shows. That puts her average gross per show at a mind-boggling 17.3 million—nearly fifteen million higher than John's average, 2.8 million. In fact, no one in the top twenty comes within five million of Swift's average grosses. The closest is Beyonce, who brought in a total of almost 580 million in her 2023 tour across 56 shows, with an average gross of 10.3 million.

The bottom line is, Taylor Swift fans do not spend an exorbitant amount of money simply to listen to her songs live: they go to see *her* perform; they go because Taylor Swift herself, through her music, has impacted their lives in some way or another. They go because they want to experience the songs they love—and for many fans the songs they grew up with—along with tens of thousands of fellow fans who share that same passion. They go because, even though the vast majority will not personally interact with her, they can say they saw Taylor Swift live—a massive source of clout in this day and age. If you asked the now nearly 6.02 million fans who have attended "The Eras Tour" in 2023 if they would sacrifice the same amount of time and money to go see a concert centered around AI-generated music, it seems a pretty safe bet they would say no (McCluskey 2024). This is almost certainly true of any fan who invests time and

money into seeing their favorite artist, but Swift stands alone as an especially powerful example.

Regardless of what one thinks about whether AI-generated music can be considered creative or not, another point that must be considered is the general reaction of the public to AI's presence in the music industry. An example of this can be found as far back as 1956, in response to a performance of Hiller's the *Illiac Suite.* "The first three movements of the *Illiac Suite* were composed algorithmically, based on traditional rules of tonal harmony", but "the fourth movement was based on probability tables, or Markov chains. They utilized the ILLIAC computer to produce intervals for each instrument, constrained by the expectations of tonal harmony" (Avdeef 2019). The audience's review of this suite was not exactly glowing. After the initial performance, "news sources derided the piece, claiming the audience was 'resentful' of being made to engage with an 'electronic brain', with one listener warning that it 'presaged a future devoid of human creativity'" (Avdeef 2019). Another, more recent example, comes from responses from "a 2018 concert of experiments in machine learning for music creation". While this concert was received relatively well, Avdeef writes:

> "amongst the positive reviews were those who expressed concerns about the new technologies and their effects…one audience member remarked, 'The computer generated pieces "miss" something—what we call this "spirit", emotion, or passion?', with another adding 'I think the science is fascinating and it's important to explore and push boundaries, but I'm concerned about the cultural impact and the loss of human beauty and understanding of music'".

Since the 1950s all the way up to today, people have expressed concerns about the erasure of human creativity from music. So, in some respects, the question of "should generative AI have a

significant role in the music industry" is maybe a less significant question than "how will the general public receive AI in the music industry?"

The final argument looks at the impact generative AI could have on individuals whose livelihood depends on their career in the music industry. In particular, consider the impacts it will have on those in the industry who are not artists—such as band members and producers. In current conversations about AI and the music industry, one of the most common talking points one hears claims "AI is not a replacement for human creativity, but rather a tool to enhance it" (Musicians Institute 2023). Gideon Kimbrell writes that "creators and musicians [could leverage] AI in their creative processes", or they could use AI to "fill skillset gaps", like musicians, creating album art, generating vocals, or songwriting. (Kimbrell 2023). AI certainly could do those things, but it would come at the cost of human jobs. Everything Kimbrell mentions can be—and until recently have been—the job of other humans. Incorporating AI into these fields may benefit individual artists in the long run because it is a cheaper option, but it will hurt the musicians, graphic designers, and songwriters who make a living working with other artists.

Granted, oftentimes this type of work is not the full-time work of whoever is doing it. So now consider a field that would be much more heavily affected by the integration of AI: production and sound engineering. There are already pieces of software out there capable of mixing and mastering tracks. One such software is "LANDR, which stands for 'left and right', [which] can master a full, release-ready track, matching the industry loudness levels for streaming platforms like Spotify and Apple Music. It uses advanced algorithms and machine learning techniques to analyze and enhance the quality of audio tracks" (Clarke 2023). As these kinds of software continue to improve and become more popular, it will likely become much

more convenient for artists to simply use them for mixing and mastering their tracks, rather than a professional sound engineer. Once again, this may benefit the individual artists in the long run, but it could obliterate human jobs from an entire field of the industry.

Conclusion

The question this paper sought to answer was to what extent will generative AI impact music? The answer depends on to what extent it is incorporated into the industry, but it will likely come at the cost of at least some human jobs. It could be just a few jobs in an obscure corner of the industry, which would hardly even cause a blip in the radar of the average person. Or it could take out massive swathes of jobs across production and mastering and other similar fields. Either way, there are people out there who will personally feel the effects of its rise.

This research paper is not meant to be an attack against artificial intelligence. AI is a testament to human knowledge and achievement, and it should be recognized as such. The goal of this paper, rather, is to point out the ways in which AI could hurt the music industry more than it would help it. This is important on both the logistical level with issues like copyright, but it is arguably more important on a philosophical level with the preservation of human creativity and expression. It is imperative to remember that humans have always been the heart and soul of musical expression, and they should continue to be. Music is a direct result of a human being creating something; AI-generated music is the result of something a human being created creating something. In AI-generated music then there is, in essence, an added degree of separation from its human components. If AI continues to take hold within the industry, we may truly be headed for the day the music dies.

References

(2023, May 24), *AI in Music Production: Enhancing Human Creativity or Replacing It?* Musicians Institute; Musicians Institute College of Contemporary Music. https://www.mi.edu/in-the-know/ai-music-production-enhancing-human-creativity-replacing/.

Avdeeff, M. (2019). Artificial Intelligence & Popular Music: Skygge, flow machines, and the audio uncanny valley. *Arts*, *8*(4), 130. https://doi.org/10.3390/arts8040130.

Christman, E. (2023, April 18). *Billboard's U.S. Money Makers: The top paid musicians of 2020*. Billboard. https://www.billboard.com/music/music-news/musician-us-money-makers-highest-paid-2020-9602078/.

Clarke, L. (2023, June 22). *Artificial Intelligence: The Future of the Music Industry?* Recording Arts. https://recordingarts.com/artificial-intelligence-the-future-of-the-music-industry/.

Copyright Registration Guidance: Works Containing Material Generated by Artificial Intelligence. 88 F.R. 16190 (effective March 16, 2023). https://www.federalregister.gov/documents/2023/03/16/2023-05321/copyright-registration-guidance-works-containing-material-generated-by-artificial-intelligence.

Don McLean. (1971). American Pie [Song]. On *American Pie.* Capitol Records.

Hunter-Tilney, L. (2023, July 20). *AI in the Music Industry*. Financial Times; Columbia University. https://www-ft-com.ezproxy.cul.columbia.edu/content/2c1c2016-69b7-48aab333-4c1380bb9102.

Kimbrell, G. (2023, May 9). *How Generative AI Can Impact Music and Content Creation*. Rolling Stone. https://www.rollingstone.com/culture-council/articles/how-generative-aican-impact-music-content-creation-1234731365/.

Lynch, S. (2021, February 16). *Enhance, not Replace: AI's Potential to Make Our Work – and Lives – Better*. Stanford University Human Centered Artificial Intelligence; Stanford University. https://hai.stanford.edu/news/enhance-not-replace-ais-potential-make-ourwork-and-lives-better.

Martineau, K. (2023, August 18). *What is Generative Ai?*. IBM Research Blog. https://research.ibm.com/blog/what-is-generative-AI.

McCluskey, M. (2024, March 15). *Taylor Swift Eras tour anniversary: By the numbers*. Time. https://time.com/6900208/taylor-swift-eras-tour-anniversary-stats/.

SAS Institute. *Artificial Intelligence (AI): What it is and why it matters*. SAS. https://www.sas.com/en_us/insights/analytics/what-is-artificial-intelligence.html.

Soundcharts Team. (2024, January 1). *Market intelligence for the music industry*. Soundcharts. https://soundcharts.com/blog/mechanics-of-the-music-industry.

Sherman, M. (2023, December 8). *Taylor Swift's Eras Tour is the first tour to gross over $1 billion, Pollstar says*. AP News. https://apnews.com/article/taylor-swift-eras-tour-billion-dollar-record-52945111233438b1f2166aa19eee365f.

Yurkevich, V. (2023, April 18). *Universal Music Group calls AI music a "fraud," wants it banned from streaming platforms. Experts say it's not that easy*. CNN. https://www.cnn.com/2023/04/18/tech/universal-music-group-artificial-intelligence/index.html.