

## ARTIFICIAL INTELLIGENCE IN MUSIC COMPOSITION AND PERFORMANCE

**Dr Gabriel Ademola Oyeniyi<sup>1</sup>, Joshua Ayobami Oyeniyi<sup>2\*</sup>**

<sup>1</sup> Faculty of Church Music Nigerian Baptist Theological Seminary, Ogbomoso

<sup>2\*</sup> Department of Creative Arts, Faculty of Arts University of Lagos (UNILAG).

*The authors declare  
that no funding was  
received for this work.*

**\*Correspondence:** Joshua Ayobami Oyeniyi



Received: 19-August-2025

Accepted: 06-September-2025

Published: 07-September-2025

**Copyright** © 2025, Authors retain copyright. Licensed under the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.  
<https://creativecommons.org/licenses/by/4.0/> (CC BY 4.0 deed)

This article is published by **MSI Publishers** in **MSI Journal of Arts, Law and Justice (MSIJALJ)**  
**ISSN 3049-0839 (Online)**

The journal is managed and published by MSI Publishers

**Volume: 2, Issue: 9 (September-2025)**

**ABSTRACT:** Artificial intelligence (AI) is changing the way music is being created and performed and is, therefore, revolutionizing the classic approach to music production. With the incorporation of Artificial Intelligence (AI) in music writing and performance, the focus in creative works seems to have moved significantly away from traditional authorship, creativity, and human sensitivity. This paper aims to discuss the changing role of AI in the music industry as a helper and a partner in the creation of music and to understand the multifaceted role of AI in contemporary music-making in regard to the self-automation or augmentation of the creative process in music. In this paper, we investigate AI-enabled composition tools, performance improvement technologies, and generative models to discuss how AI can help musicians develop their creativity without compromising the emotional content of music. Moreover, the discussion includes the humanisation of AI-generated music, where the algorithms are tuned to reproduce the natural human touch in terms of timing, dynamics, and phrasing, thus balancing the automated and the authentic. However, the attempts made in AI's quest for creativity are a half-

hearted attempt at originality and showcase a lack of originality in its output, which raises the question about the originality of AI in music and demonstrates the challenges posed in distinguishing between impersonation and innovation. As a result, the paper discusses ethical issues such as authorship, originality and the role of human musicians in the future. Through the use of case studies and critical analysis, we try to offer a guarded optimism that AI can be a useful adjunct rather than a competitor to human creativity and thus lead to a new partnership between technology and musicality.

**Keywords:** *Music Composition, Artificial Intelligence, Performance, humanisation.*

## INTRODUCTION

Determining melody and rhythm, harmonizing, composing voice-leading or counterpoint, arranging or orchestrating, and engraving (notation) are some of the tasks that have historically been involved in the composition of music (Fernández & Vico, 2013, p.515). Is it possible for machines to create music? Is composition a creative act of inspiration that is difficult for modern technology to accomplish, or is it something that a computer could help with? Algorithms that carry out particular composing tasks are described in this article. Both scholars and performers find inspiration in the fascinating field of autonomous music composition. An algorithmic component that decides which notes or sounds will be heard, when, for how long, and at what level is incorporated into the systems that carry out this duty (Kaliakatsos-Papakostas, Floros, & Vrahatis, 2012, p.426). Artificial intelligence (AI) has advanced significantly in a number of domains in recent years, including music composition. With an emphasis on how AI algorithms are being applied to produce innovative musical compositions, this essay will examine the role of AI in music production. AI has the ability to completely transform the composition and production of music, providing a plethora of chances for artists and composers to explore novel sounds and styles.

It is reasonable to assume that studying music will provide insight into how the mind and/or brain function because it is such an integral aspect of human behavior on many levels, including social, educational, sociological, and emotional. Since music

tends to overcome any gaps between emotive and intellectual aptitude, we may be able to use it to explore the relationship between the two (Sloboda, 1985).

## **Music Composition**

Music is generally described as a sequence of pitches, rhythms, or both in specific patterns. Music composition, sometimes referred to as music generation, is the process of creating a new piece of music. An original composition can also be described using this term (<https://www.copyright.gov/prereg/music.html>, 2019). Although music is "organized sound," a composition written in standard staff notation does not fully depict the piece's actual sound; instead, musicians will incorporate subtleties and patterns of minute changes in pitch, tempo, and other musical aspects. Without these rhythms, the music would not sound natural, and they also help to clarify the musical concept of gesture or expressiveness. Although the challenge of mechanically producing expressive music is significant in and of itself, it requires originality (Fernández & Vico, p.516).

Composing music demands creativity, which is the special ability of humans to comprehend and generate an infinitely vast number of phrases in a language, the majority of which have never been heard or seen before (Chomsky, 2009). Algorithmic sound synthesis, also known as computational synthesis of musical sounds, is the logical extension of algorithmic composition to short timescales; it uses languages or tools to specify and synthesize sound waveforms instead of the more abstract specification of music found in traditional staff notation (Fernández & Vico, p.516). This is a very important aspect that needs to be taken into account when designing or proposing an AI-based music composition algorithm (Hernandez-Olivan & Beltran, 2021).

Sound characteristics such as pitch, duration, intensity, and timbre are the most fundamental components of music. The melody, harmony, rhythm, and tone of the music are all formed by the combination of these fundamental components. Melody is the main goal of an automatic music generating system in the field of artificial intelligence composition (Zhao et al., 2022, p.2). Melody is the main goal of an automatic music generating system in the field of artificial intelligence composition.

The majority of melody creation algorithms aim to produce a melody that is comparable to the chosen style, such as free jazz (Vaishnavi et al., 2020) or western folk music (Medeot et al., 2018, p.725–731).

## **Artificial Intelligence in Performance**

The evolution of computer-generated music has been significantly influenced by artificial intelligence, as previously mentioned (albeit the majority of efforts have been on composing and improvisational systems). However, the use of AI in performance systems has received little attention. Performing, improvisation, and music creation are considered creative and autonomous manifestations that are not possible for a machine, which could be the reason for this. However, we cannot deny that computer music is gradually centered around artificial intelligence. As new algorithms are created every day, we are able to solve music problems with fresh methods and information. (Zulic 2019, p.107). Chamberlain (2017) was of the opinion that

When thinking about issues relating to performance (in particular) it is important to think about the way that the audience interacts with the performer and the performance, enabling the audience to fully understand the systems that are being used, could offer performers, designers and technologists a whole range of new and exciting performative possibilities that go beyond the traditional performer–consumer paradigm and offer new ways in which the audience can affect and interpret the system used

## **What is Artificial Intelligence?**

An entity (or a group of cooperative entities) that can receive inputs from its surroundings, interpret and learn from them, and display related and adaptable behaviours and actions that help the entity achieve a particular goal or objective over time is said to possess artificial intelligence. In a similar vein, Cope (2005) defines an algorithm as "a recipe, a set of instructions for accomplishing a goal," with either complete or partial automation. duties related to music making for simplicity's sake.

The scientific study and modelling of intelligent behaviour is known as artificial intelligence. It is a very interdisciplinary forum for concepts from a wide range of human and animal endeavours. (Smaill & Wiggins, 1993, p.2). According to Wiggins & Smaill (1993, p.2), most researchers' motivations for AI fall somewhere along a spectrum between two opposing viewpoints. Cognitive science, which aims to explain how the mind (and frequently the brain) functions, is at one extreme of the spectrum. Intelligent Systems Engineering, on the other hand, aims to create computer systems that are capable of carrying out tasks that are typically assumed to require human intelligence, such as responding to spoken language (Wiggins & Smaill, 1993, p.2). There are several motivations behind the desire to create intelligent systems. Since more and more people need to use computers without costly training due to the widespread adoption of computer technology, for instance, it would be much simpler for the majority of non-programmers to operate the devices if they could comprehend spoken language (Wiggins & Smaill, 1993, p. 2).

At the two extremes of AI research, cognitive scientists and engineers work together to create systems that can be used for many reasons. When it comes to engineers, the goal is not to exactly replicate human capabilities but rather to create a system that can do a task, typically with inspiration from human methods. In this situation, if the system's performance is inadequate, it needs to be tested and updated. Building a hypothesis on how certain cognitive processes in humans or animals operate, like identifying metrical patterns in music, is of interest to cognitive scientists.

### **AI for Musicians**

There's no doubt that music is an intelligent activity that functions on multiple levels in the mind. There are musical activities that are profoundly and deliberately cerebral, others that require incredibly delicate and sophisticated physical abilities that must be developed, and some that involve an almost subconscious and instinctive reaction. Smaill and Wiggins (1993, p. 3). Jones, Scarborough, and Miller (1990) believe that problems related to music perception can be studied by computer modeling. To get insight into how the performer conveys her music to the audience, we can attempt to create software that mimics human performance practice and style (Desain, 1992, p.439; 1993, p.240). Programs that aim to improvise in particular

genres can be created in an effort to explain this part of the composing process (Buxton, Dannenberg, & Vercoe, 1986, p. 42). The link between artificial intelligence and music dates back to the middle of the 1960s and is related to studies using computer programs to model music as a cognitive process or a series of activities (Harun 2019, p.101).

### **Artificial Intelligence in Composition**

Traditionally, composing has been defined as the creative process by which a human being acts as a composer by putting their inner ideas or inspiration into words to create a finished piece. In the twenty-first century, however, or even in the latter half of the twentieth century, is this concept still appropriate? This notion came under scrutiny the minute the first computer capable of creating music was introduced. The Illiac Suite for String Quartet, written by Hiller and Isaacson in 1956, is the first known example of computer composition. Since then, researchers have encountered challenges; Hiller himself observes that "Computer-assisted composition is difficult to define, difficult to limit, and difficult to systematize." (Langston, 1988, p.2)

Since the source of the composition is software creativity rather than human creativity, many questioned whether music created by artificial intelligence could truly be considered to have come from a creative process. However, this obstacle could be overcome if the process of creativity was viewed as a new way of behaving, which would include a piece of software (or one of its parts) that transcends the program's physical details (Colton et al. 2015, p.5).

Researchers studying human factors have come to the realization that letting machines produce and perform music is an exercise in designing human interfaces, according to Peter S. Langston. The fact that music deals with a human activity that is both intellectual and emotional makes it an intriguing field for artificial intelligence researchers. Though very different from spoken language and possibly less complex, it is nevertheless a language. Researchers studying telecommunications are interested in music software because, as new information formats proliferate, they will need to understand a lot about their general properties and how to alter

them to transmit them broadly. Information is also conveyed through music (Langston, 1988, p.2).

The ability to specify musical compositions (that is, "to compose") at a level higher than note-by-note is what drew philosophers to music software. This would allow humanity get closer to the direct presentation of musical ideas and, in turn, free the human spirit. Software engineers face difficult problems in fields like music creation; to simulate this intricate human activity, one needs to be skilled in optimization, expert systems, algorithm design, and other relevant software engineering fields (Langston, p.2).

No artificial intelligence system that can write music has been included into the larger music community since the first systems that could do so were created, but this is beginning to change in the twenty-first century. These companies include Popgun (2017), AIVA (2016), Melodrive (2016), Flow Machines (2016), IBM Watson Music (2016), ORB Composer (2015), Amper Music (2014), Humtap (2013), Jukedeck (2012), Ludwig 3.0 (2011), Chordpunch (2011), Google Brain: Magenta (2010), Google Experiments: Music and AI (2009), The Echo Nest (2005), and Brain.FM (2003).

### ***Artificial Intelligence Virtual Artist (AIVA)***

Artificial Intelligence Virtual Artists (AIVAs) create music in a variety of genres, including rock, electronic, classical, and cinematic. (Leung, 2024, p.27) It learns and "improves itself by predicting what will come next, then uses those predictions as the basis for a set of rules for that style of music" (Lahde, 2018). In 2017, it published Pixelfield, the first video game score created by AI.

According to AIVA (2016), AIVA "is an AI that can compose touching soundtracks for movies, video games, commercials, and any type of entertainment content." In February 2016, Pierre Barreau, Denis Shtefan, Arnaud Decker, and Vincent Barreau launched AIVA, a project of Aiva Technologies. Its data comes from a vast collection of over 30,000 musical composition scores authored by composers including Beethoven, Mozart, Bach, and others. AIVA was able to grasp the principles of music theory and the craft of music composition by studying the important figures in

musical history. Additionally, that aided AIVA in "developing a mathematical model representation of what music is." AIVA then uses his model to create entirely original music. (Harum, p. 104)

AIVA uses CUDA, TITAN X Pascal GPUs, and cuDNN in addition to the reinforcement of deep learning algorithm techniques found in TensorFlow. However, AIVA can only compose for piano; orchestration, arrangement, and production of the music still require human skills. It is also important to note that AIVA uses GPU computing, which has produced a plagiarism checker that can determine whether a created track is partially or completely plagiarized from the database AIVA learned from. In addition, multiple Turing tests conducted with music professionals have confirmed that AIVA's compositions cannot be distinguished as human or artificial intelligence work. The creations of AIVA are registered in an author's rights society.

The first program to receive formal and official recognition for producing original compositions was SACEM (Society of Authors, Composers and Publishers of Music), the author's rights organization for France and Luxembourg. This is the first instance in which a rights society has acknowledged artificial intelligence as a composer. It "is able to write beautiful and emotional music, a deed that is considered to be deeply human," according to AIVA's creators (Medium, 2016; Harum, p.104).

The composition technique used by AIVA differs significantly from that of human composers. It learns the fundamentals of style and music by using deep neural networks to search for patterns and rules in compositions. AIVA forecasts the track's next move while it is being composed. She then develops a set of mathematical guidelines for a specific musical genre, at which point she is prepared to write (Aiva Technologies 2017). The question of how sophisticated this kind of technology is and whether it can completely replace the living composer is nevertheless brought up by this (Harum, p. 105).

Shortly after the software was established, on February 8, 2016, AIVA wrote its first composition, titled Genesis. The album that was created using its works was also named Genesis. Pierre Barreau, the CEO, produced all of the album's songs. It was accomplished in the orchestral version of Composition Genesis, which is officially

structured in a variational form with epic character. One can see the striking parallels between this piece and those written in the epic style of German producer and composer Hans Zimmer, whose music is known for its military sound, masculinity, and heroism, which are typically conveyed by the use of a large orchestra and numerous percussion instruments (Harum, p.105).

The composition has 38 bars that are broken up into four parts. The main theme, which is played by the bassoon and horn in the key of F, is presented in the first part (A), and its variations are represented in the other three parts (B, C, and D). The string section plays the majority of the main thematic material (Harum, p.106). Following classical music, AIVA's compositions grew to include rock music and other forms of world music, including Chinese, Middle Eastern, and Tango. Inspired by Chinese music, 艾 妮 (ài wā) is one of AIVA's World Style CDs.

### **Advantages of AI in Music Composition**

The capacity to evaluate vast music datasets and produce original compositions based on current music's patterns and structures is one of the main benefits of applying AI to music composition. For instance, Amper Music, an AI platform for music composition, analyzes millions of songs using algorithms to produce original music compositions in a couple of minutes. Composers can draw inspiration for their own works from a huge collection of musical styles and genres by utilizing AI.

Additionally, AI can be used to help composers by giving them new tools and methods for creating and modifying musical ideas. For example, the AI music composition software AIVA (Artificial Intelligence Virtual Artist) lets composers enter parameters like mood, tempo, and instrumentation, and then creates a fully orchestrated piece of music based on these inputs. This allows composers to experiment with different sounds and arrangements and explore new musical ideas that they might not have otherwise thought of.

Furthermore, AI can support the collaborative process of music composition by giving composers real-time feedback and suggestions while they compose. For instance, the AI music composition tool Flow Machines can evaluate a composer's

work in progress and offer new melodic and harmonic ideas to improve the composition as a whole, assisting composers in overcoming creative blocks and exploring new musical directions.

Computational modeling as a paradigm has the unique benefit of relieving us of the necessity to do graphic experiments on the human brain, or "wetware." (Smaill & Wiggins, 1994, p.2). Musicologists can benefit from AI approaches as well. New approaches for text and score analysis suggest that compositions can be statistically evaluated to assist identify their creator (Cope, 1991.) Ethnomusicologists are using computer modeling to better understand the characteristics of non-Western music (Beland, 1992, p.406). Everyone may be able to learn music in a new way thanks to advancements in human-computer interface technology (Wiggins & Smaill, 1994). As technology advances at a rapid pace, artificial intelligence has made it possible for information to flow more quickly, which in turn has facilitated quicker solutions to the issues we confront in the digital world. As a result, the potential for creating new, sophisticated composer software and distributing it online are both significantly increased (Zulić, p.102).

### **Skepticism about AI in Music Composition**

Despite the obvious benefits of employing AI in music creation, there are also concerns regarding the impact of AI on creativity and originality in music. Some critics contend that the music industry may become less diverse and innovative if it depends too much on AI algorithms to create musical compositions. Proponents of AI in music composition, however, contend that technology can actually foster creativity by giving composers fresh resources and viewpoints to help them develop their creative concepts. As Ramón (2002, p.45) noted, due to a number of typical applications, music is a particularly difficult application area for AI since it necessitates sophisticated information representation, reasoning, and learning.

One of the most significant ways that people communicate their emotions is through music. Conceptually, musical emotions are seen to be a difficult-to-quantify manifestation of human feeling that evolves richly with musical development. Without anthropomorphic musical composition thinking, without introducing a

human recognition system for musical emotions, and with human-computer interaction systems that are limited to superficial information exchange, the current level of music generation intelligence is signal analysis. (Zhao and others, p.18–19).

An initial attempt at the Bach doodle revealed conflicting emotions for a hands-on composer who enjoys designing every note of every line in a work. (In 2019, Google released the Bach Doodle, an AI-powered widget that harmonizes any two-bar tune in the style of Bach.) Disappointment (the output's four-part writing looks odd), uncertainty (if the piece was produced in Bach's style), and fascination (the program's ability to study Bach and harmonize your tune with/as a machine) are all present (Worrall, 2017).

It is commonly believed that creativity is a unique human trait (Davies & Newton, 2018) or that it drives evolution (Worrall & Fuentes, 2017). Therefore, when machines started (or may have started) to change the creative industry, it became urgent to learn more about the impact of creativity and machines and to reevaluate our relationship to both as humans and as practitioners.

## **Conclusion**

Artificial intelligence's role in artistic practice has become a commonplace phenomenon, and the use of AI algorithms to generate music is a very active area of research. This paper demonstrates the connection between artificial intelligence and its influence on composition and musical performance. These two case studies have been discussed through the lens of previous research carried out in this field and the literature in the field. The development of communication technology has changed human thought because it allows us to ignore the confines of geography while compressing space and time to create a virtual reality.

The fact is that artificial intelligence has become an inevitable part of our future; many artists today work with AI in creative endeavours, and this relationship between artists and AI will only grow stronger in the future. While some musicians are alarmed by the increasing use of AI in the music industry, others are still in awe of the opportunities it presents.

However, AI's shortcomings in music composition and performance include a lack of creative thinking, multi-domain functions, intentionality, and common sense. According to Boden (2010), creativity is the production of original, unexpected, and worthwhile ideas.

## REFERENCES

1. Aiva Technologies. (2017). "Press release." Accessed February 28, 2019. <https://www.luxinnovation.lu/wp-content/uploads/sites/3/2018/01/fundraising-en-aiva.pdf>.
2. AIVA. (2016). "AIVA - Artificial Intelligence Virtual Artist." Accessed February 26, 2019. <https://www.aiva.ai/about#about>.
3. Aiva. (2018). "AIVA - 艾妮 (ài wā) - 30 min Playlist of AI Generated Music." Accessed March 5, 2019. <https://www.youtube.com/watch?v=Bd9p2oi760g>.  
AIVA. (n.d.). Homepage. Retrieved from <https://www.aiva.ai/>
4. Amper Music. (n.d.). About Us. Retrieved from <https://www.ampermusic.com/about>
5. Beland, B Kippen K. Bol. (1992). Processor Grammars. In O. Laske, M. Balaban, and K. Ebcioglu, (Eds.), *Understanding Music with AI- Perspectives on Music Cognition*, Cambridge, MA: MIT Press.
6. Boden, M. (2010). *Creativity & Art: Three Roads to Surprise*. Oxford University Press
7. Buxton, W. Dannenberg R., & Vercoe B. (1986). The Computer as Accompanist. In *CHI '86 Conference Proceedings*, pages 41–43. ACM/SIGCHI, April 1986.)
8. Chamberlain, Alan. (2017). "Are the Robots Coming? Designing for Autonomy & Control in Musical Creativity & Performance." Audio Mostly

- 2017: Augmented and Participatory Sound/Music Experiences, 23-26 August. Queen Mary University of London (London, UK) ACM - DOI <https://doi.org/10.1145/3123514.3123568> UoN ePrints)
9. Colton, Simon, Pease, Alison, Corneli, Joseph, Cook, Michael, Hepworth, Rose, and Ventura, Chomsky, Noam. (2009). *Syntactic Structures*. De Gruyter: Mouton.
  10. Cope, D. (2005). *Computer Models of Musical Creativity*. The MIT Press.
  11. Cope, D. (1991). *Computers and Musical Style*. Oxford: Oxford University Press.
  12. Dan. (2015). “Stakeholder Groups in Computational Creativity Research and Practice.” In
  13. *Computational Creativity Research: Towards Creative Machines*, edited by Tarek R. Besold, Marco Schorlemmer and Alan Smaill, 3–36. Paris: Atlantis Press
  14. **Davies, L. M., & Newton, L.** (2018, February 28). *Creativity is a human quality that exists in every single one of us*. The Conversation. <https://theconversation.com/creativity-is-a-human-quality-that-exists-in-every-single-one-of-us-92053>
  15. Desain P. 1992. A (de)composable Theory of Rhythm Perception. *Music Perception*, 9(4):439–454,
  16. Desain P. 1993. A Connectionist and a Traditional AI Quantizer, Symbolic Versus Sub- Symbolic Models of Rhythm Perception. *Contemporary Music Review*, 9:239–254.
  17. Flow Machines. (n.d.). *AI Music Composition*. Retrieved from <https://www.flow-machines.com/>

18. Fernández, Jose David & Francisco Vico. 2013. AI Methods in Algorithmic Composition: A Comprehensive Survey. *Journal of Artificial Intelligence Research* 48 (2013) 513-582)
19. Harun Zulić. 2019. How AI can Change/Improve/Influence Music Composition, Performance and Education: Three Case Studies. *INSAM Journal of Contemporary Music, Art and Technology* No. 2, Vol. I, July 2019, 100–114.
20. Hernandez-Olivan, Carlos & Jose R. Beltran.( 2021). Music Composition with Deep Learning: A Review. arXiv:2108.12290v2 cs.SD 7 September, 2021.
21. Jones, Jacqueline A. Don L. Scarborough, and Benjamin O. Miller. (1990). Gtsim– A Computer Simulation of Music Perception. In *Colloque International- Musique et Assistance Informatique, Marseille*.
22. Kaliakatsos-Papakostas, Maximos A. Floros, Andreas & Michael N. Vrahatis. (2012). “Intelligent Music Composition.” In Proceedings of the Eighth International Conference on Intelligent Information Hiding and Multimedia Signal Processing (*IIHMSP 2012*). Piraeus, Athens, Greece, 424–427.
23. Langston, Peter S. (1988). *Six Techniques for Algorithmic Music Composition*. Morristown, New Jersey: Bellcore
24. Lahde, L. (2018). How Business Innovators are Using AI Right Now. In Forbes.
25. Leung, King Heng (2024). Artificial Intelligence in Scoring for Screen: Creativity-Augmenting Applications in Creative Practice . Doctoral Thesis, Hong Kong Baptist University
26. Medeot, G., Cherla, S., Kosta, K., McVicar, M., Abdallah, S., Selvi, M., Newton-Rex, E., and Webster, K. (2018). StructureNet: Inducing Structure in Generated Melodies. In *ISMIR*, pages 725–731.

27. Ramón Lopez De Mantaras. (2002). Making Music with AI: Some examples.” *AI Magazine* 23:3 (2002), 43-57.
28. SACEM. (n.d.). *SACEM – In a nutshell*. Retrieved February 26, 2019, from <https://societe.sacem.fr/en>
29. Sloboda, J. 1985. *The Musical Mind*. Oxford: Oxford Science Press.
30. Smith, M. Smaill A., & Wiggins, G. (Eds.). (1994). *Music Education: An Artificial Intelligence Perspective*. London, 1994. Springer Verlag. Workshops in Computing series.
31. U.S. Copyright Office. (2019). *Musical composition*. <https://www.copyright.gov/prereg/music.html>
32. Vaishnavi, Keerti, G., Mukherjee A., Vidya P., Sreenithya A. S., & Nayab, D. (2020). Attentional Networks for Music Generation. arXiv preprint arXiv: 2002.03854.
33. Wiggins, Geraint & Smaill Alan. (1993). “Musical Knowledge: What can Artificial Intelligence bring to the Musician?” *Music Education: An Artificial Intelligence Perspective*. Springer Verlag, London.
34. **Worrall, S.** (2017, March 5). *How Creativity Drives Human Evolution*. *National Geographic*. <https://www.nationalgeographic.com/science/article/how-creativity-drives-human-evolution>
35. Zhao, Ziyi, Hanwei Liu, Song Li, Junwei Pang, Maoqing Zhang, & Yi Qin. (2022). “A Review of Intelligent Music Generation Systems” arXiv:2211.09124v2 [cs.SD] 22 Nov 2022.