Beyond the Algorithm.

Ethical and aesthetic challenges of AI in music

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This paper explores the intersection of music and artificial intelligence (AI). The document discusses significant projects like Sony's Flow Machines and AIVA, highlighting how AI is utilized in the musical domain as an assistive tool (e.g., in activities like editing), an analytical instrument (for understanding musical language, for instance, in musicological research), for profiling (for targeting purposes and beyond), and for generating music.

The paper lists several open questions, such as issues related to the attribution of works, the originality of AI-generated music and copyright law and it also delves into the legal and ethical implications, particularly regarding copyright and the potential for AI to commit plagiarism or create derivative works.

Key challenges and considerations in AI-generated music are addressed, including autonomy, creativity, and intentionality. While AI's capacity for creativity is still evolving, the need for human intervention in training and refining AI outputs is still crucial. The intentionality behind AI-created music and the integration of human values are critical in ensuring that the produced music is meaningful and resonates with human audiences.

Finally, this study examines whether AI can be considered a creative entity or if it functions merely as an advanced tool for human composers, analyzing the aesthetic and functional transformations brought about by AI in the realm of music creation.

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Once the process has been set up

it inexorably works itself out[1].

1.

The automatic generation of music has been fascinating man for centuries: from Renaissance music boxes to the roller autopiano of the late nineteenth century, through musical automatons, up to the Steinway Spirio pianos with self-reproducing system, but also from Steve Reich's *It's Gonna Rain*[2] to Brian Eno's *Generative Music*[3], up to Flow Machines[4] and Aiva[5], the evolution of music is the history of human-machine interaction.

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[1] S. Reich, *It's Gonna Rain*, in *Writings on Music*, *1965-2000*, Oxford University Press, New York 2002, p. 20.

[2] First piece of an electroacoustic trilogy (which also includes *Come Out* and *Melodica*), based on a mechanical generative system, consisting of two cassette recorders set at different speeds, through which the assembly of two short identical loops was created (taken from recorded audio of a sermon by the black preacher Brother Walter, speaking about the Flood in Union Square Park in San Francisco), who slowly slip out of phase.

[3] In 1995, Eno began to collaborate with the SSEYO company and to use its Koan Pro software, which allowed the definition of musical parameters (melody, harmony, rhythm, sonority: timbre, dynamics, etc.), based on which the algorithm generated unique and constantly changing songs. Eno used Koan to create his album *Generative Music 1* (1996), a pioneering work that explored the potential of generative music, describing it as a way to create «authorless» music, in which the listener becomes part of the creative process, interacting with the work in real time. Eno and Koan's influence on generative music has been profound and has inspired numerous artists and musicians to experiment with algorithmic music creation, opening up new avenues of musical expression.

[4] Flow Machines is a research and development project born from the collaboration between Sony Computer Science Laboratories (Sony CSL) and Sony Music Entertainment Japan, whose heart is an algorithm capable of analyzing musical styles, supporting musical composition and generating ideas for new melodies, harmonies and rhythms.

[5] AIVA (Artificial Intelligence Virtual Artist) is an artificial intelligence software that allows you to generate music by choosing a musical genre and the emotion you want to express and personalizing the musical parameters, in a simple way even for those without musical skills. AIVA exists as a «legal person»,

The advent of AI has undoubtedly given a strong acceleration to the evolution of the relationship between music and technology, arousing great theoretical interest[6], raising many problems and bringing to the fore the reflection on the increasingly blurred boundaries between creator, machine, performer and audience, particularly significant in the musical field: the invention of new instruments (from the electric guitar to synthesizers), the role of the interpreter (whose importance is more relevant more open[7] the musical works are), the advent of electronic music (which allows to compose the sound even before the work, and to delegate to the computer the carrying out of operations previously carried out by the composer[8]) are just some of the examples which in the last century have demonstrated the difficulty of establishing where the composer's role ends and where that of the machine, of the interpreter and also of the listener[9] begins in giving life to the musical work.

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in 2019 it published a complete album (*AI-composed by AIVA*) and due to these characteristics in the same year it was the first algorithm to obtain the registration of its compositions at SACEM (Société des Auteurs, Compositeurs et Éditeurs de Musique), the French association that protects the copyright of composers of original music.

[6] Between 2017 and 2021, many works concerning «artificial intelligence», «musical generation», «musical composition» were published: 40% produced in Asia, 30% in Europe, 24% in America (mainly US and Canada), 5% in the rest of the world (M. Civit et al., *A systematic review of artificial intelligence-based music generation: Scope, applications, and future trends,* in "Expert Systems with Applications", 209, 2022, pp. 1-16 (https://idus.us.es/bitstream/handle/11441/140136/ESA_civit-masot_2022_systematic.pdf?sequence=1&isAllowed=y).

[7] In the double sense indicated by Eco in the famous essay: every work of art is intrinsically open, presupposing the interpretations of its audience, but in a special way there are works that also leave the interpreter the possibility or the task of intervening, with more margins or less broad, on the form itself (as for example in the case of aleatoric musical works). See U. Eco, *Opera aperta. Forma e indeterminazione nelle poetiche contemporanee*, Bompiani, Milano 1995, in particular pp. 31-63.

[8] Among the software for assisted musical composition we can mention OpenMusic (a visual programming environment based on the Lisp language, created by Jean-Claude Risset and Geoffroy Delmotte at IRCAM in Paris in the 1980s, the first public version of which was released in 1996) and Max/MSP/Jitter (a versatile multimedia programming environment for the creation of music, sound art and interactive installations, created in the late 1980s by Miller Puckette also at IRCAM).

[9] *Vexations* by Erik Satie (1893) is an emblematic extreme case: the work, discovered years after the composer's death and performed for the first time in 1963 thanks to the interest of John Cage, consists of a simple melody, presented alone and with two different harmonizations, accompanied by a note by Satie: «Pour se jouer 840 fois de suite ce motif, il sera bon de se préparer au préalable, et dans le plus grand silence, par des immobilités sérieuses» (see the score: https://imslp.eu/files/imglnks/euimg/9/91/IMSLP75616-PMLP151998-Satie_-_Vexations_(piano).pdf).
The performance of the piece, depending on the speed chosen, can take from 9 to 24 hours: this makes it the longest piece ever of which there is at least one public performance and requires an entirely unprecedented level of engagement and attention from the audience. A prime example of this is *As slow as possible*, a piano composition written by Cage in 1985, divided into eight sections and lasting anywhere

In the 21st century we observe an increasingly massive use in the musical field of various types of AI: assistive (for example in activities such as editing), analytical (for example for musicological purposes), profiling (for targeting purposes, but not only[10]), but recently it is above all the use of generative AI (aimed at autonomous creation) that poses new problems for scholars.

Emblematic cases that highlight the emergence of these problems are the first AI-created compositions: in the commercial field, *Daddy's car* was the first example of a song entirely composed by an AI, precisely using Flow Machines, at the Sony CSL Research Laboratory in Paris. The French singer and composer Benoît Carré[11] selected a subset of «60s, Beatles-style» materials from a huge database (consisting of approximately thirteen thousand scores of various genres of classical music) and Flow Machines produced a song (melody and harmony) completely similar to those composed by the Beatles; Carré then integrated the result with other fragments, added lyrics and mixed[12].

The cases of completion of two symphonies are more complex: Schubert's *Incompiuta*, by the Brazilian composer Lucas Cantor[13] with the help of Kirin 980 processors with double neural processing units inside Huawei's Mate 20 and Mate 20 Pro, and

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from 20 to 70 minutes. The 1987 organ version, 'Organ2/ASLSP,' is currently the subject of the world's longest concert. Begun in 2001 in Halberstadt, Germany, this performance is expected to conclude in the year 2640. Unlike the usual listening experience of more traditional pieces, in this type of composition the listener is forced into a continuous attempt at formal reconstruction, never fully satisfactory due to the excessive length of the piece. In this sense, it can be stated that the work is co-produced by the listener.

[10] On the use of AI in recommendation systems and how it impacts music production and distribution, see for example G. Born et al., *Artificial Intelligence, Music Recommendation and the Curation of Culture*, University of Toronto, Toronto 2021 (https://tspace.library.utoronto.ca/bitstream/1807/129105/1/Born - Morris-etal-AI_Music_Recommendation_Culture.pdf) and V. de Aguiar, *Music Recommender Systems: A (Data) Science of Music Aesthetics?*, in "Semeiosis. Transdisciplinary Journal of Semiotics", 11, 1, 2023 (https://repositorio.ul.pt/bitstream/10451/61753/1/10.53987-2178-5368-2023-12-02-1702741235.pdf).

[11] Co-author (under the pseudonym SKYGGE) in 2017, together with other musicians, of the first album entirely created by an AI, *Hello World* (https://www.youtube.com/playlist?app=desktop&list=OLAK5uy_k8doYYMjB0oXxWfGI4dhO6EelsDb yQsi4).

[12] The song can be listened to here: https://www.youtube.com/watch?v=cTP0Sr_ehmY. Another example is *Mr. Shadow*, in the style of American singer-songwriters: https://www.youtube.com/watch?v=lcGYEXJqun8.

[13] https://www.youtube.com/watch?v=_6OUGRsslJY.
The algorithm was trained for two weeks by listening to the first two movements of the Symphony, analyzed in the various musical parameters bar by bar, in order to be able to attempt the completion of the third movement (unfinished) and the composition of the entire fourth (absent). Based on the data and the processed versions, Cantor intervened by selecting the most convincing results and the complete Symphony was performed on 4 February 2019 by the English Session Orchestra at Cadogan Hall in London.

Beethoven's *Tenth*[14], completed by a team of musicologists and musicians led by Matthias Röder, director of the Karajan Institute in Salzburg, performed live for the first time in Bonn, on 9 October 2021, on the occasion of the 250th anniversary of the birth of the composer.

2.

This rapid evolution poses several problems of a different nature, concerning:

- Attribution. Who is the author of a work generated by an artist using AI? Man or machine? Actually, the question is surreptitious, since human intervention has so far been necessary both for the initial training and for the selection and optimization of the results: the machine is therefore configured as a tool. Even AIVA, despite the recognition obtained from SACEM[15], is the result of the work of a team of engineers and musicians: the process implemented by the algorithm neither can be defined as creative in the strict sense, nor it is completely autonomous, having required considerable human intervention in implementation, selection and post-production.

- Copyright. This point is much debated, and the positions taken in this regard can essentially be traced back to two main lines.

On the one hand, there are those who believe that the authors of music are still human beings, at least because pre-existing materials composed by men and protected by copyright are used to train AI. Universal Music, for example, has asked streaming platforms not to allow access to its music catalog for the purpose of training AI[16]. Thirteen organizations of composers, performers and other creatives, including ECSA[17], published on 25 April 2024 a statement[18] expressing a favorable opinion towards the AI Act and calling for its rigorous and transparent application to protect the rights of musicians.

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[14] https://www.youtube.com/watch?v=Rvj3Oblscqw

[15] See note 4.

[16] C. Di Clemente, *Bach, il rap e ChatGpt: odissea nella musica* (https://www.quotidiano.net/magazine/bach-il-rap-e-chatgpt-odyssey-nella-musica-s7cth4bf?live).

[17] European Composer and Songwriter Alliance.

[18] *Joint Statement on Generative Artifical Intelligence and the EU AI Act* (https://composeralliance.org/news/2024/4/joint-statement-on-generative-artifical-intelligence-and-the-eu-ai-act/).

On the other hand, there are those who argue that AI has a margin of autonomy in the production of works which allows it to be attributed paternity and guarantee the protection of copyright. However, many unresolved issues remain, even outside of this contrast: for example, the possibility that AI plagiarizes or creates imitations of pre-existing works protected by copyright, therefore harming artists.

The main reasons why AI is more likely to plagiarize compared to human composers are the way it's trained, how fast it works, and the huge amount of content it can create. Because AI learns so quickly and produces so much, it's much more likely to create something that's very similar to something that already exists, blurring the line between inspiration and copying

- Authenticity. Where to establish the limit of similarity, beyond which it is possible to speak of plagiarism? The issues here involved are both of an economic nature (falling within the scope of copyright) and of the status of the object (can a copy, even partial, be considered a work of art?).

- Originality and autonomy. These are two crucial aspects, which also affect the aesthetic evaluation of the works and their status: since AI-created works are the result of training on a specific pre-existing repertoire, the margins of originality are very limited, while the autonomy is currently limited by the need for musician interventions to correct, adapt, integrate the AI's productions to make them more compliant with the model, more varied (they often tend to be repetitive), more coherent (formal construction is an aspect AI has not mastered yet). Naturally, it cannot be ruled out that rapid progress could remedy at least the lack of originality in the short term, through the introduction of greater elements of variety that allow the composition to deviate from the norm. Originality and autonomy must however be examined in relation to what we define as «creativity».

- Evaluation. New criteria and a new terminology are needed to judge AI-produced works: does it make sense to talk about «interpretation» in relation to Hatsune Miku's performances [19] ? If still in the 1980s Eggebrecht identified the fundamental

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[19] Properly, Hatsune Miku is not an AI, even if it exploits its potential, in particular (for what is of interest here) to compose music: it is a virtual character and a synthesized voice developed by Crypton Future Media in Japan. She is the first vocaloid of the «Character Vocal Series» project, the best known and most

characteristics of Western music in the dialectical pair emotion-*mathesis*[20], on the basis of which he proposed his definition of «music», giving a leading role to emotion, how should we think about AI-produced music, in which the relationship with emotion is controversial due to its inability to authentically experience and understand emotions?

- Definition. As during the twentieth century, when from Duchamp to Warhol conceptual art had implied a rethinking of the definition of «art» and at the same time, from concrete music to Cage, a rethinking of the definition of «music» had been imposed, also generative AI requires a reconfiguration of traditional categories, not so much aimed at coining a new definition, but rather at clarifying the nature of the relationship we establish with the musical object completely or partially produced by AI.

- Creativity. This too appears to be a category to be rethought, in relation not so much to the current possibilities of AI, but above all to future developments, which could allow greater autonomy and originality (constitutive traits of creativity).

- Ethical-political questions. AI is widely used within recommendation systems integrated into streaming platforms (such as Spotify, Apple Music and YouTube) which can be used not only to suggest users options in line with their tastes, but also to guide them (causing loss of decision-making autonomy), to manipulate behaviors, to discriminate and hide options (creating so-called «filter bubbles» that limit exposure to different genres and styles), potentially ending up limiting cultural diversity[21].

3.

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used in the world: she is an icon of digital culture and a fandom phenomenon. She has participated in virtual live concerts, appeared in video games, anime and manga, and has been the subject of countless fan art and merchandise.

[20] C. Dahlhaus, H. H. Eggebrecht, *Che cos'è la musica?*, trad. it. di A. Bozzo, Il Mulino, Bologna 1988, p. 30: «music in the European sense is mathematized emotion, or emotionalized *mathesis*».

[21] L. Manovich is among those who have questioned the risk of impoverishment of aesthetic diversity that the use of AI can determine (see *L'estetica dell'intelligenza artificiale. Modelli digitali e analitica culturale*, trad. it. di G. Bobò e V. Catricalà, Soscella, Bologna 2020, in particular p. 42 and following). The Cultural Analytics he proposes acts «Against reduction» (see *ibid.*, pp. 86-94), with the aim of «avoiding a reductive summary typical [...] of recent quantitative computational research», focusing «on the differences between numerous artefacts and not only on what they have in common" (*ibid.*, p. 93).

For the moment, the intervention of musicians is still crucial, not only for the choice of the repertoire used for training the AI, but also for the selection of the materials generated, the correction of any syntactic or stylistic error, the modification of certain passages, the integration of pre-existing materials, the addition of texts etc.

As regards the choice of repertoire, most automatic generation systems provide training using sets of musical data expressed in symbolic form (scores, MIDI, piano roll); a minority uses audio datasets; some people use sets from both categories. The datasets are very varied (ranging from Bach chorales to Turkish popular music); among the most used is Nottingham, which collects 1200 English and American pop songs, but particularly interesting are Maestro (MIDI and Audio Edited for Synchronous Tracks and Organization), which contains both audio and symbolic sets, and Lakh MIDI dataset, which collects approximately 170,000 MIDI files of many different genres. 70% of generators are based on deep learning (in particular using GANs[22]), but solutions based on reinforcement learning are also widespread.

The main uses of GANs in music concern the composition of songs in the style of a specific composer starting from a pre-existing set of data (as seen in the case of Flow Machines), the possibility of creating new sounds (this is the case of Neural Synth, one of Team Magenta's projects: a sound synthesis method based on deep learning), of creating choreographies starting from music and of generating sounds starting from movements.

GANs possess a certain degree of autonomy: they are able to modify the arrangement or instrumentation of pre-existing songs, to create new variations, to improvise by generating melodic phrases or harmonic conduct compatible with a song being performed, and in part to self-evaluate[23]. However, their use requires human guidance to manage the creative process and to optimize the results: their products are still limited in

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[22] GANs (Generative Adversarial Networks) are a type of deep neural network (DNN) architecture that exploit a competitive learning mechanism to generate new data, such as images, sounds, text. They are made up of two distinct («adversary») neural networks (one generating and the other discriminating), each with its own specific objective, which «challenge».

[23] On the use of GANs in music, see for example C. Moruzzi, *Alla ricerca della creatività: le GAN come paradigma dell'autonomia nel software per la composizione musicale*, in A. Barale (ed.), *Arte e IA. Be my GAN*, Jaka Book, Milan 2020, pp. 147-65.

terms of originality, lacking a real structure and not always coherent. More promising results seem to come from RNNs (Recurrent Neural Networks)[24].

Each generator produces music in a specific style, generally based on the training datasets used, but sometimes also on the introduction of a set of theoretical rules to be respected. Most of them are aimed at generating complete pieces (or ideas for the composer to choose from); others are designed for completing songs or repairing damaged audio. At present, a factor of weakness is the user interface, which is rarely friendly (which makes the use of automatic generators difficult outside the circle of experts).

As regards the interventions of musicians on the materials produced by AI, at present selection, integration and modifications are carried out on the basis of evaluation criteria which examine the stylistic adequacy of the reference models, the coherence of the musical structure, the quality of the codicil development, respect for the syntactic rules introduced. The role of musicians therefore remains decisive, both upstream (i.e. with regards to the choice of materials, style, syntactic rules on the basis of which the AI is trained), and downstream of production (i.e. with regards to the closure of the process and the final elaboration of the work). In addition to this, currently musical productions entirely completed by AI have not been found to be fully satisfactory, due to a certain repetitiveness and an impact judged by listeners to be «emotionally flat»[25].

4.

The first limit that studies that have as their object an analysis of the relationship between music and new technologies (AI first and foremost) sometimes encounter is that they take definitions such as «Music is the art of combining vocal or instrumental sounds for beauty of form or emotional expression, usually according to cultural standards of rhythm,

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[24] RNNs are a type of artificial neural network (ANN) that can process sequences of data taking into account past context to better understand the current input and generate more precise output. Unlike traditional neural networks, which consider each input independently, RNNs have an internal memory that allows them to retain information from previous time steps. This feature makes them particularly suitable for analyzing and generating sequential data, such as text, speech, music or time series.

[25] I. Robert-Constantin, Ș. Trăușan-Matu, *A quantitative aesthetic analysis of artificial intelligence generated music*, in "Proceedings or RoCHI", 2023, pp. 63-8 (https://rochi.utcluj.ro/articole/11/RoCHI2023-Ivan.pdf).

melody, and, in most Western music, harmony»[26], which, recalling others of eighteenth-century memory[27], seem to exclude on the one hand over a century of experimentation in Western music, on the other vast geographical areas characterized by profoundly different cultures[28].

This, moreover, is also the limit of the current field of application of AI: the reference repertoires are almost always those ranging from Baroque to Romanticism, or Western non-classical music[29], with particular reference to pop, techno and rock. The reasons for these choices are understandable: in these genres it is easier to identify repertoires that are no longer protected by copyright, with more homogeneous characteristics, less complex structures and syntactic rules that are simpler to deduce. Bach's chorales, for example, are one of the most used cultured repertoires for AI training, precisely for the reasons listed[30], as are pop and techno in the non-classical field, because they present greater regularity, repetitiveness and simplicity compared to rock and jazz – factors that make these genres more suited to the purpose.

When we talk about AI and music, therefore, we should first of all delimit the field and take into consideration within which horizon of thinkability we place ourselves (which AI, in relation to which repertoire, to do what): the automatic generation of ambient music acting as a background to purchases in a supermarket evidently does not

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[26] *Ibid.*

[27] See for example the definition of «Music» given by J.-J. Rousseau in his *Dictionnaire de musique*: «Music is the art of combining sounds in a way that is pleasant to listen to» (see A. Corbelli, *L'estetica musicale di Jean-Jacques Rousseau*, Clueb, Bologna 2006, p. 17).

[28] See the different meanings assumed in the respective cultures by terms that we translate with the word «music», but which in the original contexts have very different meanings (these are the cases of the Persian words «musiqi» and «muzik"» to whose definition it contributes the reference not to the sound, but to the function (see J.-J. Nattiez, *Pluralità e diversità del sapere musicale,* in Id. (ed.), *Enciclopedia della musica*, vol. II, Einaudi, Bologna 2002, pp. XXVI-XXVII) or of the Mapuche tayil, which «is a sui generis conceptual category that is located in the extraterrestrial and suprahuman sphere of the cosmological spheres in which the "divine music" or the " música de los espíritus"» (see M. E. Grebe Vicuna, *El* tayil *mapuche, como categoría conceptual y medio de comunicación trascendente,* in "Inter-American Music Review", 10, 2, 1989, pp. 69-75 https://revistas.uchile.cl/index.php/IAMR/article/view/53510).

[29] See for example L Casini, M. Roccetti, *The impact of AI on the musical world: will musicians be obsolete?*, in "Studi di estetica", XLVI, IV serie, 3/2018, pp. 119-34 (https://cris.unibo.it/bitstream/11585/661558/2/se3-2018.pdf).

[30] ChoraleDB is a database of Bach chorales created by scholars at the University of Glasgow, used to train AI, including DeepBach by Sony CSL Paris for the production of compositions in the style of Bach; BachBot, a chatbot developed by Google AI capable of conversing about Bach's music; Bach Unwrapped, a project developed by researchers at the University of Glasgow to analyze Bach's manuscript scores.

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pose the same problems as a chorale generated autonomously by an AI, or the use of an AI by an experimental composer.

However, a transversal problem is that of aesthetic judgment: how is music generated by an AI received? Do the same categories apply as for music composed by humans? If not, why?

Scholars are trying to answer these questions both through the attempt to identify tools to measure the aesthetic value of a song, and through psychological approaches that try to probe the listeners' attitude towards the music produced by AI.

A scientific approach that adopts computational criteria to judge the aesthetic value of musical productions generated by AI is, for example, that proposed by Robert-Constantin and Trăușan-Matu, who, using the formula developed by Birkhoff [31] for the «measurement of aesthetic» (*Aesthetic Measure = Order/Complexity*), based on the assumption that a piece of music is pleasant if it has a high degree of order, that is, if the elements that constitute it are characterized by symmetry, homogeneity (i.e. there are no sudden changes) and reduced complexity (i.e. not too many simultaneous events occur), they compared characteristics of compositions created by AI and humans and in particular evaluated the type of harmonic intervals, the degree of consonance, the symmetry and the degree of rhythmic-melodic entropy, demonstrating that the lower aesthetic quality of the compositions created by the AI is due to a greater variance in the scores relating to the parameters listed above[32].

Other scholars have proposed distinguishing between objective evaluation and subjective evaluation. According to this approach, the first would be an evaluation of the quality of a composition, obtained through the measurement of peculiar characteristics of the musical parameters (melody, harmony, rhythm) and stylistic traits, to which a score is assigned based on the proximity or distance with respect to the inputs and the desired style. The second would aim to highlight the creativity inherent in the compositions, understood as the ability to make contributions that are original and demonstrate additional characteristics such as quality, surprise or usefulness[33].

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[31] G. D. Birkhoff, *Aesthetic Measure*, Harvard University Press, Cambridge, MA 1933.

[32] I. Robert-Constantin, S. Trăușan-Matu, *A quantitative aesthetic analysis of artificial intelligence generated music*, cit.

[33] C. Hernandez-Olivan, *Music Composition with Deep Learning: A Review* (https://ar5iv.labs.arxiv.org/html/2108.12290).

The theme of creativity has been and is at the center of the reflection on the relationship between music and AI. What is creativity? Does it consist of a quality inherent to the product? Does it reside in the process that leads to its creation? Is it a characteristic of the individual who works[34]?

At present, the works created by AI cannot be considered creative – any more than the perfect imitation of a Bach counterpoint by a composition student: even though the result is in itself coherent and perfectly adhering to the model, for this very reason he evidently does not display the traits of creativity, but at most reveals excellent craftsmanship. But even if, in perspective, technological evolution were to allow AI to be able to generate partially innovative content compared to the training data, with results comparable to those achieved by a composer during his artistic evolution, would it be possible to talk about creativity?

The focal points of the discussion remain autonomy, originality, creativity, intentionality: traits that strictly pertain to the production of a musical work. These categories appear to be the decisive ones for answering the questions listed at the beginning, however autonomy, originality, creativity are by any means secondary traits, compared to the primary trait that characterizes the work of art (even musical): the fact of coming from the intention of a human being[35]. Whoever observes or listens to a work of art dedicates specific attention to it due to the fact that it is not a simple object of common or functional use[36], as analytical philosophy[37] has amply demonstrated: this aesthetic attention transforms (not necessarily in the ontological, but certainly in a functional sense) a simply beautiful object into an artistic object, into a work of art.

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[34] See C. Moruzzi, *Alla ricerca della creatività*, cit.

[35] The theme of intentionality in relation to the work of art is central to analytic philosophy, particularly in the work of G. Génette. See A. Corbelli, *L'opera dell'opera*, in F. Bollino (ed.), *L'arte in opera. Itinerari di Gérard Genette*, Clueb, Bologna 2006, pp. 105-125: «(In Génette] The artistic function or relation is triggered when the subject believes (rightly or wrongly) to read in the object a self-scaling intention from which it proceeds: a defining characteristic of works of art is therefore to stem from an aesthetic intention, that is, to deliberately seek to arouse appreciation» (pp. 116-117). This position is very close to that of E. Panofsky: cfr. *La storia dell'arte come disciplina umanistica,* in Id., *Il significato delle arti visive*, trad. it. di R. Federici, Einaudi, Torino 1962, pp. 3-28.

[36] A functional object is not always in common use: a corkscrew has a different status from an advertising jingle (although both also fulfill a function), determined by the different degree and nature of the attention paid to them.

[37] The reference is obviously to the reflection developed, among others, by N. Goodman, G. Dickie, G. Genette.

Believing that an object is intentionally offered for use as an aesthetic object, if this is based on incorrect assumptions, does not *ipso facto* change its nature (i.e. it does not transform any object into a work of art, in the absence of «a productive aesthetic intention (different from simple choice)»[38], but still transforms the aesthetic relationship into an artistic one. The articity of an object can therefore also be erroneously assumed, but this does not prevent the object, within a subjective interpretation, from functioning as a work of art (whose articity is therefore occasional, attentional), if it is perceived as the fruit of human intention[39].

The fundamental point is therefore not to establish whether AI products are (or could be in the future) creative. At present, there are difficulties that make even simple processes such as managing multiple lines in counterpoint complex for an AI; operations such as the completion of Schubert's *Incompiuta* require technical-musical, historical-stylistic and IT skills which, as we have seen[40], presuppose team work to guide, correct and complete the data obtained through AI - whilst remaining within the scope of stylistic imitation. Even more complex is the transposition of a technique learned in a specific stylistic context (for example, that of baroque counterpoint) to a very different one (for example, atonal[41]) – a fact which would make the products more original and therefore closer to an idea of creativity: as has been observed, for now the areas of application are substantially tonal or modal, because the grammatical and syntactic complexity of Western classical music since the beginning of the twentieth century (the variety of tempos, meters, rhythms, harmonic languages, formal or informal or random structures etc.) pose objective difficulties, which would require time and effort not repaid by the low relevance of the experimental music market. AI productions are more profitable in the commercial field than in the cultured field, where speed and computing power could undoubtedly support analysis and composition activities (as has already happened for decades, in more limited and less autonomous forms), without replacing a human being.

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[38] See G. Genette, *L'Opera dell'opera*, vol. II: *La relazione estetica*, trad. it. di R. Campi, Clueb, Bologna 1998, p. 243.

[39] *Ivi.,* pp. 243-4.

[40] See note 12.

[41] Think for example of the «42 real parts» that the Italian composer Adriano Guarnieri talks about in relation to the complex polyphonic interweaving in his atonal orchestral scores (private conversation).

But even if AI reached such a degree of autonomy to allow the creation of original products, it would continue to lack an intentionality driven by thoughts and emotions and by awareness of itself and of the historical-cultural context as a human being, which up until now has formed the basis of interest in works of art. In this sense, lacking human intentionality, pure AI products cannot be considered creative – at least not in the sense that has been attributed to the term so far.

It therefore seems like a false problem raised by some psychologists who complain about the existence of a prejudice towards art produced by AI and the fact that the reason (which some scholars believe to be psychological)[42] why it is difficult to attribute the same value (even aesthetic) to AI products, even when they are indistinguishable (even for professionals) from works created by human artists, or when they obtain good scores on the Lovelace tests[43]. In particular, in analogy with what some studies on the aesthetic reception of visual art have shown (works generated by Photoshop were evaluated less positively than similar works exhibited in an art gallery and seeing a robot in action while creating a work of art was found to increase aesthetic appreciation)[44], even in the musical field the aesthetic appreciation of works generated by AI and works created by musicians was greater in the latter case.

It is therefore not a question of prejudices against the machine, which are largely absent in the musical field: for example, the influences exerted by electronic music since the 1950s are undeniable, even on the thoughts of composers who created acoustic works (for example, the American minimalists: the repetition of cells and fragments is evidently the transposition of the electronic loop). Rather, the anthropomorphization of AI tells us, like the presence of the artist on stage, that what attracts us, what interests us and what

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[42] See for example R. Chamberlain et al., *Putting the art in artificial: Aesthetic responses to computer-generated art*, in "Psychology of Aesthetics, Creativity, and the Arts", 12(2), 2017, pp. 177–92 (https://doi.org/10.1037/aca0000136); D. Shank et al., *AI composer bias: Listeners like music less when they think it was composed by an AI*, in "Journal of Experimental Psychology: Applied", 2022, pp. 1-17 (https://gwern.net/doc/ai/music/2022-shank.pdf). For a critical review of the literature, see F. Poorna et al., *Assessment of Human Emotional Responses to AI–Composed Music: A Systematic Literature Review,* 2024 International Research Conference on Smart Computing and System Engineering (https://ieeexplore.ieee.org/abstract/document/10550861).

[43] The Lovelace test (named after programming pioneer Ada Lovelace) was proposed in 1950 by Alan Turing to measure the creativity of an algorithm, in particular by evaluating the machine's ability to produce a work that is not simple recombination of pre-existing elements, and which is evaluated as original by human experts. The usefulness of the test is still a subject of debate, raising fundamental questions, such as the nature of creativity and the human-machine relationship.

[44] R. Chamberlain, C. Mullin, B. Scheerlinck, J. Wagemans, *Putting the Art in* Artificial, cit.

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we seek, even unconsciously or incorrectly (in the case of the anthropomorphic robot), is the man behind the work – not necessarily his story, his biography, his ideas, his «message», but humanity, the human-being that he shares with us and that filters through the work: the particular way of being of that human-being with whom the work places us in relation.

To conclude, AI can be a formidable tool capable of supporting, assisting and facilitating the composer's work, more than software developed for assisted composition has done so far; the current lack of autonomy and inability to manage complex structures (grammatical, syntactic and formal) require the intervention of musicians, who are and will remain indispensable to give the musical object the status of a work of art, by virtue of their aesthetic intentionality. It is essential to recognize this role and protect knowledge, peculiarities and human values: in short, keep the human-being at the center, to which music is the most inherent art.

To put it in Hofstadter's[45] words reported by Melanie Mitchell: «Since I was a child, music has excited me and touched me deeply. And each of my favorite songs is as if it were a message coming directly from the soul of the human being who composed it. It was as if they were allowing me access to their innermost soul. One has the feeling that there is nothing more human in the world than the expression of music»[46].

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[45] D. Hofstadter, American cognitive and computer scientist, author of the celebrated *Godel, Escher, Bach: An Eternal Golden Braid,* Basic Book, New York, 1979.

[46] In Melanie Mitchell, *L'intelligenza artificiale*, Einaudi, Torino 2022 (quoted in C. Di Clemente, *Bach, il rap e ChatGpt*, cit.).