Faculty of Philosophy and Education Science
Ruhr University Bochum

Ivano Zanzarella
ivano.zanzarella@ruhr-uni-bochum.de

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The Problem of Musical Creativity and its Relevance for Ethical and Legal Decisions towards Musical AI

Abstract

Because of its non-representational nature, music has always had familiarity with computational and algorithmic methodologies for automatic composition and performance. Today, AI and computer technology are transforming systems of automatic music production from passive means within musical creative processes into ever more autonomous active collaborators of human musicians. This raises a large number of interrelated questions both about the theoretical problems of artificial musical creativity and about its ethical consequences. Considering two of the most urgent ethical problems of Musical AI (music job replacement and machine musical authorship), we show in this essay the strict dependence of every form of acknowledgment of a moral and legal status to systems of automatic music production from the theoretical account of musical creativity by turns implicitly or explicitly adopted, arguing, on the basis of pragmatic reasons, for the ne-cessity and the desirability of this acknowledgment.

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1 Preface: Music and AI

Among the different forms of art, music occupies a quite interesting position. In fact, music is maybe the only art which does not tend to represent external objects, independent of or unrelated to the material of the art itself – musical tones and sound sensations. Music depicts meanings which coincide with the material used to represent them [1] [Helmholtz 1863, 4], [Hanslick, 1854].

The abstractedness and the self-referentiality of music put it in a privileged relation with various mathematical and speculative disciplines already in Classical Antiquity and Middle Ages (music was for instance part of *quadrivium*) [Borzacchini 2007], [Cohen 1984], [Reese 1940]. Furthermore, they allowed music composers to interpret music itself as a mathematical game, where indeed mathematical models or geometric figures could be used for composing music [Gardner 1974], [Miller 2019], [Zanzarella 2019]. Then, once in the Middle Ages the theory of music settled as a system of discrete and finite rhythmic figures and pitches [Apel 1961] and, on the other side, different applications in the developing field of combinatorics were investigated – for example by Llull's *Ars magna* and *Ars combinatoria* – it became also quite simple interpreting music composition as a combinatorial and algorithmic problem [Gardner 1974]. On this way, later, the German Jesuit Athanasius Kircher conceived of some formal combinatorial rules for composing music [Kircher 1650], which could be even implemented into an automatic mechanical system, the *musaritmica mirifica*, that was actually built in 1670. Since then, numerous mechanical methods for composing music were developed – which used even dices, teetotums or cards in order to randomize the process of music composition – and numerous machines for automatic music composition were designed and build which could even perform what had been composed [Gardner 1974].

With the development of informatics and computer technology, the field of automatic music composition (and performance) entered a new phase. From the 1950s onwards, information theory and artificial intelligence, as well as ever more powerful computers and more sophisticated electronic tone synthesizers provided new, formidable tools for composing and perform automatically music. Algorithmic or stochastic rule-based systems were

employed for the composition of the first "artificial" musical works [2], generating and harmonizing melodies autonomously. Already from the 1960s, methods of computational analysis and pattern recognition for existing musical works (by human composers) were developed and applied in order to implement into music composition software the style of a particular author and to make them able to compose new musical pieces after it [3]. Soon, also machine-learning techniques (recurrent and convolutional neural networks, variational and adversarial training, etc.) have been employed to the same purposes – this means, without programming software or machines directly and specifically for composing or performing music [4]. On the other side, new instruments and software in the field of electronic music were developed which could not only imitate every possible musical instrument, but even synthesize completely new kinds of sound, reproduce microtones and complex rhythmic figures, etc., in a word, making possible to musicians what was unimaginable in the past [Gardner 1974], [Casini, Roccetti 2018].

Since then, the issue of computational musical creativity, composition and performance has gained great attention among AI scientists, musicians and philosophers. A great number of specialized international conferences [5] and journals are dedicating space to the research into the applications of AI in music; computers are becoming proper musical instruments ("universal musical instruments", in the definition by [Gardner 1974, 135]) and are part of the "standard equipment" of every musician, recording studio, concert hall, etc., really playing an active role in the process of music creation and performance; computational methodologies for musical purposes and electronic music currently constitute subjects of study in music conservatories and universities.

However, while, at the beginning, computational techniques – to the same extent, indeed, of other earlier algorithmic and combinatoric procedures – and computers constituted nothing but mere *means* or *instruments* for a musician to express her creativity and musical ideas, the recent developments in AI and their application to music introduced a radical qualitative change in the condition of such techniques and technologies towards music and musicians. Artificial Intelligence and machine-learning techniques are allowing machines to

become *autonomous creative subjects* and to take actively part within the creative process of music composition and performance. In other words, they are allowing machines to be rather *collaborator* of the musician who compose or perform her work than the passive instrument of expression of her creativity (see [Ferry et al. 2019] and [Section 2.1]).

For these reasons, the relationship between music and AI is also gaining a great philosophical interest. What musical creativity is, what possessing musical creativity means, whether a computer can be creative composing or performing automatically music, whether computational musical creativity is different from human musical creativity, are some of the main questions about AI and music being currently discussed by aestheticists, philosophers of AI and mind. Besides this kind of theoretical questions, there is however a wide range of further philosophical questions which concentrate more on the moral and legal consequences of the application of AI to music. If we admit the possibility for machines to be creative, thus to be *collaborators* of musicians within creative processes of musical composition or performance, if machines and humans can equally and indistinctly share the same condition of being creative subjects, a lot of moral and legal problems arise which are at the center of the philosophical reflection in some research areas within ethics of AI: will computers skilled at performing or composing music be able to replace human musicians? Who owns the rights to the music produced artificially by AI systems? To which extent will artificially produced music affect the development of personal and cultural identity [6]? Should consumers be informed about the use of AI technologies in the creation of the music they listen to? Is there the risk that AI powered software of automatic music detection and recognition operate discriminating and thus preferring systematically music only by certain authors or from certain countries? Through these and other questions is principally articulated the ethical problem of Musical AI. With a focus, in this essay, on the first two questions mentioned before, we will gain an overview of this problem in the following, more precisely in [Section 2.2].

The consideration of the ethical questions of Musical AI however requires a preliminary analysis of some important theoretical issues from philosophy of music, philosophy of

AI and mind which partly coincides with the questions on musical creativity mentioned above. This analysis will be object of [Section 2.1].

Finally, in [Section 3], we account for the strict dependence between the way in which the ethical questions of Musical AI are answered – and the possibility itself of this answer – and the specific theoretical presuppositions about musical creativity implicitly or explicitly adopted. Then, we argue for the present necessity and desirability of the attribution of a moral and legal status to artificial systems of music production.

2 Theoretical and Ethical Problems of Musical AI

2.1 Philosophy of Music and Musical Creativity

In this section we will briefly give a philosophical account of some fundamental theoretical issues about musical creativity and music in general which will be useful for introducing in the next sections the philosophical discussion of the most important ethical problems of the application of AI and technology to music.

The analysis of these theoretical issues, which cannot obviously be exhaustive here, can be more easily conducted considering the following four questions, closely related to each other:

(1) Can an artificial system act creatively as humans do?

(2) Is intentionality a necessary condition for creativity?

(3) Is there something to understand in music?

(4) What does it mean for a machine to be a musician?

> «No one [...] has yet found an algorithm for producing even a simple melody that will be as pleasing to most people of a culture as one of their traditional popular songs. We simply do not know what magic takes place inside the brain of a composer when he creates a superior tune. We do not even know to what extent a tune's merit is bound up with cultural conditioning or even with hereditary traits. About all that can be said is that a good melody is a mixture of predictable patterns and elements of surprise. What the proportions are and how the mixture is achieved, however, still eludes everybody, including composers».

With these words [Gardner 1974, 135] accounts for the difficulty to explain the "mystery", the "wonder" of human creativity and the correlated impossibility of implementing some model of human creativity into an artificial system which would thus be capable of creativity as humans themselves. Machines, as already mid-nineteenth century Luigi Menabrea and Ada Lovelace said commenting Babbage's analytical engine [Menabrea-Lovelace 1842-43], cannot originate anything and can do only what we order them to do by means of a specific program.

Scientists, philosophers and even artists have however soon refuted the naivety of retaining human creativity a mystery and artificial creativity something impossible – [Turing 1950, 450] being an early one, beginning to work from different perspectives for a scientific explanation of the former and an increase of the possibilities for the latter. One of the most representative attempts in this sense was made by [Boden 2004]. The English cognitive scientist basically holds that creativity is not a wonder which will be never explained by science. Furthermore, she believes that a scientific explanation of creativity does not correspond to a reduction of it or to a decrease of our respect for creative thought. On the contrary, science – more specifically scientific psychology and computer science – is the only possibility at our disposal for understanding human creativity and attempting to reproduce it artificially. In fact, as she says in a quite functionalist fashion [Boden 2004, 283-284], in explaining the processes and structures behind mind and creativity only *computational concepts and theories* show some usefulness, instead of vague verbal theories: this is because of the nature itself of these processes, the inherent way in which they work and are shaped, which are indeed computational and syntactical [7]. This however amounts also to say that the sort of physical hardware (silicon circuits, neurons, etc.) implementing such computational processes can be then actually disregarded. Exactly in this passage lies for Boden the possibility to speak of *computational creativity* as something that can be conceptually shared in the same way both by humans and by machines.

For Boden, a creative process is a process which brings as outcome «products – ideas or artifacts – that are new, surprising, and of value» [Boden 2004, 1]. There are basically

three ways in which such an outcome can be achieved. In other words, there are three kinds of creativity, which often appear combined: the combinatorial creativity, the exploratory creativity and the transformational creativity. In combinatorial creativity creative products are the result of the combination of familiar ideas stored in the person's mind. In exploratory creativity they are instead the result of the search of new solutions and ideas within a bounded and finite system of rules and propositions – which Boden calls *conceptual space* [Boden 2004, 4]. In transformational creativity, finally, creative products are the result of the transformation of conceptual spaces now felt as too narrow by a certain person [8]. Thus, having such an understanding of creative processes, it becomes simple for Boden [Boden 2004, 283] to think that

> «a computational approach can help to explain human creativity. It enables us to see what sorts of process may underlie our ability to learn new concepts (patterns), and to combine them in novel ways. Moreover, conceptual spaces – and the ways in which they can be mapped, explored, and transformed – are made more precisely intelligible by thinking of them in computational terms».

Summing up, after Boden's ideas, increasing our understanding of human creativity amounts to construct ever more accurate computational models of the different processes which constitute it and make it work and bring about its products. These models could be then implemented in hardware different from human brain, thus producing systems which would actually be able to act creatively, to a larger extent, the more accurate those models are.

Thus, for what concerns our question (1), science – scientific psychology, AI and computer science – could lead in the long term to artificial systems capable of *acting* creatively, i.e. of producing – by combining, exploring or transforming previous knowledge – something we could regard somehow as creative [9]. And, looking at the present state of automatic music composition and performance programs like EMI or Magenta, this appears quite probable, at least in the field of music.

However, it is insufficient claiming – in such a quite behavioristic fashion – that the acknowledgment of a certain quality of an external, concrete output (the creativity of the product or of the act) can justify the attribution of the same quality to the intrinsic nature of the subject producing that output (in our case, a computer). In other words, the fact that machines can produce something we could regard as creative is not enough: we need something more in order to consider machines as potentially creative subjects. [Casini, Roccetti 2018, 128-129] notice in fact that this "creative" output could be well understood as the mere result of some stochastic processes working in the machine or the results of statistics applied to data learned by it, which in this way could be not said to be intrinsically creative, but only accidentally and randomly.

What distinguishes an accidentally creative subject form a truly creative one is the fact that this subject act producing creative outputs showing in this intentionality. [Searle 1983, 1; Searle 1998, 85] defines intentionality as the property of mind to be «directed at, or about, or of, objects and states of affairs in the world», in other words, to have semantic content. In this sense, a subject – human or not – can be said to be truly creative if the creative output it produces correspond to an external, experienceable representation of the content of its mental states – whatever having a mind means for this subject [10]. That is to say that in the creative act the creative subject shows his *will* in creating an object which expresses the content of this will [Casini, Roccetti 2018, 128-129]. The subject *want* to create an object which can express something of him or hers.

Thus, creative processes cannot be only defined as formal processes in which knowledge is syntactically combined or transformed producing – perhaps completely randomly – a product which can be appreciated as new, surprising and therefore creative. This characterization of creative process and creative product is only necessary, but not sufficient. Creative processes are, in contrast, processes in which the creative subject wants to express the content of its ideas through a certain experienceable product which can be defined as creative even because it is acknowledged as such by other subjects provided with

intentionality and will too. Intentionality and will are, in this case, necessary, but also sufficient, conditions for creativity.

Human and computational creative subjects thus differ only in the fact that the former can *be* truly creative, because of intentionality and semantic, and therefore *act* creatively, whereas the latter can *only act* creatively but *not be* creative, because of the lack of intentionality, semantic and understanding. The (human) programmer would be here the truly creative subject. This would amount at least to the position of Searle, considering his famous argument of the "Chinese room" [Searle 1980]. Boden, for her part, remains sure about the fact that computer can *act* creatively, choosing to leave unanswered the difficult question about their *being* creative [Boden 2004, 7, 21, 277-304].

Thus, we said, answering question (2), intentionality is a necessary condition for creativity. Now, if this claim is generally true for the most diverse creative activities, it faces some problems in the case of music. Music, in fact, could represent an exception to what we said about the relationship between intentionality and creativity because it could admit creativity – processes and products *truly* definable as creative – without necessity of intentionality. This depends on an essential characteristic of music we were speaking about in the first lines of this essay: the abstractedness and the self-referentiality of music. In music meanings cannot be represented in the sense that to each particular syntactic musical element can be matched a particular reference or sense in Fregean sense [Frege 1892] which is about (experienceable) objects and states of affairs in the world, to borrow from Searle; furthermore, they do not possess a fixed or – to say it simply – "a priori" one, like generally the syntactic elements of a natural language (words) or of painting (figures, shapes, etc.) [Hanslick 1854], [Helmholtz 1863], [Scruton 1976].

Hence, if music represents nothing external to its intrinsic syntactic material (harmonies, chords, scales, etc.), if it does not express any meaning referring to external objects in the word, then, we can say, the semantic dimension of music is entirely reduced to its syntax. There is nothing else in music than its harmonic and melodic forms and structures. In this sense, if there is something to understand in music, this is not, in traditional sense,

a semantic, representational meaning beyond its syntax, but only the functional and causal role of every syntactical element within the specific musical system, form or genre considered. As a consequence of this we have that intentionality is not a necessary condition for musical creativity (see also [Ariza 2009, 64-65], [Soldier 2002], [Carroll 1999, 163], [Wimsatt and Beardsley 1946], [Zimmerman 1966]). In fact, if semantic is excluded from music – if, in other words, music cannot express meanings and be «directed at, or about, or of, objects and states of affairs in the world» – creative musical subjects (composers or performers) cannot put in musical products the experienceable expression of the intentional content of their ideas [11].

Such a formal theory of music thus defines music practically as nothing but a combinatorial game with syntactic forms and structures. This game is then supposed to bring about some products to which creativity can be attributed. This attribution is generally carried out by listeners, which *intentionally* give the music they listen to personal meta-syntactical (and mostly "emotional") meanings, taking advantage of the absence, there, of an objective, univocal semantic dimension [12].

Now, the acceptance of a formal theory of music as an answer to question (3) leads to some important consequences in relation to the last question (4), and in general to the ethical problems of the relationship between AI and music we will discuss in the next sections. In fact, accepting that musical creativity does not depend on intentionality because of the "meaninglessness" of music, and that musical products can be considered as truly creative even if they are not the expression of intentional contents and are instead only the result of some kind of syntactical manipulations, there is no problem in believing that artificial systems too, which, as we mentioned, are supposedly able to *act* creatively, could produce musical products which can be regarded as creative. In this sense, they would be creative in music in the same way humans are: if musical creativity develops as a process of syntactical manipulation of musical figures – which cannot be otherwise, since music has no intentional content – and if artificial systems can act creatively exactly manipulating syntax, it follows that the latter can potentially [13] produce creative music as humans do. This artificial musical creativity will be probably not that of replicating the style of existing music or of

composing music within traditional musical systems, but rather that of producing music in really different, maybe completely new, musical styles (see [Casini, Roccetti 2018, 128]). Defining, judging and reflecting on the forms of this new type of creativity will be the work of music aestheticists.

That artificial systems can be musically creative as humans appears quite acceptable also considering the fact that their specific creativity is already being acknowledged as such by humans (musicians or not) themselves [14]. A lot of artificially composed works have been in fact already performed in public concerts or recorded by human musicians with great appreciation of the public and whit remarkable critical acclaim. For example, Iamus's first compositions (see [Note 3]) have been performed for the first time in a public event in 2012 by human musicians and then even recorded by the prestigious London Symphony Orchestra. Moreover, several artificial systems and software have been being employed as an aid by musicians and composers in composing and performing music. Some of the most important examples are Path Metheny with his orchestrionics, Steve Reich with his phasing techniques, Iannis Xenakis, Paul Lansky, John Cage or, exiting "classical" music, the Kraftwerk and The Human League, the Daft Punk etc. (the list would be here really very long).

In the end, the potentiality of computers to be in music autonomous creative subjects is currently being boosted and realized concretely by AI, machine learning and other disciplines afferent to computer sciences, which increasingly sophisticate the computational skills of artificial systems and software used in music. To this respect, it is important to notice that progresses in this direction are impossible without having as philosophical starting point and heuristics such formal presuppositions about music and musical creativity allowing and justifying theoretically the possibility of an artificial musical creativity.

2.2 Ethical Problems of Musical AI

Answering question (4) from the standpoint outlined in the previous section, we can thus state that being a musician means for a machine firstly being able to manipulate musical syntactical elements producing outputs which, if showing an adequate level of complexity,

are considerable as *intrinsically* creative, as musical creativity does not require intentionality and semantic behind syntaxis. In addition to this, being a musician means for machines to gain external acknowledgment of their creativity.

So, on purely theoretical level, it seems that no differences between human musicians and "artificial" musicians can be drawn, at least for what concerns music composition: both of them can manipulate syntactical figures producing creative objects acknowledgeable as such. In addition to this, disciplines like AI are actually concretizing this theoretical assumption (think for example of Iamus), making computers, as ever more autonomous music-creative subjects, collaborators or even "colleagues" of human musicians.

As seen, philosophy of musical creativity and AI thus theoretically allow that computers can be treated by humans in the same way of human musicians, at least for what concerns the technical level of the production of musical creative outputs. Nevertheless, why do we continue to distinguish between human and "artificial" music, human and artificial composers? It is clear, in fact, that only a theoretical justification of the potential equality of humans and computers within music does not suffice for retaining it real and effective. In other words, there may be a further element, in spite of this theoretical justification, preventing the acceptance of computers as autonomous creative subjects in the field of music. This element is actually a (lacking) *moral and political decision about this acceptance* (see also [Boden 2004, 21]).

Even if computers are able to compose music which is acknowledgeable as creative to the same extent in which music composed by humans is, we can only hardly think of a (future) society in which, for example, human composers are entirely replaced by computers or in which computers own the entire authorship of the works they compose. This eventually depends on a moral and political decision of us as humans towards artificial systems in music which essentially aims to deprive the latter, to various extents, of the condition of autonomous creative subject and, in this way, to avoid possible situations, like those mentioned above, which could be morally and legally very puzzling.

Now, investigating whether such a decision is really necessary and really desirable is one of the central aims of this essay and we shall pursue it having as a methodological starting point particularly two of the ethical problems of Musical AI already mentioned: the problem of music job replacement and the problem of machine musical authorship.

2.2.1 Music Job Replacement

Similarly to many other human activities, the worry that AI will soon make possible a replacement of human workers with computers is observable in music too. Since the development of music composition and writing software, sound sampling techniques, audio editing software, MIDI sequencers, synthesizers and other kinds of software and electronic or digital musical instruments which now take also advantage of the most recent development in AI, music labour market has undergone several and radical changes. Many professional figures no longer required have disappeared and many others, especially those working with digital technologies and computers, have entered concert halls, stages and recording studios ([Katz 2004, 64], [Collins 2011, 35], [Sturm et al 2019, 15]). MIDI backing tracks, synthetized sounds and vocals constitute today a large portion of pop music and other related musical genres. In addition to this, as a general tendence, the first music fruition channels are undoubtedly represented today – i.e. in the time of mass success – by computers, smartphones, internet and other digital media instead of live concerts – at least for what concerns the musical genres at stake. This is also because mass success is requiring artists and musicians a certain form of ubiquity which only digital media can assure [Collins 2011, 38]. As a consequence of that, real-life human musicians accompanying pop singers with physical instruments are generally no longer a strict necessary condition for the fruition and the existence itself of music: online available recordings, music composition software and synthesizers most of the time suffice.

Nevertheless, as pointed out also by [Casini, Roccetti 2018, 127-128], these tendences does not and will never directly amount to a slow and inexorable decline of the participation of human musicians in music creation and performance processes. First of all, in fact, every

step of digital music production still requires human musicians activating and operating computers and AI systems, as well as, in some cases, recording what computers composed. In this respect, artificial systems could also be considered autonomous creative subjects and thus collaborators of human musicians relying on what we said in [Section 2.1]. However, they still require human inputs in order to activate, enter the creative process. This is the reason why human musicians are still needed in music and will not be replaced at least until AI and AGI [15] does not achieve the goal of developing machines with human-like intelligence and consciousness. Whilst, in fact, intentionality is not a necessary condition for the musical creative processes in itself [Section 2.1], i.e. for the production of a musical object which can be considered as creative, setting off this process still requires a form of intentionality and consciousness machines do not currently possess yet. In this case, not considering computers as completely autonomous creative subjects and not "dignifying" them as such depends not only on a moral decision but also on an intrinsic technical condition of them, more specifically the condition of being able in music to produce autonomously creative outputs, but not (yet) to trigger autonomously creative processes.

Secondly, the disappearance of human musical agents from music and their replacement with digital technologies and AI is currently not a concrete risk also because, even if live performance with real-life musicians is no longer a necessary condition for the fruition of music, people do not give completely up the possibility of enjoying music live. [Casini, Roccetti 2018, 128] insist on this. Nevertheless, they fails to consider at least two possible objections to this argument which could undermine the conviction that live performances can be a sort of safeguard against technology replacing humans in music jobs. Firstly, synthesizers and computers allow today to simulate faithfully almost every kind of musical instrument and even human voice. It is then not surprising that, for economic or logistic reasons, in live performances too (or for example in live television programs) an entire orchestra or vocal group of real-life musicians and singers is substituted by one or a small group of synthesizers controlled by a single musician or even by a digital (maybe AI powered) sequencer – unless by playback recordings or MIDI tracks. Such developments have indeed

been ongoing already for decades and will have even more stronger effects, the more technology and AI-systems will become powerful.

Moreover, [Casini, Roccetti 2018, 127-128] go further introducing the important concept that

> «at the center of the musical aesthetic experience, the musician often prevails over the music s/he plays. [...] In pop music [...] people do not care about the fact that the actual singers are backed up by a team of producers and are often not involved in the creation of the music that they perform [...]. People appreciate the music and the figure of the pop star and those two things are bound together. If the producers of Madonna decided to write the same songs for another singer the result would not be the same because the character Madonna is as important, if not more, as the musician Madonna. [...] For the listener knowing that there was a machine instead of a pool of 10 producers behind a singer would make no difference.»

Such assumptions can be generally accepted and can indeed count as a further argument against the possibility that artificial musical agents will completely replace human musicians. In this terms, however, this argument also lacks generality. In fact, if it is valid for genres like classical music, jazz music, experimental rock, singer-songwriting, etc. in which performers are generally not backed up by third party producers and are mostly appreciated as first-person creators of their music or as interpreters putting personal artistic thoughts and experiences in the performance, it is not for other music genres just like pop music. In this case, in fact, pop singers too, and not only "background" producers, could be replaced by AI systems. Being considered firstly for their public image than for the personal artistic contribution to the music they perform (differently, for instance, from a pianist playing Chopin or a saxophonist improvising on Brubeck's Take Five) – as just stressed by Casini and Roccetti – pop singers are theoretically more "vulnerable" to a replacement with technology [16], especially if we consider some recently developed technologies of sound sampling and music synthetization which make this perspective ever more realistic. To this respect, it is very interesting to look for example at the case study put forward by [Collins 2011, 36]. He refers to singers Hatsune Miku, Kagamine Rin and Len, and Utatane Pik for

speaking about a real «ontological progression» in the appearance of true «virtual musicians» after, for example, Ross Bagdasarian Sr.'s Alvin and the Chipmunks and the Gorillaz [17]. All of these singers and musicians are virtual, i.e. fake characters, but while behind the latter real-life human composers and performers operate, no human composer or performer is involved in the production of the music the former sing or play, composed and performed, instead, entirely by a software, Vocaloid, developed and distributed by the Japanese corporation Yamaha [18]. This example thus demonstrates how currently an artificial pop singer is possible, who has not only a virtual public figure, but also a virtual voice, in a word, no human counterpart in real life. On the contrary, no technologies are available today which could replace every kind of musician, like for example the classical musician. She is not a mere performer of third-party composed music but gives an interpretation to the played music which owns an intrinsic artistic value. Thus, once again, at least until AGI technologies will be developed, i.e. technologies capable of conscious thought, memory, etc. as humans are, no artificial system will be able to replace all kind of musicians. In this case, Casini and Roccetti's argument would still remain valid.

2.2.2 Machine Musical Authorship

The authorship of artificially composed or performed music is another important ethical and legal problem deriving from the application of AI and technology to music. We start discussing it taking the software just introduced in the previous section for speaking about virtual musicians: Vocaloid. Vocaloid is a singing voice synthesizer software that permits those who buy it to synthetize songs for some fictional singers virtually embodied by anime and manga avatars (just like Hatsune Miku and her colleagues). The original voices implemented in the software, which can be then modified, altered, adapted to certain lyrics and melodies etc. derive from the sampled voice of real human singers, whilst the fictional avatars are also created by human designers. This means, a musical product created by means of Vocaloid would have a multiple authorship since the subjects concurring in the process of creation are many: the singer whose voice was sampled, the designer of the avatars,

the programmer of the software, the company which distributes it, the "composer" who, sets up, triggers and uses the program she paid for, expressing in this way her musical ideas, and possibly, if different from that composer herself, the author of the lyrics and the melody (or, still, the programmer who produced some algorithms and software for producing them).

Already [Collins 2011, 36] acknowledges the difficulty of apportioning appropriately credits, authorship and rights to the final product of Vocaloid between these subjects. Indeed, the ethical and legal problem of the rights to AI-produced music appears quite puzzling if not really paradoxical today, especially for institutions and lawgivers. Taking another software of automatic music generation as a starting point and example, FolkRNN [19], [Sturm et al. 2019] give also an account of the problem considering the provisions on the subject put already forward by some countries around the world and suggesting some guidelines for an appropriate and effective regulation of it. He reports that, on the one hand, countries like UK, Hong Kong, South Africa, India, Ireland and New Zealand already adopted copyright laws envisaging the operator of the given computer program as the owner of the rights to the musical works generated by it [Sturm et al. 2019, 4]. This is evidently an effect of a moral and political decision which does acknowledge an active role within the artificial creative process both to the software – thus not solely to the creators and programmers of it (see EMI's case below) – and to the human subject operating with it and making all «the arrangements necessary for the creation of the work have been undertaken» [Sturm et al. 2019, 4]. This means that the artificial system is generally considered as a creative co-author of the work, whilst, however, it is always the human subject to bear entirely the *legal* responsibility for uses and misuses of its products. That artificial systems for music generation are, in these countries, at the center of a moral and political decision which acknowledges them from the moral point of view as (at least partly) autonomous creative subjects appears clearer and even more emphasized particularly in the British copyright law, that defines computer-generated works as works «generated by computer in circumstances such that *there is no human author of the work*» [Copyright, Designs and Patents Act 1988, I(X), S. 178, my italics]. For what concerns the legal point of view, as noticed also by [Sturm et

al. 2019, 4], such legislations do not allow however to regulate the matter in a homogeneous, univocal and unambiguous way and are therefore insufficient. In fact, it remains for example not completely clear, what the precise legal responsibilities of the programmer and of the user would be or in which terms the software itself could be considered legally relevant.

On the other hand, there are countries – [Sturm et al. 2019] continue – like the USA or most of Europe, in which a moral and political decision is taken towards software of automatic music generation – on the basis of which corresponding copyright laws are issued – which is opposite to that taken in the countries mentioned before. In these countries artificial systems capable of creative products certainly gain a form of aesthetic acknowledgment, which does not however have moral and legal effects: creativity is a category belonging only to humans and as such it has to be understood and treated by institutions and legal systems. If any at all, provisions regulating the authorship of computer-generated music basically apply the same legal categories of "normal" copyright laws resting on «human-centered concepts, both with regards to the beneficiary of protection (i.e., the author), the conditions for protection (e.g., originality), and the rights granted (economic, but also moral rights)» [Sturm et al. 2019, 4]. The Court of Justice of the European Union (CJEU), for example, considers a work original or creative if it is expression of the author's free creative choices, personality, or personal touch [20] [Sturm et al. 2019, 4]. In quite the same terms, taking another example, no credits are assigned to the program EMI itself by his creator, the American scientist and composer David Cope (see Note [3]), who conversely owes all rights to the works generated by it: the program is retained incapable of autonomous creativity, «the hand of the composer is not absent from [its] finished product» [Cope 1991, 2].

In this way, however, every possibility to morally acknowledge creativity to machines is excluded almost a priori and, with it, every possibility to have a copyright law protecting machine authorship and AI-generated works (of this jurisprudence too seems to be quite sure – see for example [Buning 2018], [Deltorn and Macrez 2019], [Guadamuz 2017], [Lauber-Rönsberg and Hetmank 2019], [Michaux 2018] and [Ramalho 2017], also cited by [Sturm et al. 2019, 4]). Yet, on the basis of the theoretical premises from [Section 2.1], it is

simple for us to see that this particular moral and thus legal *decision* – regarding AI-systems involved in creative processes as incapable of autonomous creativity and originality – eventually depends on a particular, *implicit* account of creativity which makes this latter dependent from phenomenological and subjective factors (author's personal experiences, touch, will etc.). As we observed, this is, after all, only *one* account of creativity, and maybe also not the more accurate, at least in the case of music. Especially with Boden, in fact, we have seen that such verbal – and indeed quite naïve – theories of creativity are insufficient in order to give a realistic account of how creative processes really work and what the necessary conditions for creativity – and musical creativity – really are. Certainly – in the absence of an AGI – phenomenological factors are still important, for instance in triggering creative processes (see [Section 2.2.1]) but, at least for what concerns musical creativity, they appear not to be so indispensable for the *intrinsic* functioning of musical creative processes, which has to do rather with syntaxis than semantics and phenomenology (see Section [2.1], [Ariza 2009, 65]). Moreover, originality too is a quite vague notion in music, just like the naïve notion of creativity itself. This concept cannot be simply taken from the everyday language and used, maybe in judgments and laws, without defining critically in advance a univocal and appropriate meaning of it. In which sense, for example, is Mozart's music original compared to Bach's one, considering that the former spent years studying and assimilating the contrapuntal innovations of the latter? What piece of music, composed by humans, could be truly defined as something *completely* original and (syntactically [21]) irrelated with the rest of the contemporary and previous music compositions? [Casini, Roccetti 2018, 129].

We could conceive for example of an AI-powered automatic music generation software which is able to compose some pieces of music in Mozart's style as a human composer too would also do. We admit that both internalized every composition of the Austrian composer (of course in qualitatively different ways). The software, due to its higher computational skills, could even explore musical combinations allowed in this musical style farther from Mozart's original compositions than those the human composer would ever find, and thus, in comparison to these latter, even more original. Now, regardless of the aesthetic

significance of the outcomes of both, in what would the composition of the one properly be less or more original than that of the other? And, in general, why it is (arbitrarily) presupposed that (subjective) aesthetical criteria can be used for stating and judging the intrinsic originality (or even creativity) of a music piece? Does this not depend, *in music*, only on a matter of syntactical combinations? (see [Section 2.1]). Furthermore, the "farther" combinations found by the software could be, at the end, only indirectly and indeed very hardly brought back to the actual intentions, experiences, touch, will, etc. of its human programmer: they are actually so far, unimaginable and unpredictable for her that no direct "phenomenological" interdependence connection can be truly stated between the two. Yet, CJEU's judgments, for example, require such a connection as a necessary condition for the attribution to the latter of moral and legal rights to the authorship of the former. Even if the existence of this connection cannot be really detected, the attribution most of the time takes place anyway: this clearly shows a theoretical bias in such kind of legislations.

Thus, copyright laws which take the originality of a musical work as a necessary condition for the attribution of moral and legal rights to its creator are simply considering the problem from a perspective which seems rather narrow and not critical enough. Originality cannot be said to be a necessary condition for musical creativity, but only a sufficient one (see [Section 2.1]), and a phenomenological account of musical creativity cannot serve as a basis for the attribution of moral and legal rights [22].

It is however quite reasonable that a more accurate and comprehensive legislation about machine authorship should be developed. Automatic systems for music composition and performance are becoming ever more autonomous, i.e. capable of truly original and creative products ([Sturm et al.2019, 4], [Casini, Roccetti 2018, 127], [Collins 2011, 37-38] we showed that this is theoretically possible in [Section 2.1]), and indeed, as we have seen in [Section 2.2.1], they already play a significant role in our present society. This means, consequently, that to them should be acknowledged some kind of moral and legal responsibilities. However, finding a way in which this could concretely happen represent currently one of the most important and difficult challenges for many countries around the world,

including EU [Sturm et al. 2019, 4]. The possible perspectives in this sense are many and different. Perhaps «authorship recognition may require an analysis of the operation of the systems and the role of the different actors involved in the process (e.g., the developer, the trainer or the user)» [Sturm et al. 2019, 4]. If AI-systems will be able to replicate famous composers or even performers, changes in the definition itself of copyright and authorship may also be required: «copyright will be perpetual [...] or effectively lawless or, most likely, will remain somewhere complexly in-between» [Collins 2011, 38], «adjustments may be needed to the existing framework to either amend the existing copyright laws or to pass new *sui generis* rights targeting AI-generated products» [Sturm et al. 2019, 5, italics in original] (see also [Schafer et al., 2015]). The owner of the copyrights on AI-generated music could no longer be determined by traditional categories like intellectual property, expression of personal creative choices, ideas, will, etc. but merely through economical ones (simply, who paid for the program has copyrights on its product [Sturm et al. 2019, 9]). Or even, «machines», when powerful and intelligent enough in a probable future, «may at some point stand up for their own IP [23] rights as dynamic creators, whilst the existing big content companies will fight to retain power as long as they can by denying that AIs have reached sufficient independence» [Collins 2011, 38].

3 Conclusion

In the previous section we have analyzed two of the most relevant and urgent ethical problems of Musical AI: music job replacement and machine musical authorship. We considered some current tendencies in music industry which could lead in the long term to the replacement of human musicians by artificial systems, as well as the reasons why this will be never completely possible without systems with a human-like AGI. Then, discussing the second problem, we had a look on the different ways in which some countries legally regulate the attribution of authorship to artificial systems, examining advantages and shortcomings of them, as well as on some possible future perspectives through which this subject may be regulated.

Discussing these problems, we noticed that beyond the acknowledgment of the creativity of AI-powered systems of music production *at mere aesthetical level* – this is eventually the reason why they are used by musicians – a *moral role* is explicitly or implicitly attributed to them, which is necessary because of the social relevance they already gained (they can intervene in music industry and interact with human musicians in working relationships, they are legally relevant subjects in the matter of the attribution of copyrights, etc.). A moral decision involving artificial systems of music production is also necessary as a basis for issuing legal provisions defining this social role and regulating the relation between them and human subjects. This appears particularly clear with regard to the problem of machine musical authorship. Moreover, we have seen that the kind of moral decision taken, i.e. the way in which the moral and social role of such artificial systems is acknowledged, essentially determines the shape of the legal provisions issued.

As emerged from the discussion of CJEU's judgments and of the problem of originality in [Section 2.2.2], every moral decision towards artificial systems of music production strictly depends on the theoretical account of music creativity explicitly or implicitly adopted. More in general, the way – and indeed the possibility itself – of solving the ethical problems of Musical AI depends on what we consider as characteristic of musical creativity. Accepting a formal, computational or syntactical theory of musical creativity, which explains human and artificial musical creative processes in quite the same terms (see [Section 2.1]), the possibility is admitted to consider human and artificial creative subjects in music morally in the same way and at the same level. Conversely, defending a theory which takes phenomenological and aesthetical factors as necessary conditions for musical creativity (experiences, will, touch, etc. of the author, intrinsic aesthetic value of the musical work) leads to the impossibility of acknowledging artificial systems of music production (still in absence of a human-like AGI) as autonomous moral subjects.

Certainly, the adoption of a certain theoretical account on musical creativity and thus the moral decision which derives from that also depends on the particular system considered and on the specific ethical and social context in which such a decision has to be

taken. This is the reason why these two perspectives still remain not mutually exclusive. Beyond the theoretical and scientific appropriacy of each of them, however, from a merely pragmatic point of view the first one actually seems to be probably the most helpful one: as we said, since artificial systems of music production are *already* part of the everyday life and the everyday work of musicians, music industry operators and music consumers [Section 2], we *already* need to acknowledge them a moral role, after which, by the way, a corresponding definition of their legal status and a corresponding formulation of laws and provisions on their use can only become possible.

It appears always clearer that, in general, we will become more and more technology- and AI-entangled, that technology and AI will gain ever more importance in every aspect of our life. Accordingly, artificial systems of music production too will be considered as ever more autonomous agents and AI-generated music as music in its own right, as independent musical genre. Thus we have simply to learn, in some way, to live with this (see [Casini, Roccetti 2018], [Sturm et al. 2019], [Collins 2011], etc.).

So, a moral decision regarding these systems is also highly desirable. Nevertheless, it is necessary that the theoretical presuppositions on the basis of which it is taken are always made explicit. Furthermore, no decision should be taken before the theoretical presuppositions on which it is supposed to be based are critically discussed. From this point of view, the importance of philosophy and science is obvious: Philosophy and aesthetics of music, philosophy of mind and AI, computer sciences, cognitive sciences, neurosciences, etc. help us a lot in understanding how music creative processes work, what musical creativity is, what we should regard as truly creative in music, etc. and this is essential, as we know, also for taking moral and legal decisions regarding artificial musical creativity.

Notes

[1] See in particular [Helmholtz 1863] who accepts this formalistic view of music as aesthetic presupposition of his acoustic theory developing as a physical analysis of the tones and the sensations of tones.

[2] The *Illiac Suite* (1957), for string quartet, was the first musical work entirely composed by an electronic computer. The computer, named ILLIAC, was programmed by Lejaren Hiller and Leonard Issacson at the University of Illinois at Urbana–Champaign [Hiller and Isaacson 1959].

[3] Examples of these software are that of Kurzweil, who in 1965 developed a computer program capable of analyzing music pieces and composing new ones; the EMI (Experiments in Musical Intelligence) by David Cope (1981), able to assimilate through techniques of music pattern recognition the musical style of one composers or more and give as output new compositions in which these different style are intersected [Cope 1992]; MIR systems (Music information retrieval), used not only for retrieving information from existing music (identification of melodies and works, automatic transcription, etc.), but also for generating new music [Downie 2003], [Typke, Wierig, Veltkamp 2005]; Aiva and Amper for creating soundtracks for advertisements; Melodrive for the automatic composition of videogames soundtracks (see [Sturm et al 2019, 2]). Almost all of these systems are based on a mathematical model termed Markov Chain (after the name of the Russian mathematician who developed it) which makes the occurrence of a certain event in a sequence of events probabilistically dependent *only* on that single event which precedes it. So, simply explained, the software calculates the probability that, in a work of a certain composer, the chords or the notes x', x'', … are followed by chords or notes y', y'', … and applies consequently this calculations in generating new music pieces "in the style of". Artificial systems able also to create new musical pieces *in the own style* are today however not lacking: an example is the Iamus computer, located at University of Málaga [Sánchez et al. 2013].

[4] The most relevant example of application of machine-learning techniques to automatic musical composition and performance is the so-called *Magenta Project* by Google (see [Miller 2019] for an overview), started in 2016. This project furthermore aims at replicating artificially human creativity in other artistic field as well.

[5] International Computer Music Conference, International Joint Conference on Artificial Intelligence, Computing Society Conference, etc.

[6] The value of music within the formation processes of personal and cultural identity has been acknowledged by many social scientists (see for example [Holzapfel 2018], [De Nora 1999], [North and Hargreaves 2008]).

[7] Such computational concepts and theories can be also formalized, and indeed have been (see [Wiggins 2006a], [Wiggins 2006b], [Mogensen 2018], [Schmidhuber 2010]).

[8] For a discussion about the sufficiency of Boden's identification criteria for creative processes and products see [Miller 2019, 25-28].

[9] The discussion and the evaluation of the appropriateness of Boden's thesis that AI and computer science can offer an understanding of *human* creativity in computational terms exceeds the aims of the present paper.

[10] The discussion about whether intentionality or will need a mind or a self-consciousness in the phenomenological sense as a substrate, and in which terms this substrate should be defined, would really lead us too far from the aims of the present essay. What matters, especially for our ethical purpose, is merely the fact that creative products represent an external expression of the will and ideas of their creators, this being a necessary condition for a creative product to be defined as truly creative.

[11] With "ideas" we mean here the *non-musical ideas*. These latter are ideas which do not regard the syntactic dimension of music and lie beyond it, expressing a sort representational meaning which has to do with things in the world. On the contrary, the only expressible ideas in music can be related only with its syntax (forms, structures, musical figures, tones, etc.), i.e. the *musical ideas* [Hanslick 1854], [Scruton 1976].

[12] An argument for supporting this view could be a musical paraphrase of Searle's "Chinese Room". We take a closed musical system, like modern tonal harmony where only a finite number of possible specific combinations between musical forms and structures is allowed. How this system works is explained by a book of rules which for example say: "The leading note goes to the tonic"; "Soprano must not be more than one octave away from Alto"; "Avoid consecutive 5ths and 8ves", etc. An imaginary subject which is able only to read and write music on the staff (i.e. with no knowledge of the system) is confined in a closed room with this book, receiving musical inputs from outside and being asked to produce an output according to the rules (for example completing a melody or some harmonic successions). Proceeding in this way, the composer will produce a whole piece of music, which will conform to the rules and be even acknowledged as creative, if the subject at stake has been able to seek out the most refined and uncommon

combinations within those allowed. By no means, however, this manipulation of musical syntactical figures will correspond to the understanding or the production of some kind of meaning or semantical content behind syntax: there are no meanings in music; musical creativity does not depend on intentionality and understanding and derives only from syntactical manipulation of musical forms and structures. [Cross 1993, 67] uses such a kind of musical transposition of Searle's argument in order to demonstrate the opposite these (music requires intentionality and understanding). He imagines two computers in a box creating music, saying that nothing is happening there which possesses factors of human participation, intervention or experience. What the computers produce is therefore not music, which instead needs those factors. However, as shown by [Ariza 2009, 65], this argument is not safe from objections: Cross ignores for example the fact that humans created the box, the book of rules followed by the computers and the computers themselves.

[13] This means, once they would reach the right level of technical complexity and "manipulative power".

[14] As we know from Boden [Boden 2004, 1], acknowledgment is a necessary condition for creativity (creative products should be «of value»). Behind the form of external acknowledgment of musical creativity we refer to in this paragraph, a further (and more rigorous) demonstration of this acknowledgement is given by several kinds of tests for the evaluation of algorithmic music systems – like, for example, the "musical Turing test" (see [Rodà et al 2015] and [Ariza 2009]) – in which people confronted with both human- and computer- composed or performed music most of the time fail to distinguish them, independently of their musical background and education.

[15] AGI (Artificial General Intelligence) aims to implement in artificial systems a kind of artificial intelligence which is oriented not only to a particular task but resemble more the human intelligence in general terms.

[16] We want to make clear that whit this discussion we are not building here a qualitative hierarchy of music genres.

[17] The fact that real-life pop singers has been in this case substituted by fake characters concretely demonstrates how in pop music public image is in a certain sense prior to the music.

[18] The cultural impact and the success of these Japanese singers has actually been very relevant: they reached both the top of music charts in Japan in 2010 and great sales records. Another example of external acknowledgment of artificial musical creativity in Boden's sense (see [Section 2.1])!

[19] FolkRNN is an open source software available online (https://folkrnn.org/) which utilizes recurrent neural networks and AI for analyzing great quantities of folk music transcriptions present in internet and producing new folk tunes from that.

[20] Infopaq: C-5/08, Judgment of the Court (Fourth Chamber) of 16 July 2009; BSA: C-393/09, Judgment of the Court (Third Chamber) of 22 December 2010; Painer: C-145/10, Judgment of the Court (Third Chamber) of 1 December 2011; Dataco: C-604/10, Judgment of the Court (Third Chamber) of 1 March 2012.

[21] Semantic relations between musical pieces are after all practically impossible to detect, since, as we know, music is not representational.

[22] We stress that this kind of discussion is valid *only* for what concerns music and not for other creative fields.

[23] IP: Intellectual Property.

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