DIGITAL ARTIFICIAL COMPOSERS: ISSUES OF AESTHETIC VALUE, CULTURAL MEANINGS, CREATIVITY, AND ONTOLOGY

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Abstract

Digital artificial composing is a new field of musical creation. Artificial composers do not mean to replace humans, but are new technological tools that support algorithm-based musical creation. However, many questions arise especially with respect to music creativity, music aesthetics and music education. The aim of the paper is to critically present and discuss the new scene in the field of musical composition regarding the digital artificial composers, taking three case studies: David Cope's creations Emily Howell and EMI, and Mellomics, created by a team from the University of Malaga. Our suggestion is that we cannot conceptualize this new way of music creation without thinking of the aesthetic context of production, issues of intellectual property, creativity, ontology and related cultural meanings and aesthetic values.

Keywords: *artificial composers, creativity, ontology, aesthetic value*

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Music is defined as a uniquely human phenomenon, according to the anthropological perspective proposed by Alan Merriam (1964), who defined music as "a product of human behavior in time and space" (p. 7). Moreover, every music form corresponds with structures in society, as music "exists only in terms of social interaction" (p. 27). Yet, in the last decades the new digital affordances have transformed the above conceptions and traditional status of musical creation. Recently, computers offer new possibilities for music creation through advanced softwares, presented as artificial composers, who are able to take on complex musical tasks, such as composing, arranging, orchestrating, transforming a musical piece into various styles, inventing new sounds, and so on. Artificial composers were not created to replace real people, but are new technological tools that change or extend the processes of musical creation. However, many questions arise, especially with respect to musical creativity, music sociology, and music aesthetics. Can artificial music be valued [evaluated] by the same criteria and within the same system that measures the value of human music? Who is the author of such works? Is that kind of music a social product and manifestation of culture? What about the 'fair use' of musical data that inform the computer database? What kinds of skills are required to produce such music? What kind of meaning resides in such musical

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forms?

Our paper attempts to critically present and discuss the new scene in the field of musical creation by artificial composers, and to cover some concerns taking three case studies: David Cope's *Emily Howell* and *EMI,* a n d *Mellomics,* created by a team at the University of Málaga. Artificial composers create aesthetic, ethical, and philosophical-ontological concerns. It will take considerable time before the symbolic, cultural and musical-aesthetic perspectives associated with these new technologies become fully understood.

Technological evolution and music

One of the most important developments in the history of music was the invention of digital audio production. Since Edison's first recording in 1877 –and the following changes from wax cylinders, vinyl, to compact discs, MIDI files, and mp3– technology has transformed music production, reception, and dissemination (Mueller et al., 2017). Humans are currently interested in building machines that mimic their music abilities and can perform complex music tasks.

The new digital environment has influenced the traditional perception of the definition of the musician. While some believe that musical creation has benefited considerably by digital tools, others reject this idea and continue to use traditional ways in composing their music. Thus it is important to understand how digital media have influenced musical creation and the production-reception- dissemination of music as a whole. Technology is both an agent and a medium in today's musical experiences. Technology creates music, it mediates music, and it allows us to interact with music (van Elferen, 2009, p. 130); it has brought considerable changes to the quality of sound and determines musical experiences. This has led to the formation of 'digital aesthetics', which stands opposed to the 'analog aesthetics' of the previous decades (Moseley, 2016).

The new generation of composers is the first one that creates within the digital revolution. A musician in today's world of music software differs a lot from the musician of the past, as "the dividing lines between the composer, the arranger, the performer, the studio engineer, and even the listener are becoming much less clear-cut" (Hargreaves, Marshall & North, 2003: 149). For digital musicians, acoustic awareness –the ability to listen to music widely and accurately and to understand how the sound behaves in space and time– is becoming increasingly important. Similarly, skills and knowledge about technology, such as sound recording, mixing, remixing, etc. are also crucial. Tasks, which until recently required a group of skilled people with professional knowledge, can now be managed by only one person, in most cases, the music creator. Musicians are now able to have their own personal home studio for sound manipulation and recording. This is a new culture of musical creation.

Artificial music composers

What exactly is an artificial composer? In fact, it is a computer program that composes music based on algorithms, a set of rules and instructions for composition. The program receives input and manipulates it in human-like ways; it analyzes the material using deep neural networks, combines information, and forms a final product. Algorithms

are designed to make decisions. Algorithms, based on probability equations, were used in most works by Iannis Xenakis. It seems that, among other things, technology breaks down the myth that creativity is purely human.

Computers can execute every task formulated in a language their hardcore understands. They use a modular language, like the human one. Most works by artificial composers are based on audio input material while the programmer is the one who designates the result.There are softwares, such as Max/ MSP/ Jitter, that allow users to manage input tones and transform them into new sounds that can be changed further. Namely, according to the artificial composer's programs, one may feed an idea into the computer and get a final output. Then they can manage this material as they want: elaborate it, modify, reverse or expand it, add various effects and so on. Algorithms for artificial synthesis can work in many ways. In one sense, the artificial composer learns almost like a human composer: it 'learns' the rules of composition, the physical constraints of the instruments, the most usual combinations that fit a particular style (Farrell, 2015). At any rate, the question we may ask is: should artificial composers be considered and evaluated as human composers?

Artificial composers, three cases: *Emily Howell, EMI,* and *Melomics*

We will discuss some examples of digital artificial composers. *Emily Howell* and EMI are two new music composers, or a 'new kind' of composers, two artificial composers, created by David Cope, composer and emeritus professor of music. The idea started in 1990 and was completed in 2003. Cope has created two artificial composers that follow two different algorithmic methods. The first method (used in EMI) involves the analysis of musical examples for motifs, rules and similarities, and the use of this data to create new original content in the style of a composer. Similarly, as Farrell (2015) observes, one could analyze Shakespeare's sonnets to identify the similarities in their underlying structures and their content, and then they can use those rules to create a new Shakespearean-style sonnet. The second method (used in *Emily Howell*) uses external association networks that give a 'response' and automatically receive external feedback as to whether or not the result produced is appropriate and acceptable. Cope's creations are some of the most well-known cases of artificial composers, with *Emily Howell* seen as the most successful. Composers' programs have allowed Cope to create hundreds of tracks within few minutes (Muscutt, 2007, p. 12) and choose the best version.

Prior to *Emily Howell*, Cope created *Emmy* following the initials of *EMI* (Experiments in Musical Intelligence), which was less active, based on his first method of analytical approach. EMI could imitate famous composers like Bach and Mozart, analyzing thousands of their works and finding similarities within them. In an interview to Keith Muscutt (2007), Cope was asked about how he felt that EMI's music could compete with real composers. Cope responded that it is not an issue about machine-versus-man, but one about a man with pen and paper versus a man with algorithmic rules. He also added that he is a human who creates music using his software tools claiming: "m y programs follow my instructions in producing what would have taken me several hundred or even a thousand times longer to create"

(p. 13). Hence, he considers *EMI* not as an autonomous entity but as an extension of his own compositional abilities. It is him who provides the music input for *EMI* in order to create music and customizes the algorithm to have the desired result. It is him who has the final word on whether the result is satisfactory. The result is not what the computer proposes, but what Cope wants.

Emily is scheduled to create music according to feedback received from Cope. Therefore, *Emily*'s compositions follow the associations network model that requires programmer's approval. *Emily*'s music has received positive critique by some reviewers though it has been criticized by others as "bland, chordal sequences [...] like a child with technical skills that tries to copy Beethoven or Bach, or even Michael Nyman on a bad day: it is good for elevator, and not for a concert hall" (Ball, 2014). The radio producer Fred Childs, who heard Howell's compositions, said that if he did not know that this was the result of a computer program, he could think it was the work of someone who might not be a great composer, but with many interesting ideas (Farrell, 2015). While *Emily* is labelled as a 'person', Cope believes that "computers simply obey their programmers' commands. [...] Computers are tools, nothing more, nothing less" (Muscutt, 2007, p. 19). *EMI* and *Emily* are tools that Cope uses for speeding up the process of composition (Farrell, 2015). Although those artificial composers produce and combine sounds, Cope is the one who has control over the starting point and the final result of music.

There are other artificial composers that work with different algorithms. The Melomics program is a compositional algorithm developed by a team at the University of Málaga in Spain, based on a biological evolution approach. According to the designers, for the creation of Melomics, nearly a thousand rules were coded to determine the environment for music creation. As opposed to Cope's algorithms, Melomics does not depend on musical data of other projects, which allows those who use it to create unique works of any kind, as the system is programmed with sufficient data to manage the species without relying on human interaction (Farrell, 2015).

Two artificial composers are using the Melomics: *Iamus* and *Melomics109*. *Iamus* was named after the mythical son of Apollo, who could speak the language of birds. It was activated in September 2010 and composes pieces in the Western art music canon. According to the Melomics algorithm, *Iamus* takes a piece of music, transforms it and checks for changes that are consistent with certain rules. The best products keep changing, allowing the most appropriate pieces to continue to evolve until all conditions are met and complete compositions are created (Ball, 2014). These compositions are not based on human feedback, as in *Emily*. *Iamus* works autonomously to create original music. The only input is what is usually provided by a human composer or by a group, guiding orchestration and duration. The rest is 100% automatic. *Melomics109* is directed towards modern popular music and was activated in November 2013. It is more commercial in the sense that it can produce mainstream music. The head of the Melomics project, Francisco Vico, has said that this project could "democratize the music" as everyone can produce music just like as everyone can shoot great photos. So there will be many more musicians (Farrell, 2015).

All the above seem exciting and promising. However, the idea of an artificial composer is not only a technological challenge, as it has musical and moral dimensions. Concerning music itself, the 'mathematical correctness' can be considered as both an advantage and a disadvantage. Surprisingly, today many are trying to create softwares to give a feeling of warmth in digital music. Regarding artificial composers, one can ask whether what we hear is the sound of the machine, and how this machine music challenges the borders of human music as we know it.

Artificial Composers: issues of aesthetic value and cultural meanings

What values are articulated in artificial compositions? What meanings reside in such musical forms? Is it possible to detect the cultural connotations of such music? For Hainge (2016), a piece generated by a non-human agentic force "is music since the sound produced results from a certain aesthetic and thus human disposition [...], even if direct agency over the actual sound produced is surrendered" (p. 215). However, "the use of generative algorithms to produce sound raises different issues since the human agent is involved only in the design of a sound-producing assemblage" (p. 211).

Confusion increases by the fact that human music and machine/artificial music cannot be placed within the same value system and aesthetic continuum, because they come from, and thus represent, different systems of thinking. In the case of human creation the music work is the product. In artificially composed music, the software is the product. This kind of music forces the listener to perceive disembodied sounds, sounds without any origin whose creator seems to be technology itself. For van Elferen (2009), such music works represent the blurring of boundaries between the once clearly designated realms of humans and machines, between human and non-human musical agencies. They are free from the constraints of materiality as they exist as numeric data. Equally significant are the ways artificial composers negotiate the complex musical forms of the past. "Emanating from the field of performance studies, recent debates over the ontology of audiovisual materials and their functions as reenactment of memories of the past have given rise to new formulations of relations between archive and repertoire, text and performance, event and trace" (Moseley, 2016, p.37).

Trying to understand how artificial composers "work", we tried to examine some new aesthetic dimensions. When we listen to this music, does it create meanings and emotions? Our suggestion is that the knowledge about the ontology of music has aesthetic implications. The process by which music works are created may influence aesthetic evaluation. Although the products of artificial composers and algorithm-based music have certain musical qualities, it is rather hard to determine if those qualities can be considered as music in human terms and have aesthetic value. In short, we claim that if one is not able to recognize the ontological category, which a music piece belongs to, it may be difficult for them to have a fully aesthetic experience. This can be connected to Green's (1988) theory about the two types of musical meanings:
a) inherent meaning (resulting from music syntax or patterns created from the organization of sounds) and b) delineated meanings (extra musical meanings associated with social, cultural, political and personal use of music). In the case

of artificial composers, the connection between inherent and delineated meanings is ambiguous and may result in musical alienation between the listener and the music.

Given that artificial composers are not free to break the rules and overcome the constraints of an aesthetic canon, we cannot conceive their outcomes in terms of reflection, musical skills, and aesthetic awareness. The meaning of such music may lie in our willingness to see issues of creativity, authenticity, ontology, and culture in new ways. Conceiving artificial composers as cultural-musical agents, we may ask whether they formulate the aesthetic protocol of the future.

Artificial composers: issues of creativity

Can only men create music? Can artificial composers be considered as creators? What about the medium? How can we define these creative procedures? Is this kind of music valuable enough to be delivered to the next generations? Thinking about creativity, we usually consider the exploration of new possibilities and the negotiation of materials, media, or ideas in order to make something new, in response to new situations. Creativity emerges when we see the world from a new point of view and it is related to open-mindedness, reasoning, imagination, and intention to reach a desirable end. It has long been seen as an ability to produce original and useful works. Seltzer and Bentley (1999) suggest that creativity is the application of knowledge and skills in new ways to achieve a valued goal.

Within the field of arts and music, creators combine various components, following or breaking certain rules, and using tools, techniques, and materials within an aesthetic tradition. They make aesthetic choices in order to express ideas, emotions, and personal experiences; they use their imagination and reasoning. During creative processes, new possibilities may arise in response to culture. More abstractly, we can think of creativity as a complex encounter of self and the world.

Musical creativity is a concept, which has had various meanings over time as it highly depends on the context. These changes represent shifts in the conception of individual agency, expressiveness, aesthetic values, and meaning. So, what happens to the idea of "creativity" when it has to do with tools, which have been elaborated and extended into softwares? Is it still valid to talk about creativity at all? According to Farrell (2015), those questions are divisive. It is clear that artificial composers, such as *Emily*, *Iamus*, etc., were not created to replace physical composers; they are new technological tools that change or extend the process of musical creation.

Creativity cannot be divorced from the context in which it is displayed. With regard to artificial composers, one option is to consider creativity in relation to both humanistic and technological terms. Obviously, computers do not create anything by themselves. Without human skills to set them in motion, computers accomplish nothing by way of innovative outputs, at least in terms of human creativity. Their operations are always restricted and never get beyond this stage. On the other hand, we must acknowledge the fact that artificial composers' programs offer a new world of possibilities for creative people who want to explore the secrets of musical synthesis.

David Cope (1991) refuses to problematize the term "creativity", viewing it simply as the utilization of particular patterns. It is convenient for him to avoid other

values, which do not fit in his computational creativity. What was Cope's thinking and motivations for the construction of *Emily* and *EMI*? Cope (2005) responds that: a) machine programs can create, b) the quality of music has nothing to do with who or what created it, and c) the only limit to what machines can do is the limit of what we as humans can do with machines (pp. 370-371).

Yet, Cope seems to ignore that humans do not just solve music problems. They also seek problems; reflect on their compositions, question their ideas, re-think and re-write certain melodic or harmonic passages. Instead of just merely applying compositional rules, they break rules seeking for new techniques and aesthetic principles. The final product incorporates all decisions the artist has made during the creative process. In this context, the computers' creative effectiveness should be questioned, because the music they produce is strictly determined by mathematical laws: the combination of sounds and the musical procedures is totally determined in advance. This aligns with the Pythagorean and Hegelian notion of music in which the relations between the notes in any musical piece are purely abstract –governed by mathematical laws.

In our view, the mechanism and ecology of the system guide the creativity of artificial composers and designate the result. The fact is that the system can only select one object from a closed set of objects. It lacks human capacity for intention and contemplation. The computational logic of music works against the idea of imaginative play resulting in the construction of a fixed meaning. Equally importantly, the constraints of the musical material do not allow the emotive and social coding (as is held to be the case for the human music). Hence, this music seems to be generative without being creative.

Artificial composers: issues of ontology

For many decades, the ontology of musical works has gained attention among philosophers. By ontology we mean the nature of music phenomena, the music practices, and the musical material. Ontology is associated to the function of music procedures and performances in social contexts. The aesthetic-ontological problem about artificial music has to do with its originality and its authorization.

Debates about the ontology of music are parts of broader philosophical discussions. It is useful to remember that music is not only a physical acoustic object but, as Arnold Berleant (2009) articulates, "a social phenomenon involving a community of composers, performers, and listeners and that it has a history of performance practice and of valuing." (p. 57). These topics are part of a wider discussion about the ontology of musical creation that includes positions such as what is and what is not music. Can music be disembodied and cut off from the social practices and human functions associated with it?

Greg Hainge (2016) poses an interesting question: What happens if we turn to the question of how sounds produced by non-human agents might be perceived by a listener not aware of how the sounds were generated? (p. 214). According to him, the answer depends on whether we are talking about "the ontology of music at the point of production or the point of reception, given that music is a complex ontological substance that is expressed in different modes". The question that emerges

has as follows: can we make aesthetic judgments in complete ignorance of the ontology of music? Young (2014) proposes that ontological judgments about works of music may have meta-aesthetic implications. “The possibility that ontological judgments have meta-aesthetic consequences remains open. […] Meta-aesthetic judgments are judgments about what sorts of aesthetic judgments are possible and the form that they take if they are possible. [...] Which aesthetic judgments can be true depends on what sorts of aesthetic properties exist.” (Young, 2014, p. 7).

Many theorists argue that we live in an age of technocultural crisis in which the presence of nonhuman agents has rendered our familiar world uncanny (van Elferen, 2009, p. 124). As with all technological advances, artificial composers seem terrifying to those who believe that artists are threatened by machines. Still, there is a risk that the market will be flooded with non-human works and new aesthetic criteria will be formed regarding the understanding and appreciation of music.

Concluding, the aesthetic and material limits of the artificial composers stand as evidence for their ontological blurriness. In other words, they resist ontological foundation: their existence relies on their being contextualized as such. If we accept the fact that music can only be understood in terms of the culture and society in which it is created, artificial composers’ products should be understood in terms of execution in the context of computation.

Conclusion

Artificial composers are probably a temporary phenomenon that may soon expire. Or, they may further develop if we invent advanced computational tools and techniques by trained programmers and software developers. We do not claim that such endeavors will eventually lose their energy and interest. Yet, the main questions still remain: Could these products meet or even outplay and replace the human music? From the perspective of music education we may ask: Does the use of such music signify practices for certain kinds of social function? Should we prepare students for careers in this field? What can artificial composers teach to music students? Should we support our students to develop skills to design or interact with such programs?

The conflict between artificial and human intelligence arises as these concepts appear in different scientific fields. In the larger picture, this probably indicates one of the several symptoms of a society obsessed with technological changes. In such context, music acquires a symbolic quality to be interpreted in light of modernistic faith of ‘progress’ and ‘innovation’.

Our suggestion is that we cannot conceptualize artificial composers’ music without thinking of the aesthetic and ethical context of production, issues of intellectual property, and their complex and contingent conjunctions. This music is almost liminal regarding notions of human mind, values, and culture. The mathematical rules impose a kind of music that does not allow for playing with sounds imaginatively and emotionally. It seems that artificial composers make us believe that interpreting authenticity and aesthetic values is obsolete. Their compositions wish to function as symbols of digital culture. In our view, the final products are open to critique and things can become political or ethical. Music that could elicit a positive response may as well

not be accepted by the same people if they are aware that a machine produces it. A critical analysis of the terms of music reception and the connotations music bears is the only way to understand its dynamic for the audience. The future might provide a full account for these issues. Time will tell.

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