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CG-Art: demystifying the anthropocentric bias of artistic creativity

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ABSTRACT

The following aesthetic discussion examines in a philosophical-scientific way the relationship between computation and artistic creativity. Currently, there is a criticism about the possible artistic creativity that an algorithm could have. Supporting the above, the term computer-generated art (CG-Art) defined by Margaret Boden would seem to have no exponents yet. Moreover, it has been pointed out that, rather than a matter of primitive technological development, CG-Art would have in its very foundations the inability to exist. This, because art is considered as one of the most unique and exclusive human manifestations of our species. On the contrary, I propose that the denial of CG-Art has an anthropocentric bias. For this, I use the recent studies that, from the cognitive sciences, have been carried out on artistic creativity. In this way, I intend to convince the reader that behind the denial of the creative artistic capacity to the machines, a negationist mysticism of the current scientific advances necessarily lies.

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1. Introduction

Artificial intelligence (AI) has developed exponentially since the beginning of the twenty-first century. Every day we are surprised by algorithms that allow machines to perform tasks previously considered impossible. We receive shopping recommendations on Amazon, and reminders of our agenda thanks to Google Assistant. Car company Tesla has invested millions in autonomous driving. Such examples continue to spread. In short, it seems that every time we exclude something from the domain of AI, researchers take it as a challenge to overcome. However, all the tasks mentioned above are perceived as mechanical, so they can be modelled mathematically to be executed by a computer. Our common sense can project the development of AI in the distant future and imagine that it will be possible to execute any mechanical task by an application or computer programme. But can a machine create art? Is artistic creation a mathematically modellable task?

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2. Creativity, limit or goal for CG-Art?

The scenario just described has led artists, philosophers, cognitive researchers and programmers to wonder if a machine has the potential to create. Thus far, computational creativity has established itself as a subfield within AI (Toivanen et al., 2019). Simon Colton and Geraint Wiggins (2012) define its research as: "the philosophy, science and engineering of computational systems which, by taking on particular responsibilities, exhibit behaviours that unbiased observers would deem to be creative" (p. 21).

The subject continues to be discussed since it requires a certain level of mathematical modelling of what we understand by creativity. In this sense, Margaret Boden (2011) proposed the following definition of creativity: "the ability to come up with ideas or artefacts that are *new, surprising, and valuable*" (p. 29). I don't think that, in general, anyone would completely object to this definition. Thus, creativity, in general, must include novelty, surprise and value. Regarding the particularity of artistic creativity, I believe that it is precisely the "value" aspect of the definition that is the most controversial when analysing creative algorithms. I will return to this later, and I will try to show that denying value to artistic creations overlooks two important facts: the mechanical evaluation of artistic work and robotic embodiment (both topics are addressed in section 4).

Creative algorithms have undergone fruitful development thanks to models based on Artificial Neural Networks (ANN). In particular, a subtype of these models, Generative Adversarial Networks (GAN) allowed the computer programme AlphaGo to defeat Lee Sedol, considered the best human Go player in the world. This competition was used to show that GAN effectively created movements that seem irrational to humans. Therefore, it is no longer absurd to argue that algorithms can at least create Go plays that are novel and surprising. However, is this homologous to artistic creation? What about the aesthetic assessment of the creations of machines?

The fundamental point here is that Boden (2011) defined a special type of art by joining the concepts "creativity" and "computing". Thus, CG-Art is understood as "*the artwork results from some computer program being left to run by itself, with minimal or zero interference from a human being*" (p. 141). There are numerous examples of algorithms that have been trained to produce aesthetically pleasing output for human evaluation. One of the most popular cases of this type of art is the painting *Portrait of Edmond de Belamy*, an AI creation sold at Christie's in October 2018 (Still & d'Inverno, 2019). That portrait, produced by a GAN, has been widely publicised as the first auction of an AI artwork. While the latter is not accurate – in 2016, an auction at the Gray Area Foundation for the Arts in San Francisco raised almost $100,000 after selling twenty-nine CG-artworks (Miller, 2019) – it is true that it has made the people wonder if a machine can create art.

Going into the past, we find that AARON, by Harlod Cohen, and EMI, by David Cope, are classic illustrations of CG-Art. In both cases the programmers were dedicated only to improving the algorithms, leaving the creation up to the software itself. But the general opinion is that the creations of AARON and EMI are the authorship of Cohen and Cope, not of the software itself. I discuss this point in section 6. But first, it is necessary to understand what is meant by art and why the lay public generally considers it distinct from mathematical modelling.

3. Is mystical inspiration the only explanation for artistic creativity?

We have seen that a GAN can create a novel and surprising play. But a third characteristic is still missing to satisfy Boden's definition of creativity: "value". I do not analyse here the value of AlphaGo's creations. My subject of investigation is algorithms for creating art, so the value I refer to here is the aesthetic type. I think that if it is already controversial to say that AlphaGo creates plays, it is problematic to affirm that machines can deliver an output of aesthetic value. In this regard, Aaron Hertzmann (2018) points out:

> The concepts of art and inspiration are often spoken of in mystical terms, something special and primal beyond the realm of science and technology; it is as if only humans create art because only humans have "souls." Surely, there should be a more scientific explanation. (p. 1)

Hertzmann, despite rejecting the idea that a computer programme can create art, forces us to question our concept of art. I agree that most artists are reluctant to believe CG-Art is art. But the arguments they use ultimately appeal to the mystical qualities of "talent" and "inspiration". It is not my goal to refute the mystical vision of art that many artists share. I understand that it is a matter of faith and therefore, impossible to refute. Of course, there cannot be mathematical modelling of this concept of art either.

Considering the above, I will dedicate myself to investigating the aesthetic aspects of algorithms or machine creations. Even so, I point out that a very simple objection to the lack of a mystical connection in CG-Art is that it is different from human art. Thus, although human artists may choose to believe in mysticism, potential computer artists do not have to submit to this requirement. I consider it much more productive to study the aesthetic value of CG-Art without appealing to concepts such as "talent".

4. The aesthetic value of CG-Art. Two approaches: human and mechanical evaluation

Next, I will examine how CG-Art can effectively produce novel and surprising works. In effect, this can be achieved by random combinations. This is not a topic that I will delve into in this text. But I postulate that the most debatable characteristic of CG-Art is its aesthetic value. I will show that CG-Art does meet this requirement through two approaches, one focused on human evaluation and the other on machine evaluation.

4.1. Human evaluation of the aesthetic value of CG-Art

Recently, people's perceptions of CG-Art were evaluated. In the article "Putting the Art in Artificial: Aesthetic Responses to Computer-Generated Art" (Chamberlain et al., 2018) the researchers studied how human observers respond to artworks generated by computers and by humans. The findings indicate a negative bias towards CG-Art. Predictably, the works in which the CG-Art expressed plastically representational features were qualified as more artificial than abstract works. In the same way, the observers valued imitations of brush strokes and small imperfections in CG-Art works more highly.

Chamberlain et al. (2018) verified that this negative prejudice towards the aesthetic value of the CG-Art diminishes when the observer can see the production of the work. This led them to suggest that increasing the anthropomorphic characteristics of a robot could tend to eliminate hostility towards CG-Art. Indeed, it seems that a human observer expects to see

artists working on their artwork. The "black box" model, in which only the printed output of an algorithm can be seen, moves away from the current human vision of artistic creation. The simple fact of seeing a robotic arm painting on a canvas increases the observer's empathy. Chamberlain et al. postulate that this may be the result of the activation of mirror neurons in the human brain.

If the "black box" model in which CG-Art works is a handicap for its aesthetic value, it is interesting to think about what would happen if we can overcome it. Unfortunately, we still do not have the technology to create a robot of the complexity that the *Westworld* series (Nolan & Joy, 2016) invites us to imagine. However, we can overcome this handicap by presenting human works and CG-Art without telling the observer which one is which. It is precisely this aspect that is investigated in the article "CAN: Creative Adversarial Networks Generating 'Art' by Learning About Styles and Deviating from Style Norms" (Elgammal et al., 2017). Through a GAN modification, the researchers developed Creative Adversarial Networks (CAN). Basically, the algorithm was optimised so that it was not dedicated just to emulating human art styles, but it was really creative. This point is developed in section 4.2.

The findings in this study showed that humans assign a higher score to the CG-Art created by CAN, surpassing a sample of Abstract Expressionism premiered at Art Basel art show in 2016. The participants were asked to assign a score of 1–5 for the qualitative indicators of intentionality, visual structure, communication and inspiration. In each of the items, the CG-Art was given a higher score than human art.

In conclusion, I postulate that in a blind test CG-Art has aesthetic value for humans. However, artworks by human artists receive constant aesthetic appreciation. So far, we have discussed only the external valuation of observers. Can an algorithm aesthetically evaluate its own art?

4.2. Mechanical evaluation of the aesthetic value of CG-Art

When Harold Cohen wrote the computer programme AARON, which he designed to produce art autonomously, he filtered the output that seemed aesthetically valuable to him. Since then, algorithms based on ANN have progressed considerably. As I mentioned earlier, the GAN subtype is the most widely used today. I explain below that in a GAN network (and of course in a CAN network), aesthetic evaluation is performed by the same algorithm.

First, we need to understand how a GAN network works:

> Generative Adversarial Network (GAN) has two sub networks, a generator and a discriminator. The discriminator has access to a set of images (training images). The discriminator tries to discriminate between "real" images (from the training set) and "fake" images generated by the generator. The generator tries to generate images similar to the training set without seeing these images. The generator starts by generating random images and receives a signal from the discriminator whether the discriminator finds them real or fake. (Elgammal et al., 2017, p. 5)

This dual model has an aesthetic assessment incorporated into it. In effect, when the "discriminator" is deceived by the "generator", the GAN reaches an aesthetic value similar to that of the original set of training images that was provided to it. It follows from this that a GAN does not create art, but rather emulates artistic styles. Fortunately, the CAN subtype has been created specifically to move away from imitation and achieve authentic creation

by an algorithm. As explained by Elgammal et al. (2017), in this modification of the GAN, the discriminator gives the generator two signals: (a) the classification of art or non-art, and (b) correspondence to a specific artistic style. In this way, "the proposed CAN model generates images that can be characterized as novel and not emulating the art distribution, however, aesthetically appealing" (p. 13).

Therefore, the statement by Hertzmann that "unlike human artists, these systems do not grow or evolve over time" (2018, p. 19) does not seem justifiable. A CAN is capable of creating and evaluating on its own. I suggest that these capabilities allow us to affirm that a CAN does grow and evolve aesthetically.

I consider this mechanical evaluation of the aesthetic value of CG-Art can be related to the concept of "creative autonomy", which has been discussed by Kyle E. Jennings in his article "Developing Creativity: Artificial Barriers in Artificial Intelligence" (2010). This author claims that the biggest challenge for an AI developer is to demonstrate that his systems are more than an extension of his own human creativity. Thus, Jennings.

> introduced the concept of creative autonomy, which requires that a system be able to evaluate its creations without consulting others, that it be able to adjust how it makes these evaluations without being explicitly told when or how to do so, and that these processes not be purely random (p. 499).

According to the above, I believe that every time you face a CAN-based system, creative autonomy will be guaranteed. However, this is not so clear in the case of works of art generated with GANs or other forms of ANNs. Those cases, I insist, can be considered emulation of styles. This is an issue that still needs to be investigated because, although it seems that all CAN is autonomously creative, that not imply that creative autonomy is exclusive to CANs. In this sense, Jukka M. Toivanen et. al, in the article "Towards transformational creation of novel songs" (2019), have discussed that a creative system must contain an architecture with at least three elements: a generator, a discriminator, and "a meta-level control layer in which the system uses this system-internal feedback to modify its own constraints" (p. 5). I think that the meta-level control layer could be the determining condition to decide if a system have creative autonomy. As we have seen, in the case of CAN-based systems, this condition will always be fulfilled.

5. CG-Art and Society

The final criticism that Hertzmann (2018) makes of CG-Art is that art is social, and since computers are not "social agents", they cannot create art. I will discuss this briefly with two answers that I think are pertinent to analyse and develop in the future.

First, Hertzmann seems to forget that he is talking about CG-Art. Although it seems indisputable that art created by humans is social, in the terms stated by Hertzmann, this does not mean that CG-Art must be social. It is analysing an algorithm. How algorithms relate is not a subject widely studied even in sociology. In my opinion, we cannot conclude that a computer cannot create art because it is not a social entity. An algorithm doesn't have the same kind of experiences a human has. The point here is to see if you can create art, not if you can create human art. The latter is not possible at present. Perhaps in the future, with an algorithm implanted in an anthropomorphised body, social interactions can be achieved that will allow this condition to be fulfilled.

But there is no aspiration for CG-Art to be considered human. Their ways of knowing and experiencing are different. CG-Art is fundamentally based on Big Data, which is the most social thing we have since it shows patterns of social behaviour. Therefore, it is not surprising that in blind tests CG-Art is valued aesthetically since it is based on a small sample of Big Data. I postulate that if we are optimistic and wait for the Big Data used by the CG-Art to be extended, we will have aesthetic works never thought of by humans.

6. Collaboration. Authorship. Apprentice and teacher. Codes and laws.

> To date, there is a rich body of computer-generated art, and in all cases, the work is credited to the human artist (s) behind the tools, such as the authors or users of the software – and this might never change. (Hertzmann, 2018, p. 2)

A final objection to CG-Art is related to the authorship of the artworks. Many postulates that the real authors of the artworks of a machine are the programmers of their code. In my opinion, this is incorrect for two reasons.

First, and as Hertzmann himself recognises, human artistic work is social. Therefore, it involves many agents. It is not necessary for only one of them to be considered an artist, since the agents may fulfil different functions. Let me give an example to clarify this point. When a film is shot, we have at least a director and actors collaborating artistically. Both functions hybridise and complement each other. We cannot say, for example, that the artwork "film" is the creation only of the director and not the actors. In effect, we say that the director fulfils the artistic function of "directing" and the actors of "acting". In both cases, art has been created and a film, which is an artwork in itself, has been created.

CG-Art invites us to think about a new art form, much more current, which underlies the collective creation. It can be argued that the programmer and the algorithm are the artists. This is so, I postulate because unlike working with a brush, the algorithm acts as a kind of creative agent or a colleague. Such co-creative artistic aspect has recent examples in the musical field. Thus, we can cite the album *Hello World* (2019), which is the first AI-human collaborated pop music record. This LP is a work of the human-AI duo called SKYGGE, a conceptual subjectivity representing the interaction between the artist Benoit Carré and the Flow Machines software, an AI-assisted music composing system. In this respect, Melissa Avdeeff (2019) has said that:

> Regardless of the "intelligence" of AI, it is principally human-driven and consumed, and, as such, it will be human agents who ultimately guide its use and progress. SKYGGE's Hello World is a product of these new forms of production and consumption, and functions as a pivot moment in the understanding and value of human–computer collaborations. (p. 11)

Another example of artistic collaboration between human musicians and AI is the album *PROTO* (2019). This avant-garde LP is a joint work of artist Holly Herndon and AI Spawn. It is especially remarkable that it is Herndon herself who created Spawn and taught her to sing (Hsu, 2019).

Nevertheless, it is true that in other artistic disciplines different than music, the software is still considered as a tool and not as a collaborative agent. In this sense, Anna Kantosalo and Sirpa Riihiaho (2019) have evaluated the human–computer co-creative processes of poetry writing, and Anna Jordanous (2017) have studied *Beyond the Fence* the first

computer-generated musical. In both cases, the software has been perceived as a passive element, moving away from the idea of a co-author that I have proposed.

Second, I propose an analogy in which a creative algorithm is to its programmer as a human apprentice is to a human master. If we assume that human art is social, then we can understand that no artist has not had a teacher. This role of the teacher can be exercised by an expert, who explicitly teaches, or by experiences lived by an artist, without being attributed to any human being in particular. In both cases, the artwork was nurtured by prior learning.

CG-Art is also based on learning. Its teacher maybe its programmer, another algorithm, a sample of artworks, and so forth. Learning from an agent does not prohibit CG-Art from creating its own art. In the same way, human apprentices do not have to grant authorship of their work to their teachers. As Arthur I. Miller mentions in his book *The Artist in the Machine: The World of AI-Powered Creativity* (2019), although Mozart has learned music thanks to his father, nobody considers Mozart's compositions as his father's property. For Miller, the rise of the GANs will make this analogy increasingly clear between programmers and AI.

Finally, there are criticisms of CG-Art based on the fact that an algorithm is a code and therefore cannot create because it follows rigid rules. But everything that exists follows inviolable rules. For example, neither CG-Art nor a human artist can violate physical laws. That is a real limitation for both types of art. In this regard, Murray Shanahan has said that "in principle, because the brain obeys the laws of physics, computers can do anything the brain can do" (as cited in Miller, 2019). Also, we all have a code that we follow. The computations performed by a CAN are complex instructions written by programmers at first, but then by the same algorithm throughout their learning. In the case of humans, we all develop genetically according to our DNA, which is a code we are born with. No artists would feel limited by having to respect physical laws and being forced to develop according to their genetic code. These criticisms seem worth investigating and developing to clarify these points with the lay public.

7. Conclusion

This article examined the relationship between computation and artistic creativity philosophically and scientifically. It argues that CG-Art is a new art form and that most of its criticisms are made from an anthropocentric viewpoint. CG-Art is not human art and is not intended to be. The works of CG-Art satisfy the criteria of novelty, surprise and aesthetic value. Moreover, in the face of blind tests, human observers consider CG-Art to be more creative than art created by humans. I, therefore, consider that greater analysis of CG-Art will allow us to broaden our aesthetic conception of what art is, as long as it is studied without prejudice.

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