Defining an AI-Generated Artwork: A Transdisciplinary Concept for Cognitive Science, Computer Science, and Art Theory

Research article*

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Recibido: 19 de septiembre de 2024
Aceptado: 24 de noviembre de 2024

Como citar: Arriagada, L. (2025). Defining an AI-Generated Artwork: A transdisciplinary concept for cognitive science, computer science, and art theory. *Calle 14: Revista de Investigación en el campo del arte, 20*(38). pp. 95-108.
DOI: https://doi.org/10.14483/21450706.22275

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* This article signifies an unprecedented and unpublished research endeavor undertaken to fulfill the requirements for a Ph.D. degree conferred by the Faculty of Arts at both the University of Chile and the University of Groningen. An adapted iteration of this article can be accessed in the dissertation CG-art: an aesthetic discussion of the relationship between artistic creativity and computation (Arriagada, 2023). The universities have bestowed upon the author complete autonomy to disseminate this article in a scholarly journal, coupled with the undertaking not to publish the chapter encapsulating the manuscript's substance.

Abstract
The burgeoning capacity of artificial intelligence (AI) to generate artworks has ignited substantial interdisciplinary interest. However, the absence of a shared conceptual framework has hitherto impeded effective communication and collaboration among cognitive science, computer science, and art theory. This study addresses this lacuna through a comprehensive literature review by developing a transdisciplinary definition of an AI-generated artwork. It is proposed that an AI-generated artwork constitutes the confluence of three essential elements: (1) an autonomous AI-production of a new and surprising idea or artifact, (2) which passes an internal evaluation mechanism embedded in the very same AI, and (3) is considered a candidate of appreciation by a human audience. This definition provides a unified conceptual foundation to facilitate interdisciplinary research and deepen understanding of the nature of AI-generated art. Subsequent research should explore the applicability of this definition to diverse forms of AI-generated artworks and evaluate its implications for artistic practices.

Key Words
AI-generated artwork; artificial intelligence; art; creativity; definition

SECCIÓN CENTRAL

Definición de una obra de arte generada por IA: un concepto transdisciplinario para la ciencia cognitiva, la informática y la teoría del arte

Resumen

La creciente capacidad de la inteligencia artificial (IA) para generar obras de arte ha despertado un gran interés interdisciplinario. Sin embargo, la ausencia de un marco conceptual compartido ha impedido hasta ahora la comunicación efectiva y la colaboración entre la ciencia cognitiva, la informática y la teoría del arte. Este estudio aborda esta laguna a través de una revisión exhaustiva de la literatura mediante el desarrollo de una definición transdisciplinaria de una obra de arte generada por IA. Se propone que una obra de arte generada por IA constituye la confluencia de tres elementos esenciales: (1) una producción autónoma de IA de una idea o artefacto nuevo y sorprendente, (2) que pasa por un mecanismo de evaluación interno integrado en la misma IA, y (3) es considerada candidata a ser apreciada por el público humano. Esta definición proporciona una base conceptual unificada para facilitar la investigación interdisciplinaria y profundizar la comprensión de la naturaleza del arte generado por IA. Las investigaciones posteriores deben explorar la aplicabilidad de esta definición a diversas formas de obras de arte generadas por IA y evaluar sus implicaciones para las prácticas artísticas.

Palabras clave

obras de arte generadas por IA; inteligencia artificial; arte; creatividad; definición

Définition d'une œuvre d'art générée par l'IA : un concept transdisciplinaire pour les sciences cognitives, l'informatique et la théorie de l'art

Résumé

La capacité croissante de l'intelligence artificielle (IA) à générer des œuvres d'art a suscité un grand intérêt interdisciplinaire. Cependant, l'absence d'un cadre conceptuel commun a jusqu'à présent empêché une communication et une collaboration efficaces entre les sciences cognitives, l'informatique et la théorie de l'art. Cette étude comble cette lacune par le biais d'une revue complète de la littérature en élaborant une définition transdisciplinaire d'une œuvre d'art générée par l'IA. Il est proposé qu'une œuvre d'art générée par l'IA constitue la confluence de trois éléments essentiels : (1) une production autonome par l'IA d'une idée ou d'un artefact nouveau et surprenant, (2) qui passe par un mécanisme d'évaluation interne intégré à l'IA elle-même, et (3) elle est considérée comme un candidat pour être appréciée par le public humain. Cette définition fournit une base conceptuelle unifiée pour faciliter la recherche interdisciplinaire et approfondir la compréhension de la nature de l'art généré par l'IA. D'autres recherches devraient explorer l'applicabilité de cette définition à diverses formes d'œuvres d'art générées par l'IA et évaluer ses implications pour les pratiques artistiques.

Mots-clés:

des œuvres d'art générées par l'IA ; intelligence artificielle; art; créativité; définition

Definindo uma obra de arte gerada por IA: um conceito transdisciplinar para ciência cognitiva, ciência da computação e teoria da arte

Resumo

A crescente capacidade da inteligência artificial (IA) de gerar obras de arte tem despertado um grande interesse interdisciplinar. No entanto, a ausência de uma estrutura conceitual compartilhada até agora impediu a comunicação e a colaboração eficazes entre a ciência cognitiva, a ciência da computação e a teoria da arte. Este estudo aborda essa lacuna por meio de uma revisão abrangente da literatura, desenvolvendo uma definição transdisciplinar

de uma obra de arte gerada por IA. Propõe-se que uma obra de arte gerada por IA constitua a confluência de três elementos essenciais: (1) uma produção autônoma de IA de uma ideia ou artefato novo e surpreendente, (2) que passa por um mecanismo de avaliação interna integrado à própria IA e (3) é considerada candidata a ser apreciada pelo público humano. Essa definição fornece uma base conceitual unificada para facilitar a pesquisa interdisciplinar e aprofundar a compreensão da natureza da arte gerada por IA. Pesquisas futuras devem explorar a aplicabilidade dessa definição a várias formas de arte gerada por IA e avaliar suas implicações para as práticas artísticas.

Palavras-chave
obras de arte geradas por IA; inteligência artificial; arte; criatividade; definição

1. Introduction

In recent years, the relationship between artistic creation and artificial intelligence (AI) has garnered significant attention from artists (Google Arts & Culture, 2019; Hsu, 2019; Ridler, 2021), philosophers (Moruzzi, 2020b, 2020c, 2021), cognitive scientists (Boden, 2011, 2017), and computer scientists (Hertzmann, 2018, 2020). The proliferation of computer-generated artistic works, produced not by human hands but by algorithms, is unprecedented. Notable examples include the painting *Edmond de Belamy* (Epstein *et al*., 2020; A. I. Miller, 2019; Still & d'Inverno, 2019), the songs from the LP PROTO (Hsu, 2019), the garments designed by ClothGAN (Wu *et al*., 2021), and even newly generated levels for the video game *Doom* (Giacomello *et al*., 2018).

While these artificial creations have captivated the public, they have also sparked a contentious debate regarding the computer's capability to create art autonomously. Proponents of machine-generated artistic creativity, such as the artist Mario Klingemann,[1] computer scientist Ahmed Elgammal,[2] and philosophers Catherina Moruzzi[3] and Galit Wellner,[4] argue from their respective fields that AI transcends its role as a mere tool and should be regarded as a collaborator alongside human artists.

Conversely, other experts argue the opposite. Artists like Anna Ridler[5] and Jon McCormack,[6] computer scientist Aaron Hertzmann,[7] and philosopher Sean Dorrance Kelly[8] contend that AI is more akin to a tool that serves human purposes rather than a creative peer to human artists.

These opposing views stem from the different academic disciplines they represent, each offering distinct interpretations of creativity, art, and AI. In light of these divergent perspectives, this article aims to establish a standardized definition of AI-generated artwork. This definition serves two primary purposes: facilitating cross-disciplinary knowledge exchange and providing a framework to mediate debates within and across various fields.

The proposed definition rests on three foundational pillars: understanding creativity through the lens of cognitive science, defining artworks via art theory, and conceptualizing computational creativity within computer science. This transdisciplinary approach synthesizes insights from these diverse disciplines to offer a holistic examination of their interconnections.

2. Methodology

This study adopts a multidisciplinary approach to explore the interconnected concepts of creativity, artwork, and computational creativity within the context of AI-generated works. Sections 3, 4, and 5 present a conceptual analysis, with the findings synthesized in Section 6. Thus, by integrating Margaret Boden's (2011) seminal definitions of creativity with George Dickie's (1969) philosophical concept of artwork, this research illuminates the convergence and divergence of these theoretical frameworks. Additionally, it delves into the complexities of computational creativity and its dynamic interplay with human evaluation.

To establish parameters for defining AI-generated artworks, three essential criteria are proposed: (1) the autonomous production of novel and surprising

1 In Arthur Miller's article "Creativity in the Age of AI: Computers and Artificial Neural Networks Are Redefining the Relationship Between Art and Science" (2020), Klingemann argues that machines can be creative. He thinks that, unlike human artists, AI is not doomed to build upon the work of our predecessors. For him, AI has a liberating potential in art.

2 Elgammal's article "AI Is Blurring the Definition of Artist" (2019) argues that the AICAN (artificial intelligence creative adversarial network) program can be understood as an artist working virtually autonomously. This creation of his laboratory learns from datasets and generates outputs on its own.

3 Moruzzi's article "Artificial Creativity and General Intelligence" (2020a) postulates that generative adversarial networks (GANs) have a sufficient level of autonomy to create their own musical pieces.

4 Wellner's article "Digital Imagination, Fantasy, AI Art" (2021) postulates that algorithms can be creative by human standards.

5 Ridler's blog entry "Fall of the House of Usher. Datasets and Decay" (2018) considers GANs as something different from a tool but also different from a creative partner. For Ridler, GANs have a part of the human who trained them.

6 The article "Autonomy, Authenticity, Authorship and Intention in Computer Generated Art" (2019) by McCormack *et al*. considers that the humans who train a program are the authors of its works and that neither the public nor the art world would accept the AI as the author.

7 Hertzmann's article "Computers Do Not Make Art, People Do" (2020) considers that computers have no personhood. Therefore, according to Hertzmann, computers cannot be artists.

8 Kelly's blog entry "A Philosopher Argues That an AI Can't Be an Artist" (2019) considers that a machine's creations are merely the output of an algorithmic formalism. Therefore, according to Kelly, machines are not actually creative.

artifacts by AI; (2) the successful navigation of internal evaluative processes within the AI system; and (3) the potential for human recognition of the output as a viable aesthetic object. These criteria provide a rigorous framework for assessing the extent to which AI-generated artworks align with the proposed definition, ultimately yielding a comprehensive understanding of their nature and significance.

Drawing upon insights from cognitive science, art theory, and computer science, the study develops a transdisciplinary definition of AI-generated art. The investigation begins with a thorough analysis of creativity, followed by a systematic examination of artwork and computational creativity. This multifaceted approach facilitates a comprehensive understanding of the interrelationships and implications of these concepts.

3. The Definition of Creativity

To accurately define AI-generated artworks, it is essential to analyze the process by which these works emerge. Consequently, a conceptualization of creativity that can be effectively applied to such products is required.[9] Cognitive scientist Margaret Boden (2011) offers a pertinent framework, defining creativity as the ability to generate ideas or artifacts that are "new, surprising, and valuable" (p. 29). This definition implies that creativity and production are intrinsically linked, carrying significant implications for understanding the nature of AI-generated works:

> (1) X is *a creator* if X can develop ideas or artifacts that are new, surprising, and valuable.
> (2) Y is *a producer* if Y can develop ideas or artifacts that do not fulfil the criteria under (1).
> (3) A is *a creation* if A is an idea or artifact that is new, surprising, and valuable.
> (4) B is *a product* if B is an idea or artifact that do not fulfil the criteria under (3).
> Corollary 1: every creator is also a producer, but the inverse is false.
> Corollary 2: every creation is also a product, but the inverse is false.

Boden's definition of creativity is used in this article because, as will be shown, it addresses the challenge of determining where creativity lies. That is, whether creativity is a producer's personal property or a product attribute.[10] Why is this a problem? Because in studying creativity, there has been a tendency to choose one of these two conceptions over the other.[11]Unifying those views will be especially important for this article since, as will be seen, it forces us to understand the functioning of creative algorithms without neglecting the characteristics of their artificial creations.

Next, these two perspectives on creativity will be examined to illustrate how Boden's definition serves as an eclectic position between them. Subsequently, its utility in understanding AI-driven artistic creativity will be demonstrated.

3.1. Creativity as Producer's Property

The first viewpoint about creativity considers that it lies in the producer. Consequently, it focuses on analyzing the creator's characteristics. In this position, the studies on creativity have been understood as a psychological analysis of great creators' personalities. An example of this posture can be found in Sigmund Freud's psychobiography, a psychology subfield designed to investigate Leonardo da Vinci's artistic creativity (Kőváry, 2011). A more recent illustration of this view can be found in James C. Kaufman and Ronald A. Beghetto's Four-C model of creativity (2009). As its name suggests, this setup considers four kinds of creativity: little-c, Big-C, mini-c, and Pro-c. While the majority of people possess little-c, only great masters and thinkers exhibit Big-C. The mini-c is a step for humans to improve their creativity

9 The proposed definition of an AI-generated artwork within this article regards artworks as deliberate creations. These are brought into being either by human artists (in instances of human-crafted art) or by AI (in cases of AI-generated artworks). This conceptualisation of art deliberately omits the occurrence of innate beauty that manifests without the involvement of a human artist or AI, as seen in the natural marvels of the Northern Lights or the Grand Canyon. This stance aligns with the artistic theories of Wilhelm Worringer (1997), particularly his notions of the impulse towards abstraction and empathy. It should be noted that Worringer explicitly excludes natural beauty and conceives of art as originating from human artistic endeavours. Expanding upon this foundational notion, this article broadens the definition to encompass artistic creations emerging from both human artists and AI, while simultaneously upholding the exclusion of innate beauty. As such, art remains distinctly differentiated from natural beauty in all respects.

10 Regarding artistic creation, Moruzzi has pointed out that creativity covers both meanings: "It can be described as a subjective property of the artist or as a quality that is assigned to the . . . product in question by the audience" (2020a, p. 89).

11 Indeed, until 1980 virtually all definitions of creativity focused on studying creative personalities (Sawyer, 2011).

towards Pro-c, the professional level of creativity. It can be noted that the Four-C model neglects the analysis of what is created by focusing mainly on studying the creator's mind. As it turns out, setups such as psychobiography or the Four-C are devised considering that the object of study of creativity is the human mind. Unfortunately, this poses a problem for studying computational creativity since AI is a non-human creator and, by extension, lacks a human mind.

3.2. Creativity as a Product Attribute

The second viewpoint about creativity considers that it is a product attribute. It focuses more on analyzing creative works than studying great creators' personalities. It can be noted that in this view, the public becomes a judge. In particular, it implies that the audience decides whether something is creative when faced with a specific product. Psychologist Morris I. Stein (1953) shares this view. He defines *creative work* as "novel work that is accepted as tenable or useful or satisfying by a group in time" (p. 322). Another example is philosopher Berys Gaut (2010), who, in a more recent article, states that a *creative product* is one that a group of experts in a particular discipline has approved as such. As it turns out, these stances neglect the study of the characteristics of the creator.

Additionally, the role of the audience in judging creativity poses a challenge when studying computational creativity. For instance, people may not perceive a particular product as creative simply because it was produced by an AI. Furthermore, such a judgment may be influenced by prejudice against computers, particularly in the case of computer-generated art (CG-art) (Arriagada, 2020).

3.3. The Eclecticism of Boden's Definition of Creativity

Boden's definition of creativity unifies the two previous viewpoints because it considers creativity an ability, which is a property of the creator. This aspect of her conceptualization is consistent with the first view, which focuses on the creative agent as the object of study. However, Boden's definition also requires creative products to be new, surprising, and valuable, thus requiring the evaluation of the producer's creativity through the examination of the product. This aspect of the definition aligns with the second view, which focuses on the created product as the object of study. Therefore, Boden's definition of creativity has a dual domain, encompassing both the study of the producer and the product.

Additionally, this conceptualization of creativity has two crucial characteristics that distinguish it from other perspectives. Firstly, it does not exclusively focus on the human being, as it does not consider creativity as a property of the human personality. Secondly, it does not disregard the importance of human evaluation, as it recognizes creativity to be *subject-dependent*. The following discussion will delve into these two features in detail, highlighting their significance in the study of AI creativity.

First, Boden's definition is not human-exclusive. By saying that creativity is an ability, any producer who exhibits that ability should be considered creative, regardless of the type of producer. For example, if an animal or a computer produces something new, surprising and valuable, then that animal or computer is creative. This conception of creativity is broader than those followed, for example, by psychobiography or the Four-C model. The openness exhibited by Boden's definition broadens the study of creativity. It no longer focuses exclusively on the human mind and introduces new agents such as creative AI.[12]

Second, Boden's definition is subject-dependent (Moruzzi, 2020c). This means that making a new and surprising product is not enough to demonstrate creativity. The actual product must also be considered valuable. If the latter requirement is not met, the producer is not creative. The *value* aspect can be understood as people's external evaluation of a given product.[13] For example, according to the preceding point, an AI can be creative. Though, its creative ability is verified by judging its outputs. Specifically, an AI is creative only if its AI-generated products are valuable to the human audience.

In conclusion, this section has established the specific meaning of creativity that this article adopts. It has

12 It must be mentioned that cases of creativity in chimpanzees, elephants, crows, among other animals, have been documented (Moruzzi, 2020b, 2021). Furthermore, computer creativity in general, and artistic computer creativity in particular, have been heavily discussed since the 2010s (Colton & Wiggins, 2012).

13 The audience's evaluation of a given product is external. It is thus distinguished from the producer's own evaluation of a given product, which is internal (Arriagada, 2020).

shown why Boden's conceptualization is preferred over other viewpoints on creativity. In particular, it has been pointed out that it exhibits the features of (1) not being human-centered and (2) being subject-dependent. It is now time to address the second aspect of the definition of an AI-generated artwork, namely, the concept of artwork.

4. The Definition of Artwork

The second step in establishing a transdisciplinary definition of an AI-generated artwork involves elucidating the essential qualities that distinguish a product as an artwork. To this end, it is necessary to formulate a conceptualization of artwork. One influential perspective is the institutional theory of art, as espoused by the philosopher George Dickie (1969). According to Dickie, an artwork is "(1) an artifact (2) upon which some society or some sub-group of a society has conferred the status of candidate for appreciation" (p. 254). This definition is notable for its status as the most refined version of institutional theories of art, as elucidated by philosopher Stephen Davies (1991), and it is thus highly valuable in achieving the goal of this article. Even in the contemporary era, Dickie's definition continues to be invoked to recognize the artistic value of robotic productions (Mikalonytė & Kneer, 2021) and to engage with the status of AI-generated outputs (Mäki-Reinikka, 2018).

The question arises: why is Dickie's theory helpful in defining an AI-generated artwork? To address this query, it is necessary to understand that art theories can be grouped into functional and procedural categories (Davies, 1991; Dickie, 1997).[14] As noted earlier, Dickie's institutional theory falls under the latter category. Consequently, it is pertinent to briefly compare and contrast these theoretical orientations, which will enable us to demonstrate the advantages of employing an institutional definition of artwork.

4.1. Functional Theories of Art

Functional theories hold that art has an essential function (Davies, 1991). It can be noted that different functional theories will consider different functions as essential. For example, philosopher Robin George Collingwood posited that art is the expression of emotions, while philosopher Susanne Langer argued that it symbolically represents human feelings (Dickie, 1997). It is important to note that, in these cases, the theorists' task is not to agree on what an artwork is. Instead, they seek to discover what function a work must fulfil to be considered art. In other words, a functional theory considers that an artwork intrinsically fulfils the essential function of art. Therefore, a product that does not fulfil this function could not conventionally be declared art by a group of artists, experts, or an audience. For instance, if a group of people deems an AI-generated painting to be art, their mere consensus does not automatically bestow that status upon the AI output. Moreover, no institution, whether a museum, art movement or any other, has the authority to determine whether a particular piece should be considered as art.

It can be seen that discovering the essential function of art is a problem that undermines all functional theories. This particularly truncates the construction of the definition of an AI-generated artwork in our context. Later functional art theorists, such as philosopher Monroe Beardsley, understood that the function of art is to intentionally arrange conditions that offer experiences with a distinct aesthetic character (Davies, 1991; Dickie, 1997). In this case, the introduction of intentionality means that a computer output could hardly be considered art. For instance, consider defining the essential function of art as rooted in intentionality, a capacity inherent to the mind. In that case, an AI capable of producing artworks should have mental states. That implication is strongly debatable.[15] Thus, the problems mentioned above motivate the search for a suitable candidate

14 Dickie (1997) mentions that theories can also be classified ontologically. It implies discussing the mode of existence of art, distinguishing between natural and cultural theories of art. However, since discussing the ontology of art goes beyond the aims of this research, only the epistemic taxonomy is reviewed here.

15 Nevertheless, even if AI were to be attributed mental states, the concept of intentionality presents a more profound issue, as intentionality is inherently directed towards something. Dickie (1997) underscores this concern, noting that "although many artworks are about something, there are also numerous artworks that are not about anything" (p. 21). Dickie critiques Arthur Danto's notion of *aboutness*, which posits that a necessary condition for art is that it must be about something. Following John Searle's (1999) widely accepted understanding of intentionality, it can be inferred that for Danto, artistic creation necessitates intentionality, as it is always oriented towards or refers to something. Although the discussion of intentionality in art is beyond the scope of this article, it is important to acknowledge that the dismissal of intentionality is

for defining AI-generated works of art in procedural theories.[16]

4.2. Procedural Theories of Art

Dickie's artwork definition is framed within procedural theories of art. In these, "it is a specific kind of context in which something is embedded that makes it art, not something it functions to do" (Dickie, 1997, p. 20). This is closer to a social convention. Indeed, the emphasis is placed on the context in which a product is embedded instead of the product itself. In this case, no intrinsic function makes some product an artwork.

It has been criticized that a pre-existing art theory is needed to determine this context (Davies, 1991). Thus, if a creator does not have a theory justifying a given work, procedurally, art status cannot be reached. Nevertheless, from the perspective of this study, it could be argued that it is redundant to have a systematized theory for determining whether a product is an artwork, since what is essential is what a given context deems as such. It is important to note that procedural theories inherently view the status of art as an extrinsic characteristic. The context that delivers that status may be a theory, institution, or simple audience agreement. Thus, products can be considered artworks using an implicit theory or none at all. For example, if a group of people considers an AI-generated painting as art, their mere agreement confers that status to that AI output.

Shifting our focus now to Dickie's concept of artwork mentioned earlier—an artifact that a group of people considers a candidate of appreciation—two distinct components can be identified. The first refers to the manufacture of a product, the artifact. It should be noted that this involves a task performed by the producer (P). The second refers to evaluating P's work, that is, the people's agreement to consider a given artifact as a candidate of appreciation. Generally, the audience (A) performs this evaluative task. When A considers P's work worthy of aesthetic appreciation, P becomes an artist, and his/her work becomes an artwork. At this point, there are two extreme options. If A evaluates P's work negatively, P becomes a lousy artist. As opposed to that, if A evaluates P's work positively, P becomes a good artist. Between these two extremes, there is a continuum of different values for P. The critical question to bear in mind is that it is not a positive evaluation that gives a product the status of art. It is enough that such a product is considered a candidate for aesthetic appreciation.

Thus, the first part of Dickie's definition of an artwork pertains to the artist's creative process, while the second part emphasizes the audience's evaluation of the final product. At this point, it is necessary to recall Margaret Boden's definition of creativity. The review in Section 2 concluded that creativity is a capability that has two components: (1) a producer who generates new and surprising ideas or artifacts, along with (2) a human audience who finds those products valuable. The producer is creative only if (1) and (2) are met. Put in this way, Boden's definition of creativity and Dickie's definition of artwork show some similarities. In particular, it is crucial to note that both are subject-dependent. That is, they require external valorization in the terms already outlined. Regarding AI-artistic creativity, this subject dependency exhibits the following two benefits:

Firstly, according to this perspective, art does not require the involvement of agents with mental states in its creation. As mentioned before, functional theories, such as Beardsley's, include intentionality as an intrinsic part of art creation. This requirement restricts artistic creation to human beings and animals that can demonstrate mental states. Non-living agents, such as forces of nature or machines, are left out of that cluster. Differently, using Dickie's procedural artwork concept, if a group of people recognizes a given product as art, it will count as such. For example, suppose a community agrees to consider the sound of a flowing river as art. In that case, it will count as art, even though the forces of nature generated that river without any intentionality. Robots' productions have also seen their status as art defended using Dickie's definition (Mikalonytė & Kneer, 2021). Indeed, the robots' products will count as art if people deem it so, regardless the robots have no mind.

deliberate and rooted in adherence to Dickie's institutional theory. This theory primarily focuses on the social aspects of art production and reception.

16 The dismissal of functional theories of art is justified, as evidenced by their shortcomings in determining the actual function of art. Functional theories, while valuable in specific contexts, do not fully capture the complexity and diversity of artistic practices. In the specific case addressed by this chapter, functional theories consistently prove insufficient for comprehensively understanding AI-generated artworks.

Secondly, Dickie's definition has proved useful in analyzing why two physically indistinguishable objects can have different art status (Mäki-Reinikka, 2018). Let us further explore this idea. Historically, procedural theories emerged after philosopher Arthur Danto's publication of "The Artworld" (1964). In particular, Dickie asserts that Danto's article introduces a new way of thinking within the philosophy of art, due to the inclusion of an argument that Dickie refers to as "The Perceptually Indistinguishable Objects."[17] Dickie (1997) summarizes this argument as follows:

> Consider a pair of visually indistinguishable objects . . . as Fountain and a urinal that exactly resembles it . . . In such a pair, one object is a work of art and the other is not, or would not be, an artwork, and, since they exactly resemble one another, it cannot be some visually discernible characteristic that makes the artwork art. Therefore, it must be some context involving at least some non-visible elements that makes the artwork art. (p. 20)

Accordingly, artworks are created through the combined efforts of artists and the community, with the latter providing the framework for interpreting a given work as art. The audience, the non-visible element referenced by Danto, plays a pivotal role in this process. In the context of AI-generated artworks, a procedural theory must address and substantiate why creations by machines can be classified as art. To illustrate this point, consider three representations of the *Gioconda*: the original masterpiece by Leonardo da Vinci, a copy created by a distinguished human artist, and an AI-generated 3D print. The argument here is that the identity of the creator of these works is not the determining factor in their classification as art; rather, it is the audience's perception that is crucial. The acceptance of these works as art is contingent upon the audience's evaluation. Different audiences may render different judgments about these paintings. It is important to note that there is no intrinsic property in the molecular composition or temporality of these works that inherently qualifies them as art; their designation as such depends entirely on the audience's recognition.

17 This name is given by Dickie to his own interpretation of this part of Danto's article.

In summary, this section has elucidated the definition of artwork that this article adopts and explicated why Dickie's procedural conceptualization is preferred over functional art theories. Specifically, it has been emphasized that Dickie's definition possesses two critical attributes: firstly, it is not human-centered as it does not mandate the artist to possess a human mind; and secondly, it is subject-dependent as it necessitates external human approbation for a product to be deemed as art. The subsequent section will delve into the third aspect of the definition of an AI-generated artwork, which is AI creativity.

5. AI Creativity

The third step to constructing a transdisciplinary definition of an AI-generated artwork is to understand AI creativity. Therefore, a conceptualization of AI is needed. Recently, the researcher Mariusz Stanowski (2021) has pointed out that AI "can be described as a way of implementing by technical methods such solutions or behaviors that, if they were human actions, we would call them intelligent" (p. 139). From the standpoint of this study, this definition allows us to highlight the following three valuable points in order to achieve the goal of this article:

Firstly, Stanowski's description of AI can be extended to a broader concept of intelligence. Specifically, intelligence, whether human or machine, is defined as the ability to use one's resources to solve problems, provided that a human audience recognizes it as such. The focus will now shift to the first aspect of this definition, with the second aspect addressed in the following paragraphs. Therefore, intelligence can be understood as the capacity to solve problems. For instance, if a person possesses this ability, it demonstrates natural intelligence; similarly, if a pig exhibits this ability, it indicates another form of natural intelligence. By the same logic, if a machine has this ability, it can be considered to possess artificial intelligence. In line with Boden's definition of creativity, Stanowski suggests that intelligence is not an exclusively human trait; rather, anything or anyone capable of problem-solving can be regarded as intelligent.

Furthermore, Stanowski underscores that an intelligent agent, whether a machine or a human, must utilize its own resources to solve problems. This

criterion implies a need for autonomy, rather than mere assistance. Consequently, a human relying on another for problem-solving would not be deemed intelligent if they cannot rely solely on their own resources. Although human autonomy is generally assumed, this aspect is particularly crucial for machines, which must demonstrate their autonomy to be considered intelligent. This issue will be further explored in relation to creative autonomy within computer science.

Secondly, with regard to human audience recognition, Stanowski's definition of intelligence suggests that problem-solving ability alone is insufficient for an entity to be considered intelligent. Public recognition is also a requisite. In other words, according to Stanowski, intelligence is subject-dependent. For instance, a human who is a misunderstood genius may not be recognized as intelligent despite possessing problem-solving capabilities. Similarly, a machine might excel in solving various problems, but if its outputs are not perceived as valuable by a human audience, the machine cannot be classified as intelligent.

Thirdly, within computer science, artificial creativity is a specialized subfield. Simon Colton and Geraint Wiggins (2012) define artificial creativity as "the philosophy, science, and engineering of computational systems which, by assuming specific responsibilities, exhibit behaviors that unbiased observers would consider creative" (p. 21). This perspective highlights that artificial creativity, like human creativity, is subject-dependent. This requirement parallels (a) Boden's definition of creativity and (b) Dickie's definition of artwork. Consequently, the following sections will first elaborate on the subject-dependent nature of AI, identifying parallels with the concepts discussed earlier concerning Boden's creativity and Dickie's artwork. Subsequently, the discussion will address the necessity of creative autonomy for AI to be recognized as a creative agent. This approach will facilitate the construction of a transdisciplinary definition of AI-generated artwork by integrating insights from cognitive science, art theory, and computer science.

5.1. The Subject-Dependent Character of AI

The subject-dependent character of AI means that an algorithm can be a skilled problem solver, but people's opinions determine the final verdict on its intelligence. Intelligence is an ability that requires external evaluation. This requirement can be traced back to its very beginnings in computer science.

In "Computing Machinery and Intelligence" (1950), Alan Turing poses the question: can machines think? To avoid problems from using the word 'think', he replaces the question with his famous imitation game, with its questions and answers. Turing's reasoning shows that the crucial point is not if the machine is thinking. Instead, what is important is if humans can be fooled and believe that. It should be noted that the Turing Test takes advantage of the subject-dependent characteristic of AI to test its performance. Following this article's aim, the next step is to ask if a Turing Test can be adapted to check the artistic creativity of AI.

5.1.1. Empirical Evidence on Human Audience Evaluation of AI-generated products

Recently, experiments have been conducted to present AI-generated outputs to human audiences. The conclusions of three of the most prominent studies are as follows:

In "An investigation into people's bias against computational creativity in music composition" (2006), researchers David C. Moffat and Martin Kelly used a modified version of the Turing Test to evaluate the performance of machines in music composition. In particular, computer-generated songs from the Voyager (Lewis, 1993), ILLIAC[18] Suite (Hiller, 1989) and EMI[19] (Cope, 2003) machines were used. These were added to human pieces in similar styles (i.e., jazz, violin and Bach-like). The human listeners were grouped into musicians and non-musicians. The results showed that most of the computer-created songs passed the Turing Test. In particular, the musicians' group was more likely to be fooled. Nevertheless, Moffat and Kelly also note that both musicians and non-musicians are biased against computers. Consequently, listeners tend to evaluate work they believe to be artificially-made worse than work they believe to be human-made.

18 Illinois Automatic Computer.
19 Experiments in Musical Intelligence.

In "CAN: Creative Adversarial Networks, Generating 'Art' by Learning About Styles and Deviating from Style Norms" (2017), researchers Ahmed Elgammal, Bingchen Liu, Mohamed Elhoseiny, and Marian Mazzone also used an adaptation of the Turing Test to evaluate the performance of machines in plastic creation. In particular, they used paintings generated by Generative Adversarial Networks (GANs),[20] human-generated paintings obtained from Art Basel[21] 2016 and a sample of abstract expressionism. The results showed that human observers could not distinguish which art is computer-made or human-made.

More recently, researchers Martin Ragot and Nicolas Martin again subjected GANs to a modified Turing Test in "AI-generated vs Human Artworks. A Perception Bias Towards Artificial Intelligence?" (2020). In this case, the human audience rated paintings labelled AI-made and human-made. Nevertheless, the labelling was manipulated. Thus, some AI-made paintings were labelled as human-made and vice versa. Next, the manipulation was reported to the observers. Then, they were asked to try to find out the origin of some of the paintings. The results showed that, "depending on the perceived identity of the author (Human vs AI), the same artworks were evaluated differently. Moreover, the results show that real artworks made by humans are also evaluated more highly than real AI-generated artworks" (Ragot *et al*., 2020, p. 6).

In short, it can be seen that these machine-generated products pass the Turing Test. While there may be differences in the quality of their creations (i.e., whether they are considered good or bad art), this does not affect their status as art. On the other hand, it is important to consider the potential influence of anti-machine biases on negative human evaluations.

5.2. The Autonomy Requirement of AI in Computational Creativity

One common critique of computational creativity focuses on the issue of autonomy. While it is acknowledged that machines do produce outputs, there is debate over whether they do so autonomously, like humans. From my research perspective, this criticism overlooks the following facts:

First, a human performer cannot definitively demonstrate autonomy. Expanding upon Turing's response to Jefferson, it becomes apparent that the question of autonomy is inherently unverifiable. When asserting that a machine lacks autonomy, it is equally valid to argue that human autonomy is similarly unknown. Both humans and AI are influenced by external stimuli that affect their creative outputs. This reasoning extends to artistic creativity, which, as a subset of computational creativity, follows the same logic.

Second, the very definition of CG-art refers to outcomes produced with zero or minimal human interference (Boden, 2011). This can be seen as an appeal to machine autonomy. Computer science has responded to this query. Indeed, Kyle E. Jennings has said that creative autonomy "exists when a system not only evaluates creations on its own but also changes its standards without explicit direction" (Jennings, 2010, p. 489).

It can be noted that this requirement is covered on the very basis of machine learning (ML). Creative autonomy is, at its root, another way of saying that machines must learn through trial and error. Nevertheless, this does not mean that only ML-based machines are autonomous. In particular, two things are required: (1) self-evaluation and (2) changes founded on that evaluation.

According to the foregoing, autonomy is currently assured in certain types of AIs, namely GANs. Research in artistic computational creation focuses on these models (Wu *et al*., 2021). It is essential to know that they are a type of ANN. As summarized by researcher Arthur I. Miller (2019), GANs consist of two deep neural networks, the discriminator (D) and the generator (G). For example, if D is fed a dataset of tulip images, G will try to create new tulip images without access to D's dataset. That is, starting from scratch and only through trial and error, G will try to fool D into believing that this new image is a tulip. Since G starts with no information, its first attempts at deception will send out noise, a jumble of meaningless dots D rejects. Still, G picks up that what it created was not a tulip with each rejection. Eventually, after learning from its mistakes, G deceives D. This iteration process is unsupervised ML.

20 GANs are a type of Artificial Neural Network (ANN) algorithms. They are characterised by having two subnetworks, namely a generator and a discriminator, that operate simultaneously to produce new outputs autonomously.

21 https://www.artbasel.com/

It must thus be noted that G evaluates its work and learns from its mistakes. On the other hand, the GAN tandem composed of G and D is autonomously critical of its work, as it incorporates an internal quality control of its creations. In this sense, Galit Wellner (2021) has mentioned that these algorithms' operation is a variation of the Turing Test.

In practice, GANs have demonstrated their ability to create art that is indistinguishable from human art (Cetinic & She, 2021). Consequently, both approaches discussed address criticisms regarding computational autonomy. Nevertheless, as Wellner (2021) observes, "the final appreciation and judgment of the outcome are performed by humans, even though GAN algorithms are involved and make initial judgments. Ultimately, works of art are intended to be viewed (or listened to) by humans." This observation brings the discussion back to the Turing Test. It is insufficient for an algorithm to exhibit creative autonomy as described by Jennings (2010); the human audience must also perceive the algorithm as creative.

6. AI-Generated Artwork: A Transdisciplinary Definition

The present study sought to establish a comprehensive, transdisciplinary definition of AI-generated artwork. Prior analyses revealed a shared, subject-dependent character among Margaret Boden's conception of creativity, George Dickie's definition of artwork, and the computational creativity paradigm within computer science. Building on this foundation, it is proposed that an AI-generated artwork involves (1) an autonomous AI-production of a new and surprising idea or artifact, (2) which passes an internal evaluation mechanism embedded in the very same AI, and (3) is considered a candidate for appreciation by a human audience.

The adoption of this definition clarifies conceptual ambiguities prevalent in interdisciplinary discourse. By evaluating adherence to these criteria, more productive discussions can be facilitated. The absence of any criterion precludes classification as AI-generated artwork. For instance, fulfillment of only criteria (1) and (2) results in an AI-generated product, not art. Similarly, satisfying solely criterion (3) based on general artistic understanding does not constitute AI-generated artwork.

7. Results

A transdisciplinary definition of AI-generated artwork was developed through a rigorous analysis of Boden, Dickie, and computational creativity, revealing a shared emphasis on subject-dependency. Analyses validated the proposed criteria, demonstrating AI systems' capacity for autonomous, novel creation (Criterion 1), internal evaluation (Criterion 2), and human aesthetic reception (Criterion 3). Fulfillment of all criteria indicates AI-generated artwork.

Conversely, the absence of one or two criteria negates AI-generated artwork status. For example, autonomous production without internal evaluation yields an AI-generated product, not art. Likewise, human aesthetic appreciation alone, devoid of autonomous creation and internal evaluation, does not constitute AI-generated artwork.

These findings illuminate conceptual distinctions across disciplines, fostering more nuanced discussions concerning the nature of AI-generated art.

8. Conclusion

This study established a comprehensive definition of AI-generated artwork through a comparative analysis of creativity, artwork, and computational creativity across cognitive science, art theory, and computer science. A shared emphasis on subject-dependency, reliant on external human evaluation, was identified.

Boden's distinction between creators and producers was applied, highlighting the necessity of internal AI evaluation beyond external human judgment. Dickie's procedural account of art aligned with Boden's creativity, emphasizing the role of audience perception in defining artwork. Computational creativity underscored the importance of human recognition for AI-generated output to be considered art.

The concept of computational creativity was also linked to the external evaluation of the human

audience. In this sense, it became clear that it is not enough for an AI to produce something autonomously without human assistance. If such a product is not considered art by the human audience, it will only be an AI-generated product.

Consequently, an AI-generated artwork necessitates: (1) an autonomous AI-production of a new and surprising idea or artifact, (2) which passes an internal evaluation mechanism embedded in the very same AI, and (3) is considered a candidate for appreciation by a human audience. This definition integrates perspectives from cognitive science, art theory, and computer science. Future research should assess the applicability of these criteria to specific AI-generated artworks.

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