

CHAPTER 1

ART, TECHNOLOGY, AND CREATIVE PROCESSES: A NEW PARADIGM FOR ARTISTIC PRODUCTION

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ABSTRACT

This study explored the evolving relationship between contemporary art, artificial intelligence (AI), and neuroscience, challenging the anthropocentric notion of artistic creation as uniquely human. The research question to be analyzed was as follows: “How are algorithms reshaping the artist and creativity in the 21st century?” To address this question, the integration of concepts from art theory, neuroscience, and AI was considered. This examination explored the manner in which neuroimaging technologies and biometric algorithms were reshaping our understanding of creativity. The study examined the impact of scientific progress on artistic expression across different eras, ranging from the advent of psychoanalysis to the emergence of computer technologies. It demonstrated how neuroscience was facilitating our understanding of the brain processes underlying creativity, including the neurotransmitters and cortical regions implicated in artistic processes. Empirical analyses were supported by neuroimaging

studies that established a correlation between brain activity and aesthetic experiences, as well as algorithmic simulations that simulated artistic cognition. Recent findings indicated an increasing role for AI in artistic production, with the technology emulating the brain's creative processes. The neurotransmitters dopamine and oxytocin were demonstrated to influence artistic motivation and pleasure. Furthermore, neuroimaging studies showed that creative activities resulted in the activation of regions such as the limbic system and the prefrontal cortex. The extension of these processes enabled algorithmic models to generate artworks that defied conventional art definitions. The investigation introduced computational mannerism, a concept in which digital interfaces and machine learning expanded artistic potential by reflecting human cognitive patterns in real-time iterations. This suggested a fusion of human intuition and machine logic, thereby challenging the exclusivity of human creativity. This integration of neuroimaging data into algorithmic systems represented a paradigm shift, giving rise to a range of ethical and philosophical questions concerning authorship, creativity, and the artist's role in the digital age. As AI progresses, it became imperative to develop novel theoretical frameworks to comprehend its cultural and meta-physical influence on artistic expression.

KEYWORDS: assisted creation, computational mannerism, aesthetics of artificial intelligence, biological pathway in creative process, neuroimages

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1 INTRODUCTION

The utilization of novel technologies, whether digital or analog, by artists to modify computer systems, devices, and software programs, as well as to engage in collaborative endeavors with engineers and programmers, has been a persistent feature of artistic production. Historically, technology has been repurposed for creative purposes, despite its origins in entirely different applications. Given the paucity of software applications dedicated to artistic creation, software intended for commercial or industrial use is often adapted to align with the creative process. This technological adaptation is driven by the necessity to expand creative limits and innovate within the artistic field. The primary inquiry guiding this investigation is as follows: How are algorithms reshaping the artist and creativity in the 21st century? This study integrates concepts from art theory, neuroscience, and artificial intelligence (AI) to investigate the ways in which neuroimaging technologies and biometric algorithms are restructuring our comprehension of artistic expression and creativity. The objective of this study is to analyze the appropriation of digital and analog technologies by artists to expand creative possibilities through technological adaptation and to examine the manner in which the practice of repurposing software designed for nonartistic purposes contributes to the process of artistic innovation. Furthermore, the research examines the influence of AI and neuroscientific principles on contemporary art, highlighting how technological mediation reshapes creative processes and redefines artistic expression in the digital age. In the domain of design, certain corporations, such as Adobe, have developed dedicated programs that facilitate artistic production.

Nevertheless, the notion of creation as a genuinely innovative act—one that, as Boden (2007) elucidates, represents “something that no one else has ever done before”—exceeds mere digital manipulation. The author posits a dichotomy between two types of creation: historical creation, also referred to as H-creativity, and original creation, which is characterized as a catalyst for advancement. Alternatively, personal creation, or P-creativity, does not include the majority of people who produce only average ideas, already known by others, although they are new to the individual in question. The act of creation, therefore, must entail the establishment of a novel paradigm for the collective. The

essence of art is encapsulated in its capacity to act as a disruptive force that transcends the boundaries of technology. The correlation between art and science is evident. Art frequently borrows methods and tools from scientific advancements, while science frequently pursues innovation and creativity through artistic experimentation. The ensuing discourse is methodically structured into distinct sections, each addressing a distinct yet interconnected facet of the intricate relationship between AI, art, and technology within the ambit of creative processes. The initial section of the text examines how artists employ analog and digital technologies, emphasizing the importance of hacking and repurposing technology due to the paucity of specialized software designed for creative innovation. This necessity for adaptation underscores the artist's role as both creator and technological manipulator, propelling the boundaries of conventional tools to achieve novel forms of expression.

Subsequently, a historical analysis is conducted to examine the impact of scientific theories on artistic practices. Concepts such as psychoanalysis and early AI investigations have had a profound influence on the development of visual and computational technologies. This study will examine the evolution of technological devices in the context of 20th- and 21st-century art. It will demonstrate how works of art are inextricably linked to the technologies available in each period, including photochemical, electronic, computational, and digital technologies. This exploration of art historiography delineates the evolution of artistic media from the advent of photography and cinema (photochemical art) to digital art. According to Paul (2015), a theorist of technologies applied in the field of arts, she proposes the term “digital art” as an umbrella to describe the great proliferation of styles that emerge from new technological devices. With each technological debut, a novel style emerges, complicating its analysis within the framework of art theory. These technological shifts signify profound transformations in creative practices and aesthetic critique, thereby unveiling a growing divide between aesthetic theory and artistic execution. This discrepancy underscores the necessity for novel theoretical frameworks that address the integration of digital technologies in contemporary art.

In its contemporary analysis, the text addresses the role of AI in creative processes, focusing on the cognitive and neurobiological mechanisms that underlie artistic production. The following

analysis will examine the brain processes that occur during the creative process and will delineate the specific stages in which brain areas and neurotransmitters act. This model proposes a methodology for the construction of a creative computer. Indeed, the act of creation in art necessitates the engagement of cognitive and affective processes. This study examines the participation of neurotransmitters and specific brain regions in creativity, highlighting how computational models can simulate these biological processes to replicate or even enhance artistic expression. This intersection of neuroscience and AI suggests that creativity, traditionally viewed as an exclusive human trait, is increasingly accessible to algorithmic replication, thereby challenging long-held beliefs about the uniqueness of human artistic capability. The section dedicated to visual interfaces explores how these technologies mediate the relationship between the human mind and the digital world, creating new possibilities for aesthetic interaction and expression. Interfaces designed with algorithmic precision have been shown to facilitate immersive experiences that extend artistic perception beyond the physical limitations of traditional media. This technological mediation enhances the accessibility of art and redefines its experiential dimension, proposing a paradigm shift toward more interactive and responsive artistic creations.

The proposed methodology delineates a framework for digital creative processes that integrates concepts of art, neuroscience, and technology. The text places significant emphasis on the importance of algorithmic literacy, underscoring the necessity for creators to possess a comprehensive understanding of, and deliberate control over, digital interfaces and algorithms. This literacy is presented as essential for navigating the complexities of AI in artistic production, where the artist's role evolves from mere creator to orchestrator of digital processes. By means of this argumentative structure, the discourse explores how the algorithmic revolution has reshaped contemporary art. It challenges traditional notions of creativity and redefines the artist's role in a digitally mediated environment, marking the dawn of a new artistic era—one where human intuition and machine learning coalesce to push the boundaries of artistic expression.

2 LITERATURE REVIEW

The methodology for conducting a literature review is structured into distinct sections that trace the development of artistic methods in response to technological progress. The analysis initiates by examining the influence of psychoanalysis on artistic movements such as Surrealism and Dadaism. The study emphasizes the impact of delving into the subconscious on shaping creative approaches. The selection of Freud's theories is attributed to their groundbreaking proposition that an unconscious mind governs the mechanisms of consciousness. The concept of the "narcissistic wound," introduced by Freud, is also discussed as a metaphor shedding light on human apprehension toward the rise of AI. The narrative then charts the gradual assimilation of technology into art, starting from traditional photochemical techniques such as photography and cinema to the realm of electronic and computational art, culminating in the utilization of digital tools and AI. This progression underscores a widening gap between artistic practice and aesthetic theory, characterized by transformations in creative methodologies and the conceptual function of the artist. The incorporation of insights from neuroscience into the development of algorithmic and computational models is deemed increasingly essential. This integration draws on an understanding of brain functionality, specialized neural regions, and models that have influenced the advancement of AI. Since the inception of the field of cognitive computing, the human brain has served as a foundational reference point, influencing the design of both the hardware components and the software programming of artificial devices.

2.1 *Historical approach: Historiography of art and technological devices*

Since the advent of the 20th century, with the emergence of psychoanalysis, the field of art has sought to explicate its own functioning, as evidenced by the emergence of Surrealism and Dadaism. Psychoanalysis is a theoretical framework that can be employed to elucidate certain creative strategies employed by artists. For instance, in developing his poetics, he employed psychoanalytic theory, particularly the concept of the unintentional,

thereby gaining access to the unconscious. It is important to acknowledge that Freud, a renowned neurologist, possessed a profound understanding of brain physiology when he developed psychoanalysis. This is the rationale behind its employment in this context. His theoretical contributions have exerted a profound influence on artistic expression and creative thinking throughout the 20th century. In addition to his theoretical work, he was also an expert in the field of brain mechanisms.

In contemporary discourse, psychoanalysis is often stigmatized as pseudoscience; nevertheless, its seminal discoveries concerning the unconscious continue to exert a substantial influence on the field of neuroscience. In his reflections on the emotional brain, neuroscientist Joseph LeDoux illuminates Freudian notions. Freud's concept of the unconscious as a storage space for conscious content is a seminal one. However, it is important to note that the unconscious is also a repository for thoughts and memories of fear and anxiety, which are stored and maintained in a way that is inaccessible to the subject. The cognitive unconscious refers to processes that activate functions that may or may not produce conscious content. When discussing processes of this nature, I opt for the term "nonconscious" to avoid confusion with the Freudian unconscious. The author proposes that emotions arise in three levels of conscious, nonconscious, and unconscious feelings. In contrast to genuine fear, anxiety is a construct of our psycho-corporeal response, stemming from adrenaline mechanisms and learned behaviors. The concept of the unconscious is theorized as a physiological response to various emotional stimuli experienced by the body. This cerebral metabolism, or non-conscious process, of anxiety and fear is present in all emotional reactions, including aesthetic reactions. In essence, he is refining certain tenets of Freudian theory. These reflections are instrumental in our proposal, as AI is capable of analyzing and precisely connecting with such visceral and nonconscious reactions. LeDoux is credited with the conceptualization of the emotional brain, and in this work, he reviews several positions on the mechanisms by which affective triggers are initiated within the cerebral amygdala, adrenaline, and noradrenaline (LeDoux, 2015).

The prevailing notion is that the fear circuit in the brain is responsible for the sensation of fear. When activated, this circuit instigates characteristic responses in humans, including paralysis, facial expressions, and alterations in body physiology. The

phenomenon of fear is frequently regarded as an intermediary between a perceived threat and the subsequent physiological and behavioral responses. Fear is a genuine phenomenon; certain factors contribute to the behavioral threat. In this study, we propose the concept of “like a key” as a theoretical framework to elucidate human responses to AI. The following inquiry is posited: what form does an imaginary fantasy assume in the aftermath of the loss of the anthropocentric protagonist of intelligence? In the historiography of art, our proposal follows a specific path that foresees demarcated phases in the use of techniques, information theory, cybernetics, and computational and digital technologies in the arts. In this article, we will employ the principles of aesthetic theory, tracing the development of this concept from its origins in the works of Kant to the present day. In their reflections on art and creativity, some authors eschew contemporary aesthetic theory. This phenomenon can be attributed to the inherent complexity and distribution of cognitive experiments. We do not seek to invalidate these authors; on the contrary, in our reflection, we will seek to add them to our proposition and reflection on art and creation (Vartanian et al., 2013). An illustration of this complexity is the pervasive and simplistic use of the term “art and technology.” This term is employed to denote art that utilizes technologies of various types and eras.

The proposal delineates discrete periods characterized by distinct formal and evolutionary distinctions from the analog and hybrid technologies of the 20th century to the digital and intelligent technologies of the 21st century. When the term is employed in a general sense, it fails to acknowledge the poetic, formal, and creative potential inherent in each technological device. These structural differences are the result of the aforementioned factors. So, we consider photography and cinema (photochemical art); analog means of telecommunications such as mail, telephone, and radio (art and communication); television video (electronic art); computational technologies (computational art); and currently the digital computer, information and communication technologies, and AI (digital art). This process commenced at the onset of the 20th century and subsequently intensified, engendering profound transformations in the realm of art from the 1950s through the 1960s. With the cessation of the Second World War, the technology industry no longer enjoyed the level of funding that had previously been provided by wars

and their technological war experiments. This pivotal moment is concomitant with a gradual relinquishment of academic and conventional pretensions in art, which sought to uphold the constraints imposed by both art in relation to traditional techniques and their circumscribed domains, and aesthetics in relation to its ontological foundations (the thematic branch of philosophy that appreciates beauty).

These novel proposals engender profound transformations, which are not always comprehended or embraced by the artistic community. This issue is further complicated by the ongoing and intensifying controversy surrounding the crises in art and aesthetics. At the core of this controversy, which has been disseminated by certain postmodern theorists, all indications pointed to a purported dissolution of both fields: art and aesthetics. This controversy emerges, at least in part, from the pursuit of beauty and its reflection in the philosophical domain by an aesthetic theory. It is evident that art and creative practices are undergoing a paradigm shift, marked by a gradual deconstruction of their underlying principles. The incorporation of the abject and the unpleasant as values to be appreciated, as well as situations of total neutrality without a priori valuation of either one or the other, is a key tenet of the philosophy. The phobic's sole object is the abject. Therefore, with fear in parentheses, the discourse will appear sustainable only if it continuously confronts this otherness, a burden that is simultaneously repulsive and repelled, a deep memory that is inaccessible and intimate: the abject (Kristeva, 1982).

Consequently, the role of aesthetics and the functions of art diverge. To achieve this objective, it is imperative to prevent governments and large corporations from exerting control over AI. The artistic process necessitates the liberty to employ any form of information, irrespective of its aesthetic quality, neutrality, or the extent to which it may be regarded as aesthetically displeasing. The increasing use of technologies as artistic tools has led to a significant and ongoing division between artistic experience, art criticism, and aesthetic theory. It is imperative to note that, while these elements should maintain synchrony and congruence in their correspondence, they have, in fact, embarked on discordant trajectories. The dissonance between the theoretical corpus and artistic practice has engendered a paradox, which is arguably a primary factor in the persistent declaration of the "death" of art

in the 20th century and, more recently, the “death” of the artist in the 21st century with the emergence of creation by AI. In another vein, during the 20th century, the advent of computational technologies precipitated a systematic investigation into the human neural apparatus. This investigation was driven by the development of computers and AI. It also sought to elucidate the mechanisms underlying creativity and the cognitive processes involved.

Preliminary research suggests that the components of computational machinery are influenced by the activation of neurons in the human cortex. This trigger is employed in research as a multidisciplinary paradigm that shifts the manner in which computers operate. Consequently, it establishes a novel cultural perspective on the opportunities for the style of creation by AI. Our gaze is subject to and respects the rules of brain functioning. For instance, ultraviolet light is not visible to the human eye and has never been represented in any artistic medium. We are subject to the laws of the brain (Zeki, 1999). Consequently, the utilization of ultraviolet light in the creative process is only feasible through the implementation of specialized software that encodes the pulses of this light, which is imperceptible to the naked eye, without the use of sensors. This paradigm shift has been particularly evident in certain scientific disciplines, marking a transition from the humanities to the exact sciences. This multidisciplinary approach has fostered behavioral understanding and its transcoding into computational language. Undoubtedly, the investigation of brain connections and neurotransmitters in creative acts constitutes a pivotal area of inquiry to comprehend the intricacies of the human process. This will be a support for the assisted creative process, which involves the use of a learning machine to assist in the creation of art, design, and other human creative endeavors. Questions of art play a crucial role in the empathic process of exchange between the computer and the human universe. The driving force behind this connection is the assimilation of data.

The significance of artificial systems in both technological advancement and the human–computer interface cannot be overstated. These factors have the potential to foster heightened empathy. Empathic technologies are defined as technological devices that investigate biosignals to comprehend the biological mechanisms in humans, thereby acquiring information about us. When humans are exposed to biometric processes and other types

of biological signal capture, such as digital watches and smart-phones, they respond with information sent by the biological signals in their brains to digital devices. These technologies are referred to as neurotechnologies. Farahany (2023), a bioethicist, lawyer, philosopher, and Iranian-American researcher, proposes that the same neurotechnologies capable of aiding neurological health, treating diseases, managing compulsions, and enhancing mental states will be sold to large technology corporations, depriving us of our mental freedom. According to her, this phenomenon is already occurring, and major technology companies are leveraging user data to influence behaviors and patterns of consumption. She asserts that in the 21st century, the preservation of cognitive freedom is paramount. The fields of machine learning and AI are undergoing rapid advancements, and existing legislation and international treaties are beginning to grant individuals even rudimentary sovereignty over their brains. The phobic reaction to AI is indicative of a narcissistic attitude. Attempts to impose control over it, whether initiated by corporations or state entities, are destined to fail. The creation and art that define human existence will only be possible if they are mediated by AI.

2.2 *Creation with artificial intelligence*

In the domain of arts, visual and music, the utilization of AI for the purpose of artistic thought and creation first emerged in the late 1950s. Since that time, it has become a recurring theme in both the realm of art and the theoretical study of art. The initial application of AI in the arts was experimental in nature, prompting inquiries into the feasibility of comparing human and artificial thought processes. To illustrate this point, consider the use of Mondrian as a database feed with original paint. The objective of this study is to generate a pseudo-Mondrian from the painter's works. The works produced met with the public's favor. This phenomenon gave rise to numerous inquiries concerning the role of art and the artist as a creative process, a social context, and other related matters. In the book entitled *Artificial aesthetics: A critical guide to AI, media and design* (Manovich & Arielli, 2021), the authors present a diverse array of examples that illustrate the utilization of AI in creative endeavors. The text offers a comprehensive exploration of the historical and contemporary applications

of algorithms and AI, while concurrently challenging the prevailing anthropocentric paradigm concerning creativity and the arts. Consequently, the utilization of AI has been adopted by artists and art critics.

In the contemporary era, marked by the advancement of algorithms and AI technologies, these discourses have acquired a more prominent dimension. The philosopher of information, Luciano Floridi, in his book *The fourth revolution: How the infosphere is reshaping human reality* (Floridi, 2014), proposes a response to our current narcissistic crisis. This phenomenon can be attributed to the advancements in AI, its integration within major technological enterprises, and the apprehension among artists regarding their potential replacement by AI. Prior to this paradigm shift, the concepts of art and creation were considered exclusively human attributes. The awareness of potential replacement in circumstances that define our distinctiveness can influence our self-perception. This implicit defense of our exceptional place in the universe, which still existed, will collapse. We were confident that no other creature on Earth could surpass us in intelligence. The infosphere is defined as an artificial informational agent that processes information on a large scale. While such agents have not yet reached the same level of intelligence as humans, they are rapidly approaching this benchmark. Advances in imaging technology have led to a situation in which our bodies, or bio-organs, are increasingly transparent. This phenomenon is evident in a variety of imaging technologies, including video surveillance, CT scans, MRIs, ultrasounds, and neuroimaging. The preponderance of contemporary medical technologies has had a profound impact on the human body, as evidenced by the significant alterations it has undergone (Floridi, 2014).

This phenomenon can be understood as a form of narcissistic terror, stemming from the realization that we are no longer the sole beings endowed with intelligence. The field of AI has reached a point where it has surpassed human capabilities. In the context of AI being tasked with the creation of objects that exhibit aesthetic properties akin to art and other human creations characterized by creativity, a pertinent question emerges: How should we, as a society, respond to these emerging realities? In Ancient Greece, Socrates established the human being as separate from nature and, consequently, initiated humanism based on language and intelligence. The concept of humanism, founded on

“anthropological difference,” was originally theorized by Socrates, who is widely regarded as the originator of the concept of man. Socrates’ radical distancing from the natural world is widely considered to be the foundation for the development of humanism (Simondon, 2008). The man commences a systematic, introspective examination of his own being. If intelligence is considered a tool for the foundation of humankind, it can also be argued that it serves to put an end to anthropocentrism. Consequently, the basis for human identity, as established by linguistic differences, also signifies the dissolution of certain fundamental characteristics and pillars of the human condition. Furthermore, artistic and creative endeavors stemming from human intelligence and emotion also demonstrate a similar tendency to succumb in this process: the conclusion of the artist in the 21st century. The notion of creation in 21st-century art is a subject that merits close examination. The process of creation, when considered as an individual and subjective phenomenon, can be understood as a more visceral and physiological occurrence than a metaphysical one. As posited by Onians (2007), “subjectivity” is a more authentic phenomenon than previously theorized, being shaped less by ideologies and discourses, and more by cerebral and visceral experiences.

The following proposal will present a theoretical framework for understanding the neurobiological underpinnings of human creativity, with a focus on the role of specific neurotransmitters and cerebral regions in facilitating creative processes. Additionally, the implications of psychological faces and subjective experiences in creativity will be explored. We will propose an analysis of empirical processes because we are artists, and our proposition emerges in the practices and creative process of our students and our own creative process as artists. The study analyzes the artistic creation processes of other artists in everyday practices that could effectively impact the creative brain, and how these areas and neurotransmitters are active in art.

2.3 *Brain steps for the creative process*

First, it is necessary to ascertain the brain regions and neurotransmitters implicated to segment the creative process into discrete phases. A synapse has the capacity to transmit signals

to multiple outputs. For instance, the primary visual cortex is responsible for processing a portion of the sensory information and relaying it to other regions of the brain: the motor cortex, the limbic system, and memory. The hippocampal apparatus is critical for the formation of explicit episodic and semantic memories, and it is believed to be associated with dreams. The neocortex is a region that stores the content of explicit memories. The amygdala plays a pivotal role in the formation of memories associated with emotions such as pleasure and fear. The basal ganglia have been demonstrated to be involved in the formation of implicit memory, which encompasses motor skills. The cerebellar region has also been implicated in implicit memory and motor learning. The prefrontal cortex is critical for short-term working memory. The phenomenon of brain stimulation is understood to occur through a specific chemical neuronal process known as the excitatory-inhibitory process. In the event that a given process is in an excitatory state, there is a reuptake of a specific kind of neurotransmitter. For example, if one situation is conducive to a depressive emotional state, the serotonin level is low, and it is captured, lowering the cortical level. This mechanism is present in every brain. When serotonin levels are high, the neuron activates the serotonin reuptake inhibitory function, thereby inducing an antidepressant state. The act of creation and the production of art invariably entail a process of recollection and remembrance. Consequently, during the creative process, acetylcholine, the neurotransmitter responsible for memory, will be inhibited. Therefore, under the fundamental principles of the creative process, the presence of these two stages is an inevitable component of any artistic endeavor. As previously mentioned, specific regions of the brain have been identified as being responsible for various cognitive functions, including memory, emotion, and motor skills. These regions have also been linked to the inhibitory and excitatory processes of neurotransmitters.

The following discussion will delineate several of the brain's stages, correlating them with the creative process. It is imperative to acknowledge that the brain does not function in a hierarchical manner; rather, it operates in a more parallel fashion. During the creative process, different stimuli and regions may be activated, underscoring the complexity of cognitive processes. Therefore, the neurotransmitter oxytocin has the capacity to elicit a narcissistic response to artistic creations. The

neurotransmitter implicated in this process has been shown to prompt artists to perceive their own work as art from an early stage (Siegel & Sapru, 2019). Semir Zeki, a neuroscientist, proposes a theory on the relationship between aesthetic pleasure, maternal love, romantic love, and the phenomenon of suspended critical judgment. According to Zeki, this suspension of judgment occurs as a result of the inhibition of the frontal and prefrontal cortex. According to the aforementioned perspective, the creative process is initiated by the artist's innate passion for their artistic creation. The term "work of art" is employed to denote an object that authentically exhibits characteristics that can be appraised as such. Second, art and creation are activities that people find enjoyable and that provide gratification and pleasure. The experience of creation evokes parallels with other pleasurable experiences. Consequently, it aligns with the principles of pleasure. In a progressive process that becomes increasingly intense for this reason, it is difficult to relinquish this pleasure. The nature of the experience, whether positive or negative, is inconsequential. Furthermore, it is imperative to encourage those who create to return to the material. Pleasure serves as a catalyst for this process. In this sense, dopamine has been linked to various experiences of pleasure, including the consumption of alcohol, drugs, sexual activities, and, notably, the aesthetic experience. This phenomenon is of interest to both the producer of the art and its appreciator.

The subjective pleasure experienced during the process of artistic creation has been demonstrated to facilitate the release of dopamine, a neurotransmitter associated with reward-related behavior. Just as the human experience of love depends on the presence of novelty to maintain dopamine levels in the brain, the human experience of art also requires new experiences to be sustained. Recent findings have revealed that dopamine's role extends beyond the realm of pleasure acquisition. This phenomenon engenders a more profound and pervasive sensation of pleasure. The objective of this study is to explore the subjective definition of pleasure. Consequently, dopamine emerges as a pivotal neurotransmitter in the regulation and prediction of behaviors. This phenomenon is observable across a wide array of human activities, including the creation of art, literature, and music; the pursuit of success; the exploration of new realms and the discovery of new laws of nature; contemplation on profound questions such as the existence of God; and the experience of romantic love. The

relationship between drug use and experiences of disappointment is a complex one. Dopamine has been shown to imply a cycle of frustration due to the necessary novelty; thus, adaptation to it is rapid. As demonstrated in the research by Lieberman and Long (2018), there has been an increase in the use of prohibited substances, including alcohol and drugs.

Consequently, the dopaminergic nature of creative activity is rooted in the inherent pleasure derived from the act of creation. Therefore, as is the case with other addictive behaviors, the experience of pleasure reemerges. The distinction in the context of creativity is that dopamine levels remained stable during these processes. This distinction between creativity and other addictive behaviors is pivotal in understanding the positive impact of creativity on the selective inhibitory cycle of dopamine reuptake. This biological dopaminergic drive then underwent a cycle in which our satisfaction became a static state, and the initial pleasure ceased to exist. The artistic creation process is cyclical, characterized by a cycle of narcissistic love for the created work, followed by a subsequent frustration that prompts a return to the artistic practice to reestablish the initial experience of pleasure and creation. The refinement of a work of art is achieved by identifying the optimal solution that will elicit a sense of pleasure in oneself and in the observer. Another important factor in art is adrenaline. The auditory cortex serves as a catalyst for adrenergic channels within the brain, thereby initiating creative processes. The process of creation, in general, and the artistic endeavor, in particular, are enhanced by a certain aggressive process.

A recent study developed by neuroscientists suggests that creativity may be enhanced in cases of frontotemporal dementia and Alzheimer's disease. From this standpoint, the notion of non-specialization in specific areas of the brain for particular tasks is contemplated (Friedberg et al., 2023). This scientific research attests to the need for the visual arts in therapies to alleviate symptoms of diseases. This prompts a pivotal inquiry: what factors underpin the observed enhancement of creativity in the context of dementia processes? If dementia is a disease that increases creative capacity in the visual arts, it may support our thesis that the creative process begins at a narcissistic stage. The initial stage in the creative process is often characterized by imitation and the suspension of critical judgment. Therefore, the existence of a particular class of neurons in the frontal and

prefrontal regions of the brain, known as mirror neurons, has been demonstrated to support certain traditional theories of art, such as mimesis. However, the mimetic process does not align with the contemporary art and creativity paradigm. In summary, we put forth a proposal for the development of an artificial creation system. The development of specialized processors and software that can substitute for the human creative cerebral mechanism is imperative. Accordingly, it can be posited that cerebral regions can be conceptualized as a distinct hardware configuration for a creative processor, with neurotransmitters functioning as the signal emitted by these regions. Regions can be considered analogous to hardware, while neurotransmitters can be regarded as analogous to software.

The subjectivity inherent in this medium can be likened to a distinct form of AI. Rather than exhausting the potential of knowledge regarding the bodily sensory reactions originating from the brain, we propose an illustration of how diverse fields must engage to generate a creative algorithm. It has become increasingly evident that interactions with the digital realm elicit behavioral modifications. The present moment is characterized by the pervasive use of social networks and search algorithms, as well as the appropriation of data from individuals by communication and information technologies. Consequently, the intervention of prominent corporations in our behaviors has become a prevailing reality. In this study, we propose a methodology for the implementation of this process through two distinct pathways. In essence, this involves the augmentation of creative capacity. In another sense, the search is underway for a truly creative entity—one that transcends the human condition and possesses the potential to augment our creative capacity.

2.4 Visual interfaces: A historical perspective

Technological devices require a solution for formal and symbolic understanding to become comprehensible and understood in the context of digital culture. The image interface is the medium through which exchanges are established between the human and the artificial domains. In *A vision of the brain*, Zeki (1993) proposes that the faculty of vision is an evolutionary mechanism that facilitates the acquisition of knowledge about the world.

He proposes that the act of perceiving is a mechanism through which individuals acquire knowledge about the world. The advent of technologies such as AI, which are capable of acquiring data about individuals through biometric analysis of their eyes, marks a pivotal shift in the relationship between humans and technology. It is evident that our society is undergoing a process of increasing decoding. It is important to note, however, that certain fields within computational science have emerged as leaders in the development of these technologies. This field of computer science research has witnessed significant advancements, including the development of virtual representations and simulations of real phenomena. The real world has been expanded by computational simulations, which have radically altered its conception and perception. To investigate and create simulations of the real world using a computational approach, neuroscience is an essential field..

The field of visual computation was established in 1980 as a subdiscipline of computer science that investigates the formation of images in the primary visual cortex. These approaches have precipitated a paradigm shift in the domain of graphic interfaces in computational vision. Consequently, the advent of new technological devices is conceivable. A computational scanning of the brain has emerged as a novel paradigm for analytical processes that occur in the brain when it is exposed to art objects or aesthetic experiences. The neuroimaging of the brain has enabled the observation of neuronal activity, cerebral processes, and cortical areas that are activated in response to aesthetic sensations. The concept of neuroaesthetics was initially introduced by Zeki (1993), and it has since garnered increasing attention from researchers worldwide. The advent of new subbranches of the aesthetic process and the brain has rendered them significant objects of investigation. Neuromarketing, neuroarthistory, and neurobiological drives are perceived as fundamental to integrating humans and artificial beings. Artificial intelligence is a new paradigm for establishing a brain-interface connection. This phenomenon is exemplified by the advent of smartphones, which have profoundly impacted human behavior and lifestyle patterns in contemporary society. This phenomenon can be likened to a shift in the configuration of our brain's neural networks.

The advent of smart technologies has precipitated a period of profound transformation in human beings, exerting a significant

influence on our social relationships, affective sensibilities, and sexual partnerships. At least, the development of a more powerful computers is a new paradigm, and the human species has become interchangeable with digital technologies. In the future, artificial devices may potentially facilitate the development of frontal and prefrontal cortices, regions associated with self-consciousness and individual identity. Consequently, the development of AI will reach a point where it exhibits self-consciousness, a concept referred to as the “singularity” within the domain of AI. Throughout the history of art, creation and experimentation by artists have played a significant role in the advancement of science and technology. The creative act, in its initial phase, is characterized by the concepts of invention and reinvention. Photography is a technique that has evolved from the primordial projections in caves to the advent of photography and photochemical cinema. Consequently, the fundamental principles of visual arts have provided a conducive environment for the development of novel concepts and methodologies in the technical realm. The utilization of creation as a medium for reflecting on the technical world has been a persistent practice among artists throughout history. These revolutions have consistently sought to broaden the creative domain. Nevertheless, experiments have historically functioned as a primary catalyst for advancements in scientific knowledge.

Art, as a primarily technical and technological phenomenon, has evolved and driven the emergence of ways of representing, constructing, and perceiving the world. Since the advent of perspective, artists have altered their perception and treatment of images, shifting from fixed images on church walls to paintings that allow the image to move. The advent of the 20th century marked the emergence of photochemical photography, kinetic works, computer art, electronic art, and, most recently, digital art, along with the integration of algorithms in artistic creation with the aid of AI. A wide array of scientific and cultural domains has exerted a pioneering influence on this process, encompassing disciplines such as art and neuroscience research. In their visual experiments, artists intuitively investigated the eye as an apparatus, thereby discovering how the visual cortex functions and thus advancing science. This paradigm shift was driven by several fields, including the transition from writing code to create programming codes to behavioral psychology to contemplate AI

(Boden, 2007). At that historical juncture, the domain of human-computer interface research was undergoing significant development, with a particular focus on image-based interfaces. This project, initiated in the 1980s, continues to the present day with the use of AI. The field of research concerning the functioning of the human brain and the manner in which we comprehend the visual world has undergone rapid development. The phenomenon of digital images, with its capacity to captivate and entice, has emerged as a recurrent subject in these inquiries. This phenomenon can be attributed to the pervasive presence of screens in our daily lives and the manner in which we engage with and process digital images (Marr, 1982).

In the 21st century, significant advancements in AI have led to a resurgence of interest in the human brain, prompting extensive research in this field. The advent of neuroscience technologies has precipitated this advancement, with biosignals being the focus of considerable research. The concept of “moistware” was developed by the artist Roy Ascott, as outlined in his *Moist media manifesto* (Ascott, 2000). In his proposal, the computational machinery must become more organic to facilitate the conclusion of fusion with our bodies. Presently, this objective remains a remote aspiration within the realm of technological advancement. The human specimen is more artificial, while the computers are more organic. It is possible that this solution is idealistic and will not become a reality in the foreseeable future, particularly in the context of technological solutions in today’s time. However, due to the limited availability of materials and minerals, research efforts must explore alternative solutions to produce new computational technologies. The proposed methodology aims to integrate concepts of art, neuroscience, and technology to investigate creative processes mediated by AI and visual interfaces. The objective of this study is to comprehend the manner in which technological advancements can augment the potential for artistic creation. To this end, an analysis will be conducted to study the biological and computational influences on the creative process.

3 METHODOLOGY: FRAMEWORK FOR CREATIVE PROCESSES IN DIGITAL ART

The proposed methodological framework integrates concepts from the arts, neuroscience, and technology to explore creative processes mediated by AI and visual interfaces. The text places significant emphasis on the concept of algorithmic literacy, asserting its indispensability for comprehending and manipulating digital media. The creative cycles, drawing inspiration from Manovich's principles of modularity and Boden's creativity levels, are methodically structured into five stages: ideation, prototyping, simulation, feedback, and finalization. This structured approach, underpinned by iterative experimentation, aims to enhance artistic possibilities. The central objective of this study is to understand how technological advancements can expand the possibilities of artistic creation. To this end, the study will analyze both biological and computational influences on the creative process. As a critical competency within this digital and algorithmic framework, algorithmic literacy is emphasized. Algorithmic literacy is defined as the capacity to comprehend, interpret, and reason about algorithms and their processes, as well as to identify their applications in both open and embedded systems. The ability to create and apply algorithmic tools and methods to solve issues across a range of fields is essential. The acquisition of an understanding of the underlying logic of algorithmic processes is integral to the development of algorithmic literacy, which enables individuals to effectively manipulate computational systems rather than being passively influenced by them. An increasing number of individuals, particularly those engaged in artistic pursuits, are advocating for the implementation of practical applications and the utilization of technology that facilitates the democratization of artistic expression through digital media (Semeler et al., 2024).

In the realm of digital art, the term “creative cycles” signifies a recurrent, iterative process entailing the evolution of concepts, their exploration, refinement, and culmination within a digital environment. This notion aligns with the perspective articulated by Manovich (2001) in *The language of new media*, wherein the author posits that digital creation is inherently modular and open to manipulation across multiple stages, facilitating iterations and real-time adjustments. According to Manovich, modularity

constitutes a foundational principle of digital media, comprising five distinct aspects: (1) numerical representation, (2) modularity, (3) automation, (4) variability, and (5) transcoding. The selection of the second principle is derived from its pertinence in the context of contemporary technological advancements. This principle is predicated on the fractal structure of new media, thereby enabling the deconstruction and reconstruction of artistic elements. Consequently, artists are empowered to experiment with different configurations and forms. This process mirrors the principles of iterative design, wherein the creative process is constantly refined through successive experimentation, embodying the concept of creative loops. Boden's (2010) seminal work, *Creativity and art: Three roads to surprise*, builds upon this perspective by exploring how computational processes not only support but also expand creative cycles. Boden proposes a taxonomy of three distinct levels of digital creativity: combinational, exploratory, and transformational. Boden emphasizes that creativity is influenced by cognitive mechanisms that can be nurtured through the acquisition of diverse knowledge, experimentation, and systematic practice within specific artistic styles.

Furthermore, she posits that cultural attitudes have the potential to impede creativity, particularly when they result in the suppression of novel and surprising ideas, thereby hindering innovation. Therefore, it is imperative to comprehend the cognitive processes underlying creative thinking to cultivate innovation in both artistic and technological domains. The fundamental understanding of algorithmic literacy can be defined as the ability to comprehend and generate sequences of instructions in a computer language that are executed to achieve a specific programming objective. The process entails the formulation of logical propositions—that is, true or false statements—through the utilization of conditions, recursion, looping, and various data structures that a computer is capable of processing. This understanding enables creators of algorithms to become proficient in any programming language, as the principles of algorithmic logic are universal across computational systems. Proficiency in algorithmic thinking empowers artists and technologists to leverage AI and visual interfaces in innovative ways, enhancing the creative process through structured experimentation and iterative refinement. Consequently, the symbiotic relationship between digital creativity and algorithmic literacy serves as the foundational

element for broadening artistic horizons in the digital era, thereby facilitating the emergence of novel forms of artistic expression and interactive design.

The stages of the creative cycle in digital art methodology was presented, which divides the creative process in digital art into five main stages, based on these theoretical underpinnings. Initial conception (ideation): At this nascent stage, the stimulation of neural activation is initiated by neurotransmitters such as dopamine and oxytocin, which are associated with inspiration and the conceptual formulation of the artistic work. This stage is characterized by the generation of preliminary concepts and the initial visualization of ideas. Visual experimentation (prototyping): The conceptual ideas are materialized within visual interfaces, thereby enabling the artist to manipulate and explore aesthetic elements in a digital environment. This phase is characterized by experimentation with various forms, colors, structures, and interactive components, which are facilitated by digital tools. The following is a discussion of technological interaction (computer simulation): The application of advanced algorithms and computational techniques is instrumental in the optimization of artistic representation. This encompasses the use of computer graphics and AI to simulate visual and behavioral effects, thereby enhancing the realism and interactive potential of the digital artwork. Creative feedback (aesthetic feedback): In this stage, the digital artwork undergoes a critical evaluation in both aesthetic and conceptual terms. Sensory and perceptual responses are analyzed, prompting adjustments and refinements to the visual representation and interactive elements of the piece. This phase is indicative of Manovich's concept of iterative design, wherein feedback loops drive continuous enhancement. Conclusion (final product): The creative process culminates with the integration of technological and artistic elements into a fully realized digital artifact. This final product represents the convergence of conceptual design, technological interaction, and aesthetic refinement, embodying the digital creative cycle's iterative and modular nature.

In this study, we propose a model that integrates aesthetics, AI, and the neuroscience of art to develop a prototype of technologies for creative applications. This approach has the potential to deepen our understanding of digital creativity and to provide artists with a structured approach to the creation of new works in a

computer-mediated environment. It achieves this by integrating neuroscience, technology, and artistic practice. The convergence of biological inspiration and digital manipulation has given rise to novel approaches in the realm of digital art, thereby extending the boundaries of what can be exhibited and experienced in digital environments.

4 RESULTS AND DISCUSSIONS

In the domain of modern art, the advent of the algorithmic revolution has precipitated a paradigm shift, profoundly altering prevailing notions concerning the nature of artistic creation and the role of the artist in the 21st century. The advent of computers and digital interfaces has led to a paradigm shift in the nature of the creative process, which is now performed not solely by humans but also by machines. Additionally, it encompasses AIs capable of artistic creation, thereby challenging the prevailing notion that human creativity is the exclusive domain of humans. In this study, we propose a theoretical framework that explores the notion that art constitutes a distinctively human form of expression that has come to the fore in the age of algorithms, capable of replicating both cognitive and aesthetic functions. This shift in perspective entails a reconfiguration of the relationship between art and technology, giving rise to a novel paradigm of “computational mannerism.” Within this paradigm, aesthetic production is influenced by algorithmic processes that emulate creative behaviors. The historical analysis presented in the document demonstrates that art has utilized scientific advancements to broaden its expressive capabilities since the advent of the 20th century. This convergence was initiated by the incorporation of psychoanalytic theories into Dadaism and Surrealism. The advent of computer systems modeled on the human brain has precipitated the proliferation of AI as a creative instrument.

This technological advancement has facilitated the materialization of abstract concepts within visual interfaces, thereby effecting a transformation in the perception of the creative process and integrating the algorithm as a collaborative agent in artistic creation. Furthermore, an understanding of the biological mechanisms underlying creativity is imperative, and neuroscience is instrumental in elucidating these mechanisms.

Neuroimaging studies have demonstrated the activation of specific brain areas, such as the limbic system and the visual cortex, during the process of creative thinking. It has been posited that the relationship between neurotransmitters such as oxytocin and dopamine plays a pivotal role in artistic motivation and the experience of aesthetic pleasure. The integration of this biological mapping into the development of algorithmic interfaces has enabled machines to imitate artistic experiences in a manner that is increasingly autonomous and intricate. Furthermore, emphasis has been placed on the notion that the concept of visual computing signifies a pivotal moment in the evolution of digital art creation. This technique, developed in the 1980s, has expanded the potential for computer art by simulating natural phenomena in virtual environments. Advancements in particle simulation, advanced graphic interfaces, and facial recognition technologies have enabled the representation of reality in a manner that is unparalleled, thereby solidifying the role of AI as a creative agent. Consequently, the theoretical analysis' findings suggest that the algorithmic revolution has not only revolutionized the production of art but has also posed philosophical questions regarding the artist's role and the essence of creativity. By incorporating biological and cognitive mechanisms, the algorithm emerges as a prominent figure in contemporary creation, signifying a future in which the distinction between human and machine becomes progressively indistinct in the artistic domain.

5 CONCLUSION

In conclusion, although the integration of art, AI, and neuroscience has advanced significantly, it is unclear to what extent AI-mediated creative processes can be considered authentic. The repercussions of this phenomenon on the conceptualization of authorship, aesthetic value, and creative consciousness remain to be elucidated. The dearth of consensual criteria for evaluating artificial creativity gives rise to epistemological and ethical questions concerning the entity responsible for the creation. Consequently, the issue of what factors contribute to the designation of a creation as genuinely creative arises. The role of emotion and intentionality in this process is a critical question that must be addressed. The integration of art, AI, and neuroscience has led

to a redefinition of the concept of creativity, thereby disrupting the long-standing anthropocentric paradigm that has sustained the idea for centuries, asserting that artistic creation is an exclusively human phenomenon. Digital technologies, propelled by advancements in neuroimaging and machine learning algorithms, have demonstrated the capacity to replicate and augment creative processes through artificial systems.

Through the implementation of algorithmic simulations and the integration of enhanced visual interfaces, it becomes evident that the materialization of aesthetic concepts is not merely an outcome of the process but rather a crucial element in itself. Moreover, the emulation of cognitive processes associated with the creative act is not merely a byproduct but an intentional component of the design. Recent neuroscientific studies have indicated that the activation of specific regions of the brain, such as the prefrontal cortex and limbic system, in conjunction with neurotransmitters such as dopamine and oxytocin, plays a critical role in the experience of beauty and the motivation for creative endeavors. This understanding facilitates the development of AI systems that replicate these mechanisms, thereby enabling artistic creation that transcends human intentionality. From this vantage point, the advent of AI-mediated artistic creation has given rise to a novel domain of theoretical and philosophical inquiry, one that interrogates the boundaries between authorship, originality, and creative awareness. The capacity of machines to engender works that evoke intricate emotional and aesthetic responses necessitates a reevaluation of the conventional notions of art and the artist. This reevaluation suggests a transition from a human protagonist to a hybrid cognition shared with artificial devices.

This phenomenon not only alters the process of creation but also impacts the manner in which we interpret and value artistic production. Consequently, the evolution of AI technologies applied to art represents more than a mere technical advancement; it is an invitation to reinterpret the aesthetic and ontological foundations of creation. The boundaries between human and machine become increasingly indistinct, and the concept of creativity expands, paving the way for an era in which art and technology coexist and influence each other and redefining the very meaning of creation. In contemplating creativity within a paradigm characterized by the pervasive apprehension of being

superseded by AI, it becomes evident that there is an imperative and urgent need for augmented investment and research in this domain. Innovation, defined as the introduction of new ideas or methods, permeates all fields of knowledge, and the basis for this is creativity. At present, we are observing a “simulation of human creativity.” However, this does not imply that AI will not eventually exceed human capabilities in this domain.

In conclusion, prospective endeavors in the sphere of AI system development include the conceptualization of methodologies that facilitate the emulation of affective states during the creative process. These methodologies are predicated on the utilization of dopamine and oxytocin models. The objective of this study is to examine the design of hybrid creative platforms that facilitate collaborative authorship between humans and AI agents. The following study will explore the legal frameworks that have been established for the management of intellectual property in the domain of AI-generated art. This study presents the findings of longitudinal studies on the evolving public perception of AI art over time.

Conflict of interest

The authors of this article declare that they have no conflict of interest.

Contribution statement

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Statement of data consent

The data generated during the development of this study have been included in the manuscript.

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