The Creativity of Artificial Intelligence in Art

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Abstract

New technologies, especially in the field of artificial intelligence, are dynamic in transforming

the creative space. AI-enabled programs are rapidly contributing to areas like architecture,

music, arts, science, and so on. The recent Christie's auction on the Portrait of Edmond has

transformed the contemporary perception of A.I. art, giving rise to questions such as the

creativity of this art. This research paper acknowledges the persistent problem, "Can A.I. art be

considered as creative?" In this light, the study draws on the various applications of A.I., varied

attitudes on A.I. art, and the processes of generating A.I. art to establish an argument that A.I. is

capable of achieving artistic creativity.

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Chapter One

1.1 Introduction

New technologies, and especially those that involve artificial intelligence, are dynamically transforming the state of creativeness. Computers are assuming very profound positions in creation: music, science, fine arts, and architecture. However, this paper suggests that we should focus on a broader association of computers and creativity. Instead of recognizing the computer as a tool to aid human creators, it could be viewed as a creative embodiment in its own light. This view has borne a new concept of artificial intelligence – computational creativity. As a result, this paper communicates the prospect of accomplishing computational creativity through the application of certain computer programs, which can replicate specific concepts of artistic behavior.

For everything one imagines, there is a possibility of realizing it. According to Oscar, "Human creativity is the only machine that never stops creating things. But could Artificial Intelligence become creative?"[1] Besides, Kurt suggested that science entails whatever we comprehend quite enough to elaborate to a computer and art entails all the things we do in that regard: "science advances whenever an art becomes science" [2]. For this paper, we dive into the transition and evolution of science and art, in which artworks are constructed using algorithms

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[1] Oscar GR, "Artificial Intelligence. The New Creative AI," Medium, last modified August 5, 2020, https://towardsdatascience.com/art-ificial-intelligence-the-new-creative-ai-8d0c4dd7d0a5

[2] D. E. Kurt, "Artistic Creativity in Artificial Intelligence," (PhD diss., Radboud University, Netherlands, 2018), https://www.semanticscholar.org/paper/Artistic-Creativity-in-Artificial-Intelligence-Kurt/c727109fd788769680668e908d443412598cf9cf.

rather than by paintbrushes. Through this symbiotic relationship, this paper regards computational creativity as an exploration avenue of the evolving interaction of machine and human intelligence.

The likelihood of accrediting human abilities to a machine is a philosophical dilemma that intrigued the mind ever since the first interaction with tools – the thinking machine? This timeline dates back to the 5th century BC, to The Iliad which is known, encompassed with written literature and complemented with automata of the Greek god Hephaestus and the woman Pandora. Ever since, scientists and philosophers have struggled to respond to the question of whether the human mind could be computed or if it can be realized in other forms. These questions act as the basis of artificial intelligence in art.

Presently, Artificial Intelligence is a concept that is evolving in various areas of our lives, especially with the ever-evolving technology. Because computer technology has significantly evolved since the 20th century, the study on Artificial intelligence and its limitless abilities have risen to be the primary focus of discussion. The primary exploration about computers: if they can do things done by humans, has risen to be the most significant question of our era. This exploration has a special place in the art and creative world. When the machines began producing artworks, they changed to be creative producers. From been imaginary themes in utopian literature and science fiction plays, the machines have become the producers of this pieces of writing and movies.

Thus, their input in the creative industry has dynamically changed. Although artificial intelligence and utilization in arts has been a significant topic for years, its popularity and acceptance has heightened in recent years. Artificial intelligence's popularity in artistic creations highlights the new art genre. However, the credibility of this art genre and the aspect of creation

are still enigmatic concepts that require intensive academic and practical investigation. Since the standard elaboration of art assesses this notion as a form of communication between individuals, new investigation that engage AI art requires supplementary strategies to the aspect of artistic work, to define a category of AI art. With this focus, this research paper investigates if machines can illustrate artistic abilities, and if this illustrative process is creative in itself.

Additionally, even if a creative process exists, are its results artistic, and if so, how is it associated with human-centered creativeness? As the great works of Paul Valery affirm "we must expect great innovations to transform the entire technique of the arts, thereby affecting artistic invention itself and perhaps even bringing about an amazing change in our very notion of art" [3]. With the rise of artistic machines and computing software, this transition in the aspect of art is becoming more visible. Besides the aspect of art itself, the inclusion of art-maker and the artwork is all together a new avenue of study that needs intense consideration.

In reference to Valerie, this research paper will attempt to offer an academic approach into the works of art in this era of mechanical manipulation and creation. Computed arts, machine intelligence, generative art, and algorithmic art that are generated using equal systems give rise to the question, can Artificial Intelligence be regarded as a generative art?

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[3] Razieh Rahmani, "Ceci N'est Pas une Ford T: Art and Reproduction inRagtime," *Critique: Studies in Contemporary Fiction* 58, no. 2 (2016): 80, doi:10.1080/00111619.2016.1158143.

Chapter Two

2.1 Overview

In order to understand Artificial Intelligence (AI), as this research's primary goal, it is essential to begin by analyzing human intelligence and its constructs. The Oxford Dictionary defines artificial intelligence as "the theory and development of computer systems able to perform tasks normally requiring human intelligence such as visual perception, speech recognition, decision making, and language translation"[4]. From this definition, it is evident that human intelligence is the backbone and AI's culmination. The term 'intelligence' conveys thinking while 'artificial' conveys computational operations. The most intriguing and widely assessed entails "AI's ability to think like a human"[5].

This chapter intents to introduce the topic of AI and associated concepts: What is a 'machine' based on computational operations, and 'thinking' based on machines? Under what circumstances can a machine be referred to as intelligent? By highlighting these questions and designing a discussion on the likelihood of achieving human-related abilities on machines, the chapter will attempt to suggest a transition from intelligence to creativity. Because creativity is conclusive in intelligence, AI-related discussions should be based on the illustration of human-enabled machines, mirrored with human intelligence.

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[4] Angus Stevenson *Oxford Dictionary of English* (New York: Oxford University Press, USA, 2010).

[5] Kurt "Artistic Creativity in Artificial Intelligence," 8.

2.2 Defining Artificial Intelligence

Kurt described the concept using McCarthy's interpretation, "the science and engineering of making intelligent machines, especially intelligent computer programs"[6] . According to McCarthy, the concept of intelligence is grounded on the computational abilities to meet specific targets. This explanation work for both humans and machines. As Brinson argues, the world is yet to get to the point in which intelligence can be independently interpreted without relying on human intelligence[7]. Besides, it is still a challenge to point out computational systems that can be evaluatively termed as intelligent. As McCarthy indicate, there are various concepts of intelligence that are yet to be comprehended[8].

To answer the question of whether machines can think, Alan Turing – considered as one of AI's father - explored the concepts -machines and thinking[9]. In Turing's evaluation on machine intelligence, he failed to address a conceptual variation between human and machine. Turing's denial or incapability to define a variation, he postulated the idea that it is challenging

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[6] Kurt "AI," 9.

[7] S. Brinson, "How Will Artificial Intelligence Impact the Art World?" Artzine, last modified 2020, https://artzine.com/articles/how-will-artificial-intelligence-impact-the-art-world

[8] John McCarthy, "What is Artificial Intelligence? How Does AI Work?" Tech News, Trends & Professional Development Resources | Built In, last modified 2007, https://builtin.com/artificial-intelligence.

[9] Jaime Zornoza, "The History of Artificial Intelligence: The Turing Test," Medium, last modified May 14, 2020, https://towardsdatascience.com/the-history-of-artificial-intelligence-the-turing-test-c1d6777d2970.

to state a distinction since machines are human-born. Hence, to get to a solid and precise comprehension of the definitions, Turing proposed the 'Imitation Game.' This game aimed at assessing the outcome in which a machine took part in a human-related role; basically, is a machine capable of manipulating a human observer into believing that it is also a real human? Consequently, the Turing Test is essential in the present day's query and navigation of AI as it explores the possibility in which a machine can emulate humanly abilities. Moreover, the test offers a precise comprehension of machine and human association.

McCarthy[10] and Kurt proposed that the aspect of intelligence is composite, thus it is impossible to use either a yes or no to the inquiry "is this machine intelligent?"[11] . McCarthy described that intelligence engage numerous approaches that machines can handle, and that those they are incapable of performing[12]. Further, he postulated that today's computational programs can to some extent, be acknowledged as quite intelligent. It could be implied that the literature on human intelligence is still in its underway evaluation. Hence, studying AI simultaneously offers more comprehension on human intelligence.

In this light, it is appropriate to suggest a parallel between the studies on AI and cognitive assessment on the human brain. AI studies are co-linked with studies that intend to apply computers to comprehend human intelligence; however, Kurt clarifies that AI need not impound itself on methodological procedures that are biologically assessible[13].

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[10] John McCarthy, "What is Artificial Intelligence."

[11] Kurt, "Artificial Intelligence," 12.

[12] John McCarthy, "What is Artificial Intelligence?"

[13] Kurt, "Artificial Intelligence."

2.3 Application of AI in Various Fields

New technologies, especially artificial intelligence, are dynamic in transforming the state of creative processes. Computers are significantly contributing to creative roles like architecture, music, fine arts, science, and so on. Apparently, computers are already musical appliances, paint brushes, and canvas. However, various studies have aimed at achieving a wilder interaction between creativity and computers. Instead of perceiving computers as mere instruments to aid human creators, they perceive it as a creative entity. This perception has activated a new segment of AI – computational creativity. In order to assess the various fields that are applying AI for artistic evolution, this paper focuses on the question of the viability of accomplishing computational creativity via particular computer programs that replicate some constructs of creative artistic actions. The discussed fields will augment the recent trends of creativity enhanced by human creativity.

2.3.1 Music

AI has contributed to computer music since its advent in the 1950s. However, most emphasis has been put on compositional and improvisational mechanisms, but little focus has been on expressive performance. This sub-section assesses various success in AI mechanization to music, with a larger focus on expressive performance.

Music Composition

The works of Hiller and Isaacson using an ILLIAC computer pioneered computer music[14]. The work's outcome was the ILLIAC suite, which is a string quartet developed using a generate and test algorithm. The suite produced notes pseudo-randomly, while applying Markov chains. These notes were later assayed using heuristic compositional basics. The notes were retained based on their compliance on the basics, but if none of the notes were found to be compliant, they were backtracked and a new cycle was initiated. Hiller and Isaacson's results did not include aspects of expressiveness and emotionality. In a cross examination, the two composers indicated that before they could address the concept of expression, they needed to tackle simpler challenges related to composition. Their observation was relevant in the 1950 setting because it compelled other researchers to use Markov probability to enhance melodic quality. However, their findings were not so conclusive because consistency was not achieved.

Consequently, Levitt dismissed the application of probabilities in his composing process. He claimed that "randomness tends to obscure rather than reveal the musical constraints needed to represent simple musical structures"[15]. Thus, his works relied on constraint-based musical descriptions. He designed a descriptive language that enabled the expression of meaningful musical transformations, like melodic lines and chord enhancement via style templates. Through this approach, Levitt managed to describe contemporary jazz player and piano simulations.

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[14] R. L. Lopez de Mantaras, "Artificial Intelligence and the Arts: Toward Computational Creativity," in *The Next Step: Exponential Life* (Spanish National Research Council (CSIC), Bellaterra, Spain: Bbva-Open Mind, 2017).

[15] R. L. Lopez de Mantaras, "Artificial Intelligence and the Arts: Toward Computational Creativity," 5.

Music Expression and Performance

One of the main drawbacks of computer-composed music is in inadequate expressiveness, or gesture. Musicians rely on gesture to illustrate unique and subtly descriptive or creative performances. The first attempt to illustrate expressiveness entailed the creations of Johnson[16]. She designed an expert program to assess the tempo and articulations to be used when performing Bach's Fugues. The program's rules were extracted from two human performers. The output produced base tempo variables and basics on notes' duration. However, Johnson's system had a limitation since it lacked generality as the fugues were developed on a 4/4 value. Besides, the lack of generality illustrated that the program's rules would only apply to the Bach Fugues.

The success achieved by Stockholm's KTH group indicated one of the long-lasting efforts on expressive performance[17]. Their recent system weaves in basics for tempo, articulation, and dynamic transformations confined to MIDI. The basics are deduced both from empirical musical knowledge and practicality through training, especially utilizing the analysis-by-synthesis methodology. The basics were put in two categories: differential basics, which augment the distinction between scale tones; grouping basics that indicate the relatable tones; and ensemble basics that synchronize voices into a quartet.

With a case-associative reasoning, Lopez de Mantaras illustrated the possibility of handling five most critical expressive constructs: rubato, articulation, dynamics, vibrato, and

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[16]R. L. Lopez de Mantaras, "Artificial Intelligence and the Arts."

[17]R. Bresin, "Articulation Rules for Automatic Music Performance," Academia.edu - Share Research, last modified 2001, https://www.academia.edu/930545/Articulation_rules_for_automatic_music_performance.

manipulation of ones[18]. To achieve expressiveness, his proposed system applies a case memory with descriptive human performances, investigated using spectral modelling methods and a basic musical knowledge. Also, the performance's score is provided by the proposed system. The primary goal of the method is to assess the notes' input determining (using basic musical knowledge) its effect on the musical phrase it is intended, clarify and extract (using the basis of human performance) notes with equal effects, and change the notes' input so that the notes' expressive constructs replicate the similarly extracted notes. Every note in the human-based case is elucidated with its effect on the musical phrase it is intended, as well as with the note's expressive constructs. Besides, the notes not only have information about every note, but they also entail contextual information at the notes' phrase. Thus, the system's cases have ambiguous object-centered illustrations.

Laetitia Sonami, an artist known for her sound and composition artistic expertise, applies AI using the Lady's Glove[19]. Her performances entail the computational creativity exhibited by the Lady's Glove, which she designed to activate and manipulate sound during performances. Moreover, Sonami develops sound creation works by integrating household machines encompassed with mechanical and electrically ingrained compounds. According to the artist, the glove came to be from a joke conceived by technology, only to evolve into an instrument. In an interview, she affirmed that,

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[18] R. L. Lopez de Mantaras, "Artificial Intelligence and the Arts."

[19] Tara Rodgers, *Pink Noises: Women on Electronic Music and Sound* (Durham: Duke University Press, 2010).

"I've been trying to figure out at which point a controller becomes an instrument. I think that when you use or design a controller, and if you're just using it to push buttons of trigger things, it does not really affect the way you think of the music or how you write the software. You have your ideas and you're using a controller as an interface. Then I would not call it an instrument. I think it becomes an instrument when the software starts reflecting and adapting the limitations and possibilities of the controller, and your musical thinking and ideas become more a symbiosis between the controller, the software, and the hardware"[20].

2.3.2 AI in Visual Arts

AARON, a robotic system, designed by a programmer and artist, Harold Cohen, picks a paintbrush using its robotic hand to paint on its own (Cohen, 1995). The system draws human beings in a botanical farm, not just replicating an existing canvas drawing, but constructing as many varied drawings on the chosen themes as it may be needed. The system has never been to a farm or encountered a human being, but it has been granted enough knowledge on body gestures and botanic using systematic rules. AARON's literacy and the way the program utilizes the ingrained knowledge is not the same as the knowledge that human beings possess and utilize since human literacy is depended on factual experiences. Besides, the system does not apply knowledge as humans since humans retrieve their knowledge via the body, mind, and genetic mechanisms.

However, like humans, the system's knowledge is gotten cumulatively. For instance, once AARON has understood the leaf's concepts, it utilizes the leaf-related knowledge anytime a

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[20] Tara Rodgers, *Pink Noises: Women on Electronic Music and Sound* (Durham: Duke University Press, 2010), 54.

theme requires it. For AARON, plants exist based on their size, composition, the limbs' thickness based on a plant's height, the rate at which these parts thin based on spreading proportionality, the extent of branching, the rate of branching, and many more aspects. These principles are consistent with leaf formation and clustering. By manipulating these aspects of growth, AARON can design and generate numerous plant types, and as a result, the system can never generate similar drawings even when it is directed to draw from plants with similar aspects. Furthermore, the programmer expects the system to understand the human body's constituents – how many, how big, and how the parts are related to each other. Further, it needs to understand how the body parts are coordinated and what forms of movement indicate particular coordination.

AARON understands that humans possess two limbs; hence, when not redirected, the system will always draw such. So, AARON cannot demean the rules or imagine the likelihood of drawing humans with uneven limbs. In that essence, the system's creativity is limited and cannot match humanly artistic. Even so, AARON's paintings have featured in London's Tate Modern and Museum of recent Art in San Francisco. So, to some extent, AARON exceeds some aspects contained in the creative Turing tests since its arts are worth to be featured alongside the works of human artists.

The Colton's Painting Fool portrays more sovereignty than Cohen's system. Even though Colton's software does not directly paint on art canvas, it models numerous creations digitally. According to Colton, "the Painting Fool only needs minimal direction and come up with its own

concepts by going online for source material"[21]. The system runs individual web searches and explores other related social websites. The focus is to allow the production of art, relevant to its target audience, since "it is essentially drawing on the human experience as we act, feel, and argue on the web"[22]. A decade ago, the Painting Fool generated its own definition of Afghanistan's wars based on a news caption. The outcome was a juxtaposition of the country's citizens, graves, and blasts.

Another illustration of computational creativity utilized in painting entail the creations of Karl Sims and McCormack. Based on an interactive model of chemicals that engage and diffuse to constitute rapid patterns, the Sims' Reaction-Diffusion encampment utilizes reaction-diffusion equations to generate patterns, with an emphasis on biological morphogenesis. This creation was featured in Boston's Museum of Arts. Previously, Sims had applied evolutionary computational mechanisms to coordinatively evolve reflections in this simulator's Genetic Imagery application.

Jon McCormack similarly looked into ways by which biological mechanisms could be effectively utilized to creative programs[23]. In a similar project entailing creative ecosystems that presided the project, Design After Nature, applied concepts conceived by biological processes[24]. These project's aim was to augment human creativity in mechanized arts.

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[21] S. Colton, "The Painting Fool: Stories from Building an Automated Painter," in *Computers and Creativity* (Queen Mary: Springer Science & Business Media, 2012), 12.

[22] Lopez de Mantaras, "AI," 17.

[23] Jon McCormack and Mark D'Inverno, *Computers and Creativity* (Berlin: Springer Science & Business Media, 2012).

[24] McCormack and D'Inverno, *Computers and Creativity.*

Golan Levin previously created the earliest forms of digital art by incorporating computer vision and installation designs. Levin has enhanced his works as Terra-pattern's project manager, focused on devising visual search tools for imagery. Besides, he heads a creative inquiry that helps develop computational events, such as the WEIRD REALITY, whose aim is in VR and AR actions. There are other artistic examples. The reported examples are not only representative, but they are significant contributors in the AI field.

2.4 Attitudes on Artwork and AI

AI is no longer a projected notion, instead it is a technology that influences our normal lives via assistants like IOS's Siri, self-ridden motors, algorithm-enabled suggestive on Google, and so on[25]. In light of the extensive significance of AI, AI is deemed vital in discussions, with some studies perceiving most recent courses as positive, while others perceive them as

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[25] A. Elgammal et al., "CAN: Creative Adversarial Networks, generating "Art" by Learning About Styles and Deviating from Style Norms," *Cornell University*, 2017, https://arxiv.org/abs/1706.07068.

negative[262728]. Hong and Curran[29] claim that AI will ease human's life and enhance their socio-economic status, while Ali [30]suggests that AI evolvement would result into uncontrollable situations and eventually threaten human existence. Other concerns are grounded in more plodding issues, like concerns about how it will influence the human resource arena, with many concerned that it will deem most opportunities obsolete.

2.4.1 Transforming Jobs

The chief concern is that AI will render most people jobless. It would not be the first time that advanced technology has had this effect. In the industrial revolution period, machines increasingly transformed the labor by performing physical tasks meant for humans since they had an agility and preciseness that was n human being could match. Yet, while most opportunities were obliterated, humans found a way to create more opportunities.

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[26] Joo-Wha Hong and Nathaniel M. Curran, "Artificial Intelligence, Artists, and Art: Attitudes Toward Artwork Produced by Humans vs. Artificial Intelligence," *ACM Transactions on Multimedia Computing, Communications, and Applications* 15, no. 2s (2019): accessed September 29, 2020, doi:10.1145/3326337

[27]Brinson, "AI."

[28] Mohammed Ali, "The Human Intelligence vs. Artificial Intelligence: Issues and Challenges in Computer Assisted Language Learning," *International Journal of English Linguistics* 8, no. 5 (2020): doi:10.5539/ijel. v8n5p259.

[29] Hong and Curran, "AI."

[30] Ali, "HI v. AI."

Now AI is emanating a similar discussion, but this time the concern is not only on physical jobs, but also remote operations. Once more, it is anticipated that while some jobs will stop being performed by humans, there are roles that humans will need to assume. Predicting the numbers is challenging, "and the variety of reports fielding attempts highlight the uncertainty"[31]. Even so, the reports further imply that artistic pursuits are less vulnerable to AI evolution, because what AI misses is, arguably, what pieces of literature say humans are good at: creativity.

As the computers immense in cognitive roles, they are highly utilizing aspects related to data processing and recognition. According to Mazzone and Elgammal[32], there are potential solutions that could amaze our markets, since AI highlights a new level of artistic creativity that is more of a solution to the impeding problem. Besides, AI is yet to devise encroachment into integrating aesthetics, novelty, and purpose, and if it succeeds, it will not without manly input.

2.4.2 AI Assistants

While it can be challenging to forecast the degree at which this technology will infiltrate on artwork, in the meanwhile, it seems quite probable that it will substantial as a tool. A recent study surveyed seventy-five people whose jobs entail creativity, and they found that a greater proportion were less concerned with AI subduing their jobs; instead, they demonstrated an interest in the possibility that AI will eliminate menial works, offering them enough time to

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[31] Brinson, "AI"3.

[32] Marian Mazzone and Ahmed Elgammal, "Art, Creativity, and the Potential of Artificial Intelligence," *Arts* 8, no. 1 (2019): accessed September 29, 2020, doi:10.3390/arts8010026

immense in important and creative aspects[33]. Moreover, Chris Duffey, Adobe's creative director affirmed that, "Today [creatives] realize that AI is in much of the technology they are already using, and it is making things more intuitive that previously perceived"[34].

Besides, in the film industry, it has aided animators' chart facial features and courses to specific characters. Presently, Adobe is utilizing AI to simplify the process of reframing videos for distinct platforms, and choosing features within the images. On the other hand, the music platform has applied AI to merge distinct instruments and generate newer music sounds.

The incorporation of art, tools ingrained with AI, and other mechanisms such as virtual realities and substantial printing, will augment the space that artists can perform. For example, Chris Milk created a digital platform that correspond the movements of fans: the Dali Museum in United States designed a life-like imitation of Dali that can communicate with the attending audience; while Anna Zhilvaeza creates her paintings using virtual reality.

According to Brinson[35], the future will allow us apply the title of an artists to people who can utilize AI algorithms. Take the case of Mario Klingemann, in 2018, he programed a system that could illustrate a consistent cascade of faces using neural networks and AI; consequently,

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[33] K. Shaw, "Survey: 75% of U.S. Workers Think Their Jobs Are Safe from Automation," Robotics Business Review, last modified June 5, 2020, https://www.roboticsbusinessreview.com/workforce/survey-75-of-u-s-workers-think-their-jobs-are-safe-from-automation/.

[34] Brinson, "AI," 10.

[35] Brinson, "AI."

the art of Mario was featured in Sotheby's auction event. As Sotheby [36] puts it, each face portrait

is unique and is designed in real time since the machine addresses specific output. To the

audience, the experience is something like viewing a non-ending series of imagination,

happening in the machine's mind, while "the human subject matter of its visions adds a further

layer of poignancy"[37].

Recently, we have observed the infamous Portrait of Edmond Belamy, generated using an

AI-based algorithm that was a product of a trio of French programmers, with the alias, Obvious.

After the artwork was sold for $432, 500 – exceeding its projected value with forty percent.

While these examples posit AI as a feature role, it would still be the case with humans since they

would be needed to kick off the project and fine-tune the outcomes. To get desirable outcomes,

intensive commitment is needed. Nonetheless, debate is due to erupt on the worth of artworks

generated by AI, if or not it should be perceived as creative, and who is entitled to take credit of

innovativeness.

2.4.3 The Wave of AI-based Art

For more than eight decades, time dedicated into leisure has risen with 4 to 8 hours in one

week[38]. Brinson [39]predicted that this increase will be substantial because automations are slowly

taking up time-consuming and routine roles. With these additional hours, people are more likely

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[36] Sotheby, "Artificial Intelligence and the Art of Mario Klingemann," Contemporary Art, last

modified February 2019, https://www.sothebys.com/en/articles/artificial-intelligence-and-the-art-

of-mario-klingemann.

[37] Sotheby, "Artificial Intelligence and the Art of Mario Klingemann," 7.
[38] Dan Cui et al., "Leisure time and labor productivity: a new economic view rooted from
sociological perspective," *Economics: The Open-Access, Open-Assessment E-Journal* 13 (2019):
doi:10.5018/economics-ejournal.ja.2019-36.
[39] Brinson, "AI."

to be involved in creative behaviors like art and music creation, while those that cannot generate art, they will consume the artwork designed by others.

In a recent report, researchers looked into various sectors that were likely to lose employments to automated systems, and compared them with those that were likely to gain with automation[40]. Of those that had a higher likelihood of gaining, the authors found to be creative sectors: a limited but growing group of artists and entertainers will be in great demand since increased income will render more demand for leisure activities. Since creativity is the main pro we possess over artificial intelligence, it suggests that more people will be involved in creative roles. This pro alongside the substantial amount of leisure time, could result into conformity to newer arts.

In addition, the numerous advances on AI has rendered software intended for music production, drawing illustrations, and other artistic expressions, inexpensive and acquirable to any computer literate individual. Thus, there are numerous hobbyists grounded on computational creativity. With the evolution in artificial intelligence, all these trends are slowly been pushed further, and in no time, AI will be obscured by no limitations. What is more is that this technology can help artist target and demonstrate their work using the same approach that other entertainment sectors like movies apply to showcase their work based on their fans' preferences.

Evidently, the future we are expecting will allow AI to play a significant part for all artists, regardless of their differences. Most likely, we will discover a universe in which machines handles all complex, data processing, and routine roles, leaving the humans to assume things in a varied perceptive, to think beyond our normality, and act on the unprecedented.

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[40] Jennifer L. Schenker, "Preparing for The Fourth Industrial Revolution," Medium, last modified February 21, 2018, https://innovator.news/preparing-for-the-fourth-industrial-revolution-33abc395fb86.

2.4.4. Controversy: The Portrait of Edmond

Ali [41]investigated the importance of human intelligence in AI-related software like the Learning Management Systems (LMS), and assayed the extent to which language learning – only applicable to humans – is crucial in machine learning and other computational applications. The researcher argues that this learning is relative to human intelligence, human neural, and there is no mechanization can pose to replace these features: specific to the human brain. Therefore, Ali placed a challenge to natural language processing (NLP) methods that asserts having trained the computer to comprehend human learning, to comprehend texts without hints, to acknowledge the complexity in human languages based on the contiguity between the context and definition, and to automate the whole learning process.

The researcher cites the existence of inadequacies in these machine's software and tools to highlight that despite the increasingly growing technology, there will always be an aspect of the human mind and intelligence that is impenetrable computers and associative software. These inadequacies emphasize the limitations of AI with its intelligent systems, confirming that human intelligence cannot be subdued by AI.

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[41] Ali, "AI."

Figure 1: The Portrait of Edmond[42]

The Portrait of Edmond de Belamy that has triggered quite a controversy after it was sold for a price exceeding its initial prediction. The piece of art feels like an unfinished work containing random brisk brushstrokes. In its bottom right corner, on can spot an artist's signature with an algorithm with which the portrait was constructed – using Generative Adversarial Network (GAN). The portrait's system was first assessed with a data set composed of 15, 000 paintings placed in the 14th to 20th century. Later, the algorithm designed new images depending on the ruled in data sets. The algorithm's second part -discriminator – compares the new images with human-painted portraits. Therefore, the portrait is not the result of a human mind; instead, it is AI's creation. However, when it was brought to Christie's auction, it sold like any other human-created art, highlighting AI Art's arrival.

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[42] Christie, "Is Artificial Intelligence Set to Become Art's Next Medium? | Christie's," Christie's Auctions & Private Sales | Fine Art, Antiques, Jewelry & More, last modified December 12, 2018, https://www.christies.com/features/A-collaboration-between-two-artists-one-human-one-a-machine-9332-1.aspx.

The painting, if that word would best define it, is among the portraits that represent the fictious Belamy lineage designed by Obvious, a collective with three programmers. According to one of Obvious programmers, Hugo, "we found that portraits provided the best way to illustrate our point, which is that algorithms are able to emulate creativity"[43].

However, one of the enthralling aspects about its depiction is that it trails away from the human idea of an ancient painting. There is something eerily contemporary about this Edmond: he seems weirdly like one of Glenn's historical placements. Why could this be the case? Hugo said that the portrait is simply "an attribute of the model that there is distortion"[44]. Therefore, the discriminator seeks the data set's image and features (eyes, faces, shoulders), but "for now it is more easily fooled than a human eye"[45].

Besides, it could be the case that the artwork is a complex genre for AI to handle, because humans are quite attuned to the curvatures and ambiguities of a features, compared to machines. However, the Christie remark identifies that the difficulty to replicate the feature was one of AI's thinking. Hugo states that they did some work with the paintings' nudes and landscapes, and fed the algorithm with various works from distinct painters. But their resulting portrait offered a clearer way to address their chief point: that algorithms can replicate creativity.

However, Elgammal refutes their ideology of creativity by arguing against the claim that the portrait was created by the machine, with no input of a human artist. Arguably, the creative process extensively depended and engaged the artists. The artist selects an array of images to

[43] Christie, "Is Artificial Intelligence Set to Become Art's Next Medium? | Christie's," Christie's Auctions & Private Sales | Fine Art, Antiques, Jewelry & More, last modified December 12, 2018, https://www.christies.com/features/A-collaboration-between-two-artists-one-human-one-a-machine-9332-1.aspx.
[44] Christie, "Is Artificial Intelligence Set to Become Art's Next Medium?" 6.
[45] Christie.

command the algorithm (pre-curation using traditional portraits). The images are later fed to the

generator to replicate these images. Lastly, the artists widely filter through distinct output images

to come up with the final piece (post-curation). Notably, the algorithm fails in creating

replications of the pre-curated images, instead it produces distorted features that stand to surprise

a viewer. If the system succeeded in wholly replicating the inputs, it would have not been an

interesting piece.

Other artists – Robbie Barrat, Tom White, Anna Ridler, Mario Klingemann, and others –

have taken up the process of creation, heightening the debate over AI arts.
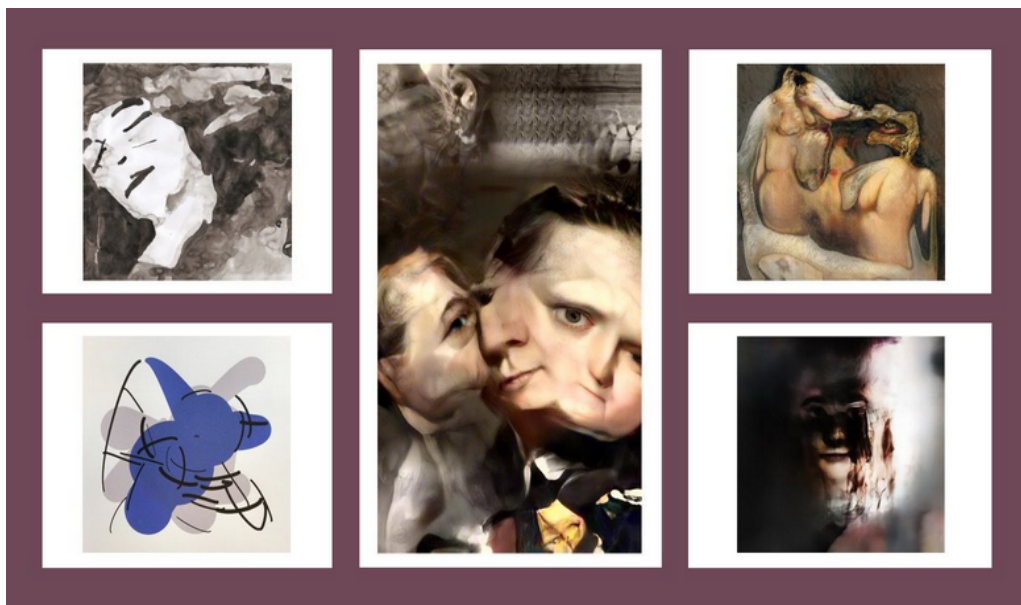

Figure 2: AI art created by the artists, Robbie White, Tom White, Anna Ridler and Mario

Klingemann[46]

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[46] D. E. Kurt, "Artistic Creativity in Artificial Intelligence," (PhD diss., Radboud University,

Netherlands, 2018), https://www.semanticscholar.org/paper/Artistic-Creativity-in-Artificial-

Intelligence-Kurt/c727109fd788769680668e908d443412598cf9cf.

The Christie's auction inflated several ethical questions on the art's attribution. Weeks before the auction, the portrait got specific criticism from its AI-based community for proving uninspired, rather than original. For instance, Robbie Barrat stated in a Twitter comment that the code that was used by Obvious' data set was his initial creation.

Figure 3: Controversy on Obvious' Code[47]

Evidently, in a documented communication on a code repository area, between Obvious and Barrat, it was clear that Obvious requested Barrat to provide the code, and consistently asked him to help change the code for their project. After the critic, Obvious confirmed the eligibility of this evidence in an interview[48].

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[47] Christie, "Is Artificial Intelligence Set to Become Art's Next Medium? | Christie's," Christie's Auctions & Private Sales | Fine Art, Antiques, Jewelry & More, last modified December 12, 2018, https://www.christies.com/features/A-collaboration-between-two-artists-one-human-one-a-machine-9332-1.aspx.

[48] Ahmed Elgammal, "What the Art World Is Failing to Grasp About Christie's AI Portrait Coup," Artsy, last modified October 29, 2018, https://www.artsy.net/article/artsy-editorial-art-failing-grasp-christies-ai-portrait-coup.

2.5 Research Questions

In this light, this research paper intends to assert its research questions based on the portrait's question of articulation and originality.

Perceiving AI art as a process-enabled abstract is essential in resolving the originality conflict. According to Elgammal, "the art is not in the outcome or final image, the art is in the process, as a form of conceptual art" [49]. If an artist replicates the process (in this case, it entails the systems, and input data), then to what degree can the originator claim for attribution. For instance, if someone acquires one of Sol Le'Witt's painting guidelines, and installs them personally, can the person claim the paining's originality? It is obvious that everyone in the art world would refute that claim. Yet this is what happened in the Edmond Portrait. If one acquires a code and certain dataset, and initiates the same process, can they assert the outcome as their own?

Question One: To what extent can an artist claim an AI art as his own?

Hong and Curran argue that AI-driven products can be related with the idea of 'art' realizing both objective and subjective standards[50]. Coeckelbergh indicated that if there exist objective standards that assess art, then it is consistent that AI can be utilized to design products that meet the standards[51]. On the other hand, if a product can be considered as 'art' depends on subjective standards, then the implication is that any product, included those generated by AI, have the opportunity of being featured as arts. Thus, Coeckelbergh's question, "Can AI create art?"[52] need to be reframed to:

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[49] Elgammal, "What the Art World Is Failing to Grasp About Christie?"
[50] Hong and Curran, "AI."
[51] Mark Coeckelbergh, "Can Machines Create Art?" *Philosophy & Technology* 30, no. 3 (2016): doi:10.1007/s13347-016-0231-5.
[52] Coecklelbergh.

Question Two: How does knowing an artist's identity (be it human or AI) affect the idea that AI can generate an original art?

Therefore, instead of assessing if products resultant of artificial intelligence needs to be summed in the contemporary definition of art, this research paper assesses if AI-created products can be considered and regarded in an equal manner as artworks generated by human artists. In this light, this research provides:

Question three: How does knowing an artist's identity (be it human or machine) affect one's evaluation of an art?

Chapter Three: Discussion

3.1 AI-Generated Painting

3.1.1 The Schema Theory

This theory offers a critical empirical framework for comprehending the audiences' attitudes on art based on the artist's identity. Hong and Curran states that a schema is "any active processing data structure that organizes memory and guides perception, performance, and thought"[53]. For instance, art Schemata would include comprehension on the art's concepts, audience perceptions of deems art more or less creative, the artworks we have been interested or not, the aspects in which we viewed the works, and so on. Moreover, people possess schemata that include assumptions on AI and specific work's creativity. Dixon elaborated that "these assumptions are part of an associative network of related opinion nodes or schemas that are linked in memory and activating one node in network spreads to other linked nodes"[54].

Based on previous experiences, Schemata could be triggered when someone interprets new information. Hence, it is viable to state that schema and stereotype perform the same as it would in cognitive processes. They perform as heuristics that enable people to devise appropriate decisions when faced with new information by reflecting on past experiences. The theory is essential in describing how stereotypes can influence one's cognitive processing. Assume that someone is watching someone else's competition. The schema can be triggered to influence the

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[53] Hong and Curran, "AI" 12.

[54] Travis L. Dixon, "Psychological Reactions to Crime News Portrayals of Black Criminals: Understanding the Moderating Roles of Prior News Viewing and Stereotype Endorsement," *Communication Monographs* 73, no. 2 (2006): 163, doi:10.1080/03637750600690643

person's information processing on the viewership. Not surprising, the postulation is widely applied in media studies where there is an interest on how prejudice influences people's media illustration of different cultures and affect the user's perceptions.

Since art is a medium that addresses various concepts, schema theory is viable on studies on artwork. Studies have indicated that visuals are effective in activating schema, so the theory is credible in comprehending how AI-related stereotypes manipulate the audience's perception on AI's input. McCarthy highlights that there are individuals who would question if AI is enabled to perform like humans, even when AI's performance is objectively similar[55].

Alternatively, even if AI-generated works are similar to those generated by humans, people will still affirm that AI is incapable of creating the works, because of their innate conviction that art is which that emanates from humanly efforts.

Therefore, this research paper evaluates different perceptions on painting created by either of the artists. When a painting is generated by two distinct constructs, how either of the work is assessed most differs depending on objective variation in composition and structure, and the audience's artistic bias.

Other studies on art indicate negative stereotypes on AI-generated paintings[56]. This paper's uses the argument that individuals are due to offer a lower rating on paintings if it is generated by artificial intelligence. Thus, based on Schema theory, this paper proposes that painting produced by artists categorized with an AI identity gain lower rating on the value of their work, compared to paintings done by artists with a human identity.

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[55] McCarthy.

[56] Ali, "The Human Intelligence vs. Artificial Intelligence."

3.1.2 Computers are Social Actors (CASA)

Many discussions concern the agreeability towards AI-generated paintings, and among one argument would to perceive a painting as a social aspect that engages communication, and forecast if AI could stand as a social actor[57]. Based on Nass and Moon's attribution, humans apt to practice social behaviors and utilize social standards without thinking when conversing or handling a computer[58]. Furthermore, humans are likely to handle computers as separate constructs from their developers and containing individual sources of data

These concepts are incorporated in CASA and various studies have widely expanded on it by interacting human and machine intelligence, to attempt to understand how human personality traits are altered when AI is put in the picture. Since the CASA theory implies that humans unconsciously use social norms when handling AI, it can be predicted that humans will perform in an equal measure when assessing AI-generated paintings compared to those created by people. Suggesting that the measurement used in investigating human-designed paintings in the professional environment is viable in evaluating those created by AI.

While deeming stereotypes from an artist's identity can affect the art's assessment, it remains to be considered if both human- and AI-enabled works can be judged using the same artistic value. According to a recent AI art study, the results indicated that individuals cannot differentiate between either of the artistic works, thus there is no significant distinction between their assessment of the two works, unless previously primed with the works' identities[59].

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[57] Clifford Nass and Youngme Moon, "Machines and Mindlessness: Social Responses to Computers," *Journal of Social Issues* 56, no. 1 (2002): doi:10.1111/0022-4537.00153
[58] Nass and Moon, "Machines and Mindlessness."
[59] Elgammal, "AI," 2007.

Nonetheless, this postulation cannot be applied by this research paper to devise a postulation because of Elgammal et al.'s assumptions. Thus, this paper assesses its relevancy using an Equivalence test, proposing that AI-generated and human-created painting can be evaluated similarly in artistic value.

3.2 Generative Adversarial Networks (GAN)

In 2014, a technology scientist, Ian Goodfellow, proposed a completely new approach of predicting generative models using adversarial pathways, which combinedly train two distinct models: first, the generative model (G) takes data distribution, while the second, discriminative model predicts the likelihood that a data sample emanated from a trained set instead of G. The word "adversarial" highlights dual functionality, placing two algorithms in a sort of race to establish dominance[60].

3.2.1 GAN's Theory

Generator Model

This model assumes a fixed random vector as its data's input and produces a sample in that particular domain. Extracted from a Gaussian distribution, the random vector is utilized to activate the generative process. After training, the values in this composite vector space relates to values contained in the problem domain, creating a compressed illustration of data distribution. The space is termed as latent with only latent variables. According to Goodfellow et al., "a latent variable is a random variable that we cannot observe directly"[61].

After training, this model is placed and applied to generate samples.

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[60] Ian Goodfellow, Yoshua Bengio, and Aaron Courville, *Deep Learning* (Cambridge: MIT Press, 2016).

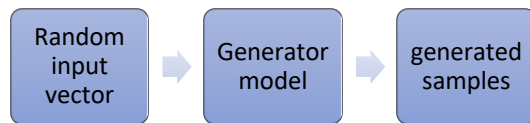[61]Goodfellow, Bengio, and Courville, Deep Learning, *short title*, 63.

Random input vector → Generator model → generated samples

Figure 4: The Framework Applied in the Generator[62]

Discriminator Model

It takes an example from the domain as either a real or generated input, and forecasts a binary category label of either of the inputs. Real examples come from the training set, while generated ones are output by the former model. According to Brownlee[63], this model is standard and easily comprehended. Soon the training is done, the model is refuted since the interest is primarily on the generator.

In some cases, the generator could be reframed since it is trained to appropriately extract constructs from examples engrained in the problem classification. Brownlee indicated, "we propose that one way to build good image representations is by training GANs, and later reusing parts of the generator and discriminator networks as features extractors for supervised tasks"[64].

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[62] J. Brownlee, "A Gentle Introduction to Generative Adversarial Networks (GANs)," Machine Learning Mastery, last modified July 19, 2019, https://machinelearningmastery.com/what-are-generative-adversarial-networks-gans/.

[63] J. Brownlee, "A Gentle Introduction to Generative Adversarial Networks."
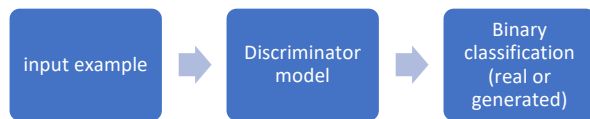
[64] Brownlee, "GANs," 42.

Figure 5: *Framework utilized in the discriminator[65]*

3.2.2 Implementing GAN into Art

Implementation entails training both models alternatively till one achieves a Nash Equilibrium, and G-produced samples are similar to the dataset's samples. The formulation is deemed contradictory since Goodfellow et al. [66]explained that this approach produces saturated values, and so, other researchers have been applying varied formulations when training the models. Nevertheless, at GAN's publication, the formulation offered some desirable generative samples than any other model, and it allowed others to manipulate the design to develop more promising samples.

Odena et al. [67]invented the Auxiliary Classifier GAN (AC-GAN). This system implements art by incorporating a classifier segment to the discriminator, while on the generator, it introduces a conditioning vector. Then the discriminator is governed to reduce classification mishaps in addition to the contemporary GAN's goal. This implementation lets labels to be standardized and offer extra information. Moreover, the generator is directed to emanate particular categories of

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[65] Brownlee. 42
[66] Goodfellow, Bengio, and Courville, *Deep Learning.*
[67] A. Odena, C. Olah, and J. Shlens, "Conditional Image Synthesis with Auxiliary Classifier GANs," ArXiv.org, last modified 2016, https://arxiv.org/abs/1610.09585.

samples. Presently, this implementation is the most conclusive and conditional GAN; in contrast to contemporary GANs that possess unlabeled classes. With this approach, and artist achieves both transfer and multitasking learning, needed for creation.

Similarly, Zhang et al.[68] proposed the Stack-GAN, which applies feature information taken from a Recurrent Neural System and a phased image production procedure. Its first phase produces a lesser resolution while the second phase utilizes the first images encode to generate substantial resolution. This feature data is executed to instruct both models to enable the art to be of a higher resolution state.

Besides, the Wasserstein GAN (WGAN) featured an entirely new empirical approach for GAN, with an emphasis on theoretical and practical outcomes. With this approach, artists reduce the vector space, which is critical in generating solutions to problems associated with generative modeling, since it devises proper gradients in the lower model that can be utilized by the generator for learning. However, WGAN was prone to inconsistencies that were rectified by Ishaan Gulrajani, who executed penalties to obscure the discriminator's slope [69].

Regan states that the forms in which neural networks have included themselves into artwork assumes an array of ways[70]. One popular usage entails the Google's Deep-Dream. The system applies GAN-mediated neural networks to access patterns encased in substantially big data as

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[68] Han Zhang et al., "StackGAN: Text to Photo-Realistic Image Synthesis with Stacked Generative Adversarial Networks," *2017 IEEE International Conference on Computer Vision (ICCV)*, 2017, xx, doi:10.1109/iccv.2017.629.

[69] ao Zhang et al., "Improved Procedures for Training Primal Wasserstein GANs," *2019 IEEE SmartWorld, Ubiquitous Intelligence & Computing, Advanced & Trusted Computing, Scalable Computing & Communications, Cloud & Big Data Computing, Internet of People and Smart City Innovation (SmartWorld/SCALCOM/UIC/ATC/CBDCom/IOP/SCI)*, 2019, xx, doi:10.1109/smartworld-uic-atc-scalcom-iop-sci.2019.00286.

[70]Regan, "Generative Adversarial Networks & The Art Market," (PhD diss., 2018).

illustrated in the input's basis [71]. It then modifies the patterns, triggering them to produce "dream-like hallucinations"[72]. According to Regan, "it is a more user-friendly version of GAN 13 that foregoes an intricate knowledge of programming dazzling spectators with deliberately over-processes imagery"[73].

While most of its outcomes are captivating, it is rather perceived as a novel illustration of the power that neural networks can utilize in art creation. A number of software implementing GAN have erupted, not limited to DeePart that enables an artist to repaint a picture based on a style that is consistent with one's favorite artist. Nevertheless, Regan points out that "these kitsch productions only obscure understanding, and deter recognition from more uniquely exploring GAN creativity.

3.2.3 Difference between the Current and Traditional GAN

Before the advent of the 2015's GAN, artists who utilized computers to create art had to put down extensive codes that detailed particular rules needed to accomplish particular aesthetics. However, what distinguishes this new model is, algorithms are constructed by an artist to "understand" the aesthetics by viewing at different images via machine learning software. This algorithm later develops other images that adhere to the learned aesthetics.

Early concerns with GAN were on quality, since the learning process often gave ambiguous findings. Mostly generating low-resolution features with unrelated curvatures, the advanced GAN has resulted into more productive findings. Executing a newer model in machine learning, under which input is hindered, Nvidia proposed a progressive mechanism that augmented an

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[71] Mark Gibbs, "Deep Dream: Artificial Intelligence Meets Hallucinations," Network World, last modified 2015, https://www.networkworld.com/article/2974718/deep-dream-artificial-intelligence-meets-hallucinations.html.
[72] Gibbs.
[73] Regan.15

image's complete quality while alternatively minimizing the model's misfortunes. In particular, this implies that an output emanating from a generative model is visually viewable: enhancing the images' quality and rating.

3.2.4 Popular GAN Artists

Mario Klingemann

The artist's paintings illustrate the distinction of simply training GAN in a particular dataset and regarding the outcome as final. Besides, his numerous works initiates what a creator works on, in varied and untouched ways to generate a specific piece of art, whose structure and form is unimaginable. His popular Self Portraits utilizes a closed entanglement with three trained GAN, inspired from countless images.

Figure 6: "79530 Self Portraits,"[74]

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[74] Maya B. Mathur and David B. Reichling, "Navigating a social world with robot partners: A quantitative cartography of the Uncanny Valley," *Cognition* 146 (2016): 23, doi: 10.1016/j.cognition.2015.09.008.

Robbie Barrat

Among the artist's earliest art in the field of GAN entailed landscape drawing and several portraiture features. While Barrat's landscapes demonstrate GAN's exemplary skill to develop almost indistinguishable painting, (figure 7), his nude epics probably produce a more unimaginable aesthetic feel in machine learning and intelligence (figure 8). Often acknowledged for addressing what robotic experts and other artistic professionals deem as "the uncanny valley", the artist's nude subjects feel as if they are human, and at the same time, they feel quite far from humanity. In a tech-perception, they could be comprehended via specific feedbacks to robots, which were simulated to resemble humans. Individuals in the uncanny valley indicate that "imperfect human-likeness provokes dislike," illustrating the common fear geared towards humanoid robots[75].

Figure 7: "Barrat's Landscape Painting series"[76]

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[75] Maya B. Mathur and David B. Reichling, "Navigating a social world with robot partners."
[76] Mathur and David.

Figure 8: The Nudes Series[77]

3.3 Creative Adversarial Network (CAN)

One of the limitations of AI entails human's inability to train computers to be creative. These machines are pretty amazing at performing what they are instructed, but creativity is a different construct, and training them towards that direction is machine learning's nightmare. However, recently, studies have introduced the concept of CANs[78]. As Thoutt posits it, "CANs are GANs that can think creatively"[79]. They are generated from GANs. Thus, to understand CANs, one needs to have basic knowledge on GANs. CANs are designed in a similar way as GAN, but with an extra component that enables its generator to function "creatively."

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[77] Regan.
[78] Elgammal, "CAN."
[79] Elgammal, "CAN,"3.

Its discriminator also attempts to learn how to group every image as either generated or real; yet it also groups the images into either of 25 styles (such as abstract, realism, cubism, renaissance, and so on). Moreover, the generator still manipulates the discriminator into imagining that its examples are real rather than generated; yet, it still groups them in the 25 styles.

Elgammal suggests that artificial intelligence should entail more than generative models. A Rutgers professor, Elgammal governs the university's AI laboratory, where they develop technologies that attempt to comprehend and improve AI art. Elgammal's mantra is such that AI need not credibly imitate existing imagery, since "that is not art, that is just repainting. . . it is what bad artists would do"[80].

In this light, Elgammal et al. postulated a new approach of creating art[81]. The approach created art by viewing an art and understanding its style, then it becomes "creative" by augmenting the activation potential of the generated work by straying from that style. The authors constructed their postulation over GAN, that has repeatedly proven its learning skills in generating desirable images. Besides, they proposed that since GANs are unable to produce creative work, improvement on their objective entity enables the production of quite "creative" designs by augmenting deviations from the listed styles and reducing deviations from design distribution. The authors found that human respondents could not differentiate paintings produced by CAN from those generated by humans.

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[80] Ian Bogost, "The AI-Art Gold Rush Is Here," The Atlantic, last modified March 6, 2019, https://www.theatlantic.com/technology/archive/2019/03/ai-created-art-invades-chelsea-gallery-scene/584134/.
[81] Elgammal, "CAN," 2017.

3.3.1 CAN Artistic Works

Elgammal's Faceless Portraits

The Hg Contemporary demonstrated Faceless Portraits, a unified effort of AICAN and the artist, Dr. Elgammal. The illustration shows two sets of series showing uncanny, imaginative imagery created by AICAN, exploring the ageless aspects of mortality with human features. The images are big, and squared: a human form, a recollection of faces, engrossed in a fierce current. Based on Elgammal' findings, ordinary audiences cannot differentiate between AICAN-enabled image and a real one in an art's fair. Hence, this is a success to CAN: the images produced have a unique coherence and likeness that would be impossible otherwise. Essentially, the 20th century paintings were forecasted on the concept of placing something in a museum deems it worth of being an art.
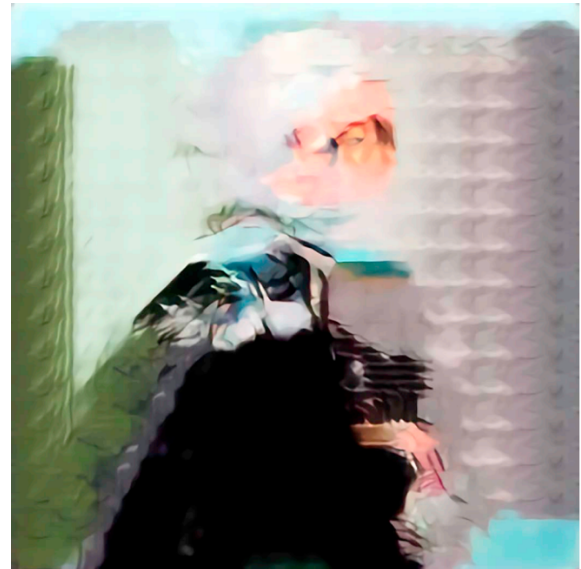

Figure 9: "Faceless Portrait of a king"[82]   **Figure 10:** "Faceless Portrait of a queen"[83]

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[82] Elgammal, "CAN."

[83] Elgammal.

Figure 11: "Faceless Portrait of a general"[84] **Figure 12:** *"Faceless Portrait of a pope"*

In an interview, Elgammal was asked to provide the renaissance artists he had identified for his

Portrait's series[85]. In response, he gave about 3000 portraits from different people, and across

two or more centuries. He elaborated that subjects are distinct, from unknown individuals who

would have settled for the portrait for known records to historical inputs. Particular subjects,

styles, and creators hold limited significance than the volume they behold to artificial

intelligence.

This is an unavoidable aspect of AI art: substantial areas of art-historical are conceptualized into

basic, visual patterns. As a result, AICAN's systems learn the basic standards of composition,

and in the process, it is likely to disregard other constructs popular in other styles of art.

Although art generated by either GAN and CAN lack the emotional intent found in humans,

these artistic AI systems are already producing art in an extraordinary form. Hence, it is viable to

regard creativity based on recent AI technologies. Even if these technologies are yet to match

human's creativity, it would be logical to imply that they have some capability to function in a

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[84] Elgamma.   [85] Bogost, "CAN."

creative form. As Regan indicated, "achieving the hardware computational capacity of a single human brain (…) will not automatically produce human levels of capability"[86]. Based on artistic extent, creativity, and emotions, both forms of intelligence may be distinct. Thus, besides AI, artificial creativity remains a question in need of evaluation. As a result, this research paper proposes to assess, "can machines be creative?"

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[86] Regan, "GAN."

Chapter Four

4.1 Could AI Achieve Human-level Creativity?

4.1.1 Human Creativity and Machine Creativity

The concept of creativity best expresses the human ability. As Sawyer (2014), American's most known psychologist in creativity and innovation, addressed creativity as a "part of what makes us human" (p.3). Thus, based on the comparison of machine to human intelligence, addressing the concept of creativity is paramount. As introduced earlier, creativity is among the chief merits that define the human brain. Besides, mass parallelism, emotional capabilities, artistic, and aesthetic extents, creativity is one of the brain's features. But what of machines, which are not only non-human, but also non-biological? Would it be appropriate to speak of them in terms of artistic intelligence and creativity? In simpler terms, "can machines create art?"[87].

In his book on creativity, Sawyer explains that "although artificially intelligent computer programs hold the world title in chess, and can crunch through mounds of data and identify patterns invisible to the human eye, they still cannot master everyday creative skills"[88]. Yet they lack standard human-related creativeness, which need physical exploit, AI, through the explained artistic works, has a particular ability to create. Boden, a respected expert in the literature of informatics, cognition, and AI, argues against the idea that creativity is incomprehensible in computational intelligence[89].

Boden offers a different approach in this discussion. This chapter intents to address an alternative perspective to creativity based on AI. Also, besides humanly features that enables creativity, the

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[87] Coeckelbergh, "Can machines create art?"

[88] Robert K. Sawyer, *Explaining Creativity: The Science of Human Innovation* (New York: OUP USA, 2014), 3.

[89] Sawyer, "Explaining Creativity."

chapter aims at considering the possibility of regarding AI creativity as an equal form of artistic creativity. To respond to these concepts, this study is grounded on artistic outputs of machine intelligence. Artistic creativity is the basis of this study as it regards aesthetic and emotional capacities that define human intelligence. As it will listed in the following forms of artificial creativity, AI artworks will be found to contain features and values that indicate their creativeness.

Sawyer explains creativity by integrating three approaches: individual, cognitive, and cultural. Based on an individual approach, Sawyer proposed that "creativity is a new mental combination that is expressed in the world"[90]. Thus, he illustrated creativity using three primary entities: first, "creativity is new"[91]. He implied that been new or original is the most significant necessity of a creative idea or behavior. Repeating a previous behavior does not qualify to be creative, so daily activities like driving to work and back using the same way is a non-creative pattern of actions. Based on Sawyer's suggestion, Boden provided that "creative ideas are unpredictable"[92]. consequently, the aspect of creativity should shine a degree of newness.

On the other hand, Boden brings out a new perception on newness. She illustrates that children could imagine concepts, new to their minds. Therefore, the basis that someone else could have thought about that concept before, does not grant their concepts non-creative. In this light, Boden highlights the aspects of historical creativity and psychological creativity. Using these distinguishable aspects, Boden highlights a new paradigm of creative ideas. The psychological creativity implies the evolution of unpredictable ideas which are new to the individual bringing it

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[90] Sawyer, "Explaining Creativity," 7.
[91] Sawyer, "explaining Creativity," 7.
[92] Margaret A. Boden and Research Professor of Cognitive Science Margaret A Boden, *The Creative Mind: Myths and Mechanisms* (London: Psychology Press, 2004), 1.

up, regardless of the idea having been conceived by other people. If an idea is entirely new and no individual has ever brought it up then it is a historical creativity.

Hence, based on Boden's suggestion, newness does not imply that something had not been thought before. This brings out Sawyer's second entity: "creativity is a combination"[93]. Every thought or idea is a composite of prevailing thoughts. According to Regan[94], remembering a previously understood concept does not indicate creativity on a particular action; instead, creativity is the combination of varied and existing concepts which were never brought together by someone else. Based on this interpretation, it is viable to suggest that since AI-generated paintings are a combination of different past paintings (for instance the Faceless Portraits), they are creative since they bring together different ideas to come up with a new idea in a surprising and unpredictive way.

This brings us to Sawyer's third entity: "creativity is expressed in the world"[95]. According to Kurt, for something to be perceived creative, it has to be expressed, because if an idea is conceived in someone's head but not expressed, it is neither seen or understood[96]. This implies that a conceived idea needs to be expressed to receive feedback. At this point, this study brings out an important aspect of art – perception and attitudes that emanate from feedback. Suggesting that a new and combined concept need to be expressed for it be considered as creative. This is one-sided definition of creative art, but based on Sawyer's individual approach, creativity could be explained using a cultural point of view. This viewpoint highlights that "creativity is the

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[93] Sawyer, "Explaining Creativity," 7.
[94] Regan, "GAN."
[95] Sawyer, "Explaining Creativity," 7.
[96] Kurt, "AI."

generation of a product that is judged to be novel and to be appropriate, useful, or valuable by a suitably knowledgeable social group"[97].

4.2 What are the values/features of AI Creativity?

In regard to the enquiry of AI's capacity to be artistically creative, Sawyer's and Boden's conceptualization attempts to understand the aspect of AI creativity, as well as the limitations that encompass this aspect. In order to demonstrate how the limitations can be refuted to explain AI's capacity to be creative, Boden highlighted three forms of creativity that can be addressed to indicate the value of AI art: combinatory, transformational, and explanatory creativity.

4.2.1 Combinatory Creativity

According to Boden[98], combinatory creativity entails "making unfamiliar combinations of familiar ideas"[99]. By including different concepts, a new combination can be created unknowingly or knowingly. However, Kurt indicates that the combination should be value-added and new[100]. To some extent, this value is consistent with Sawyer's entity of an individual approach, which explains that creativity is new and a combination.

Elgammal's Faceless Portraits illustrate combinatory creativity. As stated earlier, when Elgammal was asked to present the renaissance artists who motivated his set, he released close to 3000 portraits. One of the paints is the *Portrait of a Youth Holding an Arrow*, that dates five centuries ago. The art, among others, brings out different features that were used in creating the Faceless Portraits. The 16th century painting is of Bolognese Girolamo Casio, with a positioned arrow. The painting describes indicates the art of weaponry and aristocracy, which Elgammal

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[97] Sawyer, "Creativity," 8.
[98] Boden, "Creativity."
[99] Boden.
[100] Kurt.

uses in creating the various ideas exhibited in his series. The concept of weaponry is applied in the Faceless Portrait of a general, while aristocracy is utilized in the King's Portrait.

4.2.2 Explanatory Creativity

This form of creativity happens in a particular space and within the context of a particular style. Beginning with an existing style of thoughts, someone may take up this style and apply its basics to develop a new and inclusive outcome. Kurt [101]explains that these styles can be formulated by idealistic spaces, cultures, or social categories, which are not born of a person's mind. It could be a style of music, theory, or visual arts. Within that space or style of thinking, anyone who brings up a novel thought is perceived as creative using an explanatory perception. This form of creativity is substantial in bring light to this research's question because "it can enable someone to see the possibilities they had not glimpsed before"[102].

Machine learning: AARON

Explanatory creativity pertains producing novel concepts and thoughts by exploring the conceptual spaces and styles. The valuable ideas are mainly unexpected and new. Thus, the exploration of these ideas needs to be consistent with the standards of the adopted style of thinking. So, to satisfy the style's standards, someone needs to first understand them through learning.

Machine learning applies the idea of artificial intelligence, which offers a space of algorithmic styles that are learned so that they can be implemented in new concepts. It contains numerous concepts from a variety of fields: philosophy, science, statistics, cognitive science, control theory, and many more. According to Kurt, machine learning is focused on the idea of

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[101] Kurt, "AI."

[102] Boden, "Creativity," 8.

developing computer programs that evolve with experience[103]. When a machine implements a

change in either of its programs or set of data, it learns and enhances its next performance.

Consistent with the aspect of explanatory creativity, artificial learning engages changes with an

existing and performing computer system.

Cohen produced a drawing program, AARON, that best supports this feature of AI's creativity.

Unlike other programmers, Cohen was a renowned painter before he ventured into AI art. He had

a conceptualized painting style, illustrating ambiguous patterns that are interpreted differently by

different persons. His style illustrates that his works were focused on cognitive processes. By

enhancing his artworks on the comprehension of perceptual feedbacks, he evaluated the

variations between these feedbacks using different styles.

In Cohen's work, How to Make a Drawing, he explains the process in which he trained his

learning machine. Since AARON was a program that needed to learn how to draw, he describes

it as a student. In Cohen's opening article on how the program learned, he told AARON, "lets

begin with as a story. Once upon a time, there was an entity named AARON"[104].

4.2.3 Transformational Creativity

This form of creativity entails the transformation of an abstract space; hence, new ideas or

concepts that could not be seen, are generated.

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[103] Kurt, "AI."
[104] Kurt, "AI," 37.
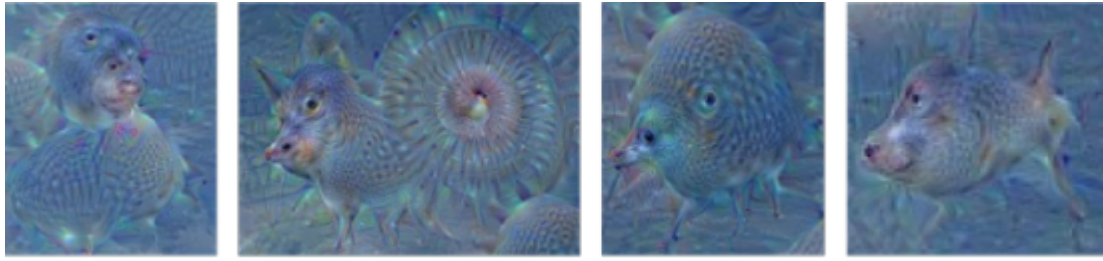
Google's Deep-Dream

Figure 13: Animal shapes imagined and created by Deep-dream[105]

Imagination is fundamental in triggering transformational creativity. AI's perception process

happens when a program identifies data in its neural system. When these neural networks are

manipulated, machines create images rather than only recognizing them based on the instructions

it is given. By utilizing the neural-assigned data, the programs generate images individually.

Even if the concept, imagine, seems incomprehensible to AI programs, Google's program, Deep-

Dream, can generate dream-like images based on the name it is assigned.

4.3 What is the Essence of AI Art? The Potential in AI Technology

AI art is often attacked based on its limitations in objectivity and originality, but Boden seeks to

understand "if computer art is apparently so problematic, why do people do it in the first

place?"[106]. Therefore, this study suggests that people who are committed in AI art are in the right

place because by doing so, they get an opportunity to explore new AI technologies, discover the

potential of a human's psychological process of creating art, and do the art. Therefore, instead of

focusing on mechanical augmentation of algorithms, artists need to explore other possibilities to

control their images within which AI programs bases its created output.

AI Art's aim is to discover the opportunities present in new technological advances. For instance,

evolutionary programming aims at achieving AI art production that is undistinguishable from

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[105] Kurt, "AI,"40.
[106] Boden, "Creativity," 34.

human art. In this case, the programmer assumes the role of an artist. But before the program is

achieved, the programmer takes up an artistic process to create a computational network that can

be utilized to generate an art. Therefore, the program itself can be deemed as an art. In this sense,

this paper is consistent with Burton's definition of AI art, that they are a "representation of a

representation"[107].

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[107] Burton, "Representing Representation,"23.

Chapter Five

5.1 Conclusion

This paper entailed AI's artistic creativity and the question that was been evaluated was. "Can computers think?" This question underlines one of AI's limitations. In chapter one we defined AI by providing a comparison of the human mind and machine. Regarding the applications of AI, it is obvious that the ultimate goal of AI in art is to produce art that reflects human intelligence. Thus, the area of AI and human's cognition are interlinked in art production. As a concept that is grounded on human intelligence, AI is due to rapidly cooperate its abilities with those of humans, to generate outputs that not only indicate AI's 'thinking' capacity, but also augment human creativity on the technologies.

Although AI is no longer a projected notion because of its contribution in applications like Siri and computer-based algorithms, it is preceded by attitudes and perceptions that deem it as either positive or negative on artwork. Some claim that it will disorient the life and social dynamics of humans, and eventually threaten human existence. Other concerns pertain more plodding issues like the influence has on the jobs that rely on the input of humans.

From the controversy, that is discussed using the Portrait of Edmond, this study introduced its topic by highlighting three research questions, which emphasize on AI art's limitations – artistic bias on value, originality, and identity. The schema theory was used to address the question on the identity of artists. The theory was paramount in describing how biasness can affect one's cognition and, in the process, affecting one's perception of the identity – human or AI. Besides, the theory that computers are social actors (CASA) addressed how cultures and social inclinations enable an audience's perception on the authenticity of AI art.

AI advances depend on algorithms, such as those engaged in machine learning, which identifies and replicates certain patterns of data. For instance, deep learning, an exemplary form of machine learning applies neural networks to augment the assigned data. In this study, we evaluated GANs and CANs that have been extensively used to produce AI Arts described in chapter three.

Acknowledged as a novel value expressed by human intelligence, creativity was evaluated as one of AI's critical focus. After responding to whether computers could think by exploring the co-relation between human and machine creativity, we assessed the features that deem AI art as creative. Through Elgammal's Portraits, we found that AI art qualify to be artistically creative because they demonstrate combinatory creativity. On the other hand, AARON program illustrated how machine learning can be engaged to augment AI's creativity by producing arts via explanatory creativeness.

This study established that AI art is often critiqued on the basis of creativity. This study suggests that people who are committed in AI art are in the right place because by doing so, they get an opportunity to explore new AI technologies, discover the potential of a human's psychological process of creating art, and do the art. Therefore, instead of focusing on mechanical augmentation of algorithms, artists need to explore other possibilities to control their images within which AI programs bases its created output.

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