
The Emergence of AI Art

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Resumo

Enquanto alguns defendem que a arte e a criatividade são consideradas actividades exclusivamente humanas, outros afirmam não existir qualquer problema em admitir que as máquinas são igualmente capazes de criar arte. Ainda assim, as coisas continuam a não ser assim tão claras, já que o assunto é continuamente bombardeado com questões relacionadas com a validação, autenticidade e sensibilidade das máquinas que, por não ser exatamente igual ao de um ser humano, deixa sempre pouco espaço para a sua total aceitação. No entanto, é inegável que o advento da Inteligência Artificial (IA) alargou as fronteiras da criatividade, introduzindo novas dimensões de colaboração entre humanos e máquinas. A intersecção entre a Inteligência Artificial (IA) e a arte representa uma fronteira fascinante no domínio da criatividade, desafiando as noções tradicionais e inspirando novas formas de criatividade.

Numa tentativa de esbater as “linhas” entre criador, máquina e público, esta exploração, irá aprofundar o contexto histórico da IA, desde as primeiras experiências generativas, tais como os testes de Alan Turing com o seu “Jogo da Imitação”, que lançou bases para algumas das mais recentes descobertas da aprendizagem profunda mas, também o seu contexto artístico, e a forma como tem influenciado o mundo da arte e os respetivos mercados; os vários tipos de IA e a sua aplicação e influência artística. De partida para esta consideração, um alvo de estudo é AARON de Harold Cohen, que rapidamente se tornou uma referência neste ramo. Não só envolve a utilização de IA para criar e ajudar em empreendimentos artísticos, como também levanta questões críticas sobre o impacto da tecnologia na arte, a natureza da autoria e as considerações éticas que acompanham esta colaboração inovadora.

Em suma, iremos ver como a IA revolucionou os processos criativos, desafiando as noções tradicionais e inspira novas formas de expressão artística, não estando a mesma isenta de desafios, como os direitos de autor, os preconceitos e a preservação da autenticidade.

Palavras-chave: Inteligência Artificial, Máquinas, Arte, Mundo da Arte, Mercados de Arte, Criatividade.

Abstract

While some contend that human creativity and art are unique to humans, others contend that it is acceptable to acknowledge that computers are just as capable of producing artistic works. However, there are also many unanswered problems about the legitimacy, sensitivity, and validation of machines—all of which are problematic since, given their differences from humans, there is never enough space to fully embrace them. Nevertheless, it is indisputable that the development of artificial intelligence (AI) has opened up new avenues for creative expression and increased opportunities for human-machine collaboration. The exciting frontier of creativity lies at the nexus of Artificial Intelligence (AI) and art, where new kinds of creativity are inspired and conventional conceptions are challenged.

In an attempt to blur the “lines” between creator, machine and public, this exploration will delve into the historical context of AI, from the first generative experiments, such as Alan Turing's tests with his “Imitation Game”, which launched bases for some of the most recent discoveries in deep learning, but also its artistic context, and the way it has influenced the art world and respective markets; the various types of AI and their application and artistic influence. Harold Cohen's AARON serves as a starting point for this analysis and has rapidly established itself as a reference in this subject. In addition to utilizing AI to produce and support artistic endeavours, it also poses important problems regarding the nature of authorship, the influence of technology on art, and the moral issues that come with such avant-garde cooperation.

In overall, we shall see how artificial intelligence (AI) has transformed creative processes, questioning conventional wisdom and generating novel forms of artistic expression. However, AI is not immune to difficulties, such as copyright, bias, and maintaining authenticity.

Keywords: Artificial Intelligence, Machines, Art, Art World, Art Markets, Creativity.

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Introduction

Given my background and passion for fine art, and the constant discussions about the future of art and the ecosystem it inhabits, it seems that there is a concern related to the lack of knowledge about this new universe of artificial intelligence and how it can change the concept of art.

Since the introduction of new trends and techniques linked with creative production, the art world and its markets have been reacting to the same demands by expanding their range of work, knowing that society has been displaying a variety of pressing needs. These new approaches and ways of working are questioning more conventional ideas of art, changing the mechanics of the market, and bringing up moral and philosophical issues. These are the different aspects that I intend to explore throughout this study, using different methods, such as literature research and conducting interviews with different agents in diverse art world fields.

In order to answer the research questions, this study will consist of five chapters, the central question being: Can AI able to express creativity?

This essay addresses the possible advantages and disadvantages of artificial intelligence (AI) in art, examines the ethical issues raised and provides case studies of significant works of art that make use of AI. The aesthetic, technological and social aspects of AI-generated art will be investigated, along with the ethical and critical discussions surrounding its creation and reception, through an overview of the literature review and a qualitative analysis of case studies.

The first chapter gives readers a thorough understanding of this technological phenomenon by defining and studying the various forms of artificial intelligence. It also offers a historical explanation of the concept based on research by pioneers in the field, such as Alan Turing, John McCarthy, and Ray Kurzweil. These studies not only present a definition of artificial intelligence but also a scientific explanation, which lays the groundwork for future philosophical debates regarding AI's creative ability.

The invention that contributed to Alan Turing's rise to fame is the "Turing machine", a theoretical model of computing. A Turing machine is a simple mathematical design that can simulate the logic and features of a general-purpose computer. It was necessary to formalize the ideas of computability and algorithmic processes. The concept underlying the "Turing

Test" is another significant, and maybe the most well-known, addition to AI. Turing proposed a test in his 1950 paper "Computing Machinery and Intelligence" to determine if a computer is clever enough to mimic a human. In the test, a human judge speaks with a computer and a human participant in ordinary English without being able to tell which is which. If the judge is unable to reliably differentiate the human from the computer based just on the structure of a discussion, the machine is considered to have passed the Turing test. During the Second World War, Turing's machines and his sophisticated decoding and machine learning techniques proved invaluable in cracking the codes of the German Enigma machine. These computational procedures played a crucial role in later Artificial Intelligence research, especially in McCarthy's contemporary studies and Kurzweil's futuristic ones.

The same chapter also discusses Quantum Computing, a cutting-edge subject with the potential to transform computing and solve challenging issues in cryptography, optimization, and other areas. Despite being in its early phases of development, functional quantum computers have the potential to revolutionize technology and problem solving due to their more intricate mechanical designs than conventional computers.

The convergence of creativity and AI has been growing significantly as a result of the ongoing advancements in technology, opening up new avenues for artistic expression. The persons primarily responsible for this trip, which started around 70 years ago, and its current state will be examined in more detail in the second chapter. One such example is AARON, an artificial intelligence artist and groundbreaking computer programme developed by British computer scientist and artist Harold Cohen. It will be feasible to connect the theoretical underpinnings of the concept of creativity to actual instances of AI inventions through these case studies. Lastly, there will be a discussion of Ian Goodfellow's GANs, a contemporary AI model that has upended conventional creative practices and revolutionized the art world by bringing in fresh approaches to production, cooperation, and appreciation. They have demonstrated that artificial intelligence (AI) is more than simply a tool; rather, it is a creative force unto itself, and as technology develops and artists continue to push the boundaries of AI art, so too will AI's influence grow.

The third chapter examines the outcomes of the interaction between artificial intelligence (AI) and the art markets. This relationship, which has shown to be dynamic and ever-changing, signifies a paradigm change in the ways that art is viewed, produced, appreciated

and then, consumed. We will examine the subtleties of this new connection in this study, as well as the opportunities and difficulties it brings. The research will also analyze the extent to which AI has benefited some aspects of activity in the art markets, such as AI-curated shows and some developed techniques for art appraisal and price prediction. The creative community and other academics are quite curious in these ongoing advancements since they seem to offer endless possibilities for creativity and innovation. However, because it is a "now" inquiry, it is still an ongoing process and there is a reasonable gap in the information available.

With the starting as being able to define artistic creativity, the last chapter will examine some of the possible advantages of this “blurred bridge” between the artist, art creation and AI machines, such as the democratization of the artistic production process and helping artists with their creative processes by utilizing the new methods that these new instruments provide, but drawbacks as well; for example, the use of AI in art might give rise to privacy problems since personal information about individuals can be utilized to produce works of art without their agreement.

Some contend that artificial intelligence generated art is a result of human programming that is influenced by human experience, rather than being really "authored" by the machine. Others argue that artificial intelligence generated art blurs the lines between human and machine authorship and represents a new kind of creativity. However, who defines it? This matter brings up another discussion topic covered in this chapter: authorship and creativity. Concerns about authenticity and originality as well as the possible loss of human creativity are also raised in this study by the employment of AI in art. While many support the use of AI as a new creative genre, others contend that the use of AI, which is based on algorithms and data analysis, might cause art to become "repetitive," which is in contrast to the emotional depth and complexity that come from human expression that can only be achieved by human ingenuity.

Other ethical concerns, like as those pertaining to intellectual property and the use of AI to the creation and consumption of art, are also quite significant. Some worry that the value of human creativity and the artist's position in society may decline as a result of AI being used in art. Some worry that artificial intelligence-generated art may lead to the automation of other creative sectors including writing, music and films.

We can safely say that artificial intelligence-generated art has intricate and interconnected aesthetic, technological, ethical and cultural components. These factors must be taken into account while evaluating AI-generated art, as well as the possible effects of this developing technology on the diverse art world agents, its markets, along with other domains.

I will conclude by summarizing the key findings from the same study, highlighting the key contributions to our understanding of the relationship between AI and the art world and its markets, outlining the investigation's limitations, offering my critical viewpoint on the subject and suggesting further research directions in the same or similar field.

Chapter 1: Birth of “Machine Intelligence”

Automation has replaced the human intellect in many jobs that it once oversaw, from driverless cars to virtual assistants that understand our every need. Algorithms and models akin to neural networks, which enable machines to learn from observations and choose a course of action, are responsible for this sequence of events.

A notion that promises to completely transform the way we live has caught the attention of scientists, researchers, and enthusiasts in the rapidly changing technology field. This novel idea is known as "Artificial Intelligence" (AI) or "Machine Intelligence" (MI). The development of machine intelligence marks a revolutionary turning point in human history. It was inspired by the desire to replicate human intellect in machines.

With origins in the 1950s, Alan Turing, a well-known mathematician and computer scientist, did groundbreaking work that helped to spark the development of automatic intelligence. Turing's seminal work "Computing Machinery and Intelligence" established the groundwork for investigating the possibility of machines displaying sentient behaviour. This groundbreaking breakthrough sparked a surge of investigations and sparked the imaginations of many futurists, beginning the hunt for sentient machines with minds similar to our own.

A broad variety of technologies and approaches are combined to create artificial intelligence, which aims to enable machines to mimic human intelligence. It spans a number of fields, including robotics, machine learning, computer vision, and natural language processing, all aimed at granting robots the ability to see, think, and learn.

Artificial intelligence's inception has already yielded impressive outcomes, transforming numerous industries. AI has made it possible for medical personnel to diagnose patients accurately, leading to quicker and more effective treatment decisions. Autonomous vehicles have become popular in the transportation sector, offering increased efficiency and safety on the roads. In the realm of personal assistants, our smartphones now have virtual AI companions that are always available to assist and anticipate our needs. However, Artificial intelligence is not without its difficulties. In order to make AI systems not just brilliant but also trustworthy and accountable, researchers are still debating matters like ethics, prejudice, and explainability. The emergence of artificial intelligence has prompted discussions about how technology will affect jobs, privacy, and social dynamics, highlighting the necessity for its responsible development and application.

It is critical that we acknowledge the promise of this revolutionary technology while also being conscious of the obligations it carries as we set out on this fascinating voyage into the world of artificial intelligence. The emergence of machine intelligence portends a bright future in which human and machine intelligence will grow together to form a mutually beneficial relationship that advances civilization. It hasn't shown to be completely successful, despite being a significant advancement in science and the "discovery" of artificial intelligence, thus it's important to be conscious of some conceptual, empirical, ethical, and, for some, mathematical limitations - especially when using them. Nevertheless, we shall address some of these constraints in a later section.

This chapter will examine the development of artificial intelligence, exploring its historical roots, the several varieties that are currently in use and its applications and the significant influence it is expected to have on our lives.

1.1. What's Artificial Intelligence?

The precise meaning of artificial intelligence has changed throughout time, but this is a topic that is developing quickly and has the potential to completely transform a number of facets of our life.

According to the dictionary description, artificial intelligence is called *“theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.”*¹ This leads us to the conclusion that, as the name suggests, intelligence has to do with human cognition and the potential for artificial mechanisms to mimic this quality. As to John McCarthy, a computer scientist, artificial intelligence is *“the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable.”* (McCarthy, 2007, p.2) As he notes, the difficulties in characterizing the kinds of computer processes that ought to be classified as "intelligent" make it impossible to come at an independent definition of

¹ https://en.oxforddictionaries.com/definition/artificial_intelligence

intelligence that is not predicated on human intellect. Certain aspects of intelligence remain incompletely understood (McCarthy, 2007, p.3).

It's also critical to remember that, in keeping with cognitive studies, understanding AI allows one to comprehend human intelligence. This makes it feasible to compare research on artificial intelligence to that on the human mind and brain conducted in the fields of neuropsychology and cognitive science. While the goal of utilizing computers to comprehend human intellect is comparable to that of artificial intelligence research, artificial intelligence (AI) is not restricted to techniques that may be observed by biological means (McCarthy, 2007, p.2). This is still a contentious topic because there are those who support it and are enthusiastic about it, saying that it will revolutionize the relevant industries and bring about unheard-of levels of progress. On the other hand, there are those who are sceptical of the potential harm that such technological advancement could cause to humanity, pointing out that robots might even start working in industries of the future.

Aside from the widespread viewpoint, it's crucial to comprehend the context of this conversation and its origins. The initial experiments and investigation into this novel instrument were carried out by Alan Turing. He contends that human intelligence can be attained by a digital machine with the right programming. Can artificial intelligence, however, become as intelligent as a human?

1.1.1. Can machines think?

Many researchers started researching on creating intelligent robots after World War II. But in the 1950s, a crucial query emerged: Can machines think? Alan Turing, a British computer scientist, cryptanalyst, mathematician, and theoretical biologist, posed the question. He was in charge of starting the search and laying out a foundation for future scientific society operations, mainly believing in programming already-built computers rather than creating new ones from the ground up. This would lead to previously unheard-of research and the creation of a novel opportunity. Turing devised a number of strategies to increase artificial intelligence because he thought it was possible for machines to think like humans. One of the founders in the field of artificial intelligence (AI), John McCarthy, is a pioneering computer scientist who states that the answer to Turing's question may be addressed with a simple "yes" or "no" (McCarthy, 2007, p.3) since, in essence, certain machines are capable of doing it and

others are not. However, He does believe that since research into this topic is still in its early stages, it is not appropriate to presume that a computer is completely intelligent.

Another prediction is made by renowned computer scientist and futurist Ray Kurzweil, who claims that AI would eventually learn to comprehend emotions, creativity, and other facets of human intellect, enabling increasingly complex interactions between people and machines. He lays out a timeline that suggests artificial intelligence could eventually reach the level of human intellect. Kurzweil claims in his book *Singularity Near* (2005) that a machine would unavoidably surpass human intelligence once it reaches that level (Kurzweil, 2005, p.127). According to him, the singularity occurs when a machine's non-biological intelligence reaches the same depth and complexity as a human's (Kurzweil, 2005, p.204). Regarding his forecasts for the development of AI, he states that it won't take more than 20 years to develop the computational power necessary for an AI (i.e., a non-biological medium) to mimic the depth of human intelligence, hence extending human intelligence (Kurzweil, 2005, p.128). Technologies like brain-computer interfaces, which enable smooth communication between the human brain and artificial intelligence, may be a part of this integration.

In his essay "Computing Machinery and Intelligence" (1950), Turing states at the outset that the topic should not be interpreted literally, citing the definitions of "thinking" and "machines." These machines are specifically referred to as "electronic or digital computers," a futuristic concept that can carry out precise, predetermined instructions. (p. 436) He states: *"This special property of digital computers, that they can mimic any discrete state machine, is described by saying that they are universal machines."* (p. 441)

In a perfect world, these computers would have infinite storage and be able to discretely replicate any machine, requiring only specific programming for each situation. For example, "the two human players in the imitation game can be replaced by a discrete state machine and a digital computer, which mimics it, and the interrogator would not be able to tell them apart." (ibid.) There are three primary components to these particular machines: The term "store" refers to a collection of data that is, as its name implies, kept in "machine memory;" an Executive Unit controls certain processes that differ between machines; and a Control guarantees that instructions are followed in the right order. These days, digital computers are constructed with these ideas in mind. All that is required to make a machine mimic the actions of a human computer is to explicitly specify those actions in the form of programming, or

tables of instructions. According to Turing, this is an old idea initially envisaged by Charles Babbage, whose Analytical Engine² shared some of the concepts of a digital computer despite being incomplete.

It is also pertinent to discuss Kurzweil's perspective, which not only asserts that the majority of computers in use today are digital devices that can execute one or two calculations at a time quickly, but also draws comparisons between them and the human brain, which can combine digital and analogue processes via the action of neurotransmitters. It is a hybrid system that combines computational and analogue components. The expert also notes that while the contrary is not feasible, a digital computer can mimic an analogue computer or a hybrid computer similar to the human brain. A digital computer cannot be replicated by an analogue computer. Analogue computing is far more effective, though. Certain electrochemical processes may be handled by a small number of transistors in analogue computing, whereas millions of transistors are needed in digital computing (Kurzweil, 2005).

Following up on his numerous observations about how universal these machines are, Turing predicts that in 50 years, computers will be able to be programmed so that an intermediary will have no more than a 70 percent chance of correctly determining whether the person speaking to them is a human or a computer. (Turing, 1950, p.442) He continues by saying that by the end of the century, educated people's general perceptions will have shifted, ending the debate over this topic. To comprehend the degree to which a "machine" may mimic a human trait, the problem is reformulated as a game, which he names the "Imitation Game". This same game consists of 3 "players": a man (A), a woman (B) and an interrogator (C), who can be of any gender. (Turing, 1950, p.433) After an initial question from C, A's objective is to try to mislead the interrogator and B's is to help the interrogator, and the answers from both must always be given in such a way that the players' voices are not identified. This regulation offers the advantage of establishing a concrete distinction between the players' physical and psychological abilities. The central purpose of this game for the interrogator, after being placed separately from A and B, is to distinguish between the two sexes and determine which of the two is the person and which is the "machine". The objective of the machine is to try to lead the interrogator to wrongly conclude that the machine is the other person, and the objective of the other person is to try to help the interrogator correctly identify the machine.

² Annex 1

We understand that the odds seem to be in the human's favor, since it's easy to impersonate a man or a woman, but if the machine responds well to your programming, it can also convince you that it's not a machine, just as a human can. Finally, if the interrogator is unable to distinguish between the machine and the human being, the machine is said to have passed the "Turing Test". [McCarthy contended that while a computer passing the Turing test is unquestionably intelligent, it need not possess sufficient human knowledge to be able to mimic a person. (McCarthy, 2007, p.4)] In this phase, Turing reveals the research questions more objectively: *"What happens when a machine takes the role of A in this game? Will the interrogator decide wrongly as often when the game is played as when the game is played between a man and a woman?"* (1950, p.434) The shift to these more exact questions ultimately helps a more precise discussion, according to Turing.

Turing clarifies in his article the criticisms that other academics have leveled at his proposition, which is very debatable. I'll simply touch on five of the nine objections here because they seem the most interesting. The *religious argument* that "Thinking is a function of man's immortal soul" is a particularly intriguing one. All men and women are endowed by God with an eternal soul; robots and other animals do not possess this attribute. No animal or machine can thus think. (1950, p.443) By claiming that, just as God did not grant animals or objects the capacity for thought, so can robots. Turing refutes the same criticism by pointing out that only God, the Almighty, could give the computer such a capability. To what degree, though, is it reasonable to consider this argument to be an objection? There are a lot of theories about it, but none of them are very factual or don't include conjecture. Numerous theological arguments, which have never been shown to be fully satisfying, serve as evidence for this. But delving into this topic is not the purpose of this study.

The *"head in the sand"* argument comes next: *"The consequences of machines thinking would be too dreadful. Let us hope and believe that they cannot do so."* (1950, p.444) Given that this point is closely connected to the preceding objection, it is interesting to see how it is supported. Humans have actively demonstrated how they view themselves in their daily lives, even when they don't say it out loud. We believe that we are better than everything else in the universe. Since animals lack the same talents that humans have only been granted by God, this argument is really related to one of the first objection's observations. Therefore, it benefits them if machines lack such strength and dethrone humanity as the dominant species. Given

that the majority's opinion is predicated on the superiority of man and what he is capable of, this criticism seems to be more persuasive. Turing ends by saying, "I do not think that this argument is sufficiently substantial to require refutation. Consolation would be more appropriate: perhaps this should be sought in the transmigration of souls." (Ibid.) The Holy Scriptures clearly state that men have become "alienated" from God (Colossians 1:21) by putting their trust in themselves. But to what extent can Turing's last observation not be considered an act of faith?

The third objection is *mathematical*. This is the most appropriate to consider, as there is a direct reference to machines and how mathematical results can prove that they have limitations. The best known of these results was Gödel's theorem³ (1931), which showed results along these lines since it "shows that in any sufficiently powerful logical system statements can be formulated which can neither be proved nor disproved within the system, unless possibly the system itself is inconsistent." (ibid.) In other words, in a strong enough system, there is a class of true statements that can be expressed but not proven within the system, and Turing himself recognizes this: *"there are certain things that such a machine cannot do. If it is set up to give answers to questions, as in the imitation game, there will be some questions to which it will give a wrong answer or no answer at all, regardless of the time allowed for the answer."* (1950, p.444) However, Turing says that this should only be a concern if humans can answer questions that are impossible for machines to answer, i.e. digital computers. These devices are restricted to answering what they have been programmed to answer, while for humans there are no "impossible questions to answer". This is because, according to the study, impossible answers are the result of the Lucas Penrose constraints⁴ to which machines are subject. Therefore, in the final analysis, when asked a question of this type, it would be easy for a human, during the Turing test, to answer correctly and identify whether the person answering was a machine or a human. In this way, the machine would fail the Turing test. However, this objection, once again, despite exerting more objectivity than those mentioned above, is somewhat disturbing. To what extent is being free of any and all constraints vital to the ability to receive? This is a complicated question to answer, and requires precise mathematical information about computer language.

³ Annex 4

⁴ Annex 3

Turing uses Professor Jefferson's 1949 Lister Oration as a source for the type of objection he believes fits under this category in the following objection, *"from Consciousness"*: *"Not until a machine can write a sonnet or compose a concerto because of thoughts and emotions felt, and not by the chance fall of symbols, could we agree that machine equals brain—that is, not only write it but know that it had written it. No mechanism could feel (and not merely artificially signal, an easy contrivance) pleasure at its successes, grief when its valves fuse, be warmed by flattery, be made miserable by its mistakes, be charmed by sex, be angry or depressed when it cannot get what it wants."* (1950, p.445) This argument is built around three observations that together make up the objection. Firstly, the only way to be sure that a computer thinks is to become the machine and understand the fluidity of thought itself; secondly, as expressed above, "not only write it but know that it had written it", in other words, there is a way to understand whether it exercises a consciousness of its own, and lastly, it is to take the mind as something "strict", in other words, to assume that it is separate from emotions and desires, which dictate human behavior. Turing ends by saying: *"I think that most of those who support the argument from consciousness could be persuaded to abandon it rather than be forced into the solipsist position. They will then probably be willing to accept our test."* (1950, p.447)

The last objection, *"Various Disabilities"*, that I will mention is somewhat related to the previous one. Turing will draw up a list of things that many claim machines are unable to do: "To be kind, ingenious, beautiful, sympathetic, to have initiative, to have a sense of humor, to distinguish right from wrong, to make mistakes, to fall in love, to like strawberries and cream, to make someone fall in love with it, to learn from experience, to use words correctly, to be the object of its own thought, to have as much diversity of behavior as a man, to do something really new." (1950, pp. 447-450) We may say that the primary problem challenges our presumption that no digital computer device is capable of doing the tasks on the list. Turing replies that this is because we already know about the capabilities of current machines and that none of them have been shown to be able to do some of these tasks. Another significant concern is brought up by the advancements made in building computers that can do the jobs in Turing's list. It is at least debatable to what degree current computers are capable of making mistakes, correctly using language, picking up new skills via experience, etc. Moreover, there is disagreement about the degree to which recent breakthroughs in other domains may inspire

further progress towards resolving these alleged limitations. Nevertheless, the Imitation Game was the best statistical test for a long time, and none of the criticisms made in relation to this argument invalidate their research.

Turing expands on the idea of "machines that learn" throughout the course of his logic. He investigates the idea that, like people, robots may learn from experience and become more proficient, just as people do through time. According to Turing, a computer cannot be deemed fully intelligent unless it is capable of learning, which is a basic component of intelligence. He offers a fictitious scenario in which a computer is given a set of questions and answers to demonstrate this point of view. The computer can learn from its past reactions and modify its responses depending on its prior experiences by going through a trial-and-error process. Turing emphasizes that learning should be iterative, enabling the computer to perform better over time, just like people do. Besides, the concept that machines are capable of developing such a strong decision-making pattern is also emphasized by Kurzweil. They also don't have the type of mechanism that permits them to operate concurrently, such as arbitrariness, but that doesn't mean they can't mimic human intellect to create a system similar to that. By utilizing appropriate algorithms and programming, robots may learn, enhance their ability to make decisions, and eventually grow more intelligent.

All of these points are, of course, open to refutation, and we cannot disregard concerns about the potential applications of artificial intelligence as well as concerns about Turing's Imitation Game predictions in particular. Some contend that genuine comprehension or the application of creativity, which are essential components of human intellect, are not synonymous with effective imitation. Considering empirical problems, is it true, for instance, that computers are already, or soon will be, able to play the imitation game so successfully that, after five minutes of questioning, an interrogator has no greater than a 70% probability of correctly identifying the subject? From a conceptual standpoint, should we assume that the machine possesses some degree of thought, intellect, or mentality given that an interrogator has no more than a 70% probability of correctly identifying the subject after five minutes of questioning?

Humans's performance as an impersonator of the machine would obviously be far inferior. The arithmetic's slowness and inaccuracy would instantly reveal it. It is impossible for a

machine to engage in what is essentially thought. Would this way of thinking differ greatly from human thought processes?

This game also started a heated discussion over the nature of consciousness and whether or not robots can experience it. Although some people maintained that only humans are capable of exhibiting actual consciousness, Turing's concept raised the prospect that robots may do so by effectively mimicking human behaviour. This has sparked continuous philosophical discussions and investigations, expanding our knowledge of consciousness and the capabilities of technology. Nevertheless, we might draw the conclusion that Turing transformed our understanding of artificial intelligence and unlocked enthralling new research directions. Turing questioned accepted ideas of what it means to be clever by arguing that a computer can be deemed intelligent if it can successfully mimic human behaviour. His impact is still felt in the discipline today, motivating scholars to investigate novel ideas while resolving obstacles and concerns in the process. Machine learning techniques, which are now widely utilized in many fields including natural language processing, computer vision, data analysis, etc., were made possible by the idea of learning machines.

McCarthy's book *"From here to human-level AI"* (2007) ends with the following query posed in its last chapter: When AI reaches human level, what will humans do? If artificial intelligence (AI) is able to reach this degree of intellect, how far can it go in expressing itself artistically and creatively, and demonstrating emotions, which are not based in "rationality"? This field is still developing and exploring the possibilities of modern artificial intelligence and how it interacts with the arts. It is undeniable that Artificial Intelligence has been used in the artistic world before; this will be discussed in more detail in the upcoming chapter.

1.2. Types of artificial intelligence

The question of whether artificial intelligence can replicate human behavior and mental processes is still an interesting one. Martinez R. (2019) notes that reactive machines, however, function differently from human beings. Put simply, they have no memory or learning curve and just follow preprogrammed patterns. Put differently, their robotic behaviors stem solely from preprogrammed concepts; they are incapable of independently adapting their iron wings to novel circumstances. Reactive machines can nevertheless have some applications, despite

this seeming restriction. Some examples are the sophisticated search features on YouTube, Siri's speech recognition skills, Tesla's self-driving car, and the sophisticated thinking involved in chess. It is crucial to look at the systems of AI applications and how they depart from human logic in order to completely comprehend the powers and limitations of these reactive computers. Still, let us begin by designating them as "a drawer" and arranging them into three straight groups.

The initial level is Artificial Intelligence Narrow (IAN), sometimes referred to as "weak AI," and it is now a part of our everyday existence. To arrange the sequence on social media timelines, match data, email screening, speech recognition (like Siri), etc., it employs sophisticated algorithms. They are excellent in the areas they have been trained in, but they are not adaptable enough to apply their expertise to other fields. Large data sets relevant to the current job are frequently needed for the training of narrow AI models. These systems' success is mostly dependent on the calibre and volume of data utilized in the training process. Narrow artificial intelligence (AI) has a significant influence on daily life, including financial markets and infrastructures, while having intelligence restricted to a single domain and perhaps failing the Turing Test due to its unique programming.

Since the early 2000s, the majority of our technical memory has been converted to digital format, and since the 1990s, digital technologies have dominated telecom information networks (Hilbert & Lopez, 2011, as cited in Kurt, D.E., 2018). Stated differently, humans have transitioned from analogue to digital storage systems. We are still talking about complicated systems that can process data and conduct computations in a reasonable amount of time, even when their primary concentration is on completing a single task. Furthermore, it is vital to mention that big data, as a crucial notion rooted in the digitalization process, denotes an analytical phenomena outside the scope of conventional data processing systems (Boyd, D. & Crawford, K., 2011). It is reasonable to assume that artificial intelligence will grow more sophisticated as data volumes rise. This is because more human data uploaded to digital storage will contribute to the mega-data network and make more data available to computer systems. (Kurt, D.E., 2018) Thus, we may conclude that a crucial component of modern artificial intelligence applications is narrow AI. Because of its task-specific design, it can effectively solve some issues, but it is not as powerful as broad artificial intelligence.

Continuous developments in narrow AI continue to influence its use in everyday applications and across a range of sectors.

Artificial General Intelligence (AGI) is the next level of AI. This is a term used to describe a kind of artificial intelligence that is on par with human intellect in terms of its comprehension, learning, and application of knowledge to a broad variety of activities. In essence, it will enable machines to do daily duties performed by humans. The hybrid digital-analogue human brain's engineering is far ahead of that of computers, as evidenced by the ease with which a machine can perform sophisticated calculations (i.e., any intellectual task that a human being is capable of performing) thanks to its digital computing system. But according to the projections of renowned AI experts like McCarthy and Kurzweil, it won't take long for powerful AI to surpass human intellect. Strong artificial intelligence (AI) can adapt and apply its intellect to a wide range of activities, displaying a degree of adaptability and cognitive flexibility equivalent to that of a human person. This is in contrast to weak AI, which consists of models with limited memory based on real-time input. Strong AI is characterized by its self-learning ability, which allows it to update itself without the need for guidance from a human agency. To put it another way, not every scenario or result will be programmed by the AGI's designer. The machine will be able to grow by itself if it is given a basic capacity. Software that can develop its own code repeatedly in cycles of improvement is referred to as "recursive self-improvement" (Spacey, 2017, as cited in Kurt, D.E., 2018). As a result, since self-improving software is clever, it will get better at improving itself. It does not require explicit programming for every job; instead, it gains experience and gradually enhances its performance.

It's crucial to remember that while scientists, academics, and industry professionals are actively trying to advance AI, there are still significant ethical, philosophical, and technological obstacles to be solved. Nevertheless, the secret to a powerful AI and the path to superintelligence would be this exponential development. Should this be accomplished, Artificial Superintelligence, the third stage of AI, will commence and become the ultimate form. It is theoretically feasible that with this advancement in AI technology, a superintelligent AI would surpass human cognitive capacities in every area, such as creativity, problem-solving, emotional intelligence, and social skills, allowing for the realization of consciousness and intention (ibid.).

Even while "artistic" AI software currently lacks human-like emotional intentionality, it is already producing art in a variety of ways. Thus, it is conceivable to discuss creativity in terms of the artificial intelligence technology of today. While AI technology is still far from reaching human creativity levels, it may be hypothesized that AI technology is capable of doing creative tasks.

Furthermore, according to Ray Kurzweil (2005), "achieving the computational capacity of the hardware of a single human brain (...) will not automatically produce human levels of capacity" (p.128, as cited in Kurt, D.E., 2018). Artificial intelligence and human intelligence can differ in terms of creativity, emotions, and musical and artistic ability (ibid.). Thus, the subject of artificial creativity remains unanswered alongside artificial intelligence. (Kurt, D.E., 2018) The discussion here is on the potential breadth of these similar skills, which have the potential to alter conventional notions of creative creativity.

1.3. Quantum Computing

This type of computing, as its name implies, is based on quantum theory, a paradigm-shifting branch of science that computes using the laws of quantum mechanics. This area of study looks at ways to use some of the peculiar properties of quantum physics to computer technology (Yanofsky, 2007). Quantum computing refers to the processing of transistors at the atomic level in computer systems, which will enable a system that can process many transistors at once, much like the human brain. As a result, it may operate in parallel, doing several tasks concurrently, as opposed to operating in series, which involves completing tasks one at a time, sequentially (Woodford, 2017, as cited in Kurt, D.E., 2018). Quantum systems in quantum computing are often in a probabilistic state. This translates to multiplying the state by matrices when manipulating a quantum system. Put otherwise, when the system is used, it will provide several outcomes. Every click will result in a "matrix multiplication". The resultant vector will represent the system's state at the conclusion of the calculation, and the change in state will be computed (Yanofsky, 2007).

Bits are the fundamental building blocks of information in traditional computers. Quantum bits, or qubits, on the other hand, are used in quantum computing. They are based on the concepts of superposition and entanglement, which are akin to the spin of a magnetic field, and allow them to exist in several states concurrently. Superposition implies that the

quantity of data that can be stored rises exponentially with the number of qubits, while being challenging or impossible to completely comprehend. Fundamental ambiguity, which is present in quantum physics, is the foundation upon which qubits operate. The qubit series in a quantum computer are effectively 0 and 1 simultaneously, in contrast to the "series of bits" of 0 and 1 in a conventional computer (Kurzweil, 2005, p.112). In terms of entanglement, this indicates that quantum computers are able to process data concurrently, in contrast to conventional computers, which can only process data sequentially. Quantum computer algorithms leverage quantum features such as quantum parallelism to address certain problems more quickly than conventional algorithms.

Based on approximations of quantum computing technology, a quantum computer might be "millions of times faster than any conventional computer" due to its parallel processing capabilities (Woodford, 2017, as cited in Kurt, D.E., 2018).

Given the current state of research, it is possible to argue that quantum computing systems will eventually be produced in practice rather than only as a theory. According to estimates, a quantum computer would be millions of times quicker than any conventional computer if it could operate in parallel. Furthermore, the development of quantum computing is crucial for the advancement of artificial intelligence, and it has the potential to completely transform industries including materials research, drug discovery, encryption, and optimization. Quantum computers, for instance, would make it possible to simulate intricate quantum systems, which would advance our knowledge of molecular interactions and allow us to create new materials with desired characteristics.

According to Ray Kurzweil (2005), these technologies will perform better than the human brain's computing capacity if they are incorporated into computer systems. Put simply, if neurons in the human brain can function concurrently, why not create a computer system that can as well? This precise potential has been made possible by the quantum system, which its researchers see as a future phenomena in the growth of technology.

Chapter 2: AI's Odyssey through the Art World

"I think a lot of people like to attribute spiritual qualities to AI, because it's something beyond human comprehension, something that's purer in that sense (...) it's quite confusing - it's just a bunch of geeky programmers and artists who are doing things."

-Amelia Winger-Bearskin

(Rea, N., *How did A.i. art evolve? Here's a 5,000-year timeline.* 2021, Artnet News)

Throughout history, human inventiveness and imagination have been reflected in art. Artists have always experimented with novel mediums and methods, pushing the frontier of what is conceivable. Midway through the 20th century, an age of unparalleled experimentation at the nexus of artificial intelligence and art emerged from the convergence of scientific genius and creative curiosity. Oceans of data may be analyzed by algorithms to assist producers in producing rare items and discoveries, but the issue of whether the code's blended brushstrokes evoke wonder is as old as time itself. Artificial intelligence AI-generated art is gaining popularity and igniting discussion over whether programming can produce true art. Established ideas about what makes an artist are being challenged by the computers churning the cultural oceans, but it is yet unclear if their aesthetic algorithms will be able to touch people's emotions. As AI transforms tradition, so-called AI-born craftsmen are becoming more and more well-known in the field of graphic representations, raising questions about what constitutes real work. The dynamic nature of artistic progress is demonstrated by the way conventional artistic media have evolved into algorithms as creative tools. While brushes, chisels, and pencils have historically been used by painters, the digital technology has brought in a new era where algorithms act as both a palette and a canvas. AI-generated art manipulates complex colours, patterns, and forms to create works that frequently defy accepted aesthetics and inspire fresh interpretations. An exciting new chapter in the history of the art world has been written with the introduction of artificial intelligence (AI). This chapter will examine the development of artificial intelligence (AI) in the field of art, making the case that this technology has raised issues regarding the nature of creativity in the digital era in addition to expanding creative possibilities.

2.1. First Trials (1950's -1960's)

AI was still in its early stages throughout the 1950s and 60s, and a group of avant-garde artists was trying to use the newfound computing capacity for artistic expression. Pioneering artists broke free from the confines of traditional media and ventured into the uncharted territory of early computer art, while mainframes hummed with the promise of a digital revolution. In addition to laying the groundwork for the mutually beneficial relationship between technology and creative innovation, this period, which was characterized by an intense investigation of algorithms, codes, and machine-generated aesthetics, also hinted at the revolutionary role that artificial intelligence would eventually play in reshaping the very fabric of human creativity. The innovative threads woven by computer scientists and artists came together in this intellectual tapestry of the 1950s and 60s, paving the way for a significant reinterpretation of what it means to make and value art in a time when artificial intelligence has penetrated every aspect of society.

The earliest AI and artistic efforts were done with basic computer systems that produced musical or visual creations. Christopher Strachey, a British computer scientist, built a noteworthy example in 1956 on the bulletin board of the University of Manchester's computer lab. He called it the "Love Letter Generator" and it used basic principles and patterns to generate love letters depending on user input. (Roberts, S., 2017) This is the first successful example of artificial intelligence experimentation with computer-generated poetry, resulting in an original and artistic literary piece. Early in history, Strachey, intrigued by the possibility of using computers to mimic human speech, identified and applied the fundamental frameworks of combinatorial literature. It only took Turing's creation of a random number generator on the Mark I machine to make digital computers with stored programmes possible. Christopher Strachey used this technology to create the love letter generator programme, which is regarded as the first example of digital art. Predating by ten years the initial instances of computational digital art from current research (e.g., highly helpful publications like *Digital Art* by Christiane Paul and *Information Arts* by Stephen Wilson), this was the first work of digital literature and art.

Since there were no sophisticated programming languages or tools available at the time, Strachey had to come up with creative ways to accomplish his objective. In an essay

published in the art journal *Encounter* in 1954, Strachey detailed the workings of this scheme. There are just two fundamental kinds of sentences, excluding the start and finish of each letter. The initial one is "My - (adj.) - (noun) - (adv.) - (verb) your - (adj.) - (noun)". Adjectives, nouns, adverbs, and verbs that are appropriate are listed, and the blanks are randomly filled up using these lists. The inclusion of adjectives and adverbs is subject to one more random selection. "You are my - (adj.) - (noun)" is the second kind, and in this instance, the adjective is always present. The sentence form that is used is up to the user; however, if two consecutive sentences of the second kind are used, the first one ends with a colon, and the second sentence's first "You are" is left out. Two words selected from the special lists open the letter, which is followed by five phrases of one of the two basic types. The letter concludes with "Yours - (adj.) M. U. C." Stated differently, he was able to code a machine using a quite simple model, saying "you are my [noun] [adjective]." My [noun] [adjective] [Adverb] [Verbs] with only a few words, you may construct a variety of combinations that range in the order of three hundred billion letters for your [adjective] [noun].

“Darling Sweetheart

You are my avid fellow feeling. My affection curiously clings to your passionate wish. My liking yearns for your heart. You are my wistful sympathy: my tender liking.

Yours beautifully

M.U.C.” (Manchester University Computer)

- One of the outputs reproduced in *Encounter*

But Strachey trained the computer to obey pre-established language models and conventions in order to generate love letters. The programme generated a logical love letter by selecting phrases and words from a specified lexicon and organizing them based on grammatical principles. The show showed how computers could produce imaginative and evocative texts, despite the language's frequent stereotyping and lack of human feeling. "There are many obvious imperfections in this scheme (in fact, very little thought went into its elaboration), and the fact that the vocabulary was largely based on Roget's Thesaurus lends a very peculiar flavour to the results," said Strachey, who was criticized for not modelling writing as a creative process but rather for representing the writing of stereotyped, uncreative love letters through his algorithm. (Rea, N., 2021)

All things considered, the experiment known as the Love Machine of the 1950s was unquestionably revolutionary for its time, showing that computers could be used for creative purposes other than just computing and setting the groundwork for later advances in machine learning, natural language processing, and artificial intelligence AI-generated content. Although the program's output may seem archaic by today's standards, the "Nineteen-Fifties Love Machine" is a monument to the creativity and vision of its creator, and it inspired a new generation of researchers and artists to investigate the possibilities of computers as mediums for communication and creative expression. It draws attention to the persistent interest with the nexus of language, creativity, and technology—a fascination that still spurs advancements in artificial intelligence and computational art today.

It's also critical to highlight one of this era's major achievements, the Perceptron, a model which is designed to accept optical, or “visual” patterns as inputs will be called “photopreceptor” which has been the foundation of Deep Learning since its debut. Frank Rosenblatt⁵ created this single-layer neural network in 1957. It may be thought of as just a set of weighted inputs that we apply an activation function to. This results in an output that is similar to the weighted sum of the inputs. Although it may also be used to regression issues, it is often utilized to classification difficulties. It was taught by displaying inputs and predicted outputs, and it was intended to identify visual patterns. The Perceptron's algorithms can automatically learn from data and get better over time, so it could then tweak its weightings to increase accuracy until it accurately recognized new patterns. (Rosenblatt, 1957) More sophisticated neural networks, which are now employed in a variety of applications, were made possible by this discovery, which also showed the promise of machine learning.

Throughout the 1960s, computer scientists and artists—most notably Frieder Nake, Georg Nees, and A. Michael Noll—kept exploring the artistic possibilities of artificial intelligence. The "3N's" were pioneers in computing who produced some of the earliest pieces of algorithm-generated art on computers. (Druid, 2022)

Frieder Nake, a German computer scientist and artist, was among the first to look into the creative applications of computer algorithms. Nake accompanied Georg Nees to lectures by

⁵ Frank Rosenblatt (1928-1971) is widely acknowledged as a pioneer in the training of neural networks, especially for his development of the perceptron update rule, a provably convergent procedure for training single layer feedforward networks. (Pater, J. (n.d.). *Did Frank Rosenblatt invent deep learning in 1962?* Umass.edu., from <https://websites.umass.edu/comphon/2017/06/15/did-frank-rosenblatt-invent-deep-learning-in-1962/>)

Max Bense⁶ at the University of Stuttgart. (Druid, 2021) He created graphics using the first computers, namely the antiquated Zuse Z64, which had constrained graphical capabilities. Simple geometric line drawings, such as 8-corner (1964), a grid arrangement of tiny glyphs composed of jagged, intersecting lines, were the outcome. The study demonstrated the logical foundation for aesthetically pleasing, supposedly gorgeous shapes in addition to the inventiveness of algorithms. Each and every one of these masterpieces might be connected to a mathematical idea. As Bense explained, the goal of generative aesthetics is the artificial production of probabilities, differing from the norm through theorems and programmes. (Max Bense, 1971) Nees also wrote computer algorithms that generated intricate geometric patterns. He could create algorithms and had access to a computer and drawing machine at the time. He considered trying to imitate Klee's style, who had a great effect on him, but it didn't seem like a good idea. Rather, he recalled a quote from Klee that went something like this: "Art does not reproduce the visible; it makes it visible." This resulted in "Hommage à Paul Klee" (1965), one of He's most well-known pieces, a series of abstract drawings inspired by Klee created on a plotter printer. The scientist started his algorithm with Klee's investigation of proportion and the link between vertical and horizontal lines in paintings, then gave the computer a limited amount of possibilities to choose from. (He, F., 2005) This frequently examines the relationship between creativity and technology, utilizing computers as active participants in the creative process as opposed to being tools. These images showed how computers may be used to create intricate, mathematically accurate artwork.

Alongside Frieder He, Georg Nees was a German computer scientist and artist who played a significant role in the early investigation of algorithmic art. Nees employed plotter printers and the FORTRAN⁷ computer language to generate artwork. His interest in mathematical aesthetics is shown in the geometric forms and patterns that he frequently used in his artwork. He created "Schotter" in 1968, a stunning work of computer-generated art with grids of crossing lines that form eye-catching patterns. The work is noteworthy for its intellectual implications in addition to its visual appeal. Though it appears random at first,

⁶Max Bense (1910, Strasbourg – 1990, Stuttgart) was a German philosopher, writer, and publicist, known for his work in philosophy of science, logic, aesthetics, and semiotics. His thoughts combine natural sciences, art, and philosophy under a collective perspective and follow a definition of reality, which – under the term *existential rationalism* – is able to remove the separation between humanities and natural sciences. (Max bense. (n.d.). Monoskop.org., from https://monoskop.org/Max_Bense)

⁷ Annex 4

"Schotter" is really the result of a well-thought-out algorithm. This algorithm most likely determines the dimensions, direction, and placement of each rectangle, producing an aesthetically pleasing and dynamic arrangement. It subcontracts the creative process to a computer code, challenging conventional ideas of authorship and artistic creativity. It poses concerns regarding the function of the artist, the nature of creativity, and the interaction between people and technology. Furthermore, it was essential in the acceptance of "computer art" as an acceptable form of artistic expression (the fusion of technology, science, and art). This classic work demonstrates the fine line that generative art draws between order and chaos, and it encouraged later generations of artists and scholars to investigate the creative potential of digital technology. It is part of the Victoria & Albert Museum's (London) collection.

Regarding A. Michael Noll, the American artist and engineer, his study was conducted using IBM 7090 and 7094 computers as well as the Stromberg Carlson SC-4020 microfilm plotter. He then created artwork and digital animations using the IBM 7090 visual interface. He experimented with producing audio and visual art using computers. He thought the resulting linear "pattern" to be visually appealing. Noll would later investigate analogous patterns using pseudo-randomness systems, at first purposefully refusing to call the outcomes artwork. He took this action to steer clear of any controversy in the conventional art world and to focus on investigating the innovative aesthetic possibilities at the nexus of man and machine. In a way, the fact that the works cannot be categorized as art shows how innovative Noll was when it came to computer art. One of his "patterns" became the first computer artist to be shown in the United States when it was shown at the Howard Wise Gallery in New York City in 1965. Piet Mondrian's artwork "Composition With Lines" was remarkably resembled by Noll's 1964 creation, Computer Composition with Lines. When one hundred individuals saw copies of both pieces, most thought the computer version was created by Mondrian and favoured it. (Noll, M., 1966)

He was a digital animation pioneer who created the first computer-animated films, such as "Five Algorithms" in 1963. Specifically, Noll's computer graphics experiments and his groundbreaking work in computerized art laid the foundation for the development of digital art and animation in the next decades.

These artists had a significant influence on the development of computer-generated art in its early years. Their work showed how creative resources like computers and algorithms might be utilized to create visually captivating and mathematically accurate art. Their efforts set the stage for the growth of algorithmic and digital art, which has since expanded into a dynamic and diversified area with a multitude of artists experimenting with the creative possibilities of technology.

2.2. Effective Systems and Origins of AI Art (1970's -1980's)

A type of systems known as knowledge-based systems first appeared in the early 1980s, going beyond simple automation in light of the rapidly changing field of artificial intelligence technology. These offer something far more profound: the condensed knowledge of human expertise contained in lines of code, where the distinction between human intelligence and machine capability is blurred and entities with the cognitive ability to precisely and insightfully solve complex problems arise.

These systems, sometimes referred to as expert systems, mimic an expert's performance in a certain subject or field of expertise artificially. Thus, an expert system can be defined as a computer programme that, after receiving appropriate training from a specialist, can infer information from a set of data and starting information using a variety of reasoning strategies, such as probabilistic inference and deductive logic, and navigating through uncertainty with a grace and adaptability reminiscent of their human counterparts. Without the assistance of a second expert with specialized knowledge in the topic, a decision can be reached. As an example, consider an expert system that advises and recommends a diagnosis and course of treatment for a patient to a general practitioner.

Expert systems do, nevertheless, present certain difficulties in spite of their complexity. Since they are machines, they are able to handle the complexity that comes with working in real-world environments where ambiguity, uncertainty, and rapid change are the norm. In addition to technical skill, their growth calls for a thorough comprehension of the field and an acute awareness of knowledge engineering. Once more, the machine is not able to think like a person. Nevertheless, the exploration of the field of Expert Systems is evidence of the astounding union of technology progress and human creativity. Harold Cohen, a visionary

artist, created AARON, one of the stars in this field that guides us through the difficulties of problem-solving and decision-making.

2.2.1. AARON, by Harold Cohen

British artist Cohen created AARON, an artificial intelligence programme that produces unique artwork. Cohen was a well-known painter before he moved to programming; his paintings, which are full of tangled forms and tracts, have been shown in a number of important exhibits, including Documenta, Tate Modern, and the Venice Biennale. (Boden, 2004, p.150) Cohen took a job at Stanford University's Artificial Intelligence Laboratory in 1971 as a guest scholar. He started working on the computer programme Aaron at the Artificial Intelligence Laboratory in an effort to formalize the process of sketching.

Although AARON was initially intended to be the first of several planned programmes, Cohen actually worked with it until the end of his life, perhaps around 1973. In contrast to what we are accustomed to, AARON is software that functions using plotters, pens, colours, and a computer rather than a traditional robot. It is essentially a programme without a body. Interestingly, he said that he needed to "understand what art is," which is why he created this programme. He became interested in computer-generated displays as a result of his fascination with the psychology of art. (Boden, 2004, p.151)

"Let's start with a story. Once upon a time there was an entity called Aaron."

(Cohen, 1982, p.1 as cited in Kurt, D.E., 2018)

In *"Parallel to Perception: Some Notes on the Problem of Machine-Generated Art,"* a 1973 article, Cohen describes his reasoning for examining the possibility that a machine could engage in "human art-making behaviour," (Schwarz, G., 2022) or that "the programme would need to exhibit cognitive capabilities quite like the ones we use ourselves to make and to understand images." (Cohen, H., 1995, p.2, as cited in Schwarz, G., 2022) He described earlier technological advancements like cameras as merely "tools [that] generally serve to extend or delimit various human functions" (ibid.) before starting his mission to demonstrate the computer's relative autonomy by teaching it to generate constantly fresh and unpredictable non-deterministic results. However, many people will undoubtedly find it difficult to believe

that the programme is able to concurrently assign colour and texture while sketching or scribbling in order to create such seemingly random compositions twice. However, Cohen would address these worries. Optimistically, Cohen proposed that "just as the artist will deal with drawings in terms of gestalts and not in terms of raw data, the machine will also have to formulate characterizations of the current state of the drawing, instead of treating it merely as an agglomeration of marks and non-marks". (ibid.)

Over the years, AARON has experienced substantial evolution, going from a basic system that emulated Cohen's creative process to a more intricate application that may demonstrate your artistic production's originality and ingenuity. Unlike the current generation of artificial intelligence imaging software, which is primarily trained on massive datasets consisting of millions of images, which it then processes and reproduces, AARON's work is done more like painting: it is done stroke by stroke, adhering to the principles of perspective and depth, creating harmonious compositions and colour theory, and using a limited vocabulary of shapes that can be customized to your artistic needs. Rather than mimicking figures, it builds them piece by piece, line by line. He improved the programme with each iterations, adding increasingly complex features until he ultimately created a feedback loop that employed archive memory to recall previous activities and guide subsequent actions in accordance with predetermined guidelines, such never crossing two lines. The crucial aspect about Aaron was that he was acquiring knowledge. This is only conceivable because of his creative process, which applies the limitations and guidelines that Cohen established in addition to introducing random changes when these guidelines are carried out. This is consistent with Nilsson's statement that the machine learns from experience and enhances its performance in the future by making adjustments to its structure, programme, or data based on inputs or in reaction to outside information (Nilsson, 1998, p.2, as cited in Kurt, D.E., 2018). The fusion of stochastic and deterministic components results in original and surprising artwork. In contrast to other AI-generated art, which is sometimes flat, clichéd, and can come off as a gimmick, AARON employs algorithms to create compositions, textures, and forms that are informed by Cohen's ideas of aesthetics - which, although being inhuman, are remarkably organic. It includes comprehensive anatomical instructions, including information on the number of limbs, the size of the hands and heads, the locations of the joints, and conceivable positions. Cohen showed AARON how to record points like the elbow's location and possible bending angle, or

the perfect spacing between fingers and wrist. Additionally, Cohen would have devised techniques to discover a code that would allow the figure to move in a specified way. As a result, in the 1980s, the programme was able to generate various real-world forms, such as human figures and plants. The "Athlete Series" (1986), in which the movement of the depicted people is undeniable, is a good illustration of this. The handling of the one facial feature it represented—the nose—was the only deviation from the protocol, as the point itself states: "The nose was seen simply as a set of marks drawn within the bounding outline of the head, and it was used as a device to establish the head's orientation." (Cohen, H., 1995, p.3-4) But at the beginning it could only create black-and-white line drawings, which Cohen then manually coloured. They could only draw crossing dots and wavy, abstract lines. After that, he changed the software to allow him to select and apply the colours on his own, producing digital prints that represent AARON's unmediated artwork. AARON, in contrast to existing generative models, has never been trained using copious quantities of data, statistics, or even pictures. Rather, AARON is a rule-based symbolic artificial intelligence that uses code to control a mechanized arm that has a stylus attached. Its early drawings are children's paintings that are evocative of abstract mazes and petroglyphs. These earlier, smaller pieces are intriguingly free-form; they demonstrate how a machine from the 1970s or 1980s might scrawl and produce images that look spontaneous and unstructured. At the end of Cohen's career, poetic abstraction resurfaces after striking portraiture and still life, all of which are charmingly dissimilar sketches. These colourful, sharply delineated scribbles seem childish in comparison to the realistic visuals produced by today's text-image models.

These manually written programmes weren't artificial intelligence (AI) in the modern sense, where a machine can learn from vast quantities of data by using strong neural networks. Rather, their "expert systems" retained human expert knowledge and transformed it into an intricate system of rules meant to mimic human judgement. Cohen created a robot that enabled AARON to behave and create "drawings" in the real environment. His initial robot, dubbed the "turtle" because of its diminutive size and ability to travel on wheels, is on exhibit at the Gazelli Art House in London alongside its more advanced and bigger replacement, which includes a robotic arm that can move a pen on paper. Moreover, some of the results of the AARON are also available at the Whitney Museum of American Art in New York. The Whitney Museum's collection of paintings that Cohen created with AARON showcases the

man-machine team's growing sophistication. This Museum provides much-needed historical context on the potential and constraints of artificial intelligence, while also mediating on the idea that technology can bring artists back to life. Among these is the massive projection by AARON Gijon, which depicts a lush, enormous, constantly-generated environment replete with neon-hued flora that changes as if it were being painted. The second live version of Cohen's AI on show, AARON Kcat (2001), presents portraits and domestic still lifes on a little smaller screen and creates pictures more akin to works on canvas and paper. Two of Cohen and AARON's "Bathers Series" pieces, which are partially based on impressionist paintings by Paul Cézanne, are on exhibit. In "Coming to a Lighter Place," from 1988, flying creatures painted in powder blue and mustard tones, a thorny forest sprinkled with orange and fuchsia, are inscribed with AARON's trademark circular, hissing lines. The picture seems to want to keep flowering, as it creaks with a fertile excitement. Some of the compositions bear similarities to David Hockney, but they also feature a purposeful and captivating flattening of the planes, which is accomplished by completely eliminating shadows. [Interestingly, in an attempt to make art more accessible, Cohen and computer scientist Raymond Kurzweil collaborated to produce a screensaver version of the programme in 2001.]

We were able to get the conclusion that AARON has created a sizable body of art including a wide range of subjects and genres. His works exhibit a great diversity and richness in his artistic expression, ranging from representational landscapes to abstract compositions. AARON's compositions, which have been shown in galleries and museums worldwide, have drawn positive and negative feedback from the general public and art critics. Aaron's example demonstrates how machine learning in artificial intelligence may facilitate exploratory creativity by producing novel and unheard-of applications of a style. According to Boden, the claim that computers are incapable of creativity because they are limited to what their programmes enable them to accomplish is untrue since computers are only capable of what their programmes allow them to accomplish. (Boden, 2009)

But because of its capacity to provoke strong feelings and cause viewers to pause and think, conversations concerning the nature of creativity and the use of technology in the arts have been triggered. In fact, Cohen's decades-long investigation of technical and creative creation never fails to captivate. His research, which was previously specialized, is now almost prophetically relevant in light of recent events. Cohen has become recognized as a

pioneer in this field and AARON's creations have stirred discussion about the possibilities and concerns of AI-generated art.

Why would a man from Cohen's background define a human being by default based on artificial intelligence? It is challenging to provide a specific response. However, in contrast to several other generative AI tools, AARON is not accessible to a worldwide paying audience with a range of conflicting expectations on the technology. As a poetic extension of Cohen's creative output, AARON is a piece of art that generates additional works of art by showcasing the artist's characteristics in his figurative work.

2.3. AI-Art: Generative Adversarial Networks (GAN's)

As we have seen, the use of Artificial Intelligence (AI) technology to create works of art, such as paintings, music and sculptures, has become increasingly common in recent years. However, these advances were made possible thanks to the development of Generative Adversarial Networks (GAN), which allow machines to generate original works of art with a minimum of human intervention. They were introduced by Ian Goodfellow in 2014 and “consist of a generator and a discriminator involved in a creative competition. The generator strives to produce realistic synthetic data, while the discriminator aims to distinguish between real data and AI-generated data. This contradictory process encourages the generator to continually perfect their craft, leading to incredibly convincing results.” (Cortuk, D., 2023) GANs “are based on a game, in the sense of game theory, between two machine learning models, normally implemented through neural networks,” whose objective is to study a collection of training examples and learn the probability distribution that generated them. (Goodfellow, I., Pouget-Abadie, J., Mirza, M. et al., 2020, pp.140-141) The generator, which begins with random noise and attempts to create synthetic data that mimics actual data, is one of the two basic parts of a GAN. The discriminator, on the other hand, assesses and discerns between synthetic and actual data. The discriminator seeks to enhance its ability to distinguish between genuine and synthetic data through training, while the generator seeks to make synthetic data more realistic so as to hinder the discriminator's ability to do so. Using the discriminator's adversarial loss, one may ingeniously introduce unlabeled samples into the training set and enforce higher order coherence. Numerous applications, including domain

adaptation, data augmentation, and image-to-image translation, have shown this phenomenon to be helpful.

Deep learning-based generative models are widely used, but GANs are among the most effective generative models (particularly when it comes to producing realistic, high-resolution pictures), producing amazing outcomes across a wide range of applications. We may better grasp their potential by looking at advancements in GANs made expressly to produce visual art, such as paintings, or to modify an already-existing picture. The power of GANs to democratize creative creation and replication is one of their most important contributions to the art industry. Ploin, A, Eynon, R., Hjorth, I., and Osborne, M. A. (2022) claim that machine learning algorithms have made this process possible and are upending conventional ideas of authorship and originality in the art industry. Artificial intelligence (AI) is a potent instrument for artists that will advance and test our perceptions of creativity, beauty, and the essence of art. The ability of GANs to recognize underlying patterns and styles makes it possible to produce fresh, eye-catching artistic creations. This is demonstrated by well-known programmes like Lensa⁸, which creates modified versions of original photos from word input, and Midjourney and Stable Diffusion⁹, which accept text as input and output images. Artists can input a content image and a style reference using methods like neural style transfer, which enables the GAN to produce an image that keeps the original's content while including the reference artwork's stylistic characteristics. This concept is exactly what made the learning systems start to auto-train more quickly and accurately. They have now advanced to the point where they can produce very accurate pictures that can't be distinguished from real-world objects, such as photos and movies of individuals who don't exist. (Marinaro, A., 2020) This technique provides countless opportunities for reinterpreting famous pieces of art, combining different styles, and developing whole new visual languages. Artists can investigate certain art historical periods, such the Renaissance, Baroque, or Surrealism, and capture the spirit of each in their works by varying the generating network's input circumstances.

GANs are being used by many modern technologists and artists to make art. Notable examples include the "Portrait of Edmond de Belamy" by the collective Obvious, which shocked the art world in 2018 by selling at Christie's for \$432,000 [Fifteen thousand genuine

⁸ Annex 5

⁹ Annex 6

portraits, drawn between the fourteenth and twentieth centuries, are the foundation of the artwork. An algorithm was created based on this data set to instruct the programme on how to paint portraits (ibid.); other notable examples include the sale of an AI-generated artwork by Beeple for millions of dollars at a Christie's auction; and, as we have previously discussed, Harold Cohen's AARON. These are just a few of the numerous instances that demonstrate how Artificial Intelligence (AI) is changing the dynamics of the art industry and related sectors. We'll look at more names and works later.

The extent to which GANs have transformed the production, dissemination, and consumption of art is indisputable. As a result, they have reshaped the prevailing conventional paradigms in the field of art and provided artists with never-before-seen tools for experimentation, innovation, and the redefining of conventional artistic processes in the context of digital art. Artists have embraced GANs as creative catalysts, pushing the limits of what defines artistic expression and questioning conventional wisdom by utilizing the power of machine learning algorithms. By enabling new forms of human-machine cooperation, encouraging multidisciplinary discussion, and democratizing access to creative production tools, the use of GANs has enhanced the creative environment by introducing fresh viewpoints and methods. Moreover, GANs have an impact on the dynamics of the art market itself in addition to shaping the creative practices of artists globally and beyond the boundaries of artistic creation. The incorporation of artificial intelligence (AI) technology into the art market presents novel concerns and intricacies, ranging from matters of authorship and authenticity to the assessment and commercialization of AI-created artwork. Consequently, the advent of GANs forces players in the art market to adjust to a quickly changing environment by forcing them to reevaluate traditional ideas of art, value, and ownership.

This shift emphasizes the need for a comprehensive knowledge of how AI affects the dynamics of the art market, taking into account technological progress, financial ramifications, and cultural shifts. Scholars and practitioners may acquire insights into future trends, foresee possible obstacles, and investigate prospects for sustainable growth and innovation in the expanding art and technology ecosystem by studying the junction of AI and the art market. Stakeholders may negotiate the changing art market scenario in the era of AI by collaborating across disciplines and engaging in critical inquiry, assuring the industry's future relevance and vitality in a world growing more and more digitalized. The problems

raised by this chapter will be further investigated when GANs and the evolving impact of AI on the art market collide. This will provide insight into potential trends and their ramifications for a range of stakeholders, including academics, dealers, collectors, and artists.

Chapter 3: Art Markets New Tool

“The digital revolution, which originated in the 1940s with the pioneering work of people like Alan Turing, is now experiencing its real breakthrough with the hype around AI and the success stories about machine learning. The debates about AI can serve as a catalyst for new and far-reaching forms of reflection about the digital transformation.”

-Gerfried Stocker, media artist, artistic director, and co-CEO Ars Electronica, Linz, Austria

The use of AI has grown more evident in creative creativity across all fields as a result of the ongoing shift in trends in the art world, much of which is caused by these new media that have revolutionized and subsequently reformed the traditional paradigms of the art market. Despite being called a "novelty," the creative sectors are beginning to welcome it more and more because they see the necessity for artistic expression that is "fresh" and renewed. We are aware that this is really necessary as it maintains price increases and grabs the public's interest in order to spark their curiosity about the newest thing. Furthermore, it is now evident that the COVID-19 lockout has expedited this trend by enabling the art industry to shift to online sales. This crucial time has encouraged collectors to adopt techniques like augmented reality simulators and online viewing rooms with high-resolution photographs to assist them see and acquire works, even if the majority of collectors still prefer the more traditional ways of purchasing and selling works of art. Virtually everything is now feasible that seemed unthinkable a while ago. Spending more time online exposes one to the major news. Artificial intelligence (AI) systems may continually learn from vast amounts of data analysis. This learning process allows the algorithms to create new compositions, which are variants of what would have required human interaction. They also aid in task automation and provide trend monitoring and prediction, which enables art experts to determine the present and prospective future worth of any piece of art.

All of these topics will be covered in this chapter. However, it's important to note that AI is having a significant impact on the art market and is changing both the business and the globe, so whether you're an investor, collector, or art fan, you should keep educated about this.

3.1. AI's effects on the dynamics of the art market

AI, in conjunction with GAN technological advancements, has significantly changed the dynamics of the art business. Artificial intelligence tools, such as large language models like ChatGPT and image generators like DALL-E, have the ability to synthesize and analyze enormous amounts of data, including auction results, art sales records, social media engagement, and art market reports. They can also automate tasks and use publicly available information to create new expressions of "art" in a variety of formats. This is in response to the explosion of digital art with non-fungible tokens (NFTs), which gained remarkable visibility during the COVID-19 pandemic. Additionally, they have the chance to level the playing field between their massive upstart competitors and small, progressive operations. (Schneider, T., Kinsella, E. et al, 2020)

Sougwen Chung, Anna Ridler, and Stephanie Dinkins are just a few of the several female artists that employ AI to question our perceptions and create provocative comments. Their work challenges our perceptions of technology's place in our lives and redefines the possibilities of creative production. It encompasses a wide range of mediums, from immersive installations and dynamic simulations to intensely personal storytelling and critical comments on societal concerns. Additionally, the algorithm for Google's "X degrees of separation" project was programmed by artist Mario Klingemann. The project's goal is to "unite" two pieces of art by displaying, based on the software's findings, potential connections between them. The system can relate any work to another over time and location by analyzing colour, pixels, and other characteristics. These artists challenge our preconceptions of art, technology, and the increasingly "mechanized" future by allowing us to investigate the nuanced relationship between human creativity and machine intelligence.

As previously discussed in the chapters, these AI processes are able to gather and assimilate data, as well as recognize patterns and connections that might not be immediately apparent to humans, thanks to the way they are constructed. Furthermore, the same mechanisms may be continuously modified to meet the needs of the market. Sang Tanzer, the creator of the German AI-powered art market data portal Sang.art, thinks AI can help consumers make sense of the data that is already available, improve access to pertinent information about the art market, and assist in making acquisition decisions. "I want to democratize and bring transparency to the art market, because 99% of art lovers have no

knowledge about the reasons to buy art as an investment," he said. (McCoole, V., 2023) In addition to offering AI-generated "growth" estimates for aspiring artists and reflecting more than 200 factors for data validation, ranging from personal details to historical sales records, Sang.art will enable users to get recurring alerts about artists and galleries they are interested in following. As soon as the technology is out, it also intends to form alliances with suppliers of art data. The algorithms would start by creating analytical profiles of individual artists, which would resemble the profiles of collectors that were previously discussed. These profiles would likely include information about the artist's educational background, gallery representation, institutional CV, past auction prices, collector base, social network, and the qualities and quantity of artworks created. High-level, data-driven forecasts on the probable worth of specific works by specific artists across a range of time periods, from a few months to many years, would be generated by these simulations. In a field where a tiny edge might mean millions of dollars, the final solution might be a "killer app" even if it only slightly increased accuracy. (Schneider, T., Kinsella, E. et al, 2020, p.32) In 2014, Carlos Rivera - a former gallerist who founded a start-up - implemented computational pricing estimates via his ArtRank platform. But in the years after its debut, the platform garnered both praise and criticism. The last public update of its artist indexes was released in December 2017, and there are no upcoming updates listed on the website. However, Kirby from Addis Fine Art notes that one constraint on these AI-enabled pricing tools is the absence of public data about primary market sales. "There is so much complexity, volatility, and uncertainty in how markets for different artists fluctuate, so I can't imagine an accurate predictive model for that," she said. "Long term, it may evolve into something viable, but the limited transparency in the market makes me nervous." (McCoole, V., 2023) Given that AI applications require a large amount of high-quality data in order to be truly valuable, we know that the art sector is relatively opaque, which makes it challenging to obtain reliable information. Furthermore, the fundamental feature of deep machine learning is that even its developers are unsure of the precise process or rationale behind the algorithms' inferences from the data sets. This raises the potential that there are defects in the underlying systems that are hidden from outside observers. The most accurate prediction models are not immune to random error. Nevertheless, there is no denying that AI is having a significant influence on the art market, evoking a variety of responses from investors, collectors, and aficionados by facilitating sales

between buyers and sellers. Despite a lot of opposition and criticism, there are already a lot of collectors that support AI's uniqueness and inventiveness as a symbol of our changing technological environment. This and other sectors have benefited from purchasers' adherence to this policy. Thanks to technology, "users would be able to access art over the web. Users would input their tastes into the site, and it would suggest other artworks they might like" (Adam G., 2014, p.120). This makes it feasible to research the market to determine what is "hot" and to take appropriate action based on this information to provide the aforementioned works with a commercial value and recognition for their authors. However, the majority of these research first started in the early 2000s when artificial intelligence (AI) technology were used to analyse data related to the art market, such as auction results, sales histories, and pricing patterns. Dirk Boll, vice-president of Christie's London's 20th and 21st century art, says that the ability of AI systems to extract data is one of their key benefits for auction houses. "We've been using it for almost a decade to prepare our cataloguing and specialist work: a preparation that, when I started working at Christie's, was done manually and took several days," he said. "Now it's done in a nanosecond with the help of the computer and manually edited and checked by our teams." (McCoole, V., 2023)

With the possibility for multifaceted databases and robust security, there are a plethora of AI-assisted sales systems available today to comfort consumers considering to spend thousands of dollars on art. While some programmes are providing exclusive discounts for the art sector, the majority boost online sales generally. In an effort to boost sales, marketing, and client interaction, auction houses and art galleries have started incorporating AI technology into their daily operations. It may even actually be a phenomena that saves time. With AI, tasks that once took days may now be completed in a matter of seconds. (Ibid.) In order to do this, a multitude of artificial intelligence (AI) systems employ machine learning algorithms to assess and forecast market patterns related to contemporary art. Artrendex is one of them; a private company founded in 2017 that offers tools for collectors, galleries and investors to discover emerging artists, namely the "company's system is an art-optimised application programming interface that analyses paintings at the stroke level to capture the spontaneous unintentional signature in the way strokes are rendered, enabling the art market industry, artists, creators, and designers to train their artificial intelligence models with few images."¹⁰

¹⁰ Taken from: Pitchbook.com. <https://pitchbook.com/profiles/company/231747-31#overview>

Regarding platforms that employ novel artificial intelligence (AI) technology, two notable examples are Artvisor and Artory, who have the esteemed auction houses Christie's and Sotheby's as customers and partners. Using AI algorithms, Artvisor is an online platform that matches collectors with a network of art experts and consultants according to their tastes, interests, and collecting objectives. Artory, on the other hand, is built on blockchain technology and makes use of artificial intelligence and cryptography to trace provenance and offer transparency in the art market. It provides a digital register where users may check ownership history, transaction histories, and authenticity of artwork.

Artory's algorithms scan metadata and picture data to verify artworks and spot indications of fabrication or tampering, while Artvisor's AI-powered recommendation engine evaluates data and user comments to deliver customised art suggestions and investment possibilities.

With the use of these tools, we are able to comprehend the many applications of AI algorithms, including data analysis for auctions, auction result prediction, process tracking, cataloguing, and pricing strategy optimisation. But, in order for a piece of art to be put up for sale, potential buyers would need to visit different locations, like galleries or art fairs, to view the piece and make a decision about whether or not to buy it. Since AI-powered virtual reality (VR) and augmented reality (AR) technologies go beyond gallery guided tours and are being used to create immersive art experiences and present works of art to remote audiences, it is also pertinent to discuss these technologies in light of the growing trend of art consumption online. Immersion reality-based exhibitions are evolving beyond a straightforward slide-show click. With the help of these new software, users may create 3D digital galleries and include whatever photographs they choose. After that, visitors may "walk" around the gallery, pause in front of a specific piece, and even read the text that is shown on the wall next to it. These programmes becoming easier to create and distribute to guests in a way that "benefits" them with every subsequent version. ArtPlacer is one programme that lets you examine art in its original location using only your mobile device. The application displays the artwork as it would seem in the designated space, taking into account its dimensions, when you point the camera in the desired location for its presentation. This makes it simple to argue that more effective and efficient ways of facilitating transactions have taken the role of conventional intermediaries, who serve as a link between supply and demand. The advent of new techniques to the appraisal and price prediction of artworks is reflected in the "augmentation"

of the human experience made possible by these same methods and the processes that underpin them.

AI algorithms analyse a variety of factors that impact the valuation of works of art, including artistic provenance, critical reception, cultural importance, and macroeconomic indicators, in addition to providing historical sales data and trend forecasting, to produce thorough valuation estimates. However, there are also issues with minimizing biases in training data and model topologies as well as reconciling algorithmic results with human evaluations of art's intrinsic worth. However, ethical concerns about the commercialization of art, cultural appropriation, and the erasure of marginalized voices highlight how crucial it is to use AI in the art ecosystem ethically. (Gangadharbatla, H., 2021)

The art industry is only one of the businesses that have started to use AI algorithms for due diligence. One area where AI technology appears promising is the authentication of artwork. Art market specialists are particularly enthused about this development since it has the potential to yield many of the same benefits as traditional authentication techniques, without some of the associated hazards. Though the number of fake artworks on the market was originally thought to be rather high, the traditional dependence on labor-intensive manual techniques of authentication has been substantially surpassed in recent years by the fast advancement of technology. Not only is this a laborious procedure requiring a great deal of experience, but most artworks up for sale may simply elide this stage of verification entirely, particularly with the introduction of the Internet. Nevertheless, AI-generated paintings were evaluated worse by art experts than paintings created by artists (less taste, fewer purchase and collecting aspirations). (Gu, L., & Li, Y., 2022, pp.1-2)

Artificial intelligence (AI) picture recognition technology can evaluate visual content to pinpoint popular topics, prominent artists, and up-and-coming artistic trends. These systems "learn" what things are based on the information that their developers input along with the data that is present in the training images¹¹. They are trained on datasets. This helps prevent fraudulent issues and make it easier to identify real pieces of art of unclear origin. It can also assist track trends in the creation and consumption of art as well as its authentication. Imagine if anybody, anywhere, could instantly and easily authenticate the artwork they are thinking about purchasing.

¹¹ To see the process of training and determining which data to use: Steven J. Frank, This AI Can Spot a Forgery, IEEE Spectrum (August 23, 2021), <https://spectrum.ieee.org/this-ai-can-spot-an-art-forgery>

One significant example is Hephaestus, which is *"the world's only company that can deploy artificial intelligence to identify artworks with greater than 98.2% accuracy."* ("Artificial Intelligence and art Authentication News", 2022) Additionally, it raises concerns about conventional authentication techniques, stating that they are susceptible to forgery. *"Historic pigments can be recreated or reused, and carbon dating measurements can be contaminated and manipulated,"* a business spokeswoman stated. (ibid.) its software, along with likely those of its rivals, adds a level of computational power and pattern recognition that the human brain just cannot match to the image of provenance identification, knowledge, and scientific analysis. Of course, having a strong library of already-existing artwork is crucial to the success of systems like Hephaestus. The capacity of the software increases with the size of the database, and the quantity of artwork with a digital footprint is increasing at an astounding rate. When a machine is trained with well-known pieces by a certain artist, it will "learn" the traits of that artist, including the power and feel of his brushstrokes and the calligraphy on his signature. After gathering thus much data, the computer will be able to determine, via the use of a designated percentage, if it was created by the artist in question with a particular degree of certainty based on its prior training. This scenario already occurred in 2019, with the AI of the Swiss company Art Recognition identifying a self-portrait by Van Gogh as having a 97 per cent probability of being an authentic work by Van Gogh. *"After being fed hundreds of original images (original and counterfeit Van Goghs), the AI pinpointed portions of the painting, highlighted in a generated heat map, that were key to assessing its authenticity to a probability of 97%."* (Lu, F., 2021) Christianne Hoppe-Oehl, a Co-Founder of Art Recognition says: *"The algorithm finds typical structural features, brushstrokes - it looks for thousands of possible common features and saves them. And then when we have an image of a painting people are unsure about, the computer does the comparison, whether it matches to what it has learnt or not."* (Ibid.) It's simple to draw the conclusion that a computer is better capable than a human expert at reaching more precise and practically realistic findings. A number of identification techniques improve the effectiveness of verifying a specific piece of art by reducing the amount of physical movement necessary for examination to just photos of the piece, saving time and preventing possible damage. AI can and has been able to detect the possibility that a work is real or fake, however previous systems of identification cannot generate a quantitative proportion of a real work. This is because there is a great deal of

diversity in the production of works of art, making an exact evaluation difficult. Moreover, the AI systems themselves would not be required to assume accountability for their evaluations. An AI computer essentially offers the foundation for the assessment: all the data in its training set. Experts, on the other hand, must supply the factual basis for their opinions. This research yields the percentage suggestion of a computer trained on all paintings assigned to an artist. An AI's identification would be based on a mechanical procedure rather than a person's subjective judgement. Even though it's not perfect, this method gets rid of some bias concerns that experts might have, such as incorrect incentives for the same services. Since the machines themselves can keep the findings about the authentication of works, using AI for this purpose also helps to strengthen the confidence of transactions in the market and offers legal protection for each actor.

Although artificial intelligence (AI) may be a useful aid in the authentication process, it's crucial to remember that authentication frequently calls for a blend of technology analysis, professional judgement, and historical study. Given that specialist knowledge and academic studies are always evolving, artificial intelligence (AI) algorithms should be employed as tools to assist human experts rather than as a full replacement for them. Moreover, judgements on authentication may be arbitrary and open to disagreement among specialists, underscoring the process' complexity.

In summary, since AI technologies are already a part of creative reality, all vendors, purchasers, and middlemen in the art industry should give them careful thought. Algorithms may be used by galleries to explore the vast expanses of the Internet for new or undiscovered talent that fits with their present plan, helping them to produce a cohesive and cohesive exhibition programme. Advisors, vendors, and auction experts might evaluate their customers' preferences to ascertain not just which other artists would most likely draw their checkbooks, but also which specific works by a certain artist would be most desirable. Collectors may be able to completely do away with the requirement for trustworthy consultants by utilizing machine learning in addition to their advice. (Schneider, T., Kinsella, E. et al, 2020)

However, depending too much on algorithms to make decisions gives rise to questions about openness, prejudice, and the commercialization of art. All parties involved in the art market would still benefit from using every resource at their disposal to boost sales confidence and steer clear of pricey legal disputes. As long as an AI system is applied sensibly

and in moderation, it may be advantageous before to, during, and possibly even after a sale. Furthermore, it's critical to comprehend public perceptions of AI-generated art as well as how they are received and assessed by the public, particularly as these works of art grow more prevalent. The spread of AI-generated art has put traditional ideas of worth and artistic merit to the test, sparking new debates in philosophy and ethics as well as a reassessment of evaluation techniques based on subjective standards and market signals. We shall look at these difficulties in the last chapter.

Chapter 4: Building a Blurred Bridge

4.1. What's artistic creativity?

"Passionate learning plus artistic creativity are what made little Tintoretto a bobby-dazzler instead of simply a paint-mixer for his dad."

- Gash, Jonathan, THE TARTAN RINGERS

Since Socrates claimed that divine inspiration is a prerequisite for creativity, a plethora of literature in the fields of philosophy, aesthetics, and psychology has been written about creativity and art (in the dialogues *Ion* and *Phaedrus*). A more romantic and expressivist perspective holds that the artist's creativity comes from "something" inside of him, such as an authentic feeling connected to his "self," and that this creative process is a kind of "self-expression." Another, more "modernized" method (though the idea itself dates back to antiquity) holds that creative inspiration often begins with the idea of mimicking an existing thing, such as a city, a landscape, etc. Nevertheless, researchers of creativity are unable to examine what they are blind to, regardless of the methodology they use. (Sawyer, R. 2014, pp.3-7) Sawyer intended to convey with this remark that anything had to be comprehensible and conveyed in order to be deemed creative. Thus, broadly speaking, the ability to generate novel and inventive concepts, solutions, and creations in a wide range of artistic fields—including the visual arts, music, literature, design, architecture, film, advertising, and pure theory and concept creation - is what we mean when we speak of artistic creativity. It is a complex phenomena that is not only aimed at one particular social group. It is shaped by the historical and social backdrop, individual life experiences, and the artist's own conceptions of creativity that are quite apart from daily life. Something that only makes you happy but has no real use. (ibid.) These concepts include embodied action, a relational process in the context of people and nature, an oscillation between asceticism and sociocultural participation, suffering, and a force greater than life. They also include creativity as a dynamic developmental and learning process marked by dedication and persistence. This was not always the case, though, since artists did not start to set themselves apart from craftspeople until the Renaissance. With the Enlightenment's impact, intellectuals came to be associated with the capacity for creation rather than merely skill or technique. The word "fine arts" was initially used to refer to the

combination of poetry, music, and visual arts later in the 18th century. (Kristeller, 1983, as cited in Kurt, D.E., 2018)

Consequently, artists began to be referred to as "creatives." As the mental ability that allows people to come up with new ideas, imagination has been defined as the central idea of creativity (Sawyer, R. 2014, pp.23-25). In the modern performing arts, artistic creativity is now a crucial step in the creative process that involves using creative imagination to come up with novel and inventive ideas. It's strongly associated with the sense of immersion or absorption that steers clear of a static link between concepts and objects, motion and cognition, inside and outside, presence and absence. The brain's entire neural workspace is involved in this endogenous process, which enables the synthesis of internal memories, external sensations, and stored emotions. It is more than just a broad ability; it is a characteristic of human intellect. To varying degrees, everyone of us is able to demonstrate creativity in our lives. But it's still a mystery since it deals with the investigation and alteration of mental spaces—a subject Margaret Boden examined. This "conceptual space" is implied by creativity as an ethereal setting where creative activities occur. Boden (2004) discusses these conceptual spaces and how computational concepts—which deal with artificial intelligence and the study of how to make computers capable of accomplishing things like the human mind does—can be used to turn them into new ones. One is deemed creative in an exploring meaning when they have a novel and inventive thought inside this particular conceptual area or way of thinking. This inventiveness is important since it can open one's eyes to possibilities they had never considered. But is it possible to include artificial intelligence in one of these scenarios?

4.2. Is AI capable of creating art?

Imagination, while seemingly unique to humans, may also be a dubious idea when it comes to artificial intelligence. The convergence of art and digital media has long been a topic of discussion among critics and artists, but with the introduction of NFTs and the subsequent broadcast of series such as DALL-E and Midjourney, the importance of this existential question has grown. It may be inferred from a study of the many AI art pieces that, despite their differences from human intelligence, artificial intelligence is capable of some degree of creativity, although a restricted one. However, the fundamental query still remains: what

really constitutes creative originality, anyway? Does the creation of art need physical labour? Does it have to be entirely original? Does the idea matter as much as, or perhaps more than, the outcome? These are highly individualized topics that are frequently debated. For instance, when a picture is created, how much of it may be done by a computer before it is no longer considered art? Using the help of apps like Procreate and Photoshop, digital painters may sketch and "paint" using a stylus, but this still requires human labour. They may, however, also use historical photos and instruct the software to make patterns, add colour, or - more lately - add something that never existed. Even while art created publicly using AI-driven programmes has room and opportunity for subjectivity, its level of originality is still debatable. Similar to Sawyer, Boden begins his explanation of computational creativity by examining human creativity. Additionally, it offers a comprehension of the creative potential of machines, demonstrating that computers may be creative to some degree. This is because computer art is sometimes seen as fake or even impossible due to its absence of certain fundamental components of real art. One may argue against the authenticity of AI art by pointing out that computers do not express their feelings via art in the same way that humans do. Argue that as computers lack feelings or aesthetic sense, they have no desire to convey a social or political viewpoint. When assessing the legitimacy of a piece of art based on the identity of its creator, these counterarguments have validity. Furthermore, every piece of art must convey a certain kind of communication through an aesthetic or emotional connection since the very definition of "art" is an experience of human communication. Nevertheless, Boden's understanding of creativity makes an effort to comprehend both the problems and the actuality of artificial intelligence creativity. She outlines three categories of creativity: combinational, exploratory, and transformational, to help explain what creativity is and how the art of AI may be categorized and defined in terms of creativity. (Boden, 2010, as cited in "Criatividade combinatória, exploratória e transformacional", 2020) The first kind is concerned with the development of concepts or artifacts using previously existing concepts or artifacts combined through combinatorial processes. New combinations can be created intentionally or intuitively, and they can involve any kind of notion or concept. Not only must the combination be novel, but it must also be profitable. Some researchers concentrate more on the "internal" workings of the machine, or the method by which the piece of art is made, while others concentrate on producing art with their machine and the "external" product. The

so-called "Turing test", which asks participants to identify which piece of art was made by a person and which by a machine, is one potential illustration of the first strategy. If individuals are unable to distinguish between the two, that is, if they believe the artwork might have been created by a human, then it passes this test even if it was generated by a computer. However, is a machine truly creative if it satisfies this test—many experts in this subject assert that machines have already done so? One notable example is Botpoet.com, a Turing test site for AI-enabled poetry generators that gathers several poetry bots and asks visitors to determine whether an AI or a human wrote a poem after comparing AI-written poems to poems by human poets. It's still challenging for most human viewers to tell which content was produced by AI or by humans. But considering the increasing number of platforms (the main one being Christopher Strachey's "Love letter Generator", chapter 2) and human relevance and evaluation, it is possible to confirm that poetry with AI can, to some extent, produce novel and unfamiliar, yet relatable and understandable outcomes by fusing familiar concepts. However, this is still a significant obstacle because AI is unable to appreciate the value of human taste or aesthetics. Combining inputs and creating a new image is simple for an AI, but the outcome may be silly or rejected; in order to become valuable, the output must be engaging and compelling.

The second kind is the result of attempting to comprehend creativity via a non-behavioral lens. This approach is associated with investigating conceptual spaces, which are defined as "structured styles of thinking" (Boden, 2010, p.32 as cited in "Criatividade combinatória, exploratória e transformacional", 2020). These include "theory in chemistry or biology; ways of writing prose or poetry; styles of sculpture, painting, or music; haute couture or choreography; [...] summarising any disciplined mode of thought familiar (and valid) to a given social group" (Ibid). It is possible to start with an existing way of thinking, embrace it, and apply its principles to come up with fresh and useful solutions within those constraints. Certain conceptual regions contain ideas that are conceivable or feasible. Possibilities are explored in exploratory creativity without altering "structured styles of thinking." For instance, we may contend that embodiment and/or imagination are prerequisites for creativity. Another question to consider is if the capacity to produce demands the capacity to assess and value art. As an analogy with "strong AI" versus "weak AI," which is discussed in the first chapter, "strong" computational creativity refers to the attempt to build a machine that has a

genuine creative process and capabilities (rather than just imitating that process and those capabilities). As per the source, the third category entails alterations in one or more dimensions that are considered relatively essential and constitute a certain conceptual space. Boden (2010) argues that a set of constraints creates a conceptual environment that facilitates the construction of structures inside it. The space will vary if any one of these restrictions is modified or removed. Ideas that were previously impractical (with relation to the original conceptual space) become plausible. Transformational innovation is associated with the birth of new paradigms in science, technology, art, and philosophy, it is far rarer and has a higher "cognitive cost." We see that a startlingly new range of conceivable issues appears when a new conceptual space does. We work with issues that were not only unimaginable, but also nonexistent. Additionally, this place modifies our prior understanding of other conceptual spaces. Transformational creativity not only changes the lens, the vision, and the observed world, but its historical trajectories. By applying these definitions to various cases of AI art, it is possible to gain perspective on how to approach artistic creativity in terms of artificial intelligence. As Boden (2009, p.27, as cited in Kurt, D.E., 2018) states, "the argument that computers cannot do anything creative because they can only do what the program tells them to do is a misleading statement, since computers can only do what their program allows them to do. By training through a well-designed program, a computer can explore new ideas within a structured conceptual space." Furthermore, all these approaches show how Boden intends to solve the subjective problem of creativity in a concrete and scientific way, emphasizing the skills of mental and mechanical processes and not the psychological aspect. Cardoso and Wiggins (2007), for example, define computational creativity as "the study and simulation, by computer means, of behavior, natural and artificial, which would, if observed in humans, be considered creative." (as cited in Coeckelbergh, M., 2017, p.289) Similarly, Colton and Wiggins (2012) define computational creative research as the philosophy, science, and engineering of computational systems that display actions that impartial observers would take in order to be creative. (Ibid.) Since these definitions put the criteria on the side of human observation, they are nevertheless intriguing. It appears that the important thing in this situation is not if a computer is creative, but rather if it can appear creative. The quality of the artwork ultimately rests on how the audience perceives it, even if the artist insists that it qualifies as art because he intended to convey an emotional and aesthetic phenomena. That is,

if AI lacks purposeful self-expression, can the audience's appreciation of an AI piece of art suffice to justify the work? Is it possible to claim that the fact that an AI created a piece of art does not make its subjective enjoyment of it valid?

4.3. Emerging of a “New Art Genre”

“The amount of control he ceded to AARON changed throughout his life according to his interests as an artist and it was not his intent to establish a process that could run without him.” (Yavuz, S. K., 2024, February 26., Harold Cohen’s pioneering AI works provide essential context for conversations about generative art. *The Art Newspaper*)

The works of great artists and their inventive ways serve as evidence to the unique powers unique to the human intellect. It is noteworthy to note that the field of art and creativity has long been viewed as the exclusive province of mankind. From breathtaking paintings to the contentious "Fountain," artistic expression has propelled artistic development and ignited revolutionary societal shifts. It is important to remember that Marcel Duchamp's choice to use a urinal to construct an installation sprang from a moment of heuristics. "A heuristic moment is a moment that initially appears insensitive but ultimately leads to a shift in paradigms," as defined by Niklas Hageback and Hedblom, 2021 (as cited in Gross, E.-C., 2023). Something that appears to be a mythical depiction of art in our everyday lives develops in the midst of the chaos of the art markets and the diverse systems that define the various creative styles: "AI Art," which is marketed as "art created by machines.”

We are aware that the so-called "AI artist" lacks human-like aesthetic and expressive talents. It is impossible to deny the existence of some form of self-expression, nevertheless. Beginning with the alteration of preexisting styles, the initiative of junction between the data entered by a human and the machine's capacity to translate and apply the same data creates something connected to "oneself" as an artist. The computational mind of AI can still create a certain kind of emotional communication with the audience, adding a self-expression element to the creative process even if it lacks the intuition or intention to convey your feelings. This is precisely what AI brings to your art as a moving feature. Consequently, this type of creativity refers to the outcome of the creative process rather than the act or the person who executes it. In this sense, artificial intelligence-produced mechanical artifacts, or works of art,

can be considered socioculturally creative outcomes. Like any other conventional piece of art, they are marketed.

A variety of disciplines, including computer programming, art, literature, poetry, film, and more, come together in the subject of AI art. It unites several social and cultural groups in addition to referring to the creative community within a certain sector. Fascinatingly, most programmers who write the algorithms for computational art are not artists, and they don't have to be. They do, however, create an object that has the ability to create art. Therefore, in order to construct these algorithms that mimic the artistic output of a human artist, the programmer himself must engage in a creative process. Two distinct thoughts must be combined in order for the AI art process to produce something new. Computing art, often known as AI art, is a novel concept that combines the two disparate ideas of art and computing systems.

This genre blends the digital and computational aspects of machine intelligence with human aesthetics, culture, and the analogue qualities of the human mind. In addition, designating a certain kind of art as autonomous validates the right of AI-generated art to be recognized as a legitimate component of the creative sector and facilitates understanding, categorization, description, and evaluation. In actuality, the field of artificial intelligence is already a creative one that has spread well beyond of computer laboratories and into literary works, film festivals, art galleries, and music industries. However, a lot of people contend that the programmer's creativity - rather than the machine's - is what's at play. These counterarguments, which deny the creative function of the machine, primarily contend that since the machine lacks consciousness, it is incapable of having any interests, preferences, or morals that would allow it to understand or evaluate what it is doing. However, wouldn't it be going too far?

4.4. Ethical & Philosophical Considerations

We are aware that evaluating the worth of art is challenging, particularly modern art. This is due to the fact that the consumption of it is driven more by the tastes of its users than by its practical purpose, with a work's designation as "good art" being determined in part by subjective and arbitrary factors. Therefore, it becomes very difficult to develop objective or acknowledged standards to precisely judge the worth of works of art because we are talking

about something subjective. Specifically, as Danto (1964) points out, "the valuation of contemporary art becomes more complex as contemporary artists may intentionally stress the work's underlying idea, rather than its beauty." (as cited in Lee, J.W., & Lee, S.H., 2022, p.5) It also matches the concept of "AI Art," which is a practice of the "now," which further complicates the issue of computational art's legitimacy. It would be impossible to take computational art seriously if one were to approach works of art with certain philosophical presumptions in mind. These normative presumptions include the following: art must be honest, rare, distinctive, and transformational; it must be based in emotion; it must originate from human activity; and it must entail the transmission of human experience. These presumptions nevertheless pose a problem to the idea of computational art; the answer is to attribute human capacities to computers or to "look" at computational art in an emotive rather than a critical manner. Nevertheless, since the people in charge of this aren't ready to change their worldview just yet, this remains impossible. It is still considered to be "very recent." Another strategy is to neutralize the machine and declare the human programmer to be the original creator. It is a common misconception that computers are incapable of purposeful creativity, yet this does not mean that artistic creativity in AI is unavoidable. It is feasible to argue that creativity occurs in artificial intelligence that is neurologically inspired to some degree. However, because the computing mechanisms that really produce the work are indirect, this method is as flawed. Put differently, the idea of computer art itself becomes inconsistent when the agency of the computer is acknowledged as a tool used by the real artist, who is a human, rather than as an actor. This is because the AI program's agency is necessary for the human programmer to create these artistic creations on their own. Moreover, neither the creator nor the AI program's effects are planned or foreseen. The AI programme evaluates the data that the developer provides it, and then creates the artwork in response. Consequently, it is possible to argue that AI creativity is predicated on the capacity to transcend AI's role as a tool. The AI computational system is the agent that exposes the artifacts of the AI art genre and empowers the human programmer since it is more than just a tool. AARON is one instance of this. As was previously said, computers have a digital computing system, whereas human intellect is a combination of analogue and digital systems. Thus, it cannot be said that intelligent programmes are inherently incapable of learning, as Harold Cohen notes. Humans pick up knowledge via experience and use their own bodies to

build physical talents. Aaron, nevertheless, doesn't actually exist. He never felt the pen's pressure against the paper as a result. It is also unable to comprehend movement dynamics in the same way that the human cognitive system does. Nevertheless, in terms of his personal development, even in the absence of some components like physical encounters or human goals, AARON showed indications of an experimental type of creativity. He began learning how to draw abstract objects and then progressed to drawing human people, rainforests, and other subjects. In addition, he acquired the ability to make decisions on the colours to utilize, which was a critical development for Harold Cohen. He trained his programme in his style, which involved an artist-program partnership. Can the machine, given this partnership, not be seen as an artist, given that it employs its own language and displays a certain level of creativity? In such scenario, might your invention qualify as a real piece of art? First of all, we may say that a machine can be deemed artistic if the person who programmed it developed a creative artistic process. Put another way, though, if the definition of art were based on objective standards, it would appear that robots may have a decent chance of being recognized as such, given that all they would need to do is be programmed to do certain actions. On the other hand, if there are just subjective standards, the computer appears to have an even greater chance of being viewed as an artist who produced a piece of art, given that the concept of art itself is still up for debate. If social consensus or subjective judgement are the only factors that matter, then the machine just requires these to function. The idea that robots might become artists is open-ended, just as the definition of art is. The outcome is the same from both angles. However, since the issue is simply getting viewers' acceptance, this debate ignores the significance of judging the piece of art, including whether it is "good" or what kind of technique was utilized. Even if computers are capable of producing art, it's important to realize that finding a "good" piece of art and its creator requires applying varying degrees of ingenuity and "taste." Even in this regard, though, it is challenging to arrive at a meaningful and universally acknowledged conclusion since the definitions of great art and a good work vary depending on the situation in which the observers find themselves. Therefore, the concern that seems more urgent may lie first in the images produced by AI that pose as originals or works of art created by humans, as it seems impossible to come to a consensus regarding the legitimization of art created by AI and there is still time and space for the subjective evaluation of art made openly with AI-oriented programmes. These "works"

highlight the doppelgänger traits obtained from some of the so-called "IA Art," essentially appropriating existing work and using "style transfers" of another person's creative process for their own gain. The setting in which these works are born offers nothing cultural to the art world. These pieces frequently copy other artists' work and deny them credit. devices capable of creating art just by copying human inventiveness.

Because AI-generated art is intended to demand less effort, we may claim that, generally speaking, there is still prejudice against it. Future research should examine the variables that affect people's accurate identification of the creators of artworks and connect this to any potential bias against those artworks because mental structures are what primarily influence aesthetic judgements. It is plausible that this bias could be mitigated by incorrect knowledge of attribution. Additionally, art recreates situations that force people to pause and consider matters that are vital to their existence by bringing to light conflicts, political tensions, and truths that society would rather ignore or not see. How many artistic genres were born from a tension similar to that created around art made with AI and which later became legitimate? "Art is what we call art, what we decide art to be, what we agree to call art. Art is subjective, depending on the individual, or it is a matter of collective agreement and institutionalization. It is individually or socially constructed." (Coeckelbergh, M., 2017, p.292) Unquestionably, artificial intelligence is much more than just a straightforward technical tool for creating art; it represents a new way of thinking about art and has an impact on human cognition. It also aids in understanding the workings of the human mind when it comes to artistic representation and has the capacity to be both an artistic and a work of art. Maybe it would be better to ignore this debate and concentrate just on the artwork itself. What more proof do we need to consider the same piece of art legitimate if we do this and it arouses in us a genuine and honest emotion, although one that the artist may not have always conveyed clearly?

Conclusion

My goal in conducting this research was to learn more about the ways that emerging AI technologies are not just transforming the art world, but also how they function. In the beginning, I gave an overview of my study, which began with defining artificial intelligence (AI), tracing its historical development, and outlining its primary goal—to meaningfully respond to Alan Turing's inquiry, "Can machines think?" The question itself suggests that the primary goal of artificial intelligence is to become as intelligent as humans. The study discussed in the first chapter demonstrates how, in some situations, machines can resemble people. Even after comprehending the various outcomes of the imitation game and the evolution of various forms of artificial intelligence over time, we can still state that a computer cannot be deemed fully intelligent until it possesses the ability to learn, which is a fundamental feature of intelligence and proves that it has not yet attained the level of human intellect. But we shouldn't take this for granted. The striking parallels between cognitive sciences and computational studies are not coincidental. Machines have a lot of potential because they already "think" within the bounds of what they can learn. This is because, in contrast to the human brain, which functions in concert with consciousness and emotions and is inherently arbitrary, machines are somewhat more "rational" because their actions are a pragmatic reflection of the data that has been inserted into them. Does this imply, therefore, that machines are incapable of being creative? This study also aims to determine if a computational system may represent an a priori quality that is unique to humans once it has gained information through learning. But, before offering a response, it was important to comprehend the early attempts at integrating artificial intelligence into the artistic realm. And following a few noteworthy attempts, like Christopher Strachey's "Love letter Generator," which was the first machine to produce literary texts by combining specific algorithms, we arrived at the foundation of what constitutes an effective system and a more precise definition of "AI art," thanks to Harold Cohen's AARON. Despite the absence of some components, such as physical experiences and human goals, this machine showed remarkable indications of an experimental kind of creativity in terms of personal growth within the environment in which it was created. Aaron began learning how to draw abstract figures and then progressed to drawing human beings (which required symbolic three-dimensionality), rainforests, and other scenes. In addition, he improved his ability to make decisions about the colours to

employ, which was a huge step forward for Harold Cohen and unavoidably had a big effect on the art world.

A brief discussion of the growing practical application of new AI technologies to assist in the tasks associated with commodifying works of art is included in the third chapter. Actually, because they have revolutionized a number of its aspects, the new efficient technologies have had a significant, complex impact on the art markets. In terms of business, it's interesting to observe how this has improved sales and marketing in general. The algorithms in question have been able to anticipate artistic values, tailor recommendations for collectors, and act as inclusive "bridges" between supply and demand, all of which have increased the efficiency and accuracy of artistic transactions. All of this has been made possible by their quick and accurate analysis of market trends. Among the aspects discussed is the manner in which a gallery's curating might be executed and then seen. AI has aided curators in the analysis of vast quantities of data, the planning of shows, and - most intriguingly - the creation of virtual galleries where a potential collector may view the current exhibitions in any specific gallery with just a single click. Furthermore, massive volumes of data may be compared and analyzed to find trends and spot copies or forgeries using machine learning techniques. Through generative AI, this has improved the confidence and transparency in the art market, which is advantageous to both collectors and artists. Nevertheless, even if these techniques are getting better, they still require a human expert's analytical "eye." As of right now, there are very few reasonably simple AI-based applications available for both evaluating and authenticating artistic creations as well as for creative work with texts, images, and music, all of which have the potential to produce results with a certain level of aesthetic convergence. Nevertheless, generative AI has made art production and consumption more accessible. It lowered entrance barriers and increased art's accessibility to a larger audience. For artists to produce visually spectacular and captivating pieces, costly equipment and professional training are no longer prerequisites. Additionally, generative AI has made it possible to create digital art that is readily shared, duplicated, and distributed across a variety of internet channels, therefore reaching a worldwide audience. This blurs the distinction between art created by humans and art created by machines, sparking discussions around intellectual property rights and the artist's role. This influence may manifest itself in modifications to the artistic process and the final output. Most significantly, though, it makes a difference in how we view and

comprehend art and its place in human society. The prior theories of human creativity that were covered in the preceding chapter have given way to a new understanding of creativity. This will make an effort to place AI art in the context of an independent creative genre, proposing a paradigm shift and providing a conceptual framework for philosophical discussion of machine art that connects the arguments in favour of and against giving computers the status of artists. Opinions on this topic vary greatly in scope. There are several theories that contend AI is only a tool for art rather than an artist. It is evident that the framework of "emotional expression" in AI art differs from that of human art. It's also true that computers are not designed to communicate ideas or sentiments in the same way that the human mind does. These arguments, meanwhile, run the risk of undervaluing AI art as a genre. Once more, the key distinction between the AARON programme and other modern art-generating programmes is that Cohen trained his programme in accordance with his style, resulting in an approximately 40-year artist-program collaboration, rather than using his programme to produce art that mimics the style of other painters. Since its birth, there has been an even greater need to distinguish serious and in-depth artistic work utilizing AI from other artistic manifestations in the AI fashion, or "style transfers," which highlight the similarities between some of the so-called "AI Art" and other forms of art whose "creativity" is intrinsic. It is true that AI can produce a vast number of variations on already-existing works of art as well as entirely new ones, but I believe that this only means that AI can generate art rather than actually creating it, since AI lacks human creativity and consciousness. This is true even though there are no clear-cut standards for defining what constitutes art. While it can show a certain level of creative originality, it still lacks the human knowledge required to fully comprehend the significance of what it is making. Nevertheless, it can be used to assess the quality of art. Furthermore, AI programmes still rely on their programmers to launch the creative process since they are started by human programmers and employ computational algorithms designed by human programmers. But this is not a static condition; in fact, many artists may utilize it today to develop their artistic practices and even create entirely new works. We must not lose sight of the fact that this technology is unique due to its autonomy. Its perceptual mechanism is different, therefore it produces new notions that weren't available before. Since algorithms create things based on their own sense of learning, they may be thought of as artists. It is our responsibility to assign the feeling that

best fits our perception to the artistic creation. Furthermore, despite the fact that critics of AI-generated works claim that these pieces suffer from its computational side due to the challenges associated with comprehending and/or embracing novelty, it is precisely this aspect that sets them apart and lends authenticity to their work. Even if AI art isn't motivated by emotion, it still has the power to evoke strong feelings in us - as long as it's done honestly. I conclude by urging that they be acknowledged as legitimate creative artists rather than only as means to an aim. Investigate the forms of algorithms' production capability in greater detail rather than concentrating just on their mechanical aspects. However, I am also aware that these robots lack, therefore this assertion will always lead to contention, which in and of itself makes the topic interesting and even intriguing.

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Annex of concepts/definitions

This annex deals with some of the more technical concepts and definitions, in order to get a broader and deeper understanding of the context in which they are mentioned throughout the dissertation. All explanations of the concepts/definitions referred to in this annex belong to the sources mentioned.

1. Analytical Engine: Though the Analytical Machine was never constructed, Charles Babbage's vision of a machine that could automate any mathematical operation was realized. Ada Lovelace, Babbage's collaborator, is sometimes credited as being the first person to programme a universal computer because Babbage used punched cards similar to those found in automated looms. But Turing's computers differed from all other calculating machines in use throughout the 1930s (and much of the 1940s) and from all earlier mental experiments (including Babbage's) in a few key ways.

Any computation that was given to Charles Babbage's Analytical Machine may have been completed. Babbage is the only person known to have invented or attempted to construct a device of this kind previously. The mill, the warehouse, the reader, and the printer were the four parts that made up the machine's design. These are the fundamental parts of every computer made today. It could perform direct multiplication and division, required the representation of decimal numbers, was divided by five units, and could be programmed using punched cards—a concept taken from the Jacquard loom—making it a blueprint for a digital computer because each of the ten discrete positions on the wheel represented one of the four arithmetic functions. On the other hand, a lot of computers in use at the start of the 20th century relied on analogue, continuous representations, including shifting electric currents or rotating devices with different speeds. These analogue computers were capable of speedy job completion. As an illustration, two electrical currents can be added by only permitting the passage over certain wires, as opposed to actually determining the two values and computing their total numerically. Analogue computers were susceptible to mistakes caused by noise and had rigid orders of accuracy because they lacked discrete states. Using binary arithmetic implemented in on/off electronics, Konrad Zuse created the first programme controlled digital computer during World War II, replacing Babbage's decimal arithmetic. This was a significant

simplification that made speed and precision advancements possible, which is crucial for modern "digital" computers.

The British government's cryptanalysis group, of which Turing was a part and which worked independently (and extremely covertly) produced Colossus, which was dubbed the first completely working electronic digital computer. Turing also played a key role in breaking the German Enigma code. To put it another way, the Analytical Engine, though never finished, is a mechanical device that was the first machine deserving of the name computer. In contrast, the Turing machine has always been a theoretical notion achieved rather than a physical mechanism. (Information based on Freiburger, P. A., & Swaine, M. R., 2023. *Analytical Engine*. In *Encyclopedia Britannica*)

2. Gödel's theorem: Gödel's incompleteness theorems are among the most important findings in modern logic. These discoveries revolutionized our knowledge of logic and mathematics and had a significant influence on mathematics philosophy. Additionally, there have been attempts to use them in other philosophical fields, albeit the viability of many of these applications is considerably more questionable.

Gödel's theorems require an explanation of its fundamental terms, such as "formal system," "consistency," and "completeness," before one can comprehend them. Generally speaking, a formal system consists of a collection of axioms with inference rules that permit the development of new theorems. The set of axioms must be decidable or finite, which means that there must be an algorithm—an effective method—that makes it possible to automatically decide whether or not a given statement counts as an axiom. If this condition is satisfied, the theory is called "recursively axiomatizable," or simply "axiomatizable." One may automatically ascertain whether or not a certain rule of inference has a valid application thanks to the efficient operations of the rules of inference (of a formal system). Therefore, it is also possible to ascertain if a given finite sequence of formulas reflects a valid derivation or a proof, given the axioms and inference rules of the system.

When every statement in the language of the system can be used to deduce (or prove) both the assertion and its negation, the formal system is said to be complete. A system is deemed consistent if it lacks a statement inside it from which both the assertion and its negation may be inferred. Only consistent systems are relevant here because, according to a basic tenet of

logic, any claim in an inconsistent formal system may be inferred, making such a system trivially complete. In mathematical logic, a formal language and a deductive system constitute a formal system. The formal language is made up of symbols and formula construction rules, and the deductive system provides instructions on how to use logical inference to deduce theorems from axioms.

Gödel found two different but related incompleteness theorems, which are commonly referred to as the first and second incompleteness theorems. "Gödel's theorem" can refer to any of these two, usually the first one, by itself or in conjunction with the other. Gödel's 1931 First Incompleteness Theorem states that any consistent formal system F that allows for the performance of some elementary arithmetic operations is incomplete because it contains statements of its language that are neither provable nor disproved in F . This means that there are true propositions that cannot be proven inside any consistent and sophisticated enough formal system to define arithmetic. Stated differently, there are statements that are true but that are not able to be verified or denied within the system.

It does, however, have ramifications since it challenges the idea of a thorough and well-organized formal foundation for mathematics. It shows that there will always be claims that a formal system cannot capture in order to capture all mathematical facts, regardless of how robust the system may be.

Gödel's Second Incompleteness Theorem is an extension of the first theorem's results. It states that no consistent formal system, even if it includes sufficient arithmetic to describe consistency, can prove consistency by itself. "For any consistent system F within which a certain amount of elementary arithmetic can be carried out, the consistency of F cannot be proved in F itself." Essentially, a formal system must be inconsistent if it can show its own consistency.

Gödel's Incompleteness Theorems, to put it briefly, are revolutionary findings that have profoundly changed our understanding of formal systems and mathematical reasoning. In addition, they cast doubt on the concept of mathematical certainty and highlight the limits of formal systems' ability to represent mathematical truth. They also highlight the gaps in mathematical knowledge and the weaknesses of formal systems. The close ties between Gödel's Incompleteness Theorems and Alan Turing's concept of thinking machines, both of which expand our understanding of the possibilities and limitations of formal systems and

computers, must also be emphasised. Gödel's findings highlight the shortcomings of formal systems, even while Turing's work provides formal models for computing, demonstrating the existence of undecidable problems and elucidating the nature of computability. (Raatikainen, P. (2022). Gödel's Incompleteness Theorems. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy* (Spring 2022). Metaphysics Research Lab, Stanford University., from <https://plato.stanford.edu/entries/goedel-incompleteness/#Int>)

3. Lucas Penrose constraints: The Lucas-Penrose Thesis, often referred to as the Lucas-Penrose thesis, is a philosophical thesis that was separately put forth by Sir Roger Penrose and J.R. Lucas. centre on Kurt Gödel's 1931 proof of Gödel's Incompleteness Theorem, a key finding in mathematical logic. JR Lucas presented a contentious anti-mechanism argument in his 1961 book "Minds, Machines, and Gödel." According to the reasoning, Gödel's first incompleteness theorem demonstrates that the human mind is neither a computer, or a Turing machine. Since then, there has been a lot of discussion about the script. If Lucas's thesis holds up, the widely accepted Computational Theory of Mind—which holds that the human mind functions like a computer—is debunked. Furthermore, "strong artificial intelligence," the theory that holds that it is theoretically conceivable to create a computer with cognitive capacities comparable to those of a person, is untrue if Lucas's reasoning is accurate. Nonetheless, there have been a lot of challenges to Luke's reasoning put out. Some of these arguments centre on the consistency or inconsistency of the human mind; Luke's argument falls short (for reasons that become evident later) if we are unable to demonstrate either that human brains are inconsistent or that they are consistent. Some disagree with the several idealizations Luke provides in his argument. Others still point even more script flaws. Physicist R. Penrose revitalized Lucas's script by formulating and defending a version of it in two works, *The Emperor's New Mind* (1989) and *Shadows of the Mind* (1994). The arguments put out by Lucas and Penrose share many similarities, but they also diverge significantly in a few key ways. Penrose contends that Gödel's argument implies a number of statements about consciousness and quantum physics, such as the necessity of a physics revolution in order to acquire a scientific explanation of consciousness and the requirement that consciousness originate from quantum processes. Moreover, there have been challenges to Penrose's reasoning and the different conclusions he draws from it. Some contest the anti-

mechanism argument in and of itself, others wonder if it encompasses the conclusions he believes it does concerning consciousness and physics, and yet others challenge his conclusions. remarks concerning physics and awareness in addition to his critique of mechanisms. (*Lucas-Penrose argument about gödel's theorem*. (n.d.). Utm.edu., from <https://iep.utm.edu/lp-argue/>)

4. **FORTRAN:** For scientific and numerical computation, Fortran is a widely used computer programming language. Although Fortran's appeal has waned outside of the scientific community over time, scientific programmers continue to be among its ardent users, and the language is still widely employed in industries including weather forecasting, financial trading, and engineering simulations. Fortran is a good language to use when writing code when performance is a priority as it allows programmes to be highly optimized to operate on high-end systems.

Fortran is a compiled language; more precisely, it is precompiled. Put another way, before you can execute your written code on a computer, you need to carry out a unique procedure known as compilation. Here's where Fortran varies from interpreted languages like Python and R, which execute commands through an interpreter at the expense of compute performance.

The initial name of Fortran was derived from the abbreviation for Formula Translation, emphasizing the language's background as one intended only for mathematical computations. Fortran is somewhat unique among programming languages in that it predates the current transistor computer - the first Fortran programme ran on the IBM 704 vacuum tube computer - having been created in the early 1950s and released in 1954. Since its creation, Fortran has outlasted many country governments and is still widely used in many specialized scientific fields today. Regretfully, Fortran is sometimes described as a "legacy" or "outdated" programming language. I disagree with this assessment since, despite its lengthy history, Fortran is continuously being updated, new features are being created and added to the language standard, and the language is still supported by a sizable community. With the publication of the most recent Fortran standard in 2018, numerous new capabilities were added, maintaining Fortran's relevance as a highly performant language for modern scientific

computing problems. (*Introduction to FORTRAN*. (n.d.). Github.io., from <https://ourcodingclub.github.io/tutorials/fortran-intro/>)

5. **Lensa:** Lensa AI has gained steam as a photo editing tool for Android and iOS. The app was developed by Prism Labs and launched in 2018, following the success of its debut app, Prisma, which launched in 2016.

It allows users to perfect their selfies by touching up facial expressions, removing unwanted objects and adding a host of different photo filters and themes from an extensive library of art styles. In addition to photo editing, videos are given the same treatment and you can even create music videos.

Lensa AI runs on the open-source deep learning AI model, Stable Diffusion. The open source element means that any company can use Stable Diffusions text-to-image AI without needing a license. And the deep learning aspect denotes how the model works. In essence, it scrapes millions of images from across the internet, which it then compiles into a database and then uses the images to learn and apply techniques to generate digital art. (Tortike, M. (2024, January 5). Everything you need to know about the Lensa AI app. *Growthtribe.io.*, from <https://growthtribe.io/blog/everything-you-need-to-know-about-the-lensa-ai-app>)

6. **Midjourney and Stable Diffusion:** Midjourney and Stable Diffusion are two leading generative AI applications that offer highly advanced functionality in their creation of images. While these two generative AI image creators share a similar focus, they are significantly different in their approach to AI image generation. Their difference boils down to a preference of artistic nuance versus extensive customization:

- Midjourney is a generative AI tool that takes in text prompts and translates them into visually stunning, art-like images that push the boundaries of digital creativity. This platform is particularly revered in the artistic community for its ability to generate unique, high-resolution images that often resemble hand-painted artworks. Midjourney provides a major AI platform for exploring artistic possibilities. (Best for creating artistic, visually compelling images)
- Stable Diffusion is a generative AI app renowned for its ability to not only create realistic, highly detailed images rapidly but also deliver an open-source platform ripe for

customization and technical innovation. Unlike the more guided experience of Midjourney, Stable Diffusion offers a more expansive interaction, allowing users to modify its code and customize its capabilities to their needs. (Best for extensive customization)

(Ayuya, C. (2024, January 31). *Midjourney vs. Stable diffusion: Best AI art generator of 2024*. eWEEK., from <https://www.eweek.com/artificial-intelligence/midjourney-vs-stable-diffusion/>)

