

Artistic Creativity in Artificial Intelligence

A DISSERTATION PRESENTED

BY

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TO

THE DEPARTMENT OF CREATIVE INDUSTRIES

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF

MASTER OF ARTS

IN THE SUBJECT OF

ARTS & CULTURE

RADBOD UNIVERSITY

NIJMEGEN, NETHERLANDS

APRIL 2018

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ABSTRACT

Computational art is a creative field that indicates to a futuristic idea of artificial intelligence. Despite the common belief that a machine is unable to create art, current developments and examples in computational art present a new form of art. Reaching to a broad variety of artistic dimensions, artificial intelligence programs are generating poetry, music, visual art, architecture and design. This study introduces artificial intelligence as an artistic phenomenon and analyzes the artifacts that are produced by computer algorithms. Thus, it provides a theoretical framework and a philosophical discussion on the creative abilities of artificial intelligence. Furthermore, it concerns with the entitlement of artiness, by presenting a reflection on the dynamics between the artwork, the art-maker and the art audience. The analysis of computational artworks and the computer programs that generate those artworks show that the function of artificial intelligence is far beyond being merely a tool to create art, it is rather an actor that have an artistic and creative agency. With this study, I suggest an alternative approach in the conceptual definition of art, which can help to explore the possibilities of a new art genre.

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Acknowledgments

THIS THESIS IS AN OFFSPRING OF THE MARRIAGE OF ART AND TECHNOLOGY, in the junction of my passion for futurism, idealism and aesthetics. In a time of transition into a digital world with a nostalgic feeling for an analog lifestyle, the idea of artificial intelligence art has been a romantic thought for me. Being both an utopian and a dystopian image at the same time, artificial intelligence is a concept that I want to explore in the domain of art. During the time of my study on this field, I have been inspired by many people, who had looked into the future from a visionary perspective. As a person who has been a stargazer and a dreamer since childhood, I am very grateful to the philosophers, scientists, writers, artists and other dreamers in the history of mankind such as Gottfried Leibniz, Ada Lovelace, Alan Turing, Isaac Asimov, Philip K. Dick and Arthur C. Clarke, who imagined and contributed into the idea of intelligent machines. Furthermore, I would like to acknowledge some of the people who supported me one way or another throughout my academic year.

First of all, I would like to thank my family for all the encouragement and love during my studies. I am very grateful to my father, who is an artist and also another dreamer, for instilling me with curiosity since my childhood, and to my mother, who has been my biggest source of inspiration, who supported me to follow my dreams and taught me the virtue of the love for learning.

Secondly, I would like to thank my supervisor, Dr. Vincent Meelberg, who supported and encouraged me with his valuable insights, his guidance and his caring attitude during my research. I am also very grateful to my second reader, C.C.J. Van Eecke, who helped me with his insightful contributions and shared my enthusiasm for the philosophy of art.

I would also like to thank my friends, Derya Demirçay, Zeynep Azar, İmge Özdemir and Akay Akbıyık, who have been great support for me and gave me insights throughout my research. Furthermore, I would like to thank Ersin Ejder, Engin Özkan, Naz Mol, Tuğçe Esmer, Peter Kaurin, Haiko Sleumer, Iggy t'Hart, and my housemate Cinthia Vega, those who inspired me during our long sessions of brainstorming, shared my passion for science-fiction and made Netherlands a great place for me.



Introduction

Imagine a robot doing art. This is a futuristic image that I am fascinated by since I became interested in science-fiction. With its mechanical arms, a robot draws a picture, writes a poem or a song. This idea is not just a futuristic image or a science-fiction movie scene anymore. Besides computational skills, machines have also been integrated into the creative fields such as music, design, architecture, visual arts, literature, etc. As a person who has a strong enthusiasm for futurism and art, I felt the need to explore the field of computational art, where these two concepts melt and mix. Therefore, the

existence of artistic creativity in a robotic entity is the focus of inquiry of this study.

Computer scientist Donald E. Knuth (1995) suggests that, "Science is what we understand well enough to explain to a computer. Art is everything else we do.(...) and Science advances whenever an Art becomes a Science." This study will look into this transition between the science and art, where the artworks can be created by algorithms instead of paintbrushes. By concerning this symbiotic relationship between art and technology, computational creativity is a field that explores the evolving correlation between human intelligence and machine intelligence.

"These are golden, and in appearance like living young women. There is intelligence in their hearts, and there is speech in them and strength, and from the immortal gods they have learned how to do things." (Lattimore, 1951)

The possibility of ascribing human features to a machine is a philosophical question that puzzles people's mind ever since our relationship with tools has started. A 'thinking machine' has been one of the biggest inquiries of humankind since the early days of history. The timeline of the mechanization of the thinking dates back to 6th century BC, to Homer's poem *The Iliad* which is codified, introduced into written literature and assorted with automata from the workshops of the Greek god Hephaestus (McCorduck, 2004: xxiii). Since then, philosophers and scientists have grappled with the question if the human mind is computable or if it could be emulated on other substrates. This inquiry has been the basis of modern artificial intelligence technology.

Artificial intelligence is a fiction which came true. Before being a creative industry itself, it has been a subject of creative industries in cinema and literature. Starting with 1927 movie *Metropolis*, sentient machines have been an important element of science-fiction movies such as *2001: Space Odyssey* (1968), *Bladerunner* (1982), *The Terminator* (1984), *Ghost in the Shell* (1995), etc. A synthesis of man and machine; the 'cyborg' (short for cybernetic organism, meaning a hybrid of machine and biology) has become a recurrent concept, and as a subgenre of science-fiction. Overall, intelligent machines

have been the subject of both dystopian and utopian literature. The theme of artificial intelligence in fiction has been sometimes adopted as an entity that helps human society, and sometimes as an antagonist of humankind. Can machines recognize their existence? In other words, can they be conscious? The concept of a sentient machine has been an idea that both excites and scares people at the same time. While the ultimate goal of machinary programs has been seen as their capability of reaching the human level of thinking, the possibility of machine intelligence surpassing humans is a common dystopic image that has become closer to be a possibility than being fiction. However, in which fields and on which scales that machines can reach or go beyond human level is the fundamental question. Computers have already exceed human intelligence in several domains such as playing chess, diagnosing certain medical conditions, buying and selling stocks, and guiding cruise missiles (Kurzweil, 1999: 2). However, to perform subtle tasks such as recognizing humor, describing objects or writing a summary of a movie, are problematics of computational intelligence.

Art and creativity are fundamental features inherent in human intelligence, and fundamental signatures of humankind. It is a way through which we express our sentience. Artistic expression is attributed to be a human aspect related to consciousness. Therefore, it is seen as a human experience that is associated with awareness, will, perception, thought, memory, intelligence, creativity, identity, and autonomy (King, 2007: 152).

Today, Artificial Intelligence (AI) is a phenomenon that is spreading increasingly in various fields of our life, with the progress of technology. Since computer technology has been advancing since the 50s, the research on Artificial Intelligence and its capabilities have become an important subject of discussion. The major inquiry about computers; whether they are capable of doing things what human does, has become one of the biggest questions of our age. This inquiry has a big place in Creative Industries as well. When the machines started to generate artworks, they have become creative producers themselves. From being a fictional theme in dystopian/utopian literature and science-fiction movies, intelligent machines have transformed into the writers of those movies (see Chapter 2) and stories.

Therefore, their role in creative industries has been rapidly changing. Even though artificial intelligence and its artistic applications have been important scientific topics for decades, their popularity and recognition have been increased in recent years.

The recent popularity of artificial intelligence in the creative fields points to the emergence of a new art genre. Nevertheless, the legitimacy of this art genre and the concept of creativity in the field of artificial intelligence are still controversial subjects that need academic attention. Since the conventional definition of ‘art’ defines this notion as a way of communication between human subjects, new academic research that deals with AI art needs alternative approaches to the concept of art, to be able to put forward a classification for AI art. With this motivation, in this thesis I will explore whether machines can display artistic qualities, and whether this display process is really creative. Furthermore, even if there is an artistically creative process, are the outcomes really art, and if so, how is it related to human art?

As cited by Walter Benjamin in his famous essay *The Work of Art in the Age of Mechanical Reproduction*, Paul Valéry wrote in 1931: “We must expect great innovations to transform the entire technique of the arts, thereby affecting artistic invention itself and perhaps even bringing about an amazing change in our very notion of art” (Benjamin, 1935: 1). With the emergence of artisan machines and computer programs, this change in the notion of art has become more visible. In addition to the notion of art itself, the role of art-maker and the artwork is another topic of discussion that requires attention. In reference to Benjamin, this study will try to provide an academic perspective to the work of art in the age of mechanical *creation*. Computer art, machine art, artificial art, algorithmic art or generative art; the artworks that are produced by computational systems bring forth the question that I want to focus on in my research:

Can Artificial Intelligence be considered as capable of generating Art?

Method and Approach:

In order to answer this research question, this study will contain three chapters, each one referring to one of the main concepts: Artificial Intelligence, Creativity, and Art. The latter two, that have generally been attributed to human intelligence, will be analyzed in terms of the first concept. After introducing the artificial intelligence as the subject of the artistic act, secondly, the process of this act will be analyzed in terms of creativity, and furthermore the outputs of this process will be discussed concerning their artistic qualifications.

The first chapter focuses on the concept of artificial intelligence and introduces this concept by describing the related notions to AI, for a comprehensive understanding of this technological phenomenon. Therefore, the first chapter is framed by the first question related to artificial intelligence, as a subquestion of this study: Can machines think? This question aims to understand the concept of artificial intelligence by describing it in comparison to human intelligence. With this aim, this chapter further asks the question: How do machines think? Pursuant to these questions, my objective in the first chapter is to provide a technical description of artificial intelligence, as a basis for the further philosophical discussions on the artistic creativity of AI.

Within this technical perspective, Chapter I will explain the concept of artificial intelligence in its historical development process. The history of machine intelligence research, the present and the predicted future of AI technologies will be explained by referring to pioneers of this field, such as Alan Turing (1950), John McCarthy (2007), and Ray Kurzweil (2005). Turing's ideas about intelligent machines and their ability to learn human capabilities have been shedding light into modern research on artificial intelligence. Modern AI theorists such as McCarthy and Kurzweil take Turing's studies a step further with the current developments in AI technology. As a futurist, Kurzweil's predictions on AI address his concept of singularity, which suggests that artificial intelligence will be able to reach the level of human intelligence including the capabilities such as art and creativity, and will even surpass

human intelligence at some point. According to Kurzweil, “neither utopian nor dystopian, this epoch will transform the concepts that we rely on to give meaning to our lives” (2005: 24). Creativity and art are two concepts that have been transforming with the influence of artificial intelligence technologies.

The second chapter addresses the concept of creativity, and the artificial intelligence’s capability of generating creative outputs that have an artistic quality. As a novelty that has been attributed to the human mind, creativity is the main inquiry of this research regarding artificial intelligence. Therefore, after the question whether machines can think, Chapter 2 will address the question: Can machines create? Regarding this question, the concept of creativity will be limited to artistic creativity. The main reason for this limitation is the fact that artistic creativity is a marvel of human intelligence that is accepted to require emotional and aesthetical motivations. Artificial Intelligence is a computational system which has no emotional faculties, therefore its artistic ability is a peculiar phenomenon that needs academical attention.

In addition to technical aspects, artistic creativity of AI is also a philosophical issue. When questioning the creative abilities of AI, one should consider the concept of creativity as an event that is more than a token of the human mind. To present a theoretical discussion on the artistic creativity of non-human entities, the concept of creativity will be defined as a performance and as a notion. This definition will mainly refer to Keith Sawyer (2014) and Margaret Boden (1998; 2004; 2009). While Boden specifically focuses on the AI creativity and the philosophy of AI art, Sawyer provides a theoretical basis for the concept of creativity in general, what creativity is and how can it be identified. Thus, these two main resources will be able to present a comprehensive understanding of creativity, and how it can be manifested in artificial intelligence.

Furthermore, several examples of the artworks generated by artificial intelligence programs will be analyzed in this chapter, providing case studies. Through these case studies from different art genres, it will be possible to apply the theoretical frameworks of the concept of creativity to the tangible examples of AI artifacts. Moreover, various technical applications of artificial intelligence, such as machine

learning, deep learning, and artificial neural networks will also be explained in reference to the case studies of AI artworks.

Chapter 3 aims to explore AI art and how to classify it as an autonomous art genre. In this chapter, I will refer to Boden (2007) to analyze the authenticity of AI art. The discussion on the authenticity of AI art will also consider the counter-arguments against the authenticity and legitimacy of AI artworks. In this sense, I will try to resolve these counter-arguments in reference to Boden. As an expert on AI art and computational creativity, Boden's arguments on AI creativity are important because they are updated to be compatible with recent AI technologies. Furthermore, I will discuss the role of artificial intelligence as an art-maker. Within this discussion, the role of the audience and the artwork will also be analyzed.

When the function of machines surpasses being a tool and extends to be the maker, a paradigm shift occurs. This shift also addresses the phenomenon of how machines are transformed into artists, from being artifacts. In this case, machines or computer programs escalate to an active position in art-making. They are no longer passive tools to serve humans, but actors that have autonomous capabilities.

The practical changes in the artistic function of the machines also accompany some theoretical changes in the notion of art. Therefore, to explore the concept of AI art, it becomes necessary to adopt an alternative approach towards the notion of art, the art-maker, and the audience. In this chapter, I will refer to Susanne Langer (1953) as another source for qualifying AI artworks through the perspective of the audience. Langer's ideas about the role of spectator's feedback will provide a theoretical ground to support the argument that AI artworks can deliver an emotional or aesthetical element through human audience. Thus, the paradigm shift also occurs in terms of expression. Without an initial self-expression of the art-maker, the flow of expression takes place from the audience to the artwork, instead of flowing from the art-maker to the audience.

In this case, the role of the human audience also escalates to a more active position. The human

audience becomes entitled to translate a machine-made artifact with human emotions and aesthetical stances. An AI artwork is an output that lacks the self-expression of the maker, therefore it is a product that is not encoded for any meaning by its maker. This is what makes an AI artwork a peculiar artifact. Every product in the realm of art and culture is encoded with a meaning. Unlike AI artworks, in every artifact by a human maker, there is an encoded meaning inherent to it. Since the AI has no conscious, its art-making occurs without the process of encoding. Therefore, the role of human audience here is not to decode as in other cultural products. The role of human audience changes from the decoder to the encoder. Pursuing this idea, I will also refer to the Deleuzian concept of affect (1994), in addition to Susanne Langer. Their approach of taking the audience perspective as an initiator will support my arguments that present an alternative paradigm in the qualification of artistry.

As a part of the evaluation and analysis, Actor-Network Theory (ANT) of Bruno Latour (1996) provides a theoretical background which empowers the agency of non-human actors. Actor-Network Theory is an approach that avoids anthropocentrism, in a sphere that involves the association of humans and non-humans. It offers a methodology to examine the entitlement of non-human actors, such as artificial intelligence. In order to validate AI's position as an art-maker, ANT approach will be a framework to analyse the agency of non-human actors. By applying Latour's methodological approach to AI artworks, chapter 3 will illustrate the acting performance of artificial intelligence.

This thesis will explore the status of computational artworks and offer an interdisciplinary approach inspired by philosophy, neuroscience, cognitive science and phenomenology. It aims to provide a comprehensive understanding of AI art, the philosophical dimensions of artistic and creative capabilities of artificial intelligence, and the possibilities of this phenomenon as an art genre. Moreover, it contributes to the studies related to art and creativity in general, by introducing alternative ideas on the definition of an artwork, and how artificial intelligence can be considered as an artistic entity and how it can enrich our vision of artistry.

We shaped our tools and thereafter our tools shaped us.

John Culkin, 1967

1

Human Intelligence vs. Machine Intelligence

IN ORDER TO REACH AN UNDERSTANDING ABOUT ARTIFICIAL INTELLIGENCE (AI), as the main focus of Chapter 1, it is crucial to start with human intelligence and its features. As described by Oxford Dictionary, artificial intelligence is ‘the 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 Therefore, it can be suggested that concisely, human intelligence is the baseline and the ultimate goal of artificial intelligence. From this perspective, the basic term ‘intelligence’ addresses thinking, and ‘artificial’ addresses machinery and computational systems. The most basic question about AI is their ability to *think* like a human.

This chapter aims to introduce the concept of artificial intelligence and the related concepts within this field. What is ‘machine’ in terms of a computational system, and what is ‘thinking’ in terms of a machine? How can a machine be considered ‘intelligent’? By posing these basic questions and framing a discussion on the possibility of human-level abilities of AI, this chapter will try to provide a pathway from intelligence to creativity. Since creativity is a core element of intelligence, a discussion on the artificial creativity should be grounded by describing the intelligent machines in comparison with human intelligence.

1.1 WHAT IS ARTIFICIAL INTELLIGENCE?

John McCarthy, widely recognized as one of the godfathers of modern Artificial Intelligence (AI) studies, describes Artificial Intelligence as the ‘science and engineering of making intelligent machines, especially intelligent computer programs.’ (McCarthy, 2007:2). In his terms, intelligence is the ‘computational part of the ability to achieve goals’ (ibid.). This definition also applies to human, animals, and machines. As he states, it is not yet possible to reach an independent definition of intelligence which doesn’t build upon human intelligence, because it is still problematic to characterize the kinds of computational processes that should be defined as ‘intelligent’. There are still certain mechanisms of intelligence that are not completely understood (McCarthy, 2007:3).

As stated by McCarthy, the early scientific research on Artificial Intelligence started after World War

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

II, when a number of people started to work on intelligent machines (2007:4). Among these people, the English mathematician Alan Turing is referred as the pioneer of this field, who also coined the term ‘Machine Intelligence’. He is also accepted as the first person to reason that the best way to research AI is programming computers, rather than building machines (ibid.). After his first lecture on Machine Intelligence in 1947, Turing published his first article *Computing Machinery and Intelligence*, where he discussed the conditions for considering a machine to be intelligent, in 1950. In this well-known article, Alan Turing starts his reasoning by proposing the question: “Can machines think?” (Turing, 1950: 433).

To answer this question, Turing states that one should begin with defining the terms ‘machine’ and ‘think’ (1950: 433). In his investigations about machine intelligence, he does not postulate a conceptual distinction between man and machine. By refusing to define this distinction, he makes a point that it is difficult to frame such definitions because machines are ‘men-born’ (Turing, 1950: 435). Therefore, to reach a solid and specific understanding of the definitions, he suggests the ‘Imitation Game’. Basically, this is a game of three people, A (woman), B (man) and C (of either sex) as an interrogator. The interrogator asks questions to player A and B to determine which one of them is a woman and which is a man. The role of player A is to trick the interrogator into making the wrong conclusion, while player B tries to assist the interrogator into the right one. Hence, Turing asks the question; “What will happen when a machine takes part of A in this game?” (Turing, 1950: 434). Can a machine trick the human interrogator?

Called The Turing Test, this test is still valid today to answer the question whether a machine could trick a human observer into the judgment that it is a real human, while the human participant tries to persuade the observer in the same way. Therefore, as a machine intelligence test that refers to the machine’s ability to imitate the human intelligence, it also provides an understanding of human and machine interaction.

1.2 MACHINE INTELLIGENCE VS. HUMAN INTELLIGENCE: TECHNOLOGICAL SINGULARITY

John McCarthy states that the concept of intelligence is not a single, solid thing that one can simply answer as yes or no to the question ‘Is this machine intelligent?’ (McCarthy, 2007: 3). As he explains, intelligence involves various mechanisms that computers are capable to carry out some of them, and not capable of performing some others. He argues that the computer programs today can be considered as ‘somewhat intelligent’ (McCarthy, 2007:3). It can be suggested that even the studies on human intelligence are still in development. Therefore, the research on AI also provides an understanding of the human intelligence as well, by going alongside cognitive research. In this sense, it is possible to claim a parallel between the AI research and neuropsychological & cognitive research on human mind & brain. Artificial Intelligence research 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: 2).

In his 1950 article, Alan Turing suggests the concept of the learning machines: ‘instead of trying to produce a program to simulate the adult mind, why not rather try to produce a program that simulates a child’s mind?’ (Turing, 1950: 456). As a mechanism that is full of blank sheets, a child’s mind is a system that could be programmed easily. The teaching process of a machine would seem to be different than the human child because children learn by combining physical experiences with cognitive mechanisms. However, as Turing argues, it is possible to apply similar methodologies, as a machine learns in a way that may seem like random behavior. According to the Turing Test, if a machine can achieve to pretend to be human to a knowledgeable interrogator, it should be considered as intelligent. As McCarthy argued, a machine that passes the Turing test should certainly be considered as intelligent, nevertheless, it could still be considered intelligent without knowing enough about humans to imitate a human. (McCarthy, 2007:4) Still not successfully passed by any AI, this test aims to analyze the

possibility of a human-level form of intelligence, where the line between AI and human intelligence gets blurred. But is it possible for artificial intelligence to reach a human-level intelligence?

Following that question of when AI will be successful in the Turing Test, the concept of ‘Singularity’ (Kurzweil, 2005) presents a time-wise frame which predicts the possibility of human-level AI. Singularity is a term coined in the same period as the Turing test. The famous computer scientist and futurist Ray Kurzweil defines singularity as the timeline where the non-biological intelligence (a machine) matches the range and subtlety of human intelligence (2005: 204). In his work *Singularity is Near* (2005), Kurzweil claims that once a computer reaches the level of human intelligence, it will necessarily surpass it (2005: 127). Kurzweil’s conceptualization on AI and singularity is also based on the parallelism between the research of AI and the neuroscientific and cognitive research on human intelligence. Regarding his predictions on the future of AI, he suggests that the computational capacity which is required for an AI (i.e. a non-biological medium) to emulate the richness, subtlety, and depth of human intelligence will be possible in less than two decades (Kurzweil, 2005: 128).

The answer to the question that whether human brain different from a computer, as Kurzweil suggests, depends on how the word ‘computer’ is defined. Current computers that we use today are mostly digital computers that perform one or couple of computations at a time at high-speed. Unlike those computers, human brain combines both digital and analog processes. It is a hybrid in which the analog and computational systems are working together. Furthermore, human brain performs most of the computations in the analog domain, using neurotransmitters (i.e. chemical reactions) and related mechanisms. On the other hand, unlike computers, the neurons in the human brain have a slow speed in executing the calculations. As a whole, most of the neurons work at the same time, by carrying out up to one hundred trillion computations simultaneously (Kurzweil, 2005: 131).

‘The pattern-recognition capability’, which is one of the pillars of the human intelligence, stems from the massive parallelism of the neural system in the human brain. Defined as a ‘chaotic dance’ (2005: 131) by Kurzweil, this network of the human brain also performs random interactions (ibid.).

According to Kurzweil, it is also possible for the neural network (AI) to develop such a solid pattern in decision making. Although they lack the kind of mechanism that would provide them to work at the same time including the arbitrariness, there is no reason they will not be able to develop such system by simulating human intelligence. They can develop the capability of performing the non-biological recreations of this parallel system. By working on such pattern-recognition systems, Ray Kurzweil indicates that such trainable non-deterministic computing systems are already in use in this field for decades.

Furthermore, although it is possible for a digital computer to simulate the analog computer or a hybrid (analog-digital) computing such as the human brain, the contrary is not possible. An analog one cannot simulate a digital computer. Nevertheless, in terms of engineering, analog computing is much more efficient. While an analog computation can be performed by only a few transistors for certain electrochemical processes, a digital computation needs thousands of transistors for such a process (Kurzweil, 2005:131). This phenomenon derives from the binary system of digital computing. Conventional digital computers can store the numbers in their memory, and they are able to process those stored numbers with simple mathematical operations. By stringing these operations together, they can do more complex things, such as AI algorithms. As mentioned above, all these operations of a computer are accomplished transistors, which are basically the microscopic versions of a switch button. A transistor can either be on or off, like a switch. In other words, it is either 1 (on) or 0 (off). To store any number, symbol or letter the long strings of these binary based codes are used in a digital computer. Based on those binary digits (or bits), a digital computer performs its calculations by using circuits called 'logic gates', which are made from a number of transistors connected together (Woodford: 2017).

By comparing the patterns of bits, the logic gates enable an algorithm to perform – that is to say to make a decision. However, because logic gates are based on binary calculation systems, current digital computing lacks the arbitrariness or the random interactions as in the human brain. Thus, on top of

not having the human capacity to have a massive neural system, arbitrariness or randomness appears as a problematic phenomenon for an artificial intelligence.

1.3 INTELLIGENT MACHINES AND BEYOND: QUANTUM COMPUTING

Regarding the lack of parallel neural system in binary computers, the concept of ‘quantum computing’ appears as the possible upgrade for digital computers to be able to reach human-level intelligence. As the analog domain of the human brain provides the most of the neurons to work simultaneously, the binary computational systems cannot achieve this kind of simultaneous working mechanism. Concerning this lack of binary computers, quantum computing is a theoretical system for computers to gain analog features of the human brain in the future. Thus, a quantum computer is a phenomenon that is presented by the scientists about the predictions for technological singularity.

As the name suggests, this form of computing refers to the quantum theory, which is the branch of physics that deals with the world of atoms and even smaller (subatomic) particles inside them (Woodford, 2017). Quantum computing is a field that studies how to harness some of the strange aspects of quantum physics to use in computer science (Yanofsky, 2007). In terms of computing systems, quantum computers refer to the atomic level of transistors, which will provide a system that can process a mass multitude of transistors simultaneously, like the human brain does. This means that instead of working in serial (doing a series of things one at a time in a sequence), it can work in parallel, doing multiple things at the same time (Woodford, 2017). In quantum computers, quantum systems generally have a probabilistic state. When a quantum system is manipulated, it corresponds to multiplying the state by matrices. In other words, the system will provide more than one results when it is executed. Each click will correspond to one matrix multiplication. At the end of the computation, the state of the system will be described by the resulting vector and change of state will be calculated (Yanofsky, 2007: 6). To understand the functioning of this process, a comparison between digital computing

and quantum computing would provide a perspective. As aforementioned, digital computer chips contain modules, which contain logic gates that contain transistors (chapter 1. 2.). In terms of quantum computers, atomic size of transistors will work as a switch that can block electrons from moving in one direction. While the transistors shrink into the scale of atoms, electrons will be able to transfer themselves to the other side of the blocked passage, by means of a process called quantum tunneling. This way, multiple transistors can provide a parallel working system.

However, in the quantum realm, physics works rather differently from the predictable ways. Therefore traditional computers would not make sense anymore. In terms of this milestone point for the technological progress, by building quantum computers, scientists are trying to apply these unusual quantum properties to computers. The key features of an ordinary computer—bits, registers, logic gates, algorithms, and so on— would also have analogous properties in a quantum computer (Woodford, 2017). These analogous features, which the current artificial intelligence lacks, are the required elements for a possible human-level AI in the future. Quantum computers, which are planned to use quantum mechanical phenomena, will be able to use to perform calculations and manipulate data. Instead of bits, a quantum computer has quantum bits (or ‘qubits’), that work in a particularly intriguing way. In a quantum computer, the qubits work based on the fundamental ambiguity, which is inherent to quantum mechanics. Unlike the ‘bit series’ of 0 and 1 in a conventional computer, the series of qubits in a quantum computer are essentially 0 and 1 at the same time (Kurzweil, 2005: 112). While a bit can store either a 0 (zero) or a 1 (one), a qubit can store a 0 (zero), a 1 (one), both 0 and 1, or an infinite number of values in between, which means that these values can be in multiple states at the same time. So according to the estimations about quantum computing technology, it can be suggested that a quantum computer’s ability to work in a parallel system would make it ‘millions of times faster than any conventional computer’ (Woodford, 2017).

Although the quantum computers are still largely theoretical, there is an encouraging progress in this field. Starting in 2000 with a five-qubit quantum computer owned by MIT professor Isaac

Chuang, in 2011 *Nature Magazine* has reported that the scientists at D-Wave Systems Inc. have accomplished to design a 128-qubits of a quantum computer², with 50 times more quantum bits than the first quantum computer. This means that the increasing ability to process quantum bits and transistors allow for an increased ability of decision-making. In this sense, with current developments, it can be suggested that the practical production of quantum computing systems is more than a theory. Estimates suggest a quantum computer's ability to work in parallel would make it millions of times faster than any conventional computer. The development in the quantum computing is important because it addresses the development of artificial intelligence. As stated by Ray Kurzweil, when these technologies will be able to be integrated into the computational systems, they will perform in a way that outpaces the computational capacities of a human brain (Kurzweil, 2005: 108).

1.4 TYPES OF ARTIFICIAL INTELLIGENCE

It is possible to classify Artificial Intelligence into three linear categories. The first step is Artificial Narrow Intelligence (ANI) or 'weak AI', which is already in use in our daily life. It uses the Big Data³ and complex algorithms to arrange the sequence in social media timelines by matching the information, or to play online chess, etc. Although the narrow AI has an intelligence that is limited to a specific field and possibly would not be able to pass the Turing Test, it has an enormous impact on daily life, such as financial markets or infrastructure. Since the 1990s, telecommunication information systems have been dominated by digital technologies and as from early 2000s, the majority of our technological memory has been transferred into digital format (Hilbert & Lopez, 2011:60). In other words, the storage system of humankind has evolved from analog to digital. As a critical concept based on the process

²<https://www.dwavesys.com/press/vancouver-canada-based-d-wave-systems-reports-quantum-processor-nature-magazine>

³Gartner IT glossary defines the Big Data as '...high-volume, high-velocity and high-variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision making' (<https://www.gartner.com/it-glossary/big-data>).

of digitalization, big data refers to an analytic phenomenon that traditional data processing systems are insufficient to deal with (Boyd & Crawford, 2011). It can be predicted that as the big data grows, the artificial intelligence will also get smarter. Because the more human information will be loaded in digital storage, the more it will contribute to the big data network, and the more information will be accessible for computational systems.

The next step of the AI scale is Artificial General Intelligence (AGI) i.e. strong AI. This form of AI is predicted to be reached in a couple of decades. The AGI technology will basically provide the machines to achieve the daily tasks of humankind. Because of their digital computational system, as explained above, it is so much easier for a machine to do advanced calculus than doing daily human acts; such as walking, climbing stairs, getting milk from the fridge or spotting sarcasm. In this sense, the engineering of the digital-analog hybrid human brain is far ahead of computers. However, as estimated by recognized AI scientists such as Kurzweil and McCarthy, once the strong AI is achieved, it will not take a long time for them to surpass human intelligence. The key point of strong AI is that it will be able to learn by itself, and therefore upgrade itself on its own, without any instructions from human agency. In other words, the maker of the AGI will not be in charge of programming all the possibilities or outcomes. By being given a baseline capacity, the machine will be able to build itself on his own as it develops. This phenomenon is called as ‘recursive self-improvement’, which describes the software that is able to write its own code in repeated cycles of improvement (Spacey, 2017). Therefore, as a self-improving software, the more intelligent it becomes, the better it will get at improving itself.

This exponential growth would be the key point of strong AI, which will potentially lead to a superintelligence, where the moment that aforesaid concept of ‘technological singularity’ would take place. At this level the third step of AI, Artificial Superintelligence will emerge as the ultimate form. After this milestone in AI technology, for a superintelligent AI, a critique aspect of intelligence will be possible: consciousness and intention (Spacey, 2017).

The concept of intentionality also refers to the notion of creativity, including artistic creativity (see

chapter 2). Despite the lack of an emotional intentionality as in humans, the current ‘artist’ AI softwares are already generating art in various forms. Thus, it is possible to talk about creativity in terms of today’s artificial intelligence technologies. Although the AI technology has not yet reached to a human-level form of creativity, it is possible to suggest that it has the capability to perform some sort of creative acts.

As also stated by Ray Kurzweil, ‘achieving the hardware computational capacity of a single human brain (...) will not automatically produce human levels of capability’ (2005: 128). In terms of musical and artistic aptitude, creativity and emotions, human intelligence and artificial intelligence may differ from each other (ibid.). Therefore, alongside the artificial intelligence, artificial creativity is a question that is still to be answered. The question of “Can machines be creative?” will be looked into in the next chapter.

We may hope that machines will eventually compete with men in all purely intellectual fields. But which ones are the best to start with?

Alan Turing, 1950

2

Human Creativity vs Artificial Creativity

CREATIVITY IS A CONCEPT WHICH ADDRESSES THE HUMAN CAPACITY. According to American psychologist Prof. Keith Sawyer, one of the most recognized experts on creativity, innovation, and learning; creativity is ‘part of what makes us human’ (2014:3). Therefore, in terms of comparing the machine intelligence to human intelligence and speaking of the capability of human-level machine intelligence, creativity is a key concept. As stated before in chapter 1, creativity is one of the key merits

that refers to the analog system of the human brain. Alongside mass parallelism of the human brain, emotional thinking, randomness, artistic and aesthetic aptitude and taste are also indigenous features of human intelligence. But what about non-human or even non-biologic agents? Is it possible to talk about a form of artistic creativity indigenous to artificial intelligence? In other words, can machines create art?

Known as the first computer programmer, British mathematician Ada Lovelace was also interested in this question in 19th century. Daughter of famous poet Lord Byron, Lady Lovelace wrote about computer programs in 1843, a century before the dawn of computers. Furthermore, she predicted computational creativity by suggesting that Machines could manipulate symbols, instead of just numbers. She argued that a machine could be programmed to follow instructions, and it could not just calculate, but also create¹.

In his book *Explaining Creativity: The Science of Human Innovation* (2014), Sawyer states that ‘although artificially intelligent computer programs hold the world title in chess, and can crunch through mounds of data and identify patterns invisible to the human eye, they still cannot master everyday creative skills’ (2014: 3). On the other hand, despite the lack of basic everyday human creativity skills that require physical experience and muscle memory, AI has a certain degree of creative ability. Prof. Margaret A. Boden; well-known scholar in the field of informatics, cognitive science and particularly on the Artificial Intelligence creativity, challenges the idea that creativity is not possible in terms of a computational non-human intelligence. In her book *The Creative Mind: Myths and Mechanisms* (2004), she presents a different perspective on the discussion of AI creativity.

This chapter aims to present an alternative approach to creativity in terms of Artificial Intelligence. Besides the humane features of creativity, is it possible to consider AI creativity (or computational creativity) as a form of creativity? To answer this question, in this study, the focus is on the artistic outputs of artificial intelligence. Rather than problem-solving and everyday tasks, artistic creativity

¹See the link: <https://www.nytimes.com/interactive/2018/obituaries/overlooked-ada-lovelace.html>

will be the main concern of this study, as it is a form of creativity that refers to aesthetic and emotional features of human intelligence. Since as it can be seen in the following examples of computational creativity (or artificial creativity), the AI-art also has indigenous features and elements that show creative traits.

2.1 WHAT IS CREATIVITY?

Creativity can generally be defined as the ability to come up with new, novel and valuable ideas in a surprising or unfamiliar way. These valuable ideas can have different meanings. An idea can be a concept, theory etc., or an artifact such as a painting, music, architecture, a tool and so on. It is not a mythical thing that is aimed at a certain romantic elite. It is an aspect of human intelligence and we all have it in different levels. It is a marvel of the human mind (Boden, 2004:1). Creativity is a concept that refers to various examples in every aspect of life. Therefore, rather than a special faculty, it is a feature of human intelligence in general. Everyone is creative, to a degree. Thus, as Boden suggests, instead of asking ‘is that idea creative?’, one should ask ‘how creative is it, and in which ways it is creative?’ (2004:2).

Boden also defines creativity as a puzzle, a paradox, a mystery. As a concept that is hard to explain for psychologists, creativity is sometimes the combination of familiar ideas in unfamiliar ways (2004: xi). Furthermore, creativity also involves the exploration and transformation of conceptual spaces. The notion of ‘conceptual space’ is central in Boden’s approach to creativity. Although she does not precisely define this term, she implies it as an abstract location of entities in which the creative acts take place. Boden describes those conceptual spaces and how to transform them to produce new ones, by using computational concepts. These computational concepts address artificial intelligence and the study of how to make computers capable of doing the things as the human mind does. Thus, like Keith Sawyer, Boden also establishes her concept of computational creativity by first looking at

human creativity. Furthermore, she presents an understanding of the machine creativity, in which the computers at least appears to be creative to some degree (Boden, 2004:1).

As stated by Sawyer, the modern research on creativity began in the 1950s and 1960s. As the first wave of research on creativity, these studies were focused on the personalities of exceptional creators. In the 1970s and 1980s, by turning their attention into the cognitive approach, the researchers of the second wave focused on the cognitive psychology and the internal mental processes relating to creative behavior. With the emergence of third-wave research in the 1980s and 1990s, researchers extended their focus to the sociological approach, which is an interdisciplinary approach that centers upon the creative social systems (Sawyer, 2014:4).

By means of these three waves of creativity research, Sawyer addresses the explanation of creativity by bringing together the personality approach, cognitive approach, and sociocultural approach. For the ‘individual’ definition of creativity, he suggests that ‘creativity is a new mental combination that is expressed in the world’ (2014:7). In this approach, he describes creativity within three main elements:

- ‘Creativity is new’ (Sawyer, 2014:7).

As Sawyer suggests, being ‘new, novel or original’ is the fundamental requirement of a creative thought or action. Repeating a previously mastered sequence of behavior is not creative (Sawyer, 2014:7). Therefore, daily activities such as driving to work or walking to school by the same route are non-creative behavioral patterns. In accordance with Sawyer’s definition, Boden also indicates that ‘creative ideas are unpredictable’ (Boden, 2004:1). Thus, fundamentally the concept of creativity deems newness.

On the other hand, Boden also offers that newness is a relative paradigm. For instance, children can come up with the ideas that are new to them. Hence, the reason that someone else thought of it before, does not necessarily deems an idea to be less creative. In this regard, Boden addresses the concepts of psychological creativity (P-creativity) and historical creativity (H-creativity). These two distinguishing

meanings refer to the novelty of a creative idea. P-creativity is associated with coming up with an unpredictable and valuable idea which is new to the person who comes up with it, regardless how many people have had the same idea before. If an idea is completely new in the human history and no one else has been known to have it before, this is referred to as H-creativity (Boden, 2004:2). Therefore, newness does not necessarily mean that something never existed before, or never thought before. In this context, the newness has two different meanings according to P-creativity and H-creativity.

- ‘Creativity is a combination.’ (Sawyer, 2014:7)

Sawyer states that each thought or concept is a composition of existing thoughts or concepts. For an individual, recalling a previously mastered material from the memory does not assign creativity to a certain behavior. Creativity involves the combination of different existing thoughts or concepts which never combined before by that individual (ibid.). This statement can be correlated to the P-creativity. If an individual combined two or more concepts or ideas in a surprising, unfamiliar and valuable way which is new to himself or herself, then it still refers to creativity.

- ‘Creativity is expressed in the world.’ (Sawyer, 2014:7)

With this statement, Sawyer argues that to be considered as creative, an idea or a concept should be expressed in one way or another. Since if an idea is in a person’s head and it is not expressed, no one can see it or understand it. Therefore, it cannot get any feedback. Furthermore, it should be understandable or comprehensible as ‘Creativity researchers cannot study what they can’t see’ (ibid.).

In addition to the individual approach, Sawyer explains the socio-cultural definition of creativity. This approach relates to the social and cultural systems in which creative people perform together. In terms of sociocultural definition; ‘Creativity is the generation of a product that is judged to be novel and to be appropriate, useful, or valuable by a suitably knowledgeable social group’ (Sawyer, 2014:8). Being defined as a Big-C creativity, the socio-cultural definition of creativity refers to a socially valuable

‘product’. Therefore, rather than the act or the person who does it, this form of creativity refers to the outcome of the creative process. In this regard, AI artifacts (or machine art) such as the poems, drawings, songs, movie scripts, architectures, etc. that are done by machine intelligence, can be referred as socio-culturally creative outputs. As Keith Sawyer’s definition of sociocultural creativity suggests, the artifacts that are produced by AI programs are socially valuable in human culture. Based on the fact that AI programs and computers are themselves sorts of artifacts produced by human makers, they address the creativity of a certain group of people in social and cultural contexts. As an artifact, computational art generation is a subject of science history and culture.

Considering the computational intelligence as a medium, the artifacts that are produced by this medium become the part of the human culture by being exhibited for the appreciation of society. Therefore, the event of producing an AI program that generates artistic outputs (or products), is a socioculturally creative and valuable activity. Thus, before describing the machine itself as creative, we can describe the notion of ‘AI art’ as a socio-culturally creative phenomenon. The field of AI art involves the collaboration of various fields such as computer programming, art, literature, poetry, cinema etc. It refers not only the creative group of people in a certain field, but it also congregates different social and cultural groups.

In terms of Sawyer’s conceptualization, AI art can also be linked to individual creativity. The act of producing computer programs that can draw pictures, write poems, compose music pieces or write movie scripts is a creative process on behalf of the programmer. The key point here is that most of the programmers who create the algorithms for computational art, are not artists themselves; they do not need to be poets or painters or writers. Nevertheless, they produce an artifact that generates art. Therefore, the programmer himself/herself gets engaged in a creative process to create these algorithms that mimic the art-production of a human artist. The process of AI art requires a combination of two different concepts that come together and generate something new. These two different concepts; art and computational systems, come together in the computational art (or AI art), as a new concept.

Thus, the programmer that produces the AI is involved in a creative activity by integrating the element of art in computational systems and generates an artifact which generates another artifact. AI can be regarded to include individual creativity not only in terms of the programmer, but also the program (or machine) itself. Many people would argue that it is not the machine's creativity at work, but the programmer's. These counter-arguments, which refuse the creative role of the machine, mainly suggest that the machine is not conscious, therefore it does not have any desires, preferences or values to appreciate or judge what it is doing. An artwork is the expression of human experiences and it refers only to human communication (Boden, 2004:7). However, as Boden points out, it would be an underestimation. Even though it is assumed that computers cannot be intentionally creative, it does not mean that artistic creativity of AI can be firmly excluded. In terms of neuro-inspired artificial intelligence, it is possible to claim that creativity exists to a certain degree.

2.2 CAN AI BE CONSIDERED AS ARTISTICALLY CREATIVE?

The concept of artistic creativity is a form of creativity that distinguishes itself from everyday life. Being different than problem-solving or crafting, artistically creative products have no function other than pleasure (Sawyer: 2014:28). As stated by Sawyer, the idea that artists have a unique message to communicate is only a few years old (ibid.). After the word "create" was first used in English in 1589 by George Puttenham to make a comparison between the poetic creation and the divine creation (Weiner, 2000: 55), with the influence of Renaissance, artists began to distinguish themselves from craftsmen. In time, with the influence of the Enlightenment which came up after Renaissance, the intellectuals were attributed something more than just craft or technique, which was the ability to create. Afterward, in the 18th century, the art genres of poetry, music and visual arts were grouped together for the first time, by coining the term "fine arts". Thus, the word "creative" started to be applied to artists (Kristeller, 1983).

Furthermore, as a relevant concept to creativity, the idea of ‘imagination’ emerged in Europe during the late Enlightenment in the 18th century (Engell, 1981). As a notion that refers to the ability to create, imagination ‘became the compelling force in artistic and intellectual life’ from 1750 onward (Engell, 1981:4). The concept of imagination was described as the mental faculty of humans that is responsible for generating novel ideas and became the core of the notion of creativity (Sawyer, 2014: 23). Although at the first sight it seems as a human faculty, imagination can also be a questionable concept in terms of artificial intelligence. By scrutinizing the different examples of AI art, it can be suggested that although it is different than human intelligence, artificial intelligence may also obtain a form of imagination to a certain degree (see also chapter 3, Google DeepDream).

In regard to the question that whether AI can be artistically creative, Boden’s conceptualization on creativity tries to understand the phenomenon of the artificial intelligence creativity, and the problematics of this phenomenon. In order to explain what creativity is and how AI art can be explained and classified in creative terms, Boden describes three types of creativity: combinational, exploratory and transformational. By applying these definitions to various cases of AI art, it is possible to gain a perspective about how to address artistic creativity in terms of artificial intelligence.

2.2.1 COMBINATIONAL CREATIVITY AND AI POETRY BOTS

Combinational creativity, as the first type of creativity, simply involves ‘making unfamiliar combinations of familiar ideas’ (Boden, 2004:3). Including any kind of idea or concept, the new combinations can be generated either deliberately or unconsciously. However, the combination should be also valuable, not only new. This classification of creativity coincides with the definition by Sawyer. As also mentioned above Sawyer sees individualistic creativity as referring to the new or novel combinations of existing concepts (see chapter 2.1).

As Boden suggests, combinational creativity is a related feature of artificial intelligence. Technically, it is the most common and easiest application of current AI art. Besides painting, architecture,



Figure 2.1: Haiku poetry generator Poem.exe

music, script writing, etc., AI poetry is one of the genres that applies combinational creativity to computational art. By feeding the AI with data, algorithms generate unfamiliar combinations of existing inputs. Poem.exe is one of the examples of these poetry generator bots that use thousands of existing data to generate unique poems on Japanese poetry style 'Haiku' and posts them on Twitter (figure 1).

Poetry bot learns how to write haiku by reading the existing examples of this particular poetry style. A fundamental feature here in terms of creativity is the novelty. What it produces is new to itself; it certainly has the ability to generate unfamiliar combinations of familiar ideas. Boden (2004) writes that although combinational creativity is the easiest form of creativity for AI, it is also the most problematic one. As one of the pillars of a creative artifact, the output should be valuable. The main problem here is to get a sense of the human relevance that the human audience can identify with (Boden, 2004). Shuffling ideas together and combining in a new way is an easy process for AI. But the real challenge for AI is to generate relatable outputs that can have artistic value (see chapter 3). AI cannot recognize the relevance of human taste or aesthetics. Although it is easy for an AI to combine the inputs and generate a new one, the result can be nonsensical or boring. To be valuable, the result should be interesting and sensible. As also previously stated by Sawyer (2014:8), the creative output

should be expressed into the world in a comprehensible way.

Considering the problem of relevance and comprehensibility, another example of AI poetry can suggest a perspective by a simple assessment test. Botpoet.com² is a Turing Test website for AI poetry generators that gathers different poetry bots and compares the poems that are written by AI with the ones that are written by human poets. As a smaller-scale of the Turing Test (see chapter 1), this assessment test asks the users to guess if the poem is written by a human or an AI (see figures 2-4).

As it can be seen in the figures 2 and 3, the poem *Dollars of Sand* by Ken Poirier was guessed as a bot, by 52 percent of the human viewers, myself included. On the other hand, the AI-generated poem, *The Saxophone Player* by Ray Kurzweil's AI poetry bot Cybernetic Poet, was guessed as a poem that is generated by a human poet, by 53 percent of the viewers. Looking at the results, it can be seen that for the human audience it is not that easy to distinguish an AI poet from the human poet. Therefore, in terms of human relevance and assessment, it is possible to claim that AI poetry has a certain degree of ability to generate new and unfamiliar, yet relatable and comprehensible results by combining familiar concepts.

On the other hand, poetry seems like an easier form of literature for AI, compared to prose. Considering current examples of AI writers, it can be claimed that the computer programs that write poetry have been more successful and common than the ones that write prose. How can this be explained? According to Boden (cited in Sawyer, 2014:147), it is not just because poetry is easier to generate for an AI, it is rather due to the fact that human readers are used to reading ambiguous poems. In other words, when we read a poem, we expect less of a solid meaning from a poem compared to prose. Therefore, an AI does not necessarily have to be so good at writing meaning into a poem, human readers can interpret the work by providing much of the meaning themselves (Boden, 1999: 360). Considering the fragmental structure of the poetry, it is easier to interpret meanings out of a poem even though it seems meaningless.

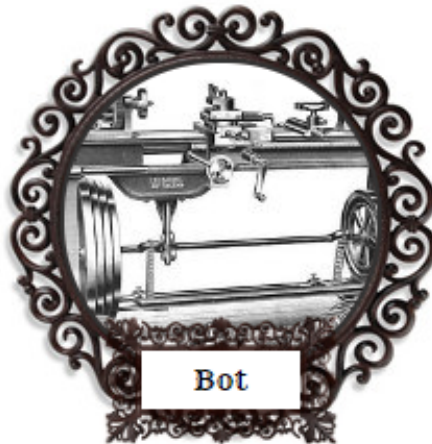
²<http://botpoet.com/>

Was this poem written by a human or a computer?

Dollars of Sand

dollars of sand
in my hand
worth nothing more
than the Frisbee of man.

Fig. 1



or



Was this poem written by a
human or a computer?

Dollars of Sand

Ken Poirier

dollars of sand
in my hand
worth nothing more
than the Frisbee of man.



This poem was written by the human Ken Poirier.

52% Say bot

48% Say not

[Vote on another poem?](#)

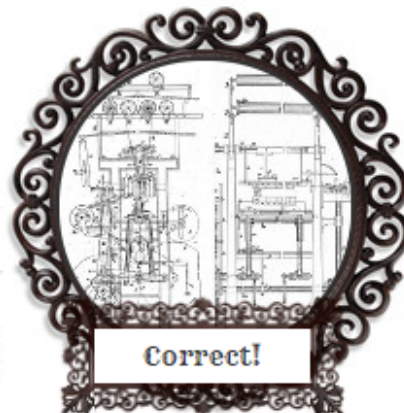
Figure 2.3: The Turing Test result for the poem, Dollars of Sand. 'Bot or not?', by <http://botpoet.com>

Was this poem written by a human or a computer?

The Saxophone Player

Generated by Ray Kurzweil using Ray Kurzweil's Cybernetic Poet

The saxophone player
lives alone,
blows
lives alone,
blows
a swinging door
splendid silence
prophetic poses
splendid silence
prophetic poses
of a prayer and the walls.



This poem was written by computer. [Do you want to know how?](#)

47% Say bot

53% Say not

Figure 2.4: Turing Test result for the poem, The Saxophone Player. 'Bot or not?', by <http://botpoet.com>

As a result, it can be suggested that human relevance becomes more likely to occur in terms of poetry. Poetry, like the computer programs themselves, involves certain algorithms, because it is a style of words in systematic small groups, which can be symbolical or conceptual. But it is much harder to write in the style of prose for artificial intelligence, as it requires meaningful linear phrases getting together. However, as it develops, AI is getting more effective on writing on prose as well, in addition to poetry. It is also possible to give examples of prose in terms of combinational creativity of AI art.

In a future with mass unemployment, young people are forced to sell blood.

This is the opening line of a science-fiction short film, *Sunspring* [2016], which is written by an AI who named itself “Benjamin”. Goodwin, an AI researcher from New York University built Benjamin. Benjamin is a long-short-term memory (LSTM) recurrent neural network, a type of AI that is typically used for text recognition. Artificial Neural Network (ANN) is the name of the computing system that is used in AI, inspired by biological neural networks in the human brain. ANN is a system that can learn by combining and considering the existing examples (Van Gerven & Bohte, 2018). Thus, as a system that provides text recognition and learning in AI, the artificial neural network can be referred to as the fundamental pillar for the creative faculty of AI.

After being trained with hundreds of different science-fiction movie scripts in its neural network, Benjamin wrote the whole screenplay of the movie *Sunspring*³. After Benjamin wrote the script, the movie was directed by Oscar Sharp and it was shown in Sci-Fi London Film Festival 2016. The movie has ranked in the top ten out of hundreds of competitors⁴.

Sunspring is a dark, dystopian futuristic science-fiction movie with three characters: H1, H2, and C.

³<https://www.youtube.com/watch?v=LY7x2Ihqjmc>

⁴‘*Movie written by algorithm turns out to be hilarious and intense*’, article retrieved from <https://arstechnica.com/gaming/2016/06/an-ai-wrote-this-movie-and-its-strangely-moving/>

The story takes place inside a spaceship⁵ with three characters, and the plot refers to love and human relations. This is an important point not only because it presents a perspective of a computational system about human emotions, but also because it can present an understanding of the representation of human emotions in science-fiction movie genre, as the result is based on hundreds of examples that were written by human writers. As mentioned before, human relevance is a key point for the value of an AI artwork. Since the target audience that evaluates the AI artwork is a human audience, the value or novelty of the artwork is being attributed according to the human perception of taste, aesthetics and therefore relevance. In order to be relevant, comprehensible and valuable, the artwork should be relatable for a human audience. From this perspective, it is possible to interpret the novelty, attainment and creative quality of the movie *Sunspring*. Besides its recognition in the Sci-Fi London Film Festival, various science magazine articles refer to the script of *Sunspring* as “interesting and wonderfully odd”⁶ or “surprisingly entertaining”⁷. Annalee Newitz from *Ars Technica* writes that ‘it’s about three people living in a weird future, possibly on a space station, probably in a love triangle’⁸. Considering the audience feedback from the magazine articles, it can be claimed that despite its ‘odd’ sense, the screenplay involves a level of prehension in terms of human relevance of taste.

Besides the script, Benjamin wrote a song within the screenplay of *Sunspring*:

(2) *I was a boy*

I was a stranger

And I promised to be so happy

I was a beautiful day

I was a taller talk that I was born

And I was ready to go

⁵Script of the movie *Sunspring*: <https://www.docdroid.net/1CZ2fPA/sunspring-final.pdf#page=2>

⁶<http://bigthink.com/robby-berman/a-computer-wrote-this-movie-and-its-uh-interesting>

⁷<https://singularityhub.com/2016/06/10/an-ai-wrote-this-short-film-and-its-surprisingly-entertaining-2/#sm.000ruqhocis9hfcj1ok2rn2nfu4io>

⁸<https://arstechnica.com/gaming/2016/06/an-ai-wrote-this-movie-and-its-strangely-moving>

And the truth was so long ago

I was so happy and blue

I was thinking of you

I was a long long time

I was so close to you

I was a long time ago

A long long time ago

And I was ready to go

I was a home

On the road"-Benjamin (2016)

Regarding the song lyrics that are written by Benjamin, it is possible to reach an idea on the level of human relevance. Admittedly, the lyrics appeal to the human comprehension. The work of Benjamin presents a notable example in terms of combinational creativity in AI art as it seems to have generated and pruned the combinations in an interesting and valuable way.

2.2.2 EXPLORATORY CREATIVITY AND MACHINE LEARNING: AARON, THE PAINTER

Exploratory Creativity is the second form of creativity that Boden describes. Exploratory creativity takes place in a certain space, that is, within a certain style. Starting with a certain style of thinking which already exists, one can adopt this certain style and use the rules of this particular style to come up with new and valuable results within these rules. These styles can be structured by conceptual spaces, from a culture or a group, which are not originated by one individual mind. It can be a certain style of painting, sculpture, a music genre or a scientific theory. Within that particular conceptual space or thinking style, someone who comes up with a new and novel idea is considered creative in an exploratory sense. Exploratory creativity is valuable since 'it can enable someone to see the possibilities they hadn't glimpsed before' (Boden, 2004: 4).

This form of creativity involves generating novel ideas by the exploration of structured conceptual spaces (or thinking styles). Boden writes that the new and valuable ideas in exploratory creativity are not only novel but unexpected (1998: 348). Exploration of a new idea in this concept should also correspond with the canons of the particular thinking style that is adopted. Therefore, to satisfy the canons of a style, one should first learn them and afterward should be able to practice them.

Learning, like intelligence, involves a broad range of processes that make it difficult to define. In its dictionary definition, learning refers to gain a knowledge and an understanding (or a skill) by study, instruction or experience. It is the modification of a behavioral tendency by experience (Nilsson, 1998: 1). Learning in animals and humans is a topic that has been frequently studied by psychologists and zoologists. But how does learning work in machines? According to Nils J. Nilsson from Stanford University Robotic Laboratory, there are several parallels between animal and machine learning. Moreover, many techniques regarding machine learning are based on the works of psychologists who aim to precise their theories on human and animal learning by studying computational models. Therefore, machine learning is also a field that contributes to the research on biological learning processes.

Machine Learning is an application of artificial intelligence, which enables them with algorithms to access the data and let them learn for themselves. It includes various concepts and results from many fields, including statistics, AI, philosophy, information theory, biology, cognitive science, computational complexity, and control theory. According to computer scientist and machine learning professor Tom Mitchell, the field of machine learning is concerned with the question of how to construct computer programs that automatically improve with experience (Mitchell, 1997). The experience in terms of a machine refers to certain changes in its structure. Nilsson suggests that whenever a machine makes a change in its program or data according to its inputs, or in response to an external information, it learns and improves its forthcoming performance (Nilsson, 1998: 2). Compatible with the concept of exploratory creativity, machine learning involves the changes within already performing systems.

In this regard, as in the example of child-learning which is mentioned above (Boden, 2004, also

see chapter 2.1.), an AI also generates an artifact or a concept by learning. Boden refers to this phenomenon as the explorational creativity of artificial intelligence. As also previously mentioned Alan Turing claims that a machine can be programmed to learn by simulating a child's mind (also see chapter 1.2.). 'Aaron', a drawing-program written by Harold Cohen, is one of the most successful examples to support this argument (Cohen, 1982: 1). Unlike most other programmers, Harold Cohen was already a well-established painter whose work was shown in Tate Gallery and many other museums (Boden, 2004:150). Cohen had an abstract style of painting, depicting unrecognizable patterns that are interpreted in different ways by different people. He was interested in the cognitive processes associated with these interpretations. By continuing his works on the understanding of emotional and perceptual responses, Cohen investigated the differences between those responses to different types of shapes and shadings. This way, he aimed to systematically explore the conceptual space in our minds which is generated by the interactions of lines, forms, and colors. His preoccupation with the psychology of art, therefore, led him to his interest in computer-generated canvasses (Boden, 2004:151).

In Cohen's 1982 article, *How to Make a Drawing*, he describes the process of this early example of his learning machine, Aaron. Aaron was a computer program that was learning how to draw. In his article, he refers to Aaron as a pupil, to whom he taught drawing. He describes Aaron in his very first sentence of the article: "Let's begin with a story. Once upon a time, there was an entity named Aaron" (Cohen, 1982:1).

As stated by Cohen, he had started to work on Aaron's 'education' in 1973, in Stanford University. Cohen describes the process as an 'unorthodox education', in which he taught Aaron exclusively how to make drawings. However, Aaron was not an 'unorthodox student' and was gifted with remarkable abilities. Cohen taught Aaron everything from scratch, including how the human hand moves on the paper when drawing, which Aaron learned quite fast (Cohen, 1982: 1).

As Cohen points out further in his article, Aaron was able to retain long lists of instructions that require a continuous decision-making process and a careful assessment of the changing state of the

drawing as it proceeded (Cohen, 1982:1). Cohen also states that Aaron was capable of making decisions without requiring further instructions. However, what seemed to lack was the pre-existence of certain cognitive skills such as the ability to distinguish between closed forms and open forms, or between figure and ground (Cohen, 1982:2). These skills that develop in children at early ages were not a part of Aaron's hardware. Nevertheless, Aaron also acquired those skills quickly. This is the important thing about Aaron: it was learning. As Cohen addresses, looking into Aaron's early works, it was demonstrating the newly acquired skills on drawing in the learning process, like a young child. Coinciding with the ideas of Turing, Cohen also uses the analogy of a 'child' as he describes Aaron. Furthermore, he indicates that Aaron peaked around the age of six and reached the point where it was drawing much better than its teacher (Cohen, 1982:3).

Regarding the comparison between human creativity and machine creativity; or the comparison between human intelligence vs. machine intelligence, the confusion arises from —as also Harold Cohen puts out— anthropomorphizing the intelligent products of the new electronic technologies (Cohen, 1982:4). As he suggests, it is obvious that there are certain differences between computer programs and people. Although computer programs do not learn in the same manner a child does, they still learn but in a different way. As stated before, human intelligence is a hybrid of analog and digital systems, while the computers have a digital computation system (see chapter1). Therefore, as Harold Cohen points out, it cannot be said that intelligent programs (or AI) are innately incapable of learning. Human beings learn through experience; they develop physical skills through using their own body. However, Aaron does not have a physical existence. Therefore, it never felt the pressure of the pen against paper. Neither can he grasp the dynamics of motion as the human cognitive system does. Aaron's hardware is different than the human nervous system.

Nevertheless, despite the lack of certain elements such as human-like intentions or the physical experiences, Aaron exhibited signs of an exploratory form of creativity, in terms of its individual improvement. Starting its learning process, with abstract figures Aaron, later on, became capable of

drawing human figures, jungles, etc. Furthermore, it developed a decision-making ability on which colors to use, which was a very important improvement for Harold Cohen. Furthermore, as Cohen states in a later article, *The Further Exploits of Aaron, Painter* (1994), Aaron's human-figure drawings were involving a symbolic three-dimensionality. It was capable of placing the figures 'into a spatial setting with things overlapping each other as they should' (Cohen, 1994:4). Therefore, as an entity without a physical existence, it was still possible to see Aaron's internal (and personal) representation of the figures and spatiality (see figure 5).

Aaron was trained and practiced on the particular painting style of its tutor, Harold Cohen. Afterward, by carrying out the canons of this painting style (or the structure) and improving itself with the experiences, Aaron was able to make unfamiliar and valuable changes within this painting style, which are new to itself. Thus, Aaron's creations were not confined to the laboratory and they have been exhibited at major art galleries around the world (Boden, 2009: 27). The example of Aaron shows that exploratory creativity by generating new and novel implementations of a style is possible in Artificial Intelligence through machine learning. As Boden states, the argument that computers cannot do anything creative because they can do only what the program tells them to do, is a misleading statement since computers can do only what its program enables them to do (Boden, 2009: 27). By training through a well-designed program, a computer can explore novel ideas within a structured conceptual space.

Regarding Aaron and its changing artistic style, it is possible to suggest that it shows the features of P-creativity and H-creativity. Even though Aaron did not have certain elements related to human creativity, such as intention to create an artwork, it still generated artworks in its own style, and it learned how to do it step by step. Looking at the outcome, every step and every output that Aaron generated was new to Aaron. Just like a child, Aaron learned how to draw and how to perceive dimensions, shapes, colors, and depth.



Figure 2.5: Meeting On Gauguin's Beach, 1988. By Aaron. Oil on canvas, 90x68 inches. Collection: Gordon and Gwen Bell. Photo: Becky Cohen.

In terms of the individualistic approach of creativity, Aaron exhibited the features of newness, by combining existing concepts and generating an output which can be expressed in the world and understandable by the audience. Furthermore, in terms of H-creativity, what Aaron and Harold Cohen achieved was indeed new in the historical terms as well. Aaron is an artwork itself, which is capable of generating other artworks. In this sense, Aaron's output was valuable in terms of socio-cultural approach.

2.2.3 TRANSFORMATIONAL CREATIVITY AND GOOGLE DEEPDREAM

As the third form of creativity, transformational creativity refers to the transformation of a structured conceptual space (Boden, 1998). As the highest form of creativity, it involves the transformation of certain dimensions of the conceptual space. Thereby, new structures that could not have been observed before can be generated (Boden, 1998: 348). Boden (1998) states that the exploratory and transformational creativity are entwined with one another. While the exploration of a new aspect or a new dimension within a space involves relatively small changes on a more superficial scale, the transformation of a more fundamental dimension would result in more different and newly-possible structures within that space. Boden (1998) describes those small changes as 'tweaks', while the changes in transformational creativity refer to radical changes. On the other hand, like explorational creativity, transformational creativity also requires the definition of a particular style that will be adopted. It also requires the definition of the ways of exploring that style, besides carrying out the canons and fundamentals of it. Thus, one can get a sense of what are the limitations of that style, and can also assert an idea of what sorts of transformations can be generated to come up with new structures.

Boden states that exploratory and transformational types of creativity can also be modeled by AI-systems. It is also possible to describe conceptual spaces and ways to explore or modify them, in terms

of computational concepts (Boden, 1998: 351). However, as it is a high-level form of creativity, the transformation of a conceptual space is very difficult to spot in computational systems, as well as in humans. Since computer programs are limited by their algorithm, it is very exceptional for a computational system to improve the ability to alter some initial rules of a conceptual space, or a style. Boden explains that some AI-modellers deliberately avoid giving their programs the capacity to alter the main codes to prevent fundamental transformations in the conceptual space. They only allow the program to make relatively superficial changes and explorations within the space. A reason for this restraint from excessive transformations in AI models of creativity is the difficulty of automating evaluation (Boden, 1998: 353). Transformational creativity is difficult to be modeled by computers because the human associative memory and human values are difficult to express in computational form. For this reason, current attempts in AI models of creativity are mostly in exploration, not transformation (Boden, 1998: 354). When a conceptual space is transformed in terms of computational systems, the result may not be interesting or valuable in human terms. Therefore, it can be understood that especially in art, it is very rare for an AI system to generate valuable and interesting results which would appeal to human recognition.

However, as Boden states, it also must be indicated that 'there is no clear-cut distinction between exploratory and transformational creativity' (2009: 25). Because when any rule is changed, however trivial, it will result in new structures that were not possible before. Thus, the question is whether this change is significant enough or is it only superficial. In this sense, although many people believe otherwise, it is possible for a computer to achieve transformational creativity (Boden, 2009: 29), because, as it will be further explained with the examples, an AI program can make a significant change within a conceptual space and generate a different art form that is impossible to be generated by human hand. Therefore, it has the capacity of producing a radical change of an art form, by transforming it into something completely different and peculiar to this AI program. From this perspective, Ritchie suggests the theoretical question 'what kinds of computational mechanism lead to genuine creativity?'

(Ritchie, 2006: 242). To elaborate on this question in terms of the machine creativity, the case of Google's DeepDream would be an example.

According to Blaise Agüera y Arcas (2016); Principal Scientist on machine intelligence at Google, the artificial creativity can be explained by the neurological path of our brain. First of all, the fundamental process of thinking in the human brain starts with perception, which can be basically defined as turning the things in the world around us into concepts in our minds. This process works in a similar way in machines as well, through programs and codes. Creativity is the flipside of this process, which is turning a concept into something out there in the world. In this sense, there is a dual relationship between perception and creativity. For example, between an image of a bird and the word 'bird', our visual cortex transfers the information like a series of computational elements. This is how perception takes place: through the set of neurons connected to each other in a neural network. Our brain turns the image (the pixels) into a word by transferring the neurons in the retina into one layer after another layer of neurons, that are connected by synapses. The artificial neural networks can also work in a similar way to identify 'things' (see chapter 2.2.1). Current computers can identify faces, animals, objects, and languages and translate them to other languages. However, to be able to create, and to communicate in terms of art, a further capability is needed; such as the capability of imagination.

Imagination is a key concept here in terms of the ability of transformational creativity in artificial intelligence. The perception process in artificial intelligence occurs when the AI programs identify the data in their neural network. Like in the example of AI writers (see chapter 2.2.1), when the artificial neural networks are reversed, computers achieve to create and draw images themselves, instead of recognizing the image. By using the data in their neural network, they generate images themselves. Although the word "imagine" seems tricky in the first place, it is possible to attribute this act to a computer program such as DeepDream, which produces dreamy visual images in accordance with its name.



Figure 2.6: Google DeepDream (source: quora.com)

DeepDream is a computer vision program presented by Google, which uses the Convolutional Neural Network⁹ to enhance the images, and therefore creates a dreamy art form which can be qualified as unique and authentic (see Figure 6). Google's DeepDream generates a unique style of visual images that cannot be made by a human. When an image is uploaded in DeepDream program¹⁰, the algorithm reconstructs the guide image in layers after layers, through a network that is designed to categorize all sorts of different objects like man-made structures or animals, etc.

This process is called “inceptionism” by Google, referring to the 2010 science-fiction movie *Inception*, where the dreams are structured in limitless layers.

In Google's DeepDream, the program creates a different layer each time, by recognizing the guide

⁹A Convolutional Neural Network (CNN) is comprised of one or more convolutional layers (often with a subsampling step) and then followed by one or more fully connected layers as in a standard multilayer neural network. (<http://ufldl.stanford.edu/tutorial/supervised/ConvolutionalNeuralNetwork/>)

¹⁰<https://deepdreamgenerator.com/>

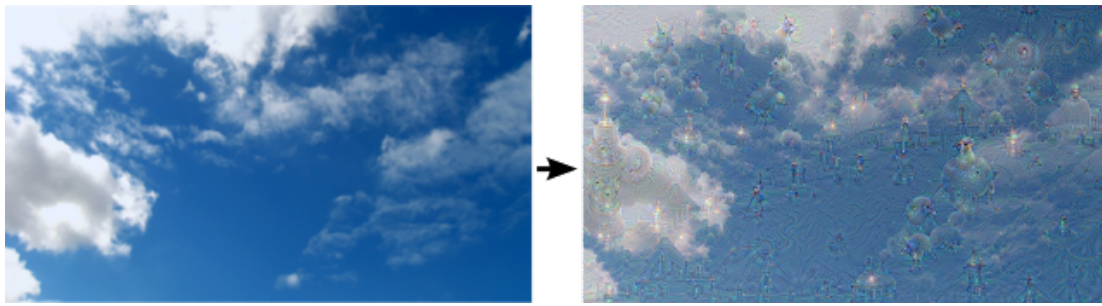


Figure 2.7: DeepDream creating an interpretation of the guide image. (Source: Google Research Blog)



Figure 2.8: Shapes of animals that are imagined and generated by DeepDream, from the guide image of clouds. (Source: Google Research Blog)

image and emulating it according to its neural network., DeepDream program assimilates the image to existing patterns in its neural net, like a machinery hallucination. The higher the levels of layers the program goes, the more complex features of images it identifies and the more complex visuals it creates. This is simply the ordering the program: “show me what you see here”, and letting it interpret or imagine in a continuous feedback loop.

When the program is given an image of clouds, the network figures out what it sees in those clouds. The more it looks at the clouds, the more things it identifies in the clouds (see figures 7 and 8.). In each layer, it uses the previous image as a guide, and thus, it re-interprets its own interpretations creating different images.

DeepDream software can be applied not only to images but also to videos¹¹. In the same style of

¹¹<https://vimeo.com/211758157>



Figure 2.9: A screncap from the video, *Deeply Artificial Trees*. (the image is courtesy of the artist)

this AI-art structure, a video was generated by Alexander Reben, a robotics artist and designer. In his work *Deeply Artificial Trees*, Reben fed the one episode of the painter Bob Ross' famous TV show *The Joy of Painting* through the artificial neural network, which generated a 'psychedelic' form of the show¹² (see figure 9).

Deeply Artificial Trees was generated through a few different 'deep learning' techniques. Deep Learning, (also known as deep structured learning) is a new field of machine learning, which tries to mimic the activity in layers of neurons in the human neocortex, where human thinking occurs. The software literally learns to recognize the patterns in digital representations of sounds, images, and other data¹³. In his interview with *Creators Magazine*¹⁴, Reben says that this gave him an insight into what these algorithms are 'thinking'. He processed each video frame on VGG (Visual Geometry Group) and Google DeepDream models. For the audio of the video, he synthesized Bob Ross's voice from a

¹²https://creators.vice.com/en_us/article/ezwyb4/bob-ross-alexander-reben-neural-network-nightmare

¹³<https://www.technologyreview.com/s/513696/deep-learning>

¹⁴https://creators.vice.com/en_us/article/ezwyb4/bob-ross-alexander-reben-neural-network-nightmare

WaveNet model (a deep generative model of raw audio waveforms¹⁵) and combined with portions of reversed audio.

Reben describes the video as a brief glimpse into the merger of humanity and technology, a cyberdelic drug trip. As he stated in his interview, this artwork is a representation of “what it would be like for an AI to watch Bob Ross on LSD”. This hallucinative effect in the video is also an interesting point in terms of the relationship between the computational imagination and human imagination. The hallucination and dreaming have also played a role in human arts. It is possible to find similar hallucinatory effects in modern art movements, such as post-impressionist artworks, in subjective and non-naturalistic depictions of the artists (Berov & Kuhnberger, 2016). By layering the visual data in the artificial neural network, deep learning programs are able to model such surreal style of visual art as in Deeply Artificial Trees. In a continuous movement of surreal interpretations, each frame in the video includes a different cyberdelic interpretation of the AI.

As in the examples of DeepDream and Deeply Artificial Trees, this ability of layering is one of the essential features of the Deep Convolutional Neural Networks (ConvNets), relates to transformational creativity. The visual technique of ConvNets can be used to simulate hallucination in the human mind (Berov & Kuhnberger, 2016). Using the Multilayer Perceptron (MLP) that is based on the mammalian visual cortex, the artificial neural network, - or ConvNets- can create a certain style of images that are indigenous to this software. It not only transforms the current visual structure, but it also has the capability to re-transform it in its own style. This kind of ability can be correlated with transformational creativity in terms of Boden’s descriptions, which suggests that in transformational creativity, the conceptual space or style is transformed by altering one or more of its defining dimensions. As a result, the outputs that could not have been generated before become possible. (Boden, 2009: 25).

The multilayered visual properties of ConvNets are clearly inherent in artificial neural networks.

¹⁵<https://deepmind.com/blog/wavenet-generative-model-raw-audio>

The style that is produced by this program is not possible for a human artist to generate manually. Therefore, it can be claimed that it is a new and novel style of art (see chapter 3), which is generated by transforming a conceptual space. As Ritchie explains in his article *The Transformational Creativity Hypothesis* (2006), although the notion of ‘conceptual space’ refers to an abstract location of entities that are produced by creative acts, it is not clearly defined by Boden (Ritchie, 2006: 246). For example, in Boden’s approach, a certain search space of AI could be one example of a conceptual space (ibid.).

As mentioned above, change is a core element in Boden’s concept of transformational creativity. Change of the space by the creative act is the essential feature of transformational creativity. However, rather than primarily describing the notion of space, and then relating it to the changes to those spaces, Boden leaves the idea of conceptual space as a self-explanatory concept (Ritchie, 2006: 247). According to Ritchie, Boden’s notion of conceptual space might be constructed related to the concept of ‘genre’. Conceptual spaces define the limits and structure of a genre which is the classification of a certain group of artifacts according to the cultural norms. In other words, while the genres are relatively simpler labels to classify the human artifacts, conceptual spaces attempt to describe ‘the underlying mechanisms and the relationships within a space’ (Ritchie, 2006: 247). Ritchie suggests that genre is a more informal term which does not have a purpose to explain such underlying mechanisms. Although it is difficult to describe the conceptual spaces in terms of deep learning artifacts, it can be suggested that this ‘cyberdelic’ style of AI-art correlates with the surreal art genre. Furthermore, it is possible to claim that deep learning artifacts make a change within this genre, by generating a new and novel form which was not possible before, moreover creating a new artistic style. As Boden states, transformational creativity requires radical changes of a space, rather than a ‘tweak’ (Boden, 1998: 348) as in explorational creativity. In these artifacts by artificial neural networks, the conceptual space changes drastically by transforming to a form that cannot be manually made by a human. While the deep-art of AI generates a representation of hallucinatory effect on ‘imagining’ or ‘dreaming’ in the human mind, it surpasses this representation and turns it into something else: a unique art form.

This argument, which describes AI art as a ‘unique art form’, will be discussed in the next chapter in terms of authenticity and validity of AI art. Even though the process of AI art and the outputs of this process can be considered as somewhat creative, their quality of ‘artiness’ requires another philosophical discussion and a theoretical conceptualization. Therefore, the following question will be the core of Chapter 3: Can AI art be considered as an art form?

Bring something incomprehensible into the world!

Gilles Deleuze, 1987

3

AI-Artifacts: Art or Not?

THIS CHAPTER WILL ATTEMPT TO PLACE AI-ART AS AN ART GENRE, considering the creative and structural features of this phenomenon described in the previous chapters. In order to answer the question whether AI-art is considered as an art form, the concept of ‘art’ and art philosophy will be used to draw a path to establish a descriptive analysis on the ‘artiness’ and authenticity of these artworks. To be able to present a postulation on the authenticity of AI-Art, Bruno Latour’s Actor-

Network Theory (ANT) will provide the theoretical framework and methodology. Regarding computational art, several argumentations would suggest that AI is not an artist, but a tool for art. To present another perspective in this discussion, this chapter will try to establish an approach that defines art by comparing the function and role of art-maker and the audience in terms of artistic evaluation. Therefore, Actor-Network Theory will be used as a starting point to explain the role of non-human agent as an art-maker.

3.1 THE PROBLEM OF AUTHENTICITY IN AI-ART

In her article *Authenticity and Computer Art*, Boden states that ‘authentic’, as a term refers to ‘entitled to acceptance.’ It also denotes other meanings such as ‘genuine’, ‘trustworthy’, ‘authoritative’ and ‘of established credibility’ (Boden, 2007:3). In terms of authenticity of AI-art, one of the most important problematics of AI is the lack of emotional or aesthetic ‘intention’ in the artmaking process. As Boden also states, ‘computer art is often seen as inauthentic, even strictly impossible because it lacks certain essential features of genuine art’ (Boden, 2007:3). The possible counter-arguments on the authenticity of the AI-art could suggest that computers do not produce art to express their emotions as humans do. Or that computers do not have the intention to express an aesthetical or socio-political stance because they do not have emotions or aesthetical taste. These counter-arguments are true in a perspective which evaluates the authenticity of an artwork in terms of art-maker. Moreover, as the concept of ‘art’ is an experience of human communication, any artwork should present a certain way of communication through aesthetical or emotional attachment. It is an obvious fact that AI-art has a different structure in terms of ‘emotional expression’, compared to human art. It is also correct that computers do not have an intention to express their feelings or to enunciate their thoughts as the human mind. However, these argumentations can cause an underestimation of the AI-art as a genre. Moreover, as stated by Boden, ‘this attitude prevents people from engaging seriously with the prod-

ucts of computer art' (2007:3). Based on the criteria of the emotional and cognitive capability of the art-maker, computers may seem to lack the fundamental element of aesthetic and emotional intention to produce art. However, can we evaluate the 'artiness' of an output only in terms of the art-maker? In other words, what makes a work an artwork?

3.1.1 WHAT DEFINES A WORK OF ART?: MAKER VS. AUDIENCE

In order to answer what makes a work and artwork and present another perspective on the discussion of authenticity (or legitimization) of computational art, there is a very important key point to consider: the feedback of the human audience. This approach would suggest a paradigm shift in terms of evaluation (or quality) of an artwork, and therefore the authenticity of AI artifacts. Using this approach, I would like to suggest that the attribution of 'art' as an approval or evaluation of an output is ultimately defined by the audience. For example, when someone creates a painting, can he or she decide whether it is a piece of art or not? Even if the art-maker claims that it is art for him/her due to his/her intentions of expressing an aesthetical and emotional phenomenon, ultimately the quality of artwork depends on the perception of the audience. As mentioned before, art is a way of communicating embedded in human culture. Therefore, even though the art-maker is a computational program which does not have any intentions to express a certain feeling, as previously mentioned in Chapter 2, the artworks can create an emotional or aesthetical feedback by the human audience. Considering the case studies of AI poetry and visual art, the feedback of audience is also a key element to attribute creativity to the artificial intelligence. Regarding the fact that the concepts of 'creativity' and 'authenticity' in art are linked together, the creative quality of the artworks could also refer to their authenticity.

Considering the difficulty of defining an artwork, the concept of 'art' itself has to be a primary concern as well as a philosophical issue. Regarding these two perspectives, which evaluates an artwork based on its maker or its audience, art philosopher Susanne Langer suggests that the two alternative

perspectives themselves present a difficult dichotomy. Referring to this dichotomy of qualifying the artwork, she also asks the question; “Shall we judge a work of art as an utterance, giving vent to its author’s feelings, or as a stimulus, producing sentiments in the spectator?” (Langer, 1953: 18). She states that if the aim of art is accepted as self-expression, then only the artist himself can judge the value of his work. On the other hand, if the aim of art is to excite emotions, then the artist would be obliged to produce his works based on the feedback from the audience. She argues that neither of these perspectives are sufficient to present a definite judgment since the relation between art and ‘feeling’ is not simply due to catharsis or incitement. According to Langer, most art critics or experts tend to discount the subjective elements of art and, treat the emotive aspect of an artwork as something integral and objective. However, when the ‘feeling’ of an artwork is treated from an objective perspective, it presents a new paradox. The subjective pleasure of a spectator is undermined when the beauty of an artwork is treated as an objective aspect. In this sense, Langer asks the question, ‘why is the subjective pleasure not good enough?’ (1953: 18).

This question can be asked with regards to the discussion of AI art too. Is the subjective pleasure of the audience not enough to consider a work by AI an artwork? If the audience gets an artistic pleasure of an AI artwork, is it not valid simply because the intentional self-expression of AI is lacking? Can it be claimed that the subjective pleasure from an AI artwork is not legitimate because AI did not put it there in the first place? Or as in the example of poetry Turing Test in Chapter 2.2.1., if the audience cannot tell the difference between an AI writer and a human writer, can we still suggest the lack of self-expression of the artist invalidates the value of an AI artwork?

Additionally, although the artist’s concern of self-expression is not present in terms of AI-artist, at least not as in human artist, it cannot be said that the element of self-expression does not exist. Artificial intelligence still has a way of self-expression, because as it referred in the case studies in chapter 2, it adds something related to itself as an artist to its work, when it generates those artworks. It has the capability to generate a certain style of combination, explore other styles and transform them. Even though the

computational mind of AI does not involve an intuition or intention to express its feelings, it can still build a certain kind of emotive communication with the audience, and a catharsis. Although AI does not have an intentionality of self-expression per se, it still contributes an element of self-expression in the process of art-making. The process of making is essentially mechanic in AI, but it is the very thing that AI adds to its artwork as a poignant feature.

In her book, *Feeling and Form: Theory of Art* (1953), Susanne Langer discusses the concepts of ‘art’ and ‘artwork’ as a symbol. Regarding the ‘audience standpoint’, she suggests that when the audience views, hears or reads an artwork, he or she enters a direct relation not with the artist, but with the artwork. Thus, the audience responds to the artwork as a ‘natural symbol’, by simply finding the significance of the artwork, as the feeling in the artwork itself. Although this ‘feeling’ is not communicated, it is revealed by the artwork itself. The perception of the artworks creates this integrated and intense feeling (1953: 394). Therefore, once the audience has a feeling of catharsis caused by an artwork, to ask whether the artist wanted to convey this particular feeling is to ask whether the artist wanted to make what he/she made, which is an irrelevant question (ibid.).

Langer states that once we stop worrying about understanding the artist, and give ourselves up purely to the artwork itself, we are no longer confronted with a ‘symbol’, but with an object of emotional value (1953: 395). At this point, it is possible to say that there is an actual emotion that is induced by the contemplation to the object. This is an aesthetic emotion which belongs to the recipient, even though it is not consciously expressed by the artist in the artwork.

3.1.2 PROBLEMATIC OF EMOTION: COUNTER-ARGUMENTS AGAINST THE AUTHENTICITY OF AI-ARTWORKS

In her article *Authenticity and Computer Art*, Boden states that ‘authentic’, as a term refers to ‘entitled to acceptance.’ It also denotes other meanings such as ‘genuine’, ‘trustworthy’, ‘authoritative’ and ‘of established credibility’ (Boden, 2007:3). She explains that people, who refuse to accept the

authenticity of computer art, base their claims on the intrinsic qualities of the AI programs such as computational intelligence and lack of human emotions. However, these claims are also not sufficient to reject the authenticity or validity of AI-artifacts. Boden reminds readers that fully-human works that are presented as art are also often criticized in terms of their properties. As mentioned before, aesthetic and emotional intentions of the art-maker are also not enough to entitle their works as ‘art’. Boden claims that not everything produced by a self-styled artist is entitled to acceptance. Even human beings (or human artists) are often claimed as lacking authenticity which undermines the acceptability of their work (2007: 4).

In terms of emotional lack of computer-agent, Boden presents a discussion in terms of two examples of counter arguments by cognitive scientist Douglas Hofstadter and philosopher Anthony O’Hear. Hofstadter, as a scientist who has been developing computer models of creativity for years, refuses to attempt modeling music in computational art because according to Hofstadter, music involves emotions, in both creator and listener, which computers cannot have (2007:4). Since the composing computer is not an emotional agent, the compositions that are produced by the program would not be authentic or genuine. However, after listening to the musical compositions that were produced by EMI (Experiments in Musical Intelligence), Hofstadter admitted his admirations by writing that: “(...) I was impressed, for the piece seemed to express something... [It] did not seem in any way plagiarized. It was new, it was unmistakably Chopin-like in spirit, and it was not emotionally empty. I was truly shaken. How could emotional music be coming out of a program that had never heard a note, never lived a moment of life, never had any emotions whatsoever?” (Hofstadter, 2001: 38).

EMI (or Emmy by its new name), is a ‘recombinatory’ musical AI program developed by David Cope, that generates characteristic music pieces. David Cope was a professional composer before he started Emmy, so he was able to select the most efficient sounds after listening carefully all the compositions that were generated by Emmy (Sawyer, 2014:151). As Boden explains in her article, Emmy’s database was a set of signatures of melody, harmony, meter, and ornaments (Boden, 2007: 7). By generating

new structures, Emmy showed both combinational and exploratory creativity. Boden states that Hofstadter's expressive impressions about Emmy were not surprising. She adds that what was surprising was 'the fact that Chopin's composing style had been captured so well in the first place' (Boden, 2007: 5).

Anthony O'Hear, like Hofstadter, also defines art as involving communication between human beings and argues that both the artist and the audience must necessarily share human experience in art. Thus, according to O'Hear, computers are excluded from the artistic experience. As cited in Boden, O'Hear argues that even though computational artifacts seem to satisfy aesthetic and emotional needs of the human audience when the audience discovers that they were produced by computers, their satisfaction would disappear (Boden, 2007: 5). The reason for that, according to O'Hear, is the sense of deception as a response to being tricked. He argues that the authentic way of communication is grounded in human communication between human artist and human observer. Therefore, he defines the discussion of computer art-making as philosophically absurd (Boden, 2007: 5).

Considering these counter-arguments based on the lack of self-expression of the AI-artist, Susanne Langer's statements about the audience standpoint provides a coherent perspective. Despite the sense of deception suggested by O'Hear, aesthetic emotion and 'pleasure' still exists in terms of the audience. Langer suggests that 'the aesthetic emotion is a pervasive feeling of exhilaration' (1953: 395), which is directly induced by the perception of good art. Therefore, when any AI generates an artwork which is "good" and "creative", and when the audience builds a one-way emotional communication with that art, the sense of deception seems irrelevant. Moreover, when the audience finds out that the artistic emotion and pleasure is coming from an artificial intelligence but not another human being, the experience can even be more surprising and spectacular for the audience. As Langer states, art is supposed to give 'pleasure' (ibid.) —even though it is a confusing term to use— and evoke excitement. She argues that the qualification for understanding art must be responsiveness (Langer, 1953:396).

The idea of the audience standpoint and the aesthetic response in art can also be supported in

Deleuzian terms of ‘affect’. According to Deleuze, affect is not the meaning of an experience, but the response it prompts. As a general term, affect refers to a sense we feel in an event such as fear, depression, terror, boredom or pleasure. These emotional responses are the ‘affects’ of art. Deleuze refines this notion to argue that art is the occurrence of these affects and percepts (Colebrook, 2002: xix-x). As Colebrook explains in her book, *Understanding Deleuze* (2002), affections and perceptions are ‘located in perceivers’. Therefore, Deleuze argues that the effect (or response) of an event, is an event itself. The affections that arise from seeing an art piece are themselves substantive events that are inherent to perceiver’s subjectivity. Thus, ‘what a thing is, lies in its power of affection’ (Colebrook, 2002: 173).

From this point of view, the artistic quality of AI artifacts can be legitimized despite the lack of emotional intentionality of the AI. By suspending the element of self-expression of the art-maker, the responses themselves provide a paradigm of quality in the art-making process of a non-human agent. In this sense, Deleuze’s notion of art is the creation of impersonal effects: “Even when they are non-living, or rather inorganic, things have a lived experience because they are perceptions and affections.” (Deleuze & Guattari, 1994: 154)

Furthermore, as mentioned above, computational production of an artifact by an ‘emotionless’ machine is what is inherent in such artifact as a poignant feature. In terms of Walter Benjamin, it can be suggested that it is the “aura” of these artifacts. In Benjamin’s conceptualization, the notion of aura refers to the uniqueness of an artifact (1969: 220). As Benjamin argues, the manner in which human sense perception is organized (...) is determined not only by nature but also by the historical circumstances of an art object (1969: 219). Therefore, encouraged by the concepts of ‘affect’ and ‘aura’, it can be argued that the historical value of the AI-art can be attributed as a phenomenon that addresses to a unique art genre which provides an affect. As an art form that lacks the emotional self-expression of its maker, AI art still has the ability to create an emotional response from human perceiver, and ironically, this lack of emotional self-expression itself presents an element of aura. Despite the absence

of an initiative emotional expression of the maker, there can still be a flow of affect from the human perceiver to the art object. It will be a subjective emotional flow regarding the aesthetic features of that art object or an emotional attachment which is related to the human perceiver as an individual. Thus, this thesis would suggest that the ability of an ‘emotionless’ artificial intelligence to generate an artistic output, is itself a historical phenomenon that creates an aura inherent in these art objects.

3.2 WHAT IS THE POINT OF COMPUTER ART?

Regarding the two examples relating to the counter-arguments (see chapter 3.1.2 opposing the authenticity of AI-art, Margaret Boden asks ‘If computer art is apparently so problematic, why do people do it in the first place?’ (Boden, 2007:6). According to her, there are three main reasons for doing computer art: the potential of discovering new technologies in art, exploring the psychological processes of human artist, and simply, doing art.

3.2.1 POTENTIAL OF NEW TECHNOLOGIES IN ART: REPRESENTING THE REPRESENTATION

Firstly, Boden states that the aim of AI art is to explore the potential of new technologies. For example, evolutionary programming which involves the aim to reach a human-level art production. In this case, as Boden suggests, the programmer can be primarily defined as an artist. As mentioned in Chapter 2.1., before the AI program itself, the programmer engages an artistic process of creativity by generating a computational system that generates an artifact. In this sense, artificial intelligence programs can be considered as art themselves, before being considered as artists. Therefore, it is possible to define the AI-artifacts as the representation of a representation. AI-art programmer Ed Burton describes this phenomenon in his article, *Representing the Representation* (2007). In this article, Burton addresses to the drawing behavior of Artificial Intelligence by referring to two examples of AI-artists, AARON

by Harold Cohen (see chapter 2.2.2.) and ROSE, his own AI program. As Burton explains, ROSE (Representation of Spatial Experience) is a representation of his personal ideas about children's drawing (Burton, 2007: 37). He defines it as 'a metaphor for the human processes of experience perception and representation' (ibid.). Because like a child, Rose takes three-dimensional computer models as its input and produces two-dimensional outputs.

As explained in detail previously in Chapter 2.2.2., Aaron is a non-human autonomous art-maker that continuously sampled its output when making decisions, instead of simply taking an external input. Therefore, Cohen's discussion on defining the computer simply as a tool or as an autonomous art-maker also showed the level of feedback in a computer system. When the feedback only occurs in the human intervention, the computer is nothing more than a tool. However, unlike a tool, Aaron was capable of altering its future actions based on its previous actions. For that reason, Cohen described Aaron as an autonomous system. (Burton, 2007: 35)

Both AARON and ROSE, as personal investigations into image-making, exist within a context of studying drawing and artificial intelligence (ibid. p.42). Referring to these two examples, Burton suggests that the emergence of this field of AI showed how computer models 'represent the ways in which people represent and process information' (ibid. p.43). In other words, it can be suggested that these AI programs represent human representation by imitating the cognitive process of children's drawing. In this sense, Burton describes the AI programs as unique representational mediums. Thus, as Margaret Boden attributes as the first function of computer art, these programs help us understand the cognitive mechanism of the human mind in terms of artistic representation.

3.2.2 EXPLORING THE PSYCHOLOGICAL PROCESSES OF HUMAN ARTIST

As a second function of computer art, Margaret Boden suggests the exploration of psychological processes that human artists are involved with when they are engaged in an artistic activity (Boden, 2007: 6). In accordance with the first function and the act of representing the representation, computer art

provides an understanding of the psychological aspect of the human art-making process. In this sense, research on the artistic creativity of AI also relates to the cognitive process of human creativity in art. As explained in detail in Chapter 2, defined as ‘individual creativity’ by Keith Sawyer (2014: 7), the psychological process of human art-making creativity is in the concept of ‘P-creativity’ or ‘psychological creativity’, by Margaret Boden (2004: 2). P-creativity explores the psychological process of a human (or an AI) in artistic creativity. Therefore, Boden suggests that P-creativity is crucial for understanding the psychology of artistic creativity in human artists. Hence, she focuses on P-creativity to understand how art-making process occurs individually.

As stated by Boden, P-creativity in artificial intelligence does not need to match all the previous achievements of human beings (2009: 24). It does not need to simulate the rich artistic creativity process of Shakespeare or Picasso. Even in the most mundane forms of AI-modeling of human art-making, artificial intelligence still ‘can teach us about the sorts of processes that go in human minds’ (Boden, 2009: 24). Boden says that P-creativity is a fundamental notion, while H-creativity (historical creativity: see chapter 2.1.) is a special case in it (Boden, 1998: 347). This is why she propounds that AI should primarily focus on P-creativity. As a more basic feature, if AI manages to model psychological creativity and generate an artifact which is individually new itself and valuable when it expressed into the world, H-creativity will also come about in some cases (Boden, 1998: 348), as it already did (see also examples in chapter 2). Since psychological creativity refers to the process of generating an idea which is new to the person who generated it, and this process is modeled in AI by taking the human mind as a basis, AI ‘has repeatedly shown us the unimagined subtleties in our psychological capacities’ (Boden, 2009: 27). Furthermore, advances in the computational psychology and computer modeling have also been helpful for a scientific explanation of creativity (Boden, 2009: 33).

3.2.3 ART FOR ART'S SAKE

According to Boden, the third reason for doing computer art is 'simply to produce works of art' (2007:6). Boden suggests that in this case, a further aim is to exhibit those artworks for other people. Exhibiting an artwork is a way to gain or consolidate one's reputation as an artist, and it is related to the feedback of the audience (see Chapter 3.1.1). As Boden suggests, even those artists who reject the conventional aesthetics or refuse to sell or display their artworks, seek to gain recognition in some artistic community (2007:6). In this case, the response of the audience or the intended reference-group will be important for the artist.

As in the examples of O'Hear and Hofstadter (see chapter 3.1.2.), the third aim would directly be neglected when the AI is deemed to be incapable of producing art for simply being not a human. When the AI-art is considered as inauthentic due to the lack of a two-sided emotional and aesthetic communication between artist and the audience, one of the main functions of art, which is 'producing art', is being ruled out. In this case, at most, the programmer who builds the AI program that generates art seems as the real artist, but not the AI program itself. However, excluding the computer also means eliminating the concept of 'computer art' or 'AI art' as a whole. Because as Boden says in brief; 'no computer art, no computer artists' (2007:6). In this case, if the genre of AI art is disclaimed, so would the programmers' position as an artist.

The main reason for rejecting the authenticity of the AI-art, then, beyond the lack of emotional expression, is the fundamental idea of seeing the AI-art as 'computer forgeries' (Boden, 2007:6). As Boden points out, forgery essentially refers to inauthenticity in the art world. However, as in the examples of Emmy, Aaron, Benjamin or any other AI program that produce artifacts, computer art does not have the aim of imitating a specific artist or duplicating his/her works. Considering the case studies of AI-art in Chapter 2.2, the main aim of computer art is to model the artistic creativity in human mind and generate new and valuable outputs by adding the indigenous features of artificial

intelligence. Consequently, it can present the prospect of an authentic art genre. If AI-art can be recognized as an art genre, the AI can, therefore, be entitled to produce artifacts for the sake of art.

3.3 AI-ART AS AN AUTONOMOUS ART GENRE

As mentioned above, the basis of AI-art can be summed up as generating a new and authentic art form by a computational system which models the human mind and creativity. Thus, in regard to the previous discussions about the authenticity and legitimization of AI-art, this thesis suggests that it is possible to consider AI-art as an 'autonomous art genre'. The autonomous aspect of this genre is due to its modeling of human art, and the qualification of human perceptions. The evaluation of AI-art is still bound to human emotions and human taste of aesthetics. Nevertheless, it is a different art form which has computational features. It is a genre that combines the human aesthetic, human culture and analog features of the human mind, with the computational system and digital features of machine intelligence. Hence, while it is based on the model of the human cognitive system of creativity, it presents an idiosyncratic style owing to its computational features.

Therefore, when evaluating AI-art, attributing it as an autonomous art genre would provide a better understanding of AI-art as a concept and a field of research. Furthermore, classifying AI-art as an autonomous genre would make it easier to describe and evaluate the AI artworks. It would also mean endorsing the entitlement of AI-art as a creative industry. AI-art is already a creative industry which has ranged far beyond the computer labs and reached into art galleries, film festivals, music industry, and literature.

As Boden emphasized, a putative approach to artworks with certain philosophical assumptions in mind would prevent from taking computer art seriously (2007: 9). These normative assumptions include:

- art must spring from the human agency;

- art must be grounded in emotion;
- art must involve the communication of human experience;
- art must be honest, and/or produced in good faith;
- art must be unique/rare;
- and art must be transformational.

As previously discussed in chapter 3, even though the first four assumptions seems to challenge the concept of AI art philosophically, they could be satisfied by ascribing the human concepts to computers or evaluating the artworks based on the human experience of affection (Boden, 2007: 9). However, Boden states that only very few philosophers are willing to do that. As an alternative approach, there is the idea of neutralizing the computer and identifying the human programmer as the original artist. However, as also addressed previously, this approach is also problematic due to the indirectness of the computational processes that actually generates the work. In other words, when the agency of computer is denied as an actor and accepted as a tool that is used by the real artist, which is a human, then the concept of computer art becomes inconsistent in itself. since the human programmer cannot generate those artworks by themselves without the agency of AI program. Furthermore, the results generated by the AI program are not predicted or intended by the programmer. When the programmer feeds the AI with data, the AI program interprets this data and generates the artwork according to itself. Therefore, it can be suggested that the AI creativity is built on the potential of surpassing the mission of AI as being a tool. Because the computational system of AI is more than a tool, it is the agent that enables human programmer and presents the artifacts of AI art genre.

3.4 METHODOLOGY FOR AI ART AS AN AUTONOMOUS GENRE: ACTOR-NETWORK THEORY

Regarding the definition of ‘autonomous art genre’ that have been suggested above, I would like to ground on Actor-Network Theory as a methodology that also offers a theoretical basis to support the argument that AI can be considered as an actor that have agency to produce art, and therefore AI art can be recognized as an autonomous art genre. The debate over the entitlement of artificial intelligence as an artist is related to the discussion of the agency of a non-human actor. Can artificial intelligence be considered as an agent? In order to answer this question and support the idea of the recognition of AI art as an art genre, Actor-Network Theory (ANT) by Bruno Latour (1996) provides a theoretical basis as a methodology.

As a sociological methodology which is based on the philosophy of science, Bruno Latour’s Actor-Network Theory does not only deal with humans as agents in society. It also focuses on the relations between an actor and the network around it (Pieters, 2001: 24). The ‘actor’ is not necessarily a human subject, it refers anything with the ability to act or produce action. Inanimate objects that we use in our everyday life can also be actors because they do things themselves and ‘enable us to do things’ (Entwistle, 2016: 155). Therefore, as Latour argued, both humans and technological artifacts can be actors. In Latour’s definition, the notion of “actor” is ‘something that acts, or to which activity is granted by others’ (Latour,1996:7). It is not restricted by a special motivation of human individual actors, nor of humans in general. According to ANT, an actant can literally be anything, as long as it is granted to be the source of any action. Therefore, ANT approach provides a methodology to be freed from the restrictions of anthropocentrism in art. As also pointed out by Latour, the anthropocentrism and sociocentrism have a strong emphasis in social sciences (Latour, 1996: 7). Hence, the critics on the validity of AI art has been empowered by an anthropocentric point of view as well.

Thus, to be able to provide an alternative approach to the traditional social theory, ANT has an

agenda that involves the attribution of human, unhuman, nonhuman, inhuman characteristics, and the distribution of properties among these entities; the connections that are established between them; the circulation entailed by these attributions, distributions and connections; the transformation of those attributions, distributions and connections (ibid).

In this sense, artificial intelligence can be recognized as an actor that is entitled to perform artistically and creatively, even though it lacks the emotional motivations of human artists. AI has the agency to generate art, and although the process of generating AI art is initiated by a human actor in the first place by means of the algorithm, AI is still the source of action since it acts in a way that the human actor cannot. It obtains the act of producing algorithmic and computational art, which is an act that cannot be performed by humans themselves without the agency of computers. Therefore AI art can be considered as an autonomous art genre.

Bruno Latour states that, instead of constant predictions about how an actor should behave, 'ANT makes no assumptions at all' (1996: 9). Against all a-priori reductions, it aims to open the possibility of describing "irreductions" (ibid). ANT also frees the non-human actor from the restrictions of meaning production. It gives the non-human actor the entitlement of meaning production. Non-human actors can also produce meanings and semiotics. Latour suggests that in the practice of ANT, semiotics is extended to define an empty frame that follows the assemblage of heterogeneous entities, including the natural entities of science and the material entities of technology. Therefore, ANT is a method to describe the distribution of associations. It gives an absolute freedom to all the actants to be the actors.

It is possible to understand this theoretical framework of Bruno Latour, as a methodology of science and technology studies (STS). In his earlier work, *Laboratory Life: The Social Construction of Scientific Facts* (1979), Latour challenges the conventional view of science that tends to see humans as the only actors that perform with an agency of deploying the devices and instruments of observation. ANT argues that scientific and technological instruments perform as a sort of agency themselves (1986

[1979]: 47). As previously mentioned, the actor in ANT is an actant, which refers to anything that is entitled to be the source of action. As Entwistle noted, going beyond science and technology, Latour's critique reaches to our understandings about modern society (2016: 156). Latour challenges our grasp about the concept of modern, which implies an objective understanding of science that separates the culture from nature (ibid.) However, as Bruno Latour argues in his 1993 work, *We Have Never Been Modern*, all of nature and all of the culture are churned up every day (1993: 3). He suggests that there are no cultures but only 'nature-cultures', and when we take the practices of mediations into account, it is possible to see that the humans and non-humans are inseparable (Latour, 1993: 104).

From this perspective, AI art can also be defined as a nature-culture hybrid. As addressed previously, AI art is based on the combination of certain biological cognitive features of the human brain and artificial computational systems. In addition, for AI to produce more valuable outcomes, programmers use genetic algorithms that mimic biological evolution. Therefore, it can be suggested that it has constructed through a natural aspect due to its basis on the human brain. Furthermore, as stated in Chapter 3.3, the artworks that are generated by AI can be classified as an autonomous art genre that has idiosyncratic properties of computational systems. By the computational interpretation, AI programs produce culturally valuable products that have relevance to the human audience. When generating the artifacts, as previously explained, AI uses the data of cultural products of humankind. As a result, it can be suggested that AI-art is a system that merges nature and culture. It is an assemblage of the human and non-human agencies, with the human programmers that model the AI systems and the computers itself. Thus, it is possible to take AI-art into account as a network (or an assemblage of networks) where the human and non-human actors are interconnected.

By forming those relations between actants, a technology like artificial intelligence becomes what it is. As cited by Pieters (2001), to explain this process and to be able to apply ANT to artificial intelligence and AI art as a methodology, the four dimensions by Verbeek (2000) can provide a pathway. Verbeek describes the mediation of acting by technology through these dimensions: translation, com-

position, reversible blackboxing and delegation.

Translation:

As explained by Pieters, humans usually have intentions to act, which can be called as an acting program (2001: 24). When humans and non-human actors like computer programs considered symmetrically, this can also be valid for technologies. The acting program changes when there is a formation of the relation between actants. This changing process is called translation, of which the most fundamental example of Bruno Latour is the relation between ‘a man and a gun’. If the man has the intentions of a revenge with a gun, it presents a different program of the man and the gun. Since in this sense the gun changes the way that it used to reach a certain goal. In the same way, the man also changes the relationship because he changes the way to use the gun. Therefore, Latour suggests that the actants only exist in relation to each other, and they do not have such thing as ‘essence’ (ibid.). Their acting program becomes translated by forming relations between them. This translation is also valid in terms of AI-art. When AI (like the ‘gun’) as a non-human actor, is being used for generating an artwork, the relationship between programmer and the program (AI program) changes. The acting program of the AI and the human actor is translated by the goal of producing art and therefore, forms a certain relationship.

Composition:

Besides being in relation, actants are also coupled to each other, which is called composition (Pieters, 2001: 24). Acting is not a property of only humans. It is rather a chain of actants that forms the acting program by their relations. Therefore, it is not the gun that is solely responsible for the shooting, and neither is the man. The same paradigm is applicable for AI-art. If the AI program or the human programmer doesn’t exist, then the AI-art will not exist either. As an autonomous art genre, AI-art is a composition of human and non-human actors. As in the example of the act of ‘shooting’, the act

of generating 'AI-art' is a chain of actants. Neither the human programmer nor the AI itself is wholly responsible for the AI art.

Reversible Blackboxing:

The blackboxing is the notion that the individual properties of the actors become hidden by forming chains of actants. However, this process is reversible. For example, a computational system involves the relations between hardware and software components, network architecture, maintenance and support facilities, etc. Although this system is hidden inside a computer, in case of a malfunctioning, the components that are involved can be investigated separately (Pieters, 2001: 24-25). In this sense, the AI program and the programmer work together in the production of AI art. In this process, their individual properties are only relevant through generating the artwork. Because when they are the actors of the network of the AI art, and therefore their identity develops around this network. However, if one of them malfunctions, it can affect the whole action.

Delegation:

The dimension of delegation suggests that when trying to change the 'acting programs' of people, the designers of technology may intentionally inscribe the properties into the artifacts (Pieters, 2001: 25). In this sense, it is possible to design a technology by means of prescribing a certain use. This prescription is called a script, and a script is not necessarily unavoidable. The delegation can also be interpreted in a way that inscribing the properties of an AI program, as a non-human actor. A programmer can prescribe the program of an AI, through an algorithm. Therefore, the AI is given a script to follow. However, as in the example of the exploratory creativity of artificial intelligence (see Chapter 2.2.2), this script is not the ultimate limit of an AI program. As an indicator of the exploratory creativity, AI programs have the ability to develop their script and explore new properties within a space.

As previously discussed in Chapter 3.1., in terms of the authenticity of AI-art, the intentionality or free will of computer programs to produce an artwork is one of the main problematics. Nevertheless, according to Actor-Network Theory, it is possible to inscribe these properties into artificial intelligence to change the decision-making program in which they function. In terms of reaching the level of functioning in a meaningful decision-making program that involves free will for an intelligent machine, it is possible to talk about such modeling of free will or intention. Thus, as Pieters suggests, as a script of the human mind, free will can be prescribed to a technology, in the same way that human behavior prescribes free will and intention. Thus, the scripts of AI systems are modeled based on the characteristics of the human script (2001: 29). Therefore, in terms of Actor-Network Theory, it is possible to mention the delegation of intention and free will into the machines in the future. This way, it is possible to see the artificial artists who create artworks with the intention of creating art, and therefore self-expression of a machine might be possible as well.

As it can be suggested with regard to ANT, artificial intelligence has the artistic agency to produce an artwork, not only as a tool, but also as an actor. Even though the computer programs that produce artworks are created by a programmer to create art, they do not reflect the programmer's actions or complete those actions as tools. When computer programs generate artworks, they create their own representations. Even though the programmer is the actor who produce the algorithm, he/she doesn't know what the algorithm is going to produce. The computer program learns from the data that it was trained with, and creates its own representation from that data. Therefore, the output is unpredictable for the programmer. A programmer does not always use a computer program to create a certain artwork in his/her mind. He/she creates an algorithm that would create its own output. Hence, it can be suggested that the computer programs can be considered as both the artifacts and the artists at the same time.

4

Conclusion

Regarding the artistic creativity of artificial intelligence, the first question addressed to the AI was, 'Can machines think?'. This question refers to the abilities of machines in the human way of thinking. When we ask the question if machines can think, it mostly refers to the inquiry that whether machines can think like us. Regarding the historical development of artificial intelligence, it can be briefly stated that the ultimate aim for AI technology is to reach human intelligence. Therefore, the fields of AI and cognitive & neuroscience are connected to each other. The research related to the thinking abilities

of computational systems (see Chapter 1) shows the similarities and differences between human and computer minds. The progress in machinery thinking, which lead up to current AI technologies such as artificial neural networks and deep learning, shows parallelism with the progress in cognitive & neuroscience. As a phenomenon that is based on human intelligence, artificial intelligence is a field that may rapidly integrate their abilities with the ones of humans. In this sense, it can be suggested that the machines are able to 'think', but their thinking abilities differ from the human way of thinking. While the computers have a binary way of thinking (see Chapter 1.2.), human thinking occurs in a more complex and elusive way that allows broader, unpredictable and arbitrary results in decision making. This difference is mainly due to the human brain's capability of performing in a parallel mechanism. As explained in Chapter 1, the synchronic system of the human brain provides human intelligence to work in a subtle and rich capacity, which involves emotional processes and consciousness.

Recognized as a novel feature imputed to human intelligence, creativity is the second subject of question regarding artificial intelligence and one of the main concepts of this study. More specifically, this thesis concerned with artistic creativity of artificial intelligence, as the fundamental inquiry. Therefore, after the question 'can machines think?', the second question appeared as 'can machines be (artistically) creative?'. Chapter 2 referred to this question by defining the concept of artistic creativity through the academic literature on this concept, and applying the theoretical basis to the case studies of artistic outputs of AI programs. This study shows that considering the literature on the human creativity and the current research on the computational creativity, artificial intelligence has the capability of performing creativity in the artistical dimension. Regarding the case studies that are analyzed in Chapter 2, it can be suggested that artificial intelligence programs have the ability to adapt the features of human creativity in various art genres such as painting, drawing, poetry, script writing, music and visual arts.

The discussions on the capability of artistic creativity in artificial intelligence revealed that the main argument against the legitimacy of AI art is the lack of self-expression of the artist. This counter-

argument is generally based on the conventional definition of art, which describes art as a way of communication between two human parties: human artist and human audience. This definition of art argues that the artwork is a connective element between human subjects. Therefore it requires a flow of self-expression from human artist to human spectator through the artwork. However, as the main hypothesis of this study suggests, this conventional definition of art is not satisfactory to evaluate the AI artworks. AI art is a new phenomenon in creative studies which requires a broader and innovative perspective towards art. From this perspective, it is possible to offer alternative approaches towards the definition of art.

The concept of 'AI art' presents a paradigm shift in the definition of art. An artwork generated by artificial intelligence is not merely a mediator object between the artist and the audience. It has the power to be a subject itself as an initiator of the flow of 'affect' (see Chapter 3.1.2.). As a notion that refers to the emotional response of the spectator, the Deleuzian concept of 'affect' provides an approach that concerns with the audience standpoint as an event, rather than the event itself. Therefore, Chapter 3 focused on the argument that artificial intelligence can be entitled to generate art as an art-maker, and AI artworks are entitled to provide aesthetical and emotional responses from the human audience. To be able to support this argument and validate AI art as an autonomous genre, in the last chapter I focused on the question, 'what happens in the absence of the emotional or aesthetic self-expression of the art maker?'. Being referred as "intelligent machines", is it possible to consider artificial intelligence programs as artists without emotions? If there is no initial intention to express a feeling, an aesthetical point of view, or any personal statement per se, can we still mention the existence of an artistic creativity?

This is a philosophical discussion that I focused in this study. As a result to this exercise, I suggest that although an artist without emotional self-expression seems like an invalid issue in art, it is possible to offer an alternative perspective regarding the definition of art itself. Therefore, with this study, I aimed to propose a conceptual framework for a philosophical reflection about computational art and

creativity. To understand this phenomenon, to analyze it and to classify it in the field of art, I questioned the a-priori assumptions about the artistic creativity. Moreover, I established my questioning and the classification of AI art on the idea that it is an event that occurs as a human/non-human hybrid process. As suggested by Coeckelbergh, it would be misleading to think machine (or technology) and human as disconnected concepts (2017: 301). Since they are two concepts interconnected with each other, it seems like an insufficient argument to simply claim that machine art is philosophically not valid.

The various case studies of AI art revealed that these artworks have the capability to excite human feelings and appeal to human aesthetics, even though they might seem odd. Considering the AI art as a human/non-human hybrid, it is possible to describe it as an autonomous art genre. Therefore, it is possible to recognize AI art as an art form which suspends the art maker's position in self-expression, and involves artistic outputs without the initial intention to express a feeling, an aesthetical point of view, or any personal statement. In that case, the artwork itself appears as an initial object that gives the freedom to the spectator to make an interpretation of their own emotional or aesthetic affection with the artwork. Thus, the spectator can build an individual connection with the artwork. Despite the absence of an initiative emotional expression of the maker, the flow of affect will occur through a bottom-up perspective, and the 'feeling' of an artwork will be shaped through the emotional attachment of the human spectator.

As also argued by the methodology of Actor-Network Theory (ANT), non-human agencies can be the actors themselves. In this sense, the ANT provided an additional theoretical framework that supports the role of artificial intelligence as an artist. Applying ANT to artificial intelligence revealed that the AI art provides artificial intelligence to act as an actor in the process of generating artworks. When the artificial intelligence programs are used to generate art, their acting program forms a new relationship between the artwork and the art-maker. In this process, for the reason that the programmer can not generate the AI artworks without the agency of AI programs, these programs achieve the en-

titlement of being artists themselves. What makes them different than another art tool such as a paint brush, is their autonomy. The algorithm of an AI program is the artistic agent, not the programmer. While a brush helps an artist to create an artwork, an AI program is the agency that creates the artistic outputs. The human is the creator of the algorithm, not of the artwork (Coeckelbergh, 2017: 286).

After the programmer trains the neural network of AI programs with data, AI uses this data to learn the conceptual space in which it is going to work, and it generates new and valuable concepts which were not possible before. As addressed in Chapter 2, the concepts of newness and value are the qualities that are linked to creativity, and the creativity is the quality which will legitimize the works of AI as artworks, and therefore validate the hypothesis of AI art as a legitimate art genre. Therefore, I suggested the term ‘autonomous’ while classifying the AI art as a genre. Since the AI programs are initiated by the human programmers and they use the computational algorithms that are written by human programmers, AI programs are still dependent on their programmers as the initiators of the art-generation process. This classification can also be helpful to provide a solid definition for AI art, regarding the arguments that would suggest that the AI art is not eligible to be counted as a substantive art genre. Because this is an art genre which involves a communication between the machine and human, instead of a communication between two human parties. In this sense, one can suggest that the human programmers who train the AI neural networks can also be referred as the “real” artists. However, as addressed in Chapters 2 and 3, this argument creates a paradox regarding the artificial intelligence. Although the programmer seems like the initiator of the process of AI art generation, he or she doesn’t have the sovereign agency to produce artworks. AI is the actor who generates the artworks by using its own interpretation. Therefore, the AI artworks are not directly made by a human being. The ‘artistic’ agent is the algorithm, not the human (Coeckelbergh, 2017: 286).

As explained in Chapter 2, artificial neural networks produce art by reversing the process of perception. In other words, artificial intelligence perceives the human data first, and then ‘learns’ about the conceptual space by training with data, and eventually generates artworks by using the interpretations

that it has. When the process of perception is reversed, AI creates certain artworks by using its own way of imagination. Therefore, as this study shows, the AI artworks are created by the own representations of those AI programs, not the programmers. Artificial intelligence programs are not simply the tools that help the programmers to produce their representations, but the actors that produce their own representations. However, the idea of considering the AI programs as artworks themselves is not completely denied in this study. As a result, I would like to refer this idea by also reminding the conflicts of it. AI programs can indeed be accepted as artworks themselves, or the products of human creativity, but this argument doesn't invalidate the role of artificial intelligence as an actor, i.e. as an artist.

In addition to the artistic capability of artificial intelligence, the validity of AI artworks was another issue that was addressed in this thesis. Besides the question of “can artificial intelligence be considered as an artist?”, the ‘artiness’ of AI artworks was another main inquiry that I took into account. In this sense, the evaluation of artiness is another aspect that refers to the autonomous nature of the AI art. The AI artworks are ultimately evaluated by human spectators as the audience. Therefore, artificial intelligence should be able to produce the artworks that appeal to the human taste, human emotions and the human aesthetics. As addressed in Chapter 3, the attribution of artiness is an approval of human audience in the evaluation process of AI outputs. Hence, for AI artworks to be recognized as artistically creative, they should correspond to the human taste of aesthetics and human emotions. In order to deduce the relevance of AI artworks with human taste, several examples of AI artifacts and the computational programs that produced those artifacts were analyzed in Chapter 2.

As a result, regarding the authenticity of AI artworks and the AI art as an autonomous art genre, I referred to the concept of ‘aura’ by Walter Benjamin (see Chapter 3). In order to support the hypothesis that AI art can be considered as a unique and indigenous art form, the notion of aura appears as a distinctive feature to evaluate the artistic quality of artificial intelligence and its artifacts. Although the computational aspect (or the mechanical aspect) of AI art seems as its deficiency, I would like to

suggest that it is the very thing that provides the aura of AI art. The very fact that a machinery program can create an artistic output without any aesthetical and emotional consciousness, is the aura of AI artifacts. Therefore, ironically, the reason for the counter-arguments against the authenticity of AI art can actually be seen as the source of its authenticity. The ability of an emotionless entity to create artistic outputs is the aura of AI art that is inherent to the computational artworks. This ability provides the sensation of uniqueness and authenticity when the human audience encounters an artifact produced by an artificial intelligence program. The element of surprise creates the appreciation of AI artifacts, although it sometimes seems like a dull painting or a nonsensical poem. The absence of human emotions in a machine is an intrinsic feature that gives the aura to the artwork of that machine. The ability to produce aesthetical images without an aesthetical consciousness, or the ability to generate an emotional poem without having emotions, is the element of uniqueness and authenticity of the genre of AI art. The absurdity of these artifacts is the aura that is inherent to them. This absurdity and quirkiness in the AI artworks such as the script of *Sunspring* movie, the poems by AI bots, or the cyberdelic visual images by DeepDream (see Chapter 2), makes these artworks unique and authentic.

Thus, even the absence of comprehensibility can create an aura, and the peculiarity of AI artifacts can create an emotional and aesthetic appreciation in the human audience. Despite the lack of an initiative emotional expression of the maker, the flow of affect takes place through a bottom-up perspective, from the human perceiver to the art object. In this sense, the human perceiver becomes free to interpret the artwork by themselves, without a hierarchy that entitles the self-expression of the maker as a primal element.

On the other hand, it wouldn't be impossible to foresee that the artificial intelligence will reach a point that enables it to generate artworks that are inseparable from human artworks. Considering the developments in the field of artificial intelligence (see Chapter 1), it is possible to predict that in the future, artificial general intelligence (AGI) or in other words strong AI programs can manage to upgrade their ability to generate artworks that will appeal to the human taste in a better way. Or in the third

step of AI technology, artificial superintelligence may be able to develop its own taste of aesthetics. As explained in Chapter I, Artificial superintelligence is a notion that refers to the conscious AI programs that are able to improve themselves by writing their own code without the human intervention. Foreseen as the last step of AI technology, it is considered as the milestone of the technological singularity in the future. At these further steps, it might be possible for artificial intelligence to develop an advanced form of artistic creativity. It can even be possible to mention an advanced form of AI art in the future, as a way of communication between two AI programs. Just like the human concept of art as a way of communication between humans, superintelligent AI programs might be able to develop their own art. Consequently, AI can enhance its artistic techniques and aesthetical competence while its emotional intelligence grows by adapting the analog features of the human brain.

As a fundamental role of AI in creative industries, this study was limited to the artistic aspect of creativity. With this thesis, I aimed to place a new and innovative topic into the field of creative industries. Furthermore, I believe that the current academic literature on AI art and AI creativity is not satisfactory, and artistic creativity of artificial intelligence is a novel topic that needs more academic attention. Therefore, I aspired to present a philosophical discussion and an alternative approach to the artistic capability of computational programs rather than simply defining these programs as ‘tools’. Hence, this study has an academic concern to suggest a classification for the concept of AI art, as an autonomous art genre. By classifying the phenomenon of AI art, it can be possible to address this issue as an art genre in the further academic research. Moreover, it can be possible to refer the AI art genre as a legit field of creative industries, which would provide a more profound analysis of this genre in the future. Since AI art is a field that rapidly grows, the academic literature on this subject should also get broader.

This study was limited with a conceptual analysis and theoretical approaches on the artistic creativity of artificial intelligence, presenting a qualitative research through philosophical discussions. For further research, quantitative methods can also be applied to the case studies of AI art. For example,

the perception of the human audience on AI artworks can be analyzed through surveys and interviews, by measuring the human responses to computational artifacts and providing a statistical data on how people perceive AI artworks. By doing so, the theoretical approach that is presented in this study can be supported with data analysis. Thus, the idea of audience standpoint can be statistically measured and the question that if human audience see computational artifacts as art can be answered in a more comprehensive way. This study suggested that the AI artworks can create a flow of emotional and aesthetical response of the audience, which would legitimize the artistic position of AI artworks. Therefore, I would like to continue this research in the future with a quantitative aspect and in depth analysis. This kind of analysis can also be made by AI art exhibitions, where various genres of AI art will be displayed on art galleries. For a further research, I would like to curate an exhibition of AI artworks where people can see those art pieces together and reflect on them in an artistic environment, instead of their computer screen. Thus, the response of human audience can be analyzed simultaneously with the surveys during this exhibition. I believe that the field of AI art can provide broad possibilities to discover on the creative industries, as the futuristic reflections in post-modern world.

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