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Examining the Capabilities and Challenges of AARON (Painter Software)

Introduction

Whether the result of the random or trained activity of animals such as chimpanzees, elephants, dogs, etc., or events that create phenomena in nature according to human aesthetic taste is art is the pivotal point in the definition of art and aesthetic articles. Needless to say, however, if we overlooked the art of more than a century ago, that is, from about 1900 A.D., or did not experience it, perhaps such issues would not be raised at all. But here and now is the point where we stand and face such questions. We also sometimes face other challenges that manifest themselves in new forms of art: what is computer art? What is its boundary with digital art and what is its relation with internet art? Finally, can computer art be inherently new art?

These two categories of questions are both important and influential and can be an important part of theoretical research in contemporary art. However, this article focuses on a collection of works that can be called a relatively new and unfamiliar title "Artificial Intelligence Art". Also, according to the authors of the article, linking these two categories of questions and seeking answers to them are yet unexplored territories: aesthetics and inhuman art.

Various attitudes have existed toward artificial intelligence since its introduction in the 1950s, ranging from a rosy future to a cataclysmic apocalypse [28, p. 5]. AI has rapidly developed, opening up new research areas into its potential applications in a wide range of fields. However, serious concerns have been raised regarding its inexplicability, limitations, potential risks, and social implications. The incorporation of artificial intelligence into the process of creating and perceiving works of art is currently one of the most intriguing and, at the same time, controversial issues [4, p. 1].

In parallel with the emergence of artificial intelligence, a number of artists made computer programs to create artworks. In many cases, these programs contain intelligent components. Harold Cohen was a pioneering figure in this field. Aaron is an art software designed to generate paintings based on the rules that Cohen had coded into it. Several forms of artificial intelligence-based art have emerged in the years following Cohen's groundbreaking work. Machine learning algorithms are perhaps the most significant evolution in this field. An important distinction between traditional algorithmic art and machine learning algorithms is that rather than the artist writing detailed code in advance and specifying the desired aesthetic rules, the artist can now create algorithms capable of learning aesthetics by studying many images. Generative Adversarial Network (GAN) is the most widely used tool in this category [12, p. 2].

Nonetheless, as previously discussed, the development of various applications for artificial intelligence in a wide range of fields, particularly the strange concept of "artificial intelligence art," raised serious philosophical and ontological challenges and questions. A major question that was raised by the likes of Hertzmann and Coeckelbergh was, "Can machines produce

Fig. 1. The monk's initial impression of the kangaroo, 1990 [6, fig. 1]

Fig. 2. The monk's new conception of the kangaroo, 1990 [6, fig. 2]

art?" [5; 9]. Moreover, what are the characteristic(s) of works produced by programs such as Aaron that qualify them as works of art? Of course, it is possible to formulate this question more precisely: What occurs during the production of works (made by artificial intelligence), including Aaron, so that the final product can be considered artwork?

Regarding this category of questions, it is clear that the positive role that artificial intelligence plays in art has not been ignored; in many cases, it has been positively evaluated [24; 15; 4; 2]. However, artistry and creativity are still viewed as human activities. Some restrict the creation of art to the realm of human activities [24; 15], arguing that art is inextricably linked to the concept of creativity. On the other hand, the topic of "creative artificial intelligence" is currently the subject of much technical discourse [4; 26]. While researchers such as Boden have specifically pointed out "Aaron's creativity" [3, pp. 352–353], they have argued that the scope of human and machine creativity differs when considering their respective concepts.

In their view, machine algorithms can be used to make exciting changes to existing images, but an artist with an artistic background is essential for presenting these images. Making creative decisions is the essence of creativity in art making, an act that transcends current technologies [24, p. 78]. Furthermore, Hertzmann contends that art is inherently the product of social factors, and thus artificial intelligence algorithms (as they are currently understood) cannot be considered art's authors [15, p. 19]. This perspective is founded on the notion that the existence and significance of art are inseparably linked to human-human interaction [4, p. 1].

Many scholars and art critics have embraced artificial intelligence due to its potential as an artistic tool. Aaron Hertzmann, for instance, believes that technological advances, such as artificial intelligence, can positively impact the art world.

The advancement of technology has supplied art and artists with new tools and techniques of expression, contributing to the ongoing vitality of art [15, p. 2]. Meanwhile, some artists who have employed artificial intelligence in their work believe that the interplay between artificial intelligence and art and artists is not a new phenomenon. Overlaps between AI-based artistic methods and the use of technology in previous periods of art history have been identified. In general, there have been no dramatic changes in the relationship between artists and their "medium" [24, p. 78]. However, some researchers believe artificial intelligence has a broader role than merely acting as a tool for creating artwork (even though they are unwilling to use the terms creator and artist). In their opinion, artificial intelligence can execute considerably more sophisticated tasks than basic tools like paintbrushes when it comes to creating art. The brush lacks the ability to "change," it does not "decide" based on past painting experiences, and it is not "trained" to learn from data. In contrast, algorithms cover all these possibilities [21, p. 8].

Obviously, the purpose of this study is not to investigate these issues and, in particular, the role of artificial intelligence in art in its broadest sense (as a creator, tool, or medium). However, we sought to delineate "Aaron" and the works it has generated as one of the "oldest" and

"most lasting" collaborations between artificial intelligence and humans to create works of art. Additionally, Aaron's unique characteristics are highlighted, which may contribute to its closer alignment with the definition of "human creativity."

Harold Cohen and AARON

The young Harold Cohen was a relatively prominent painter in the British art scene during the 1950s and 1960s, and he was lucky to become a lasting name in the London art scene. However, from

Fig. 3. Anatomical study, 1988 [5, fig. 4]

the time he became acquainted with the computer, he posed the main question that occupied his mind for the rest of his life and changed his artistic experience: Can this device in front of me produce art? He cites a fascinating example from the time he first entered the University of California, San Diego, and heard music playing from a computer at the Center for Computer and Art Studies. The sound of music fascinated him, and at the end of that piece of music, he asked if there was another piece he could hear from the computer. The disappointing response he heard made him realize that the computer, with all its complexity, required the input of the original human musical notes and could not play without it. Therefore, we can state that all his extensive efforts in three decades of activity focused on the creation of a program that can produce images and works of art independently of humans. AARON was the result of thirty years of effort [9, pp. 2–3].

AARON's (metaphorically) works are massive images (usually 2.3 meters or even larger murals) in a style and context close to the expressionist literature of the early 20th century (Ill. 150). Although features such as linear value and especially coloring were gradually embedded in different versions of AARON, we are mostly faced with linear images (so-called design) in the initial versions. In some versions, Cohen, after finishing the work, gives himself the right to add color to it. In later versions, he started to learn illustration, and progressed to the know about forms of nature, including figures and leaves and trees, and made internal or external combinations of humans with pots, flowers and trees in some periods. In the early years of the 21st century, he returned to more abstract forms and experienced defining forms, especially more independent coloring. So, it was Cohen's process of continuous training and his empiricism that made this AI mysterious, fascinating, and exciting at the same time.

The artistic works created by AARON are not very impressive in terms of illustration, and perhaps, along with the works of their contemporaries, they may be able to catch the eyes of critics less frequently and may attract enough attention when the audience is aware of the process of creating or producing the work. However, it seems that the issue of the quality level of these works is of lower importance and the most important point of the study should be the issue of creation or non-creation by computer or program. More interestingly, the collection of works of this program from the first years, i.e., the 1970s, was displayed in some important museums and galleries of the world, such as Los Angeles County, San Francisco, Brooklyn, Amsterdam and Japan, and the remarkable collection of works by AARON now
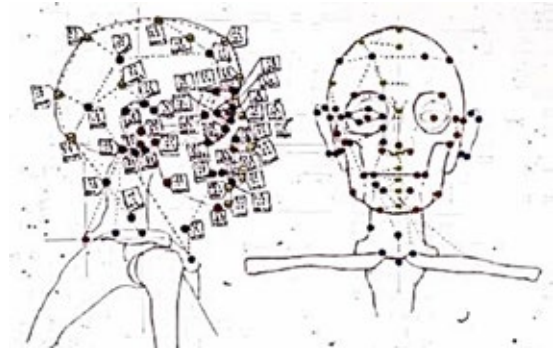
housed in the Victoria & Albert Museum (Ill. 151). In the following, various aspects and consequences of accepting AARON paintings as artistic works will be explored and the issue of selection will be raised as the main condition and criterion for accepting creative action in this software.

From the late 1960's [19, p. 6] and post-minimalist works, multimedia titles, videos, etc. appear in books on the history of contemporary art or title tags in galleries [1, pp. 585–586]. From this period, media such as screens, printers, projectors and the like have been used in the works of modern artists. With the advent of computers, especially the deep and sometimes inherent connection of media and these gadgets with computers, the title "computer art" is simply used for these kinds of digital works. Hence, especially until the mid-1990s, there was no clear distinction between digital and computer art. But as the analysis of concepts and meanings progresses, the distinction between the two arts becomes clearer.

The first questions are: what is digital art? Should we consider it a new kind
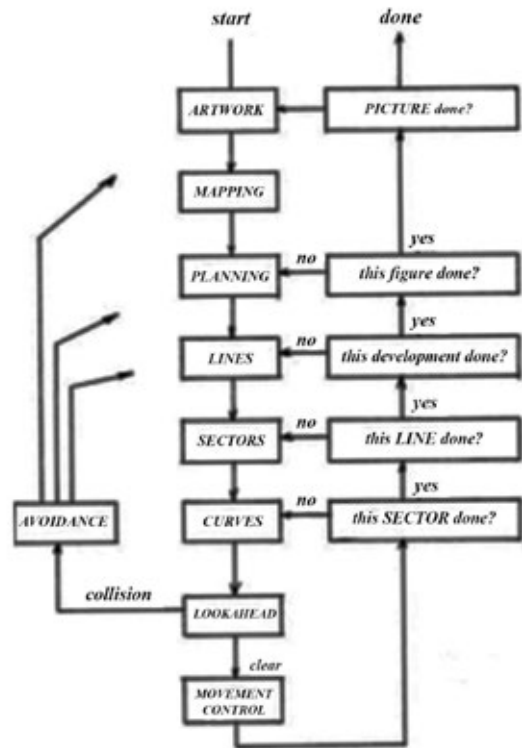

Fig. 4. The system's organization is hierarchical, in the sense that the higher levels are responsible for decisions that constrain the domain of action for the lower levels [6, fig. 5]

of art? For example, in some works of video art, an act is originally performed by a person or persons, and then by recording this action or event, the audience can replay it. In such works, the difference between the original act and its replay is more often called a "Remediation". In this sense, digital cannot be considered an independent medium or art tool; because it seems that an artistic action has been reproduced in a new format with classical tools (such as show and body) [20, pp. 16–19]. Therefore, the title of digital art in this sense will not be an accurate title, at least for the above-mentioned works. Probably the same criticism can be applied to some works that are basically related to computers. For example, suppose in an interactive work, whatever the audience depicts on the paper in front of them is depicted in sizeable dimensions on a giant tower. In this work, the computer plays the role of a mediator of image transfer and its existence cannot be considered vital in the formation of the work. For example, the same work may (albeit with a troublesome mechanism) be implemented through the usual optical laws, namely lenses and mirrors.

In short, according to Lopes, a work can be called a computer art when the computer media, rather than as a tool for transfer and remediation, acts mainly as a vital tool for creating the work [20, p. 18]. Successful examples of such works can be found in the relatively minor

subset of Internet art, especially works that are created based on public interaction. For example, in a work titled "9", nine groups of audiences are allowed to share their text and images, and finally a random combination of these materials is displayed on their screen [13, pp. 171–174].

Regarding AARON, at least according to the software manufacturer's claim, which will be investigated in more detail below, the computer plays a key role in creating works, and according to Lopez, AARON can be easily included in the scope of computer art. However, there are other examples with a mechanism close to AARON, in which the computer plays a vital role.

Fig. 5. Turtle, 1979 [4, fig. 10]

PINDAR is a live and ongoing project called Robot art [22]. In this project, images such as portraits of famous people are analyzed by a computer and then reproduced in a pop art style through a transformation based on special software command. At this stage, the image execution command is transferred to a robotic arm (similar to the AARON project until the 1990s), and the arm carefully dips the brush into the dye tank and slides on the bottom plate with controllable pressure. Finally, the image is drawn step by step like a man-made painting (Ill. 152).

Thus, it can be concluded that even based on Lopez's relatively [20] strict definition, both AARON and PINDAR fall into the category of computer artwork. In the following, the distinctions between AARON and other examples are elaborated to define a new and sparsely populated AI artwork.

At the beginning of the discussion, chimpanzee painting was mentioned, which somehow creates art of non-human origin. Congo is perhaps the most famous example of an artist animal. As an intelligent chimpanzee, he practiced the art of painting, and the works recorded under his name match the works of abstract expressionists [17].

We are confronted with a pattern of animal behavior in such works, which is called "conditioning," and it is claimed that the animal, in the form of a set of controlled actions in the reward and punishment system, has learned that if he takes the brush and pulls it like this, he will receive a reward or will not be punished anymore and thus:

1. Congo is not aware of the meaning of his behavior.
2. His artistic action is not based on free will.

Basically, these two conditions are the basis of our evaluation and even our enjoyment as an art audience. For example, if we encounter a scene where objects happen to be juxtaposed attractively, we will immediately look for these two features. Any audience will probably be able to find objecting and environmental references by observing a large number of dead salmons gathered on the surface of the shallow pond. But when someone makes him aware of the fact that this is not the result of a specific human conscious action, and goes back to the nature of this fish and its death after spawning, these references will disappear immediately and he will no longer have any definition of protest or warning against environmental damage. Until this time, as an artist, he somehow conveys the desired situation or report it to a museum or exhibition, and then the audience will be ensured that, regardless of the high or low quality of the work, the conscious, meaningful and voluntary action of the artist as the creator of the work lies behind it.
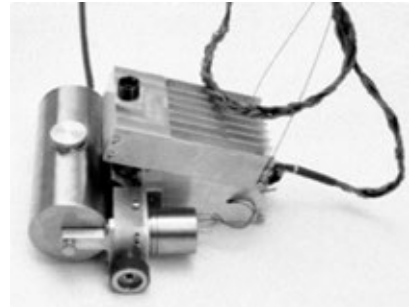
In many examples similar to the PINDAR project, the same two conditions strongly resist the acceptance of the artistic aspect of the project: The behavior of this program is a set of complex computational patterns that include image analysis, image metamorphosis, new image analysis based on execution order and complex calculations to control the robotic arm. Therefore, the program begins with the simple command "Turn Image A into a work of art". The program receives the image and delivers image B at the appropriate time. In this set of patterns, there is no sign of free will and meaning. Although the calculations are quite complex, the process is completely involuntary, meaning that ideally it is expected that if the image input of Paul McCartney's face is consecutive twice, both output works will be of the same quality. However, some production features can be manipulated to solve this problem:

For example, the article authors programmed PINDAR to convert an image into a work of analytical cubism. This process involves transforming image A with a crystalline pattern. But the degree or number of pieces of this crystal that will ultimately control the output image features is adjustable. This degree can be assigned to the program selection in an acceptable range, or even the program can be forced to prevent the repetition of a certain number and degree twice. Therefore, we will be sure that two consecutive images of Paul McCartney's face will not be similar, and PINDAR will be free to choose the output image. Yet, the process of image metamorphosis seems to be a process similar to mathematical functions. There is still a range of degrees of crystallization between image A (McCartney) and the range of output possibilities, and it may be a time-consuming process for the PINDAR to return, but it is possible. Analogizing PINDAR to simpler models of popular image restoration software filters, such as Photoshop, makes this meaning more tangible to the users of this software. Each filter based on pre-adjusted numbers may provide infinite possibility. But after repeating previous settings, in the ideal form, the same result is obtained each time. For this reason, the concept of free will is still not achieved as expected, and at the same time, the other condition, which is the acquisition of meaning, is not met for this program. In fact, the PINDAR program executes the "analyze" command and does not understand the meaning of creation.

AARON has a different function in both conditions. Basically, Cohen seems to have been aware of this point and has tried to avoid it as much as possible. PINDAR and similar programs are written primarily based on the analysis of human behavior algorithms (artists of a particular style or movement) and its transformation into software behavioral patterns. Therefore, they create something similar to human creation, and it seems that the same originality of the human product is interpreted exactly as the opposite of machine creativity. Cohen contends that he developed this program to realize machine creativity possibilities. AARON gives things their physical and visual relationship, and, in turn, teaches how machines create new possibilities with this tool. Cohen also mentions elsewhere that he does not seek to teach images to AARON, but rather to teach drawing to machines [6, p. 1]. He describes his work with an interesting example: Imagine a monk in the 14th century heard a definition of a kangaroo from an Australian tourist. A friend told him that a kangaroo is an enormous mouse with a bag on the front of its body. With these descriptions, the monk will draw something like this (Fig. 1).

But after showing the picture to another Australian friend, he realizes that the kangaroo has a bag in the abdomen area rather than in her hands. It is also upright and has much larger hind legs. With these descriptions, his new picture of a kangaroo is as follows: (Fig. 2).

Although this picture does not quite look like a kangaroo, it is enough to describe its appearance [6, p. 1]. Cohen says that this process of describing form in human language and

experience, as mentioned, is based on simile and metaphor, and the humans use this network of similes and metaphors to explain concepts. However, he has to explain each object or phenomenon separately to AARON with great difficulty [10, pp. 1–5]. In this way, he provides AARON with three types of information:

1. Encyclopedic information that reveals objects as a network of concepts;

2. Visual information of each phenomenon. For example, the human body and each of the organs and physical / physical characteristics, including joints and movement restrictions (Fig. 3);

3. Information and physical rules, such as depth, overlap, color, and shadow [10, pp. 6–7].

The design process is also described as Fig. 4.

Clearly, of all these steps, the only step is the lines, where for the first time something is really drawn, and before that, everything was imagined, calculated or machine-coded.

Therefore, we are faced with software that has a relatively coherent imagination of the universe components, without having any visual experience. It also recognizes the appearance of objects and has a semantic connection between a name and an image, and its components. Therefore, the meaning of orchard, in a simple form, is a set of plants and trees, and has both linguistic and visual meaning. On the other hand, the linguistic and visual meaning of people is defined for it. It also knows the rules of drawing a set of plants for each time. So, it can create (or at least combine) meaningful images for the first time in the event of the Command "Draw people in the garden" (Ill. 153). Notable, the most humane and, at the same time, creative part of this process is the decision to choose the right combination (both volume and type) of human and plant and arrange it in space. This process seems to occur between mapping and planning [7, p. 6]. The program repeatedly prepares a map of its imaginary scene and arranges its objects in accordance with the rules of composition, and again evaluates and corrects its values and arrangement in mapping, and this process happens many times. This process can be compared to the works of all classical painters (in the general sense), each of whom created several sketch designs of their desired space. According to the authors of this article, the software manifests its free will at this stage. It has the general components and rules, but by coincidence and based on calculation, it often chooses between possible and probable combinations, until it is satisfied with the final composition and enters the coloring and execution stage. On the other hand, the concept of meaning is also quite true here. AARON seems to dominate its performance in a way that deserves to be called the "awareness of creation." The question raised for authors is: what is left? AARON does not even depend solely on the subject matter, and there are many examples of abstract and non-objective works (quite competitive with the works of painters such as Joan Miro and Kandinsky) in the early versions.

We do not intend to discuss the complex philosophical analysis of the definition of the art concept. The history of the last few decades has taught us that the general process and the macro innovation / reception system make more appropriate judgments than our philosophical and logical predictions. If, for any reason, we do not consider AARON's works to be art, would it make any difference if it is now housed in the treasures of the Victoria & Albert Museum in Britain and has the same financial value as other contemporary works of art?

Apart from the philosophical research, we need to see the quality of AARON's works in a long line, preceded by Piero Manzoni's *Shit' cans* and John Cage's *4'33"*. Taking the future of this art as the 'AI art', there are some objections to these works that should be briefly investigated:

Low quality of works; If we assume that the audience or critic is not aware of the process of creating the work by AARON, does the detailed description in the previous section still make sense? This question can be answered from two perspectives: a. The aesthetics of computer art is fundamentally different from visual aesthetics. Lopez has rightly described the difference: when the specific features of a tool are among the limitations and thus the advantages of a work of art, we call it the meaningful (or important) features of the tool. Paying attention to these features has transformed the criticism and evaluation of the works of modern art; b. It may be better to separate the two issues of art and non-art from good and bad art. Perhaps the most important point in this article was an investigation of the reasons why we are allowed to consider AARON a creative artist. Although we believe that the addition of an audience feedback system can easily match AARON's work with the collective taste of critics, Cohen's initial thought pattern still encourages us to embrace the machine's free will. Perhaps, the long-term results of Cohen's work will teach us a new and perhaps "machine-friendly" system of aesthetics.

The Question of the aesthetic value; There are some unique properties in the works and creation process of AARON which makes a vast plot to scrutinize its different aspects; Studying project AARON, we came to a moderate understanding of the concept of creativity which proves to be more inclusive to embrace the algorithm of the machine. By the same token, there emerges the question of aesthetic or artistic value in this process. Although there are many representational and expressive properties unique to the program which have been previously discussed, its own main problems should be discussed:

The issue of predestination and free will; Why is this machine not free to take on a different style from expressionism? To answer this question, we draw attention to the fixed and dominant paradigms of several thousand years in the art of Egypt, India, Mesopotamia, and even the art of cavemen, all of which, incidentally, is considered as art. It is not yet clear to what extent Cohen could reinforce the self-learning and deconstructive aspect of representation in AARON. It seems convincing that this innovation has continued its progress.

Harold Cohen, the designer and project manager of AARON, passed away in 2016, and we never imagined that as a follower, we would soon be faced with the question "what will happen now?" The destiny issue is complex for Cohen and his AARON. Basically, when does each work start? When will it end and what is its relationship with other works in the collection? Are we talking about AARON as a single work? In other words, is AARON a work or a path for the formation of several works? Is their code a work, a printed version, or a robot that, until the 1990s, did not cross the surface, between the paper and the canvas in Cohen's words, like a 'turtle' and engrave an image on it? These are all questions that change our perception the work and its destiny in this project. Therefore, in the following sections we will investigate each issue.

The ontological question; Yak Hui dedicates a whole chapter of his book, On the Existence of Digital Objects, to discuss the ontological origins of the digital. After an extensive review of the ongoing accounts of the subject, he prefers to make his more original account, referring to the phenomenological background and its subtractions, namely Husserl's and Heidegger's. Especially based on Heidegger, He tries to build a separation between the primary ontic conception of being, and an ontological analysis of the concept and notes that a more effective account of the mode of being we are looking for, should be synthesized from both aspects [16, pp.104]. Yet, Hui's main concern is how to find an ontological framework for the relations of digital objects to the one's of the real world; Therefor the author choses to establish a bi-exis-

tential framework to include the semantic and syntactic aspect of the object and fails to meet the subject in terms of its mode of being.

In the 1960s, Richard Wollheim [27] and Nelson Goodman & Catherine Elgin [14] almost simultaneously addressed the ontological issue of the relationship between the work of art and reproduced version works. Each with their approach attempted to define "Single and original-based" works, such as Ulysses novel, Rosenkavalier opera, and others, not as a work, but in the form of a type or species. Ulysses does not belong to James Joyce in any manifestation including the (handwritten) manuscript, edition, translation, or printing (film and zinc). It seems that, according to Wollheim [27, pp. 119–123], we should consider it an ontological type and consider everything that is inferred from it as a reproduced version or example of that type. Basically, how Wollheim and Goodman treat reproducible images and artworks, can be discussed under the Type–Token relation mode [18, p. 16]. Crowther as well admits the Type–Token relation may fairly prove to be valid in discussing digital artworks [11]. In Type–Token relationship, the main idea of the works which here proves to be a mental content, is the type of which a set of instances of the artwork are executed or reproduced. Yet it should be noted that since AARON is not an interactive one, here the interactivity of the works has been ignored; Perhaps that is why Thomson- Jones and Moser prefer to discuss the mode in terms of "Displays" [25]. Here as we pick the Type–Token relationship to discuss the work, we come to a twofold situation:

AARON's single works which have a recorded code system notation, held by the project owners, is supposed to be the Type; and all physical versions can be called the Tokens. But on the other side:

AARON as a unique coded project with its continuity, is as well supposed to be the type, then all the works produced as AARON's oeuvre, can be defined as the tokens which could be reproduces as second-hand tokens perhaps.

Given that any surviving AARON work is in the form of a collection of codes which can be stored, transferred, and reproduced, any view of these works, and neglecting the possibility of reproducing them with the same details at any other time and place, will be an unbalanced and non-technical view of these works. On the other hand, one can think of the fact that, like any other reproducible version work, such as a molded sculpture or a single hand-printed manuscript whose stereotypes are preserved, the work itself, created in agreement with and under the control of the artist, has its unique value. Also, approached legally, the reproduced version works will have a different value from the custom of the art market under the defined supervision and process; even if it is not technically and aesthetically significantly different from the original work. However, in the case of digitally replicable works, reproducible versions will also have their economic definition. Currently, out of the 41 works kept in this software at the Tate Modern Museum London, their replicable works are sold like other works, with their definition, and the project website also directly reproduces, publishes, and sells some of the works. In this sense, according to the conditions defined for a work, the soul of an original work will have an independent and unique existential status, and its reproduced versions, according to predefined conditions by Cohen, will have a different status. This difference is obvious in the price of the work and its place in the economic market of art.

Certainly, if the original work is lost for any reason, it can no longer be replaced; it cannot be assumed that the work has vanished, nor can the reproduced version work be considered in the same position. Therefore:

— "A" is the original work if it was created with the intention of the artist and under the conditions of "H".

— And the work (s) "A1" are the reproduced version of work "A" if they are created under "H2" conditions.

Importantly, although the AARON's work in question has emerged under certain circumstances, it can be considered a "single and original-based" work. On the other hand, the work created by AARON depends on a set of recorded and documented coding. He may decide to reproduce or print the work by simply accessing a standard predefined printer. It should not be forgotten that Cohen has attempted in various situations to divert the attention of the audience and critics from the centrality of the visual output and attract it to the process of its formation. In his interview [7], he says that since the mid-1990s, he has been frustrated by the audience's over-attention and surprise at the image-implementing robot, and since then 'Turtle' (Fig. 5) has taken the same field-print robot out of the demonstration path to avoid distracting the audience.

This retrospective view can be evidence of the claim that the artist is not bound so much by the set of reproduction conditions and thus does not pay much attention to the final image product and, therefore, has little sensitivity to the ontological status of the objective work. But if he is less sensitive to the objective product, what is he more sensitive to?

In various reports on the development of the project over the decades, Cohen has shown that he entirely focused on the behavior that he has taught to AARON itself and that he is fascinated with this software and does not hesitate to regard it as an algorithm. He regards it as a child that creates an image in a humane way and in a machine way in another stage. Thus, his definition of the centrality of artistic action in the AARON project relies on AARON itself; and if we want to give an ontological description of his interpretation of the work, he has turned the process of work formation into a product and offered a process-product interpretation. In this perspective, basically, if the destiny is deemed for his work, it is the end of the AARON project and not the destiny of the works. The survival of the AARON project determines the lifespan of the work.

Many of AARON's works have been displayed and purchased by major collections over the past four decades; for example, if we look at the data of the Victoria & Albert Museum in London, despite all that Cohen was interested in, AARON (1979), which is also one of his earliest works, is all registered under the name Harold Cohen and the name AARON does not appear next to the artist's name. In this sense, AARON is regarded as a part of the production tool in this database and there is no appropriate definition in the production or creation of the work. The same is true of other collections, including the Tate Modern Museum London. According to this definition and from the perspective of collectors, the works produced by AARON are directly the Cohen's works, and although terms such as "Computer-Made" are used to describe the technique, the works are neither "Artificial Intelligence", as Cohen himself wanted to regard it as such. It is clear that from an economic point of view, knowing these works as unique and single works will bring more benefits to these institutions. In addition, it should be noted that as much as the works are directly related to and completely dependent on Harold Cohen from the outside, Harold Cohen's artistic character, after drawing his attention to software art and the AARON project, did not turn to the production of art works outside this path at all. Also, the factors that shaped Cohen's artistic identity in these four decades, from the 1970s until 2016 and his death, was the collection of works that emerged from the

AARON path. Accordingly, the artist's death markes the end of the current series of the AAR-ON project, and this makes the issue challenging.

In Cohen's simple literature, AARON is a complex algorithm and is derived from the visual equivalent of objects, creates novel compositions, and forms and independent coloring. Thus, if we are faced with a variety of visual and stylistic periods in AARON visual expression, it is equivalent to reprogramming, enhancing or changing AARON's view, and understanding the visual world not equivalent to innovation in image creation by the software. In simple terms, contrary to what has become especially prevalent in the painting tradition since modern times, the artist, who in this case is AARON, has not chosen one of the possible styles and expressions before it, based on its desires or circumstances. Therefore, despite AARON being free to combine forms and themes to shape the work, the style in the works of this software is not an optional, creative and thus artistic action. Therefore, our interpretation of it as aesthetical is largely a matter of our choice. Yet, its connection to a world of wider choices, such as Cohen's upstream intelligence and willpower, will give Cohen's aesthetic credibility. In this sense, we are not dealing with the AARON with different styles, works and many manuscripts, but with several AARON's manuscripts, each of which has a significant number of unique works only in its expressive range, which are similar in expression, as well as distinct and unique in visual features, and at the same time, each of which can be reproduced many times. Therefore, for example:

1. Three periods or collections of works made by AARON are discussed;

2. Each period has the members who do not have the same identity;

3. They have common features that make us consider a single style and expression in our mind.

Nevertheless, Cohen's causal influence is removed from the end of the first proposition, and logically Cohen's presence or absence or death will not affect the quality or characteristics of the members of the existing collections. Cohen is only present in defining or redefining collections, and from that stage onwards, the production of works will not affect him in any way. However, the experience and history have shown that despite the ability to create a new work, no new work with this interpretation has been created by AARON since 2016.

In an interview in 2011, Cohen reiterated that the AARON project for him was not even a collection of coding written first in C programming language and then in the more specialized Lips language.

... AARON is not the set of code I compiled and written in twenty minutes; rather, it is the result of years of thinking and experience to finally teach the humanistic behavior of producing a painter's image to artificial intelligence [7].

Thus, for Cohen, an idealistic interpretation of AARON's work can even be offered. The basis of the work production is not the existence and the objective soul of the images; even in this perspective, it is not a process of formation. The work before us is the idea of AARON. It is AARON that is the work, and other imagined or made things are instances of it. Cohen has made his best effort to bring all the senses closer to AARON itself. Therefore, according to this interpretation, the beginning of the work is Cohen's unique will to create this software, and of course, the end of the work occurs when AARON stops moving and operating. The simple question here is this: Is AARON still active?

Briefly, the AARON project has come to a standstill with Cohen's death. Cohen did not have a personal website and linked his name to the AARON project. The website www.aaronshome.

com contains all the joint works of the artist and his software in its heart, and no artistic prestige can be found in Cohen apart from this project. Two types of data can be obtained from this website: the documents about the project based on Cohen's writings, and the visit plan and displaying the projects ahead of AARON. The documents which entirely depend on Cohen and have not changed since 2016, advancing as far as Russia, ceased in early 2017. It also seems that only the commitments, which were made before the death of the great artist, have continued until then, remaining unchanged. It also seems that while AARON is a dynamic system with the ability to produce in a collection with its latest style, it practically lost its dynamics.

There is no doubt that Cohen's identity was entirely linked to AARON and his work. Lev Manovich made this clear at a criticism session in 2011, and Cohen accepted it without hesitation. He dedicated his artistic life to acquire this identity. It seems that the AARON project, even legally, owes part of its identity to the Computer and Art Research Center at the University of San Diego. However, in all these years, it is always the name of Cohen, which is listed next to the name of AARON, and the name of this center is only in the section of Cohen's academic resume and biography of the project website. While one can learn from the breadth of the university in allowing the artist to form an independent legal identity, it should be noted that although all AARON project activities have the characteristics of a cultural and artistic foundation, their link is so personal that caused the foundation to dissolve immediately after the death of the artist, despite the existing capacity.

Conclusion

According to the above discussion, it can be stated that the question of what AARON is and which of these components can assume the role of artist and work is challenging and controversial, and that the role assignment can be illustrated from different perspectives. Here, the software has a relatively coherent view of the universe components, recognizes the appearance of objects, and has a semantic connection between the name, image, and components. In the meantime, the most humane and yet creative part of AARON performance is the decision to choose the right combination of the components of the universe and arrange them in space so that AARON's mastery of its performance can be considered awareness of creation by this software.

Although the AARON project had the potential for the production of new works and for the reproduction of earlier works, as well as the provision of live and active services, with the tragic death of Cohen and the lack of organizational will to keep the project alive have prevented this from happening. As a result, all the existing capacities in this project are reduced to a traditional artist-work relationship, which prevented the flourishing and realization of the project's idea, that is, the desire to approach an independent artificial intelligence of the artist.

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Title. Examining the Capabilities and Challenges of AARON (Painter Software)

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Abstract. The present article probes Harold Cohen's AARON software and its unique features which brings it closer to the definition of "human creativity:, making it distinct from

other computer software or basic computer artworks. AARON's (metaphorically) works are massive images (usually 2.3 meters or even larger murals) in a style and context close to the expressionist literature of the early 20ᵗʰ century. Although features such as linear value and especially coloring were gradually embedded in different versions of AARON, we are mostly faced with linear images (so-called design) in the initial versions. In the early years of the 21ˢᵗ century, he returned to more abstract forms and experienced defining forms, especially more independent coloring. So, it was Cohen's process of continuous training and his empiricism that made this AI mysterious, fascinating, and exciting at the same time.

Here, first, a description of digital and computer art is presented and its characteristics are discussed. Afterward, the artificial intelligence (AI) art and its similarities and differences with human art are addressed using AARON software, and its distinguishing feature, that is the selection in the process of forming the artistic work, is described. Finally, some challenges to this type of art, including the lower quality of the works created by this software, the issue of predestination and free will in its performance, and especially the issue of AARON destiny will be discussed.

Keywords: AARON, Harold Cohen, Artificial Intelligence, AI, computer art

Название статьи. Изучение возможностей и проблем AARON (программного обеспечения для живописи)

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Аннотация. В статье рассматривается специфика программного обеспечения автомата AARON, сконструированного художником Гарольдом Коэном в начале 1970-х гг. Изображения, сгенерированные при помощи AARON, напоминают полотна, созданные живым человеком: именно эта черта отличает эту программу от других. Работы AARON представляют собой экспрессионистские по стилистике фигуративные произведения большого формата (в среднем 2,3 м в высоту). В современной модификации AARON внедрены линейные алгоритмы и похожая на ручную работа с цветом, однако в более ранних версиях эти параметры отсутствуют. На это указывает тот факт, что первыми произведениями AARON были монохромные композиции (так называемые «чертежи») и абстракции. Именно благодаря непрерывному процессу обучения искусственного интеллекта AARON Г. Коэну удалось существенно обогатить спектр возможностей данного устройства.

Статью открывает описание цифрового искусства, после чего обсуждаются его особенности. На примере AARON изображения, сгенерированные искусственным интеллектом (ИИ), сопоставляются с произведениями реальных художников. Также в статье дана характеристика отличительной особенности AARON — принципу «выбора», лежащему в основе алгоритма формообразования. На примере AARON рассмотрены две ключевые проблемы генеративного искусства: это, с одной стороны, более низкий уровень качества работ относительно произведений, созданных человеком, а с другой — проблема «свободы воли» программного обеспечения, действующего по заранее заданному алгоритму.

Ключевые слова: AARON, Гарольд Коэн, искусственный интеллект, ИИ, генеративное искусство

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