DIGITAL ART AS A FUTURE VEHICLE OF CONTEMPORANEITY: NFTs (NON-FUNGIBLE TOKENS*)*

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1. NFT digital works

In a previous paper on "Artificial intelligence and digital reproduction in art", it was pointed out how the growing presence of Artificial Intelligence (AI) in the management of civil and social life, as well as economic and political organizations, has led to various scientific, philosophical, legal, and moral questions in cultural debates. For example, the artistic beauty emanating from artworks produced using AI and artworks that have been digitally reproduced has been questioned, as they have given rise to a new kind of creativity, which has been added to the natural human creativity used by artists to create their artwork. Another issue has arisen in attempting to resolve the much-debated problem of the attribution and authentication of a work of art - a highly complex process [1], where it has been suggested that specific generative algorithms could be employed to carry out the task. But the difficulty in doing so derives from the fact that between the authentic work and the fake, there are many intermediate categories or different degrees of certainty in the attribution of a work of art: authentic, original, replica, copy, attributed to, signed by, school of, follower, fake, and reproduced [2]. It is in reference to this difficulty, which can also be attributed to the many varying degrees of certainty, that the use of NFTs (acronym for Non-Fungible Token) has taken over in the art world to certify the authenticity, uniqueness and ownership of a work of art. The reason for this is the fact that NFTs have democratised art because they are accessible to anyone, anywhere without censorship or restriction. However, an NFT is not the actual work itself, but the certificate that guarantees its uniqueness, since it confirms who produced the artwork and establishes who owns it. To make this possible, each token is unique and can neither be modified, nor indeed, replaced (it is not fungible): this is why it is protected by coding such as cryptocurrencies. These virtual currencies, used as a method of independent payment when compared to real currencies, are not subject to any constraints and are often considered as particularly speculative and could even be used for illicit payments as they are not limited by banking circuits or subject to em bargoes by governments [3].

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In 2014, the first NFT entitled "Quantum" was created: an animated pixelated[1] octagon that changes colour and contracts rhythmically like an octopus. The author of this first "work" was Kevin McCoy and was registered on the blockchain[2] Namecoin [4]. NFTs first became popular in 2017 when the "CryptoKitties" website went viral, raising an investment totalling $12.5 million [4-5]. In addition, the sale of the animated work "Nyan Cat" (Figure 1) in February 2021 by the U.S. digital artist Christopher Torres caused a particular uproar; the value associated with the sale was 300 Ether, equivalent to 587,000 US dollars at the time

Figure 1. Nyan Cat, the first work that became famous for being sold in 2021 for the sum of 300 Ether, equivalent to 587,000 dollars, through digital channels.

of the transaction. Ether is a digital currency belonging to the Ethereum network, second in terms of fame, price and diffusion, only to the more famous Bitcoin [6]. It should be noted that NFTs took hold with content defined in digital jargon as "memes", from the Greek word *μίμημα – mímēma* – imitation. The term was coined by Richard Dawkins in 1976 in his essay "The Selfish Gene" to indicate a cultural element that propagates, like a genetic character, by imitation, from one individual to another and that can take the form of an idea, an image, a person, a style or a behaviour [7]. Memes spread through interpersonal relationships and through mass media such as the internet, which are subject to natural selection, expanding their concept and application to cultural content. To date, it is the subject of debate whether they can be considered works of popular art or whether they are only a cultural expression of a historical period [8]. Later, it was the American artist Beeple, who in 2021, sold his work "Everydays: The First 5,000 Days" for $69.3 million at Christie's, guaranteeing the authenticity of his work with an NFT. After him, a significant number of digital works protected by NFTs have been created in recent years: they are not limited to only drawings and images of all kinds but also include tweets (images sent via instant messaging to a website, such as a social network, to communicate in real-time), videos, animated images, audio (e.g., music, interviews, seminars, etc.). The introduction of NFTs caused a major speculative crisis in 2021 due to the simultaneous placing on the market of a huge number of works - more than 270,000. In the period following the opening of these platforms, the price of commissions for the purchase of NFTs exceeded $10,000, a price far greater than the cost of the NFTs themselves [9]. After Christie's, Sotheby's also launched itself into this lucrative market that is shaking the art world, with other art galleries specializing in this particular area also springing up in Italy and other countries. The digital art world is not only related to works executed by painters producing artificial images (generated by computers and AI) or excellently reproducing important works to the point of seeming the real thing, it includes existing works, or even famous paintings that can be completed using an AI technique called outpainting. Today there are many outpainting sites, where for example, you can imagine an extension of the room where Johannes Vermeer's "The Girl with a Pearl Earring" is

or see beyond the man screaming in Munch's artwork or even find out where Leonardo da Vinci's "Mona Lisa" is located and so better understand the expression on her face.

2. Blockchain and NFTs

The security of NFTs is based on blockchain technology; without it, NFTs would not exist. Any blockchain consists of a network of connected computers that exchange and possess the same information, thus ensuring a high degree of redundancy in the stored data. To date, it is considered extremely secure by cybersecurity experts [10]. All cryptocurrencies are based on blockchain, although the technology is also used for other purposes where data security and immutability are of primary importance such as in online voting, or the management of government databases. This therefore ensures the reliability and certainty of the data contained and, in the specific case of NFTs, includes the exact knowledge certified by the network itself regarding the intellectual property information of the works (author, owner of the rights, type of work, etc.). This information is reported within digital contracts called *smart contracts*[3], which are recorded and made public by the blockchain network to protect their use

This technology allows the problem of the infinite reproducibility of a digital asset to be overcome because it does not need a central server or an authority to certify its originality, but anyone connected to the network can share the information. This has allowed the creation of NFTs, as it guarantees the buyer and the artist from the absence of copies and objectively certifies the ownership of a work [11].

The main blockchain networks used today in the NFT field make use of public networks that are widely disseminated, thus ensuring data credibility, and possessing high characteristics of resistance to cyber-attacks. The guarantee of ownership of a given NFT is directly proportional to the degree of network security used, as it is externally difficult, if not impossible, to misappropriate these assets, as long as the network consists of a sufficient number of connected nodes (computers). In addition, through NFTs it is possible to divide the economic ownership of the asset among several buyers, who can share the rights following the purchase.

3. The sustainability of NFTs

Today, it is also essential to discuss environmental, social and energy sustainability in the art field. Although the topic is easily relatable to other areas of knowledge, such as engineering or social fields, sustainability should also permeate the cultural and artistic field [12]. Cultural heritage can indeed be a tool to address important global challenges, such as reducing poverty in marginalized groups (economic dimension); gender equality and women's empowerment (social dimension); and environmental sustainability (environmental dimension) [13].

It follows from what has been said that in addition to the social dimension, there is also a less intuitive one for works of art, especially when it comes to new technologies, as in the case of NFTs, which involves the energy and environmental dimension.

In fact, since NFTs employ blockchain networks, they require a high cost of maintenance and management. To function and be secure, a blockchain network needs a huge number of devices connected at the same time capable of updating its database synchronously and reasonably quickly. This leads to enormous energy expenditure and a consequent high CO_2 emission [14–17]. As for NFTs, in an article by

A. Storey an analysis was made of 8,000 transactions that took place on the Super-Rare platform suggesting an average consumption of 340 kWh of energy per NFT [18].

Referring to updated numbers from the private statistical consultancy company DemandSage, the number of NFT buyers has reached 794,763, while the number of sellers stands at 377,711 [19]. From calculations made by CBS [20] and based on Storey data, the Ethereum network alone today consumes as much as the whole of Sudan, for a total of 44.94 TWh of electricity and 21.35 tons of [18] CO_2 equivalent. These numbers are fortunately destined to decrease in the future [21].

In conclusion, the sustainability of NFTs from an environmental and energy point of view is very low, and only a few artworks really need to use this technology, which is often abused in speculative terms. Evaluating the value of an artwork, which is not a simple meme and therefore subject to selection and death over time, should be carried out by experts, equipped with up-to-date knowledge and a good vision of the future. Not everything is art, and with the introduction of generative artificial intelligence, which is able to quickly produce many works by replacing the operator, there is a high risk of fraud due to the false promise of large profits using very little effort.

4. The NFT digital artwork market

The creation of collections of works exemplary of their style, which blend visual art and poetry in a single medium, is already underway in the NFT art market. For the "drops", which in NFT jargon refers to the sale of works, important online auction platforms for digital art have been chosen. The works go up for auction without any auction base for the NFTs to be awarded. If demand exceeds supply, the works are raffled off in a sort of virtual lottery. A couple of hours before the drop it is possible to dialogue with the author during a live chat. The sale of works of art preserved in blockchain, a shared and immutable digital file, has increased exponentially in recent years. Digital art has entered important collections as well as having conquered important personalities and emblazoned auction houses such as Christie's and Sotheby's. Advances in modern technologies with high-definition screens, projectors, and virtual reality headsets are evolving beyond measure, and it is not surprising, therefore, that the use of works of art in digital form is an ever-growing trend. Nevertheless, despite the enthusiasm shown for NFTs, especially in 2021, the year in which the NFT market won the title of the most profitable sector in the cryptocurrency space, there was a significant slow-down in the market in 2022. The crisis has been linked to the parallel crypto-currency crisis and some scandals. But in 2023, the value of sales increased significantly, recording a decidedly upward trend. Referring to the relationship between a person and the multifaceted reality that surrounds them, in the art field "reality" translates into the increasingly strong presence of digital art with the introduction of NFTs. A debate on the relationship between paper and digital is therefore opened and starts with a question: "Paper or NFT? What is the future of the art market?". A topic that has already been the subject of conferences in recent years. In this regard, it was reiterated that for the next 20- or 30-years paper will always be a winner in the art sector, mainly because historically artistic production has been largely made on paper and continues to have a key role, even today. The more distant future is still to be discovered.

5. The digital revolution: blockchain, metaverse, cryptocurrencies

It is evident from the above that the digital revolution is underway and in the not-too-distant future, the world will be a very different one from today's. This is due to the effect of new technologies and their impact also on the relationship between companies and consumers. Blockchain, the metaverse (a sort of parallel universe)[4] and cryptocurrencies (virtual currencies) are changing the way we do business, also improving the user experience for families.

Many companies, for example, already use blockchain for tracking supply chains. It is not yet entirely clear what the right areas of application may be, but it is clear that the potential of blockchain is very high, also in terms of greater security. As highlighted by the research theme "Together Toward Tomorrow" in the Events Mastercard Innovation Forum 2022, the challenges and opportunities of digitization for businesses can also be applied in the art sector by creating knowledge and strengthening education.

The metaverse is also giving life to a thriving new economy, which is not only linked to augmented reality but also to events that are enjoyed directly in virtual worlds and ways, with exchanges and interactions in buying and selling. Although, it is a technology that is still in its infancy, it is growing and giving an important boost to the world of digital payments and cryptocurrencies. At the same time, in an increasingly digital world, the security of data travelling on the network has also become a priority, owing to the growing number of connected platforms and devices, a situation which has greatly increased security risks.

As for the question of what types of artwork NFTs can lend themselves to and whether they contribute to changing the concept of beauty, it is worth noting that there are indeed different aesthetic logics and even ethics, so it could be said that the progenitor of these works may be conceptual art. It is also true that among NFTs there is often a sense of deformed reality, a certain taste for the maniacal and obsessive, for example, the same character remade in a multitude of colours. This does not mean that there are no interesting artistic projects.

Yet another aspect relates to the possibility that the blockchain system can lead to a reduction in mediating and mediators, meaning that the work of art enters the system using very little mediation. The most significant aspect of all is that blockchain technology is not owned by anyone but shared by those who use it.

Cryptocurrencies are not validated by banking institutions; indeed, they were born after the 2008 crisis to eliminate them. It is uncertain whether this road will lead to a better world, making us question whether this technological complexity makes it too difficult for us to understand it enough. There are cultural obstacles and habits, but inevitably everything will be simplified: technology will be accessible to as many people as possible. While twentieth-century institutions continue to be exasperatingly slow, digital civilization has yet to express itself at its best.

6. The human and the digital in art

In conclusion, how can we not point out that there is an unjustified sense of threat in reference to the dialectic between the two worlds, i.e. between the human and the digital, dogmatically anchoring oneself to the opinions and/or research of one or the other as a unilateral prerogative?

And it is precisely on this indisputable truth that the Journal, *Conservation Science in Cultural Heritage* rests, as has been repeatedly pointed out in numerous works published over the years. Undoubtedly, the knowledge and competence of the hu-

manist, the result of positive interaction between the different and disparate disciplines, highlights their ability to read history and goes hand in hand with their erudition. With the formula of "digital humanism", today we would probably relocate man by seeing him compared with machines and artificial intelligence. Marginality is now sometimes perceived as an unwanted consequence of new technologies: according to this viewpoint, digital, as some scholars have pointed out, would be the new "bitter source" from which a "poisoned present" inevitably derives.

This vision of "machine versus human" feeds mistrust and pervades the dialectic - which it would be better to establish between the two universes and could mark a degree of progress - with an unjustified threat. This is because identifying a centre, with a human and a digital world that mutually exclude each other, risks being an operation that is not only complex but above all misleading with respect to the humanism we would like to recover and feel we need, in order to obtain an effective tool to oppose the silent and incessant work of predictive algorithms.

As Guido Carli, who was an Italian economist and politician, as well as Governor of the Bank of Italy, pointed out, it is not yet time to elaborate a proposal for a "digital philology" and we have no idea how long it will take humans to develop the right tools to understand what we call artificial intelligence without being overwhelmed by it, but we can perhaps suggest that a new integral humanism should not give up looking for the profound meaning of machines and their impact. What is needed is interdisciplinary training, which is the Journal's intent and objective, and thus make it possible to create and study beauty by embracing both the human and the digital.

In this regard, mention is made of the portrait of Alan Turing, the mathematician and father of computer science, sold by Sotheby's auction house in 2024 for £1.2 million, a record figure for a painting made by artificial intelligence (Figure 2). Unique in its kind, so far, this sale relaunches a new frontier in the global art market, setting the auction benchmark for a humanoid robot artwork. Advances in artificial intelligence suggest even wider participation, with more artists researching works where there is a fine line between human and mechanical creativity. Until now, however, these innovative experiments had not met with the power of the market. The Sotheby's auction marks a turning point, demonstrating how robotic art is gaining increasing recognition, and asking questions about its value and meaning. Some critics and collectors see robots as a mere extension of human capabilities; others consider them true creative agents capable of exceeding the limits of our imagination. In both cases, the fundamental question remains: can the art produced by robots be considered au-

Figure 2: "A.I. God" portait of Alan Turing generated by the AI robot Ai-Da in 2024.

thentic? And, if it is, who is the author: the programmer, the robot or both? The idea that art bears witness to the transfiguration of reality, moreover, is not to be ignored. An example of this is Maurizio Cattelan's conceptual artwork entitled "Comedian", auctioned in 2024 at Sotheby's in New York for a record $6.2 million: it is a banana, stuck to the wall with a piece of tape, sold earlier on in Manhattan by the greengrocer, Shah Alam, for 26 cents and then resold for $6.2 million at Sotheby's. Calling it a work of art sounds illogical, bizarre and even paradoxical if you think that "Comedian" (Figure 3), only 5 years earlier was sold for $120,000 in the Art Basel Miami Beach 2019 fair, and that its value increased 50 times over the following five years. This is how the present has become a world in which "branding" can replace critical judgment, not only in the field of art but also in that of information. Stigmatizing "Comedian" does not determine a mere provocation but is considered a conceptual work of art as Cattelan claims, transforming a banana into a metaphor for the world in which we live. Consequently, the fact that it is talked about, criticised and considered a joke with diverse comments, reactions, and emotions only increases its value. This then, is the meaningless aspect of art just like many other aspects of our present-day lives.
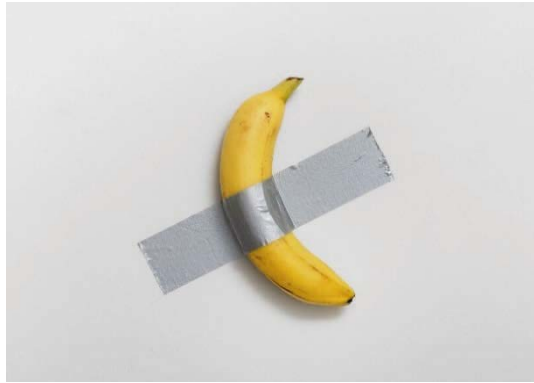

Figure 3. Comedian, a contemporary work of art signed by the Italian artist Maurizio Cattelan in 2019.

7. Conclusion

Within the context of today's digital revolution, it is also important to talk about the philosophy of information and that of technology, alongside digital ethics, and artificial intelligence.

All philosophers, from Plato to Descartes and Kant, have always implicitly used the concept of information that underlies everything on the narrow path that exists between the dissemination of knowledge and respect for its complexity. It is a philosophy of our times for our time and, to stay in our time, a philosophy of commitment that must be part of the intellectual resources that solve problems, passing from social networks or *à la carte* pamphlets and criticizing a society that has become dull as the result of an uncontrollable appetite for data without asking itself what the difference is between data and knowledge, in other words, information, because in this society inundated with data, people must be made aware of its nature. And this is even more relevant today, because artificial intelligence transforms data into information: in fact, AI is being used as an interface for navigating; search engines are no longer sufficient. We are not satisfied with just a list of links, we also want ready-made lists of data from today's digital society.

Hence the need for correct information.

Notes

[1] In image digitization techniques, the pixel (hence the term "pixelated"), is the smallest element (from *pix*, for *picture*, and *el*, element) distinguished by color, intensity, etc., of which an original image is composed. The term pixelated therefore indicates a *pixel size* that is clearly visible to the naked eye.

[2] A blockchain is an encrypted database in which data (referred to as "blocks") cannot be modified or deleted but only added sequentially and shared among users. An encrypted database consists of a database equipped with an encryption algorithm capable of transforming the stored data from a readable state into a ciphertext of unintelligible characters.

[3] A smart contract is a digital transaction governed by a contract for the transfer of one or more tokens.

[4] The metaverse is a virtual world where everyone can create their own avatar and buy dematerialized objects, such as a work of art, a car, a house. The development of the metaverse gives a boost to digital payments

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Federico Cinquepalmi (PhD) holds a master's degree in architecture from the IUAV University of Venice (Italy) and a PhD in Science and Technology for Industrial Innovation from the Sapienza University of Rome (Italy). Since March 2022, he has been a full professor of Project Management at the faculty of Architecture at the Sapienza University. Previously, from 2009-2022 he was senior researcher at the Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) and at the Italian National Agency for Environmental Protection and Re-search (ISPRA). In the meantime, he was appointed Director of international affairs at the Italian Ministry for Universities and Research. In the last 30 years he has focused his scientific research in the sectors of sustainable development and policies applied to build environments, digital technologies for building management and cultural heritage

Summary

NFTs are the main tool for certifying the authenticity and ownership of digital artworks. An NFT is an immutable digital certificate secured via blockchain, a secure technology that ensures the integrity of information without the need for intermediaries. The use of NFTs has become popular since 2017, with the public sale of the first digital artworks and has opened up new opportunities in the art market even within traditional channels such as auction houses. NFTs are often linked to conceptual art and are rapidly evolving along with the concept of "beauty", with works that sometimes explore deformed realities or obsessive aspects. The work of art becomes a metaphor for our world, in which value grows through discussion and social reaction, fuelling a cycle that reflects our often absurd and contradictory reality. The growing popularity of NFTs also raises concerns related to sustainability, as blockchain technology requires a large amount of energy, contributing to CO_2 emissions. Digitization, blockchain, the metaverse and cryptocurrencies are rapidly transforming the art market, leading to a new virtual economy and a change in interactions between artists and society, and fostering a more direct system between artists and audiences. In the era of digital humanism, we should aim for a synthesis between the human and the machine and avoid a distorted one-sided vision; it is necessary to be able to understand the impact of new technologies, including artificial intelligence, without being overwhelmed by them. Artificial intelligence and robotic art are gaining ground, but we need to ask ourselves who the real author is, the programmer, the robot or both.