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The Immutability of Artwork in the Age of Digital Reproduction: NFT from the insiders' perspective

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The Immutability of the Artwork in the Age of Digital Reproduction: NFT from the insiders' perspective

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Abstract. A Non-Fungible Token (NFT) is a combination of a digital object and its blockchain-based certificate that promise to solve problems of authenticity and traceability of digital objects. Focusing on art domain, this study explores the operations and implications of NFT-based digital artwork markets through the viewpoint of artists and collectors. The first data were collected in 2021 from various insiders in the NFT community: the interviewees working and earning in this market segment are the most suitable profiles to delineate the structure of these activities; their responses were analyzed against the theoretical framework that includes the notions of digital objects and blockchain technology, outlining NFT properties. The results were consistent, showing that blockchain technology can overcome the limitations of digital objects while opening up new challenges and possible risks.

Keywords: Artwork, Non-Fungible Token, Authenticity, Blockchain technology, Digital Scarcity

1 Introduction

In the last few months, Non-Fungible Tokens (NFTs) have monopolized discussions about art and collectibles, creating a new market segment that allows transactions for billions of dollars weekly. Due to the novelty of the NFT technology, its potential for radical changes is still unknown, but those who acted and adapted rapidly to this revolution are now in a privileged position where they can gain from their intuition.

Digital art plays a significant role in our daily lives and sometimes goes unrecognized. In the digital world, it is easy to steal art created by anyone or to copy and use it. In the analogic world, patent rights of the entity protect the artwork and prevent someone from copying or remaking it, while in the digital world NFT technology can be used to address this problem. With NFT, artists can validate their digital art and make money from it. Programmable art is the most common use case of NFT, as it is a perfect mix of creativity and technology. Several limited-edition artworks are currently in circulation. For example, the digital artwork titled "Everydays - The First

5000 Days", by M. Winkelmann, professionally known as Beeple, was sold to Christie's Auction House for $69.3 million in March 2021. There are many online platforms that provide auction rooms or sales counters, among the main ones OpenSea [1]. Another form of digital art are digital reproductions of tangible artworks. For instance, the Uffizi Gallery in Florence (Italy) has sold a digitized version of Michelangelo's "Tondo Doni" at € 240.000 [2].

Despite the raise of digital artwork markets, a number of issues emerge from the application of NFTs to digital art. For instance, establishing whether NFT is of the same quality as the artwork or, because there can be n reproductions of an artwork, it is worthless, has many legal and art-historical implications. Therefore, an exploration on the effects of NFTs on digital art is needed to identify major themes that are relevant in this domain. Moreover, due to the recent implementation and popularity of NFTs, the academic literature lacks a theoretical understanding of such novel form of digital object. The purpose of this paper is to identify relevant themes emerging from the use of NFTs in digital art. We also aim to discuss how the NFT properties can challenge the existing conceptualization of digital objects [3, 22] and how this can contribute to formulate new research problems in the Information Systems (IS) field.

Consequently, our research question is: "*How can NFTs change the market of digital artworks?*". To answer this question, we investigate a case of NFTs adoption in the digital art sector, by comparing traditional art and digital art. In fact, we investigate the value that digital artwork produces for stakeholders, considering the advantages/disadvantages of the NFTs market, the possible influence of non-materiality on the value of artworks, whether blockchain technology create a reliable state of scarcity (a primary property that identifies an object as collectible), knowing from Kallinikos et al. [3, 22] that digital objects lack the plenitude and stability of traditional media. Furthermore, the nature of blockchain and its ability to create unique and immutable certificates can have implications for the issue of reproducibility of digital objects and the desire to collect them.

The theoretical framework is based on the properties of digital objects [3], and on Benjamin's breakthrough essay *The Work of Art in the Age of Mechanical Reproduction* (1935) [4], in which the author argued that the ease of reproduction of a work of art changes the value of the work itself and that art was never intended for the masses; a socio-economic context that can be seen as similar to today. All of the above considerations help create a framework for NFTs and identify their main properties, some of which are shared with digital objects, others with blockchain technology.

This paper is organized as follows. The next section briefly describes the basics useful for the purpose of the paper. Section 3 presents the methodology, including the research design. Section 4 shows the results. Finally, the discussion and conclusions, including limitations and future developments, are presented in Section 5 and Section 6, respectively.

2 Background and Definitions

2.1 Non-Fungible Tokens

The first use of NFT can be tracked in 2015, with the Etheria project (that have been mostly remained unsold until the 2021 NFT frenzy), but the majority of scholars agree to identify 2017 as the turning point for NFTs with the creation of a virtual game named CryptoKitties, where users can purchase, collect, breed and sell virtual cats, and a series of digital characters named CryptoPunks. NFTs have a wide range of application: in the luxury field, in the art market, in the diamond industry and so on. We will focus here on the art domain.

NFTs are similar to physical collectibles, but they are digital. As a result, rather than receiving a physical oil painting to hang on the wall, the customer receives a virtual image.

As mentioned above, NFT stands for Non-Fungible Token and refers to tokens that can be used to represent the ownership of unique objects. It is a unique and indivisible blockchain-based virtual asset [31]. NFTs are data stored packets recorded on a public ledger, linked to a certain real-world item (that can be physical or digital), and prove authenticity and ownership of the said item, acting as digital certificates. In recent months, NFTs have become synonym, among communities, with a unique combination of digital assets: an item that falls into the realms of collectibles and art, connected to the underlying digital passport recorded on one blockchain [32]. NFTs are most often carried on the Ethereum network [33], and because Ethereum is never idle, tokens will always be available for trading. This peculiar combination implies a set of properties that are not intrinsic to digital objects.

2.2 Digital Objects

A digital object, or artifact, is defined as any type of item produced and stored in a digital version, featuring on digital ecosystems and deriving utilities from the relationship with them [22, 30]. In fact, the very nature of digital objects, that cannot afford the plentitude guaranteed by analog ones because they lack the stability that traditional media have, prevents them to be archived in their original and immutable version [3]. Specifically, digital objects are editable and unstable (by their very digital nature), reprogrammable, open, perpetually in the making and intentionally incomplete because of the ever-changing digital landscape in which they are created, abundant, infinite and easily replicable as a consequence of their main characteristics [3, 5, 6, 7, 8]. All these properties highlight that it is extremely difficult, and in most cases impossible, to collect and archive digital object because they lack a mechanism that can guarantee authenticity and provenance [3, 4].

In a context of non-materiality, in order to be collected, digital objects need a trusted ledger which certifies their authenticity. In the outlined environment, blockchain's networks can solve the issue. In fact, the blockchain technology [9] is a distributed public ledger that is immutable, integer, transparent and public verifiable by definition. It is a sequence of blocks that keep track of all transactions. At the core of block-

chain, there is a computer protocol acting as an automatic contract enforcing exchanges between parties by means of irreversible and secure transactions [10]. Blockchain-like models have been proposed since the '80s (David Chaum [11] in 1982 proposed a structure that awarded him the title of inventor of digital cash), but the first-ever implementation has been Nakamoto's Bitcoin blockchain in 2008-2009 [12, 13]. Immutability and transparency of the records ensure the solving of the two main issues connected to the archiving of digital objects. In fact, records of the blockchain cannot be altered (issue of authenticity - ownership cannot be falsified) and every transaction involving a certain digital asset is recorded (issue of immutability and traceability in space and in time - the history of ownership is guarantee), allowing the proliferation of cryptocollectibles and cryptoart.

2.3 Artwork in the Age of Digital Reproduction

As early as 1935, the German philosopher and critic Walter Benjamin wrote an essay on the socio-economic value of art in the context of easy mechanical reproduction [4]. This work is almost 90 years old, but can still be related to the similar context in which digital art is finding space to proliferate: today digitalization of art has taken to extremes the ease of reproduction and the availability of the artwork, that is now ubiquitous. The conclusions he draws can be applied to our society, where digital art can be reproduced at the click of a mouse.

The essay opens with a quotation to Paul Valery [16] in which the French poet states that "*the amazing growth of our techniques, the adaptability and precision they have attained, the ideas and habits they are creating, make it a certainty that profoundly changes are impending in the ancient craft of the Beautiful*" and continues saying that "*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*".

The author begins his discussion by stating that a work of art has always been reproduced: by students to master their craft, by artists to disseminate their work, by third parties for personal gain. He also asserts that techniques for reproducing a work of art have always existed, but that the more they have developed, the more meaningless art has become. The author argues that "*even the most perfect reproduction of a work of art lacks one element: its presence in time and space, its unique existence in the place where it is located*". The author states that creating works of art with "*barely a movement of the hand*" causes the artwork to lose its meaning. The reproduction of an artwork lacks the "*aura*" of the original work, its presence in time and space. In other words, an artwork that cannot be protected by reproduction cannot have value.

Benjamin focuses on the value of the work of art in relation to its environment. He states that there are two opposite poles on place for an artwork: cult value and exhibition value. For instance, Benjamin talks about authenticity and the value of the art in a mass-society context. The main criticism raised by Benjamin is that art should be contemplated from afar, while the masses bring it closer by reproducing the objects. Benjamin states that the contemporary masses have a desire to "*bring things closer,*

spatially and humanly", a desire as strong as their inclination to overcome the uniqueness of each reality by accepting its reproduction.

He also asserts that the concept of original presupposes the concept of authenticity. The German critic states that an original, when confronted with its copies, always maintains a level of authority that is unobtainable in the reproduction of a piece. Mechanical reproduction operates according to the latter perspective, separating art from its cult base (portability). This new predominant level changes the function of art (from contemplation to distraction).

Hence, it is of extreme interest to understand from artists and collectors what are their thoughts on NFT nature and potential, if scarcity still matters in a world where valuable assets are easily reproducible, what are the differences between a physical tangible work of art and their digital creations, if NFTs can create a disruptive innovation in the art market to better understand in which way NFTs are still art and in which way they are digitalized valuable assets.

3 Methodology

Due to the recent gain in popularity of NFTs, as well as the lack of a theoretical under-standing of digital artwork, the research question is addressed from the perspective of insiders.

The adopted approach can be defined as qualitative and interpretative, with a constructivist paradigm. In fact, the main data are opinions collected throughout semi-structured interviews which are then thematically analyzed. The interview approach ensures the exploration of the phenomenon from a variety of perspectives to understand its many facets. Constructivists argue that truth is relative and depends on one's perspective. This paradigm, according to Crabtree and Miller [34], "*recognizes the importance of subjective human creation of meaning, but does not reject the notion of objectivity altogether. It emphasizes pluralism, not relativism, and focuses on the dynamic circular tension between subject and object*". With this method of inquiry, interviewees are able to tell their stories and describe their views on the context, helping the research to understand participants' actions and decisions.

The main intent was to understand how the NFTs market operates and the resulting implications. First data was collected in 2021 from different insiders (11 interviewees) of the NFT community, that can be categorized into two main groups: artists (also called sellers) and collectors (also called buyers). Interviewees work in and gain from this market segment, making them the most suitable profiles to outline the structure of these assets. These profiles are of well-known personalities within the NFT community, thus for privacy reasons we have guaranteed them full anonymity. The interviews have been conducted by mail with all English-speaking profiles, except for one interview conducted in Italian with an online meeting (lasted about 30 minutes and answers have been transcribed) with an Italian artist. When useful for research, the answers are cited in the next section.

The homogeneity of data collected indicates that these interviews have been consistent and results can be academically relevant, observing the reliability property.

Moreover, the profiles interviewed cover the perspective of a NFT transaction, which is performed by two active profiles. In particular, artists (first profile) sell their work to collectors (second profile), by registering a NFT version of their artworks on a NFTs marketplace. It is obvious that to collect opinions from inside, the profiles to interview must be either digital artists or NFTs collectors. Because of the insightful nature of the questions, opinions from enthusiasts that do not directly deal with NFTs would have not been sufficient.

For major detail, collectors of NFTs are not necessarily art collectors, they can be also collectors of what is defined as "collectibles" and can bring a profit. This explains why NFTs are also referred to as "cryptocollectibles". It is explicit in some of the answers that have been collected from collectors, where they talk about "flipping" art and "flippers". To "flip" an artwork, or a collectible, is the action of buying a piece of art to simply resell it at a higher value, at some point in time. An artist, on the other hand, is the creator of artwork endowed with aesthetic value in the fields of painting, music, fashion, writing.

As mentioned before, the issues in archiving digital objects can be primarily correlated to the non-materiality of digital objects and the absence of a state of scarcity. These problems, combined with the research question, outlined the draft interview and what was crucial to understand from the insiders.

The 11 interviewees, whom we can call experts, are classified as artists (5 in total), collectors (6 in total). The study sample may be considered limited, but it is still sufficient to gain insights from the perspectives of artists and collectors, considering also that the topic was not of interest to the general public less than a year ago. For a more in-depth look at the interviewees, readers can refer to Table 1 where the profile of each interviewee is briefly described.

Table 1 Interviewees' profiles

Profiles	*ID*	*Description*	*Method*
Artist	Al	Worldwide famous Italian artist. Produces both digital and analog art.	Online meeting, Skype.
Artist	A2	Mature artist. Has been in the industry for many years. Produces both analog and digital.	Written interview, e-mail.
Artist	A3	Young abstract artist. Produces both analog and digital art.	Written interview, e-mail.
Artist	A4	College student and artist. Pays off student debt with NFT. Produces both analog and digital.	Written interview, e-mail.
Artist	AC	Swiss artist and collector. Does not rely on art as its main income.	Written interview, e-mail.
Collector	Cl	Digital collector Owns art and collectibles. Entered the segment with speculative intentions.	Written interview, e-mail.
Collector	C2	Digital art collector. Never understood the art segment before NFT.	Written interview, e-mail.
Collector	C3	Digital art collector. The community is inspiring them to pursue art creation.	Written interview, e-mail.
Collector	C4	Digital collector with mainly speculative intents.	Written interview, e-mail.
Collector	C5	Digital collector.	Written interview, e-mail.
Collector	C6	Collector and investor. Entered the segment to become an expert.	Written interview, e-mail.

The research design can be described as exploratory, because the purpose is to understand the role of NFTs in changing multiple sides of the digital artworks market.

The interview track is based on 9 open semi-structured questions, to trace the borders of the topic, but let the interviewees feel free to answer in their personal manner. The interview was the same for the profiles considered in this study. The interview's questions can be categorized into sections. For instance, questions 1 and 2 explore the choices of entering the NFTs world. Answers to questions 3 and 4 outline the main differences between digital art and traditional media. Questions 5 and 6 are about the ease of reproduction and scarcity. Question 7 is about the ecosystem around the NFT community. Question 8 asks about the immateriality of digital collectibles. Question 9, with no academic purpose, asks interviewees their opinion about the future of NFT.

The conclusions show that empirical findings have been crucial to answer the main research question.

4 Findings

The presentation of the findings, which are resulted from the interview questions, is organized into seven major themes: Reasons for Entering the NFTs Market, Cryptoart and Traditional art, Ease of reproduction, Scarcity role, Immateriality role, NFT Community, Potential of NFT.

For each of such themes, the opinions of the two different roles interviewed in the NFT community were distinguished. It means that, to facilitate reading, the perspectives used to present findings are: creating and selling (i.e., the profile of artists), and buying and collecting (i.e., the profile of collectors).

Reasons for Entering the NFTs Market.

According to the collected opinions, it is not common for an artist to start making art to enter the NFT world; while, when looking at collectors, most of them became interested in art with the explosion of NFTs popularity. In other words, artists were driven by their artistic instinct and impulse to create art, while collectors entered the segment primarily for the possibility of economic exploitation.

Artists. When we consider the expert's history with art and NFTs, all artists stated that they started interacting with art before NFTs even existed, and their current interaction with art has not changed and the feelings they look for when making art are still clearly tangible even when they realize digital art. In fact, two artists indicated that art has always been their channel for exploration and discovery. Artist A2 responded that the first approach was "*the joy of making art in complete freedom, without knowing how the art world works and without having gallery representation*", while artist A4 stated, "*I create art that I enjoy with the hope of sharing this pleasure with others. If it moves others, it is a victory for me*". To quote another response, AC profile said, "*what I look for with art and what I look for in art is always the same, the only difference is the medium*". In addition, artist Al revealed that "*the process of digitizing their sculptures and tangible artworks brings me new enthusiasm*", saying

that coordinating a team to digitize some of their products also challenges their managerial side.

Moreover, artists entered the NFTs world as a medium to spread their art without limits from others. The most famous artists interviewed began to take an interest in this segment as early as 2017 with CryptoKitties and CyberPunks, when the sector was still not developed. Artist A2 argued "*I've decided to enter the NFT world because there are a lot of benefits for artists. 1) There are no gatekeepers, and we can exhibit wherever we want without anyone getting in the way. 2) There are a lot more opportunities available and it's so much easier and cheaper to do even group shows with digital files. 3) For the first time in history, artists can get royalties on secondary sales. 4) Commission rates on sales are lower. 5) Galleries have no control over where we show and whom we sell to. 6) It's early in the game and NFTs are going to change the world and be a part of everything mainstream, just like websites and social media are today*", reinforcing the idea that NFTs make the art market more accessible not only for collectors, but for artists too.

Collectors. While artists may have an artistic drive to enter the NFTs market, most of the collectors do not. For instance, one collector said he became interested in art when they first met their significant other, but did not really participate in the art community until NFTs became popular. Cl stated "*prior to NFTs I'd never really understood art and certainly hadn't collected any*", while another one gave a similar answer, stating that he started looking into generative art (that is created through coding) because of "*the hot NFTs market*". Two collectors responded similarly, with C2 stating "*I was introduced to NFTs by a friend who had a drop on Nifty Gateway (one of the most popular NFTs marketplaces). At the time, I still did not fully understand the concept but I wanted to support him, so I purchased one of his pieces. This was at a time when the prices of Nifty Gateway were much lower, so there was less of a financial barrier to entry*". C6 mentioned one great advantage of NFTs saying "*NFT is connected to cryptocurrencies, it doesn't only let you create a piece, but the NFTs world lets you have profit out of an art. And create liquidity out of it*". In fact, a NFT can only be acquired and sold with cryptocurrencies, that also fluctuates and can bring a profit. One collector said that nostalgia for collecting Pokémon cards first drove him to NFTs but remained in the segment for profit. All of the collectors interviewed saw an opportunity of investment in NFTs, rather than wanting to expand their art collection, except for one that stated the appealing nature of interactive assets and that they like to collect cryptoart because "*it's art that can be displayed and no maintenance is required. No sun damage, no water damage, no other damage*".

Cryptoart and Traditional Art.

Artists. When asked what the main differences are in creating, producing and selling art in the NFTs market rather than in the traditional art segment, artists mentioned that NFTs offer more possibilities than traditional art and that most of the process can be quickened with this new technology. For instance, Al mentioned that "*even if my work started in the physical art market, I always used processes like scanning and digital modelling to create my work. Cryptoart cuts most of the processes involved in physical art and I can manage my time better, dedicating most of it to creative exploration*

of the digital", while another stated "*I feel that the digital medium offers more possibilities for an artist than the physical, like animation, 3D, Augmented Reality art, et other digital forms of art. Also, with blockchain technology, an artist can precisely define how and how many artworks the viewer can experience*". In a similar fashion, A2 said about the low barriers to enter, mainly talking from an economic point. They also said that even if top developers often collaborate with each other and share information, the original developer of a certain code will always have a market advantage among educated buyers. Artists stated the ease with which artworks are sold and the price range that is extremely different from analog art. In this regard, they argued "*People are willing to spend that in crypto, not so much in cash. Crypto-users are already in the game to gain more money. Another difference is the support. The art community doesn't look favorably on NFTs, so there's a lot of backlashes. On the other hand, I've gotten so much support from the NFT community. They're willing to give feedback and praise whereas the art community was almost stuck up and provided nothing*".

Among the major features that differentiate digital art from analog art is the non-materiality for artists. For instance, A2 stated "(one of the) *major features that differentiate digital from analog art* (is that) *we cannot directly touch, feel, mold the art with our bare hands, as we can do with paint, clay, paper, et cetera*", while also adding "*the experience of digital art is limited to the technology available to access it, which is most often a small screen. There is social interaction around digital art, but it feels a little distanced as compared to meeting an artist in a gallery exhibition*". Social interaction is a theme that has been mentioned by different interviewees. AC explained that the differences are mainly due to the tools used to create the artworks. A4 expressed a similar sentiment, adding "*there are, however, some things that digital cannot recreate, such as certain brushstrokes or hues*". The same artist continued saying that digital art can interact with the environment and change depending on where it is displayed, while he emphasized that digital art is forever and immutable (alluding to the use of blockchain technology). Al pointed "(digital art) *gives a new vision of what is and what is not matter*".

Collectors. Similar sentiments to the artists response are expressed by collectors, for whom the ease of collecting and the security of blockchain are the main differences with analog art. In this regard, Cl stated, "*Digital artworks are all purchased online. The other difference is paying commissions to the store or buying online for analog, while with digital there is a commission to buy/move things on the blockchain*". C5 mentioned volatility as the main difference with analog art and said that the hype around an object can cause its price to skyrocket in a matter of minutes. C3 said that blockchain adds an extra layer of security to the object owned, while C4 said that even though digital art is protected by blockchain, the ease of reproducing a digital artwork is something slightly troublesome for a collector.

Collectors had also a similar view of differences between analog and digital art, as most of them cited tangibility and non-materiality as the main properties that differentiate the two, but they see it as an advantage, as far as collecting, opposed to the artists' vision where non tangibility is just a characteristic. In this regard, Cl said "*personally I find the portability of digital art much more exciting. Analog art takes up*

space and requires effort to display whereas I find digital art convenient, displaying through online gallery platforms and digital displays. Additionally, I can display the same art in multiple locations - it's simply more flexible". C4 expressed similar feelings, stating "*Beyond the weight and substance of physical tangibility or the difficulty of convincing reproduction, I simply cannot think of any advantages that aren't completely shadowed by the advantages digital art brings. Since digital art doesn't take up space and is easily accessible from any device, it is much more convenient than going to an art gallery and buying a painting, not to mention much easier to sell. Beyond this, digital art NFTs can be tied to different functions previously unheard of due to the flexibility and functionality of the blockchain and smart contracts*".

Ease of Reproduction.

Artists. The opinion of most of the artists interviewed is that ease of reproduction does not change the value of an artwork. In this regard, AC said, "*I think there are several things that contribute to the value of a work of art. Some say it's the status of the artist, some say it's other* (characteristics)*; but I think art is about emotions* [..] *and if something is great, the intrinsic value doesn't change over time*", while A2 said that the masses accept and change the value only of works that fall into the realm of pop culture, and added, "*Banksy still sells at high prices, despite being popular*". A4 said, "*In America, artists have struggled for the right to have their works appreciated. Early Americans struggled without the media to help them get their work out there. Today we have access to an even greater source, the Internet. I don't think that has changed the value of works of art. The difference is who notices it and how it is trending now. Even then, popular works were remembered and noticed. It just took a little longer to do that. What the media did was remove the barrier for people who are not really art experts to try to add their pieces to the game. Similarly, the competition is high*". Al said that they do not believe that the ease of reproduction changes artworks' value because "*what we define as digital art is just images, just like photos of every known artwork that you can look up on your phone*".

Collectors. Collectors, likewise, feel that a NFT is more than enough to ensure ownership of digital artwork and drive the demand/supply model. In this regard, C3 said "*digital art and its convenience has opened up art to a broader audience, just as mechanical reproduction did. A bigger audience in a supply and demand situation would usually mean greater demand and therefore higher prices. Widespread access to digital art initially cheapened the value of said art because there was no sense of ownership and one could simply take the art with a simple copy-paste. NFTs provide a sense of ownership, because each NFT has a unique signature on the blockchain that is instantly verifiable and can be connected to functions within the blockchain that give the art a usage case. You could certainly still copy-paste the image tied to the NFT, but it would have no place on the blockchain and no potential usage*". C2 answered "*I think the exclusivity around traditional art collecting was partly why I never collected art previously. By making art more accessible digitally, I've been able to be a part of communities with other collectors making it feel more welcoming. As more people have access to the art, more people will see and experience it, which drives FOMO* (Fear Of Missing Out*) in those yet to collect and so increases the price.*

On the flip side, by having more people collecting there are fewer `rules' around how art should be resold, so pricing may be more volatile than in the traditional art world". Expressing similar feelings, other collectors attributed the value of an artwork to the demand/supply mechanism.

Scarcity.

Artists. Artists agree that scarcity is still an objective when creating and selling art, and they believe blockchain technology is sufficient to ensure a trusted level of scarcity. In this regard, Al said "*NFT shifts the paradigm. NFT can now differentiate the uniqueness of one art piece*". AC stated that "*NFT brings the two possibilities together, everyone can see the art, but only a few can be the owner of the art*", while also adding that "*scarcity is about owning and not seeing*". A4 affirmed that "*scarcity is an important aspect of NFT art, that an artist must be thoughtful about*", while adding that an artwork "*can be copied by screenshot, but won't have the same value as the one which was tokenized. Although it is nonmaterial, it remains exclusive*".

Collectors. As for collectors, scarcity is obviously an important property to have for the items they collect. Cl stated "*Scarcity is my main metric for art I invest in and I see blockchain technology as essential to that. There is a degree of trust that the artist won't simply create additional collections of the same artwork, but generally the community is aware that this reflects badly on the artist so* (it is) *self-polices to some extent. Non-materiality is a nonissue in my opinion, where prints exist in the analog art world and can be produced with no real guarantee of scarcity*". C2 expressed similar sentiments, saying that the main problem with digital art is that the actual creator of a work may create multiple legitimate copies of the same work, but this is not common. Cl also asserted that "*there will be fakes, whether analog or digital works. The difference with blockchain is that you can track everything through blockchain if you want to verb the authenticity of a piece or collection. Do you want to own the real Mona Lisa or a copy of the Mona Lisa? I think it's kind of flattering to have fakes of your own artwork, it's in high demand if people want to try to reproduce it. Those who approach NFTs and blockchain need to make sure they do their research to make sure they are buying what they think they are buying*". C5 added "*Scarcity has different levels of importance for collectors, depending on the popularity of a collection or the use case of NFTs, but in general, yes, scarcity is a goal for collectors. There are several methods of creating NFTs scarcity* [..] *A more innovative way of creating scarcity that I have seen is to provide collectors with an incentive to burn their NFTs for rewards in burn events, so that the burned NFTs become scarcer, while the best burners get some other reward for their sacrifice. The only way I see the blockchain creating exclusivity for simple jpeg files is to create smart contract functions that provide some other use or higher form of enjoyment of NFT art. There is no other way, in my opinion, in which blockchain can elevate the exclusivity of something so accessible*", an opinion with which most insiders agree.

Immateriality and its implications.

Interviewees were asked where they can find a difference between enjoying analog and digital art, considering that digital art must be enjoyed with a physical device.

Artists. Artists agree that digital art needs a physical device, but they argue about the ubiquity of digital artworks. In fact, A2 said "*digital art does need a device to be enjoyed but uses the device to be more accessible to a wider arrange of people, which has never happened with physical art. In fact, during lockdowns, devices were the only way to access even physical works*", while AC affirmed that "*this is only a new medium*". On a similar note, A4 stated "*Whether you're drawing on a digital tablet or computer or creating photos, painting, sketching, etc., there isn't truly a difference in enjoying the art. Everyone has a style or niche and that applies to both analog and digital. Digital art is probably 10-15 years old at this point. I remember when Wacoms* [a graphic tablet] *first became a thing. I think the only real difference is where people enjoy art now. People have been liking and saving art pieces forever on the Internet*". The artists see digital art and NFTs as a new opportunity for art that is detached from traditional art. For instance, A2 said "*Digital art is not an evolution of physical art, it's a different form of art, like how a painting is different from sculpture and they're both different from installation. All of them will coexist with digital/NFT art. It is definitely a new opportunity for artists, and thankfully a direction that forks away from traditional art and its repressive systems. My guess is it will run parallel to the traditional art world and converge at some points with physical gallery exhibitions*". AC said that the separation between digital art and traditional art reminded them of when photography was not considered art. They stated that digital art is a new medium, a new tool and NFTs are a new form of authentication, but they are simply another branch of art. It is clear that artists do not think of NFTs as a new form of expression, but they attribute to them art-like properties.

Collectors. Similarly, collectors expressed similar sentiments. Cl said "*I think this started with digital picture frames, people wanted to share more photos in their home by uploading an album and spinning all the photos. I think this is slowly evolving with companies like NiftySlabs creating physical NFT cards*". Similarly, C3 argued "*I think the difference in the way art can be enjoyed is the way art is presented: analog art can be felt while digital art can only be seen or heard. It is certainly a new opportunity for every artist because it is a new technique and everyone can discover their own style and be good at it. However, I think they will move laterally; both have their own market. Maybe traditional art would be for the mass of people, but they cannot own it. However, digital art can go up because of marketing and people's demand*". C5 emphasized that the main difference with traditional art is that he does not collect for artistic pleasure, saying, "*I personally do not consider NFTs as something I collect only for their artistic value, and I would not be comfortable doing that anyway*". C2 said that digital art can enable new forms of enjoyment: "*My first real appreciation of a digital artwork was when I experienced it in an online Virtual Reality/3D gallery. I was able to 'walk' up to the work and see its details up close. Digital art can be infinitely more enjoyable because of its portability or use of mixed media. Simply hanging a digital screen on a wall and displaying an image is a low-cost solution and comparable to displaying analog art on a wall, but with the ability to interact with the digital art, moving around it or even through it, can make the experience much more exciting*".

NFT Community.

Artists. Artists have agreed that there is an ecosystem around NFTs, but rather than influencing and affecting the process of creation, the community around NFTs helps artists to grow. For instance, A2 asserted that "*communities and forums are very active and people are extremely supportive of each other, such that they even suggest techniques and processes creating the art, which the artist may not have thought of earlier. For example, an artist suggested I animate some of my images for the NFTs, which changes the pieces themselves.* [...] *This happens very rarely in the case of analog art. Also, collectors are not as easily accessible nor as friendly or social in the analog world*". Also, artists say that communities are being created around the main marketplaces and they see communities at the center of NFT's future. A4 described the typical process of creating art and understanding the market, as a flow where the art is created and then immediately uploaded to social media; if the art gets some tractions, then the artist will start to produce similar pieces and upload them on a blockchain, otherwise, they will rethink their art. They also stated that this is a similar process to showcasing analog art and understanding a segment in the traditional art market, but it is easier and cheaper due to the lack of physical space needed to show a work of art. Expressing similar feelings, Al stated that there is an "*entire ecosystem of artists, collectors and observers*" and that "*perhaps because it's intrinsic of the blockchain's nature, perhaps because everything is just starting, there is a cut of everything and everyone that is an intermediate, easing the process of bringing enthusiasm without filters*"; they also added that "*there is an important level of liquidity*" in this segment and this is one reason that made this market the most important, as for now, art market.

Collectors. Collectors have expressed a strong sense of belonging to the NFTs community. For collectors, communities are the primary source of information and often determine the value of an artwork. Communities are populated not only by collectors, but also by artists; in this regard, C3 affirmed "*For digital art* [..] (the community*) has influenced art in the aspect of marketing/promotion*". C2 stated that the NFTs community is what inspired him to collect art.

Potential of NFT.

While in general not so great differences can be identified in the positions of the different profiles regarding other aspects, when they express themselves on the potential of NFTs the related points of view are all diverse, in terms of content and of trust in their own statements.

Artists. Some artists believe that the NFTs segment is just another market. For instance, A4 argued "*To be honest, view NFTs as almost a market of sorts. People are selling their art. Collectors are buying it. They may turn it around for profit or hold onto it. This is a concept that's age as old as time. It's just digital now. NFTs, I believe will continue to be around and take off*', stating that the only growth they can see for NFTs is in popularity. A3 expressed similar feelings, saying that NFTs unveiled a new different branch for art and digital items, with art becoming interactive and with authenticity linked to the blockchain. A2 said that it will depend on new interactions

with blockchain and whether this technology has already tapped its potential, stating "*For example, generative art like CryptoKitties and CryptoPunks were great innovations, but the many similar projects that followed were just conceptual copies. When someone uses blockchain technology in a way that has never been used before, it will become art* [...] *but we can't tell at this stage*". One response comes from Al who said "*I think the collector of the future, and if we are talking about the future then we are talking about infinite time, will perceive a digital object in the same way we perceive physical objects today, so there will be no difference between digital and physical. Maybe digital will have more value because it is more fluid, lighter and because of its method of certification. I think digital art will find more and more space and become more and more valuable, reaching similar or higher levels than tangible art, with digital museums of great prestige and consideration*".

Collectors. Some collectors were very cautious in their responses, with C3 saying that "*we are becoming more and more digital, from paying bills to transferring money to investments, so digital art has great potential as it is also about assets. Blockchain technology is one of the major paperless transactions, so they could be related and if one has potential the other will follow*", while C5 stated that "*NFTs that only give art value are probably in a bubble right now, but even when the bubble bursts, many art NFTs will still be worth pennies, which is more than you can say about simple jpegs. Pieces like Beeple's NFT will likely retain much more value because of its notoriety and prestige, and the fact that NFTs can inspire such a vision of a work of art shows how blockchain technology is a legitimate medium for art and its exchange of value*". Cl was very brief and concise, saying only that the potential is unlimited. C2 expressed the opinion that "*I don't think we are close to understanding the potential yet, but even at a basic level, the possibility of adding utility to digital art beyond images will be huge. With blockchain technology, an artist could easily give away* (airdrop) *additional artwork to the current owners of his or her work. Or, by owning a particular piece, give access to an experience, both digital and real*". Expressing similar sentiments, C6 stated that "*I don't think NFT has reached its potential, the Metaverse is still under construction. More Virtual Reality features will come out, with platforms and portfolios interacting with them. NFT will come to life and be displayed wherever you want it.*"

Summary of positions.

Table 2 summarizes and briefly compares the positions of the two profiles on the seven considered themes, as emerged from the analysis of all questions highlighted in this section.

Table 2 Summary of interviewees' positions

Themes	*Profiles*	
	Artists	*Collectors*
Reasons for Entering the NFTs market	Artistic instinct to create art.	Profit opportunity.
Cryptoart and Traditional Art	The major difference is non-materiality of artwork. They find convenient to work with cryptoart	The major difference is non-materiality of artwork, portability, ubiquity, and more accessibility.

	because less expensive and more accessible.	
Ease of Reproduction	It helps to increase popularity of their artwork without consequence, provided that blockchain technology is applied and the original artwork is tracked.	The pieces are not interchangeable, each one is authentic.
Scarcity	Blockchain technology ensures a trusted level of scarcity and consequently the immutability of an artwork.	It is a goal, and blockchain technology is essential to ensure the immutability property.
NFT Community	Supportive and collaborative.	Influence price/marketing.
Immateriality	It doesn't compromise the quality of the artwork. It is a new medium. Interactivity and communicability.	It needs a physical device to enjoy. It is a new form of enjoyment. Interactivity and communicability.
Potential of NFT	Cautious viewpoint.	Enthusiastic viewpoint.

5 Discussion

To facilitate the reading and preserve clarity, the analysis of answers will follow the categorization of the previous section.

The main Drivers to enter the NFTs Market. Most collectors have entered the art segment primarily for profit, while artists have been driven by their artistic instinct and impulse to create art. Possible reasons for the popularity of NFTs can be found in both the traction gained by the online community on various platforms and social media (e.g., Twitter, Reddit, Discord) and the fact that entering the market and selling an artwork is extremely easier than in the traditional art market, where gatekeeping is a diffuse practice and the entry barriers are usually high. Both artists and collectors have noticed that, in terms of participation, accessibility and community, the NFTs market is a better choice.

Analogies and Differences between Digital and Analog Art. Artists and collectors found the main difference, between digital and analog art, in the non-materiality of the product. Artists find it convenient to work with digital art, which is less expensive and more easily accessible. This freedom of creating and ease of producing has been also referred to as automation [6]. In fact, interviewees said that the main difference between digital and analog art is that the former has no barriers to entry and that digital art and collectibles are so easily "*flippable*" (i.e., an object can be bought and sold to make a profit) that some people rely on NFTs as their main income, adding that the fact that collectible NFTs can have such interesting and far-reaching applications that can unite unlikely groups of people is simply amazing.

Collectors have often cited accessibility and portability as the two main properties that differentiate the collecting of tangible physical art from that of cryptoart, explaining that the latter, being online, can be displayed anywhere without effort. Ubiquity is not tied to digital objects only and, as an artist mentioned, during lockdowns caused by the Covid-19 emergency, the only method to visit museums, galleries and exhibitions has been with digital technology. Digital paintings can be enjoyed by millions of people simultaneously, reinforcing Benjamin's concept of value displacement. Collec-

tors also agree that there is no real difference in the enjoyment of physical and digital art, but in the availability of an artwork wherever one is. This gives new meanings and characteristic to art.

Ease of Reproduction and Scarcity. In his essay, Benjamin [4] reflects on how the ease of reproduction can change the value of an artwork. Although the premise of Benjamin's work is that the ease of reproduction shifts the values of art in a negative way, he acknowledges both artists and collectors positive consequences: first and foremost, accessibility to a wider audience. Our findings reveal that the ease of reproduction helps artists increase the popularity of their work without consequence, provided that blockchain technology is applied and the original work is tracked. Similarly, it emerges that digital reproduction does exactly the same thing as mechanical reproduction in providing a wider audience for artists [4], and that a wider audience usually means a higher value for the artwork in the simple supply/demand mechanism. NFTs combine the artist's need to disseminate his or her artwork, being digital objects, and the buyer's need to secure ownership, being linked to a blockchain.

Cryptoartists and cryptocurrency holders combine the unique properties of digital objects and the blockchain ledger to create an almost perfect digital object. Almost because the blockchain does not provide a level of protection against copying a work of art. For this reason, Trautman [26] stated that we own almost nothing online. It has to be clear that NFTs provide a certificate of ownership, not of copyright. For this reason, cryptoart can still be reproduced infinitely, but the original artwork remains unique. Collectors have noticed that artists can sell the same piece multiple times. This practice is completely legal and each different copy is recorded on the blockchain with its own personal record (the pieces are not interchangeable). They also added that the market itself regulates this kind of behavior, because an artist who is known to produce more than one copy of the same artwork is usually not highly regarded in the segment. However, this is not an inherent practice of cryptocurrency players, but rather of collectors. Taking the structures of collectible cards as an example, we can see the same pattern. Each copy of a collectible card is authentic and identical, and its value is based primarily on the availability of the card. The same logic applies to cryptocurrencies.

As one collector noted, you can display a copy of Leonardo da Vinci's Mona Lisa in your living room: would you have the same artwork preserved in Louvre Museum in Paris? They would be identical, but they would not be the same work. Similarly, an immutable record of ownership guarantees the value of an artwork and its scarcity. This approach is similar to that with which the German critic [4] introduced the concept of "*aura*". The aura of an artwork depends on two main characteristics: the authenticity of the item, the locale (in time and space) of the item. Therefore, even the most accurate reproduction of a work of art cannot be compared to the original, because it lacks the original's presence in time and space.

Platforms, Ecosystems and Platform Ecosystems. Most artists noted that the community is extremely supportive and that it is not uncommon to find other members suggesting creation processes to improve their work. Collectors cited communities for influencing the value of artworks and helping especially in the promotion/marketing

aspect of the segment. NFTs marketplaces fit neatly into the definition of platform ecosystem given by Van Alstyne et al. [24]. The platform ecosystem is the structure where producers (artists) and consumers (collectors) come together. In this scenario, these platforms operate on the blockchain and register NFTs; in practice, they are the managers of the network and this explains the cost that artists and collectors have to incur to upload and purchase digital goods [25]. However, NFT platforms do not interfere with the marketplace and only provide the structure to make contracts work. On the other hand, in the traditional art world, intermediaries work only for profit.

Immateriality and Quality of Artwork. Regarding immateriality, an interesting contribution is about virtual reality experience that a digital object can generate compared to the visual experience of traditional tangible artwork, as stated by a collector and an artist. Through augmented and virtual reality, digital art will bring viewers an experience that is not comprehensible today by 'walking among art pieces'. In this regard, in our findings it emerges that interactivity with digital artworks plays a great role and that the potential of NFTs is exploited when enjoying some NFT with virtual reality. This type of behavior falls into two categories: interactivity [3], which differs from editability because it does not allow the asset to be modified but rather to explore information, and communicability [19], the property of interacting with actors in a digital ecosystem.

In the context of production, sale, purchase, and exhibition, all profiles positively argue that non-materiality provides artworks with the property of ubiquity, facilitating all processes involved in the enjoyment of the artwork. All profiles agree that immateriality does not affect the value of an artwork, but it can influence the process of enjoyment. Immateriality takes the concept of "*exhibition value*" proposed by Benjamin [4] in his essay to the extreme. Immateriality implies interactivity through new technologies. All this innovation can be classified primarily as product innovation, and thus we can say that digitization, the encoding of analog information into digital format, makes digital products programmable, addressable, sensible, communicable, storable, traceable, and associative [19]. With ubiquity being one of the main properties of NFTs, the exhibition value of an artwork cannot be more stressed. In a similar fashion, Maggaudda [29] states that digital music consumption "(does) *not mean less materiality and* (does) *not imply a less relevant social role for material objects within consumption processes*". He concludes that "*material `stuffs' still occupy a relevant position, and materiality seems to 'bite back,' playing an even more essential role in consumer practices*" [7].

Regarding the properties of immateriality, one issue that can be raised is that of object quality. We need to distinguish between two moments. The first, when collectors view the artwork on the NFTs marketplaces and the quality of the image is not the same as that of the artwork: mainly because of problems related to the size and quality of screens, collectors are presented with a "preview" of the artwork. The second, when collectors own the artwork and the quality of the original artwork is preserved because collectors can enjoy on the most suitable device the certified asset with the same quality with which it was conceived. On the quality, the consideration also arises as to the size/format with which an artwork can be uploaded as a NFT. The answer is that it depends entirely on the specific rules of the platform. Generally, platforms

allow images, audio, video, and 3D models to be uploaded as NFTs, and the formats supported vary from marketplace to marketplace. Similarly, the size of a NFT varies depending on the platform chosen (e.g., OpenSea, Mintbase, Foundation, et cetera).

The future of Non-Fungible Tokens. Defining disruptive innovation as the application of new technology in an already existing market, with a process that starts from simple applications at the root of a segment [17], NFTs can definitely create disruptive innovation in the art market. It is the opinion of some of the interviewed experts, in fact, that digital art will tower over the traditional art domain. However, it is clear that the future of blockchain technology is unknown and that the size of the network is an unsolved problem (where are the sizes of blockchain headed?). Hence, in a scenario where technology can no longer keep up with Moore's law [14], the size of the network implies environmental problems due to the energy consumption required to run the ledger by increasing global warming and pollution. Under this perspective, it is impossible to ensure that NFTs allow for the abundance and stability of digital artifacts, nor that these records will be permanent because, as stated by other scholars [3], the technology that allows these objects to be stored today may not be accessible or adaptable in the future.

The main purpose of this paper was to understand whether NFTs can be considered a novel form of digital object that empowers the proliferation of a new digital art market. The simple answer is yes. NFTs, as digital immutable certificates of ownership, allow digital assets to be archived, stored and collected. In fact, provenance and traceability are properties intrinsic to NFTs. Combined with the immutability of data, these new assets allow the proliferation of a new market that can parallel the traditional art market. This is also possible because NFTs are based on blockchain technology, which, due to its inherent characteristics, is able to overcome the limits of digital objects.

The focus of this paper is on the context of digital art, but the results discussed can be applied to other contexts involving digital objects, to whom NFTs change some intrinsic properties. The coexistence in a NFT of a digital object and a certificate registered on a distributed ledger leads to reconsider some of the characteristics of digital objects identified by Kallinikos et al. [3], so far uncontested.

Specifically, NFTs are digital objects that, instead of being *unstable* and *perpetually in the making* [3], are *immutable* and *incorruptible*, that is, once the code of a NFT is recorded on the blockchain and confirmed by other peers, the information cannot be changed [12, 18]. Anything stored on a blockchain cannot be modified, at most it can be deleted by the owner. To delete a non-fungible token, the owner must send it to the blockchain's "burn address", an address that can be considered a data blackhole. This is the only way to actually erase data from the blockchain, but it requires the owner of the object to do so. One collector mentioned burning as a way to create scarcity. Other properties include *uneditability* of the digital object contained in a NFT, instead of intrinsic *editability* of digital objects [3]. NFTs are also *authentic* (intrinsic feature of blockchain technology) and *unique*, and cannot be falsified (even when an artist creates two identical objects, their passports differentiate them). Consequently, NFTs allow digital objects to become *scarce* (every asset recorded on the blockchain cannot be reproduced; combining irreproducibility with uniqueness and immutability, every

registered object can be considered scarce) and *transferable*. NFTs are *storable*, *traceable* and *transparent* in space and time. The data recorded on the blockchain is immutable and integer [20], so digital objects recorded on the blockchain are traceable and every transaction involving them is recorded.

In terms of value, all collectors and artists responded similarly, agreeing that NFTs make them feel safe and that blockchain technology provides immutability and reliable proof of authentication, two features that are interconnected. Digital objects are ubiquitous, infinitely replicable, abundant. This is the main problem with their collection and storage [3]. Blockchain technology is effective to solve this problem in an extremely simple way: by attaching an immutable digital passport to the asset. Blockchain technology is immutable and incorruptible [20], and its integrity is the perfect property to add to a digital object for ensuring its scarcity. With the addition of the digital passport, blockchain technology provides a level of trust and transparency that no other structure could provide. These properties, intrinsic to the blockchain, contrast with some intrinsic properties of digital objects ending up with resolving them. If the blockchain were not able to guarantee a level of rarity compared to the traditional art market, there would be no point in collecting cryptoart to make money by reselling it.

Referring to the literature, the answers have shown that cryptoart is *sense-able* [19] and *associable* [5], because it can be aware of the context, interact with the environment and carry information related to places and actors; moreover, it is *ubiquitous* and *self-referent* [19], meaning that has to be operated with digital technology depending on it. In addition, Kallinikos et al. [3] mention the interdependency of digital objects with other entities in large digital ecosystems, reinforcing the theory that digital objects need digital technology, while Manovich [6] state that the computer layer of a digital object influences the cultural layers of it.

6 Conclusion

The biggest challenges for digital collectibles have always been traceability, scarcity and authenticity. NFTs, as a combination of a digital artwork and its blockchain-based certificate, overcome the limitations of digital artifacts and enable the collection of them. Blockchain technology solves the two main problems (stability and authenticity) of archiving digital objects noted by Kallinikos et al. [3]. Since NFT is traceable and immutable, the authenticity is guaranteed and the provenance can be traced through ledger entries. Ultimately, it can be said that NFTs are more stable and bounded than simple digital objects and that blockchain offers solutions to what scholars had identified as problems.

In summary, it can be concluded from our study that some of the properties of digital objects described by Kallinikos et al. [3, 21, 22, 23, 30], which can be read as limitations at least in some field of application, like with artworks, have been overcome thanks to NFTs and blockchain technology. Future studies can further investigate the ontological properties of digital artworks as digital objects and contribute to new conceptual developments in the area of blockchain-based solutions [35].

Given the pace at which technology advances, future research is needed to monitor the behavior of NFTs, also in contexts different from the art domain. NFTs are at the beginning of their path and the potential seems, for now, unlimited: further studies monitoring the evolution of the NFTs market will help to understand whether it is in a bubble and what growth expectations it may have. This technology has already been applied to tangible objects, but developments with digital objects mainly concern collectibles; scholars will have to analyze the evolution of technology in different digital environments.

A limitation of this study refers to the fact that the proposed analysis is based on a small number of interviewees, and can be somehow affected by the recentness of the application. These aspects call for further investigations. Moreover, the external validity of our findings can be improved by extending the scope of the empirical analysis to additional profiles and levels of analysis. For instance, a focus on digital platforms [36] and online marketplaces [37] can improve both the external validity of the results and the generalizability of the contribution. Indeed, this work is related to the context of digital art, but the results discussed can be applied to other contexts involving blockchain-based solutions [38]. For example, the same conclusions can be drawn in any context where blockchain technology is applied to solve problems related to the storage and collection of digital objects.

In addition, the use of NFTs opens new risks and challenges to be investigated, such as jurisdictional issues, intellectual property, security concerns (e.g., cyber threats related to smart contracts, because patches cannot be applied as with 'ordinary' code), financial and business aspects [15], and the role played by intermediaries such as the marketplaces.

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