From the Algorithm to the New Art Collector. Design, Development and Launch of an Innovative NFT Collection

Dario Lanza(✉)

Complutense University of Madrid, Urban, Spain
dlanza@ucm.es

Abstract. Blockchain technology is opening up new and interesting spaces for creative sectors, redefining the relationship between the artist and the public, enabling the collecting of digital artworks and the incorporation of digital artists into the art market. New artistic formats such as PFPs, 1:1 Art and Generative Art make up what we generically term NFT Art, a wide range of new offerings that is undergoing increasing interest, both for creatives and for collectors.

This paper aims to aid understanding of these new paradigms, beginning with a description of the concepts in question and then developing a practical applied generative art project which will enable us to offer a first-person look at all the stages, from conception to public launch. In this way we can offer here a guide we hope will be useful to future artists and designers who wish to approach these new and fascinating art spaces.

Keywords: Digital Art · Generative Art · Art Market · Non-Fungible Token · NFT Art · Algorithmic Art · Ethereum Blockchain

1 Introduction

We are currently witnessing the development and consolidation of new technological and social paradigms and concepts, such as the notions of the metaverse, blockchain, NFTs or non-fungible tokens, which are profoundly changing the way we interpret many aspects of contemporary culture. Creative activities in general, especially art, are not exempt from these new paradigms, and today they are seeing the unprecedented rise of new and exciting forms of art. With a view to offering an in-depth understanding of said phenomena, we would like to propose an exploration that is as exhaustive as possible and goes from a description of the concepts that govern these new blockchain environments, to a first-person look at the new market for NFT art. To do this, we need to begin our itinerary by asking: what is blockchain?

If we look at Wu & Li (2021)'s definition of the term, blockchain is "a distributed and decentralized data structure that allows users to conduct secure and verifiable transactions without the need for intermediaries" [1]: in other words, a decentralized network of interconnected computers that share and manage information between themselves. These description may initially seem identical to one of the Internet itself, but the core difference

N. Martins and D. Brandão (Eds.): DIGICOM 2023, SSDI 35, pp. 67–78, 2024.
https://doi.org/10.1007/978-3-031-47281-7_6

with this new paradigm resides in the word "decentralized". The difference between blockchain and the computer networks that make up the Internet is that the latter are centralized around servers which host the information, the "intermediaries" to which Wu & Li refer, constituting structures much more vulnerable to manipulation or even the potential for disconnection of said servers, which would lead to the total loss of the information contained in them. On the contrary, when the information is replicated on thousands of computers across the world which are constantly collating it and checking its veracity, a process normally called data mining, the information is better protected from external manipulation or accidental loss. Looking at the design of these structures and their technological capacities, we find different types of blockchains, being the Bitcoin blockchain the first and best-known of them. The Bitcoin blockchain is usually defined as an open, public, and permissionless network of computers that maintains a decentralized ledger of transactions, whose activity is focused on the computers calculating countable adjustments related to their own token, which is the bitcoin. Such is the trustworthiness, transparency and security of this network that over the past decade bitcoin has acquired solid monetary value as many users find it more reliable than traditional currencies associated with countries and managed by banking entities, which are also susceptible to fluctuations. It is possible that in the near future we will see a significant portion of the economy move from traditional financial structures to decentralized structures like this.

The success, solidity and possibilities offered by the first blockchains such as Bitcoin has motivated the development of a second blockchain generation which is more technically sophisticated. The main blockchain of this second generation and the one with which this study is concerned is Ethereum, which in addition to processing its own currency, the *eth*, allows applications and smart contracts [2] to be executed. These two features have made this blockchain the perfect network for the creative sector by allowing the storage of audiovisual content like illustrations, art, design, photography or music, enabling algorithms to be executed as per the requirements of generative art, and letting purchase contracts for artworks be managed automatically and with transparency along with the management of royalties between creators and collectors.

In the sense of token processing, these new networks can mine and manage both fungible and non-fungible tokens, the latter being of most interest to the creative industries. But what are fungible and non-fungible tokens? A fungible token is an asset all of whose units have the same value, following the "equivalence principle" [3], as defined by Casey & Wong (2018), being completely interchangeable with each other. A one-dollar coin is a fungible asset as it has the same value as any other one-dollar coin and can be interchanged with it without affecting the value of a transaction. A photo in JPG format is also fungible since it is identical to replicas produced of it. By contrast, a non-fungible token, currently abbreviated to NFT, is any type of asset whose nature is unique and not interchangeable with any other [4]. An oil painting on canvas by an artist is a non-fungible token, as it has qualities that make it unique and it is not interchangeable with anything else.

For decades, digital creators and artists had very limited commercial possibilities for their work due precisely to the fungible nature of digital files by which any digital creation or design can be copied into identical replicas with no notion of which is the

"original". This has disincentivized any buying and selling and has inhibited the existence of a healthy collectors' market, something which has always occurred naturally in every other sphere of artistic creation.

Now, thanks to the capabilities of this blockchain, a digital file can be "uploaded" to the Ethereum network and registered as a non-fungible element in a process known as tokenization [5] or minting, in such a way that an individual and unique registration is generated in the blockchain for that artwork in question. The ownership of this can change hands just like for any other property, which enables transactions to take place. The JPG file for the artwork is not in itself the asset being bought and sold, as it is still a fungible item that can be downloaded and replicated between computers, but what is commercialized is the countable blockchain line, the registration of ownership, which does have a non-fungible nature.

This new panorama has allowed for the development of what is generically known as NFT Art: a vibrant scene of new artistic proposals that use the blockchain as a space to exhibit and commercialize artworks. Nowadays, the most commonly-found artistic categories in the blockchain are those known as PFPs, 1:1 Art and Generative Art, and of course we can expect new formats to keep developing in the near future.

PFPs, or profile picture projects, are collections of images created to be used as avatars or visual representations of users' online identities. They are normally generated by recombining individual elements based on, for example, a collection of eyes, noses, mouths, bodies and the like, in sufficient quantities to guarantee that every resulting illustration is unique. The rarest combinations are those most highly valued by collectors. The most famous examples of PFPs are CryptoPunks and the Bored Apes Yacht Club series, projects that have quickly grown popular due to the perceptions of exclusivity, value and status associated with the possession of these avatars [6].

Generative Art includes projects in which the artist creates an algorithm which automatically generates the artwork [7]. We will describe this category in greater depth in the next section, as it constitutes the central axis of this study.

Finally, 1:1 Art is a wide and varied category encompassing any form of art that does not belong to the above categories and which has a more individual conception for the pieces. It has a position closer to traditional art and includes digital photography, designs, collages, 3D renders, GIFs, animations, but also physical paintings done on canvas or drawings on paper which are digitalized in order to be incorporated into the blockchain. Usually the creator of a piece produces a single token for it, hence why it is known as 1:1, but we can also find artists who sell a small numbered series of NFTs from one piece, such as what traditionally occurs with limited editions of etchings and engravings. The best-known example of 1:1 Art is the piece *Everydays: the First 5000 Days* by the artist Beeple, a JPG made famous for being auctioned at Christie's for sixty-nine million dollars in 2021.

2 State of the Art in Generative Art

2.1 Generative Art and the New Role of the Collector

This paper will focus on this category, which Galanter (2017) defines as "any art practice where the artist creates a process, such as a set of natural language rules, a computer program, a machine, or other procedural invention, which is then set into motion with some degree of autonomy contributing to or resulting in a completed work of art" [8], in other words, forms of artistic expression where the artist, rather than producing a piece, designs and constructs a system that produces the pieces autonomously, introducing into the creative process elements that are not directly controlled by the artist. This incorporates an element of randomness into the creation and the artist relinquishes some control in order to allow external phenomena, generally random, unpredictable or at least not completely controllable, to participate in completing the piece. In line with this definition we see that this idea is not necessarily linked to computer use, since algorithmic behaviors are also present in non-digital works. We need only call to mind artists such as Cai Guo-Qian, Antony Gormley, Olafur Eliasson or Neri Oxman to observe notable examples incorporating physical, chemical or biological processes as active ingredients in the artistic production.

Moving into the digital context, the first expressions of generative art using computers were found in the sixties with the experiences of pioneers like Georg Nees, Frieder Nake and Michael Noll in 1965, consolidated from the seventies onwards by artists such as Manfred Mohr, Vera Molnár and Herbert Franke. In digital generative art, what the artist produces is an algorithm, instructions written in programming language, which when it is executed produces an artwork, normally visual –a graphic–, although not only that. Carter & Levin (2020) even talk about "collaboration between humans and machines, where the artist sets the rules and the algorithm implements them to produce art" [9]. If the algorithm is designed with no random function and no parameter that varies every time it is run, the same output will always be produced. If, on the other hand, the artist uses variables that take different random values every time, the algorithm can produce different outputs.

Digital generative art evolved gradually and silently from the sixties onwards, staying somewhat on the margins of the usual circuits of the art market and exhibition spaces. It is due to the recent development of blockchain technology, specifically networks like Ethereum with its previously described ability to run applications, that generative art seems to have found its perfect setting, piquing interest and achieving unprecedented visibility. By giving works of generative art a unique and authenticatable character, NFT technology has managed to materialize the value of these creations and incorporate them into the art market.

Part of the success that generative art is currently experiencing is due to an original paradigm of generation that turns the buyer of a piece into a participant to a certain extent in the creation process. To understand this, let us go back to the idea of a generative algorithm that uses random numbers to construct pieces to make the results varied and unpredictable. The novel thing about this approach, which is making these pieces so appealing to collectors, is that now the algorithm can be configured to make the random numbers derive from the identifier of the buyer, which is called their personal *hash*,

and from data like the exact date and time that the purchase is made. This means the construction of the piece is influenced and marked by these variables, which the algorithm can use as a seed for its random numbers, so the very mechanics of the purchase makes each piece unique and different from what would be produced if the purchase was made a second later or by someone else. However, as the algorithm does not run until the collector makes the purchase, they only know the style of the collection they are interested in from some sample outputs, acquiring the piece before it is generated, before it exists. We could say that the primary buyer, in their role as co-generator, acts somewhat blindly, but this is generally compensated for by the fact they are made a participant in the creation process. Here we mean that their participation is, obviously, more mechanical than intellectual or conceptual, but it is enough to establish a new and powerful link between the collector and the piece they are acquiring. We see the artist as the designer of the system and indisputable author of the pieces, but we also see how they concede some creative space to entities they have no control over, some to unpredictable random numbers and some to the actions of an external buyer.

Immediately after the purchase is made, the algorithm is run and once the piece is finished it is automatically registered in the blockchain through the process of minting described above, keeping a record of the piece in question, the authorship of the artist and the collector who owns it.

This model, whose novelty lies in incorporating information of the collector to construct the piece, was originally formulated and developed by the platform for launch and generative artist promotion Art Blocks, which has been recently joined by other alternative platforms like GM Studio and Fxhash, with somewhat similar approaches.

2.2 Primary Collectors and Secondary Collectors

After the primary collector generates and mints the artwork, they can freely sell ownership of it to third parties. This transaction will lead to the registration in the blockchain of this change in ownership and such information is public and transparent at all times. It is important to highlight that what is bought and sold in these markets is ownership of the piece, the countable note registered in the blockchain which certifies the legitimate owner, but not the image file, in any digital format such as JPG or GIF, which due to its fungible nature is infinitely cloneable and so cannot be transacted.

Unlike the primary market, where the collector "blindly" acquires a piece which has not been generated yet, secondary buyers do know the piece they are going to acquire, a piece which was previously generated during the primary purchase, so they have the option of being selective and choosing the piece that interests them most among those on offer on the secondary market. In exchange they renounce the sensation of co-authorship of a piece that was generated and minted by the primary buyer. This ultimately establishes a primary and secondary market for digital artworks, markets which so far were inaccessible to digital artists due to the fungible nature of digital files.

Another novelty that blockchain technology is incorporating into the art market context is that it is now possible to establish, in the smart contract linked to the algorithm, the percentage of royalties that the artist will receive both through the primary sale and through all successive secondary sales. This payment is made automatically, transparently and reliably in perpetuity every time a piece changes hands and it is not possible

to elude this payment. This protects the artist, offering a flow of income that is fairer and more continuous than traditional models, where the creator was usually left on the margins.

These new approaches, which interweave the artist's creative contribution, the somewhat mechanical participation of the primary collector, the unpredictable action of random numbers and the movements of secondary collectors, are producing an interesting and vibrant art market with attractive dynamics that are not present in traditional art markets.

Although some traditional art galleries and auction houses are already beginning to exhibit and auction generative work, like Christie's and Sotheby's, the main market on the NFT scene is in what is known as marketplaces, online platforms specifically dedicated to exhibiting and trading digital art. Portals like OpenSea, Rarible, SuperRare and Nifty Gateway open the doors to new ways of exhibiting and experiencing art, allowing for more democratization in the production and consumption of art [10]. Here we find showcases where new creations can be exhibited, with a great sense of inclusivity and openness to all kinds of art formats and varied dynamics of buying and selling including fixed-price sales to auctions by ascending and descending bids. By offering a digital platform accessible for the promotion and sale of artistic creations, these marketplaces have enabled the participation of emerging and unconventional artists in the art market, breaking down existing hierarchies and structures [11]. This democratization is also extended to collectors, allowing a wider audience to access and acquire artwork and challenging the exclusivity and elitism traditionally associated with the art market.

3 Design, Development and Launch of an Innovative NFT Collection

3.1 Concept for a Practical Project

Once the keys to this new and emerging scene have been understood and assimilated, we wanted to explore this novel context in a practical way, in first person, developing an applied generative art project that we could use to document every stage, from concept and design to public launch, a large-scale project, sufficiently elaborate and complex to produce a collection of 999 different pieces to enable us to experience all the difficulties in the process and record them to help future creators.

The starting point for our proposal consisted of the challenge of programming an algorithm that could generate digital art that was not perceived as geometric or mathematical. And we talk about programming because, as we've been describing, what we aim for with this project is not to paint physical artworks to later photograph them and upload them to the Blockchain, but to program an algorithm that digitally draws these pieces through code at the very moment of their purchase. As geometry is a relatively immediate resource for digital construction, due to the mathematical, polygonal and geometric nature of the entities that make up all programming languages, here we looked for the challenge of distancing ourselves as much as possible from that context, trying to explore the limits of programming. The starting reference, chosen because it is a diametrically opposed aesthetic to the mathematical and geometric, was the expressivity,

passion and energy of abstract expressionism, specifically of artists like Jackson Pollock and Franz Kline. The name of the collection, *Catharsis*, would evoke that passion and energy associated with expressionist creative delirium. Reaching this organic nature through geometric entities like the straight line, circle or polygon, was the first difficulty we had to overcome. It took a lot of time and effort in research and development, breaking down the main functions and working on randomness at a pixel level to manage to get away from the harmony, stability and predictability inherent to geometry. The lines of work included a realistic representation of the interweaving of canvas threads, simulating the fluidity and viscosity of paint, or its impact on the surface or transparency of color when diluted (see Fig. 1).

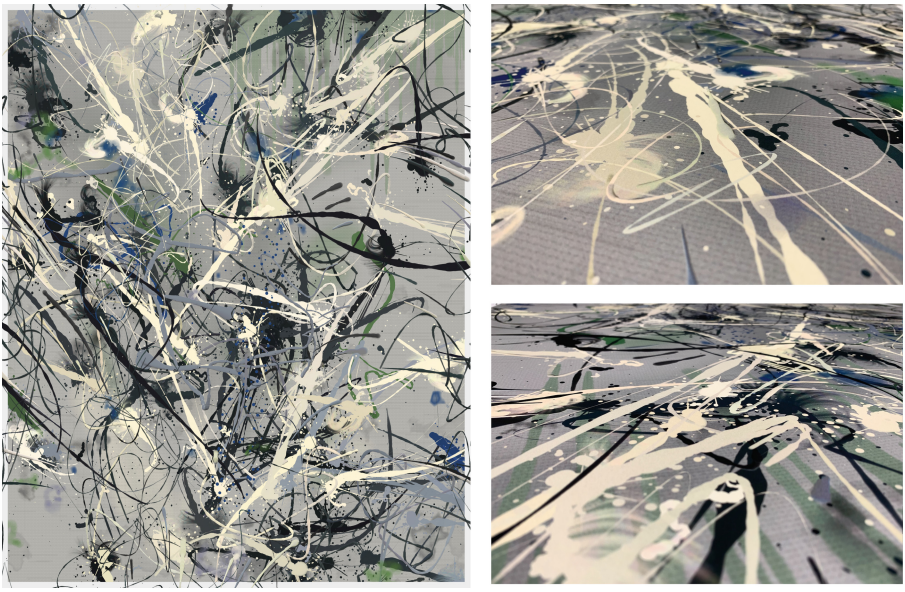

Fig 1. Energy, fluidity and organic sensation from geometric entities in *Catharsis #204 - Nuages* (detail)

Once the organic goal had been achieved, the project faced a new challenge: throwing the paint in a completely random way against the surface produced a distribution of color masses that was excessively arbitrary, homogenous, lacking in meaning and too similar from piece to piece. To avoid this problem, we had to orchestrate the throwing of the paint in such a way that, while maintaining randomness, it had a rhythm and suggested movement within the piece, evoking the arm gestures of a hypothetical painter. Designing this internal rhythm, which orchestrates the appearance of paint on the piece, meant a delicate balance between control and chaos where too much prefixing of the behavior of the paint would have resulted in pieces that were excessively repetitive, "prefabricated" and dead, while giving too much space to randomness would produce a homogenous result that was equally lacking in life. We see here the usual debate relating to the space given to randomness and external factors in generative art. It is necessary to design

within the piece both the elements we want to control and those that we allow to remain outside our control.

Technically, the creation of this internal rhythm required each piece to develop certain trajectories and attraction/accumulation spots where the paint would prefer to land, which would imitate the organic arm movements of a painter and the paint that is thrown due to those movements, while offering enough randomness around these fixed structures (see Fig. 2).

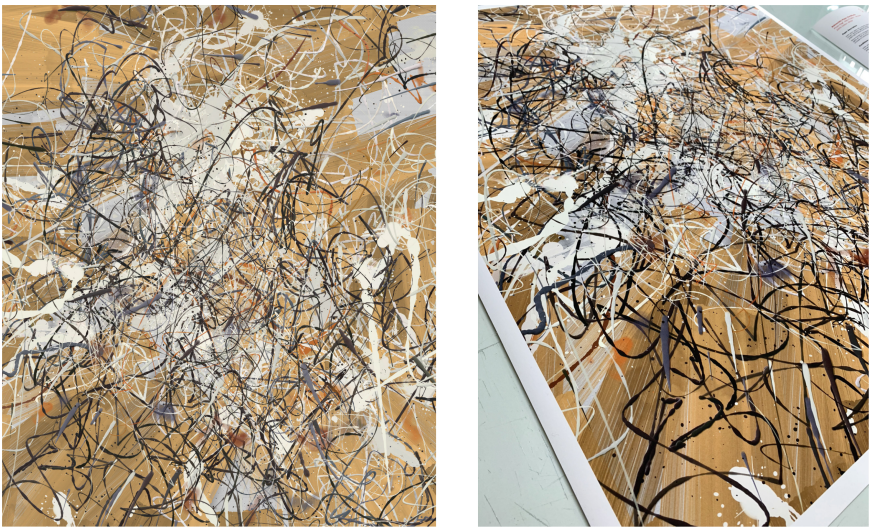

Fig 2. Internal rhythm orchestrating the movement of the painting in *Catharsis #781 - Beautiful Love* (detail)

3.2 Continuity and Evolution

Once the rhythm of the paint on each canvas was developed, the idea came up of making that movement, the trajectory that orchestrates on each canvas the disposition of the paint, extend from one piece to the next and for there to be continuity so that the rhythm extended beyond the limits of the canvas. This idea was algorithmically complex and required each piece to know its position in the series and to be able to use information taken from the previous piece, develop itself based on that information and prepare the following piece which had yet to be generated. Once we had achieved this sophisticated development, *Catharsis* presented an interesting innovation in the context of generative art: the potential for a piece to continue in the next which would enable the creation of diptychs and triptychs with continuity between them. This movement, which runs along each canvas and spills over the edges of a piece extending to the next, turns the collection into an immense polyptych of enormous dimensions where there is physical and visual continuity from piece 1 to piece 999.

To increase the possibilities of pairing, the algorithm was refined until each piece could present continuity, not just with the pieces immediately next to it but also in multiples of 50, both to the left and to the right. So, for example, piece 394 would have continuity with pieces 393 to the left and 395 to the right, but also could be paired with 445, 495, 545, 595, 895, etc., giving the collector a wide space to configure their own diptychs and triptychs (see Fig. 3). This offered new and interesting dynamics in the generative art space, where so far each piece has always been developed on its own without an awareness of those around it, but also replants the concepts of the diptychs and triptychs of traditional art. Historically, the creation of diptychs, triptychs and polyptychs has responded to material matters, usually motivated by the impossibility of having large enough canvases or slabs, demands made by the exhibition space available, like in cycles designed for decorating retablos or predellas, or aesthetic preferences of the author, like in the triptychs of Francis Bacon, but they were always predesigned by the artist to operate as a unit in a predetermined configuration. In *Catharsis*, the diptychs, triptychs and polyptychs can be freely configured and recombined by collectors, creating a space for interaction between them and the artworks. Here, continuity offers an interesting creative space for the collector, who is normally kept on the margins in a unidirectional communication but who can now participate in the artistic experience by configuring sets according to their own conceptual or aesthetic criteria. This turns the collection into an immense game board where each piece can form part of a great number of different diptychs and triptychs, a new space which invites active participation where the collector's creative contribution is essential to complete the artistic experience.

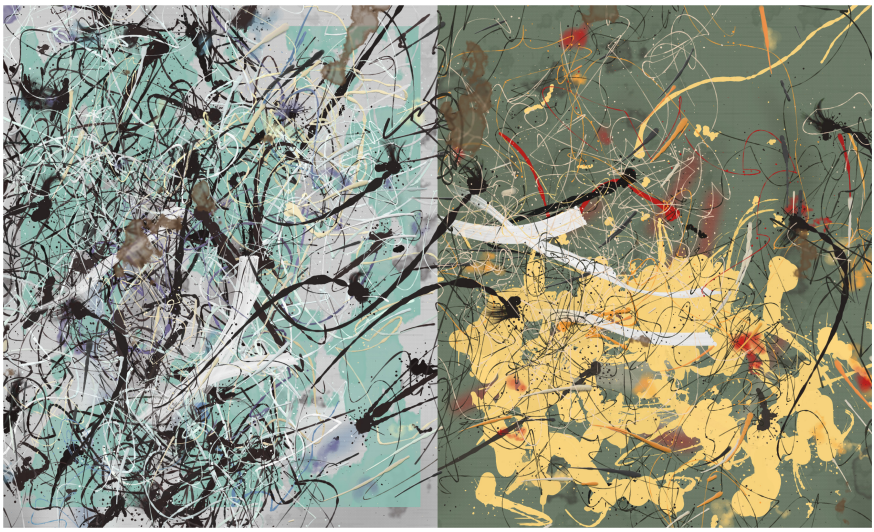

Fig 3. Painting that spreads from one work to the next. Diptych composed by Catharsis #394 - After I Say I'm Sorry (left) and Catharsis #445 - Make Believe (right)

Another innovation that was incorporated into the project was the possibility of conceiving the collection, the linear series of 999 pieces, as an evolutionary process that

would present some kind of transformation every time it was run. To achieve this goal it was necessary to incorporate into the algorithm the possibility of evolving throughout the series, presenting artworks with different characteristics as the collection progresses. With this objective, the algorithm was configured to offer pieces with a more timid and tranquil appearance at the beginning of the series, and the passion and energy represented in the painting would increase every time it was run to reach an intense and explosive finish. This made the whole collection into a linear episode of increasing intensity, a cathartic process of creative liberation. Here not only does each individual piece evoke a catharsis, but the whole collection becomes a creative catharsis, a process that begins timidly and which gradually grows in intensity and density as the paint is launched in an increasingly passionate and expressive manner (see Fig. 4).

Fig 4. Evolution in increasing intensity throughout the series Catharsis #74 - Topsy (left) and Catharsis #864 - Hymn to Freedom (right)

This conceptual axis constitutes another interesting innovation for generative art, where as we have mentioned, each execution of the algorithm had always been independent of all the others and each piece developed in an aesthetic space that was totally distant from its context within the collection. In *Catharsis*, the continuity and evolution of the algorithm create new and fertile relationships between the collector and the piece, and between the piece and the rest of the collection, enabling new conceptual and creative space that we believe will inspire future generative artists to continue exploring.

3.3 Launch of the Collection and Conclusions

Catharsis was presented to the launch platform for generative artists GM Studio for evaluation. GM Studio boasts a team of curators comprised of artists, critics, and art

historians, who analyze and evaluate each project submitted through a rigorously anonymous process. This curation team accept or reject each project based on the majority's decision, aiming to select those they deem of greater interest, innovation, and relevance while avoiding any bias. Under these circumstances, *Catharsis* was accepted in May 2022 and the launch of the collection took place on September 10th 2022 (see Fig. 5), with a huge success from the first moment. The 999 pieces sold out on the first day and, from there, the collection has continued to move through the secondary market where the pieces have kept increasing in value and generated over 1 million euros in the first six months, proving the interest that this project and its innovations have awakened in this particular art market.

Fig 5. Screenshot from the promotional video of the launch campaign

All of this indicates to us the great interest awoken by generative art among a new generation of collectors for whom art lives more naturally in the blockchain than in auction houses. Generative art highlights the potential and tensions that arise from the interaction between art, technology and the observer, suggesting new limits and possibilities for artistic creation and consumption. But it also speaks to the interest that the innovations incorporated into this project, like continuity and evolution, bring to generative art specifically and to the artistic context in general. The collection conceived as a linear series that evolves by itself, the collector who can now have a creative space in the artistic experience, the physicality and tangible sensation obtained out of cold geometric and mathematical entities, offer new and interesting perspectives to explore that we hope will serve as inspiration for future artists.

The project, conceived with the objective of enabling us to write this paper, has offered us the chance to get close to this new and vibrant reality, beginning by understanding the key principles of the blockchain and the context of non-fungible tokens, to the design and development of a practical applied project experienced at every stage.

New horizons for analysis emerge from this point, such as the study of the current and future evolution of generative art, the new dynamics of collecting and curating in this new art market, or the development of new long-structure projects in the future. However, at the very least, we have been able to provide a complete experience that we trust will serve to bring closer this world that is still unknown to many artists and designers, and which we can confirm offers interesting possibilities, both creative and economic, and interesting challenges for the future that are worth exploring.

References

1. Wu, H., Li, S.: Blockchain technology: a review and future research directions. Int. J. Inf. Manage. **61**, (2021)
2. Swan, M.: Blockchain: Blueprint for a New Economy. O'Reilly Media (2015)
3. Casey, M. J., & Wong, P.: Global Cryptocurrency Benchmarking Study. Cambridge Centre for Alternative Finance
4. Ferrari A, Pensa RG (2020) The tokenization of assets: an analysis of the legal issues. Eur. Bus Organ Law Rev. 21(3):455–477
5. Werbach K (2018) The Blockchain and the New Architecture of Trust. The MIT Press. https://doi.org/10.7551/mitpress/11449.001.0001
6. Schwartz, J.: The Rise of NFT Profile Pictures and Generative Art. Medium. Retrieved from https://jschwartz390.medium.com/the-rise-of-nft-profile-pictures-and-generative-art-414c5f410ccc (2021)
7. Smith J, Chen L (2021) Exploring the aesthetic possibilities of generative art. Int. J. Creative Technol 4(2):123–138
8. Galanter P (2017) Defining generative art: contexts, processes, and outcomes. Art Complex. 8(1):40–54
9. Carter R, Levin G (2020) Human-machine collaboration in generative art. J. Comput Cult. 1(2):64–79
10. Capurro, M., Lorusso, A., & Ragnedda, M.: NFTs, blockchain, and the future of art: A critical analysis of the art market. Information, Communication & Society,pp. 1–18 (2022)
11. Bruns C (2022) Digital art and NFTs: The rise of the virtual gallery. Art and Design Review 10(1):1–12