

The Sentiment of Crypto Art

Massimo Franceschet

Department of Mathematics, Computer Science, and Physics – University of Udine – Italy

Abstract

Crypto art is a beautiful example of a side effect of a technology: blockchain. While commonly associated with decentralized finance and cryptocurrencies, blockchain technology allowed to create scarcity in a world – digital art – where everything can be infinitely duplicated and freely saved with a right-click of the mouse, forstening the growth, burst, and stabilization of a dizzying market made of artists, collectors, art galleries and curators. In this preliminary work we assess the sentiments expressed by crypto artists when they create art and those coveted by crypto collectors when they collect art. We find that artists communicate positive emotions like joy and trust instead of negative ones like fear and sadness. However, collectors are agnostic to these emotions. This might be useful information to integrate into a crypto art discovery system that we are currently building.

Keywords

blockchain, non-fungible tokens, crypto art, text mining, sentiment analysis

1. Introduction

Blockchain technology, while commonly associated with cryptocurrencies, has shown potential to bring radical structural change to the arts and creative industries [11]. Blockchains are hard to grasp at first. The basic scientific research from which the technology emerged – a journal paper by Stuart Haber, a cryptographer, and Scott Stornetta, a physicist [6] – is distinct from the financial systems it later generated – the advent of Bitcoin and other cryptocurrencies [9].

Haber and Stornetta were trying to deal with epistemological problems of how we trust what we believe to be true in a digital age. In particular, they started from two questions [11]:

1. *If it is so easy to manipulate a digital file on a personal computer, how will we know what was true about the past?*
2. *How can we trust what we know of the past without having to trust a central authority to keep the record?*


These questions were solved by Haber and Stornetta [6, 7], with a contribution by Satoshi Nakamoto 17 years later [9], using a combination of tools borrowed from mathematics, computer science, economics and political science.¹ Formally, a blockchain is a distributed ledger, using cryptography to secure an evolving consensus about a token with economic value [13].

In their original, far-sighted proposal, Haber and Stornetta envisaged the adoption of blockchains beyond texts, and maybe in the context of art as well [6]:


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 massimo.franceschet@uniud.it (M. Franceschet)

 0000-0001-9490-1464 (M. Franceschet)

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¹Satoshi Nakamoto is the pseudonymous used by the person or group of people that developed Bitcoin, authored the Bitcoin white paper, and created and deployed Bitcoin's original reference implementation.

Of course digital time-stamping is not limited to text. Any string of bits can be time-stamped, including digital audio recordings, photographs, and full-motion videos. [...] time-stamping can help to distinguish an original photograph from a retouched one.

Indeed, the blockchain has core use cases in the arts including *provenance*, *fractional ownership* and *digital scarcity*. A notable example of the first use case – provenance – is the sale in 2018 of the Barney A. Ebsworth collection at Christie’s for 318M\$. The auction was held in partnership with the technology provider Artory using a blockchain solution to record information about the auction and all future sales of the auctioned artworks. As for fractional ownership, in 2018 the company Maecenas bought Andy Warhol’s 14 Small Electric Chairs and divided it up into shares sold as so-called ART tokens. The company raised 1.7M\$ for 31.5% of the artwork at a valuation of 5.6M\$.

Crypto art is related to the third use case of blockchain in art: digital scarcity. The novel idea is to make a digital file scarce by associating it with a *non-fungible token* or NFT [2, 5]. NFTs are cryptographic tokens stored on a blockchain that represent something unique, for instance, a one-of-a-kind collectible, a weapon in a blockchain game, or a portion of digital land. NFTs are not interchangeable and cannot be divided, as opposed to fungible tokens (cryptocurrencies like Bitcoin or Ether), which are interchangeable and can be split in smaller pieces whose sum is equivalent to the whole. In crypto art, an NFT certifies the scarcity (number of copies), ownership (current owner) and provenance (historical owners and creator) of a digital artwork. Transferring the NFT is akin to transferring the certificate of ownership of the artwork. However, like in traditional art, ownership rights generally do not include intellectual property rights such as copyright claims and rights for any commercial re-use.

Crypto art draws its origins from conceptual art, sharing the immaterial and distributive nature of artworks, and the rejection of conventional art markets and institutions [3]. A niche artistic movement until early 2020, crypto art market went parabolic in late 2020 - also because of the COVID pandemic and the consequent digitalization of our lives - attracting the attention of major mass media and major auction houses. Recent notable sales of crypto artworks include:

1. *Everydays: The First 5000 Days*, by digital artist Beeple, was the first NFT sold at Christie’s on March 2021 for the record-breaking amount of 69M\$ through the crypto art gallery MakersPlace;
2. *The Fungible*, by digital artist Pak, is an NFT collection sold in April 2021 at Sotheby’s in collaboration with crypto art gallery Nifty Gateway for almost 17M\$;
3. Nine CryptoPunks from Larva Labs’ own collection sold in May 2021 at Christie’s for 16.9M\$. It is, unsurprisingly, the first time an NFT has been offered alongside work by Andy Warhol and Jean-Michel Basquiat.

As a significant by-product, crypto art is generating increasing amounts of openly available structured and unstructured data, and this is probably the main feature that sets it apart from traditional art. Indeed, all trades in crypto art are immutably recorded on a public blockchain, and this data is potentially available for analysis. Moreover, artworks metadata like title, description, tags as well as the digital files representing the artworks themselves are stored on peer-to-peer networks like IPFS and are available to download. On the contrary, in traditional art this information is typically secreted or available only for a (significant) fee.

Mind that, despite the apparent availability of blockchain data, we experienced that collecting blockchain art data is not a trivial task. First of all, most galleries do not offer a reliable API, hence we had to rely on general purpose solutions like the API of the Ethereum blockchain explorer etherscan.io. When data are downloaded, they need to be filtered by smart contracts of the gallery. Typically, a gallery uses different contracts for different purposes and this information is generally difficult to find and is not well documented. Moreover, changes like the update of a contract or the deployment of a new contract needs to be taken into account. Finally, there exists no standard for operability of crypto art galleries. Each gallery implements its own business logic written in-home using the smart contract language of the blockchain where it operates, like Solidity on Ethereum. Therefore, each gallery needs to be treated as a particular case, and this clearly hinders the scalability of the data fetching engine.

Besides *open data*, another facet of crypto art that distinguishes it from its traditional counterpart is *velocity*. In crypto art events happen at every instant: an artist mints a new piece or accepts a bid made from a collector, a collector bids or directly buys an artwork, two users flip artworks, and more. From a data science viewpoint, the crypto art market corresponds to an open, real-time stream of data, more akin to financial trading than traditional art.

In this paper, we focus on the unstructured, textual metadata that accompanies each artwork. This includes a title, a description and a list of tags for each tokenized artwork. In particular, we use sentiment analysis [1] on the textual metadata to mine the sentiment of each artwork. The goal is twofold:

1. discover what sentiment poles (positive or negative) and emotions (anger, fear, anticipation, trust, surprise, sadness, joy, or disgust) are expressed by crypto artists when they create digital art;
2. find out if crypto collectors are influenced by these emotions when buying digital art.

It is worth saying that this work is part of a larger project that aims to devise recommendation systems for crypto art. The goal is to help users find artworks that they might have overlooked otherwise. Users can be artists, interested in discovering similar artists for the sake of collaboration, or collectors and art investors willing to find new art to purchase that is somewhat overlapping with that already present in their collection. The sentiment expressed by an artist or looked for by a collector is precious information in view of this recommendation system and this sentiment information can be integrated with different signals, for instance with the aesthetic features extracted from the images that represent the artworks.

2. Sentiment analysis

To answer the above-mentioned questions, we analysed the sentiment of all artworks of SuperRare, a peer-to-peer marketplace for non-fungible tokens built on the Ethereum blockchain. More plainly, SuperRare is a marketplace to collect and trade unique, single-edition digital artworks. Each artwork is authentically created by an artist in the network, and tokenized as a crypto-collectible digital item that you can own and trade. SuperRare is one of the earliest crypto art galleries (it started in April, 2018) and is among the most important crypto art marketplaces, by popularity and volume of exchanged artworks. As of today (14 June, 2021), these are some figures for the gallery:

- number of tokenized artworks: 25,375;

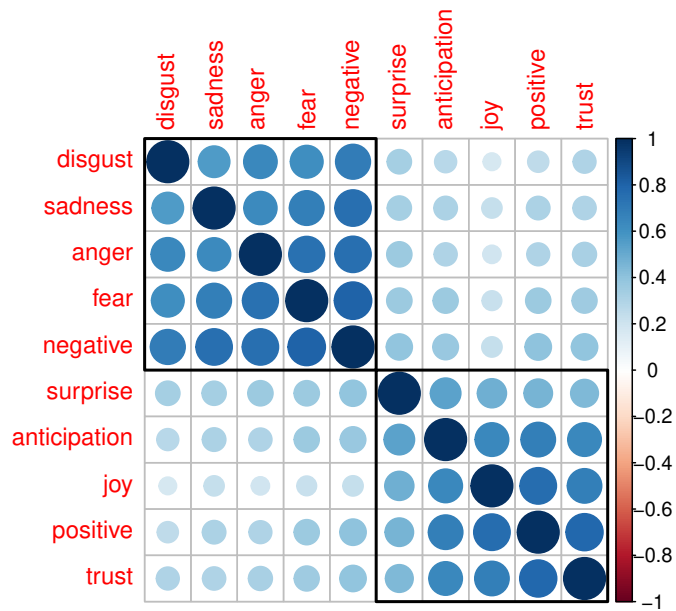


Figure 1: The (Pearson) correlation plot among emotions. The size, color and transparency of the bubble indicate the correlation. Notice the top-left positive block and the bottom-right negative one.

- number of sold artworks 15,829 (62%);
- sale volume: 46,595.78 ETH or 58,723,268 USD (change rate at transaction time);
- number of active users: 3579;
- number of users that sold at least one artwork: 1679 (47%);
- number of users that bought at least one artwork: 2757 (77%).

The SuperRare dataset was acquired from the gallery’s API and is set available on Kaggle [4]. For the analysis we used the *tidyverse* R packages for data science and the *tidytext* R package for text mining [12, 10].

We applied lexicon-based sentiment analysis on the text found in the artworks’ metadata (title, description and tags). It is worth mentioning that on SuperRare gallery this metadata is written by the artists that mint the artwork and not, for instance, by the art curators working for the gallery, if any. We used the NRC Emotion Lexicon by Saif Mohammad and Peter Turney [8]. The NRC lexicon is a list of English words and their associations with eight basic emotions (anger, fear, anticipation, trust, surprise, sadness, joy, and disgust) and two sentiment poles (negative and positive).

As a start, we correlated the emotion ratings for each artwork. With little surprise, we find out – see Figure 1 – that the emotion variables cluster in two main groups:

- a *positive* group containing joy, trust, surprise and anticipation;

- a *negative* group containing sadness, disgust, angry and fear.

Next, for each artwork and emotion, we computed the *emotional score* of the artwork as the relative number of words used in the artwork metadata that match the emotion. For instance, if an artwork has 5 words expressing joy, 3 words expressing sadness, and 2 words expressing trust, then the emotional scores for joy, sadness and trust are $5 / (5 + 3 + 2) = 0.5$, $3 / (5 + 3 + 2) = 0.3$ and $2 / (5 + 3 + 2) = 0.2$, respectively. For each emotion, we sorted the artworks by the emotional score. Here are the artworks leading the emotion rankings along with a short description:

- The most positive artwork is *C.C. Crypto Capital* by *skygolpe* and *alecttn* (emotional score 0.39, token id.² 10345) The authors explore the concept of transition, depicting the idea of renovation through a vibrant, sharp composition.
- The most negative artwork is *Kozachok's Inferno: 9th Circle of Hell: Treachery* by *Kozachok* (emotional score 0.27, token id 9472). *Kozachok's Inferno* is a customized representation of Dante Alighieri's *Inferno*. The negativity of the artwork is immediately perceived from the start of the description: *In this circle, we can notice people being caught in this frozen lake, from their waist up to their neck, unable to escape. All senses are present, including the constant pain of the ice. We see a huge creature, a monstrous and terrifying hybrid entity, playing golf with the heads of the people trapped in the frozen lake.*
- The trust ranking is lead by *Gavin Wood, The King of Cross-Chain* by *undeadlu* (emotional score 0.28, token id 19259). The commissioned artwork is dedicated to Gavin Wood, one of the most privileged minds of the crypto world, involved in several far-sighted projects like Ethereum, Polkadot and Kusama.
- Emotions fear and anger are captured by *Inferno III: Lake of Fire* by *deathimself* (emotional scores 0.28 and 0.17, token id 15388). This is a scary and irated excerpt from the author's description: *The heat is intense, your flesh feels as if it's been melted off entirely, and the smell of sulfur and burning meat fills the air.*
- Sadness dominates in *The Struggle* by *mayaguy* (emotional score 0.20, token id 24663). Again, the emotion shines through the words used by the author: *Everyone has a mental struggle of some sort at some point in their lives. It can be difficult to pick yourself up, the feeling of a great weight burdening your very soul. We try to fight, pushing back against these feelings, pushing forward, lifting ourselves up day after day. For many the burden is too much and they collapse under the pressure, for some the pain becomes less and they can once again stand tall.*
- Joy and surprise both emerge in *Spring Bloom* by *kristyglas* (emotional score 0.19 and 0.12, token id 19484). This in an adventure series about discovery, persistence and personal growth, set in a fantasy world that takes life of its own. Some of the tags used in the artwork actually express these feelings: adventure, color, fantasy, flowers, magic, nature, plants, spring.

²To get the URL of the artwork in SuperRare gallery just concatenate the URL prefix <https://superrare.co/artwork-v2/> with the token id of the artwork. For instance, in this case the URL is <https://superrare.co/artwork-v2/10345>.

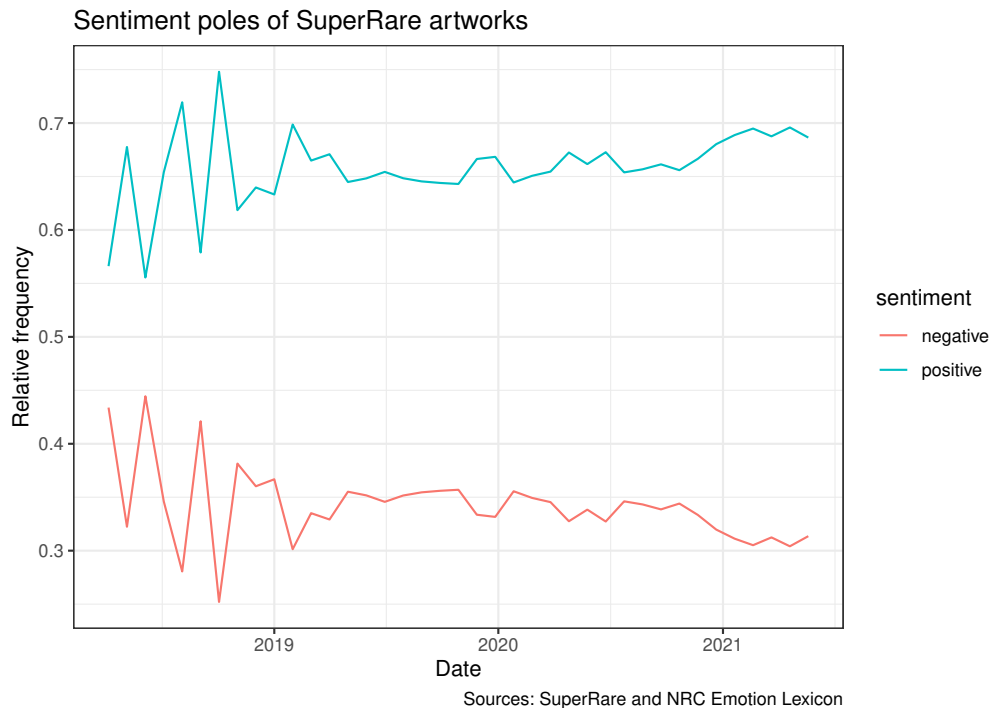


Figure 2: The evolution of sentiment poles (positive and negative) of crypto art over time. Positive sentiments neatly dominate negative ones all over the history of the gallery.

- Anticipation is well represented in *Camp Log #256: Abbot* by *kreaturekastle*. (emotional score 0.19, token id 19920). This is a crypto comic featuring different outdoor-centric characters. The hopeful motivation for the artwork is quite telling: *After over a year spent in lock-down in our cramped 1st floor Brooklyn apartment near noisy neighbors, and little exposure to the outside world (we have to be super careful due to folks in our household being immuno-compromised), suffice it to say I needed some way to escape aside from video games and our short little walks around the neighborhood.*
- *Kozachok's Inferno: 3rd Circle of Hell: Gluttony* deservedly leads the disgust ranking (emotional score 0.14, token id 8795). A few sentences from the description are more than enough to convey the feeling: *Each person is trapped and tied in unbreakable chains in their own boat, they are not feeling any hunger or thirst, but they are uncontrollably voiding their bowels every other day inside their boat. Left exposed in the sun and surrounded by their own feces and vomit in that same water, insects would descend. Stinging and biting insects like wasps and other mosquitoes would torture the victim, but worse, others would crawl inside the cracks made by rodents and other unprotected orifices of the subject and lay eggs, eating them alive from the inside out.*

We are now interested to explore the following queries: what are the emotions and sentiment poles that are most expressed by crypto artists? What is the temporal evolution of the emotional spectrum? To this aim, we divided the history of SuperRare gallery in slices of 30 days and analysed the aggregated sentiment of artworks in each time interval. The outcomes are depicted in Figures 2 and 3. We observe that:

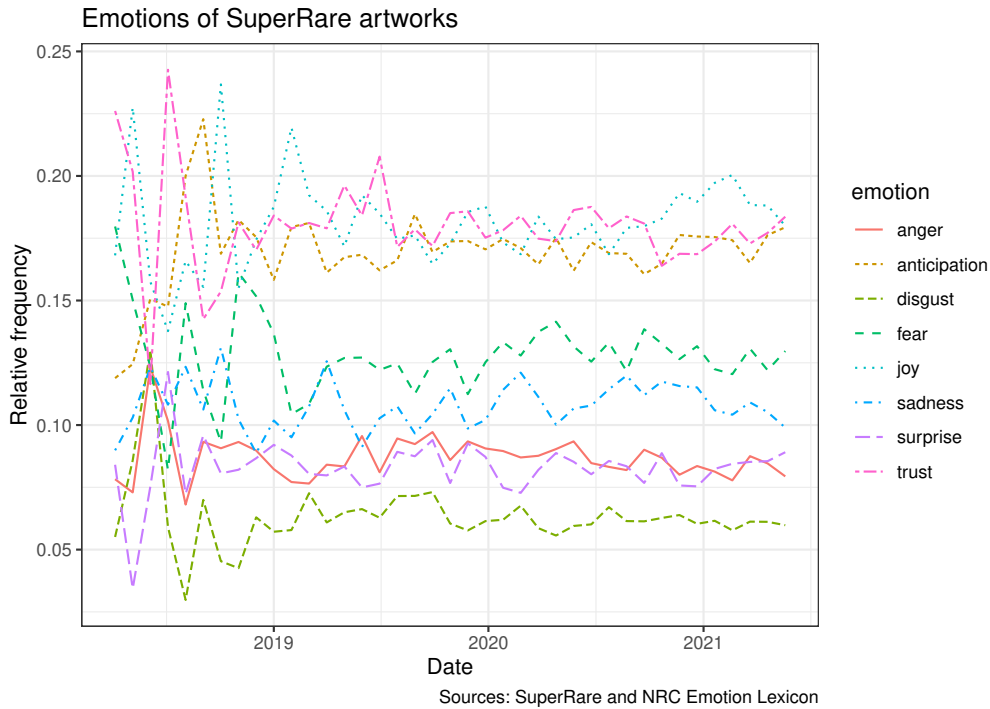


Figure 3: The evolution of emotions of crypto art over time. After an initial start of emotional confusion, crypto art assumed a positive, joyful and hopeful personality.

1. after an initial period of emotional instability, characterized by chaotic oscillations of sentiments and emotions, the emotional spectrum chills down, getting more regular and even;
2. positive sentiments dominate over negative ones;
3. emotions joy, trust and anticipation lead the emotional spectrum. They are followed, at a distance, by fear and sadness. Disgust is the least represented emotion.

It is worth noticing that these results are not an artifact of the NRC lexicon. Indeed, in this lexicon there are more negative than positive words (3324 against 2312). Moreover, the frequency of words associated to emotions are as follows: fear (1476), anger (1247), trust (1231), sadness (1191), disgust (1058), anticipation (839), joy (689), surprise (534). In particular, joy is among the least frequent emotions in the lexicon but it is the most represented emotion in crypto artworks. We conclude that crypto artists, at least for what concerns the dataset at hand, create with a clear positive intent and aim to mainly express positive emotions like joy, trust and anticipation. Fear is the most represented negative feeling, while disgust is the least expressed one.

We now want to find out if the same holds for collectors: do they collect artworks that express clear emotions? To find an answer we correlated the emotional scores of artworks with several market variables indicating artwork success, including: number of bids, bid volume, number of sales, and sale volume of both primary and secondary art market. We noticed no correlation, either positive or negative, among sentiment and market success of artworks. We conclude that while the average artist favors some emotions among others, the average

collector is agnostic to the emotion expressed by the art they collect. However, particular top collectors might have prefer some specific sentiments when they buy. For instance, we noticed that *whaleshark*, a top collector on SuperRare, prefers positive works more than the average collector, while *momus*, another notable collector, favors negative art.

3. Limitations

The present work is a preliminary study and has some known limitations that we want to acknowledge in the following:

1. we are assuming that the feelings of the artist are expressed by their work and in particular that they are expressed by the texts that describe it. It is worth noticing that on SuperRare gallery the text accompanying the work is typically written directly by the artist when they mint the work and not by curators of the gallery. As a crypto artist, I can witness that, at least in my limited experience, these hypothesis are valid. However, a more careful consideration of these assumptions is needed for an extended version of this work;
2. we did not consider the visual qualities of the image (or video) representing the artwork and we assume that there is no major discrepancy between emotions expressed in the image and in the text of the artwork. We do not see good reasons for describing in a positive way an artwork that expresses negative emotions, or vice versa. Of course, there might be exceptions but, given the size of the dataset, we consider them not statistically significant. Furthermore, analyzing the sentiment of an image is not a trivial task and we postpone this further analysis for future work;
3. we observed the dominance of positive sentiments expressed by crypto artists and noticed that this is not an artifact of the lexicon used. However, we did not check this prevalence in other art-related corpora. Is this positivity peculiar of crypto art? Again, being an early and active member of this space, I can only witness the optimism and enthusiasm of the majority of individuals working in this thrilling space, hence the result is in some sense not surprising to me. However, a comparison with texts associated with contemporary traditional art is a good hint for the future.

4. Conclusion

We have mined the sentiment of more than 25,000 digital artworks tokenized on the SuperRare marketplace using textual information contained in artwork's metadata. Our main conclusions are summarized as follows:

1. artists express clear emotions through their art: they are more positive than negative, they mainly convey feelings of joy, trust and anticipation instead of negative emotions like sadness and disgust;
2. on the other hand, the average collector is not much influenced by the emotion expressed by the purchased art;
3. however, we noticed that single whale collectors prefer certain sentiments when they buy art;

4. finally, emotions expressed by artists were confused in the early period of crypto art but they soon settled down: crypto art assumed a positive and joyful personality, full of trust and anticipation.

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