Artworks and blockchains

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Abstract:
For several years now, the art market has been adapting to the digital transition. Several forces are acting on it: the new technology's impact, the changing profile of art collectors (turnover of generations) and the 2008 financial meltdown, which, by upending the bond market, reinforced the perception of artworks as financial assets. Digitization has also exposed the flaws of a system that is, rightly or wrongly, deemed opaque and cliquish. Several scandals have broken out about intellectual property rights, authenticity and the provenance and value of artworks. In this context, blockchain technology can, owing to its inherent properties, boost confidence, make electronic transactions secure, and respond to the issues that have cropped up in this changing market.

On 30 November 2011, Knoedler, the oldest art gallery in the United States (nearly 200 years old), suddenly shut down.[1] This institution, with a spotless reputation, was caught up in a scandal involving sales, over a fifteen-year period, of a series of supposedly extremely rare artworks of abstract expressionism that turned out to be fakes. Their authenticity and even more their provenance were strongly disputed. Such was the case for a painting by — or rather attributed to — Jackson Pollock that two of the biggest auction houses (Sotheby's and Christie's) refused to put up for sale. This affair, one among many others, illustrates a key problem on the art market: authenticating an artwork by proving its provenance.

1. Trust and provenance

Proving an artwork's provenance entails providing information on its history to authenticate its originality and establish lawful ownership.[2] This process is intended to prove that the artwork is not a fake; and has not been stolen or looted or exported illegally. The quality of information on provenance can significantly alter the work's artistic and, therefore, economic value. This quality is judged by the degree of certainty about the artwork's origin, the status of its former owners and the evidentiary documents. The strength of this evidence comes from verifying information of which the integrity and pertinence ought not be questionable.

Most exchanges of artworks, are done on paper, a fragile medium easily lost, forged or stolen. These risks are all the greater since, in practice, there are no required standards for conservation or for coding. Among the evidentiary documents is the certificate of authenticity, for which there are no official regulations. Nor are there any for indexes and reference works, such as the *catalogues raisonnés*, of which the methodological strictness and objectivity are often challenged.[3]

Meanwhile, the digitization of the art market has shed light on the imperfections (if not defects) of a system that makes it laborious and, sometimes, questionable to reliably establish provenance. Paradoxically however, the digital transition has added a new layer of complexity: many stakeholders are migrating to (and operating through) centralized information systems, which are managed in line with the policies established by the organizations that run them.

[1] This article has been translated from French by Noal Mellott (Omaha Beach, France).
[2] https://en.wikipedia.org/wiki/Provenance & https://fr.wikipedia.org/wiki/Provenance
[3] *Cf*. the lawsuit Mayor Gallery Ltd. v. Agnes Martin Catalogue Raisonné LLC, *et al*.

Apart from the risks related to digital security as such (theft, the corruption and manipulation of data), the data themselves are heterogeneous, even disparate. This creates, in turn, opportunities for acts of delinquency. The wrongdoer must deceive his contacts about the physical work of art itself and, too, about its "pedigree". He thus sets a "provenance trap". In a book devoted to this topic, Noah Charney relates the astonishing stories of the most famous forgers in art history.[4] Most artworks are authenticated as a function of their provenance and of the paper trail attesting their history. For a provenance trap to work, the fake must be technically good enough to convince experts, but most fakes are not that good. But less talented forgers are able to trick the art world if they manage to set a good enough provenance trap.

Two notorious forgers, John Myatt and John Drewe, forged both artworks and the documents for attesting their authenticity. John Myatt did not make copies; instead he adopted the style of famous artists, while John Drewe made the fake documents and managed to place them in the archives. When an expert wanted information about a work, he would go to the archives and miraculously find there a letter (or other document) to which no one had previously made reference. Nowadays, John Drewe's "heirs" are trying to penetrate information systems and databases!

To summarize, the fragility of the documentation, the absence of standardized practices, the fragmentation of the art market, the growing number of players (who operate on their own) in this market, the centralization of information systems, and the lack of coordination among them… all of this makes it very complicated to bring an impeccable proof of provenance. In the light of this remark, distributed ledger (or blockchain) technology seems to be an ideal solution for efficiently handling the problems of an art market with agents and channels so numerous that traceability is a genuine issue.

2. The potential of a distributed system and of algorithms for trust services

Blockchain is a technological innovation with the potential to radically change how we make and trace transactions.

There are many certification services (such as e-vaults) that rely on centralized structures for management and maintenance. At their center however, we come upon human beings, there where blockchains place algorithms.

Blockchain technology was, it should be pointed out, deployed at the end of 2008 — a time when trust had vanished from the human institutions and organizations that were supervising commercial and financial transactions via centralized information systems. Satoshi Nakamoto, the pseudonym of the "father" of the Bitcoin blockchain, started out from the postulate that human beings cannot be trusted since they make mistakes and naturally tend to pursue their own interests. Its corollary is that human beings, alone or together, will try to manipulate transactions for their own profit.

A frequently accepted definition of blockchains (of which there are many types) is: a fully distributed ledger containing all transactions, safely and immutably. The operation and management of this ledger rely on cryptographic techniques and an algorithmic consensus procedure, all of this on a peer-to-peer network.

To simplify, imagine a distributed database that makes it impossible to falsify the history of transactions, since all users have a copy of it, and its security is guaranteed by all nodes (called "miners") in the network. These nodes perform the necessary controls and verifications by finding the solution to a mathematical problem involving, in the Bitcoin network, a "proof of work". The data are thus protected from attempts to manipulate or corrupt them.

Each user has a unique digital identification verified via asymmetrical cryptography (*i.e.*, a private/public key combination for identification and authentication); and a hash is generated to represent the set of elements of an operation of any sort. This hash function is one-way, since the

[4] Noah Charney, *The Art of Forgery: The Minds, Motives and Methods of Master Forgers* (London: Phaidon) 2015.

input information cannot be reconstituted or discovered from the hash. It is a technique of “letter by letter” encryption in the sense that, if one bit of the input message is changed or altered, the output (the hash) will be different. For example, if a comma or space is changed in a message, the chain of characters corresponding to the hash will be radically different. This technique is used in peer-to-peer exchanges to check whether the file at destination is fully identical to the original file, and verify that it has not been modified, altered or manipulated.

The hash, which represents everything in a transaction, is inserted in a file with the list of transactions on hold. This file forms a “block” that is waiting to be validated by a “miner” node in the network. Together, these miner nodes control, and agree on, the validity of transactions using an algorithmic consensus process: “proof of work” for Bitcoin, “proof of stake” for List, and “proof of authority” for Hyperledger.

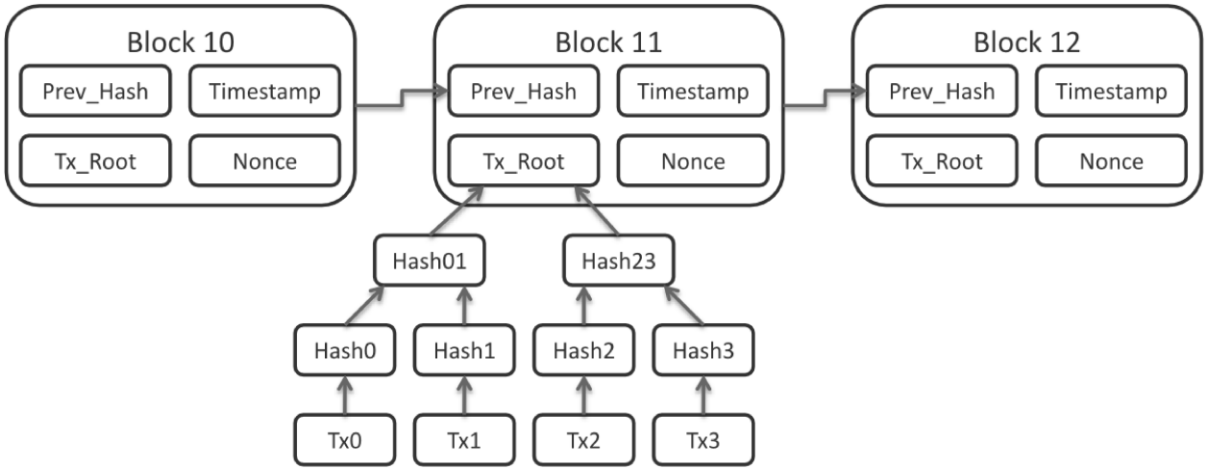

Figure 1: The operation of a blockchain.
Source: Wikimedia Commons.

Let us look at a proof-of-work system. This proof entails solving a mathematical problem by finding an identification for each block of transactions by using the identifications (hashes) of the preceding blocks (Prev_Hash-1+ Prev_Hash-2 + Prev_Hash-n) to which are added special conditions, such as finding a number (the nonce), that affects the result of the hashing function. This problem’s level of difficulty is automatically adjusted as a function of the size of the peer-to-peer network and its computing power, so that it is solved every ten minutes. In other words, one block can be validated every ten minutes. Once a block is validated, all nodes in the network synchronize on it. The block is then replicated throughout the peer-to-peer network, whence the phrase “distributed database”. The whole forms a chain of blocks. Modifying one block implies recalculating the identification of each previous block before the validation of a new block (every ten minutes). Fraud is directly conditioned by computing power, which cannot at present be reached with state-of-the-art technology.

This general schema does not take account of the creation of programable blockchains. Ethereum, for instance, has significantly augmented the already numerous possibilities of the blockchain as originally designed. These newer blockchains with “smart contracts” have the same benefits but also allow for “encoding” the terms of a contract to be automatically executed. During a transaction for an artwork, the certificate of authenticity could thus be automatically transferred to the new owner; and related rights (*e.g.*, to collect royalties on resales) could be enforceable on third parties and produce their effects automatically.

A blockchain — a system with unequaled resilience and security — is ideal for protecting transactions of material assets, for making them traceable and for auditing, all the more so in that the transactions can no longer be canceled. This has been called the "Internet of value"! Applied to the art market, it would provide unforgeable guarantees of the certification and provenance of artworks, and reduce the risks of fraud!

3. Uses by the art market, and benefits

As explained, blockchain technology allows for recording and certifying the history of an artwork (its creation, sale, exhibitions, loans, transfers of ownership, restoration, etc.). While managing interactions between the parties to a transaction, it could provide a reliable, undeniable guarantee of provenance. The authenticity, historicity or even value of an artwork would become verified, immutable information that circulates in full security between all parties in the chain.

Beyond the issue of traceability, blockchain technology could form a new grounds for establishing intellectual property rights, copyrights and royalties. The artist would be sure to be the only person in the world who is able to prove beyond any shadow of doubt the authorship of his/her artwork and its history (collectors, art dealers, property rights, powers of proxy, etc.).

Let us look at two events that have roiled the art market: the Peter Doig affair and the lawsuit Mayor Gallery Ltd. v. Agnes Martin Catalogue Raisonné LLC, *et al*. A blockchain would have spared the art market both these affairs!

In the first, Peter Doig, a renown contemporary painter, had to battle in court to prove that he did not make a painting that Robert Fletcher claimed he had made in 1976. This art collector wanted to put the painting up for auction at Sotheby's for several million dollars (the tort: three years of court proceedings and legal fees, the voiding of the painting's value).

In the second case: during a retrospective of Agnes Martin's work in the autumn of 2016 at the Guggenheim Museum, Mayor Gallery, a London art gallery, sued the committee of authentication of the foundation, Agnes Martin LLC, which had refused to authenticate thirteen works for its clients when the artist's *catalogue raisonné* was made in 2014. By not recognizing these paintings, the foundation stripped the works acquired by these clients of any value; and the clients were demanding reimbursements (tort: $7.2 million).

In general, a blockchain could serve to manage and enforce rights related to a work of literature or art. Besides copyright and ownership, it is easy to imagine an automatic follow-up on resales (and related rights), distribution rights, etc. An infrastructure could also be developed for facilitating, simplifying and securing interactions between players in this market. For example, an artist or gallery that put works up for sale on an on-line platform and that, at the same time, authorizes some of the works for a show. A blockchain makes it less complicated to manage situations involving several parties but a single piece of art, especially when the latter is used in ways entailing different rights and obligations (including those undue: insurance, transportation, customs formalities, etc.). With respect to insurance, a blockchain could help to reduce risks and clarify the scope of liability; and smart contracts could be used for insurance policies drafted for one-time operations (loans, rentals, leasing, etc.).

This is but the start: with machine learning and data mining, the art market could benefit from new data-processing tools as part of a big data strategy based on blockchains. The prospects are vast. It is up to professionals — even more so given the change of generations — to seize the opportunity for reinventing services while capitalizing on good practices. The art market is a chrysalis from which can spring the worst or the best. It is up to players in this market to make the choice!