How Intellectual Property Rights Can Complicate NFT Market

By **Collin Starkweather, Izzy Nelken and Sam Miller** (August 17, 2021)

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Over two decades ago, Lawrence Lessig famously declared that "code is law,"[1] a maxim that finds fresh relevance with nonfungible tokens, or NFTs, for digital artwork and other intellectual property capturing headlines recently.

Recent highly publicized sales include $69 million paid for an NFT associated with a piece of digital art titled "Everydays: the First 5000 Days" sold by auction house Christie's on behalf of Mike Winkelmann, the artist more popularly known as Beeple;[2] $2.9 million paid for an NFT of Jack Dorsey's first tweet on Twitter;[3] and $5.4 million paid for source code originally used to create the World Wide Web written by Sir Tim Berners-Lee.[4]

While the hype has been met with equal parts skepticism,[5] as with cryptocurrency, their close cousin in the blockchain family of technologies, the interest in NFTs and associated valuations may wax or wane, but they are likely here to stay in some form.

For those participating in the market for NFTs, the maxim "caveat emptor" is the order of the day.

While they have been widely described as conveying ownership in the underlying digital asset,[6] the nature of any conveyance may be quite different from what is traditionally thought of as ownership. What is actually conveyed and how it is conveyed depends on a variety of factors including the inherent features of the technology itself and the metadata[7] associated with the NFT.

Moreover, conveyance of digital assets via NFT alone does not bestow the buyer with traditional intellectual property rights, such as copyright.[8]

In some ways, the technology underpinning NFTs may allow buyers and sellers to craft transactions with terms that are not feasible or practical under traditional forms of conveyance, but traditional intellectual property rights, such as reproduction rights, are not transferred with NFTs unless provided for in the terms associated with the NFT.[9]

For these and other reasons, those who wish to participate in these markets should be aware of the implications that the features of the technology may have for the value associated with the digital assets being conveyed and the absence of transference of associated intellectual property rights. The technical features of NFTs are important determinants of value and understanding them may be the first step in performing due diligence.

This becomes even more important as NFTs expand to provide rights in real-world assets, a use case that is being actively developed with initiatives such as Nike's CryptoKicks,[10] which tokenizes the ownership of exclusive shoes, Mattereum,[11] focused on creating technologies that provide holders of NFTs with rights, such as the right to take physical custody, in an associated physical object, Diamond Standard,[12] which establishes

ownership of physical diamonds through blockchain tokens, and The Fine Art Ledger,[13] a fine art title and authentication platform working to enable physical art to be connected to NFTs.

In this article, we'll discuss some important technical features of NFTs, including specific examples of conveyance associated with several prominent NFT sales. In the process, we'll highlight several important but underappreciated technical aspects of NFTs that inform the relationship between NFTs and intellectual property rights and ultimately the valuation of NFTs conveying ownership of assets. Finally, we'll discuss some takeaways.

Hashing Out Hash Functions, Uniform Resource Identifiers and Smart Contracts

NFTs are a type of smart contract that associates an asset, such as digital art with a unique or nonfungible digital token on a blockchain that can be transferred between digital wallets similarly to cryptocurrency.[14]

Traditional intellectual property rights in the associated asset may or may not be transferred with the NFT, and in many NFT marketplaces, conveyance of IP rights such as copyright is the exception rather than the rule.[15]

As Beeple himself commented, "I think that people don't understand that when you buy, you have the token [or NFT]. You can display the token and show you own the token, but, you don't own the copyright."[16] To the extent traditional intellectual property rights are conveyed, that conveyance may be expressed in the NFT's metadata.

The asset itself is typically located off chain. It is not practical to preserve digital art or other digital assets on the blockchain itself in the typical use case given the size of the media and the fact that blockchains that comprise freely distributed ledgers, such as the Bitcoin or Ethereum blockchain, are available for download by anyone.

Clearly, if anyone could add data of arbitrary size to the blockchain, it would soon become too large to be easily distributable, and thus impractical as a distributed ledger.

So blockchain platforms such as Ethereum dissuade large additions to the blockchain by charging prohibitive fees for storing large blocks of data on the blockchain.[17] Instead, internet addresses in the form of uniform resource identifiers and cryptographic hash functions are commonly used to identify digital assets associated with NFTs.[18]

Cryptographic hash functions take an input, such as a digital asset, and produce a hash value, a complex string of characters which for all intents and purposes is uniquely associated with the input,[19] and thus can be used as a unique identifier in the NFT in place of the digital asset itself.

Typically, the use of a hash value would be accompanied by posting the digital asset at a publicly available address on the internet using a uniform resource identifier, so the hash value can be verified by any interested party.[20]

A URI may be a web address of the kind that is accessible to a web browser, but as we'll discuss in further detail below, it is not uncommon for uniform resource identifiers to point to locations on platforms such as the InterPlanetary File System, or IPFS, that are not immediately accessible using leading web browsers.

The smart contract that comprises an NFT is a computer program that typically implements

a standard for specifying NFTs such as ERC-721.[21] As a computer program, it may also support any functionality available to the programming environment used for the smart contract over and above the interface defined by the standard.

In some instances, the smart contract that specifies the NFT may support ongoing, value-relevant functionality past the point of the original conveyance of the token.

Take, for example, CryptoKitties. This popular distributed application, which exploded onto the crypto scene in 2017, is built on the Ethereum platform[22] and consists of NFTs specifying cartoon cats, each with its own set of attributes, or "cattributes." As NFTs, owners can buy or sell them, but CryptoKitties extends the core NFT feature set with functions such as "pregnant" and "birth" to allow CryptoKitty owners to breed their stock.

More recently, with the rapid rise in prices paid for artwork and other digital assets, artists have written terms into the smart contracts that specifies that the NFT automatically compensate the artist with a portion of the sale price of any future conveyance, or what is commonly known in the art world as a resale right.

For example, the NFTs associated with Beeple's digital art provide that he will receive a 10% royalty every time the NFT changes hands.[23]

The Uniform Resource Identifier

In some cases, NFTs are associated with internet addresses, but not with a hash value.[24] For this and other reasons, value-relevant considerations including validation of the NFT may factor in the potential for link rot[25] or other circumstances in which the uniform resource identifier becomes invalid or no longer resolves to the relevant digital asset.[26]

The integrity of the link may be of particular interest to the owner of an NFT if, for example, they have concerns that the incentives of the maintainer of the link do not align with their own.

Even where the maintainer of the link may have every intention of preserving the link, circumstances may change, such as through the acquisition of a domain or other transfer of assets.[27] In addition, parties with nefarious intent and an interest in compromising an NFT, such as hackers, may find the website hosting the linked data to be a more attractive target than the NFT itself, whose integrity is guaranteed by the blockchain on which it resides.

In response to these kinds of issues, technologies such as the IPFS, a peer-to-peer network for storing data in a distributed manner, and Arweave, a protocol designed to achieve sustainable data permanence,[28] have been designed to, among other things, store data in a persistent manner which is resilient to deletion, corruption, or blockage and are commonly used to store digital assets associated with NFTs.[29]

Even when digital assets are located on persistent storage such as the IPFS, potential issues with link rot are not always fully obviated. For example, the original JPEG image of Beeple's "Everydays" is located on the IPFS, though the URL referenced by the NFT is located on an IPFS Gateway operated by MakersPlace.[30]

Thus, if MakersPlace ceases operation of its IPFS Gateway, though the JPEG image may continue to reside on IPFS, the link in the NFT would cease to point to a valid URL.

The Hash Function

The nature of the hash function has implications for what might be thought of as derivative works.

Among the more powerful rights, if not the most powerful right,[31] conferred with a copyright is the right to create derivative works, in which a work is adapted, modified or improved, creating a new copyrighted work that vests with the copyright holder. However, the hash function used to uniquely define an NFT has no facility to distinguish a work that is in some sense may be close to another.

For example, Beeple's "Everydays" was a JPEG image comprised of roughly 444 million pixels.[32] If Beeple were to change a single pixel among the hundreds of millions of pixels in the artwork, say, by making a dark blue pixel a slightly paler shade of blue, the resulting hash value would be quite different despite the visual similarity with the original work.

Whoever retains the copyright to "Everydays" — presumably Beeple — would also retain the right to create and market such derivative works, including the right to generate and market an NFT for that almost imperceptibly modified digital asset.

The Smart Contract

The right to create derivative works aside, Beeple could issue another token for the very same artwork using the very same hash value. The token ID 40,913 is associated with "Everydays" in the smart contract used by Beeple to create the NFT. If Beeple decided to generate another NFT with a different token ID using the same hash value, there appears to be no functionality in the smart contract that he used which would prevent him from doing so.[33]

What's more, there is no intrinsic functionality on the Ethereum platform that would preclude any other Ethereum wallet holder from writing their own smart contract that issues an NFT targeting the very same hash value that identifies "Everydays."

A separate NFT for the very same artwork could also be minted on another blockchain. While many NFT platforms and marketplaces such as OpenSea, Foundation, Rarible and SuperRare use the Ethereum blockchain, others such as VIV3 and NBA Top Shot use a separate blockchain known as Flow.[34]

Dapper Labs, the creator of CryptoKitties, will reportedly be migrating the CryptoKitty NFTs from the Ethereum to the Flow blockchain,[35] which could conceivably impact the value of the CryptoKitty NFTs residing on the Ethereum blockchain, and from a technical standpoint, there is nothing to prevent anyone, including the artist or copyright holder, from creating separate NFTs on each blockchain for which NFT markets have been developed.

The InterNFT Working Group has proposed standards for interoperability of NFTs across blockchain networks, including management of metadata and linked resources, to address this issue.[36] Platforms may use other means to limit the possibility for duplicative minting of the same associated asset, such as The Fine Art Ledger, which contractually requires an undertaking from the creator of the asset or the owner of the physical artwork not to remint the asset.[37]

As discussed above, the smart contract underlying an NFT can also support idiosyncratic, value-relevant functionality over and above the basic functionality required of all NFTs,

including ongoing functionality that may extend beyond the point of sale. That would argue for due diligence performed on any transaction to include a detailed review of the source code of the smart contract itself.

Takeaways

Ultimately, there would ostensibly be a variety of reasons NFT creators would not have an incentive to engage in such shenanigans, but it serves to illustrate that the technical specifications underlying NFTs may create the possibility of potentially perverse incentives or outcomes relative to those associated with physical art and other traditional assets.

Purchasing an NFT does not necessarily absolve purchasers from the need to perform due diligence as they would when considering the acquisition of a traditional asset such as a piece of art. In fact, the diligence required in purchasing an NFT should arguably be even more extensive.

As with real-world assets, intellectual property rights do not automatically follow the transfer of ownership in the asset, and if one is seeking to acquire these rights in an NFT, care needs to be taken to ensure that these are specifically legislated for in the NFT, just as one would in the real world.

Those who participate in markets for NFTs should also be aware of important factors that form the basis of value of the NFTs that are being transacted, particularly where they differ from those of traditional assets.

Those include the rights that are conferred with the NFT, and what actually is being bought, as well as both the inherent and idiosyncratic technical features of the NFTs themselves, such as the NFT's metadata and functionality specified in the smart contract.

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[1] Lawrence Lessig, "Code is Law – On Liberty in Cyberspace," Harvard Magazine, January 1, 2000, available at https://www.harvardmagazine.com/2000/01/code-is-law-html.

[2] Jacob Kastrenakes, "Beeple sold an NFT for $69 million," The Verge, March 11, 2021, available at https://www.theverge.com/2021/3/11/22325054/beeple-christies-nft-sale-cost-everydays-69-million.

[3] Maria Armental, "Jack Dorsey's First Tweet Sells as NFT for $2.9 Million," Wall Street Journal, March 22, 2021, available at https://www.wsj.com/articles/jack-dorseys-first-tweet-sells-as-nft-for-2-9-million-11616455944.

[4] Kate Knibbs, "What Tim Berners-Lee's $5M NFT Sale Means for Web History," Wired, June 30, 2021, available at https://www.wired.com/story/www-code-nft-tim-berners-lee-auction/.

[5] For example, in a recent Law360 article, the authors note that "… experts and commentators have been quick to question the staying power of NFTs, claiming these novel assets are in fact nothing more than a kind among techies and journalists that is likely to burn hot but fast." David Ervin, Kayvan Ghaffari, and Carissa Wilson, "Navigating NFT Brand Management Risks and Rewards," Law360, April 30, 2021, available at https://www.law360.com/articles/1380197.

[6] For example, The Verge reported that "NFTs are designed to give you something that can't be copied: ownership of the work …." (Mitchell Clark, "NFTs, explained," The Verge, March 11, 2021, available at https://www.theverge.com/22310188/nft-explainer-what-is-blockchain-crypto-art-faq.) The Wikipedia article for Beeple's digital art titled "Everydays: the First 5000 Days" lists the "Owner" as "Vignesh Sundaresan (MetaKovan)," the purchaser of the associated NFT.

[7] Metadata is commonly described as "data about data." (See, e.g., https://en.wikipedia.org/wiki/Metadata.) For example, in a database, data about users (such as users' names, addresses, ages, etc.) might be kept in a table named "Users." However, the database will separately store general information about the "Users" table, including the names of the fields (such as "username," "address," "age," etc.), the data types of the fields (such as string or integer), and other information defining the structure of the table, which would be considered metadata.

[8] "[T]he artist can still retain the copyright and reproduction rights, just like with physical artwork." (Clark, "NFTs explained.") NFTs may also be associated with other traditional IP rights such as trademarks. See, e.g., ibid.

[9] Lewis Cohen, a principal at DLx Law, noted that "it doesn't buy you any rights to the underlying work," and even went so far as to observe that "[i]n most of the NFTs I've seen, most people aren't even purporting to convey any meaningful transferable rights." Elise Hansen, "NFT Craze Generates Slew of Legal Questions," Law360, April 2, 2021, available at https://www.law360.com/articles/1371872.

[10] Tim Fries, "CryptoKicks: Nike to Tokenize Shoe Ownership on Ethereum," The Tokenist, May 25, 2021, available at https://tokenist.com/cryptokicks-nike-to-tokenize-shoe-ownership-on-ethereum/.

[11] See https://mattereum.com/about-us/.

[12] See https://diamondstandard.co/.

[13] See https://www.thefineartledger.com/" target="_blank">https://www.thefineartledger.com/.

[14] Consider a basic transaction of cryptocurrency. In such a transaction, the sender has cryptocurrency in an encrypted wallet and wants to send it to the receiver's (also encrypted) wallet. The transaction, reflecting a transfer from the sender to the receiver, is recorded on the blockchain, which is then propagated throughout the distributed ledger, ensuring that the transaction is immutably preserved. A similar process is used for recording the sale of an NFT, except that instead of preserving the transaction of cryptocurrency from one wallet

to another, a specific type of smart contract associates a digital asset with a digital 'token' that can be transferred in a manner similar to cryptocurrency.

[15] See quotation of Lewis Cohen in above footnote and, for example, Yam Karkai and Raphaël Malavieille, "Digital art ownership custom licenses for NFT artists," posted as a publicly available Google Sheets spreadsheet at https://docs.google.com/spreadsheets/d/10ZA9HOqT19s6DbWkb3Uii9Geoo4a3C_1ZTKWJ_ST1kg.

[16] Taylor Locke, "Millionaire artist Beeple: This is the very important thing 'I think people don't understand' about buying NFTs," CNBC, March 21, 2021, available at https://www.cnbc.com/2021/03/26/digital-artist-beeple-common-misunderstanding-about-nfts.html.

[17] Storing a gigabyte of data on the Ethereum blockchain at the time of this writing would cost tens of millions of dollars. We can do a "back of the envelope" calculation to estimate just how much. Storage on the Ethereum blockchain is measured in units of gas. The Ethereum "yellow paper" references around 640,000 gas per kilobyte for storage on the blockchain (see Appendix G) and with gas priced around 50Gwei (as of this writing, it's 22, but can range into the hundreds) would result in a charge of 32,000 ether to store one gigabyte on the blockchain. As of this writing, the price of one ether is around $1,800, which would make the price of storage of a gigabyte roughly $57,600,000. Retrieving data from the Ethereum blockchain, on the other hand, is free. (See, e.g., Albert Palau, "Storing on Ethereum. Analyzing the costs," Coinmonks, July 17, 2018, available at https://medium.com/coinmonks/storing-on-ethereum-analyzing-the-costs-922d41d6b316.) Beeple's "EveryDays" digital art that sold for roughly $69 million was in the form of an image that occupies roughly a third of a gigabyte. (Robert Graham, "Deconstructing that $69 million NFT," Security Boulevard, March 20, 2021, available at https://securityboulevard.com/2021/03/deconstructing-that-69million-nft/.)

[18] As a part of the NFT interface specification given in EIP-721, NFTs optionally include a tokenURI attribute specifying a JavaScript Object Notation (JSON) data structure including a Uniform Resource Identifier (URI). (See, e.g., https://eips.ethereum.org/EIPS/eip-721.) URIs identify a logical or physical resource used by web technologies by name and location. (See, e.g., Wikipedia, "Uniform Resource Identifier," available at https://en.wikipedia.org/wiki/Uniform_Resource_Identifier.) The location in a URI is specified with a Uniform Resource Locator, or URL, which reflect locations (or addresses) on the web along with the means by which to access them. For example, the Wikipedia article on URLs is available at https://en.wikipedia.org/wiki/URL, indicating the location on the web is en.wikipedia.org/wiki/URL and the means to access it is via the Hypertext Transport Protocol Secure (HTTPS) protocol.

[19] To be precise, hash functions produce hash values as output that are almost, but not quite, uniquely associated with the output. With many hash functions, it is technically possible in very rare instances for two inputs to produce the same output value, known as a "hash collision." See, e.g., Wikipedia, "Hash collision," available at https://en.wikipedia.org/wiki/Hash_collision.

[20] For example, Beeple's "Everydays: The First 5000 Days" is associated by its NFT with hash value in hex format of 6314b55cc6ff34f67a18e1ccc977234b803f7a5497b94f1f994ac9d1b896a017, or, in MultiHash format, QmXkxpwAHCtDXbbZHUwqtFucG1RMS6T87vi1CdvadfL7qA. The hash value can be verified by downloading the image, which is publicly available at the

URL https://ipfsgateway.makersplace.com/ipfs/QmXkxpwAHCtDXbbZHUwqtFucG1RMS6T87vi1CdvadfL7qA, and running the SHA-256 hashing algorithm on it.

[21] Just like fiat currencies, cryptocurrencies were designed to be fungible, and as with dollars, one bitcoin is as good as another. The nature of fungibility in cryptocurrencies has been memorialized in the Ethereum Request for Comment 20 (ERC-20) standard for fungible tokens, which has been used for a substantial number of cryptocurrency issues. (See https://ethereum.org/en/developers/docs/standards/tokens/erc-20/ for more detail. Since the Ethereum platform is commonly used for minting both new cryptocurrencies and NFTs, we'll reference Ethereum standards in this discussion.) NFTs, on the other hand, are unique by design. It is their uniqueness that lends them to being tied to unique digital assets such as digital art or real-world objects such as physical art or collectibles. The ERC-721 non-fungible token standard is commonly used for specifying NFTs, though the development of standards for NFTs is evolving, with new standards such as ERC-1155, designed to address use cases common to online videogames, being proposed and adopted. (See https://ethereum.org/en/developers/docs/standards/tokens/erc-721/ and https://eips.ethereum.org/EIPS/eip-1155 for more detail.)

[22] "CryptoKitties craze slows down transactions on Ethereum", BBC News, December 5, 2017, available at https://www.bbc.com/news/technology-42237162.

[23] James Tarmy, "NFTs Are Booming, But They're Nothing New in the Art Market," Bloomberg, March 2, 2021, available at https://www.bloomberg.com/news/articles/2021-03-02/nft-art-boom-is-the-same-concept-as-the-photography-market.

[24] For example, digital artwork sold for roughly $180,000 on the OpenSea marketplace by the Associated Press titled "The Associated Press calls the 2020 Presidential Election on Blockchain – A View from Outer Space" was associated only with a URL (https://ap-nft.everipedia.org/api/presidential-2020/1), not with a hash value.

[25] "Link rot" refers to a hyperlink that is broken and no longer points to the content originally available at that link (or even any content at all). See, e.g., Wikipedia, "Link rot," available at https://en.wikipedia.org/wiki/Link_rot.

[26] For NFTs associated only with links (rather than hash values) as is the case with the NFT for digital art sold by the Associated Press for $180,000 described above, if the link were to be broken, interested third parties would no longer be able to verify the artwork associated with the NFT, and if the file at that URL were to change, there may be a question as to what artwork the NFT is associated with.

[27] Ben Gilbert, "Here's what happens to digital artwork – like the $69 million Beeple collage – if the site it's bought on goes offline," Business Insider, March 19, 2021, available at https://www.businessinsider.com/what-happens-to-digital-art-nft-servers-shut-down-2021-3.

[28] Arweave is a permanent way to store data, https://www.arweave.org/

[29] See, e.g., Patrick Collins, "How to Create NFTs with Solidity," BetterProgramming, March 2, 2021, available at https://betterprogramming.pub/how-to-create-nfts-with-solidity-4fa1398eb70a; The Arweave Project, "NFT Permanence with Arweave," Medium, May 30, 2020, available at https://arweave.medium.com/nft-permanence-with-arweave-35b5d64eff23.

[30] An IPFS Gateway provides access to the file on the IPFS to common browsers (such as Google Chrome, Microsoft Edge, and Mozilla Firefox) that do not support direct IPFS access. The raw image associated with "Everydays" is accessible via the MakersPlace IFPS Gateway at https://ipfsgateway.makersplace.com/ipfs/QmXkxpwAHCtDXbbZHUwqtFucG1RMS6T87vi1CdvadfL7qA, or for browsers that support IPFS directly, at ipfs://QmXkxpwAHCtDXbbZHUwqtFucG1RMS6T87vi1CdvadfL7qA. The MakersPlace URL (rather than IPFS URL) is referenced in the NFT sold by Beeple.

[31] Some consider the right to create derivative works to be "the most powerful" of rights granted by copyright. See, e.g., J. T. Westermeier, "Understanding the Importance of Derivative Works," Finnegan, March 2009, available at https://www.finnegan.com/en/insights/articles/understanding-the-importance-of-derivative-works.html.

[32] The JPEG image was 21,069 by 21,069 pixels. 21,0692 = 443,902,761.

[33] Beeple used a MakersTokenV2 smart contract to create the token for "Everydays." (Robert Graham, "Deconstructing that $69million NFT," Security Boulevard, March 20, 2021, available at https://securityboulevard.com/2021/03/deconstructing-that-69million-nft/.) The source code for the MakersTokenV2 can be found at https://etherscan.io/address/0x2a46f2ffd99e19a89476e2f62270e0a35bbf0756#code, and, based on a perusal of the code, does not appear to contain any limitations on the issuance of multiple tokens using the same cryptographic hash value that represents the digital asset.

[34] Robyn Conti and John Schmidt, "What You Need To Know About Non-Fungible Tokens (NFTs)," Forbes, May 14, 2021, available at https://www.forbes.com/advisor/investing/nft-non-fungible-token/; Werner Geyser, "Top NFT Marketplaces for Creators to Sell Non-Fungible Tokens, InfluencerMarketingHub, April 26, 2021, available at https://influencermarketinghub.com/nft-marketplaces/. See also Dapper Labs, "Flow Primer," available at https://www.onflow.org/primer.

[35] Andrew Hayward, "What is Flow? The Blockchain Built for NFTs," Decrypt, July 2, 2021, available at https://decrypt.co/resources/what-is-flow-dapper-labs.

[36] See https://internft.org for more information.

[37] See https://www.thefineartledger.com for more information.