VIRTUAL ART AND NON-FUNGIBLE TOKENS
[Pre-Publication Draft]

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ABSTRACT

Fueled in part by the wealth recently created from digital currencies, major art dealers such as Christie's and Sotheby's have embraced the sale of non-fungible tokens attached to unique digital works of art. What are non-fungible tokens, how is this related to the blockchain and what do we know about this rapidly evolving market for digital art? It appears that digital art can be added to the growing list of uses for blockchain technology now becoming a part of modern life.

This article proceeds in seven parts. First, is a discussion about the new and explosive market for digital art. Second, I explore the evolution of the digital world and virtual property. Third, is an explanation and historical account of the blockchain and virtual currencies. Fourth, is coverage about non-fungible tokens. Fifth, is a brief look at unresolved issues impacting the law of NFTs and potential solutions are provided. Sixth, are a few thoughts about the future of digital property. And last, I conclude.

This dramatic extension of blockchain and other digital technology to the world of art and music represents a new and exciting platform for creative expression. I believe this paper offers a valuable addition to the literature by providing a readable introduction and overview of what is now known about the likely impact of blockchain technology and non-fungible tokens to music and art. This important development should have a significant impact on the future of innovation and property law.

Keywords: art, Beeple, bitcoin, blockchain, Christie's, climate, collectibles, Coin Desk, copyright, crypto asset, cryptocurrency, CryptoPunks, crypto-theft, digital art, ethereum, intangible, intellectual property, law, music business and publishing, Nifty Gateway, non-fungible tokens (NFTs), online payment systems, ownership, possession, property law, Second Life, smart contract, Sotheby's, synthetic worlds, token, virtual property, virtual real estate,

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OVERVIEW

On March 11, 2021, Metakovan, a pseudonym, paid $69 million for a piece of unique digital art titled "Everydays - The First 5000 Days," and paid for it with ether, a cryptocurrency.[1] With this landmark purchase fueled in part by the wealth recently created from digital currencies, art buyers, creatives, and investors became suddenly aware of the exploding market for unique digital art. The art world, major traditional art dealers such as Christie's and Sotheby's, have embraced this new development. The underlying strange brew of cryptography, game theory, interest in art collection, need for the creation of true unique digital ownership interests, and a solid dose of speculative hype has now fermented into a term that has become one of the driving law and technology stories of the year: non-fungible tokens. Also during 2021, $2.9 million was paid "for the NFT of Twitter founder Jack Dorsey's first tweet, which you can easily see on-line" 'just setting up my twttr.'"[2]

What then are non-fungible tokens, how is this related to the blockchain and what do we know about this rapidly evolving market for digital art? It appears that digital art can be added to the growing list of uses for blockchain technology now becoming a part of modern life, such as: accounting and auditing;[3] agriculture;[4] artificial intelligence (AI);[5] business supply chains;[6]

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[1] Scott Reyburn, *The $69 Million Beeple NFT Was Bought With Cryptocurrency*, N.Y. TIMES, March 12, 2021, https://www.nytimes.com/2021/03/12/arts/beeple-nft-buyer-ether.html.

[2] Andy Kessler, Op-Ed, *Mark Cuban Known Crypto*, WALL ST. J., May 24, 2021 at A17.

[3] *See* Lawrence J. Trautman & Mason J. Molesky, *A Primer for Blockchain*, 88 UMKC L. REV. 239, 267 (2019), https://ssrn.com/abstract=3324660, *citing* Volodymyr Babich & Gilles Hilary, Blockchain and Other Distributed Ledger Technologies in Operations, (unpublished ms.), https://ssrn.com/abstract=3232977; Sean S. Cao, Lin William Cong & Baozhong Yang, Auditing and Blockchains: Pricing, Misstatements, and Regulation, (unpublished ms.), https://ssrn.com/abstract=3248002; Maria Karajovic, Henry Kim & Marek Laskowski, Thinking Outside the Block: Projected Phases of Blockchain Integration in the Accounting Industry (2017), https://ssrn.com/abstract=2984126; Chandra Shekar Mylaavaram, R. Kumaran & R. K. Mishra, Blockchain Technology - An Exploratory Study on Its Applications, THE MGMT. ACCT. (June 2018), https://ssrn.com/abstract=3194522; Daniel E. O'Leary, Configuring Blockchain Architectures for

carbon markets;[7] commercial real estate;[8] commodity platforms;[9] copyrights;[10] creative and artistic endeavors;[11] economic planning;[12] elections;[13] fiat money;[14] financial services and capital

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Transaction Information in Blockchain Consortiums: The Case of Accounting and Supply Chain Systems (unpublished ms.), https://ssrn.com/abstract=3102671; Reinhard Schrank, Audit Quality, Legal Liability, and the Audit Market Under Risk Aversion (unpublished ms.), https://ssrn.com/abstract=3258555; Ting Yu, Zhiwei Lin & Qingliang Tang, Blockchain: Introduction and Application in Financial Accounting (unpublished ms.), https://ssrn.com/abstract=3258504.

[4] *Id. citing See* Emily R. Lyons, David A. Crass, Cheryl I. Aaron & Sarah C. Helton, What Blockchain Means for the Agriculture and Food Industries, Michael Best & Friedrich LLP (Dec. 26, 2018), https://www.michaelbest.com/Newsroom/192905/What-Blockchain-Means-for-the-Agriculture-and-Food-Industries.

[5] *Id.* at 268, *citing* Bo Xing, & Tshilidzi Marwala, The Synergy of Blockchain and Artificial Intelligence (2018), https://ssrn.com/abstract=3225357. *See also* William Magnuson, *Artificial Financial Intelligence*, 10 HARV. BUS. REV. 337 (2020).

[6] *Id.* at 269, *citing See* Volodymyr Babich & Gilles Hilary, Distributed Ledgers and Operations: What Operations Management Researchers Should Know About Blockchain Technology (2018). Forthcoming in Manufacturing & Service Operations Management; Georgetown McDonough School of Business Research Paper No. 3131250. https://ssrn.com/abstract=3131250; Chris Berg, Sinclair Davidson & Jason Potts, Outsourcing Vertical Integration: Distributed Ledgers and the V-Form Organisation (2018), https://ssrn.com/abstract=3300506; Bhavya Bhandari, Supply Chain Management, Blockchains and Smart Contracts (2018), https://ssrn.com/abstract=3204297; Jiri Chod, Nikolaos Trichakis, Gerry Tsoukalas, Henry Aspegren & Mark Weber, Blockchain and the Value of Operational Transparency for Supply Chain Finance 2018). Mack Institute for Innovation Management, Working Paper Series, https://ssrn.com/abstract=3078945 (providing signals enhancing finance); Henry Kim & Marek Laskowski, Towards an Ontology-Driven Blockchain Design for Supply Chain Provenance (2016), https://ssrn.com/abstract=2828369; Adam J. Sulkowski, Blockchain, Law, and Business Supply Chains: The Need for Governance and Legal Frameworks to Achieve Sustainability (2018), https://ssrn.com/abstract=3205452.

[7] *Id. citing See* Adrian Jackson, Ashley Lloyd, Justin Macinante & Markus Hüwener, Networked Carbon Markets: Permissionless Innovation with Distributed Ledgers?, (2018). Edinburgh Sch. L. Res. Paper No. 2018/07, https://ssrn.com/abstract=3138478; Robert Leonhard, Developing the Crypto Carbon Credit on Ethereum's Blockchain (2017), https://ssrn.com/abstract=3000472; Robert Leonhard, Forget Paris: Building a Carbon Market in the U.S. Using Blockchain-Based Smart Contracts (2017), https://ssrn.com/abstract=3082450; Justin Macinante, A Conceptual Model for Networking of Carbon Markets on Distributed Ledger Technology Architecture. Edinburgh Sch. L. Res. Paper No. 09/2017, https://ssrn.com/abstract=2948580.

[8] *Id. citing* Hitesh Malviya, Blockchain for Commercial Real Estate (2017), https://ssrn.com/abstract=2922695; Sergio Nasarre-Aznar, Collaborative Housing and Blockchain, 66(2) ADMINISTRATION 59 (2018), https://ssrn.com/abstract=3189050.

[9] *Id* at 270, *citing* Jianfu Wang, Commodity Trade Finance Platform Using Distributed Ledger Technology: Token Economics in a Closed Ecosystem Using Agent-Based Modeling (2018), https://ssrn.com/abstract=3152093.

[10] *Id. citing* Annabel Tresise, Jake Goldenfein & Dan Hunter, *What Blockchain Can and Can't Do for Copyright*, 28 AUSTL. INTELL. PROP. J. 144 (2018), https://ssrn.com/abstract=3227381; Jake Goldenfein & Dan Hunter, Blockchains, Orphan Works, and the Public Domain, 41 COLUM. J.L. & ARTS (2017), https://ssrn.com/abstract=3083153; Nick Vogel, The Great Decentralization: How Web 3.0 Will Weaken Copyrights, 15 J. MARSHALL REV. INTELL. PROP. L. 136 (2015).

[11] *Id. citing* Jason Potts & Ellie Rennie, Blockchains and Creative Industries (2017), https://ssrn.com/abstract=3072129; Stan Sater, Tokenize the Musician, 21 TULANE J. TECH. & INTELL. PROP. (2018), https://ssrn.com/abstract=3160798 (music recording and performance economics and observing that Blockchain tokens enable established musicians to remain independent longer, thus enabling

markets;[15] and the Internet of Things (IoT);[16] just to name a few. But the application of NFTs to art is a central application in a new direction. After all, one bitcoin is much like another. But an

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the negotiating of better terms with record companies); Bo Xing, Creativity and Artificial Intelligence: A Digital Art Perspective (2018), https://ssrn.com/abstract=3225323 (digital art, creativity, and AI).

[12] *Id.* at 271, *citing* Kartik Hegadekatti & Yatish S. G., The Programmable Economy: Envisaging an Entire Planned Economic System as a Single Computer Through Blockchain Networks, (2017), https://ssrn.com/abstract=2943227.

[13] *Id. citing* Usman W. Chohan, Blockchain Enhancing Political Accountability? Sierra Leone 2018 Case (2018), https://ssrn.com/abstract=3147006; Kartik Hegadekatti, Analysis of Present Day Election Processes vis-à-vis Elections Through Blockchain Technology (2017), https://ssrn.com/abstract=2904868; Samuel Martin, Blockchain as a Solution to the United States' Voter Turnout Issue (2018), https://ssrn.com/abstract=3177523.

[14] *Id.* at 272, *citing* Richard Senner & Didier Sornette, The Holy Grail of Crypto Currencies: Ready to Replace Fiat Money?, 53 J. ECON. ISSUES, __ (20__), https://ssrn.com/abstract=3192924. *See also* Jeanna Smialek, *Virtual Money and cash Must Coexist, Fed Says*, WALL ST. J., March 19, 2021 at B2.

[15] *Id. citing* Lawrence J. Trautman, *Is Disruptive Blockchain Technology the Future of Financial Services?*, CONSUMER FIN. L.Q. REP. 232, 234 (2016). *See also* Jun Aoyagi, Daisuke Adachi, Economic Implications of Blockchain Platforms (2018), https://ssrn.com/abstract=3132235; Catherine Martin Christopher, The Bridging Model: Exploring the Roles of Trust and Enforcement in Banking, Bitcoin, and the Blockchain, 17 NEVADA L.J. 1 (2016), https://ssrn.com/abstract=2851492; David Lee Kuo Chuen, Decentralization and Distributed Innovation: Fintech, Bitcoin and ICO's (2017), https://ssrn.com/abstract=3107659; Shaen Corbet, Charles James Larkin, Brian M. Lucey, Andrew Meegan Larisa Yarovaya, Cryptocurrency Reaction to FOMC Announcements: Evidence of Heterogeneity Based on Blockchain Stack Position (2017), https://ssrn.com/abstract=3073727; Giuseppe Giudici, Legal Problems of the Blockchain: A Capital Markets Perspective (2018), https://ssrn.com/abstract=3240273; Peter Gomber, Robert J. Kauffman, Chris Parker & Bruce Weber, On the Fintech Revolution: Interpreting the Forces of Innovation, Disruption and Transformation in Financial Services, 35 J. MGMT. INFO. SYS. 220 (2018), https://ssrn.com/abstract=3190052; Gur Huberman, Jacob Leshno & Ciamac C. Moallemi, An Economic Analysis of the Bitcoin Payment System (2018), https://ssrn.com/abstract=3025604; William J. Magnuson, Regulating Fintech, 71 VAND. L. REV. 1167 (2018), https://ssrn.com/abstract=3027525; William J. Magnuson, *Financial Regulation in the Bitcoin Era*, 23 STAN. J.L. BUS. & FIN. 159 (2018), https://ssrn.com/abstract=3148036; José Parra-Moyano, Tryggvi Thoroddsen & Omri Ross, Optimized and Dynamic KYC System Based on Blockchain Technology (March 14, 2018), https://ssrn.com/abstract=3248913; Max Raskin & David Yermack, Digital Currencies, Decentralized Ledgers, and the Future of Central Banking (2016), https://ssrn.com/abstract=2777326; Margaret Ryznar, The Future of Bitcoin Futures, __ HOUSTON L. REV. (Forthcoming), https://ssrn.com/abstract=3127327; Anne M. Tucker & Holly van den Toorn, Will Swing Pricing Save Sedentary Shareholders?, 2018 COLUM. BUS. L. REV. __ (2018), https://ssrn.com/abstract=3173736.

[16] *Id.* At 275, *citing* Arushi Arora & Sumit Kumar Yadav, Block Chain Based Security Mechanism for Internet of Vehicles (IoV), Proceedings of 3rd International Conference on Internet of Things and Connected Technologies (ICIoTCT), 2018 held at Malaviya National Institute of Technology, Jaipur (India) on March 26-27, 2018, https://ssrn.com/abstract=3166721; Rejwan Bin Sulaiman, Applications of Block-Chain Technology and Related Security Threats (2018), https://ssrn.com/abstract=3205732; Bjorn Lundqvist, Portability in Datasets under Intellectual Property, Competition Law, and Blockchain (2018). Faculty of Law, Stockholm University Research Paper No. 62, https://ssrn.com/abstract=3278580; Lee W. McKnight, Richie Etwaru & Yihan Yu, Commodifying Trust: Trusted Commerce Policy Intersecting Blockchain and Internet of Things (2017), https://ssrn.com/abstract=2944466; Scott J. Shackelford, Governing the Internet of Everything: Applying the IAD and GKC Frameworks to Improve the Security and Privacy of Things (2018). Kelley School of Business Research Paper No. 18-86., https://ssrn.com/abstract=3266188; Scott J. Shackelford, Smart Factories, Dumb Policy?: Managing Cybersecurity and Data Privacy Risks in the Industrial Internet of Things (2018). Kelley School of Business Research Paper No. 18-80, https://ssrn.com/abstract=3252498; Lawrence J. Trautman,

NFT equivalent of the Mona Lisa is very different from the NFT equivalent of Action Comics #1. NFT technology leverages digital uniqueness in a way that makes a new social phenomenon possible. There is only one Mona Lisa in the Louvre: owning a copy doesn't provide the same thrill.

This article proposes that pent-up demand for true digital uniqueness -- collectability -- will drive the online market for NFTs to survive the current crypto-crash. Values for digital art will be down in the short term, certainly, as people absorb paper losses from paper gains. But if we mean to say -- as we do mean to say -- that the technology will be more than a flash in the pan, it is worth delving into the roots of the demand for online uniqueness. The demand for one-of-a-kind art has roots as firmly planted online as off, and showing that the demand for digital collectibles has long driven economies in online environments and virtual worlds will help ground the inevitable discussion over whether NFTs are merely a fad or a phenomenon.

Our thesis is simple: We believe humans value rarity and uniqueness particularly in a social context. When it comes to art, the value that humans attribute to uniqueness is tied to the strength and breadth of communities that gather around the art, that admire it, value it, and provide social value to those who collect, support, and enjoy it. Collecting art is social. This article will establish that where strong social bonds form online communities around items, whether a community of admirers of Banksy, or the players of an online role-playing game, markets for unique items and arts will arise. Thus we argue that the NFT phenomenon is largely independent of valuation of cryptocurrencies, except to the extent that those who are excited

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Mohammed T. Hussein, Louis Ngamassi & Mason Molesky *Governance of The Internet of Things (IoT)*, 60 JURIMETRICS 315 (2020), http://ssrn.com/abstract=3443973;
Lawrence J. Trautman & Peter C. Ormerod, *Industrial Cyber Vulnerabilities: Lessons from Stuxnet and the Internet of Things*, 72 U. MIAMI L. REV. 761 (2018), http://ssrn.com/abstract=2982629.

about cryptographic token technologies are more likely to understand and value unique tokens, and in a crypto boom, are more likely to pay eye-grabbing sums.

This article proceeds in seven parts. First, we discuss the new and explosive market for digital art. Second, we explore the evolution of the digital world and virtual property. Third, is an explanation and historical account of the blockchain and virtual currencies. Fourth, we explore non-fungible tokens. Fifth, we look briefly at unresolved issues impacting the law of NFTs and provide potential solutions. Sixth, we present a few thoughts about the future of digital property. And last, we conclude.

This dramatic extension of blockchain and other digital technology to the world of art and music represents a new and exciting platform for creative expression. We believe this paper is a valuable addition to the literature by providing a readable introduction and overview of what is now known about the likely impact of blockchain technology and non-fungible tokens to music and art. This important development should have a significant impact on the future of innovation and property law.

I. MARKET FOR DIGITAL ART EMERGES

On March 13, 2021, *The Wall Street Journal* reported a first sale of an entirely digital work by auction house Christie's, creating "a frenzy in crypto asset markets by paying a record sum for… artwork that exists only digitally. Its authenticity is verified primarily because it carries an NFT, or digital proof of purchase that is recorded on a digital ledger known as a blockchain."[17]

The NFT Gold Rush

[17] Kelly Crow & Caitlin Ostroff, *Crypto Investor Won record Auction of Beeple Digital Art*, WALL ST. J., Mar. 13-14, 2021 at B12.

According to Christie's, "a cryptocurrency investor based in Singapore called Metakovan won Beeple's $69 million digital collage at auction−a sale that smashed records in markets for both art and non-fungible tokens, or NFTs."[18] As reported:

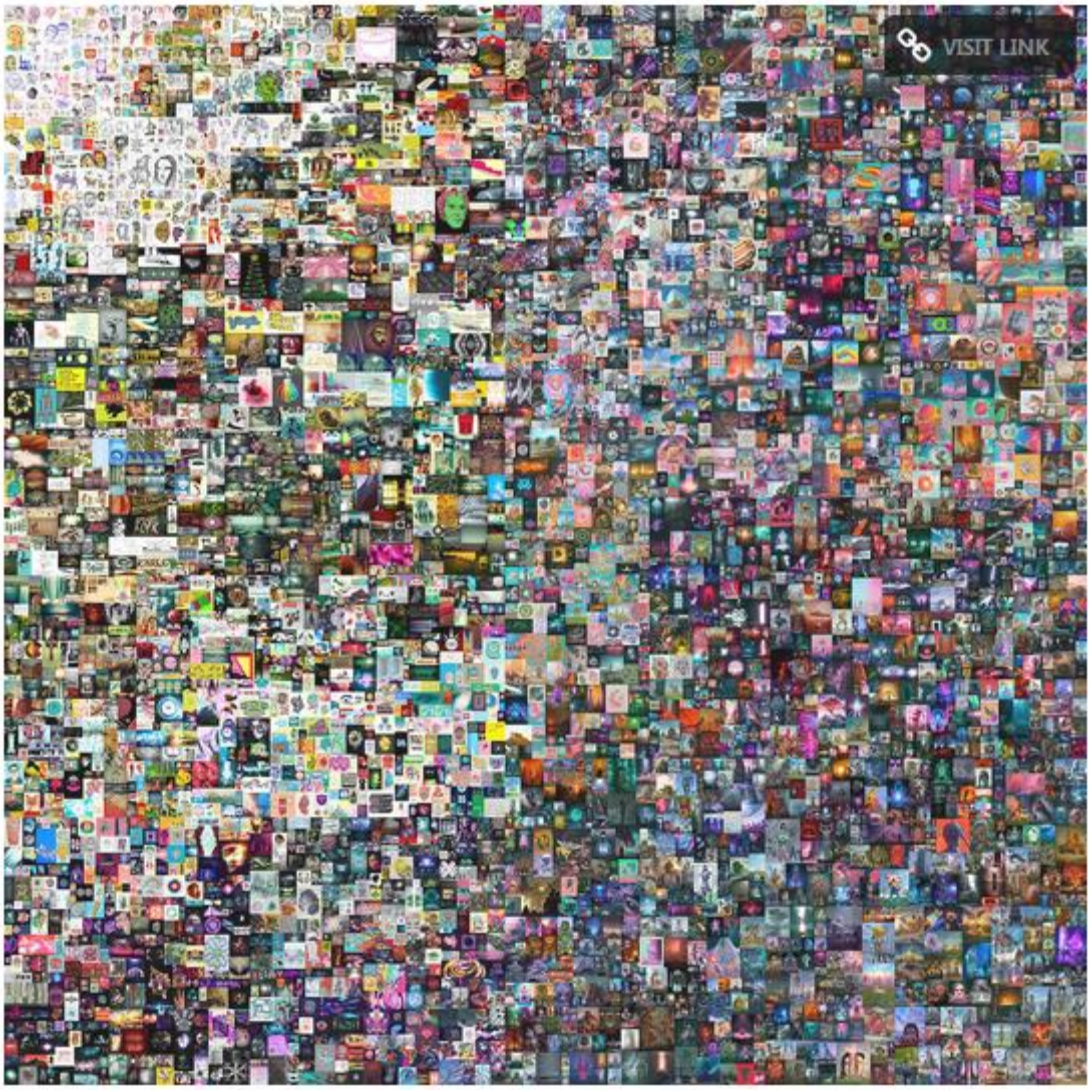
> Metakovan is the founder of Metapurse, a crypto-based investment firm. [A spokesman for Metkovan known as] Twobadour said that their fund outbid dozens of rivals over the course of the 15-day online contest to win Beeple's pixilated amalgamation of irreverent drawings and fantastical landscapes that the artist combined into a single collage called 'Everydays: The First 5000 Days'…
>
> NFTs are all the rage now, but Twobadour, who spoke on Metakovan's behalf as the fund's steward said he and his partner have spent the past several years focused on amassing what might be the world's biggest collection of tokenized collectibles and art, worth nearly $120 million combined, with Beeple serving as its star. Four months ago, the fund paid $2.2 million for a different set of 20 Beeple works on the online marketplace Nifty Gateway…
>
> The artist [Beeple], whose real name is Mike Winkelmann, is known for completing a new work each day for the past 13 years and counting… Metapurse has been able to scoop up Beeple's works at such high prices because Metakovan was an early investor in cryptocurrencies, starting around 2013… After buying that previous set of 20 Beeple works in December [2020], they bought land in digital gaming spaces and built museums to display the images before minting tokens off the virtual experience they created. An initial 1.6 million tokens of B.20 were sold at 36 cents apiece. By [March 12, 2021] the cost of one token had risen to $16.35, giving the tokens a collective worth of 163.5 million, according to Coinmarketcap.com.[19]

Reports document that just a month before, digital art depicting "Donald J. Trump facedown in the grass, covered in words like 'loser,' sold for $6.6 million, a record for a non-fungible token, or NFT… Fittingly, the image was paid for in Ethereum, a form of cryptocurrency that, among millennials, is almost as well known as Bitcoin."[20] Although U.S.-centric, *The New York Times* provides a potential explanation for this phenomenon by observing "Rather than elbowing past one another for reservations at the latest restaurants… or getting into bidding wars for apartments at 740 Park Avenue, they are one-upping one another in online auctions for jewelry, watches, furniture, sports cards, vintage cars, limited-edition Nikes and

[18] *Id.*
[19] *Id.*
[20] Jacob Bernstein, *Bored Rich People Spend Money,* N.Y. TIMES, Mar. 21, 2021 at Styles 1-8.

crypto art."[21] A Christie's spokesperson indicates their shift in strategy "ahead of the NFT boom, but the sudden popularity of the digital medium indicated that the art world was primed for an overhaul. 'People are collecting art differently now, and it's time for some radical changes."[22] Exhibit 1 depicts an image of Beeple's EVERYDAYS: THE FIRST 5000 DAYS, 2021.[23]

Exhibit 1
EVERYDAYS: THE FIRST 5000 DAYS, 2021[24]



[21] *Id.* at 1.
[22] Kelly Crow, *NFT Works Spark Frenzy In Art World*, WALL ST. J., Mar. 18, 2021 at A12.
[23] EVERYDAYS: THE FIRST 5000 DAYS, 2021, Non-fungible token (jpg). 21,069 x 21,069 pixels (319,168,313 bytes). Minted on 16 February 2021, Christie's, https://www.christies.com/features/Monumental-collage-by-Beeple-is-first-purely-digital-artwork-NFT-to-come-to-auction-11510-7.aspx.
[24] *Id.*

Evident now, "The art market, coming off a pandemic year marked by sluggish sales, also sees an opportunity to cozy up to a largely untapped audience of crypto-millionaires."[25] *The Wall Street Journal* reports:

> Christie's is capitalizing on the momentum by reorganizing its sales in May in part to appeal to millennials and cryptocurrency investors who want more emerging art and NFTs, the house said. Instead of labeling its two biggest sales by their artistic styles− like impressionist-modern and postwar-contemporary− Christie's will slot its offerings by time frame, specifically the 20th century and 21st century.[26]

Bids from more than 30 were received, resulting in a winning offer of "350 Ether, or about $560,000.[27] Accordingly, Mr. Roose writes, "I listed it on Wednesday morning, and before I went to bed that night, the top bid had risen to more than $30,000. When I woke up the next morning, it was $43,000. In the final hour of the auction… a bidding war broke out."[28] Bids from more than 30 were received, resulting in a winning offer of "350 Ether, or about $560,000. A few minutes later, after the auction platform had taken its cut, nearly $500,000 in cryptocurrency landed in my digital wallet."[29] Exhibit 2 is an image of Mr. Roose's winning art. Mr. Roose reflects:

> Some NFT collectors believe that owning early, prominent crypto-tokens, will eventually be like owning rare, first-edition books or priceless paintings. [NFT collector] Mr. Ouyang admitted that the value of my NFT was 'still highly speculative and subjective.' But he said he believed that NFTs and other blockchain-based technologies would ultimately reshape the entire media landscape, allowing creators to reimagine how they create and monetize their works.
>
> This particular NFT from The New York Times is one of the answers and will become a historical landmark in this inevitable movement,' he said. 'That's why I think it is valuable.'[30]

[25] Kelly Crow, *supra* note 22.
[26] *Id.*
[27] Kevin Roose, *$560,000 For a Picture Of My Word,* N.Y. TIMES, Mar. 27, 2021, at B1, *citing* Kevin Roose, *Buy This Column on the Blockchain,* N.Y. TIMES, Mar. 25, 2021, at B1.
[28] Kevin Roose, *$560,000 For a Picture Of My Word,* N.Y. TIMES, Mar. 27, 2021, at B1-7..
[29] *Id.* at B7.
[30] *Id.*

Exhibit 2
A Picture of My Words Was Worth $560,000 in the NFT Market[31]

Business
The New York Times

Buy This Column on the Blockchain!

Why can't a journalist join the NFT party, too?

On May 28, 2021 we read about historical documents of interest being monetized by the University of California at Berkeley. According to *The New York Times,* UC Berkeley's plan is to "auction the first of two digital art… NFTs. The object being offered is based on a document called an invention and technology disclosure. That's the

[31] *Id.*

form that researchers at Berkeley fill out to alert the University about discoveries that have the potential to be turned into lucrative patents."[32] Originating in 1996:

> The title of the invention… is 'Blockade of T-Lymphocyte Down-Regulation Associated with CTLA-4 Signaling.' The University hopes that potential bidders will be attracted to an early description of a revolutionary approach to treating cancer developed by James P. Allison, then a professor at Berkeley. He found a way to turn off the immune system's aversion to attacking tumors and he showed that it worked in mice.
>
> That advance eventually led to the creation of Yervoy, a drug for the treatment of metastatic melanoma, and Dr. Allison, who is now at the MD Anderson Cancer Center at the University of Texas, shared the Nobel Prize in Medicine in 2018. Thus, the Berkeley disclosure form could be thought of as the scientific equivalent of Mickey Mantle's rookie baseball card - a memento of the beginnings of greatness. 'I think of it almost as a history of science artifact,' said Richard K. Lyons, the chief innovation and entrepreneurship officer at Berkeley. 'Imagine somebody saying, 'I want to own the NFTs for the 10 most important scientific discoveries of my lifetime.'" A 24-hour auction of the NFT of Dr. Allison's invention disclosure will take place as early as June 2 [2021] using Foundation, an NFT auction marketplace that uses Ethereum, the cryptocurrency network of choice for NFT collectors.
>
> Eighty-five percent of the proceeds will go to Berkeley to finance research, the remainder to Foundation. If the piece is later resold, Berkeley will receive 10 percent of the sale and Foundation 5 percent. Because the making of an NFT requires a lot of computing power, part of the money the university earns from the NFT sale will be used for carbon offsets to compensate for the energy consumed, Berkeley officials said. The second NFT that Berkeley plans to auction in the coming weeks will be the disclosure form describing the CRISPR-Cas9 gene editing invention by Jennifer A. Doudna, a professor of molecular and cell biology at Berkeley. She shared the 2020 Nobel Prize in Chemistry with Emmanuelle Charpentier of the Max Planck Unit for the Science of Pathogens for their work on technique.[33]

History of Digital Art

Christie's provides a history of digital art, "dating back to the 1960s. But the ease of duplication traditionally made it near-impossible to assign provenance and value to the medium." During November 2018, Christie's first transaction of this type took place, "when it registered the entire 42-lot Barney A. Ebsworth Collection of 20th-century American Art on the Artory

[32] Kenneth Chang, *University to Auction NFTs Of Early Nobel Prize Work,* NY TIMES, May 28, 2021 at B4.
[33] *Id.*

blockchain. The collection totaled more than $322 and marked the first time an art auction at this price level had been digitally recorded." Robert Alice's Block 21 was offered by Christie's during October, 2020, "as part of its Post War & Contemporary Art Day sale… The first work of art with an embedded NFT to be offered at a traditional auction house, the lot attracted non-traditional bidders and crypto enthusiasts alike−and sold for almost 11 times its low estimate."[34] Christie's states:

> The recent introduction of Non-fungible tokens (NFTs) and blockchain technology has enabled collectors and artists alike to verify the rightful owner and authenticity of digital artworks. *EVERYDAYS: THE FIRST 5000 DAYS* will be delivered directly from Beeple to the buyer, accompanied by a unique NFT encrypted with the artist's unforgeable signature and uniquely identified on the blockchain.[35]

Additional transactions taking place before the Christie's $69 million Beeple's sale are reported by financial journalist Jason Zweig who notes, "In February [2021], an NFT representing the Nyan Cat video meme, which looks like a feline Pop-Tart dragging a rainbow through outer space, sold for more than $500,000. A video NFT of LeBron James dunking a basketball sold for $208,000."[36]

Rapid technological changes brought about by significant product developments such as the Gutenberg Press often help facilitate Renaissance-like artistic creativity. The Gutenberg "formation of the printing press in the fifteenth century paved the way for mass production of texts and images. With new communication capacity being enabled by this technological advancement, the widespread of material and intellectual exchange becomes possible."[37] In

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[34] Beeple: *A Visionary Digital Artist in the Forefront of NFTs*, Christie's, https://www.christies.com/features/Monumental-collage-by-Beeple-is-first-purely-digital-artwork-NFT-to-come-to-auction-11510-7.aspx (last viewed Mar. 26, 2021).
[35] *Id.*
[36] Jason Zweig, *The Method to the Madness Of a $69 Million Art Sale*, WALL ST. J., Mar. 20-21, 2021 at B5.
[37] Bo Xing, Creativity and Artificial Intelligence: A Digital Art Perspective 1 (2018), https://ssrn.com/abstract=3225323.

modern times, "many of the working approaches used by digital artists can be traced back to the early days… of computer development. Since the emergence of the World Wide Web in the 1990s, a diverse variety of opportunities were further opened for visual arts with seemingly infinite permutable dimensions."[38] Bo Xing attributes the emergence of digital art to three primary factors:

> Firstly, it is such a common practice for artists, in particular young professionals, to use a wide range of media arts for creative purposes, producing static/dynamic images, as well manipulating sound tracks and text scripts;
> [S]econdly, digital art is not an isolated practice, divided from other forms of arts. It is essentially a methodology that incorporates all types of interconnections with other art exercises together with other manner of presentations and enquiries, illustrating that we are witnessing and experiencing a new wave of creative revolution; [and] [L]ast but not the least, it is worth noticing that an army of digital artists are now working in numerous industries shoulder to shoulder with hardware and software practitioners at the forefront of innovation.[39]

Just as in the physical world, the advent and growth of the electronic social spaces, from games like World of Warcraft to blockchain-based environments like Decentraland, to the social bubbles of Twitter have fostered a need for online value, both in terms of currency and payment, and in terms of unique digital assets to hold that value. Paying fungible currency--dollars--for a unique creation--art--is a loop we have not yet experienced in the present economy. Our economies remain half online, half off. While current laws and the scope of regulations struggle to keep up with rapid technological change, policy makers and criminal enforcement officials face significant new challenges.

According to Harvard professor Jonathan Zittrain and researcher Will Marks, in sum, an NFT's "first buyer is getting three things: the warm feeling that may accompany financing an

[38] *Id.*
[39] *Id. citing* J. Sefton-Green & V. Reiss, Multimedia literacies: developing the creative uses of new technology with young people. In: Sefton-Green J (ed) Young People, Creativity and New Technologies: The Challenge of Digital Arts. (Routledge, 1999); A. Bentkowska-Kafel,T. Cashen & H. Gardiner, Digital art history: a subject in Transition (2005).

artist; the pride that comes with claiming a relationship to a digital artifact and its creator; and perhaps most tangibly, an asset that can be traded…"[40] Consider:

> The buyer is not, however, acquiring that they alone can use. In the physical world, if you purchase a candy bar, you can't give someone a piece of it without losing a few bites of your own. That makes your freedom to take a bite valuable, because the bar has only so much chocolate.
>
> By contrast, an NFT buyer is not purchasing a work, but rather a publicly available token that links to a work. For example, for a digital picture, the token may be a unique number and a link to a copy of the picture, hosted on a service such as IPFS. The token itself is visible to all, as is the work to which it points, so anyone else can look at the work and download it. And most NFT transactions don't purport to convey copyright or other intellectual-property interests regarding the work in question, so owning an NFT tied to an animation of, say a flying Pop-Tart cat doesn't put you in a position to use that animation any differently than someone who hadn't bought it. You have only a token that is hosted publicly online, 'registered' as assigned to your digital wallet rather than someone else's. If you orchestrate your wallet through an app, the app might present you with a handsome visual trophy case listing the NFTs that you've purchased. (As you can see, we're having to reach to describe unique value..)[41]

Christie's announced the sale of works made during the mid-1980s by Andy Warhol that were recovered from obsolete floppy disks during 2014. These five original Andy Warhol works, existing previously only as digital files "will be brought to life again as 1 / 1 NFTs… They are being offered for sale individually by Christie's on behalf of the Andy Warhol Foundation for the Visual Arts established by Warhol."[42] The online sale ran on Christie's website from May 19, 2021 to May27th.[43]

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[40] Jonathan Zittrain & Will Marks, *What Critics Don't Understand About NFTs,* THE ATLANTIC (Apr. 2021), https://www.theatlantic.com/ideas/archive/2021/04/nfts-show-value-owning-unownable/618525/.
[41] *Id.*
[42] Press Release, Christie's Presents Proof of Sovereignty: A Curated NFT Sale by Lady PheOnix (May 2021), https://www.christies.com/about-us/press-archive/details?PressReleaseID=10079&lid=1 (last viewed May 26, 2021)
[43] *Id.*

CryptoPunks

Noah Davis, Post-War and Contemporary art specialist at Christie's, New York states, "The CryptoPunks are the alpha and omega of the CryptoArt movement… This is a historic sale."[44] Accordingly, during Christie's 21st Century Evening sale on May 13, 2021, a single lot of nine Punks, courtesy of LarvaLabs were brought to market. About three years earlier "two software developers created a quirky art project called CryptoPunks that posed a serious and provocative question: Could a few lines of code translate to a feeling of meaningful ownership? It was a crazy idea that would require, in their words, 'a conceptual leap.'"[45] Christie's contends that CryptoPunks is now regarded as the genesis of the CryptoArt movement of today. The experiment begins, when, according to Christies:

> In 2017, Matt Hall and John Watkinson, founders of New York-based software company Larva Labs, created a software program that would generate thousands of different, strange-looking characters. At first, they thought they might have had the makings of a smartphone app or game.[However, as we have seen, their creation "was a paradigm-altering model for the digital art market and a challenge to the concept of 'ownership' itself.
>
> Larva Labs launched CryptoPunks on June 23, 2017. The CryptoPunks are a collection of 24x24, 8-bit-style pixel art images of misfits and eccentrics. There are exactly 10,000 of them, each with their own ostensible personality and unique combination of distinctive, randomly generated features. Each Punk has its own personality, thanks to distinct, randomly generated features, from glasses to caps to hoodies. Pictured above: CryptoPunks 58, 603 and 768, three of the nine works featured in Larva Labs' single lot [were] offered in 21st Century Evening Sale on 11 May at Christie's in New York.[46]

In sum, "There are 6,039 male Punks and 3,840 female Punks. A total of 696 wear hot lipstick, while 303 have muttonchops. There are 286 Punks with 3-D glasses, 128 rosy-cheeked Punks, 94 Punks with pigtails, 78 Punks with buck teeth and 44 beanie-wearing Punks."[47] In

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[44] *See 10 things to know about CryptoPunks, the original NFTs,* Christie's, https://www.christies.com/features/10-things-to-know-about-CryptoPunks-11569-1.aspx (last viewed May 30, 2021).
[45] *Id.*
[46] *Id.*
[47] *Id.*

addition, "eight Punks with no distinctive features at all — sometimes referred to as Genesis Punks — and only one with seven attributes: CryptoPunk 8348 a big bearded, bucktoothed, cigarette-smoking Punk with an earring and a mole, wearing classic shades and a top hat."[48] The London punk scene is attributed as the grand inspiration for this project:

> To Hall and Watkinson, there was a raucous, anti-establishment spirit to the early days of the blockchain movement. It was a vibe they wanted to reflect in the look of their Punks. 'They needed to be a collection of misfits and non-conformists,' they explain. 'The London punk movement of the 1970s felt like the right aesthetic.' The dystopian grit of cyberpunk as typified by the film *Blade Runner* and William Gibson's novel *Neuromancer*, was also an influence. Inspired by the '70s London punk scene, many Punks have mohawks and wild hair, like CryptoPunks 532 and 602, two of the nine works featured in Larva Labs' single lot offered in 21st Century Evening Sale on 11 May at Christie's in New York . Anyone and everyone can view any one of the CryptoPunks . There's a composite image of all 10,000 CryptoPunks on Larva Labs' website. Anyone can save a copy of the image file to their memory stick or hard drive. Each Punk also has its own page, detailing its special features and complete transaction history. But only one person can *officially* own a CryptoPunk . Official ownership of each work is outlined, in code described by one fan as elegant and beautifully written, in a contract on the publicly accessible Ethereum blockchain. The record, as Larva Labs explained to Christie's, 'is incorruptible and promises to be extraordinarily long-lived.' The ownership history of every artwork is tracked and documented in the blockchain, too The system Hall and Watkinson came up with is sometimes compared to owning a work of physical art that's permanently on loan to a public museum. It also inspired the now widely accepted ERC-721 standard for NFTs, laying the groundwork for today's NFT market.[49]

To be expected, some CryptoPunks are rarer than others. In an homage to popular culture archetypes, by tweaking software algorithms, Hall and Watkinson created both human CryptoPunks and "a scarcer number of fantastical, non-human works, adding 88 green-skinned zombie Punks, 24 hirsute ape Punks and nine light-blue-skinned alien Punks to the series. Like their human counterparts, the non-human Punks have different combinations of accessories: one alien is smoking a pipe…and has been dubbed the 'wise alien'."[50] Christie's writes:

[48] *Id.*
[49] *Id.*
[50] *Id.*

> CryptoPunk 635, one of only nine alien Punks and the only one with a sub-1,000 series number, is the highlight of the nine works featured in Larva Labs' single lot offered…11 May at Christie's in New York. 'The core of the idea was that every character should be unique,' says Larva Labs. 'The advantage of generative art is that the process, once set in motion, can produce results that are even surprising to us. We ran the generator hundreds of times, reviewed the results, and made adjustments. Then, with little fanfare, we ran it one last time, linked it to the Ethereum smart contract that we deployed, after which the CryptoPunks were completely set in stone.' The collection of 10,000 Cryptopunks is definitive and unalterable. In accordance with the nature of blockchain, once the project went live, Larva Labs couldn't alter the existing series, even if they wanted to. 'It's odd to think of what might have been different if we had run the generator just one more time, or used the penultimate run's output.' The creators regard each work as individual pieces of generative art, while allowing that the entire project itself might be thought of as a larger conceptual piece. 'It's possibly the first work of art with a self-contained mechanism for recording and transacting its ownership.' CryptoPunks inspired a community of collectors and connoisseurs. Once minted, Hall and Watkinson offered the CryptoPunks for free, not forgetting to claim 1,000 for themselves, 'just in case it becomes a thing,' as Hall put it. At first, there was very little interest. 'We were starting to think, ah no, this doesn't really have it,' Watkinson has recalled. But before too long, Punks were selling for thousands of dollars. 'For fans of collectibles, it's clearly a version of trading cards or something similar. However, generative art fans see it as an interesting example in that category. We like that its perception is flexible and brings together several of these worlds into a single project'…[51]

Christie's describes The CryptoPunks market as "extremely active," observing that "As of early April 2021, over 8,000 sales had been recorded in the previous 12 months, with an average sale price of 15.45 ether ($30,412.40). The total value of all sales is 127,360 ether ($251,620,000) — and that value grows daily."[52] Noteworthy other sales include, "In February, CryptoPunk 6965, a fedora-wearing ape Punk, sold for 800 ether — equivalent to $1.5 million… on 11 March 2021, CryptoPunk 7804, the previously mentioned pipe-smoking 'wise alien,' was sold for the equivalent of $7.5 million — the highest amount ever paid for a Punk at the time."[53] Exhibit 3 depicts the CyberPunk work:

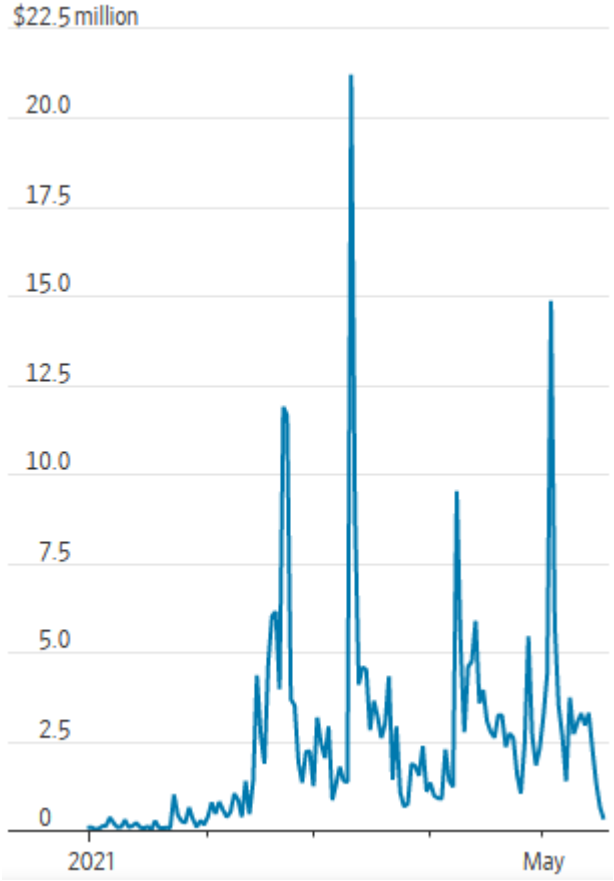
[51] *Id.*
[52] *Id.*
[53] *Id.*

Exhibit 3
CyberPunk work[54]

According to *The Wall Street Journal* Sarah Meyohas's art "places her at the vanguard of this art-world revolution. She will be relaunching an early project, Bitchcoin, on the Ethereum network, with a public presale at Phillips auction house on May 25 [2021]. Her 2015 project sold tokens entitling investors to portions of her photographic prints."[55] Ms. Meyohas reports, "The new Bitchcoins will be backed by flower petals from a previous work called 'Cloud of Petals… many of the artists who have been doing well financially tend to release 'drops' of hundreds of the same image."[56]

[54] *Id.*
[55] Bourree Lam, *Finance Meets Crypto Art,* Wall St. J., May 24, 2021 at B7.
[56] *Id.*

Exhibit 4
Total Amount Spent on CyberPunks Daily.[57]



In retrospect, "Bitchcoin functioned as a sort of proto-NFT, and the boom in digital tokens has brought a niche of tech-focused artists into the mainstream… Ms. Meyohas revived Bitchcoin to mark her place in the NFT boom."[58] According to proponents, "NFTs empower artists to sell their own work online, by-passing traditional auction houses… solv[ing] a key problem in the digital age: how to verify the authenticity of an infinitely replicable artifact that exists as computer code."[59] *The Wall Street Journal* writes, "Sales of CryptoPunks - early NFTs of pixilated digital images of humans, aliens and other creatures - peaked in mid-March at

[57] *See 10 things to know supra* note 44.
[58] Bourree Lam, *supra* note 55.
[59] *Id.*

about $21 million in one day, according to data-tracking site NonFungible.com."[60] Exhibit 4 illustrates total daily spending on CyberPunks.[61]

Between May 25 and June 3, 2021, Christie's hosted a collaboration with media landscape influential voice Lady PheOnix to present an expertly curated online, "sale of both legacy and newly created artwork as unique NFTs. The online auction, PROOF OF SOVEREIGNTY… brings together more than 20 new media artists utilizing blockchain technology, but also employs metadata, storage and legal standards that have been virtually absent from millions of artworks associated with [NFTs]."[62] Featured as "Leading the auction is a historic NFT from the estate of Nam June Paik - considered the grandfather of video art – that both memorializes and revitalizes the artist's seminal work, Global Groove, originally aired on WNET-Chanel 13 in 1974."[63] The point here is that "NFT technology is repurposing and giving strength to a digital art movement that has been building strength for fifty years, supporting the hypothesis that NFT art markets stand independently from cryptocurrency.[64] Christie's states:

> Paik's famous piece heralds the age of global connectivity through a hypnotic visual and sonic rhythm - creating an endless loop of ecstatically groovy energy. The subsequent works, introduced by Lady PheOnix, highlight a diverse selection of new media artists, whose collective practice spans more than 20 years. Marguerite deCourcelle, also known as 'Coin Artist', creates visually compelling puzzles coded directly into the Polygon blockchain. Joshua Davis, known as 'Praystation', has created colorful, generative, audio reactive artwork. Claudia Hart implements the still life motif, inverting Matisse and Picasso references into a stimulated, uncanny composition. Lethabo Huma of Pretoria, South Africa, captures the warmth of human connection through soft color and vulnerability. Internationally renowned artist KESH creates an intimate dialogue between experimental music, photography, film, fashion and sculpture. Pioneering new media artist Tamiko Thiel will be minting her work on a proof-of-stake blockchain to retain the values of her environmentally conscious art practice.

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[60] *See 10 things to know, supra* note 44.
[61] *Id.*
[62] *See* Christie's Presents *supra* note 42.
[63] *Id.*
[64] E-mail from Joshua A.T. Fairfield, William Donald Bain Family Professor of Law at Washington and Lee School of Law (Aug. 3, 2021, 11:09 CST) (on file with author).

> While most of these names may be new to the traditional blue-chip collectors, Jenny Holzer, Urs Fischer and Gerald Laing Estate will also offer works, recognizing the importance of the emergent NFT market. Ultimately, PROOF OF SOVEREIGNTY is at once a celebration of both 20th and 21st century digital works and new media artists, providing a tantalizing glimpse of the future of art itself.[65]

Nifty Gateway

Twins Griffin and Duncan Cock Foster "started Nifty Gateway to mainstream what had been a highly technical subculture by, among other things, allowing civilians to buy nifties (on the Nifty Gateway website) with credit cards."[66] During 2019 they sold the less-than-a-year-old company to another set of twins, the Winklevosses (of Facebook start-up fame). Now, the Winklevoss-led company called Gemini has big plans for Nifties:

> The brothers' stated mission is to have 1 billion people collecting them. They talk about how nifties could one day be paired with physical assets, so you could use a digital token to prove your ownership of say, real estate. But in these early days, the use cases can seem generationally exclusionary. The first nifty to go viral was *CryptoKitties*, a game featuring a digital feline you can collect and breed. A single CryptoKitty has sold for a record $170,000, and venture capitalists including Union Square Ventures and Andressen Horowitz have put money into the company behind the game. '*CryptoKitties* was the thing that got my attention,' Duncan said. 'The amount of money people were spending on CryptoKitties was remarkable.'[67]

More recently, journalist Benjamin Wallace writes that Nifty Gateway 2.0 provides "a marketplace to buy and sell nifties along with several nifties by noted artists with whom they've partnered. The brothers sketch a vision of a fully niftified world: 'We want Supreme making nifties,' Duncan said. 'We want some CryptoPunks in the permanent collection of MoMA.'"[68]

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[65] *Id.*
[66] Benjamin Wallace, *The Twin Blockchain Entrepreneurs Who Dream of 'Digital Air Jordans' Forecasting the Future of Art Collecting With Duncan and Griffin Cock Foster*, NY Mag. (Mar. 4, 2020)
[67] *Id.*
[68] *Id.*

Impact of Bitcoin Price Volatility

During May 2021 China's ban on financial service crypto services, along with Elon Musk's comments about massive energy consumption from the process of mining Bitcoin resulted in a massive several-day decline in the value of Bitcoin, resulting in greater uncertainty about "the nascent use of Ethereum to buy digital artworks as non-fungible tokens."[69] Only now, "Compounding the battering by China's move, Ethereum has been forced into remodeling its underlying infrastructure to slash carbon emissions by a hundredfold. Proof-of-work cryptocurrencies have been widely condemned for being obscenely harmful to the environment, because each transaction or recording of an artwork requires massive computing power."[70]

The Wall Street Journal reports, "China's efforts to restrain cryptocurrency trading and mining are adding to the wild moves in bitcoin and other markets. Already down hard... bitcoin and other digital currencies sold off sharply last week after Chinese authorities reviewed pressure on the country's banks and payment companies to curb cryptocurrency-related transactions."[71] The impact was swift and severe:

> Markets stumbled again after a powerful super regulator chaired by Vive Premier Liu He pledged to crack down on bitcoin mining and trading… China is trying to rein in cryptocurrency activities even as the country has embraced the technology underlying bitcoin and has plans to roll out its own digital yuan that will be controlled by its central bank. Beijing also wants to shut down cryptocurrency-mining activities because they consume massive amounts of electricity, often from coal-fired power plants, while the country pledged to manage its carbon emissions. 'The Chinese government does not like the highly volatile, speculative nature of the cryptocurrency market,' said Fan Long, a co-founder of Conflux, a government-backed public blockchain network in China. He said the authorities could take further action to restrict or eliminate ways for Chinese citizens to exchange yuan into cryptocurrencies in the over-the-counter market.

[69] Natasha Gural, *How The Cryptocurrency Crash Could Impact NFT Art Sales With Ethereum*, Forbes, May 19, 2021, https://www.christies.com/features/10-things-to-know-about-CryptoPunks-11569-1.aspx (last viewed May 30, 2021).
[70] *Id.*
[71] Elaine Yu, Chong Koh Ping, *China Curbs on Bitcoin Add Volatility*, Wall St. J., May 25, 2021 at B1.

> [On May 23, 2021], Huobi, a major cryptocurrency exchange, said it would stop selling mining machines and related services to new users in mainland China. It will also suspend futures contracts, exchange-traded products and leveraged investment products to new users in a few countries and regions. OKEx, another popular digital-currency exchange, on Monday said its own token, OKB, can no longer be traded with the Chinese yuan.[72]

With a population of 1.41 billion and important global economy and trading-partner to other countries, Chinese policy regarding cryptocurrencies and NFTs is important. *The Wall Street Journal* reports, "Crypto-related activities have posed two serious issues in China,' namely financial stability and energy consumption, said Shen Wenhao, a Beijing based partner at JunZeJun Law Offices."[73] However, "Cracking down on Chinese bitcoin miners won't affect the supply of bitcoin - as cracking down on miners of, say, metals might affect... the price of metals… because the bitcoin algorithm releases new bitcoins to miners at a predetermined rate, regardless of how many miners are competing for them."[74] In addition:

> Cryptocurrency exchanges that operate offshore can be accessed by people in China by using virtual private networks that help them bypass the country's internet restrictions. Some of the exchanges have been facilitating bitcoin and other digital currency trades with China's domestic currency, the yuan. Such transactions typically take place over the counter in what is known as the peer-to-peer market. They have proved challenging for Chinese regulators, banks and payment companies to track and curb, because they involve direct fund transfers between individuals….
>
> As far back as 2013, a consortium of Chinese government agencies and regulators issued warnings about the anonymity, borderless and unregulated nature of bitcoin and told domestic financial and payment institutions not to carry out bitcoin-related activities. The authorities said they wanted to protect the legal currency status of the yuan, prevent money laundering and maintain financial stability.[75]

[72] *Id.*
[73] *Id.*
[74] *Id.*
[75] *Id.*

NFTs and Energy Consumption

In their compelling article about NFT energy consumption, WIRED magazine reports, "Two years ago, Joanie Lemercier, a French artist known for his perception-bending light sculptures, took on a new role as climate activist. He attended protests against coal mining... and began a campaign demanding Autodesk stop selling its design software to fossil fuel operations."[76] Artist Lemercier "also took a closer look at his own energy use, which included a hefty heating bill for his studio in Brussels, electricity for the high-end computers to render his creations, and dozens of flights each year to exhibitions around the world."[77] And:

> Then, a few months ago, in the course of a few minutes, his progress was erased. The culprit was Lemercier's first blockchain 'drop.' The event involved the sale of six… NFTs, which took the form of short videos inspired by the concept of platonic solids. In the clips, dark metallic polyhedrons rotate on loop and glisten - a reference to Lemercier's installations in the physical world. The works were placed on a website called Nifty Gateway, where they sold out in 10 seconds for thousands of dollars. The sale also consumed 8.7 megawatt-hours of energy, as he later learned from a website called cryptoartWTF. That figure was equivalent to two years of energy use in Lemercier's studio. Since then, the art has been resold, requiring another year's worth of energy. The tally was still climbing. The problem, as Lemercier saw it, went well beyond himself. His fellow artists were becoming millionaires overnight as the cryptoart world exploded. But so was their role in admitting carbon. Artists didn't seem to understand the scope of this problem - Lemercier himself hadn't - and the platforms making the sales didn't seem interested in clarifying.[78]

Eden Fine Art Gallery

A particularly thoughtful and informative source of NFT information, Eden Gallery writes, "Crypto art can take many forms, from digital graphics to music, VR dreamscapes, or programmable art. These digital assets can have a collector's value and can represent items,

[76] Gregory Barber, *NFTs Are Hot. So Is Their Effect on the Earth's Climate,* Wired (Mar. 6, 2021), https://www.wired.com/story/nfts-hot-effect-earth-climate/ (last viewed May 25, 2021).
[77] *Id.*
[78] *Id.*

including still graphic images, photography, GIFs, videos, music, and much more."[79] In sum, "The crypto art concept revolves around the idea of digital scarcity… you treat digital art like physical goods and buy, sell, trade and collect it. Like traditional art, crypto art exists in limited quantities, and in some cases, buyers can purchase the rights to partial royalties and reproduction..."[80]

While discussing the art of Alec Monopoly, Eden Fine Art Gallery observes that his works, "draws the viewer in with its vibrant color schemes and iconic characters, that he uses to portray the lifestyles of the rich and famous. Apropos to the Miami scene Monopoly sets his painted characters atop yachts, flying helicopters, or coming out of the bank with overflowing bags of money."[81] Exhibit 5 displays one of the works by the artist known as Alec Monopoly.[82] Further:

> Alec Monopoly entertains his audience with his brightly colored embodiments of the wealthy one percent in his graffiti-styled art. Represented by the 'Monopoly Gang,' embodying the wealthy elite, epitomize the lifestyle of the rich and famous. As detached from our own world as they may be, these characters still remain relatable as they are the ones that we grew up watching on television and read about in our comic strips. Richie Rich, the world's richest kid, Scrooge McDuck, a duck that enjoys swimming in his fortune, and everyone's favorite family, The Simpsons, are some of Monopoly's favorite characters to illustrate the story of luxury living.[83]

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[79] *Monop$ in Miami*, Eden Gallery, *Monop$ in Miami*, (Nov. 28, 2019), https://www.eden-gallery.com/news/monops-in-miami/ (last viewed May 25, 2021).
[80] *Id.*
[81] *Id.*
[82] *Id.*
[83] *Contemporary Comics: How American Comic Art Stays Relevant in 2020,* Eden Gallery (Apr. 20, 2020), https://www.eden-gallery.com/news/contemporary-comics-how-american-comic-art-stays-relevant-in-2020/ (last viewed May 25, 2021).

Exhibit 5
Work by Alec Monopoly[84]

Eden Gallery writes, "It can be difficult to wrap your head around the idea of buying digital art that can be copied. You can certainly copy a digital file, including art sold with an NFT. In some cases, the owner can buy the rights to reproduction, although artists usually retain this."[85] While the original version of any artwork can only have one owner, "An NFT grants… ownership of the work, but it can be copied with permission or illegally. This is not actually that different from the reproductions we see all the time of traditional artwork. Just as the Mona Lisa

[84] *Monop$ in Miami*, *supra* note 79.
[85] *What is Crypto Art and How Does It Work?*,Eden Gallery, (May 19, 2021), https://www.eden-gallery.com/news/what-is-crypto-art/ (last viewed Aug. 27, 2021).

has been reproduced countless times in print and digital…"[86] Regarding crypto art platforms, "With no less than 20+ individual marketplaces available on Ethereum, it is currently the most extensive network for crypto art."[87] Consider:

> Each marketplace on Ethereum caters to its own specific artistic style, so you can find something that suits your niche or style. Some marketplaces like Raible and Mintable offer a complete range of digital art. Others like Ephemera cater mainly to photographers. The digital art marketplace is a constantly changing world, with new entries popping up almost weekly. Most, but not all, crypto art marketplaces require a portfolio review to gain entry. The ones who do are quite obvious upon inspection of the site. So, make sure you are working with the most reputable and focused marketplace for each artistic medium.
>
> Sites like the aforementioned Raible, Mintable, and Ephemera are older and more established in the crypto marketplace world, so they are highly regarded. But don't let that stop you from searching out other marketplaces like… ArtOlin; Crypto.com NFT; Ethereum; EOSIO; Flow; Hive; Near; Phantasm; Tezos; Waves; Zilliqa; [and] VeChain Thor. It's always a good idea to look around and do some research before making a big purchase or investment. Just as you would when buying art from galleries, do your due diligence before purchasing an artwork, be it analog or digital!... Just as they day about classical artwork, you may not know much about crypto art, but you know what you like. There are many different genres of crypto art available, so if you go looking, you're likely to find something that suits your taste. If you like the work of a digital crypto artist, then crypto art could be a good investment.[88]

Crypto Art in Sports

Worldwide, in just a short period of time NFTs have become wildly popular and a significant revenue source for sports teams.[89] In just one recent example, journalist Patrick Murray writes, "The Golden State Warriors today launched a new NFT… collection, becoming the first team in U.S. professional sports to release their own officially licensed NFTs."[90] Forbes reports:

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[86] *Id.*
[87] *Id.*
[88] *Id.*
[89] Patrick Murray, *Golden State Warriors Launch NFT Collection, Becoming First U.S. Sports Team to Release Own NFTs,* Forbes (Apr. 27, 2021), https://www.forbes.com/sites/patrickmurray/2021/04/27/golden-state-warriors-launch-nft-collection-become-1st-sports-team-to-create-own-nfts/?sh=626a00921d94 (last viewed May 25, 2021).
[90] *Id.*

> NFTs have exploded onto the scene over the past few months, and nowhere has that explosion been more visible than on NBA Top Shot, the marketplace where basketball fans and collectors can buy, sell and trade NFTs… NBA Top Shot alone was responsible for a third of the $1.5 billion NFT trading volume seen in the first quarter.
>
> So what's the appeal of NFTs, and why have they emerged so suddenly? 'If you compare a basketball card to a Top Shot moment, you start to realize why people like NFT's'. Schneider, a long-time baseball business executive, explained. 'Baseball cards - you have to send them somewhere to get graded, that takes six months to a year, you've got to store them somewhere, then you've got to figure out where to sell them. You don't know how many of them are created, you don't know what the card has sold for before, who's owned it. Then compare that to an NFT, or in this case, NBA Top Shot moment. You know everyone that's owned it and what price it sold for, storing it is obviously not an issue at all. You don't have to worry about getting anything graded. There's full transparency…
>
> As for the warriors jumping in first, Schneider believes that there is real value in the legitimacy of something created by an NBA franchise in a marketplace where anyone can create and sell an NFT. Then there's the product itself. 'There is a lot more you can do with an NFT than a static sports card,' Schneider added.[91]

The global sports market for NFTs is well represented by the world's most popular sport, football (known as soccer in the United States). To better understand the relationship between avid soccer sport-fans and the market for NFTs, we offer the following courtesy of Coinbase. For background, consider the following event taking place on the evening of December 5, 2020: "in a soccer stadium just north of Moscow, a football club called Spartak, of the Russian Premier League, played FC Tambov. It was a cold night. The few fans in attendance, bundled in heavy jackets, cheered as the home team routed Tambov 5-1."[92] In brief, "The hero of the match was Ezequiel Ponce, a 24-year-old Spaniard who scored two goals. It was a forgettable game. Most

[91] *Id.*

[92] *See* Jeff Wilser, *In Europe, Football NFTs and Tokens Are No Fantasy*, Coindesk.com (Apr. 6, 2021), https://www.coindesk.com/europe-football-nfts-tokens-fantasy-socios-sorare (last viewed May 26, 2021).

of the world ignored this random match, one of hundreds played around the globe every day."[93]

Here is where the example of connection to NFTs takes place. We learn that:

> Grant Anderson, an IT business analyst who lives in Edinburgh… tracked the match on his phone. He followed the score obsessively. Anderson owned a non-fungible token card pegged to Ezequiel Ponce, and this NFT card, from the blockchain project called Sorare, is not just a collectible. It's a radically new way to play fantasy football, with the word 'football,' of course, meeting what it does basically everywhere on the planet besides the U.S. With Sorare, you create fantasy football (soccer) lineups using NFT cards that you actually own. When the players score on the field, you win real money. The match in Russia notched Anderson a prize of 0.25 ETH (now worth about $500) and additional NFTs - more playing cards - now worth over $2,000. Sorare doles out these prizes *constantly*. 'I saw the potential right away,' says Anderson. 'This is fun and engaging, and I can win NFTs and [ETH] using my passing for football and sports.' Anderson is part of a rabid group of soccer fans (120,000 active monthly users) obsessing over Sorare - an addictive blend of fantasy football, collecting and the wheeling and dealing of crypto trading. He loves it so much he started The Sorare Podcast, where guests join him to geek out over strategy.[94]

In another example we learn, "With traditional NFL fantasy football, you plunk down some money at the beginning of the year and then you hope to win a small weekly purse or a bigger payout in the playoffs."[95] Of the niche crypto sports platforms, "Sorare and Socios are both blockchain project involving soccer [and are] 'crossover' use cases, bringing non-crypto people into the world of blockchain… Blue-chip teams like Manchester City, AC Milan and Juventus now use Socios tokens as a way to engage their fans."[96] In terms of rapid growth, "Nonfungible.com ranks Sorare as the third-most active NFT project, trailing only CryptoPunks and SuperRare. Twenty thousand soccer fans played it in February and this exploded to 120,000 in March. When Sorare launched in January 2020, it had $70,000 in trading volume. [During March, 2021] it topped $27 million."[97]

[93] *Id.*
[94] *Id.*
[95] *Id.*
[96] *Id.*
[97] *Id.*

Topps Ventures Into NFTs

The Topps Company announced on April 12, 2021 "the release of 2021 Topps Series 1 Baseball NFT… collectibles, ushering in a new era of baseball card collecting in partnership with Major League Baseball and MLB Players, Inc."[98] Topps says, "Launching Tuesday, April 20… Topps will build on its legacy as an innovator of digital collectibles by releasing its flagship yearly baseball card collection for the first time as NFTs."[99] Evan Kaplan, the Managing Director of MLB Players, Inc. states, "As collectibles enjoy a breakout moment with NFTs and blockchain technology, we can't think of a better way to honor the legendary players from years past… today's stars and breakout rookies… offer[ing] a new innovative way for today's collectors and fans to connect with their favorite stars."[100]

Topps describes itself as "a global consumer products company that entertains… consumers through a diversified, engaging, multi-platform product portfolio that includes physical and digital collectibles, trading cards, trading card games, sticker and album collections, memorabilia, curated experiential events, gift cards and novelty confections."[101] Evolving from a family-owned Brooklyn, New York-based chewing gum company founded in 1938, Topps is now "a global sports and entertainment, digital/media and confections company."[102] Topps discloses that during fiscal year 2020 that it:

> generated $566.6 million in net sales, $83.7 million in net income and $101.0 million in Adjusted EBITDA… Our focus on product and platform innovation has fueled expansion of our digital businesses which has driven

[98] Topps Debuts its First MLB Baseball Card NFT Collection With Topps Series 1 Baseball Launch, TOPPS NEWS (Apr. 12, 2021), https://www.topps.com/blog/topps-debuts-its-first-mlb-baseball-card-nft-collection-with-topps-series-1-baseball-launch-.html (last viewed Aug. 27, 2021).
[99] *Id.*
[100] *Id.*
[101] Mudrick Capital Acquisition Corporation II, Proxy Statement on Schedule 14A, filed May 12, 2021, 167, https://www.sec.gov/Archives/edgar/data/1820727/000119312521160680/d161477dprer14a.htm#rom161477_20. (last viewed Aug. 27, 2021).
[102] *Id.*

> significant margin expansion alongside strong revenue growth. Our net sales, net income and Adjusted EBITDA in fiscal year 2020 reflect compound annual growth rates of 11.9%, 491.9% and 60.3%, respectively, since 2018…Our Sports & Entertainment segment produces products in the form of physical and digital collectibles including trading cards, trading card games and sticker and album collections and curated experiential events featuring sports and entertainment personalities, as well as manages the gift card programs for widely recognized global digital companies… including a 70-year relationship with Major League Baseball ("MLB"), a 43-year relationship with Lucasfilm for Star Wars (The Walt Disney Company), a 15-year relationship with World Wrestling Entertainment, a 12-year relationship with the German Bundesliga ("Bundesliga"), a 7-year relationship with Major League Soccer, a 6-year relationship with UEFA Champions League and a 4-year relationship with the National Hockey League. Most recently, we added Formula 1 and other UEFA tournaments.
>
> In addition to mobile digital applications, we are focused on developing digital collectibles that utilize blockchain technology and successfully released several products in 2020 with more planned in the near-term… Our Sports & Entertainment segment generated $368.2 million in net sales and $88.4 million in Adjusted EBITDA (an Adjusted EBITDA margin of 24.0%) for fiscal year 2020. Fiscal year 2020 net sales and Adjusted EBITDA reflect compound annual growth rates of 28.0% and 122.7%, respectively, since Fiscal year 2018.[103]

Topps describes its new technology (NFT) business model as "undergoing significant innovation and continued transition to utilize various digital ecosystems. In addition to mobile digital applications, we are focused on developing digital collectibles that utilize blockchain technology and non-fungible tokens ("NFT"), and we successfully released several products in 2020, with more planned in the near-term."[104] According, Topps, "successfully released Garbage Pail Kids collections using a blockchain platform in 2020, and… see further opportunity to expand into other properties with this and other digital platforms that protect the authenticity of our consumers' digital product purchases while providing… incremental net sales generated through… [asset] secondary trading."[105] Topps warns:

[103] *Id*. at 168.
[104] *Id*. at 56.
[105] *Id*. *See also* Neal F. Newman & Lawrence J. Trautman, *Special Purpose Acquisition Companies (SPACs) and the SEC*, (unpub. ms.)

> There are significant uncertainties with respect to our blockchain and NFT expansion. The technologies supporting blockchain and NFTs are new and rapidly evolving. To the extent these technologies become more widely utilized in the industry, revenues from our mobile digital applications could be negatively impacted. If we fail to explore these new technologies and apply them innovatively to keep our products and services competitive, we may not experience significant growth of our business. Our business may also be adversely impacted if our competitors obtain competing or additional blockchain rights that make our products less desirable. In addition, we may be required to pay significant fees to obtain certain blockchain rights, which may prevent us from profiting from the monetization of these rights. Furthermore, the regulatory environment surrounding these digital technologies is evolving and any unfavorable developments may adversely affect our business. As blockchain and NFT technologies become more widely available, we expect the services and products associated with them to evolve. As a result, to stay current with the industry, our business model may need to evolve as well. While we have devoted significant resources to the utilization of blockchain and NFTs, we may not be able to realize our expected long-term goals. Furthermore, we do not have blockchain rights for all of our licenses, and there is no guarantee that we will be able to obtain blockchain rights for these licenses or additional licenses that we enter into in the future. As a result, our business, financial condition and results of operations may be adversely affected.[106]

II. EVOLUTION OF THE VIRTUAL WORLD

Part I explored the digital art market and showed how demand for digital art emerged prior to blockchain technologies. It also showed how artists, auction houses, and platforms developed blockchain technology to create a value ecosystem distinct from fungible cryptocurrencies, using blockchain technologies to innovate new forms of art and new methods of selling and collecting art.

This Part comes at the problem from a different direction. It shows that just as digital art predated blockchain, so did demand for unique digital assets. A developed literature of digital property, particularly concerning ownership of virtual property in online games and virtual worlds, shows that demand for true ownership of digital assets was both strong and constrained by the inability of online property systems to transcend centralized databases: the owner of a

[106] Mudrick Capital, *supra* note 101 at 56.

valuable virtual asset cannot transport it out of the game for which it was created. Thus, this Part concerns the development of demand for online assets, which tilled the field for NFTs. It shows the components that go into creating value in digital assets and demonstrate how NFT technology energized this demand by solving some key problems of digital ownership.

To understand the components that go into the value of an NFT -- technological and social -- we look back to the virtual environments in which markets for fully digital personal property first evolved. We propose that value in digital art and collectible objects stems from two components: a combination of digital uniqueness and a socially engaged audience to admire and value the collector's action. After all, a digital asset isn't worth much if anyone can have a copy at the click of a button, nor is it worth anything if nobody knows or cares if you have it.

As we will discuss below, the technology to make digital objects truly decentralized, unique, and rivalrous simply did not exist at the beginning of the internet. But there were approximations: imagine, for example, a game creator who kept a database list of who owns what in the game. If one player had a special or unique item -- or, in non-game virtual worlds, had a unique piece of digital property -- the scarcity of the item was created by the fact that no-one, no player, can unilaterally add more of that item to their account. Virtual worlds and online games created early testing grounds for the creation of markets in unique items and non-fungible tokens, with sales regularly reaching into the tens of thousands of dollars nearly two decades ago. The fact that the game creator kept a database assigning items to accounts created an approximation of the digital scarcity and rivalrousness that the world needed.

Virtual worlds also created the second half of value: sociality. Virtual worlds provided a ready-made audience. If one player earns a particularly coveted item, avatar, or digital clothing, there existed a ready-made audience, a group of people invested in the collector's digital

possession. Showing off is the root of value. Thus, closed environments like virtual worlds were the birthplace of emergent markets for fully digital assets. They were one of the places where digital collecting first took off, because the world creator could create scarcity through a centralized database, and there was an audience that was invested in the assets and admired those who were able to collect them.

It is for this reason that we turn here briefly to the history and characteristics of virtual worlds. As we will see in the following section, blockchain technology decentralized databases, letting people take assets from one environment to another. An original problem with virtual worlds was that you could not take Excalibur with you when you left! That changed with decentralized databases.

Yet the need for a *context* and *an audience* never changed. NFT investors build virtual spaces to display their digital artworks. NFT collecting sites are communities: their technological affordances are aimed as much at making collections visible as they are at enabling collection. And so the characteristics we discuss below are now emerging yet again in new form as NFT art collectors seek to display their collections to admiring audiences, maintain the social value of the activity of collecting, and confirm the value of the collector's individual actions and collection.

Virtual worlds are powerful engines for online value because they present a strong context and invested community. Virtual worlds are "graphically-rich, three-dimensional (3D), electronic environments where members assume an embodied persona (i.e., avatars) and engage in socializing, competitive quests, and economic transactions with globally distributed others."[107] Such worlds have millions of users interacting 24 hours a day 365 days a year.[108]

[107] Ulrike Schultze, Starr Roxanne Hiltz, Bonnie Nardi, Julie Rennecker & Susan Stucky, *Using Synthetic Worlds for Work and Learning*, 22 Communications of the Association for Information Systems 351 (2008).

They are "immersive, simulated, persistent, and dynamic environments that include rich graphical three dimensional spaces, high fidelity audio, motion, viewpoint, and interactivity."[109] A panel of information systems professionals observe, "The term Virtual Worlds describes online immersive 'game like' environments where participants engage in socialization, entertainment, education, and commerce. As a genre, these environments are classified as massively multiplayer online (i.e, MMO) virtual environments."[110]

Genesis of Virtual Worlds

Debuting in 1985, *Habitat* is acknowledged as an early example of a virtual environment, using:

> Two-dimensional graphics to represent spaces such as home, hotel and arcade, where cartoon-style characters controlled by users could talk and interact. The landscape was scattered with vending machines from which users could purchase virtual items ranging from weapons to furniture. Purchases were paid with a currency called Tokens, which was distributed to the users for free. The most desirable items were spare heads that could be used to customize one's character.[111]

Edward Castronova reports that while virtual worlds "can trace their history back to on-line games on the ARPA-net in the 1980s, the game that started the recent explosion of VWs was Meridian 59, or M59, begun in 1995 by Andrew and Chris Kirmse, two Microsoft interns."[112] Making its debut during October 1996, M59 survived almost four years, "when competitive

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[108] Mark W. Bell, Edward Castronova & Gert G. Wagner, *Surveying the Virtual World: A Large Scale Survey in Second Life Using the Virtual Data Collection Interface (VDCI),* 7 (June 12, 2009), http://ssrn.com/abstract=1418562.

[109] Ulrike Schultze & Wanda J. Orlikowski, *Virtual Worlds: A Performance Perspective on Globally Distributed, Immersive Work,* 21 Information Systems Research 810 (2010).

[110] Brian Mennecke, Edward M. Roche, David A. Bray, Benn Konsynski, John Lester, Michael Rowe & Anthony M. Townsend, Second Life and Other Virtual Worlds: A Roadmap for Research, 28th International Conference on Information Systems (ICIS) (Dec. 11, 2007), https://ssrn.com/abstract=1021441.

[111] Vili Lehdonvirta, Terhi-Anna Wilska & Mikael Johnson, *Virtual Consumerism: Case Habbo Hotel,* 12 Information, Communications & Society 1059, 1060 (2009), *citing* J. Dibbell, *My Tiny Life: Crime and Passion in a Virtual World,* New York: Henry Holt 172 (1998).

[112] Edward Castronova, Virtual *Worlds: A First-Hand Account of Market and Society on the Cyberian Frontier* (December 2001). CESifo Working Paper Series No. 618. 6 http://ssrn.com/abstract=294828.

pressure from much larger [virtual worlds] forced its closure."[113] The first of these much larger virtual worlds was *Ultima Online* (owned by Electronic Arts), and launched during Fall 1997; *EverQuest* launched in Spring 1999; and *The Sims Online* (the first virtual world not based on killing and adventuring) became a major title and became available during 2002.[114]

In these early environments, one of the game activities was buying and selling, winning, collecting, and obtaining. This was called 'consumption play': markets as simulation. But it was very little time until this kind of consumption play formed the core of real markets fueled by real money.[115] Of course it did: what humans value, they are willing to pay for:

> In so-called massively-multiplayer online role-playing games ("MMORPGs") launched in the late 1990s, consumption play began to be mixed up with real money. In *Ultima Online* and *EverQuest,* hundreds of thousands of players 'traded' with other players to exchange game assets accumulated during months of play for other game assets. As with the previous systems, the economy was intended to be like *Monopoly*: no real money would change hands. But in 1999, some players put their game assets on auction at eBay. Perhaps surprisingly, they received bids from other players. When an auction was completed, payment was carried out using ordinary means such as cheque or money order. The two players then met up in the game and the seller handed the auctioned object to the buyer. This way, an exchange value measured in US dollars could soon be observed for virtual goods ranging from castles to gold nuggets. In 2002, a massively multiplayer online version was created of *The Sims,* and real-money trading followed.[116]

Virtual World Characteristics

An excellent tour guide to a *virtual world* is provided by Edward Castronova in his hugely influential seminal article titled *Virtual Worlds: A First-Hand Account of Market and Society on the Cyberian Frontier.*[117] Accordingly:

> To enter a VW, the user is first connected to the server via the Internet. Once the connection is established, the user enters a program that allows them to choose an

[113] *Id.*
[114] *Id.* at 8.
[115] Vili Lehdonvirta, et. al., *supra* note 111.
[116] *Id.*
[117] *See* Castronova, *supra* note 112.

> avatar for themselves. In all of the major VWs, one can spend an extraordinarily long time at this first stage, choosing the appearance of the avatar as well as its abilities. Always wondered what it is like to be tall? Choose a tall avatar. Want to be one of the smart people in society? Make your avatar a brilliant wizard. Need to get out your aggressions? Give your avatar immense strength and a high skill in wielding a mace. Think it would be fun to be a beautiful dark-skinned woman? Go for it. These choices occur under a budget constraint that ensures equality of opportunity in the world: Your mace-wielding ogre will be dumb, and your brilliant wizard will have a glass jaw. At the same time, the budget constraint ensures equality among avatars along dimensions that most people think should not matter for social achievement. In particular, male and female avatars have the same initial budget of skills and attributes. Avatars whose physical characteristics (i.e. skin tone, size) are associated with any benefit in the game must accept some compensating disadvantage. Any inequality in the VW can only be due to one of two things: (a) a person's choices when creating the avatar, or (b) their subsequent actions in the *[virtual world]*.
>
> Once the avatar is created, it is deposited some place in the *virtual world.* Because most of the laws of Earth science apply, most of the time, it is quite easy to 'become' the avatar as you perceive the world through its eyes. You cannot run through walls; you can only see where you are looking…. If you jump off a roof, you will fall and hurt yourself. When the sun goes down, it gets darker and you will need a light. If you do something over and over, you will get better at it. You can give things to another avatar if you wish…. You can kill them if you wish. And they can kill you.
>
> Of course the natural laws of Earth need not apply in a world that exists entirely as software, and much of what defines an avatar's uniqueness is its ability to bend or break some of these laws and not others. Depending on the skills chosen, an avatar might be able to fly, see for miles, hypnotize, heal wounds, teleport themselves, or shoot great flaming fireballs at other avatar's heads. Again a budget constraint applies: those who can heal or hypnotize often have difficulty summoning a fireball worthy of mention. As a result, avatars come to view themselves as specialized agents, much as workers in a developed economy do. The avatar's skills will determine whether the avatar will be a demander or supplier of various goods and services in the VW. Each avatar develops a social role.[118]

As an example of some of the ways in which the *virtual world* community is far different from just an electronic extension of the *real world*, consider Piotr Czerski's 'We, the web kids' manifesto, as it appears on You Tube:

> The Internet to us is not something external to reality but a part of it: an invisible yet consistently present layer intertwined with the physical environment. We do

[118] *Id.*

> not use the Internet, we live on the Internet and on it…. [there is] a natural Internet aspect to every single experience that has shaped us: we made friends and enemies online, we prepared cribs for tests online, we planned parties and studying sessions online, we fell in love and broke up online.[119]

Often thought of as "technologies of play, *synthetic worlds* range from *massively multiplayer online games* (MMOGs) such as *World of Warcraft,* to virtual reality environments such as *Second Life*."[120]

> [V]irtual worlds have gained legitimacy in business and educational settings for their application to organizational endeavors such as distributed collaboration, virtual teamwork, multimedia meetings and training, as well as real-time simulation…. And in organizations such as hospitals, universities, and the military, virtual worlds are being used for action learning and immersive training (through simulations and rehearsals). Virtual worlds are also emerging as interesting sites of innovation and experimentation among scientists, educators, and software teams…. [121]

Professor Ulrike Schultze states, "Technological advancement is continuously changing the issues and questions [Information Systems] researchers need and want to explore."[122] As we see in our daily lives, "technological developments are fundamentally changing the nature of work and institutions as the workforce is becoming more mobile, virtual and global."[123] This trend was both accelerated and disrupted by the 2020-2021 global pandemic.[124] Professor Schultze observes:

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[119] Ulrike Schultze, *Performing Embodied Identity in Virtual Worlds,* 23 EURO. J. INFO. SYS. 84 (2014).
[120] Ulrike Schultze, et al., *supra* note 107.
[121] *See* Schultze & Orlikowski, *supra* note 109. *See also* Ulrike Schultze & Jo Ann Brooks, *An Interactional View of Social Presence: Making the Virtual Other 'Real,'* INFO. SYS. J. 1 (2028) (discussing how social presence is accomplished in virtual environments) .
[122] Ulrike Schultze, *What Kind of World Do We Want to Help Make With Our Theories?, 27* INFO. & ORGANIZATION 60, 65 (2017).
[123] *Id. See also* Lawrence J. Trautman, Rapid Technological Change and U.S. Entrepreneurial Risk in International Markets: Focus on Data Security, Information Privacy, Bribery and Corruption, 49 CAPITAL U. L. REV. 67 (2021), https://ssrn.com/abstract=2912072.
[124] Eddie Bernice Johnson & Lawrence J. Trautman, *The Demographics of Death: An Early Look at Covid-19, Cultural and Racial Bias in America,* 48 HASTINGS CON. L. Q. 357 (2021), http://ssrn.com/abstract=3677607.

> [T]echnology is becoming so entangled in individuals' everyday lives, that traditional dualisms of work-vs-play, actual-vs-virtual and human-vs-machine are rendered less and less meaningful. Highly personal uses of technology (e.g. wearables and ubiquitous computing), where issues of multiple embodiments and the integration of technology with the user as an embodied, sensory being, form part of the research agenda Yoo (2010) outlines for experiential computing. Experiential computing is contrasted with traditional computing that occurs as a separate activity in organizations and that is driven by the goal of improving organizational performance. Defined as 'digitally mediated embodied experiences in everyday activities through everyday artifacts that have embedded computing capabilities (Yoo, 2010), experiential computing is moving the field of IS beyond the organization.[125]

How Large the Virtual World?

The question of the size of the known universe of virtual worlds can be on several different levels. From the standpoint of universes known and postulated, physicist Brian Greene has written that the term universe "has given way to other terms that capture the wider canvas on which the totality of reality may be painted… [many terms are] among the words used to embrace not just our universe but a spectrum of others that may be out there."[126] Among these possible realities, depicted by physicist Greene as his eighth variety of possible multiverse (the Simulated Multiverse),[127] asks the disturbing question, "How do you know you are not hooked into the Matrix?"[128] In his query about whether "a distant descendant, or an army of such descendants possibly millennia down the road"[129] are responsible for the universe in which you perceive yourself, your loved ones, pets, everything? Pursuit of this inquiry much further is far beyond the scope of this article. However, let me just plant the intellectual seed for those having additional interest. As more fully demonstrated in the pages to follow, many of us by the millions are engaged deeply in simulated computer worlds. Professor Greene discusses the

[125] *See* Schultze, *supra* note 122.
[126] BRIAN GREENE, THE HIDDEN REALITY, ALFRED A. KNOPF 4 (2011).
[127] *Id.* at 287.
[128] *Id.* at 281.
[129] *Id.* at 275.

curious work of Oxford philosopher Nick Bostrom, and observes the likelihood that our descendants will continue to create simulated universes in large numbers, "filled with a great many self-aware, conscious inhabitants."[130] As Greene observes, "if someone can come home at night, kick back, and fire up the create-a-universe software, it's easy to envision that they will not only do so, but do so often."[131] Taken to its logical conclusion, the Bostrom reasons that, "if the ratio of simulated humans to real humans were colossal, then brute statistics suggests we are *not* in a real universe. The odds would overwhelmingly favor the conclusion that you and I and everyone else are living within a simulation…"[132] Enough then for a few words about where all this might lead according to the math and conjecture from some of our leading physicists. Now, let us turn our attention to contemporary virtual worlds, their markets, economies, and what we might conclude about foundational property law for virtual worlds. Consider:

> In a society marked by globalization, virtual work and the use of social media, individuals are increasingly experiencing their lives in a luminal space that combines virtual and actual reality. By posting blogs, images, tweets, profiles and films that materialize them in multiple settings, technology users create digital bodies that extend their physically embodied senses and turn them into cyborgs, that is, a dialectic synthesis between physical and digital bodies. In light of these multiple embodiments the production of self-identity, that is, 'the self as reflexively understood by the person,' becomes an increasingly complex project that involves the ongoing negotiation of what identity performances count as 'real.'[133]

[130] *Id.* at 288.
[131] *Id.*
[132] *Id.*
[133] Ulrike Schultze, *Performing Cyborgian Identity: Enacting Agential Cuts in Second Life, in 'Beyond Interpretivism? New Encounters With Technology and Organization*, L. Introna L, D. Kavanaugh, S. Kelly, W. Orlikowsky & S. Scott (eds, Ch 11, Springer 2016) (internal citations omitted).

It appears that growth of entertainment oriented virtual environments continues to be explosive worldwide. By 2004, more South Koreans are reported "to play in virtual worlds than watch television."[134] Castronova observes in 2001, that:

> [T]here is often very little public information about the subscriber base of the different *[virtual worlds]*. *EverQuest's* base was public information until August 31, 2001, when Verant stopped publishing the data. The official reasons for the decision were openly strategic: why help competitors by releasing data on the customer base?[135]

Writing about virtual land NFTs in March of 2021, professor Michael M. Downing remarks about how "early 2021 has seen these markets explode in popularity."[136]

Stickiness; The Virtual World is Addictive

Living in or visiting the *virtual world* for many seems to be a highly addictive and "sticky" experience. Castronova observes as early as 2001 that "as it turns out, VWs seem to be able to offer entertainment that is attractive enough to many people that they sacrifice major portions of their time to it. A survey of *EverQuest* users…. Indicates that the typical user spends about 22 hours per week in the game."[137] Another survey by Castronova, conducted about the same time found that "the median user devotes 4 hours per day and more than 20 hours per week…."[138] During Nicholas Yee's study, he found that:

> [M]any people used the term 'addiction' to describe their own behavior, perceiving their time in the VW as a source of serious conflict with various Earth activities and relationships. If we take the economist's view, however, and see their behavior as rational choice, we must conclude that VWs offer something that is perhaps a bit more than a mere entertainment to which the players have become addicted. Rather, they offer an alternative reality, a different country in which

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[134] Joshua Fairfield, *Virtual Property*, 85 Boston U L.R. 1047, 1061 (2005), http://ssrn:com/abstract=807966, *citing* Mimi Luse, *More than a Game*, E.Peak, July 19, 2004, http://www.peak.sfu.ca/the-peak/2004-2/issue12/fe-online.html.
[135] *See* Castronova, *supra* note 112 at n6.
[136] Michael M. Dowling, Fertile LAND: Pricing non-fungible tokens (Mar. 18, 2021), https://ssrn.com/abstract=3813522.
[137] *See* Castronova, *supra* note 112, *citing* Yee 2001…
[138] *See* Castronova, *supra* note 112 at 10.

> one can live most of one's life if one so chooses. And it so happens that life in a VW is extremely attractive to many people. A competition has arisen between Earth and the virtual worlds, and for many, Earth is the lesser option.[139]

As to *virtual world* "stickiness," it is significant to note that "the tendency to network monopoly is enhanced by the fact that most people seem to be willing to 'live' in at most one fantasy world at a time, and switching is costly as it can take weeks to become familiar with a new world."[140]

Lehdonvirta and Virtanen ask the questions: "why are so many people suddenly willing to spend money on such seemingly frivolous objects? Is it a fad that will die away as suddenly as it started? Accordingly:

> Lehdonvirta suggests that the value attached to virtual objects is a reflection of how important digital spaces have become in our lives: how many aspects of life from hobbies, friendships, and work are now played out in part through mobile phones, social networking sites, console games, and online communities. Virtual goods are built so as to have very tangible functions in these digital spaces. Sociologists moreover note that goods are valued not only for their functional and aesthetic attributes, but also for their symbolic uses in demarcating identities and social relationships. As a result, consumers are now buying virtual goods for many of the same reasons they buy material goods. As long as we live in a consumer society where digital spaces increasingly pervade into everyday life, the present attraction to virtual goods is unlikely to die away.[141]

III. THE BLOCKCHAIN AND VIRTUAL CURRENCIES

Virtual property remained a characteristic of closed environments like virtual worlds for the first decade of the millennium because of two problems, one technological, one legal. The technological problem was a matter of databases. Virtual worlds creators maintained single databases listing who owned what. Thus, if a person's avatar earned the Sword of Admiration, the game creator's database reflected that she owned that sword (and thus the avatar would

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[139] *Id.*
[140] *Id.* at 8.
[141] Vili Lehdonvirta & Perttu Virtanen, *A New Frontier in Digital Content Policy: Case Studies in the Regulation of Virtual Goods and Artificial Scarcity,* 2 Policy & Internet 7, 12 (2010).

display it, and the sword appeared in the avatar's inventory), but no-one else would have such a sword available. But the player could not take the item out of the game, or into any other virtual environment. And, this single database created single point of failure. If other players figured out how to hack or otherwise fool the creator's database into allowing them access to the item (or, into giving them access to the original player's account to steal the item), then the player's item was either no longer unique or rare because others were able to duplicate it, or gone from her inventory because someone stole it. (We expect this problem to crop up in some of the virtual museums that are displaying high-value NFTs.)

The second problem was legal. Most virtual world creators ran games and wanted to prevent players from having any legal interest in game components. Imagine the legal difficulties involved in kicking a player off of a game for cheating if that player could sue for their lost items, worth tens of thousands of dollars. Thus, most virtual worlds creators followed the standard path of intellectual property holders generally: they reserved all rights in their creations to themselves, and offered only limited legal licenses to players. In the example above, our player who earns the Sword of Admiration does not in fact own it at all, even if she paid the game creator for it. She owns a limited license to use it within the context of the game. In the virtual environments where the game creator did not assert intellectual property license control over creations -- like Second Life, in which players could create their own items -- copyright infringement ran rampant. Once one person got a copy of an item, they were able to duplicate it and give it to everyone else free of charge. Caught between runaway copyright infringement in non-game worlds, and game creators' refusal to grant ownership interests in game worlds, consumers had no way of satisfying pent up demand for owning unique digital artifacts.

Both of these issues -- the non-portability and hackability of digital property, and the fact that users did not in fact own the assets they had earned or purchased -- constrained the market for unique items and art in virtual worlds. Who would buy something that they don't truly own? Who would invest in art that they merely license? Who would invest in something that ceases to exist if the game company turns off the servers? Although the emergent markets in digital art and assets were robust in the face of attempts to shut them down (for example, game companies routinely tried to shut down the real-money markets operating in legal grey areas around their games), the combination of creator-managed centralized and controlled databases, and license restrictions on ownership kept digital property from flourishing. Both of these obstacles were significantly (although not entirely) reduced with the advent of blockchain technology.

The Blockchain

Much has been written about the likely impact of blockchain technology during its brief, approximate decade-long existence. As shown by the recent gain in popularity of NFTs, "Rapid introduction and diffusion of technological changes throughout society, such as the blockchain, continue to [challenge] the ability of law and regulation to keep pace."[142] It appears that Blockchain is proving as disruptive to entrenched societal institutions and business models as: electricity, radio, television, or the Internet.

According to Aaron Wright and Primavera De Filippi, "[t]he blockchain is a distributed, shared, encrypted database that serves as an irreversible and incorruptible public repository of information. It enables, for the first time, unrelated people to reach consensus on the occurrence of a particular transaction or event without the need for a controlling authority."[143] In sum,

[142] *See* Trautman & Molesky, *supra* note 3. at 267.
[143] *Id.*, note 3 at 239, *citing* Aaron Wright & Primavera De Filippi, Decentralized Blockchain Technology and The Rise of *Lex Cryptographia* 2 (Mar. 20, 2015, revised July 25, 2017) (unpublished manuscript),

"blockchain is simply a data structure that leverages hash functions and encryption to provide the security of information like never seen before."[144] Valentina Gatteschi explains the progression of blockchain technology:

> Three different blockchain evolutions can be identified: Blockchain 1.0, 2.0, and 3.0. [] Blockchain 2.0 is about registering, confirming, and transferring contracts or properties. Application fields range from the use of blockchain as a decentralized copy of local databases (especially for public records and attestations) to more sophisticated applications. The most relevant feature of Blockchain 2.0 is the integration with smart contracts 1.0 is strongly related to Bitcoin and cryptocurrencies…. In Blockchain 3.0, the application field is no longer restricted to finance and goods transactions, but embraces sectors like government, health, science, education, and more."[145]

The Mechanics of Blockchain

For purposes of readability and our intended audience for this Article, we will minimize the technical aspects and mechanics of blockchain creation. However, Trautman and Molesky report elsewhere:

> Blockchain is a modification and conglomeration of existing technology and concepts. Michael Scott explains, "The blockchain is a testament to the power of a single cryptographic primitive – the hash function. Really nothing else is required, so if you can get your head around the hash function, you can understand the basics of the blockchain."[146] Mr. Scott describes a hash by stating:
>
> A cryptographic hash function takes one input and calculates one output. For example, for the input 'We hold these truths to be self-evident', the well known hash function SHA256 produces the output:
>
> 84ba74b2661c87470665a1a5f5ab526afcf266f8c5effb795bef2d2514a8afd3
>
> For the slightly different input "we hold these truths to be self-evident" (note the lower case w), the output is

---

https://ssrn.com/abstract=2580664. *See also* John W. Bagby, David Reitter & Philip Chwistek, An Emerging Political Economy of the BlockChain: Enhancing Regulatory Opportunities (2018), https://ssrn.com/abstract=3299598.

[144] *See* Trautman & Molesky, *supra* note 3 at 239, *citing* Aaron Wright & Primavera De Filippi.

[145] *See* Valentina Gatteschi, Fabrizio Lamberti, Claudio Demartini, Chiara Pranteda & Victor Santamaria, *To Blockchain or Not to Blockchain: That Is The Question,* IT Professional 62 (March/April 2018), IEEE Computer Society.

[146] *See* Michael Scott, *The Essence of the Blockchain,*1 (unpublished manuscript) (on file with authors).

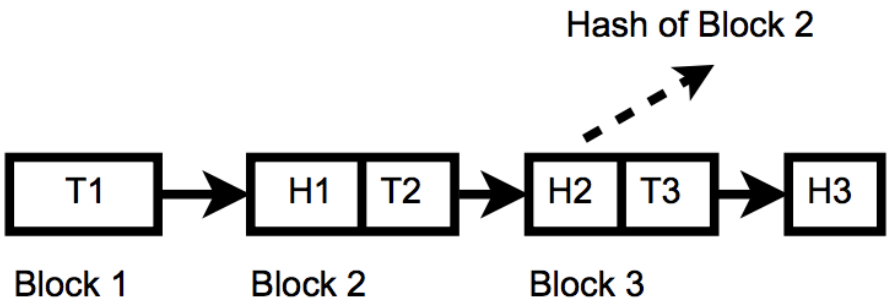
246160c031a4ddd9d940e931721fdec7e72087c8eccf5ea5621bb15d22959c19[147]

The above examples provide information about hash functions. Mr. Scott writes:

> The output bears no obvious relationship to the input, indeed it looks completely random. A tiny change to the input produces a completely different output…. given just the output it's impossible to determine the input. For this reason the hash function is often called a "one way" hash function. Also, it's impossible to find two different inputs which give the same output. For the function SHA256, the 256 refers to the fact that the output is always the same length (actually 256 bits), independent of the length of the input.[148]

Blockchain gets its names from the chaining of the hash. Mr. Scott provides us with a diagram appearing here as Exhibit 6.[149]

Exhibit 6
A Simple Hash Chain[150]



Mr. Scott writes the following explanation:

> Here the T are "transactions" of some sort. Examine this diagram for a while, and appreciate the power of the chaining. The value H3 is calculated by hashing the whole of block 3, which includes the hash of block 2, which in turn includes the hash of block 1 etc. Note that because of the one-wayness of the hash function, this chain can only be calculated from left-to-right. So already we have some of the properties we want. This hash chain can potentially be used as an immutable record of transactions. Any attempt to tamper with it can be detected, as the hashes will change.[151]

[147] *Id.*
[148] *Id.*
[149] *Id.* at 2.
[150] *Id.*
[151] *Id.*

Virtual Currencies

The genesis of virtual currency appears to result from the massive popularity of currencies in online games and the real-money grey markets surrounding those currencies (think here of buying World of Warcraft gold for real dollars), described above.[152] As of March 21, 2021, Coinmarketcap.com lists 8,905 different cryptocurrencies, having a total market capitalization of approximately $1.782 trillion.[153] This contrasts with 1,935 cryptocurrencies and aggregate market capitalization of about $191.54 billion reported by professor Trautman at September 11, 2018.[154] And, just a little more than two years prior, as of July 15, 2016, professors Trautman and Harrell report that the market capitalization of virtual currencies at that time approximates just $13.01 billion.[155]

Ranked by market capitalization at March 21, 2021, the top ten cryptocurrencies are: Bitcoin ($1.073 trillion); Ethereum ($205.48 billion); Binance Coin ($41.351 billion); Tether ($39.616 billion); Cardano ($38,288 billion); Polkadot ($34,199 billion); XRP ($23.489 billion);

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[152] *See generally* Hiroshi Yamaguchi, *An Analysis of Virtual Currencies in Online Games* (Sept. 1, 2004), http://ssrn.com/abstract=544422; Vili Lehdonvirta, *Real-Money Trade of Virtual Assets: New Strategies for Virtual World Operators* (2008). VIRTUAL WORLDS, Ipe, Mary, ed., pp. 113-137, Icfai University Press, Hyderabad, India (2008), http://ssrn.com/abstract=1351782; Levent V. Orman, *Virtual Money in Electronic Markets and Communities* (June 7, 2010). ICAST Journal of Institute for Communication, Social Informatics, and Technology, Johnson School Research Paper Series No. 27-2010, http://ssrn.com/abstract=1621725; Sulin Ba & Dan Ke, *Optimal Pricing and Permissions Strategy for Virtual Good Creators in Second Life* (Sept. 15, 2008), http://ssrn.com/abstract=1271684; Vili Lehdonvirta, *Virtual Item Sales as a Revenue Model: Identifying Attributes that Drive Purchase Decisions*, 9 Electronic Commerce Research, Vol. 9, 97 (2009), http://ssrn.com/abstract=1351769; David A. Bray & Benn Konsynski, *Virtual Worlds: Multi-Disciplinary Research Opportunities*, 38 The DATA BASE for Advances in Information Systems, Special Issue on Virtual Worlds, (2007), http://ssrn.com/abstract=1016485; Sukwon Thomas Kim, *Why Bitcoin?: Structure and Efficiency of Markets for Online Game Currency* (Dec. 18, 2013), http://ssrn.com/abstract=2334000; Matthew Elias, *Bitcoin: Tempering the Digital Ring of Gyges or Implausible Pecuniary Privacy* (Oct. 3, 2011), http://ssrn.com/abstract=1937769; Jun-Sok Huhh, *An Economic Analysis on Online Game Service* (Aug. 28, 2009), http://ssrn.com/abstract=1335120.

[153] *All Cryptocurrencies,* Coinmarketcap.com (Mar. 21, 2021), https://coinmarketcap.com/.

[154] Lawrence J. Trautman, *Bitcoin, Virtual Currencies and the Struggle of Law and Regulation to Keep Pace*, 102 MARQ. L. REV. 447, 453 (2018), https://ssrn.com/abstract=3182867.

[155] *See* Lawrence J. Trautman & Alvin Harrell, *Bitcoin Versus Regulated Payment Systems: What Gives?*, 38 CARDOZO L. REV. 1041, 1053 (2017), http://ssrn.com/abstract=2730983.

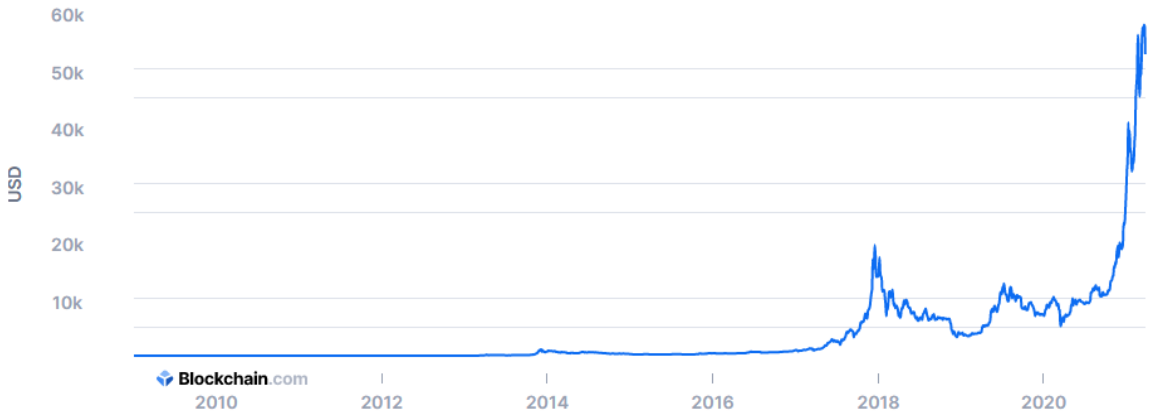
Uniswap ($17.416 billion); Litecoin ($13.016 billion); and Chainlink ($12.075 billion).[156] Note that as of the relevant date, Bitcoin (BTC) comprised 60.2 percent of all virtual currency market cap, while Ethereum (ETH) approximated 11.5 percent.[157]

Bitcoin

Influenced by ideas from b-money[158] and Hashcash,[159] "Bitcoin is a cryptographic object represented as a chain of digital signatures over the transaction in which the coin was used."[160] Bitcoin "aims to be completely distributed, free of central authorities or points of control, and at least somewhat anonymous."[161] As shown in Exhibit 7, Bitcoin has grown rapidly, from a mere idea during 2009 to a legitimate currency by 2021, priced at over $52,000 each on March 24, 2021, and market capitalization of bitcoins in circulation, valued in excess of $1 trillion US during late March, 2021.[162]

[156] *See* All Cryptocurrencies, *supra* note 153.
[157] *Id.* note 139.
[158] Joshua A. Kroll, Ian C. Davey, & Edward W. Felten, *The Economics of Bitcoin Mining or, Bitcoin in the Presence of Adversaries,* The Twelfth Workshop on the Economics of Information Security (WEIS 2013) 3, Washington, DC, June 11-12, 2013, *citing* W. Dai, *b-money*, http://www.weidai.com/bmoney.txt (1998), http://www.weis2013.econinfosec.org/papers/KrollDaveyFeltenWEIS2013.pdf.
[159] *Id. citing* A. Back et al., *Hashcash-a denial of service counter-measure,* http://www.hashcash.org/papers/hashcash.pdf (2002).
[160] *Id.; See also* Robert McMillan, *The Two Sides of Bitcoin: It's a Crypto-anarchist rebuke of the Fed! No, It's the Future of Payments! Inside the fight for the soul of a New Currency*, WIRED 96 (April, 2014).
[161] *Id.*
[162] Blockchain.com, *Market Capitalization (USD), https://www.blockchain.com/charts/market-cap* (last viewed Mar. 26, 2021); *See generally* Robin Teigland, Zeynep Yetis & Tomas Olov Larsson, *Breaking Out of the Bank in Europe - Exploring Collective Emergent Institutional Entrepreneurship Through Bitcoin* 3 (May 11, 2013), http://ssrn.com/abstract=2263707; *See also generally* David Christopher Vitt, *Breaking Bitcoin: Does Cryptocurrency Exchange Activity Lead to Increased Real Activity Outside Cryptocurrency Exchanges?* (Dec. 5, 2013), http://ssrn.com/abstract=2371343.

Exhibit 7
Bitcoin Market Price 2009-2021[163]



Threat of Data Breach

Data breach negatively impacts many aspects of modern life and remains a threat to individuals,[164] business enterprises,[165] and all nation state actors.[166] While the integrity of blockchain distributed ledger technology seems to hold at this point, several entities actually holding blockchain assets have been breached. One example of "a smart-contract-based attack happened on Ethereum in June 2016, when about $60 million was stolen."[167] More recently, customers of cryptocurrency company Coinbase suffered from a similar hack, resulting in

[163] *Id.*
[164] Lawrence J. Trautman, Mohammed T. Hussein, Emmanuel U. Opara, Mason J. Molesky & Shahedur Rahman, *Posted: No Phishing*, 8 EMORY CORP. GOV. & ACCT. REV. (2021), http://ssrn.com/abstract=3549992.
[165] Kenneth A. Bamberger, Ran Canetti, Shafi Goldwasser, Rebecca Wexler & Evan Zimmerman, Verification Dilemmas, Law, and the Promise of Zero-Knowledge Proofs (Feb. 7, 2021), https://ssrn.com/abstract=3781082 ; Michael Mendelson, *From Initial Coin Offerings to Security Tokens: A U.S. Federal Securities Law Analysis*, 22 STAN. TECH. L. REV. 52 (2019); Lawrence J. Trautman, Seletha Butler, Frederick Chang, Michele Hooper, Ron McCray & Ruth Simmons, Corporate Directors: Who They Are, What They Do, Cyber and Other Contemporary Challenges, 70 BUFF. L. REV. (2022), http://ssrn.com/abstract=3792382; Lawrence J. Trautman & Neal Newman, Securities Law: Overview and contemporary Issues, http://ssrn.com/abstract=3790804; Lawrence J. Trautman & Peter C. Ormerod, *Corporate Directors' and Officers' Cybersecurity Standard of Care: The Yahoo Data Breach*, 66 AM. U. L. REV. 1231 (2017), http://ssrn.com/abstract=2883607.
[166] Lawrence J. Trautman, *Is Cyberattack The Next Pearl Harbor?*, 18 N.C. J. L. & TECH. 232 (2016), http://ssrn.com/abstract=2711059.
[167] *See* Gatteschi, et. al., *supra* note 145 at 68. *See also* Adam J. Kolber, *Not-S-Smart Blockchain Contracts and Artificial Responsibility*, 21 STAN. TECH. L. REV. 198 (2018).

"drained accounts."[168] Accordingly, attorneys Cohen, et al., warn, "Ensure you understand where the underlying work referenced by your NFT is stored. In most cases, the work is not actually stored on the blockchain and the NFT will "point" to a traditional internet site where the work is housed." [169]

Theft of virtual currencies and other digital assets from data breach takes place in several ways. As Andrew Balthazor describes, "Crypto-theft occurs when a person dispossesses the rightful owner of the address's bitcoin without the true owner's consent. This may happen because the private key (which controls the bitcoin address) was compromised, which is what occurred in the Mt. Gox hack."[170] Observe that "Private keys are stored in any number of ways: digitally, online, offline, encoded into devices, or written down on paper.[171] Crypto-thieves acquire an address's private key by hacking, malware, social engineering, coercion, or any other manner of taking the private key from a person."[172] Consider:

> The thief then uses the stolen private key to send the address' bitcoin to another address under the thief's control, stealing the bitcoin from the true owner. Alternatively, an owner may be extorted or forced to transfer cryptocurrency to a thief's address without necessarily surrendering private keys. For example, criminals may infect a system with ransomware (a form of malicious computer code), which infects a system and denies access to user files until a bitcoin payment is made to a specific address.[173]

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[168] Kellen Browning, *Coinbase Users Got Hacked,* N.Y. TIMES, Mar. 27, 2021, at B1.
[169] Daniel S. Cohen, Clifford C. Histed, Jeremy M. McLaughlin, Jonathan M. Miner & Anthony R.G. Nolan, *The Coming Blockchain Revolution in Consumption of Digital Art and Music: The Thinking Lawyer's Guide to Non-Fungible Tokens (NFTS),* XI NATIONAL L.J. (Mar. 28, 2021), https://www.natlawreview.com/article/coming-blockchain-revolution-consumption-digital-art-and-music-thinking-lawyer-s.
[170] Andrew Balthazor, *The Bona Fide Acquisition Rule Applied to Cryptocurrency,* 3 Geo. L. Tech. Rev. 402, 407 (2019), *citing* Robert McMillan, *The Inside Story of Mt. Gox, Bitcoin's $460 Million Disaster,* Wired (Mar. 3, 2014); *see also* Lawrence J. Trautman, *Virtual Currencies: Bitcoin & What Now After Liberty Reserve, Silk Road, and Mt. Gox?,* 20 RICH. J. L. & TECH. 13 (2014), http://www.ssrn.com/abstract=2393537.
[171] Balthazor, *supra* note 170, *citing* Max I. Raskin, *Realm of the Coin: Bitcoin and Civil Procedure,* 20 FORDHAM J. CORP. & FIN. L. 969, 989 (2015).
[172] Balthazor, *supra* note 170 at 407, *citing* Mariella Moon, *Cryptocurrency Expert Kidnapped for $1 Million Bitcoin Ransom,* ENGADGET (Dec. 30, 2017).
[173] Balthazor, *Id.* at 407, *citing* Kate O'Flaherty, *How to Survive a Ransomware Attack–And Not Get Hit Again,* FORBES (Aug. 17, 2018). *See also* Lawrence J. Trautman & Peter C. Ormerod, *WannaCry,*

IV. HOW NON-FUNGIBLE TOKENS MAY SOLVE ART WORLD PROBLEMS

Mechanism of Action

Alan Majer observes, "Most items in the world are *non-fungible*; they each have characteristics and properties that uniquely distinguish them… In short, non-fungible items are not all the same - one item is not necessarily a substitute for another."[174]

Financial journalist Jason Zweig, writing for *The Wall Street Journal* observes that while previously discussed "prices are baffling−and may, in fact, be crazy−NFTs could solve problems that have dogged the art world and other markets for centuries. Think of a non-fungible token as a unique serial number that certifies the authenticity and ownership history of an associated object."[175] The value of an NFT rests in its ability "to transform a digital good that can be endlessly copied into something one of a kind. When someone buys an NFT, what they're effectively getting is the knowledge of owning an official version of a cat with a Pop-Tart body,"[176] among other examples. Mr. Zweig writes, "Think of a non-fungible token as a unique digital serial number that certifies the authenticity and ownership history of an associated object."[177] Consider:

> By connecting the blockchain to art and other creative work, NFTs bring the objectivity of computer code to fields that are notorious for subjectivity. Artists, writers and musicians struggle to find audiences and make a living. Curators, dealers, collectors and art historians bicker nonstop about the quality and value− and the authenticity−of major works.
>
> Consider the French artist Jean-Baptiste-Camille Corot, who was jokingly said to have painted 3,000 canvases, 10,000 of which were bought in the U.S. Is a particular Corot genuine or a forgery? Who were its previous owners? Has it ever

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Ransomware, and the Emerging Threat to Corporations, 86 TENN. L. REV. 503 (2019), http://ssrn.com/abstract=3238293.

[174] Zweig, *supra* note 36.

[175] *Id.*

[176] Shira Ovide, *Some Straight Talk on NFTs,* N.Y. TIMES, Mar. 29, 2021 at B3.

[177] Zweig, *supra* note 36.

> been exhibited at a museum or previously sold at auction? Was it ever seriously damaged and extensively restored?
>
> Until now, buyers often had to take the answers to such questions on faith. An NFT, however, can integrate reams of information about an artwork into an authoritative, permanent digital record.[178]

The Wall Street Journal explains, "NFTs act as virtual deeds, conveying ownership of a digital asset. Each one gets uploaded to a digital ledger where it tracks information such as the date it was created, when it was sold, for how much and to whom."[179] Attorneys Cohn, West and Parker write:

> Smart contracts are most efficient for contracts that can be reduced to simple 'if-then' statements, as their terms are easy to convert to computer code and can be executed automatically… a blockchain-based smart contract is a contract between two or more parties that is stored and digitally executed on the blockchain using code. While human involvement is needed to define the contract and input the code, the actual execution of the contract is automated based on a defined parameter, such as an event or price.[180]

This smart contract allows the original creator to establish "the terms of this digital certificate of authenticity… and it allows the creator to take a cut−in music, usually 10% to 30% −of any resales."[181] Of great significance to song writers and musicians, "Owning an NFT doesn't equate to owning the copyright to a given asset, music or otherwise, but scarcity helps push up valuations."[182]

Worthy of brief mention while discussing the mechanics of blockchain technology, a common question posed from readers on this topic relates to the infrastructure necessary for a successful sale of NFT artwork. Christie's, for example, has partnered with Monegraph, described by Christie's as "the premier provider of rights management technology for NFTs and

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[178] *Id.*
[179] Anne Steele, *Musicians Find Revenue in NFTs,* WALL ST. J., Mar. 24, 2021 at B4.
[180] Alan Cohn, Travis West & Chelsea Parker, *Smart After All: Blockchain, Smart Contracts, Parametric Insurance, and Smart Energy Grids,* 1 GEO. L. TECH. REV. 273, 281 (2017).
[181] Steele, *supra* note 179.
[182] *Id.*

other cryptoassets Monegraph duties include providing support for "the artists and associated galleries in registering their copyrights and managing their rights on the blockchain. Based on global patents for media copyrighting and licensing, the company provides infrastructure to support the seamless sales and transfer of media rights on the Ethereum, Bitcoin and various other blockchains."[183]

NFT Revenue Source for Musicians

The Wall Street Journal reports, "After a year with no live performances, musicians hope to connect with their fans on the blockchain and make up for lost revenue by selling them non-fungible tokens."[184] For example, "Electronic-music artist Justin Blau, known as 3LAU, fetched $17 million… from NFTs, helped in part by a tokenized release of his three-year-old album 'Ultraviolet,' which grossed $11.6 million and briefly held the record for the highest price paid for a single NFT, $3.6 million."[185] Musician Justin Blau observes, "It's a way to monetize your fan base in a way that's never been possible… I think this technology will definitely change the world, but I'm cautiously optimistic because no one really knows how to value this stuff."[186]

The Business of NFTs

The business environment of NFTs is an amalgam of various areas of law and enterprise and may encompass issues involving: art, copyright, cybersecurity, entertainment, intellectual property, music, performance, technology, and video editing, just to name a few.[187] In just a matter of months, "In new online marketplaces such as Nifty Gateway, SuperRare, and

[183] *Id*.
[184] *Id.*
[185] *Id.*
[186] *Id.*
[187] Lawrence J. Trautman, Anthony "Tony" Luppino & Malika S. Simmons, *Some Key Things U.S. Entrepreneurs Need to Know About The Law and Lawyers*, 46 TEX. J. BUS. L. 155 (2016), http://ssrn.com/abstract=2606808.

Foundation, artists can upload, or 'mint,' their works as unique N.F.T.s, then sell them."[188] As an informative case study of just one example, journalist Kyle Chayka writes:

> On October 30th [2020], Winkelmann [Beeple] launched his first 'drop' of three art works on the N.F.T marketplace Nifty Gateway, to test his salability. One was a piece called 'Politics Is Bullshit,' featuring a diarrheic bull half-daubed in an American flag pattern amid a rain of dollar bills. The work came in an edition of a hundred, at a cost of one dollar each. A core feature of blockchain technology is 'immutability': all transactions recorded are permanent and transparent, which means that any N.F.T. purchase or sale is visible to the public. As of March, 2021, the editions had resold for as much as six hundred thousand dollars. (In N.F.T. marketplaces, artists receive a percentage of resale prices, typically around ten percent.)[189]

Attorneys Cohen, Histed, McLaughlin, Miner, and Nolan write, "If you are an artist or musician who is interested in issuing NFTs as a way to monetize your creative content, you need to be careful on how you proceed."[190] The authors list the following considerations:

- Ensure that the piece of art/image, digital music or other creative work associated with the NFT is unique and authenticated. Ensure that you have all of the rights necessary to reproduce and distribute the work.
- Work only with a reputable technology company that will issue the token on your behalf in a manner that is transparent and secure.
- Inquire about the technology company's position on payment of royalties. While certain token standards prohibit royalties (because they are viewed as stifling the ability to freely transfer tokens) there have been discussions in the Ethereum community about the creation of a royalty standard.[3] At present, artists generally receive a payment when their NFTs are initially sold, but often not if they are resold in the future.
- Work only with a reputable marketplace that does not over-promise or hype the NFTs, and that does not require you to make significant up-front payments in order to issue and sell your NFTs. Find out which blockchain platform the technology company is using…
- Make sure disclosures are clear regarding the purpose of the NFTs as a royalty vehicle, whether there is expected to be an established trading market for

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[188] Kyle Chayka, *How Beeple Crashed The Art World,* NEWYORKER, Mar. 22, 2021, https://www.newyorker.com/tech/annals-of-technology/how-beeple-crashed-the-art-world (last viewed Mar. 28, 2021).

[189] *Id.*

[190] Daniel S. Cohen, Clifford C. Histed, Jeremy M. McLaughlin, Jonathan M. Miner & Anthony R.G. Nolan, *The Coming Blockchain Revolution in Consumption of Digital Art and Music: The Thinking Lawyer's Guide to Non-Fungible Tokens (NFTS),* XI NATIONAL L.J. (Mar. 28, 2021), https://www.natlawreview.com/article/coming-blockchain-revolution-consumption-digital-art-and-music-thinking-lawyer-s.

> them, risk factors or other special considerations, and whether they are or are not investment contracts or other types of securities.[191]

In sum, "NFTs and the related concept of the blockchain hold the promise to, in part, give people ways to make their work more valuable by creating scarcity. There is promise in letting creators rely less on middlemen including social media companies, art dealers and streaming music companies."[192] For example, on March 31, 2021 we learn, "Michael Jordan and Kevin Durant are among those betting that the company behind NBA Top Shot is poised to build on the craze over digital collectibles. Dabber Labs Inc. said… it raised $305 million from investors… [valuing] the company at $2.6 billion."[193] *The Wall Street Journal* reports:

> The sums reflect an exploding interest in non-fungible tokens, or NFTs, which use the blockchain technology behind cryptocurrencies to authenticate unique digital assets such as art, music or video of basketball highlights. The market for NFTs grew to at least $338 million in 2020, according to a report from NonFungible.com and research firm L'Atelier, from around $41 million in 2018.[194]

Nascent Artists Emerge

During August 2021 several teenage artists are reported to have had great success with their NFT art. For example, two such artists, "jstngraphics, a 17-year old from Washington State, and Solace, an 18-year old from Soledad, Calif… have been making NFT art for less than a year, and first drew attention by selling through the online auction site SuperRare... [receiving prices] from about $1,000 to $7,250, [selling] out.[195] Also presenting recently are "Community NFTs,"

[191] *Id.*
[192] Shira Ovide, *Some Straight Talk on NFTs,* N.Y. TIMES, Mar. 29, 2021 at B3.
[193] Sebastial Pellejero, *Starts Help Raise $305 Million for Basketball NFT Site,* WALL ST. J., Mar. 31, 2021 at B4.
[194] *Id.*
[195] Steven Kuretz, *Teenage Artists Reap a Digital Bonanza,* N.Y. TIMES, Aug. 15, 2021 at ST8.

that are "released in sets of unique but thematically linked images that can be bought and sold individually."[196]

V. LAW OF DIGITAL PROPERTY

Professor Joshua Fairfield provides an excellent discussion about the law of digital property, its history, technology, current deficiencies, and proposes a detailed schematic for the future.[197] I will not attempt to recreate that here. The center of my argument is this: markets in art-linked NFTs depend on technology that creates uniqueness,[198] an environment and context that provides an audience for the purchase,[199] and law that supports ownership rights in fully digital assets.[200] As discussed above, the technology by and large works. The questions of audience and market are important for us to understand in order to understand the value of NFTs, and they are critical for sellers to craft[201] (for example, websites like Rarible and SuperRare that create a viewing experience for others' collections to spur demand, or the creation of museums in Decentraland to display NFTs) and buyers to seek out.[202] Failing to do so will result in purchasing something no-one cares about, a sure way to lose money.

The last component, however, has gone deeply under theorized in the law and literature. The centralized ownership and licensing model laid out in the discussion of virtual worlds, above, in fact governs ownership disputes of almost all digital assets. You do not own your

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[196] Kevin Roose, *'Metaverse is Overrun By a Huddle Of Penguins*, N.Y. TIMES, Aug. 14, 2021 at B1.
[197] *See* Joshua Fairfield, *Virtual Property*, 85 B.U. L. REV. 1047 (2005).
[198] *See* Joshua Fairfield, Forthcoming, *Tokenized: The Law of Non-Fungible Tokens and Unique Digital Property*, IND. L.J. 3 (April 6, 2021) [hereinafter *Tokenized*] (noting that digital items "derive value from their scarcity").
[199] *See id.* at 44 ("Property both physical and digital, derives value from the context of which it is a part.").
[200] *See id.* at 58 (noting that establishing clear "principles surrounding digital personal property . . . is necessary for NFTs to succeed").
[201] *See id.* at 93 (stating that cryptocurrency initial coin offerings seek to "create value by creating demand").
[202] *See id*. at 93 ("A buyer of a piece of art, or a trading card, or a unique digital pet expects to be able to profit from its rise in value.").

iTunes music.[203] You do not own your Amazon e-books.[204] And unless the law evolves significantly, you will not truly own much for your $69 million purchase of NFT-linked digital art.[205]

As scholars, we have tended to keep an eye on the practical above the theoretical. The practical truth is that while police may refuse to prosecute the theft of swords from players in virtual worlds,[206] law enforcement agencies will likely not refuse to prosecute the theft of a cryptographic token valued at $69 million.[207] And while a judge may consider the games in a player's virtual game library to be based on contracts and licenses, rather than real property interests, and thus not to pass to the next generation after death,[208] no judge will refuse to allow bitcoin to pass by will or intestate succession.[209] In short, people have had enough with the persistent refusal of internet law to recognize online property interests, and the amount of money at stake is now sufficient to hire teams of lawyers to make the changes stick.

This paper's core prediction, therefore, is that not only will NFTs survive the most recent crypto-crash, but that the example of NFTs will serve as a grounding analogy that courts will use for a major course correction, away from the Kindle-and-iTunes model of "you don't own

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[203] JOSHUA A.T. FAIRFIELD, *OWNED: PROPERTY, PRIVACY, AND THE NEW DIGITAL SERFDOM* 74 (2017) [hereinafter *OWNED*] (stating user only has a license to hear music).
[204] *See Tokenized, supra* note 198, at 3 ("Amazon Kindle denies that Kindle e-book purchasers truly own their purchases." (citing Joel Johnson, You Don't Own Your Kindle Books, Amazon Reminds Customer, NBC NEWS (Oct. 24, 2012)).
[205] *See id.* at 34 ("[T]he legal framework surrounding NFTs is not conducive to ownership, because the intellectual property regime that currently governs the internet is hostile to digital personal property ownership, imposing the contract-and-licensing regime of intellectual property instead.").
[206] Wayne Rumbles, Theft in the Digital: Can You Steal Virtual Property?, CANTERBURY L. REV. 354, 365 (2011) (noting that when a virtual sword was sold without the "owner's" permission, Chinese police refused to assist because "virtual property [was] not covered as a protectable asset under the then current law").
[207] *Cf.* Samantha Bomkamp, *Chicago Trader Accused of Stealing $2 Million in Cryptocurrency in City's First Bitcoin Fraud Case*, CHI. TRIBUNE, (Feb. 16, 2018), https://www.chicagotribune.com/business/ct-biz-bitcoin-fraud-trader-charged-20180217-story.html.
[208] *Cf. OWNED, supra* note 203, at 86 (referencing legal disputes involving ownership of deceased soldiers' social media accounts, and companies arguing that social media accounts are merely contractual services).
[209] *See Tokenized, supra* note 198, at 57 (stating NFTs will be inherited under the law of wills).

anything" to the establishment of real and enforceable legal online rights in digital property. We are standing at the start of a shift in law as significant as the developments around online contracting, that have now rendered the Facebook Terms of Service more practically important to many citizens' lives than the United States Constitution. The introduction of true property law -- not merely a collage of patched together license rights and misleading advertising copy -- into online spaces will revolutionize the internet.[210] Once Vignesh Sundaresan (MetaKovan) establishes clear ownership rights over *The First 5,000 Days*, and at $69 million for a piece of internet history, he absolutely will, the ripple effects will include the undeniable introduction of a form of property ownership that companies have sought desperately to prevent through license agreements that claim purchasers have no rights.[211]

To reach this point we will need a robust theory of virtual property. That is the immediate challenge we face: to lay out in unambiguous terms how courts can and inevitably will separate the kinds of digital assets subject to contract-and-license regimes from those subject to the simple law of personal property.

Virtual Property and "Bundle of Rights"

What do we own when we own something? When we own a work of art? Traditionally, courts have determined that we own the copy (not the copyright, more on that in the next Section), the object. Our power over that object is endorsed by the state. We are able to use, exclude others from using, transfer, or even destroy the item without legal interference or repercussions.[212] For example, if I own an apple iPhone, ask "Will it Blend?" and put it in a

[210] *See id.* at 59 ("NFTs represent an important opportunity . . . to rebalance a low of digital transactions that has nearly eliminated online personal property interests entirely in favor of long-term control by those who pretend to have sold them.").
[211] *See Id.*
[212] *Cf. OWNED*, *supra* note 203, at 15 (explaining traditional property rights as a "bundle of sticks").

blender, no police officer will stop by to arrest me.[213] If I do so with someone else's iPhone, I will be arrested. If I transfer something that is mine, then law recognizes the ownership of the new recipient. For example, if I give you my watch and someone subsequently steals it, then their offense is against the new owner, not me. If I permit you to swim on my land, and sell the land to Santa, suddenly you are bound to respect Santa's wishes with respect to how, where, and whether you may swim.

We recognize this bundle of rights (and I have included the traditional ones. There are updated versions we should have for our digital property -- the right to repair, modify, hack, run code, and so on)[214] for the purposes of giving effect to humans' wishes. We pay more to own something than to merely license or rent it. We do so because we value the increased freedom, the extra capabilities.[215] This is the work made famous by Amartya Sen and Martha Nussbaum: rights mean nothing if citizens do not have the capability of carrying them out.[216] A right to vote means nothing without a car to drive to the polling station. A property interest is a demand on resources that the owners can exercise without the "mother-may-I" of the state.[217] Of course, reasonable constraints on the use of property are necessary for us to live together in harmony (or else Joshua's right to play his Metallica records at the aesthetically correct high volume might disturb Larry's sleep) but property secures to people the ability to do what they wish to do

[213] *Id.* ("[T]he power to destroy can be described as the ultimate exclusion: excluding everyone from enjoying the property, including the owner.").
[214] *See id.*
[215] *See id.* at 95 (giving the example of buying a car, instead of renting, so "we do not have to care about the rental agency's requirements").
[216] *See* Martha C. Nussbaum, *Capabilities and Human Rights*, 66 FORDHAM L. REV. 273, 288 (1997) (positing that empirical truths include the capability to "hold property"); *see also OWNED, supra* note 203, at 19 (stating that "[P]roperty rules should promote not just the technical right to do something, but the actual ability to do it.").
[217] *See id.* at 18 (stating "property means a kind of liberty from government interference" (citing *JEBEDIAH PURDY, THE MEANING OF PROPERTY: FREEDOM, COMMUNITY, AND THE LEGAL IMAGINATION* 19 (Yale University Press 2010)).

without needing to seek permission from anyone else. That direct satisfaction of preference through expanding capabilities is the core of property.[218]

One such capability is of particular importance in our current discussion: the ability to earn by owning.[219] Imagine you rent an apartment, and it burns down through no fault of yours. Who is damaged? The true owner of the apartment, of course. Conversely, imagine that the land and the apartment building appreciate in value? Who benefits? The owner. The point here is that ownership is necessary for earnings based on the rise in value of assets. This is no minor point. Redlining and racist lending practices have cut Black buyers out of one of the primary means for wealth creation for generations in the United States.[220] We ought to take attacks on the ability to earn by owning something extraordinarily seriously: that value will go to *someone*, and the question is whether the kinds of earning humans want to do can happen without the ability to transfer clear ownership over an asset to another owner.

I believe it cannot. And as the following section demonstrates, that is currently the state of affairs that has traditionally plagued attempts to create markets in digital assets,[221] and if it does not adequately resolve, it will render the law incapable of adequately supporting the NFT market in art, in particular because the dollar figures of individual purchases are so high. Buyers will simply not tolerate a system in which their ability to earn is curtailed because of license and

[218] *See id.* ("Property is thus to be measured by the yardstick of human capability.").
[219] *See Tokenized, supra* note 198, at 39 ("One of the ways of determining ownership throughout law is to look at who gains when the property rises in value, and who loses when the property falls in value." (citing U.C.C. § 1-203 (Am. L. Inst. & Unif. L. Comm'n 2002)).
[220] *See* Charles Lewis Nier III, *The Shadow of Credit: The Historical Origins of Racial Predatory Lending and Its Impact Upon African American Wealth Accumulation*, 11 U. PA. J.L. & SOC. CHANGE 131, 194 (2008) ("[O]ne of the primary explanations for the large racial disparities in terms of wealth is a direct consequence of discrimination in credit markets which has acted to both limit minorities' access to home ownership and to increase the cost of achieving home ownership.").
[221] *E.g., Tokenized, supra* note 198, at 39 (explaining the failure of ReDigi).

contract conditions that, despite the surface appearance of ownership, in fact demonstrate there are serious limits to true ownership.[222] We believe this will force the law to evolve.

Problems With Existing Legal Framework

In 2010-11, the Ninth Circuit Court of Appeals decided two cases about whether someone owned a digital work -- in one case, music electronically encoded onto a CD, in the other, software encoded onto a CD. In both cases, the transferees claimed they had an ownership right in the asset and were free to transfer it and sell it on to someone else. The same panel on the same day came to opposite conclusions. They decided that the recipient of the music owned it free and clear,[223] whereas the purchaser of the software did not.[224] The fighting question, said the Court, was whether the transaction at issue was a sale (which would transfer an ownership interest) or a mere license. In determining the sale / license distinction, the court relied on laughable criteria: first, they relied on whether the parties called the transaction a sale or a license.[225] This of course ignored what wiser courts have long called the "economic realities" of a transaction.[226] If a transaction transfers all risk to someone who rents a car, for example, courts will usually say that the transaction was a disguised sale. Second, the court asked whether or not the license restricted the licensee's ability to transfer the asset.[227] This flatly ignored the question: if the transferee were the owner of the asset, they would have the ability to resell it

[222] *See id.* at 57 ("[I]f the technology is analyzed primarily within the framework of intellectual property and contractual licensing rather than the law of personal property, NFTs become copyright licensing with extra steps. They lose the characteristics of ownership that interest vendors and purchasers.").
[223] *See* UMG Recordings, Inc. v. Augusto, 628 F.3d 1175 (9th Cir. 2011) ("We conclude that, under all the circumstances of the CDs' distribution, the recipients were entitled to use or dispose of them in any manner they saw fit, and UMG did not enter a license agreement for the CDs with the recipients.").
[224] *See* Vernor v. Autodesk, 621 F.3d 1102, 1111 (2010) ("We hold today that a software use is a licensee rather than an owner of a copy where the copyright owner (1) specifies that the user is granted a license; (2) significantly restricts the user's ability to transfer the software; and (3) imposes notable use restrictions.").
[225] *See id.*
[226] *E.g.*, United Housing Foundation, Inc. v. Forman, 421 U.S. 837, 851-852 (1975) ("In considering these claims we again must examine the substance—the economic realities of the transaction—rather than the names that may have been employed by the parties.").
[227] *See* United Housing Foundation, Inc. v. Forman at 1111.

despite any contractual reservation of rights by the transferor. So the court's question was circular: if the court decided that the transferee were the owner, the restriction on sale would be ineffective. And finally, the court asked whether the purported license imposed other restrictions on the use of the asset.[228] Which invoked the same problem: owners are allowed to do some things with digital assets (like make backup copies, for example, or other things that are an essential step in using the asset), so the determination of whether the transferee was an owner or a mere licensee *preceded* the question of whether the restrictions on use of the asset were permitted.[229]

The upshot was that the Ninth Circuit permanently muddied questions of digital ownership. The resulting legal regime has been another decade in the wrong direction. Digital assets are overwhelmingly governed online by license conditions (why are they licenses? Because they say they are, even if the site or service claims they are *selling* the digital asset), and those license conditions assert that buyers do not own what they purchase.[230]

This is merely part of the comedy of errors that has been the thirty-year history of development of the relationship between ownership of a digital item, a digital piece of art or other unique asset, and ownership. The upshot is clear: online, we own next to nothing. Indeed, this law is beginning to creep back into realspace. As Joshua Fairfield has written, you do not truly own your smartphone, tablet, smart car, internet-enabled television. These assets do not

[228] *See id.*

[229] *See* Vernor v. Autodesk at 1109 ("[W]e consider all of the provisions of the agreement to determine whether the transferee became an owner of the copy or received a license. We may consider (1) whether the agreement was labeled a license and (2) whether the copyright owner retained title to the copy, required its return or destruction, forbade its duplication, or required the transferee to maintain possession of the copy for the agreement's duration.").

[230] See *Tokenized, supra* note 198, at 65 ("For example, when a person buys a Kindle e-book, they agree simply by opening the app that they merely license the book, they do not own it." (citing Kindle Store Terms of Use)).

answer to you, but to the companies that own the intellectual property in the software that runs them.[231]

NFTs are not free from the sale-license distinction, or from the copy-copyright distinction that follows from it.[232] Buyers of NFTs are startled to learn that terms and conditions often apply: terms and conditions that would be flatly absurd if imposed on the purchaser of multi-million-dollar physical artwork. These limits include constraints on the very core of an art-NFT purchase: the ability to earn based on the art's appreciation in value (which, incredibly, some art-NFT marketplaces cap),[233] transfer fees that kick back to the NFT seller with each subsequent sale,[234] the seller's ability to pause the transferability of the NFT,[235] even restrictions on legal rights that stop the purchaser of an NFT from vindicating their rights in court.[236]

The example of art-linked NFTs is so compelling because it implicates all of the usual problems of distinguishing a copy of artwork from the copyright in the art, and does so without any physical object, not even a CD, to ground the personal property interest. When courts begin to recognize the property interests in NFT-linked art -- and we confidently predict they will have no choice but to do so -- they will finally have to set a framework in place that goes beyond purely listening to the characterization of the selling party, or looking for a physical object to ground and distinguish the personal property interest from the contractually determined license

[231] *See* OWNED, *supra* note 203, at 47 ("[W]e only have claims on our digital and smart property through our license relationships with intellectual property rightsholders.").
[232] *E.g.*, *Tokenized*, *supra* note 198, at 69 ("The all-important copyright, the right to make reproductions, that is absolutely necessary to convey a digital item from one person to another, is expressly retained by [the NFT minter].").
[233] *See id.* ("There is no limited exception for transfer and, indeed, owners cannot exploit their [NFTs] for commercial gain (which, under relevant internet law emphatically includes reselling a digital asset for profit. . . . ").
[234] *See id.* at 70 (explaining a specific NFT minter "claims right to collect a commission of 4.5% on all forward sales").
[235] *See id.* at 37 (explaining that tokens can be coded so that the transfer function of the token can be made "'pausable,' such that the original creator of the token can pause its future transfer").
[236] *See id.* at 87 ("Almost every online contract contains an arbitration clause, an agreement that the buyer gives up her right to go to court, and must instead proceed to arbitration, where consumers nearly never receive redress.").

interest to determine which digital assets are owned free and clear, and which were never truly sold at all.

Proposed Framework for Digital Property

An updated framework for determining digital property interests distinct from contractually-derived license terms and conditions is proposed. I begin by reaching back to work from 2005, in which Joshua Fairfield argued that virtual property gained its value by virtue of being rivalrous, persistent, and interactive. First, for an object to gain market value as a digital asset, especially in a collector's sense, it needs to be rivalrous.[237] As a judge wrote when adjudicating ownership of a domain name URL: property is anything susceptible of unique possession.[238] If I own LarryTrautman.com, you don't. If I have the art-NFT, you don't. Assets that are not rivalrous are like air: everyone has access free of charge (for now, we'll be bottling it soon enough), and so even though we value it deeply, nobody pays for it. There is no market in it. Next, it appears digital objects gain market value by being persistent over time: that is the very reason we are forced into streaming services. The copies are not persistent, every time we must request permission to listen to the music again. If we give up our subscription to Spotify, the music is gone. An item in a virtual world is fairly persistent: it may last as long as the world servers are up. But an NFT is even more persistent. Because it is recorded in a decentralized database, it does not die when the world servers go down.[239] NFT-linked art may be displayed in

[237] *See* OWNED, *supra* note 203, at 149 ("Rivalrousness becomes profitable through the mechanism of scarcity.").
[238] See Kremen v. Cohen, 337 F.3d 1024 (9th Cir. 2003) ("Property is a broad concept that includes every intangible benefit and prerogative susceptible of possession or disposition. . . . [Property] must be capable of exclusive possession or control.").
[239] *E.g.*, *About*, InterPlanetary File System, https://ipfs.io/#why ("IPFS powers the creation of diversely resilient networks that enable persistent availability — with or without Internet backbone connectivity.").

a range of virtual settings, from a tweet to a Decentraland-based virtual museum.[240] The very indelibility of blockchain technology speaks to the persistence of blockchain-based assets.

The last criterion, then, is interactivity. In a virtual world, interactivity can be immediate and visceral: player A can hit player B with the Sword of Admiration. But interactivity goes far deeper. The criterion speaks to the sociality of the asset. In a way, it is the opposite of the rivalrousness criterion, defining a sweet spot that we call property. Under the rivalrousness criterion, we assert that if everyone can have an identical copy of the thing, then it is not really owned.[241] Under the interactivity criterion, we argue that if *no-one* other than the owner can possibly interact with it, then it also is not the proper subject of property.[242] Here we must be careful: property ownership of course includes the ability to exclude others from seeing, using, or otherwise interacting with an asset.[243] The owner of the Mona Lisa could in fact prevent anyone else from seeing it. But interactivity as an asset feature means that people other than the owner *could* interact with it. They could see it, they could buy it and receive it if the erstwhile owner were to gift it to them.

If, then, an asset is rivalrous, persistent, and interactive, then how are we to determine who owns it? One thing we cannot do is rely on license characterizations. First, parties may lie: characterize a transaction as a license when it is in fact a sale of an asset. And second, the economic realities of the transaction may indicate that one party or the other was promised the owners's ability to bear the downside risk of loss and the upside chance of gain. When that is the case, the "economic realities" of the transaction are that the transferee is the owner of the

[240] *See* Clive Thompson, *The Untold Story of the NFT Boom*, N.Y. TIMES, May 12, 2021, https://www.nytimes.com/2021/05/12/magazine/nft-art-crypto.html (last viewed May 28, 2021) (discussing the creation of Colborn Bell's Museum of Cryptoart and other virtual museums).

[241] *See* OWNED, *supra* note 203, at 148 ("If an item is non-rivalrous, both you and I can have it at the same time.").

[242] *Id.* at 16 ("We do not buy property just to kick others off it. We buy it so we can control it -protect it from others, use it ourselves, and, if we permit them to, determine how others use it.").

[243] *Id.* at 15 ("Historically, the power to exclude has been the most well-developed of [property] rights.").

asset.[244] The seller has not merely rented out what belongs to her. This is not a difficult task: courts routinely determine whether someone has bought a car or is renting it, for example. Both contain monthly payments to some other entity. The transactions are almost always called rentals instead of true sales (because doing so gives certain advantages to the seller). But when courts pop the hood of the transaction, they determine that underneath the transferee bears all of the downside risk of loss in value, and reaps the benefit of the upside gain.

The other elements of the Vernor v. Autodesk attempt to differentiate between license and sale are just as intellectually bankrupt. If the seller of an NFT claims the ability to restrict transfer (or extract payments upon transfer) the relevant question is whether that demand sticks. If the transaction was a sale of an ownership interest, then the request of the seller for extra power or money is moot. Consider whether you could sell a car, and then demand payment the next time your buyer sold the car further on: you could not.

The better move is to follow courts in looking to the economic realities of the transaction. Where something like an art-NFT has been marketed and sold to the purchaser as the transfer of ownership -- a sale, not a rental or a mere license -- then courts should consider the asset to be owned as a matter of traditional personal property ownership. In particular, where the *entire purpose of the transaction* is for the buyer to carry the downside risk of depreciation in the property's value, and reap the upside gain if the market swings up, courts must laugh claims that the asset was merely licensed rather than sold out of court. There is no need to invoke the bizarre patchwork of law that surrounds e-books, streamed music, iTunes, or video games -- law that determines even digital assets that are fully bought and paid for are not owned but merely licensed. Rather, we can return to a simpler and more direct legal form: the true sale of personal

[244] *See Tokenized, supra* note 198, at 39 ("One of the ways of determining ownership throughout law is to look at who gains when the property rises in value, and who loses when the property falls in value." (citing U.C.C. § 1-203 (Am. L. Inst. & Unif. L. Comm'n 2002)).

property. This has one additional particularly important effect. It normalizes the collection of digital art within the art collection world, setting owners of art in the same position regardless of whether their purchase is online or off.

VI. THE FUTURE OF DIGITAL PROPERTY

As professors Schultze and Mason write, "Virtual communities and social networks assume and consume more aspects of people's lives. In these evolving social spaces, the boundaries between actual and virtual reality, between living individuals and their virtual bodies, and between private and public domains are becoming ever more blurred."[245] We will now provide a few thoughts about likely futures for digital property.

Artificial Intelligence (AI)

Reports abound of artists using various machine learning techniques to create novel works of art. At the Google Cultural Institute, code artist Mario Klingemann, "is applying deep learning to large datasets for creating huge, stunning digital art."[246] Another example of those "who have started a journey of finding out how creativity can be enhanced by AI… [is] Matthew Yee-King, a musician who is employing evolutionary and genetic algorithms to work on sound synthesis."[247]

Payments for Artistic Endeavors

[245] Ulrike Schultze & Richard O. Mason, *Studying Cyborgs: Re-examining Internet Studies as Human Subjects Research*, 27 J. INFO. TECH. 1 (2012).
[246] Bo Xing, Creativity and Artificial Intelligence: A Digital Art Perspective (2018), https://ssrn.com/abstract=3225323.
[247] *Id. citing* Carnegie Mellon University, Machine learning for artists and designers, School of Art, ArtFab, (2018), https://artfab.art.cmu.edu/tutorials/machine-learning-forartists-and-designers .

Financial journalist Jason Zweig suggests that NFTs' provide an opportunity for artists to gain a greater payback for their labors by providing "an ownership stake they've never had before."[248] He presents the example of:

> Josei Bellini, an artist based in Chicago who majored in finance in college and worked briefly at an investment-advisory firm. Since late 2018, she has sold about 300 of her paintings this way.
>
> One of her NFTs, a dazzling digital work titled 'Yours Truly #0,' is on sale by its current owner, an account called Bitbuzz, for 250 ether. That's a cryptocurrency, worth a total of about $450,000. Ms. Bellini, who sold the NFT for 50 ether in February 2020, will receive a 5% royalty if it sells−now and anytime again in the future.
>
> Typically, when an NFT is traded on the blockchain, that network won't allow a sale and purchase to be completed without forwarding the predetermined royalty to the wallet, or account, of the artist who created it.
>
> 'It's so amazing that even if it gets traded 10 or 20 times or more, I'll still be getting my fee for it,' Ms. Bellini says. 'That's totally not how the art world has worked until now.'[249]

Future Regulatory Compliance Issues

Rapid adoption of novel technologies such as NFTs vividly illustrate the struggle for our laws and regulations to keep pace.[250] Characterizing the technologies involved and use of these assets may have different legal outcomes raising new issues in law. Among the questions that may arise include: whether your NFT or work of art is characterized as a commodity, security, or usage subject to money transmitter laws that continue to evolve. Attorneys Cohen, et. al., warn:

> Understand whether the NFT sponsor is carefully addressing compliance with regulatory requirements, and understand the potential effect on liquidity if the NFT is marketed as a security or a commodity, and understand potential rescission rights if an NFT that is not marketed as a security is subsequently

[248] Zweig, *supra* note 36.
[249] Zweig, *supra* note 36.
[250] Lawrence J. Trautman, *Governance of the Facebook Privacy Crisis,* 20 PITT. J. TECH. L. & POL'Y 41 (2020) (Facebook struggling with privacy issues), http://ssrn.com/abstract=3363002. *See also* Lawrence J. Trautman, *How Google Perceives Customer Privacy, Cyber, E-Commerce, Political and Regulatory Compliance Risks,* 10 WM. & MARY BUS. L. REV. 1 (2018), https://ssrn.com/abstract=3067298; Lawrence J. Trautman, *E-Commerce and Electronic Payment System Risks: Lessons from PayPal,* 17 U.C. DAVIS BUS. L.J. 261 (2016), http://www.ssrn.com/abstract=2314119.

> determined to be a security that was issued in violation of the registration requirements of the securities laws.[251]

The Future of Digital Property

As to the likely future of NFTs, professor Michael M. Dowling reports that his initial finding suggests inefficiency in pricing along with "a rapid rise in value."[252] Professor Dowling observes, "Early-stage markets tend to be driven by a volatile search for suitable pricing models and only slowly emerging market efficiency."[253] Exhibit 8 depicts the NFT U.S. Dollar Price Chart and the rapid rise in total dollar expenditures since January, 2021.[254] Christie's 21st Century Art Specialist Noah Davis says, "I feel honored to have been welcomed into this insanely creative [cryptoart] community, humbled by their virtuosic talents, and inspired by their utopian visions. I see so much potential for blockchain technologies from Smart Contracts to DAOs - to revolutionize (some might say 'disrupt') our way of doing business."[255] And as a view from one of the world's major historical art auction houses, Christie's specialist Mr. Davis states, "Blockchain isn't just going to shake up the art world and decentralize the financial industry, it's going to change the way artists make art, and the way every creative industry operates, by democratizing access to information, diminishing opacity in favor of transparency, and empowering creative people everywhere."[256]

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[251] Daniel S. Cohen, Clifford C. Histed, Jeremy M. McLaughlin, Jonathan M. Miner & Anthony R.G. Nolan, *The Coming Blockchain Revolution in Consumption of Digital Art and Music: The Thinking Lawyer's Guide to Non-Fungible Tokens (NFTS),* XI NATIONAL L.J. (Mar. 28, 2021), https://www.natlawreview.com/article/coming-blockchain-revolution-consumption-digital-art-and-music-thinking-lawyer-s.
[252] Dowling, *supra* note 136 at 9.
[253] Dowling, *supra* note 136 at 9.
[254] NFT U.S. Dollar Price Chart, Nonfungible.com, https://nonfungible.com/market/history (last viewed Mar. 27, 2021).
[255] Press Release, Christie's Presents Proof of Sovereignty: A Curated NFT Sale by Lady PheOnix (May 2021), https://www.christies.com/about-us/press-archive/details?PressReleaseID=10079&lid=1 (last viewed May 26, 2021).
[256] *Id.*

Exhibit 8
NFT U.S. Dollar Price Chart[257]

Tech-savy entrepreneur and owner of the Dallas Mavericks, Mark Cuban, observes "NFTs are just one application of smart contracts. Think about textbooks being NFTs. You buy it. Use it. Easily resell it. Publishers get royalty on each sale. Think how stocks work right now. Most people think they own the stock."[258] However:

> They own the right to the stock. It's held in street name. It gets lent out to shorts and they don't collect the vig on the borrow. And then of course there is front running and payment for order flow and the fact that a share of stock doesn't truly convey the holder any real ownership rights. If every share or block of shares was an NFT then it all would be transparent…
>
> Smart contracts on blockchains, particularly Ethereum, is an enormous game changer that every company will use… Weather insurance (Arbol is a great example). With a smart contract I'm soon going to be able to have the Mavs buy weather insurance where using a smart contract I pick the temperature and precipitation thresholds and the smart contract checks the National Weather Service for my ZIP code or another chosen data source and on that day or period if the threshold is met, I get Ethereum deposited into my account automatically. 'No different that the Internet of 1995 where people weren't quite sure but eventually they saw the network effect and value. Smart contracts are going to eat a lot of the software-as-a-service world.'[259]

When asked about the recent high level of transaction costs, Mr. Cuban replied, "It is too expensive. But that's specific to original Ethereum. There are changes coming to Ethereum 2.0

[257] NFT U.S. Dollar Price Chart, Nonfungible.com, https://nonfungible.com/market/history (last viewed Mar. 27, 2021).
[258] *See Kessler, supra*, note 2.
[259] *See Kessler, supra*, note 2.

and immediate options with Layer 2 enhancements with a bunch of companies… Coinbase is the Netscape of now… There will be cheaper options."[260]

Writing about virtual land NFTs in March of 2021, professor Michael M. Dowling remarks about how "early 2021 has seen these markets explode in popularity." In a personal conversation on the topic he remarked:

> We've seen prices for every NFTable part of virtual worlds shoot up this year, but that was following a similar growing trend in 2020. It was just not as notable in 2020 because the absolute prices were not as high. That's on the back of some clear value propositions emerging. Worlds like decentraland, unlike a lot of their early competitors, genuinely look good, and so people are starting to see sparks of how this could become a viable business in addition to a viable metaverse.[261]

VII. CONCLUSION

Several puzzles related to the emergence of a new form of fully digital property, the NFT, have been explored as it relates to the art market. My goal is the creation of free and fair markets. The challenge to free markets is the degree to which NFTs will function as clean packages of rights, easily transferable in markets without trailing strings of rights that render them ultimately unattractive as collectibles. In particular, the trailing string of intellectual property poses a serious challenge to the viability of NFTs as art forms. As things stand, NFT owners do not truly own the artwork linked to their token. If courts shape legal policy appropriately, NFT-based transactions may come to reflect the same or a similar compromise to that from which real-world art collectors benefit: the owner may use, display, benefit from, capture the rise in value from, and otherwise benefit from the social value of being the owner of the item. The link between an NFT and hyperlinked art is looser than that between physical canvas and paint and the intellectual property that inheres in the artist's creation.

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[260] *See Kessler*, *supra*, note 2.

[261] E-mail from Michael Dowling, Professor of Finance, DCU Business School, to author (Mar. 28, 2021 at 7:15 CST)(on file with author).

The challenge to legal theory will be in tightening those linkages, despite the fact that NFTs do not have any physical copy to anchor the copy-copyright dichotomy. Some similar deal will have to be hammered out. I propose, and believe that the future will inevitably lead to, some form of true digital online property, in which the digital token takes the role of the presence of a physical copy -- the thing owned by the collector -- and that will be distinct from the right to make infinite copies of the art -- a right retained by the artist or rights holder. Some provision for in-between states will need to be made. For example, the owner of a digital painting will need the right to transfer it, and it is well-established law that computers cannot transfer information without copying it. For this reason, the copyright in a digital artwork will need to be further divided between the right to transfer and the right to make infinite copies. Both involve copying, but only one makes additional permanent copies. Courts have been loath to make this distinction, but they will have no choice. NFT investors have been promised in no uncertain terms the ability to sell their property and realize the market rise in value. Courts will not take it away from them, nor will sellers who insist on the technical version of the no-copying rule survive as sellers: they cannot be trusted.

So much for free markets. As for fair, I have proposed that courts look to the economic realities of the deal rather than its surface characterization. As in many other legal contexts (the lease - sale dichotomy chief among them), courts must recognize that sellers will sell NFTs as personal property, but attempt to litigate them as intellectual property licenses. This flies directly in the face of the form of the transaction, in which a buyer makes a one-time transfer and is promised a permanent transfer of limited rights in a digital object. Humans understand what objects are, what personal property is, because of their experience in the real world. When NFT sellers invoke the similarities of their wares to personal property, to true ownership, they must be

held to their promises, no matter what it says on page 17, sub-paragraph C of a license agreement the buyer cannot possibly read.

The effects of these two shifts will be profound. Online property has suffered under an overexpansion of intellectual property rights. One need look no further than the license agreement for a Kindle, or the iTunes license. Online, we do not own even what we fully buy and pay for. That cannot be the case for NFTs: millions of dollars and a clear expectation of securing the rise in value of the asset to the owner and not the creator is at stake. These cases will be litigated and owners will win. And it is that combination of satisfaction of profound pent-up demand for digital online ownership, plus a technology that provides a component of the asset -- the token -- which is clearly independent of IP rights and which purports to carry an ownership interest, that will establish precedent for the ownership of personal property online. It does not seem likely that the deal between owners and creators will be worked out in a season. But the interest and resources brought to play in a dispute over the ownership of a digital Mona Lisa will not brook the kind of casual dismissal of ownership claims in digital books and music to which courts have been prone.

In the end, art-NFTs will establish the case for digital property as fully distinct from intellectual property. Bitcoin started this process -- no court seriously questions whether it is property, and for precisely the reasons we have discussed above. The issue has remained: will digital personal property interests vanish on contact with intellectual property, or will they survive and become part of a negotiated deal, of a similar type to that worked out between collectors and creators of the world's great pieces of real-world art. Once that linkage has been established, the property forms established by art-NFTs will feed back into the legal-technological ecosystem, and will support the recognition of many other kinds of digital property

interests. The demand for true ownership online is large and has until now been by and large unsatisfied because unsupported by basic legal protections for owners. Art-based NFTs are a killer app that will force the law to change. Once it does, we will become as used to owning fully digital assets as we are to owning our watch, car, or home.

