

Hope, hustle, and hype: The rise and fall of Art Non-Fungible Tokens (NFTs)

A sociotechnical analysis of emergence and failure

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Abstract

This article examines the technological emergence trajectory of Art Non-Fungible Tokens (NFTs), exploring their initial promise and then failure as transformative commodities disrupting art economies. Operating within an analytical framework of hope, hustle and hype, death and taxes, we investigate the interplay of technological, cultural, and economic trends shaping this trajectory towards failure. We identify the sociotechnical imaginaries clothing art NFTs and consider their relationship to both the acceptance and rejection of this technology. Our analysis contends that the desire to escape economic exclusion created a collective hope through which social adoption occurred. However, delving into the digital graveyards of Art NFTs, we identify external forces such as cultural shifts, social backlash, and regulatory interventions extinguishing the public's 'cruel optimism', leading to the revocation of the social licence to operate for this emerging technology.

Keywords: Art NFT, Web3, technological diffusion, sociotechnical imaginaries, failure, celebrities

1. Introduction

Beyond usefulness, new technologies run on hope, hustle, and hype to prompt uptake and adoption, expand their market reach, establish their brand visibility, and bolster their (profit) viability. This well-traversed innovation trajectory of technology development and experimentation is not always a success story. It often features hastily launched projects, poorly conceived business models, smoke and mirrors redirects (fronts), and a mix of sceptics and true believers. Given the frequency and fast pace of this trajectory and these practices – technological innovation riding high on social, cultural, and economic promise, and then skulking into obscurity after a moment in the (very) painful spotlight of public and regulatory scrutiny – in this article we pause to ask, 'what have we learned?'.

To do this, we focus on the emergence of Art NFTs which are based on the technological convergence of non-fungible tokens (NFTs), blockchain, smart contracts and cryptocurrencies. According to advocates this combination of technologies affords ownership, authenticity, exclusiveness, and traceability of digital works (Calvo, 2023). We build a conceptual model underpinning of the technological emergence and

diffusion lifecycle that allows us to examine failure through an examination of the promise and spectacular collapse of art NFTs.

An Art NFT is a unique, media-carrying cryptographic token on a blockchain, which in turn is a decentralised digital ledger technology that supports token economies. What distinguishes NFTs from other token-based blockchain technologies such as cryptocurrencies (digital assets often referred to as digital cash), is that each token is unique and is not interchangeable with another. NFTs can represent ownership of digital assets such as artworks, collectibles, virtual real estate, or any other unique digital item, providing verifiable proof of authenticity and ownership (Pinto-Gutiérrez et al., 2022). At present highly-cited definitions of NFTs (Nadini et al., 2021; Pinto-Gutiérrez et al., 2022; Wang et al., 2021) focus on the technical underpinnings of NFTs, and are not focused on defining Art NFTs specifically.

For the purposes of this study, we define Art NFTs, as art-based NFTs that do not have a prior relationship with an existing event, object, or brand. Art NFTs are minted for the purpose of becoming NFTs. However, like the Bored Ape NFTs, they may produce broader communities of engagement and practice that exist outside the blockchain.

To ground this definition, we consider two contrasting examples of Art NFTs that illustrate the potential and pitfalls. Tyler Hobbs' 'Fidenza' project (Hobbs, 2021), launched in 2021 with 999 unique, algorithmically generated artworks created specifically as NFTs (Hobbs, 2021). The collection demonstrates the potential for rapid value appreciation; Fidenza #313, initially acquired for \$1,400, later sold for \$3.3 million (BlockTides, 2023; Tonelli, 2021). Hobbs' subsequent 'Incomplete Control' collection pushed boundaries further, with collectors paying \$7 million for 'golden tokens' redeemable for unseen artworks (NFTevening, 2023). On the other hand, the 'Frosties' NFT project exemplifies the risks and failures in the space. Launched in January 2022 (2022), Frosties featured 8,888 cartoon-style ice-cream characters and quickly sold out. However, the project's creators abruptly shut down all communication channels and transferred the funds (approximately \$1.1 million) to other wallets, executing a 'rug pull' scam. This led to criminal charges, marking one of the first such cases in the NFT space (Elliptic, 2022).

In this article we develop a conceptual model of the technological emergence and diffusion lifecycle through which we explore failure, the elements of which we illustrate through examples from the promise and spectacular collapse of Art NFTs. We propose a 'lifecycle' model with three stages of hope, hustle and hype, death and taxes to draw out sociological insights into the emergence and diffusion of Art NFTs. While we can criticise the Web3 space for its scammy and opportunistic nature, we also acknowledge that it offers an alternative vision of the future; a compelling vision for which we currently lack in this interregnum of transitional ambiguity (Streeck, 2014: 37).

2. Technology diffusion, imaginaries and failure

This article deliberately draws upon a wide range of interdisciplinary research to comprehensively analyse the diffusion of Art NFTs as an innovative technology. The rationale behind this approach lies in the fact that understanding the trajectory of Art NFTs requires knowledge that is distributed across multiple disciplinary fields, extending beyond the domain of art-making practices and the economic and entrepreneurial ecosystems surrounding the distribution and ownership of digital art. By bridging these disparate bodies of work, this article provides a unique and holistic perspective on the rise and fall of Art NFTs.

It is worth acknowledging that studies on technology innovation and diffusion often flourish in areas with clear funding agendas and large-scale use cases that have significant economic and institutional implications. Our study diverges from these typical investigations. Art NFTs represent a niche technology space that experienced a rapid boom followed by a significant decline. This focus on a technology that didn't achieve sustained, large-scale adoption offers valuable insights into the barriers to innovation diffusion. In essence, we are digging in the digital graveyards, excavating the remains of a once-hyped

technology to understand its lifecycle. Importantly, our analysis reveals that the limited adoption of Art NFTs was not solely due to technological factors but was significantly influenced by social dynamics and logics that are often overlooked in conventional diffusion studies. By examining these social factors amidst the digital artefacts left behind, we gain a more nuanced understanding of why initial hype and investment in a technology may not necessarily translate into long-term, widespread adoption.

The trajectory of technological emergence that we begin with starts conventionally with innovation through the development and convergence of existing and new technologies into a unique product or service. The novelty of the product or service often lies affordances that either improve/make more efficient — or create a state change in (disrupt) - commercial markets and existing firms, social interactions and relationships, organisational structures, institutions and public policies (Schuelke-Leech, 2018). At the innovation stage, developers, entrepreneurs, start-ups, scale-ups and investors working within an entrepreneurial ecosystem seek to bring a new product or service to market. In this narrative juncture, technology is frequently perceived in deterministic terms, expected to exert transformative influence upon the prevailing status quo. This often entails a reduction of the complex issues it seeks to address, simplifying them in the process. However, it is also at this stage of tool focus that emerging technologies are imbued with our hopes for them and clothed in a sociotechnical imaginary (Jasanoff and Kim, 2015). This process transforms the technology from a problem-solution paradigm to a future-making project. These symbolic connotations feed into the hustle and hype surrounding an emerging technology which pushes it into and through the market. As will be demonstrated in the case of the Art NFTs presented in this article, the purpose of hype is to nudge and shape social adoption, a core indicator of technological diffusion and acceptance.

Social adoption is often achieved when the hustle and hype surrounding an emerging technology encourages a networked effect of users into the business model of the product or service by signing up, purchasing, licensing, connecting with others, and engaging with the product. During this time investors keep a sharp eye out for the desired hockey stick revenue-growth curve associated with rapid social adoption of a new product or service that represents their potential return on investment (Gillis, 2022; Henry, 2018). Start-ups and entrepreneurs are incentivised to pursue this form of rapid adoption in their accountabilities to their investors, often seeing half-baked projects leap into markets through the ‘move fast and break things’ motto made famous by Facebook (now Meta). What tends to co-occur socially is a more complex web of social appropriation in which the technology may be domesticated and used within or beyond its intended use cases to become ‘useful’ (Carroll et al., 2003; Carroll et al., 2002). The hustle accompanies both the processes of social adoption and appropriation where influence is used by a myriad of ecosystem players to monetise the technology, either directly by selling a use case for it (product or service), by affiliation with it (branding), or by leveraging its affordances and vulnerabilities for more ambivalent purposes. Through these combined processes, social logics of use arise in which the technology is embedded into existing social structures.

For a technology to be adopted, it must be perceived as useful and intersect with existing social practices, filling a recognised or unrecognised need that drives transitions to use. However, the technology may be appropriated for purposes beyond its original intent, as users exploit new tools to serve their own ends. Neves et al. (2023) provide a sociologically nuanced framework for understanding technology interventions as purposive social action, drawing upon the work of Robert Merton (1936) to explain the social impacts of technology. They observe that purposive social actions can yield both intended and unintended consequences. In the context of Art NFTs, the notion of purposive social action is an integral component of the innovation process, linked to the deliberate development of novel technologies designed to disrupt existing business models and social practices. Merton (1936) attributes unintended consequences, which can be positive or negative, to factors such as ignorance, error, immediacy of interest, or fundamental values that prioritise subjective satisfaction over objective outcomes. These attributes and practices are evident in technology innovation contexts, perpetuated by the capitalist logics of entrepreneurship and the ideologies permeating innovation hubs like Silicon Valley

(Barbrook and Cameron, 1996). Neves et al. (2023) articulate Merton's categorisation of undesired effects as unexpected benefits, drawbacks, and perverse results. We argue that through the adoption process, users shape the ways in which technology is used and the purposes it serves, potentially leading to perverse results that undermine the original vision of Art NFTs and contribute to their failure to achieve widespread social adoption due to disillusionment and backlash. To illustrate the process for how social logics give rise to unintended consequences that reify existing social inequalities we turn to the work of Sheoran (2015). Her anthropological examination of the social uptake of the contraceptive pill (a medical technology) in India illustrates clearly how a technology intended to support an agenda of poverty alleviation through population control at the site of the woman's body ended up reinforcing existing social inequalities through its culture of adoption and the logics that arose around its use. While conventionally, the technological trajectory sees the technology hit a plateau of tinkering and application, which is has done with the contraceptive pill, as is evidenced in this case example, sometimes these logics and uses diverge from the developers' initial intentions and give rise to unintended consequences. If these logics and unintended consequences drift away from the promised sociotechnical imaginary, disillusionment, social backlash, and regulatory intervention arise that either stymie or extinguish the uptake of the original technology.

We evoke the concept of a sociotechnical imaginary through which to frame the visions of the future that emerging technologies are often saddled with, through the lens of innovation, that tend to offer a panacea that carries the promise of curing socioeconomic ailments almost irrespective of what these ailments are or how they have arisen (Pfotenhauer and Jasanoff, 2017: 784). This concept is argued by Jasanoff and Kim (2015) to bridge the gap between empirical research on the politics of science and technology and theoretical work on the formation and genesis of collective social imaginations. van der Maarel et al. (2023) draw together composite bodies of social theory on future imaginaries, innovation, and expectation (Jasanoff and Kim, 2015; van Lente et al., 2013) to describe how sociotechnical imaginaries frame innovations based upon what problems are at stake, what solutions build help and who should be involved. In tweaking their definitional work to build in the digital public realm, we articulate sociotechnical imaginaries as a collection of co-produced and dynamic, yet organised, social practices involving actors, institutions, platforms, and technologies that operate at an intersubjective level by bringing members of a social community together in shared or overlapping perceptions and expectations of futures that should or should not be realised.

Through their ethnographic study of a Dutch Military Innovation Hub, van der Maarel et al. (2023) observe that sociotechnical imaginaries do materialise in social practice but may also be in a translatory friction with it in ways that impedes their realisation. Drawing on their work we articulate how the translatory friction of the Web3 sociotechnical imaginary can be traced through iconic examples, future projections, discursive constellations, and master narratives (van Lente, 2021: 25). It is an analysis of iconic examples, events, future-oriented hopes, and narratives in digital public discourse that form the bedrock for the development of the conceptual model we present here. Such sociotechnical imaginaries weave through the technology innovation cycle and see a cast of characters, including "charismatic CEOs, technology gurus, and sycophantic pundits" on a relentless hype trail (González, 2022: 67) that tend to distort this translation.

We highlight the sociotechnical imaginaries of Web3 innovation as occurring within the context of a specific political, economic, and cultural moment in which we are facing increasingly unequal societies. Berlant (2011) coined the term 'cruel optimism' to describe our yearning for unattainable fantasies of a good life, acknowledging the inability of liberal-capitalist societies to fulfil promises of upward mobility, job security, political and social equality, lasting intimacy, and lives that 'add up' to something. We speculate that perhaps these conditions make us more vulnerable or susceptible to such disruptive sociotechnical imaginaries that hold the promise of an economic loophole (to get rich quick through non-traditional pathways) or an alternative mode of wealth distribution based upon changing permissions and affordances around digital ownership.

Amid current uncertainties, research on the financial behaviours of young individuals reveals a pursuit of economic alternatives, potentially involving speculation (Hendry et al., 2021). We contend that this pursuit forms a susceptible or delusionary bubble, supported by denial, enabling the embrace of narratives promising an alternative future—an outlook aligning with the frequently invoked sociotechnical imaginary of emerging technologies. Web3, including the art NFT bubble, exemplifies such visions morphing into an environment of networked scams, illustrated in Swartz’s (2022) exploration of an ICO collapse. Swartz demonstrates how a sociotechnical imaginary in Web3 can be ambivalent, depicting network scams as collaborative efforts to bring about a shared future, but one that is fundamentally characterised by arbitrage on an uneven belief among participants in that future ever coming to pass. This concept eloquently captures the conflicting agendas driving the hustle and backlash surrounding art NFTs, leading to disillusionment stemming from an unfulfilled sociotechnical vision (van der Maarel et al., 2023).

In this article we focus on this downward trajectory in which projects languish in ‘digital graveyards’ where they either fade into obscurity or get repurposed while the next thing emerges to grab the spotlight and investor money. Drawing on Bickford’s (2018) study of the failed experiment for the idiophylactic soldier, van der Maarel et al. (2023) observe that such failures are political and create new areas of exploration and exploitation. Within the milieu of web technology scholarship there is a tendency to focus on the next thing rather than digging back through what went wrong. This is partly because the harms of web technologies tend to be erroneously couched as immaterial harms. People lost money — we burned through some fossil fuels. The perceived immateriality is what allows the lifecycle to continue because it does not seem like the mistakes matter. But they do. In exhuming the dead, we are materialising these failures, looking at what produced them and what the consequences of them are. For this post mortem, we pick through the digital graveyards of the Art NFT technological trajectory. By doing so we aim to produce a sociological account that situates the opportunistic and often reactionary arc of technological innovation and experimentation within a broader context of neoliberal agendas, precarity, contingency, uncertainty, and crisis (Ang, 2021), and a desire for economic mobility and a more stable/hopeful future.

3. The hope

NFTs gained popularity during the onset of the pandemic crisis and as recently as 2022 it was possible to introduce them as a potentially transformative, high-yield commodity disrupting art economies (Wilson, 2022). Additionally, NFTs have been touted as a new cultural technology, reflecting shifts in art forms, akin to video art in the 1960s, virtual reality in the 1990s, and augmented reality in the 2010s (Wilson, 2022). NFTs are tokens on a blockchain, unique cryptographic digital assets that can be owned, traded, and collected (Beyer, 2023); acting as a certificate of ownership implemented through encrypted metadata pointing to a unique copy of a digital file (Jia and Yao, 2024). They exist purely digitally, which, as the co-founder of OpenSea, Alex Atallah, suggests: “If you spend 10 hours a day on the computer, or 8 hours a day in the digital realm, then art in the digital world makes tonnes of sense – because it is the world” (Howcroft and Carvalho, 2021).

As a conceptual medium, Artists utilise NFTs by transforming them from financial contracts to standalone artworks. Examples include conceptual artist Rhea Myers and interdisciplinary artist Sue Beyer, who use NFTs to explore the boundaries of art and technology (Beyer, 2023). Beyond a conceptual medium, Art NFTs and their marketplaces are also a financial and distributive instrument based upon a tokenised economy and the permanent record of objects and transactions held on blockchain ledgers. The blockchain technology is a distributed computing model that has been used for more than ten years to record transactions in a distributed database-based, peer-to-peer network (Taherdoost, 2023). In her discussion of the multifaceted nature of NFTs and their transformative and conceptual potential Beyer (2023) compares blockchain technology to a permanent record, akin to the Akashic records, that stores immutable information accessible through specific rituals. Blockchain’s decentralised nature pairs with

its function as a secure and permanent database to enhance provenance information (art authenticity) and its ability to host smart contracts.

Smart contracts, distinct from traditional contracts, operate as technological protocols that automatically execute and enforce instructions in various scenarios (Beyer, 2023). They play a pivotal role in NFTs, allocating ownership to the creator during their minting. Taherdoost (2023: 3) provides an accessible explanation that balances how they function with what they do by observing that they are “simply containers of code that encapsulate and replicate the terms of real-world contracts in the digital domain” and that they may be used to automatically negotiate, carry out, and enforce the terms of a legally binding agreement. The ownership and transfer of NFTs are typically managed through smart contracts, which include information about the digital content, ownership details, intellectual property, and other relevant metadata. They can, for example, enable creators to embed resale royalties in the token metadata for example, automatically ensuring artists receive royalties upon each resale (ArtsLaw, 2024). When an Art NFT is sold, smart contracts facilitate ownership transfer, ensuring provenance and authenticity tracking (Hedera, 2023). While ownership of an NFT grants substantial control over a creative work, this control is not automatic (Grimmelmann et al., 2022a). Copyright entitlements do not automatically extend to the owner of an NFT unless the creator actively takes steps to ensure they do. This can be achieved by executing a standard, formal copyright licence to the work connected to the NFT, embedded in the metadata (Grimmelmann et al., 2022b). Consequently, the rights conferred to NFT purchasers, particularly regarding real-world legal considerations like copyright, remain inconsistent and unclear (Mackenzie and Bērziņa, 2022).

Ownership rights are over the entire token, and these rights are secured on the blockchain. The indivisibility of NFTs contributes to their uniqueness and scarcity, factors that often contribute to their perceived value in the digital art market. However, within the NFT world, ownership of a token is divisible in a different way through smart contract executions. For example, through the terms encoded into a smart contract, sellers can retain copyright relating to the NFT token. This was the case for a slam-dunk video of basketballer LeBron James released by the NBA as a part of limited-edition collectibles (Cointelegraph, 2022). This type of divisibility foregrounds the collaboration between human and non-human agents in the execution of contracts (McMillan et al., 2020). These contracts, or persistent scripts as Vitalik prefers to refer to them as (Vitalik.eth, 2018), are likened by Beyer (2023) to spells or recipes, representing a form of technological magic that transforms the ordinary. In this case, a JPEG or media object into an ownable and unique work of digital art. The language describing the role of smart contracts in Art NFTs — switching across texts and authors between digital property, law, code, the more-than-human, and magic — represents the discursive constellation within the sociotechnical imaginary of this tokenised blockchain technology.

The master narratives accompanying Art NFTs include that they can provide a new income stream for artists, address art fraud by guaranteeing authorship, authenticity and originality through the blockchain (Mackenzie and Bērziņa, 2022). They are also positioned through an inclusion lens as a way for often disadvantaged groups such as First Nations artists to create additional revenue streams (Harris, 2023; Houlbrook-Walk, 2022). This suite of tools and networked functions have been heralded as a way for digital artists to make a living from their work in an environment where anything can be (and often is) endlessly copy/pasted and circulated without attribution and compensation. When aggregated into marketplaces, NFTs are argued to offer artists an alternative way to financially benefit from their work (Chalmers et al., 2022; Kelso, 2023), hold direct relationships with art consumers and retain differentiated rights to their work overtime. These are largely attractive propositions in an economic and social climate that often makes it difficult to make a viable career from creative arts.

Art NFTs embody a set of values held across the broader Web3 ecosystem that include encryption, decentralised peer-to-peer exchange, trustless systems, and transparent actions with (pseudo) anonymity. They also align with other technological, cultural, and economic trends, including the growing accessibility of immersive environments, practices of sharing and repurposing in digital cultures, the

pervasive nature of social networking, the emergence of ‘whole-of-life’ marketplaces¹ like that proposed by Meta, and the success of in-game economies². NFTs, as a component of the larger movement surrounding digital ownership, play a crucial role in securely verifying the provenance and ownership of digital art (Abutu, 2023). This function aligns with the foundational structures of Web3 technologies, contributing to its sociotechnical imaginary. Art NFTs navigate a complex sociotechnical imaginary, merging ideologies of laissez-faire digital cultures, the hacker ethos of information freedom, and capitalist motives of scarcity and profit. While these functionalities within one technology suite are distinctive in the art world, the underlying logics echo familiar themes of wealth concentration, and the allure of quick riches veiled in notions of equity and inclusion.

To understand the social processes and community dynamics that shape token-economy technology adoption we can look to cryptocurrencies and cryptomarkets. Overlaps with other token-economy based dynamics can also be found in the collector cultures surrounding trading cards for example (Russell, 2022). As Childs (2023: 2) observes of the adoption of privacy focused-cryptocurrency Monero (a fungible token) in an illicit market ecosystem, “these are often unstable sites of exchange as new technologies are quickly embraced (and then rejected) and new practices are adopted (and then abandoned)”. Childs further describes this ecosystem as a coming together of three domains: 1/ individual practices and norms 2/ the technological infrastructure required for coordinating activity (including encryption, platforms, and their technological affordances), and 3/ the cultural and legal contexts shaping marketplaces. These attributes can also be used to articulate the domains across which the communities surrounding art NFTs act.

In his analysis of discourse on Monero in a darknet subreddit, Childs (2023) identifies three key themes that hold value for this work also. The first theme relates to the role of online communities in sharing knowledge and guiding technology transitions. We have seen this in the way Art NFTs quickly proliferated and were initially traded amongst crypto-ingroups who already possessed digital wallets, had cryptocurrencies, and knew how to build and use marketplaces, before they then spilled out into wider cultural domains with many a ‘how to’ explainer. Second is the diversity of perceptions around digital trace visibility and risk management strategies that shape cryptocurrency adoption. As we will see in the subsequent discussion of the Art NFT lifecycle, several consumer risks relating to rug pulls, influencer pump-and-dump manoeuvres (Schrader, 2024), hacks (Pereira, 2023), and value volatility (Choi, 2023; Yang, 2023) can be found in the world of Art NFTs. The substantial visibility of these bad actor activities within news and social media have dogged and shaped the adoption of Art NFTs and perception of their value. Third, he identifies the ideological and symbolic drivers of adoption. Some of these drivers for Art NFTs we have mentioned above, however he names more universal ones also that apply broadly across the Web3 ecosystem. These include the influence of cyber libertarianism, the mirage and allure of imagined futures, and the normalisation of practices and communication of ideologies that facilitate technology adoption.

Drawing on the concept of assemblages, Childs (2023) sees cryptomarkets as human and non-human forces in a dynamic system that is always in a process of becoming. In witness to the focus of his work, they are also always teetering on the brink of abrupt decline. We propose to extend this thinking by arguing that this decline for Art NFTs occurs when external forces of culture, social backlash and regulatory approaches snuff out the cruel optimism (Berlant, 2011) of a community. This is more than the disillusionment and disappointment that we see in technology hype cycles arising from the misfit of the sociotechnical imaginary with its materialisation (van Lente et al., 2013). We extend more firmly

¹ In the context of NFTs, whole of life marketplaces refer to platforms that support the entire lifecycle of a digital asset, from creation and minting to trading and retiring. These marketplaces typically allow users to create, buy, sell, and trade NFTs, as well as track ownership history and manage royalties. Examples include OpenSea, Rarible, and SuperRare.

² In-game economies are virtual economic systems within video games or virtual worlds where players can earn, trade, and spend virtual currencies or assets. These economies often involve the exchange of in-game items, currencies, or services, which may have real-world value. With the integration of blockchain technology and NFTs, some in-game economies have expanded to allow players to own, buy, and sell unique digital assets that can be used both within and outside the game environment.

upon these explanations of failure to say that the social licence to operate for this emerging technology has been revoked.

4. Hype and hustle

NFTs exploded in popularity in mid 2021 as pictures of apes sold for tens of millions of dollars, and an endless supply of headlines about million-dollar hacks of NFT projects and corporate cash grabs piled on top of each other (Clark, 2022). Here we see the bedfellows of hype and hustle in action. Understanding how the hope outlined in the previous section is transformed into and by hype and hustle, is an important part of understanding the social and cultural lives of NFTs as material objects, beyond the insider bubble and the influence of vested interests. The notion of hype refers to widely varied ‘hype patterns’ that explain hype cycles in which waves of media attention are combined with high expectations on technological possibilities and the associated attraction of attention, resources, coordination of activities, and the spurring of competition (van Lente et al., 2013). A common referent for this cycle is the Gartner hype cycle which describes the cycle in the evocative language of a technology trigger, a peak of inflated expectations, a trough of disillusionment, a slope of enlightenment and a plateau of productivity (O’Leary, 2008). van Lente et al. (2013) observe that hypes are usually followed by disappointment when high expectations are not met by the actual outcome of innovative activity. They observe however that whilst hype cycles in public discourses are often seen as exaggerated, deceptive, misleading, and presenting faulty predictions of the future, hype can also be seen as collectively pursued explorations of the future that have a performative capacity that affects activities in the present.

The seamless transition of Web3 hype cycles into the Web 2.0 and social media influencer landscape is unsurprising, given the digital, distributed, and peer-based nature of the ecosystem. NFTs gained prominence through celebrification, aligning with their platformisation in marketplaces like OpenSea, facilitating broader accessibility and social visibility. Influencers, particularly celebrities, play a crucial role in accelerating the adoption and legitimisation of emerging technologies, leveraging their social media presence. The hustle economy, as described by Cottom (2020: 19), involves influencers developing personal brands on social media platforms. Research indicates that social media influencers significantly impact the adoption of emerging technologies, enhancing consumers’ intention to adopt endorsed applications through trust transfer (Hu et al., 2019). Finfluencers, providing financial advice on cryptocurrencies via social media, marked the initial convergence of Web3 hustling with broader digital cultures. Recent trends involve celebrities endorsing/boosting crypto products without properly disclosing that they were paid for their endorsements (Contreras, 2023). This section explores how celebrities and social media users employ hustle tactics to shape the social licence of Art NFTs, asserting that this mechanism determines the success or failure of the technology.

The concept of a social licence has circulated in academic literature since the 1970s (Dennis, 1975), and typically indicates the social permissibility of a particular behaviour, particularly where social norms might supersede legal ones. However, the term social license to operate emerges as an extension of this concept and is most frequently associated with mining and other resource-intensive industries (Gehman et al., 2017). Gehman et al. (2017) identify several models that scholars have used to theorise the social license to operate, but they argue what links them together is the concept of legitimacy. Legitimacy as a social concept can be traced back to Weber (1978), who links legitimacy to conformity to both formal and informal social norms. Scott (1995: 45) argues that “Legitimacy is not a commodity to be possessed or exchanged but a condition reflecting cultural alignment, normative support, or consonance with relevant rules or laws.” Thus, the legitimacy or the social licence to operate that both NFTs and cryptocurrency rely on depends on a cultural alignment with their product offering, in this case ahead of relevant rules or laws. As identified earlier in this paper, NFTs and cryptocurrencies tend to initially operate in a legal grey zone where policy and regulation is yet to catch up with the novel actions and opportunism emerging technologies like this make possible.

The formalisation of the social licence to operate through social scientific research confers the concept with a much more solid and structured form than is often the case. Discussions of the social licence to operate invoke formalised discussion between the community, key stakeholders, and the corporations, which reflect its origins in the resource industry (Owen and Kemp, 2013). While the social licence to operate and legitimacy are two separate concepts, Gehman et al. (2017) note that they overlap considerably in their definition. We argue that the social licence to operate where it concerns new digital technologies, hinges on a level of permissibility that is predicated on the extent to which these technologies are culturally aligned with dominant social norms, and facilitated by what Aldrich and Fiol (1994: 648) identify as sociopolitical legitimacy, or “the process by which key stakeholders, the general public, key opinion leaders, or government officials accept a venture as appropriate and right, given existing norms and laws.” It is the ‘key opinion leaders’ that we now turn our focus to, as they have been central in establishing NFT’s social licence to operate.

Celebrities play a crucial role in conferring legitimacy to Non-Fungible Tokens (NFTs), leveraging their influence through endorsements and branded offerings. Notable figures, such as Paris Hilton and Tony Hawk, entered the NFT market during its peak, enhancing the socio-political legitimacy of these digital assets. Hilton is on the record publicly praising NFTs as an investment, stating that “I just started looking into what they were doing and was like, ‘Wow these guys really know what they’re doing, this is next level. I want to be involved, can I invest into this?’” (Youshaei, 2022). Beyond public statements of support, public displays of high-value NFT purchases, exemplified by Eminem and Snoop Dogg at the MTV Video Music Awards, further contributed to the perception of NFTs as a viable investment. Socialite turned crypto promoter Paris Hilton, was an investor in at least one NFT platform, and sold her own Planet Paris NFTs for more than \$1 million (Wilser, 2021). Paris Hilton’s dual role as a crypto investor and NFT seller, as observed by Mull (2022), underscores the speculative nature of NFTs, reliant on public investment for sustained growth. The traditional framework of celebrity endorsements falls short in comprehending the dynamics of NFT ownership and who profits. Mull (2022) contends that the influx of capital into cryptocurrency startups, often shrouded in secrecy, complicates the understanding of these celebrity-driven transactions. Gottsegen (2022) highlights the less visible influence of entities like MoonPay, a crypto custodian, in leveraging celebrity endorsements for marketing purposes. This practice, labelled as ‘perverse deal-making’, creates an illusion of an NFT gold rush, fostering FOMO and reinforcing individualistic, capitalistic neoliberal ideals amid societal uncertainties. It impresses upon individuals that they are responsible for their own financial wellbeing in what are increasingly difficult conditions and that they should “jump now” to shore up their future against uncertain conditions. It is not an accident that NFTs and cryptocurrencies boomed during the pandemic. But this social licence to operate is predicated on NFTs’ ability to hold ever-increasing value.

The social licence to operate is so central to NFTs because the financial backbone they rely on (cryptocurrency) is characterised as a trustless system in which the middleman (the bank or art broker/dealer/gallery) is removed. This removes a central credibility marker; the middleman and trust must therefore be placed in the technology. Arguably, blockchain infrastructure dispenses with the need to trust other people or, indeed, institutions (Dodd, 2018). Dodd (2018: 37) argues that rather paradoxically, the communities that have emerged around Web3 are sustained by the belief that these technologies (including Bitcoin) have “replaced social relation- the trust on which all forms of money depend-with machine code”. However, following Dodd, we argue that NFTs thrive precisely because, due to the celebrity endorsement, and broader mainstreams of NFTs, people were prepared to trust in these new forms of technology, extending them a social licence to operate and social legitimacy in the absence of broader material benefit. This is essentially the influencer trust transfer process rather than trust in the technology. NFTs initial premise drew on utopian sociotechnical imaginaries that are also embedded in blockchain and of self-governance, financial freedom, and a monetary system uncoupled from the nation-state (Dodd, 2018). However, as highlighted above Web3 technologies, including NFTs, are very much reliant on existing social institutions, which both constrain and enable their capacity.

To a certain extent the ‘hustle’ of NFTs, their massification through celebrity culture, confused visibility with social legitimacy and a social licence to operate. While NFTs were hyper-visibly embraced by professional sports leagues, rappers and a wide variety of other celebrities, this phenomenon is not the same as legitimacy. While celebrity endorsements mainstreamed the concept and recognition of NFTs as a way of trading and storing value, it also ran contrary to other internet cultures and attitudes. For example, on Twitter NFTs became highly trollable. Briefly, Twitter provided special avatar frames to users who had an NFTs as their profile picture, distinguishing them from ‘regular’ profile pictures (Adams, 2024). While their purchase is recorded on the blockchain, the actual image of the NFT is still infinitely copyable, which other internet users could, and did do (Morse, 2021). Binance responded to this practice in a Jan 11 2023 tweet, in the style of the “you wouldn’t steal a car” meme (Wikipedia, 2023), writing, “You wouldn’t steal a car. You wouldn’t steal a handbag. You wouldn’t steal a TV. So don’t right click save my NFT.” (binance, 2023).



Figure 1. Binance ‘Right click save’ [tweet](#) (Jan 11 2023)

While this tweet may not be completely serious, it illustrates the issues with generating broad-based social legitimacy for a digital ownership model that is immaterial and somewhat esoteric. The enrolment of celebrities to ‘hustle’ NFTs was one way in which the NFT industry attempted to close this gap. It is difficult to ascertain the precise networks through which this occurred, but the intermingling of celebrity and Web 3 industries are evident in NFT projects. For example, ‘Stoner Cats’, an NFT funded animation series helmed by Mila Kunis, has Ethereum co-creator Vitalik Buterin as the voice of one of the characters, Lord Catsington (Hayward, 2021). A lawsuit filed against Yuga Labs (most famous for the Bored Ape Yacht Clubs NFTs) suggests that Yuga Labs paid for celebrity endorsements and made them look ‘organic’ as a way of boosting prices (Whiddington, 2022). In using celebrities, money and visibility to establish a perception of socio-political legitimacy, the initial hope of NFTs, that they would help support more equitable models of income for artists was drained.

While artists may have benefited from the boom of NFTs in some ways, the copy-paste affordance of digital content also meant that some had their work copied and sold as NFTs without their permission (ArtsLaw, 2024), placing the income stream in the hands of those who were not the creators of the content. The hope of Art NFTs is further undermined by the shifting of their purchase and sale off the blockchain. As discussed above, the blockchain upon which both cryptocurrencies and NFT rest, is meant to be a ‘trust free’ technology, erasing their need for a mediating party through which these transactions are managed. However, the blockchain itself is slow, often expensive to interact with, and riddled with adhoc coding that ultimately makes it easy to steal NFTs, which people did. To extend the cultural reach of NFTs then, platforms and corporations developed intermediary interfaces to facilitate buying, selling and collecting, for example collectible NFTs sold by the NBA were exchanged through their platform,

Starbucks also supplied the platform infrastructure to support its (failed) NFT venture. What is an NFT without the utopian ideal of trust-free technology underpinning frictionless exchange? It's a hustle.

5. Death and taxes

In this section, we consider the death throes of Art NFTs in the media, and from environmental, reputational, and legal issues and regulatory intervention, resulting in their loss of a social licence to operate. Media coverage and industry reports over 2023 collectively portray a troubled landscape for the NFT market, with numerous reports indicating a substantial devaluation of NFTs. For example, NFT sales were reported to have a sharp decline, peaking at USD 12.6 billion in January 2022 and reaching barely over USD 1 billion by June 2022 (Milmo, 2022). By October 2022, sales had fallen more than 90% from the previous year's measurements in nearly every category, including volume and price (Parisi, 2022). Despite these hurdles, the market showed signs of a post-crash recovery however the DappRadar data from October 2023 indicates a continued decline in NFT market indicators and also a rise in exploits and hacks within the decentralised application sector (Gherghelas, 2023). We observe that it is no accident that most of the legal and regulatory changes in response to NFTs and cryptocurrency have occurred in what is called the 'crypto winter' the vernacular for the massive loss in market cap after the crypto and Web3 bubbles burst. The significant drop in the value of NFTs has had financial repercussions for collectors, artists, and auction houses, as highlighted in various cases and lawsuits.

The complex nature of NFT investments, coupled with legal uncertainties, poses challenges for the long-term sustainability of the market. In an early observation on these issues that have dogged crypto projects since their inception, Smith (2019) argued that there was a clear need for a critical re-evaluation of NFT investments and a deeper understanding of the market dynamics to navigate its uncertainties successfully. However regulatory approaches towards NFTs are more likely to follow the crypto regulatory playbook that sees the implementation of chokepoints or a bottleneck strategy of governance (Smith, 2019) through mechanisms such as taxation and regulatory classification - property or currency, asset or security, legal or illegal, innovative financial technology or tool for criminal activity. An example of a recent but extended classification roadblock can be found in the actions of the US Securities and Exchange Commission who is reportedly "a bogeyman for the crypto industry" and rejected many applications for Bitcoin to be offered as an ETF (Exchange-Traded Funds) since 2013 for example (Dugan, 2024). The main concerns here for regulators being about consumer protections against market manipulation and investors losing money. This has meant, Dugan (2024: np) argues, that to date there has not been an "easy, cheap or low-risk way for regular folks with a 401(k) or a brokerage account to buy into the digital currency", stymieing its mainstreaming within the investment sector. While Bitcoin and Ether have now gained ETF status (Zaslowsky, 2024), this bottlenecking strategy of governance acts in lieu of outright banning/throttling remains - however Smith (2019) observes that it is difficult to implement for a decentralised and easily replicable technology. The intricate interplay between legal and financial mechanisms create potential avenues through which regulatory bodies could exert control despite the decentralised nature of the technology.

Given their decentralised and digital-only presence, these technologies are de-materialised in popular imagination. Existing on the blockchain and within the Web3 ecosystem, they often seem untethered from the materialities of technologies, interfaces, and production. This obscuring of the material conditions of NFT production makes it easier for consumers to buy into the utopian dream. However, like all internet-based technologies (Velkova, 2019), they do have a very material infrastructure through their reliance on cloud computing and more uniquely, the computing power they require to be minted (produced onto the blockchain). The White House reported that in 2022 that cryptocurrency assets exceeded national electricity usage, accounting for 0.4% to 0.9% of the world's yearly electricity consumption (OSTP, 2022). However, the exact means through which the calculation of energy consumption of blockchain-based technologies appears to be inconsistent (BBC, 2017), leading to claims for example that the Bitcoin

cryptocurrency consumes as much power as the nation-state of Ireland (Hern, 2017) and to the refutation of this claim (Bevand, 2017). Of the principle behind this issue, Giungato et al. (2017) elaborate that the system upon which both fungible and non-fungible tokens are generated has been built in a way almost like the mining of a natural resource: costs and efforts rise as the system reaches the ultimate resource limit. The verification or consensus mechanism through which the intensification of resource consumption is achieved on the blockchain is referred to as Proof of Work. Within the broader discourse on the environmental consequences of cryptocurrencies and blockchain technologies, an ongoing critique scrutinises the environmental implications of Non-Fungible Tokens (NFTs), particularly within the realm of ‘cryptoart’.

This scrutiny of Art NFTs, often characterised in media narratives (Calma, 2021) and by activist artist collectives and scholars (Calvo, 2023; Truby et al., 2022) as environmentally unethical, has generated claims of threats to global temperature and increased death rates through energy consumption and emissions that, while resting on inconsistent measurement approaches, bear reputational repercussions regardless. In review of the wide-ranging commentary, it appears that non-fungible tokens (NFTs) may be harmful to the environment depending on how they are produced aka minted (Garnett et al., 2022). The blockchain underpinning many NFTs, Ethereum, used Proof of Work up until mid-2022 which was an environmentally costly process and was the focus of much of this critique. NFT platform providers such as Tezos positioned themselves early within this ecosystem as an environmentally sustainable blockchain that contrasted to Ethereum based upon its use of the Proof of Stake consensus mechanism (Evans, 2023; Segre, 2023). Ethereum shifted to proof of stake in September 2022, a move touted by Ethereum’s founder, Vitalik Buterin to reduce its global electricity usage by 0.2% and cut crypto carbon emissions by 99.992% (Vitalik.eth, 2022). Truby et al. (2022) argue that social pressure from the art market prompted the switch away from resource hungry proof-of-work blockchains to more sustainable consensus protocols, however commensurate social pressure, and the community itself have been working on this issue for much longer. Despite this change, it remains unclear whether Ethereum’s PoS really is a sustainable alternative to PoW (Ho, 2023) and it appears that a deliberately high energy-intensive Proof-of-Work blockchain remains the most popular choice for blockchain consensus protocols (Truby et al., 2022).

Beyond their environmental concerns, NFTs remain problematic from a legal stance. The predominant legal challenges associated with Non-Fungible Tokens (NFTs), as posited by Jia and Yao (2024), primarily revolve around issues concerning the attribution and utilisation of Intellectual Property (IP) rights pertaining to the underlying content. Furthermore, they observe that legal disputes often arise in the form of non-contractual matters, such as instances of theft. Illustrating the convergence of intellectual property (IP) and theft concerns, the case of a BAYC NFT owned by actor and creator Seth Green serves as an example. In 2021, Green obtained Bored Ape Yacht Club NFT #8398, and dedicated substantial efforts to creating the series “White Horse Tavern” based on this NFT as the main character, only to have it and 3 other Bored Ape NFTs stolen through a phishing scam (Newar, 2022) and then on sold as a part of a larger multi-million-dollar scam operation (Emerson, 2022a).

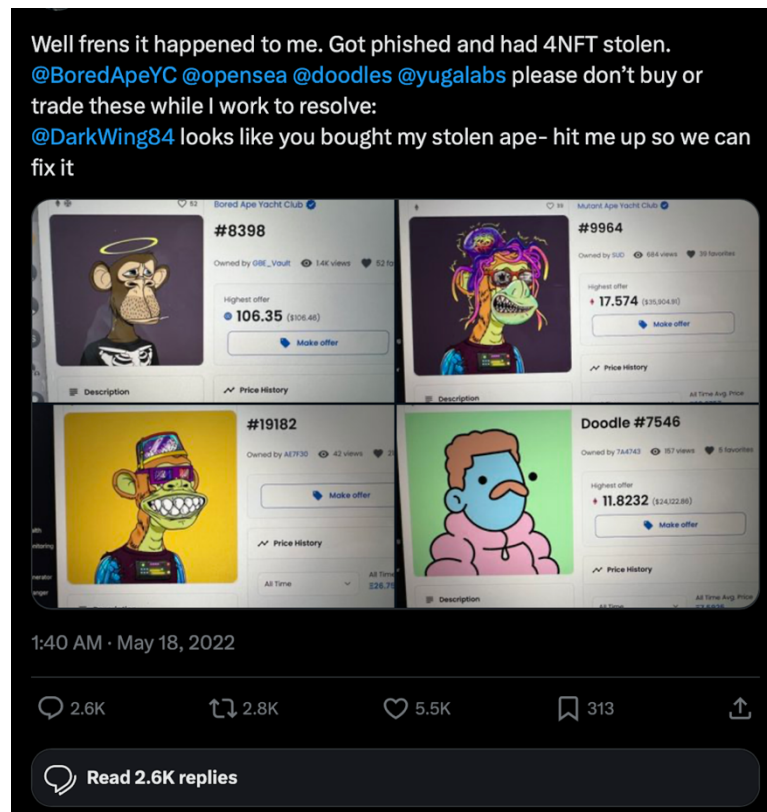


Figure 2. Seth Green's [Tweet](#) (18 May 2022) indicating his Bored Ape NFTs were stolen through a Phishing scam.

The theft raised questions on whether Green was still allowed to use the Bored Ape for the show or if he lost the BAYC intellectual property rights that the NFT came with once it was stolen and on sold (Rizzo, 2022). BAYC's license does not stipulate instances of theft but states simply that when purchased, the NFT smart contract terms mean the owner holds the underlying Bored Ape, the Art, completely (Newar, 2022). Interpretations of these terms varied in the resulting commentary surrounding the theft, with some believing this meant that even if the NFT is bought from a thief, the usage rights transfer to the new owner. The absence of established legal precedent in this matter necessitated a hiatus in the show's development (Zilko, 2022), thereby exemplifying the real-world impacts of the unresolved complex legal challenges inherent in litigation pertaining to stolen NFTs (Newar, 2022). Green indicated publicly that he would go to court to get back the BAYC NFTs if it was not returned by buyer (Green, 2022). The stolen NFTs were eventually returned to Green for a reported \$100,000 premium (Emerson, 2022b). More recent instances of NFT related cyberattacks, such as the NFT Trader attack through smart contract vulnerabilities (CryptoNews, 2023), highlight the ongoing risks associated with speculative investments in digital assets amid evolving cyber threats. Further complicating such matters, Jia and Yao (2024) point out that legal cases involving NFTs frequently manifest an international dimension, given the decentralised nature of the technology underpinning their development. This decentralisation is reflected in their distribution across servers located in numerous countries, coupled with the global user connectivity facilitated by trading platforms, thus contributing to the transnational nature of litigations in this domain.

A renewed focus on regulation of the Web3 space has been further spurred by the entanglement of key crypto and NFT figures with the criminal justice system. IMF backed commentary provided in July 2023 on the emerging challenges governments face of taxing crypto assets notes that:

The collapse of FTX last year and recent US Securities and Exchange Commission lawsuits against Binance and Coinbase have fed anxiety among users while the appeal to criminal activities has been reflected in high-profile seizures of billions of dollars. These developments have triggered increasing scrutiny from policymakers and widespread calls for regulation (Baer et al., 2023: np).

In November 2023, one of the key figures associated with the crypto boom and bust, Sam Bankman-Fried was convicted of fraud and conspiracy in the Manhattan Federal Court (Cohen and Godoy, 2023). Likewise, the CEO of Binance, a crypto trading platform, also pled guilty on November 21. In the NFT space, the developer of the Mutant Ape Planet NFT project was charged in January 2023 with a 2.9 million dollar ‘rug pull’ and subsequently pled guilty (USAO, 2023). A rug pull is a scam in the cryptocurrency or NFT space where developers encourage investors to buy into the project, then abandon it and abscond with the invested funds, leaving the digital tokens or NFTs essentially worthless. Michel allegedly promised investors exclusive rewards, giveaways, and access to a marketplace for NFTs, but never delivered on these promises. Instead of continuing to develop the project, Michel allegedly transferred the funds to his personal wallets. The NFTs didn’t become entirely worthless immediately, but their value significantly decreased due to the lack of promised development and benefits. Regardless, it is difficult to argue for the success of ‘trust-free’ technologies when they are litigated in court. Web3 is meant to be self-governing and self-regulating; every failure puts to light that this is not a functioning proposition. It is the community that (in part) provides the legitimacy for NFTs, and the community that can withdraw its agreement to support their social license to operate. In death we can observe the intervention of legal and regulatory frames which may have previously struggled to catch up to surging new technologies. Part of the imposition of legal and regulatory frames is due to the failure of the social licence to operate.

Like most emerging technologies, Art NFTs rely on network adoption, a conducive or slow-to-catch-up regulatory environment, and an underlying community that tinkers with the possibilities they offer, expresses creativity and entrepreneurial endeavour through them, and imbues them with perceived value (seeing as how tokens on a blockchain have no material or otherwise inherent value). Lotti (2016: 105) argues that normative power of the blockchain alone is not enough to emancipate art from contemporary financial logic. Further arguing that tokenisation can reproduce and amplify existing financial logics in the digital sphere by offering more precise ways to monetise digital interactions and take advantage of the speculative nature of markets (Lotti, 2016: 288). We also observe a cultural clash between hobbyist logic and capitalist cultures within NFT communities, showcasing the challenges faced by technologies seeking long-term persistence. As Calvo (2023: np) points out in what is clearly a provocative position piece on Art NFTs there are three principal positions that those in the art world take towards cryptoart: “those who believe it is a new bubble; those who think it is a revolution; and those who think the idea has failed”. We observe that hobbyist cultures persist after failure in practices of creation, while speculative capitalist tech cultures move on to the next thing. Already it is clear that the pillars of NFT development and visibility, venture capital money, social media platforms and talent, have shifted from crypto-projects to (Generative) AI (cf. Coll-Beswick, 2023).

6. A eulogy for Art NFTs

This article has proposed a ‘lifecycle’ model through which we might understand the hope, hype and hustle, death and failure cycle of Art NFTs. In this concluding section, we reflect on the ‘death’ of Art NFTs as a mainstreamed social phenomenon and consider the broader applications for the technological emergence lifecycle model with this downward arc built in.

We acknowledge that Art NFTs still have a place in the broader art ecosystem, but we contend that these remain ‘edge’ cases, and the sociotechnical imaginary filled with hope, hype and hustle that fuelled the boom of Art NFTs, now lacks social legitimacy and social licence. Sociologically finessed ideas of

legitimacy and a social licence to operate have rarely been extended to the sociotechnical sphere in focus in this article. However, as we have demonstrated in our analysis of Art NFTs, they play an important role in the lifecycle of emerging technologies, and often function ahead of institutional regulatory responses.

Art NFTs were not an innovation without demand. They are responding to legitimate issues that artists face in response to the difficulty of making a living through art. Art NFTs open a potentially transformational relationship to art creation, sale, and resale. However, as most recently explore in the documentary *The Stormtrooper Scandal* (Mangan, 2024), these exchanges can quickly become ethically and practically murky. In this instance (and many similar as previously enumerated), the potential financial rewards of NFTs quickly outstripped any broader ideological project or utility to artists. Ultimately, the Stormtrooper NFT project culminated in a quasi-rug-pull. The NFTs had been minted without the artist's permission, and those involved in the crypto side of the project quickly disappeared into the digital wilds after receiving their cut. With the NFTs eventually removed from sale by OpenSea, the investors, and the creator of the project, Ben Moore, have been left holding the (empty) bag.

To unpack the implications of our findings, it is essential to consider the broader social and economic context in which the Art NFT phenomenon emerged and declined. NFTs boomed in the precarious economic conditions of the COVID-19 pandemic and seemed to promise a way out of the economic instability of late-capitalism, compounded by the uneven impacts of the pandemic. Art NFTs, and arguably the broader Web 3 system (including blockchain and cryptocurrency) seemed to offer a new democratised model of investment, and (potential) financial freedom in the face of growing precarity and inequality.

The financial incentives of Art NFTs were also supported by their perceived cultural and social legitimacy. The lifecycle described through this study owes a lot of its intensity to the involvement of celebrity, which brought Art NFTs broad, mainstream legitimacy. Further, cultural gatekeepers like Christie's lent their institutional reputation to the Art NFT project, where at its peak they auctioned Beeple's *Everydays – The First 5000 Days* for auction, ultimately selling for \$69 million. While Christie's NFT project continues, Sotheby's a competing auction house, also involved in the art NFT space is being sued for allegedly deceptively representing the level of mainstream interest in Bored Ape Yacht Club NFTs (Chow, 2023). These issues, among a slew of others too numerous to discuss fully in this space, illustrate the long tail of the 'death' of emerging technologies, and raise attendant questions about who ultimately bears responsibility for these risks.

Through our conceptual framing of the Art NFT hope, hype, hustle, and failure lifecycle, we propose a real-world derived model for analysing technological trajectories and potential failures. This model offers valuable insights beyond the realm of Art NFTs, proving applicable to various emerging technologies. The cycle of hope, hustle, hype, death, and taxes that we've observed in the Art NFT space are a recurring pattern in the broader technological landscape.

By applying this lens to other innovations, we can better illuminate and acknowledge the generative tensions between technological potential, societal expectations, and practical realities. Consider, for instance, the 2021/2022 upwelling of investment and hype around the metaverse (Chow, 2022; Grayscale, 2021), and Meta's subsequent shift away from this hype (Sevilla, 2022). Similarly, the current landscape of generative AI (GenAI) tools demonstrates a surge of hype and hustle reminiscent of the early stages of the Art NFT boom. The sociotechnical imaginary surrounding GenAI is rife with promises of revolutionary change across industries. However, as our model suggests, this prevalent hype tends to obscure a clear view of the technology's actual capabilities, limitations, and societal implications.

Our lifecycle model offers a real-world derived tool for analysing these emerging technologies. By identifying stages, anticipating challenges, guiding development, informing regulation, and encouraging critical analysis, this model can foster more informed, ethical, and socially responsible approaches to technological innovation. Understanding where in the lifecycle a technology sits can potentially help us make more socially responsible and ethical choices about its regulation and development.

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