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Digital Collectibles: Exploring Non-Fungible Tokens (NFTs) Through Twitter Messages

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ABSTRACT

The growing popularity of non-fungible tokens (NFTs) has created a new digital collectibles asset class and market. NFTs are unique digital tokens built on blockchain technology that can represent anything from art, property rights, certificates of authentication to sports collectibles. The use of blockchain provides the framework for digital ownership and brings the notion of scarcity to the digital NFT asset class. With the emerging NFT market and growing consumer base little work has investigated the factors behind NFT interest and participation. Using a dataset of 26,444 tweets on NBA Top Shot, one of the largest and most popular NFT platforms for digital sport collectibles, we use exploratory data and content analysis to generate insights from NFT Twitter messages. Our results suggest that both hedonic and utilitarian factors are driving NFT tweets and should be considered by NFT platforms to encourage participation. Our results show that consumer messages on NFTs are based on the ability to demonstrate ownership, compete against other collectors, provide personal enjoyment and for the opportunity to receive financial returns. This research is one of the first to examine the factors exploring NFT Twitter messages and our results provide early insights for practitioners and academics interested in exploring NFT digital collectibles.

Keywords: Non-Fungible Token, NFT, Blockchain, Digital Collectibles

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INTRODUCTION

Non-fungible tokens (NFTs) may revolutionize the way people buy, own and sell digital goods. NFTs are a relatively new type of digital asset class, with Google Trend data showing the term NFT having virtually no interest up until January 2021. NFTs are cryptographic assets that use blockchain technology to represent unique ownership of digital goods and are viewed as an essential element of the Metaverse (Bao & Roubaude, 2002). NFTs or "crypto collectibles" include digital art, a virtual piece of land, memes, music, digital houses, augmented reality sneakers, sports trading cards or any other digital collectible that is recorded on a blockchain. NFTs are seen as the key to unlock the market for digital collectibles and NFTs have an estimated market cap of over $80 billion by 2025 (Canny, 2022). The increased momentum in NFTs comes as blockchain and cryptocurrencies gain acceptance and popularity throughout the world. Collectors and investors are spending and investing hundreds of thousands of dollars and sometimes millions of dollars on NFTs. For example, in early 2021, a digital art video clip NFT by the artist Beeple sold for $69 million (Bursztynsky, 2021). An NFT from the CryptoPunks collection sold for $2 million (Browne, 2021). In addition, $208,000 was paid for an NFT of professional basketball player LeBron James' on the NBA Top Shot marketplace (Robinson, 2021). To some these are just JPEGs or videos with no real value, but to examples demonstrate that to some they represent an investment and/or opportunity to own a digital asset. These high dollar transactions for essentially a series of computerized zeros and ones prompts this paper's investigation into understanding a user's NFT interest and participation.

Researchers and practitioners are in the early stages investigating NFTs as an application of blockchain technology. The potential of blockchain has been widely discussed by academic and practitioner communities, and researchers believe that NFTs have the potential to revolutionize digital property and transform the gaming, media and arts industries, yet rigorous empirical and theory driven research on blockchain remains scarce (Chong, Lim, Hua, Zheng and Tan, 2019; Kanellopoulos, Gutt, & Li, 2022; Pawelzik & Thies, 2022;). Earlier research has examined the role of NFTs to represent both digital goods such as virtual gaming assets, digital artwork and software licenses as well as physical assets such as luxury goods and cars (Griffin, 2018). NFTs as digital collectibles are designed to address the collectibles market problems of fraud, counterfeiting and the limited control over secondary transactions (Beck & Müller-Bloch, 2017). These early studies on NFTs demonstrate the opportunities presented through NFTs, but they do not develop a comprehensive model explaining NFT interest and participation. Unfortunately, in-depth investigations reviewing the design and use of NFTs is missing (Bao & Roubaud, 2022; Du, Pan Leidner, & Ying, 2018; Regner,

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Schweizer, & Urbach 2019; Rossi, Müller-Bloch , Thatcher, & Beck, 2019). Given the growth in NFTs, gaps in the literature and the values being placed on NFTs it is critical that we explore NFT interest and participation.

What are NFTs and How do They Work?

NFTs are digital tokens that can represent anything from art to sports memorabilia that are recorded on a blockchain. Blockchain technology is a distributed ledger that is regulated through a consensus mechanism and secured with cryptography (Nakamoto, 2008). The blockchain digital ledger for the NFTs is similar to the network that is the backbone of Bitcoin and other cryptocurrencies. Transactions are securely registered on the data structure or ledger that is distributed across a network of peers that validate the entries using a consensus mechanism. New records are cryptographically linked to existing ones, rendering them virtually immutable.

Blockchain technology provides the means to create, sell, authenticate and exchange NFTs. The belief is that the uniqueness, originality and proof of ownership via the blockchain makes the NFT rare and allows the owner to later sell the NFT (Haselton, 2021). Blockchain as the underlying technology provides the infrastructure to serve as a trusted third party (Auinger & Riedl, 2019; Pillai, Biswas, Hou & Muthukkumarasamy, 2022). The blockchain has the ability to promote confidence among the stakeholders in the transaction where trust may not be easily achieved and reduce uncertainties. The auditability and transparency provided through blockchain technology is now being applied to digital collectibles and thus ensuring the originality of the NFT digital collectible (Sedlmeier, Lautenschlager, Fridgen & Urbach, 2022). Thus, the ability to authenticate NFT ownership and ensure scarcity through blockchain technology is fueling NFT participation by both enthusiasts, collectors and investors.

The term fungible refers to the interchangeability of each unit of a commodity with other units of the same commodity. A fungible unit can be swapped with the same amount without any gain or loss. Whereas non-fungibility is the opposite as every token is distinguishable and thus also cannot be divided or merged (Voshmgir, 2018). For example, cryptocurrencies are fungible, since any Bitcoin is equivalent in value to any other Bitcoin, just like a dollar is equivalent to any other dollar. Non-fungible assets are unique and differentiated from one another. Each NFT built "or minted" on the Ethereum Request for Comments 721 (ERC-721) standard is stored on a blockchain, has a globally unique id, ownership that can be tracked and transferred, is unique and cannot be replicated. NFTs were created for a specific purpose – to represent ownership (Entriken, Shirley, Evans, & Sachs,

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2018). The NFT is therefore unique and can be traced back to its rightful owner with no need for a centralized clearing house keeping records of every transaction. Through ownership, uniqueness and scarcity, users are attaching a value to an NFT. NFTs fall into the age-old debate of what makes some collectibles worthless and other collectibles worth hundreds of millions of dollars, it all comes down to what the marketplace values (Robinson, 2021). The attraction to buyers is that NFTs possess characteristics similar to personal property that can be bought, sold, displayed, gifted or destroyed.

The unique characteristics of ownership, scarcity, and trust in the blockchain technology ensuring the authenticity of the digital collectible allows both buyers and sellers to place value on the NFT. Since the beginning of the Internet, the notion of scarcity was considered non-existent since data on the Internet can be freely and easily copied destroying the notion of ownership. NFTs are a formalization of digital ownership rights that distinguishes the digital assets market from the traditional connection between the internet and digital goods. People are buying NFTs out of the belief that they will be able to prove ownership of the virtual item. Each NFT can be viewed as a unique item that nobody else owns. Often the NFT is an image or a video, which is publicly available on the Internet, whereas anyone can copy it, store it, and view it, but the certificate of ownership linked to it cannot be copied. The blockchain technology allows the items to be publicly authenticated as a one-of-a-kind (Sedlmeier et al., 2022).

One of the more popular NFT collectible platforms is NBA Top Shot @ www.nbatopshot.com, which allows sport enthusiasts and collectors the ability to purchase, own and sell short video clips showing highlights from the National Basketball Association (NBA) and the Women's National Basketball (WNBA) games called "moments". A moment is an officially licensed NBA digital collectible that celebrates and displays some of the NBA's most epic highlights from NBA players as a video clip. All moments are limited edition collectibles secured by the blockchain. NBA Top Shot launched in late 2020 and a year later the platform reported 1.1 million registered users (Dillet, 2021). In 2021 NBA Top Shot made over $780 million in sales (Figure 1). Sales take place in the site's peer-to-peer marketplace, with the NBA receiving a monetary royalty on each and every sale (CNBC, 2021). Each NFT is minted with a limited-edition size and a unique serial number with guaranteed scarcity and protected ownership guaranteed by the blockchain. For the NBA, the venture is another revenue stream, where the NBA receives a cut on each transaction through royalty payments. Dallas Mavericks owner Mark Cuban has said it could become one of the NBA's top-three revenue producing streams in the future (Robinson, 2021). As a result of its growing

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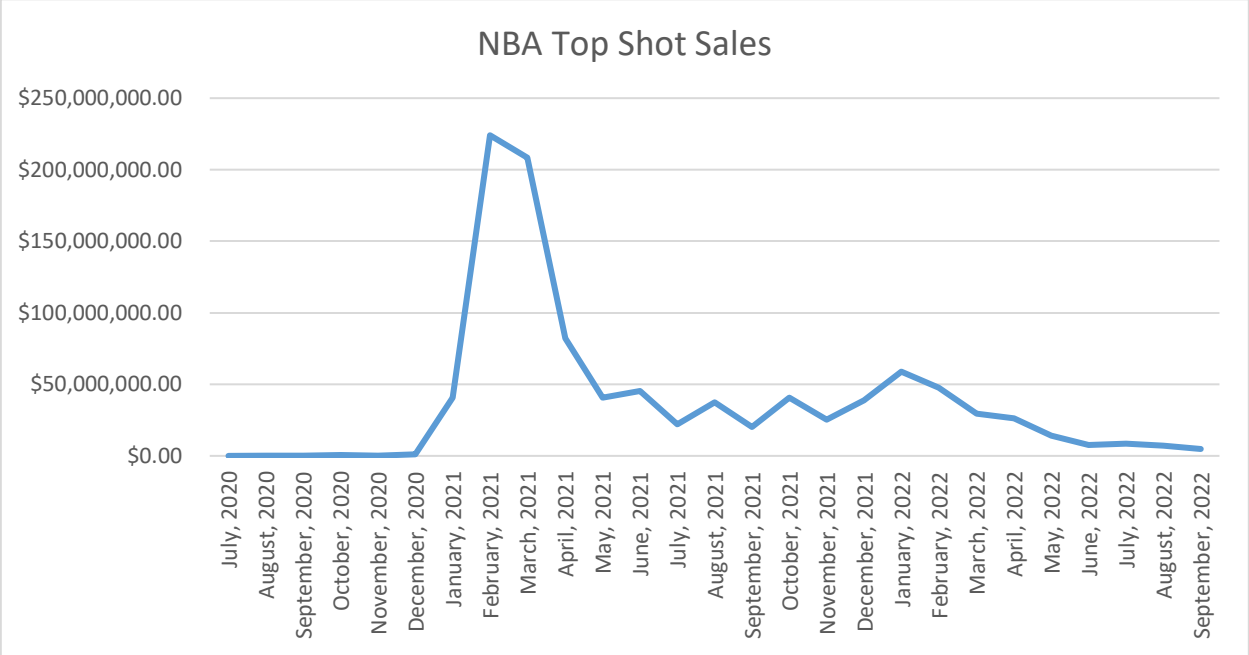
popularity and usage, the NBA Top Shot platform will be used to investigate messages made on the NFTs.



Data available in: http://cryptoslam.io/nba-top-shot/sales/summary/

Figure 1. NBA Top Shot Sales July 2020 – September 2022

DATA AND METHODOLOGY

To better understand the underlying messages made on NFTs, this research uses Twitter data. Twitter is a real-time microblogging service with over 396 million users as of 2022. Twitter is a service in which users can interact with one another using 140 characters via a tweet. The tweets are expressions of consumers in real life and are therefore a relevant source of consumer data (Guzman, Alkadhi, & Seyff, 2017). The tweets provide researchers a low-cost access to data and allow data to be collected anonymously, in a naturalistic and unobtrusive setting and offers many advantages over qualitative data, such as face-to-face interviews (Makarem & Jae, 2016). The analysis of tweets allows researchers to obtain precise, complete and unbiased data from the public conversation for free (Twitter, 2022). Thus, Twitter data is well suited for research involving an emerging technology topic of NFTs that have a relative recency and novelty.

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Given the relative recency and novelty of NFTs, Exploratory Data Analysis (EDA) was deemed an appropriate initial analytical technique. EDA is an approach to summarize data by reviewing the emergent main characteristics and visualize it with proper representations. EDA has been identified as a valuable tool for identifying patterns, trends, correlations, or relations among data to generate insights or hypotheses (Leek and Peng 2015). This study applied a mixed-method approach for data analysis that involved both a qualitative content analysis of tweets to identify themes related to the messages shared on the NBA Top Shot platform. Next, we used descriptive statistics to study the tweets made on NBA Top Shot. The general characteristics of the tweets were analyzed via content analysis techniques to study the substance of the tweets (Neuendorf, 2002).

Our data collection resulted in 26,444 unique tweets that were posted between June 17, 2020 and November 07, 2021 by 8,996 unique Twitter accounts featuring the text or hashtag 'NBATopShot'. The dataset is available for public download.[1] Concentrating on a hashtag makes it easier to capture messages on a specific theme and the user's choice in deciding to include a hashtag in his/her tweet adds context to the message and in this regard contributes consciously to a public (Twitter) dialogue on a certain theme. (Uhl, Kolleck, & Schiebel, 2017). The timeframe selected coincides with the start of NBA Top Shot and captures the peak of sales (Figure 1) along with a few months of stabilization after the sales peak. The authors believe this selected timeframe allows for a wide variety of tweets based on the initial growth of NBA Top Shot along with the significant market fluctuations that were experienced during this timeframe. Thus, the goal of this paper was to aggregate tweets and information from those who deliberately made or shared tweets about the NBA Top Shot NFT platform.

The two authors of this study performed a content analysis of the NBA Top Shot tweets collected. The main objective of the content analysis was to identify the major themes in the tweeted messages related to the NBA Top Shot NFT platform. The NBA Top Shot platform is viewed as an information system (IS) and when investigating use, one needs to consider the factors driving its usage. Understanding usage has been a seminal research theme in IS with both utilitarian and hedonic factors influencing usage identified as common themes (Hu, Poston, & Kettinger, 2011; Kamis, Koufaris, & Stern, 2008). Earlier research has suggested that consumers consider both hedonic and utilitarian values, and that their

[1] [1]The authors have the dataset available for public access at https://github.com/murraylax/nft-nba-twitter.

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perceptions, attitudes, and intentions depend on the product's nature to drive consumption (Turel, Serenko, & Bontis, 2010). In addition, deciding whether the product is hedonic or utilitarian is suggested to drive the consumers' decision whether to purchase or use the item (Batra & Ahtola, 1991; Dhar & Wertenbroch, 2000). Consumer perceived utilitarian factors of IS usage have been defined as IS usefulness in enhancing efficiency and effectiveness for task performance and goal achievement (Venkatesh, Morris, Davis, & Davis 2003). On another hand, hedonic consumer factors of IS usage have been defined as the extent to which the activity of using an information system is enjoyable (Davis, Bagozzi, & Warshaw, 1992). This hedonic factor is reflected in a person's experiential feeling with IS usage such as enjoyment and playfulness (Agarwal & Karahanna 2000). In this regard, studies suggest a positive relationship between user perceptions of utilitarian and hedonic factors and a consumer's motivations to use an IS (Dai, Hu, & Zhang, 2012). Research has validated the pursuit for utilitarian and hedonic factors as important antecedents of IS usage (Kamis et al. 2008). Thus, with the relative infancy of NFT research, this study will explore Twitter messages on NFTs through a hedonic and utilitarian lens to improve our understanding of NFT interest and participation.

From a utilitarian view, NFT platforms are designed to provide an efficient easy to use marketplace via blockchain technology that can provide ownership, scarcity, privacy, and financial impact benefits. From a hedonic view, NFT participation satisfies a user's social interaction needs through NFT online communities. In addition, the activities and content provided by NFTs are often engaging and cognitively playful which may provide competition and escapism opportunities that fit within a hedonic framework. The authors expect the exploratory study to identify the utilitarian and hedonic factors driving NFT use. To identify the hedonic and utilitarian themes, the authors reviewed previous information systems research theories and findings as a starting point (Table 1). Our review of the IS usage literature identified nine categories where the content categories could be relevant. Next, a keyword analysis was run across all 26,344 tweets to tally and provide frequencies and percentages on the content areas included in the tweets (Table 2). In Twitter, users use the hashtag "#" symbol to mark the topics of their tweets. Hashtags are helpful when sharing news, knowledge, or general contributions to a certain topic and to spread information across the network. In addition, hashtags make it easy to search and collate information, discussions, or central actors regarding a specific theme. We used the R package 'rtweet' to access the Twitter application programing interface (API) for academic research to download tweets

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from the Twitter Full Archive.2 We identified tweets that included both 'NBATopShot', the hashtag used by the NBA to market NBA Top Shot NFTs and words that may have included motivations for owning and purchasing NBA Top Shot NFTs (Table 2). To include only unique tweets, the search did not include retweets, which is when a twitter user posts a link to another user's tweet.

All keywords were selected from the most mentioned words and categorized by theme (Table 3). The authors collaboratively performed a pretest review involving 100 tweets to categorize the tweets using #NBATopShot on the identified themes (Table 1). The authors worked together to review and classify the 100 tweets into the identified utilitarian and hedonic lens frameworks. This was followed by an analysis of the entire data sample of 26,344 tweets to assign the tweets to existing categories and inductively come up with additional categories for tweets that did not fit existing ones (Hoffmann, 2011). After reviewing around 500 tweets, no additions or changes to the thematic categories were required and all tweets were classified into the established themes using the keyword analysis presented in Table 2. Thus, this provides support for the generalizability of our findings about the interests and participation factors for the period of our data collection.

Table 1. Utilitarian and Hedonic Exploratory Lens

Hedonic Factors		
Variable	**Definition**	**References**
Competition	Competition is defined as the act of competing where there is some prize or honor.	Dwyer et al. (2018)
Enjoyment	Enjoyment of an activity, similar to the emotional response of pleasure.	Koufaris (2002)
Social Interaction	Social interactions represent the power of relationships and the quantity and quality of socialization that occurs for the user.	Hu et al. (2016)
Utilitarian Factors		
Variable	**Definition**	**References**
Ownership	Ownership can be demonstrated on a blockchain that can therefore be unique and the NFT can be traced back to its rightful owner with no need for a centralized clearing house keeping records of every transaction.	Haselton (2021)

[2] The 'rtweet' package is a front-end for Twitter API for the R programming language. It was developed and continues to be maintained by Posit PBC, the creators of Rstudio and hundreds of R packages. Since the name change from Twitter to X, the package and Twitter API continue to be functional and available as of October 2023.

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Financial Impact	Under an economic perspective, putting a given amount of money at stake, bearing the risk of losing it, but with the chance of returning a larger amount.	Wulfert et al. (2008)
Scarcity	The notion of scarcity does not exist on the Internet since digital assets can often easily be copied and shared. However, blockchain technology can ensure scarcity for digital assets.	Robinson (2021)
Ease of Use	The degree to which a person believes that using a particular system would be free of effort.	Davis (1989)
Skeptical	Skeptical people perceive a technology as less useful because they are generally more concerned about risks in usage and tend to doubt benefits from using it.	Blut and Wang (2020)
Privacy	Ability to control the acquisition and use of an individual's personal information. Privacy concerns arise in the context of blockchain since, transactions are not anonymous but pseudonymous.	Fabian et al. (2016)

Table 2. Keyword Tweets Using #NBATopShot

Word	**Freq.**	%	**Keyword**	**Freq.**	**%**	**Keyword**	**Freq.**	%
community	1289	4.9%	enjoy	240	0.9%	collectors	852	3.2%
friends	392	1.5%	happy	475	1.8%	own	1831	6.9%
friend	777	2.9%	wow	154	0.6%	mine	1675	6.3%
nftcommunity	26	0.1%	legendary	498	1.9%	rare	860	3.3%
winner	751	2.8%	easy	278	1.1%	scarce	34	0.1%
win	2960	11.2%	simple	84	0.3%	original	93	0.4%
chance	1073	4.1%	value	1038	3.9%	private	30	0.1%
drawing	60	0.2%	valuable	135	0.5%	secure	54	0.2%
won	704	2.7%	worth	932	3.5%	anonymous	3	0.0%
challenge	1709	6.5%	money	1081	4.1%	safe	61	0.2%
challenges	402	1.5%	rich	122	0.5%	dumb	57	0.2%
awesome	709	2.7%	collect	3668	13.9%	stupid	74	0.3%
cool	1027	3.9%	collector	1761	6.7%	waste	36	0.1%
fun	1092	4.1%	collecting	908	3.4%			

Table 3. Themes & Keywords

Theme	**Keywords**
Social Interaction	community, friends, friend, nftcommunity,
Competition	winner, win, chance, drawing, won, challenge, challenges
Enjoyment	awesome, cool, fun, enjoy, happy, wow, legendary
Ease of Use	easy, simple
Financial	value, valuable, worth, money, rich
Ownership	collect, collector, collecting, collectors, own, mine

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Scarcity	rare, scarce, original
Privacy	private, secure, anonymous, safe
Skeptical	dumb, stupid, waste

FINDINGS AND DISCUSSION

The content analysis of the #NBATopShot tweets led to the identification of nine themes across utilitarian and hedonic frameworks. Six themes emerged within the utilitarian framework: ownership, financial impact, scarcity, ease of use, skeptical and privacy. While three themes emerged through a hedonic lens: competition, enjoyment, and social interaction.

We report on the results by applying descriptive statistics. When collecting our data, we assembled all tweets that included #NBATopShot. The results from a tally of the tweets (Figure 2) made by theme showed that Ownership (18.8%) was mentioned the most across the collected messages. Competition at (18.4%) was the second highest percentage themes mentioned across the messages. Enjoyment (13.7%), Financial Impact (11.2%) and Social Interaction (7.3%) were mentioned as the next most frequent theme across the messages. The remaining themes of Scarcity (3%), Ease of Use (1.2%), Skeptical (0.6%) and Privacy (0.5%) were all respectively mentioned less frequently using the #NBATopShot.

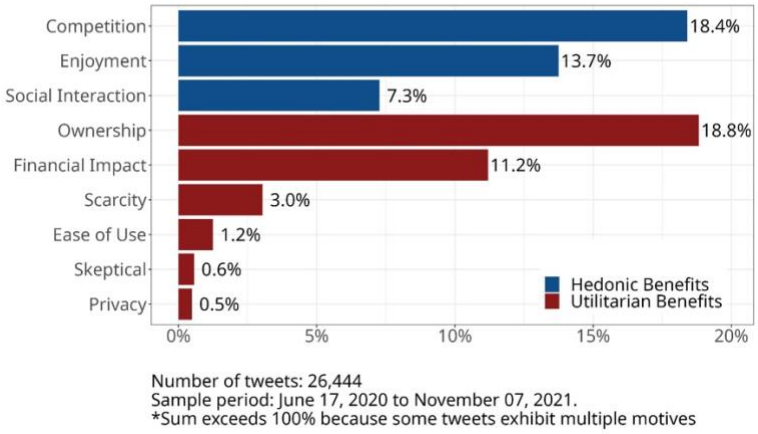

Figure 2. Percentage of #NBATopShot Tweets by Themes

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A tally of the frequencies and percentages for tweets across both a hedonic and utilitarian framework shows that the hedonic themes of Competition, Enjoyment and Social Interaction in total were mentioned in 36.8% of all messages (less than the sum because some tweets exhibit multiple themes). Utilitarian themes of Ownership, Financial Impact, Scarcity, Ease of Use, Skeptical and Privacy were identified in total across 33.2% of all tweets.

Figures 3 and 4 show the frequencies and the percentages of tweets made by theme over the collected time period. The review of the data suggests some evident trends. When reviewing the data via a hedonic or utilitarian lens, the data demonstrates an upward trajectory for the hedonic themed messages. Competition, Enjoyment and Social Interaction tweet percentages were all on an upward trajectory. Whereas the utilitarian themes such as Ease of Use, Financial Impact, Ownership, Privacy, Scarcity and Skeptical were decreasing or stabilizing over time. One could suggest that as the NBA Top Shot platform has matured the hedonic factors focused on enjoyment and playfulness were growing in importance to NBA Top Shot users. As the platform has developed, NBA Top Shot has made efforts to increase the gamification within the platform and this appears to have resulted in an increase in messages centered around hedonic themes. On the other hand, we can see less messages tweeted regarding the Financial Impact, Scarcity and Ownership utilitarian factors. These trends would suggest that as the platform matured, consumers were less concerned about the financial returns and the technology behind the NFT platform. Our findings suggest that NFT platforms may want to focus on the hedonic factors rather than the utilitarian factors in their marketing campaigns to attract consumers. Hedonic factors appear to be driving the messages made involving the NBA Top Shot NFT platform.

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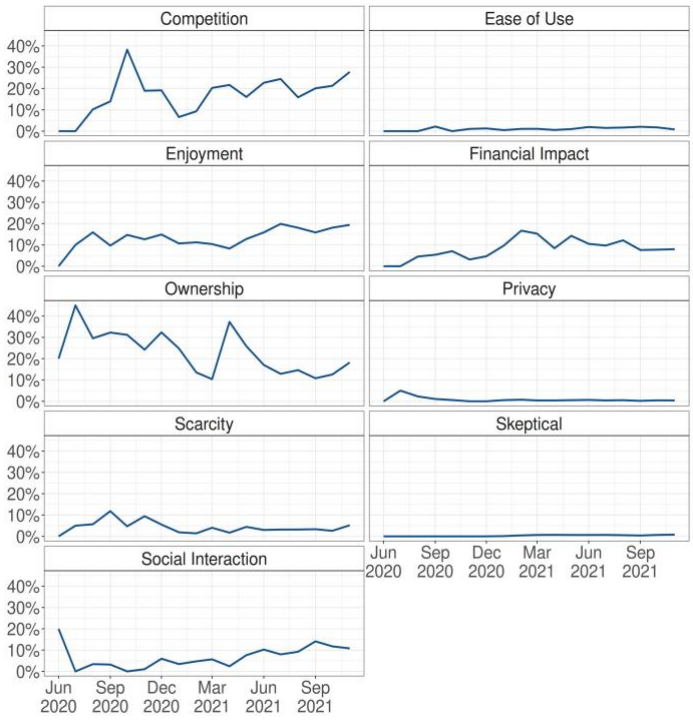

Figure 3. Percentage of #NBATopShot Tweets over June 2020 – November 2021

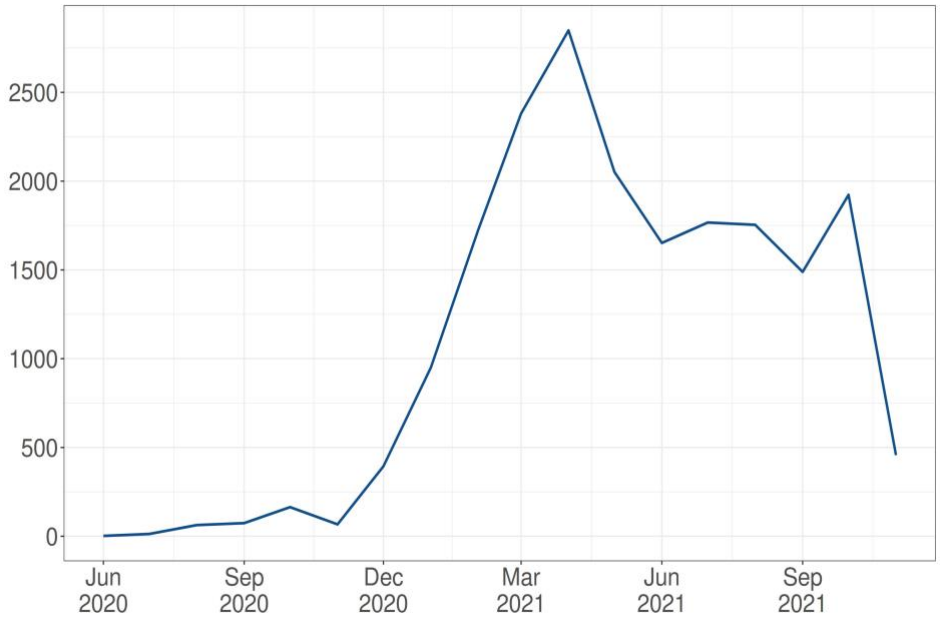

Figure 4. Total #NBATopShot Tweets over June 2020 – November 2021

A review of the utilitarian findings present inquiry into why ownership and financial impact led the messages tweeted using the #NBATopShot. Ownership is at the core of what an NFT represents and this emphasis on the mentions of ownership is not overly surprising. Ownership has been identified as one of the key drivers behind the emergence of NFTs (Regner et al, 2019). As reported, the financial fluctuations of the NBA Top Shot market (Figure 1) should not make the higher percentage of financial impact surprising. Previous studies on the NFT market have found similar results with a high importance on financial returns driving NFT participation (Borri, Liu and Tsyvinski, 2022; Kong and Lin, 2021). The relatively low mentions of scarcity, ease of use, skeptical and privacy requires further review and explanation. NFTs as a non-fungible token are designed to be unique, this unique attribute does not seem to be important to those a tweeting about NFTs. It is possible that those tweeting have a general knowledge of NFTs and by association are not tweeting about common NFT knowledge at this stage of maturity in the NBA Top Shot marketplace. Our findings may be going against the common notion that humans value uniqueness and scarcity both economically and sentimentally. Earlier NFT research suggests that economically, the scarcer an item is, the more consumers value and tend to be willing to pay for the item (Hartwich,

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Ollig, Fridgen and Rieger, 2022). Our research did not focus on purchasing behavior, but the lack of mentioning scarcity may suggest a need for further research.

Privacy is another area that has received early attention by blockchain researchers. Information privacy is defined as the ability to control the acquisition and use of an individual's personal information (Westin, 1967). In most blockchains, and specifically the NBA Top Shot platform, transactions are not anonymous but pseudonymous. Transactions can be traced back to their initiator and recipient, who can be identified through their public addresses. The low mention of Twitter messages mentioning the privacy theme is not surprising and supports previous information privacy research. Previous research has shown that users are often not aware of the privacy issues involved on the blockchain (Fabian, Ermakova, & Sander, 2016), even though research has demonstrated that it may be possible to reveal users' real-world identities (Yin, Langenheldt, Harlev, Mukkamala, & Vatrapu, 2019). NBA Top Shot user-ids are publicly available, and users leave openly available data trails on buy and sell transactions and our findings suggest that privacy concerns are not mentioned much on Twitter. Most users do not use their "real name" with their NBA Top Shot user ID, which may be influencing the perceived privacy in using the platform. The public would not know directly the identity behind the individual's blockchain transactions. Future work is encouraged to better understand how de facto immutable transaction data may affect a user's willingness to engage in blockchain transactions. The low mention of the privacy theme continues to suggest that users are either not concerned about their privacy using blockchain or they are uneducated in blockchain privacy or the pseudo anonymity through the NBA Top Shot user ID could be impacting privacy concerns. Overall, future research is encouraged to develop a more refined understanding of privacy, given that concerns about privacy may shape user behavior.

LIMITATIONS AND FUTURE RESEARCH

In any research project, choices made by the researchers might induce limitations in interpreting the results. A possible limitation of this research is the choice to limit our data collection to Twitter data. One should note that Twitter as a data analysis approach should not be seen as a representative sample of a population. Our data should only be seen to provide insights on the online population using the Twitter service (Uhl, Kolleck, & Scheibel, 2017). In addition, Twitter data does not provide data on participant characteristics. Thus, it prevents us from describing our sample and/or linking individual differences such as gender and age to the identified themes. However, Twitter users are likely to be a bit younger, higher educated and

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more active in terms of communication (Pew Research Center, 2022), which does align with the expected demographic adopting an emerging technology such as NFTs. Earlier research has noted the limitations with a hashtag-based approach. There is a concern that research based on a selected hashtag may miss out on alternatives contributing to the same discussion and users may reply without the use of a hashtag (Bruns & Stieglitz, 2014). Critics are justified, since focusing on a specific hashtag may exclude some messages. However, the hashtag approach is an effective way to capture a good part of the discussion on a topic and allows researchers to collect data on users who consciously contributed by knowing and using a specific hashtag (Uhl, Kolleck, & Schiebel, 2017). The authors recognize that it is difficult to impossible to determine whether authors who tweeted on NBA Top Shot actually own NFTs provided through the platform. However, the goal of this research was not focused on purchasing behavior, rather the messages made on Twitter regarding NFTs on the NBA Top Shot platform. Looking back at the Google Trends data on NFT reveals many areas of future research that can be pursued. The trend data shows a decline in the search traffic regarding "NFTs" starting in early 2022 with another spike in searches starting in early 2023. Much of the early enthusiasm for NFTs centered around the investment potential and as the price has fluctuated, along with the uncertainty of government regulation during this time a relationship between investment returns, government regulations and searches appears linked. Future studies are encouraged to apply our framework to investigate NFT messaging during this downturn and investigate time periods where an upturn in NFT search data is presented. The authors recognize that there is an almost limitless population of NFT platforms being developed daily involving both digital and even non-digital assets such as artwork, software licenses, luxury goods and even cars (Pawelzik, 2022). Future research has an opportunity to compare our early NFT findings with more mature NFT platforms. The timeframe studied can be considered as a time of early NFT adoption and future research is encouraged to compare the evolution of hedonic and utilitarian factors on NFT Twitter messages and extend to other more mature NFT platforms. We encourage future researchers to extend our research findings to the limitations identified to these emerging NFT applications. These limitations notwithstanding, we believe that the study has provided some early insights into factors driving NFT messaging.

CONCLUSION

In this paper we explored the messages contained in Tweets regarding NFTs. Using Twitter data, we were able to collect publicly available data regarding factors included in NFT Twitter messages. Applying an exploratory utilitarian and hedonic lens, we found that competition, enjoyment, ownership and financial impact were the leading messages published on NFTs on the NBA Top Shot platform. These

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findings will help organizations design better NFT platforms and identify features that need improvement or changes. We are just entering the era of the meta-verse and NFTs are viewed as an early piece of the future digital universe. Our findings have provided early insight into the messages being shared on NFTs for both practitioner and academic communities. We hope that our study helps provide a foundation for further studies on NFTs since many believe that NFTs will continue to become integrated across both digital and non-digital domains.

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