

Does #selling sell? Analyzing content of *CryptoKitties* traders' talk on Discord

Alesha Serada¹

¹ University of Vaasa, PL 700, Vaasa, FI-65200, Finland

Abstract

Blockchain technologies have further gamified finances and created new classes of tradeable digital assets. Their early adopters anticipate mutually beneficial 'sharing economy' on integrated blockchain platforms, but the practice of non-fungible token (NFT) trading seems to be undermined by the dubious 'ludic ethics' of virtual worlds. To find out who benefits from decentralized ecologies on blockchain, this study explores the marketplace of the first popular and the longest-running blockchain-based game *CryptoKitties*. It uses mixed methods content analysis to analyze textual communication on the gaming platform Discord that serves as the primary tool to advertise tokens on sale. Quantitative measurements and qualitative assessment are applied to approximately 100,000 lines of marketing messages posted in the dedicated channel within the first two years of the game's existence, which encompasses development, maturation and decline of the *CryptoKitties* market. Three main ways of value construction in NFTs emerge from the linguistic data based on three main types of actors: developers, players, and traders. Furthermore, four distinct clusters of sellers are revealed, whose marketing strategies are characterized by both qualitative and quantitative differences in the language. According to the data, the gaming ecology of *CryptoKitties* relies on informational asymmetry and monopolization of buyers' attention. This suggests that a typical NFT marketplace could be better described as a 'bazaar economy', rather than a 'sharing economy'.

Keywords

Non-fungible tokens, multiplayer games, virtual economies, Discord, mixed method content analysis

1. Introduction

Cryptocurrencies and other blockchain technologies have streamlined gamification of finances in the 2010s and early 2020s. New projects of decentralized digital economies have been proposed on the basis of non-fungible tokens, or NFTs [1]–[4]. These tokens are created ('minted') on blockchain and traded for cryptocurrencies or, sometimes, real-world money, on a variety of online platforms, such as OpenSea [5]. Creators and traders of NFTs take inspiration from the preceding virtual worlds and multiplayer games [4], and base their valuation on the principle of 'artificial scarcity' [6]–[8].

It remains the subject of discussion who eventually benefits from these new forms of value creation on blockchain. In theory, decentralized architecture of blockchain platforms may create a more equal, self-regulating environment that enables mutual exchange and collective creation of value [2]. By 'minting' and trading NFTs for gaming purposes, players may enjoy a higher degree of ownership and control [1] than in a virtual world completely owned by its publisher, at least, according to blockchain developers [9]. In practice, however, subjective self-reported stories of success [10], [11] and projections of future growth [4] are overshadowed by the studies that show stagnation and speculation on blockchain-based marketplaces at large [12]–[17].

7th International GamiFIN Conference 2023 (GamiFIN 2023),
April 18-21, 2023, Lapland, Finland
EMAIL: aserada@uwasa.fi
ORCID: 0000-0001-6559-7686



© 2023 Copyright for this paper by its authors. Use permitted under Creative Commons License Attribution 4.0 International (CC BY 4.0).

CEUR Workshop Proceedings (CEUR-WS.org)

Finally, legal rights of NFT holders remain problematic [18], [19] as well as highly unequal distribution of wealth among them [15].

In the field of marketing studies, we can find similar discussions in research on multisided platforms (such as Uber and AirBnB) [20]. On such platforms, value is created by voluntary and mutually beneficial exchange. Eckhardt et al. describe the resulting ecosystem as a ‘sharing economy’ [21]. On the one hand, technological platforms are crucial in collective value co-creation. On the other hand, friction between different actors on the platform may lead to exploitation and financial harm, as Zhou et al. demonstrate [22]. The same seems to be true for blockchain platforms, which are also conceptualized as a ‘sharing economy’ by Teck Ming Tan and Jari Salo [23].

Theoretically, blockchain is expected to streamline collaborative creation of value for all participants (stakeholders) [1], [2], [4], [23]. This is in line with the intent of blockchain adopters, explicitly expressed in such crucial manifestos as the Ethereum white paper [24]. In practice, however, blockchain games tend to reproduce the dubious ‘ludic ethics’ of preceding virtual worlds [25], sometimes described as ‘second morality’ [26]. Cheating and speculation are always a part of the ‘crypto game’, as it has been demonstrated in the studies of the most typical case, *CryptoKitties* [13], [14], [27].

CryptoKitties is the first successful and the longest running blockchain-based game. The essence of the game is in creating NFTs (‘kitties’) in a complex game of chance [28] and then trading them in hope to make profit [27]. There were 136,732 unique crypto wallets registered in the game as of March 1, 2023, although factual participation is much lower [29]. The number of active players exceeded 17,000 soon after their launch on November 30, 2017, but immediately dropped to several thousands and, as of recently, hundreds of daily active players [30].

The initial motivation for this research was to find out how value is constructed on blockchain-based platforms in the case of *CryptoKitties*. It is almost impossible to calculate a ‘fair price’ of an NFT: each instance is unique, and its value can change over time due to various game events, general changes on the market and the ‘digital destiny’ of the token itself [31], [32]. Eventually, it became clear that the most important question is not ‘how’, but ‘for whom’: who benefits from this particular decentralized economy, and how these stakeholders make this value-generating

mechanism work for them? This evolution of the research problem is reflected in the following research questions:

Q1: What constitutes the value of a CryptoKitty NFT based on its description?

Q2: What linguistic strategies do sellers use to establish the value of tokens?

Q3: Who benefits from these strategies of value creation and appraisal in a blockchain-based game?

2. Data and methods

Communication in and around NFT projects typically happens in social media: Twitter, Reddit, Telegram and, most frequently, Discord. Discord is an online text and voice chat platform initially developed for gamers. Founded in 2015, it gained over 250 million users in the following four years [33]. A significant share of the platform’s users are interested in blockchain-based games and NFTs: for example, one of the leading Discord servers in January 2023 belonged to the community of the play-to-earn ‘crypto game’ *Axie Infinity* [34].

NFT servers typically have dedicated trading channels, or chat rooms, where sellers advertise their tokens on sale. A qualitative content study of such server dedicated to NBA themed NFTs was published by Trevor Zaucha and Agur Colin [35]. Similar to their research, the initial choice of content analysis for this paper was motivated by the assumption that the value of NFTs is discursively constructed in dedicated social media channels, before it is economically tested on peer-to-peer marketplaces. Being a relatively old and well developed NFT ecology, *CryptoKitties* has offered additional insights that could be obtained by qualitative means. The scale of obtained data required statistical evaluation, as well as comparison with the basic market data openly available on blockchain.

As this study proceeded, it oscillated between quantitative and qualitative content analysis and eventually integrated both approaches into mixed methods analysis. This particular mode of research was facilitated by the software WordStat by Provalis Research [36]; its canonical use case aims to identify temporal changes in value systems of different groups [37]. WordStat allowed to visualize dynamic trends in language use, and to build the vocabulary of ‘kitty’ traders, from which three main dimensions of value constructions were extrapolated.

2.1. Data

The data was obtained from the #selling channel of the *CryptoKitties* Discord server on November 21, 2019, by scraping it with Discord Chat Exporter [38], and saved as a .csv file. The data covered the first 720 days, or 105 weeks of the game: from December 4, 2017, when the #selling channel was created, to October 21, 2019, when the data sample was obtained. This was the formative period of the community, which activity has gradually declined by 2020.

This particular channel on Discord was created with the purpose to promote sales to other members of the official *CryptoKitties* Discord server. This server is free and open to anyone interested in the game. Informal consent to scrap the data for research purposes was obtained from the moderators and participants before data collection. Pseudonyms of sellers were present at the initial quantitative stage to evaluate their participation, but deleted from the dataset at the stage of qualitative analysis.

The original sample included 108,421 lines of messages before cleaning and 97,029 lines of messages after removal of emojis, other non-textual responses, pseudo-textual embellishments and accidental empty lines. Discord messages that consisted of several lines were transposed into separate rows in Excel in order to reduce complexity of the data structure.

2.2. Analysis

WordStat 9.0.10 was used to perform quantitative measures on recurring keywords and phrases. In order to see the differences in communication style of different actors, the vocabulary of sellers was created in WordStat. This procedure followed the commonly adopted guidelines suggested by Bengston and Xu [37]. The iterative process of building a vocabulary involved applying extraction of phrases and keyword-in-context checkup for the purposes of disambiguation. Keyword-in-context “allows one to assess whether the meaning of a particular word is dependent upon its use in certain phrases or idioms” [36, p. 299] in order to preserve context sensitivity. In addition, WordStat gives preference to long phrases over short phrases and single words: it calculates frequency of single words and phrases separately, and excludes single words that are also parts of phrases from the final frequency count.

Finally, words and phrases related to NFT trading and the value of *CryptoKitties* were assigned to a four-level categorization according to their contextual meaning. Irrelevant words and meaningless noise were put on the Exclusion list. Altogether, 56.3% of all words were coded as relevant to trading and meaningful in terms of value construction, and the total coverage that counted functional and irrelevant words reached 98.8% of all messages. The resulting vocabulary of 'kitty traders' is available for free download [39].

In the meantime, qualitative content analysis helped to clarify the contextual meaning of dubious terms. In the words of Yan Zhang and Barbara Wildemuth, “qualitative content analysis emphasizes an integrated view of speech/texts and their specific contexts” [33]. In our case, qualitative analysis helped to understand the context in which particular keywords are used. The interpretation was supported by the knowledge of common gaming practices, as discovered in previous ‘nethnographic’ research [40].

3. Results

3.1. Typology of sellers

To start from, the number of active sellers and messages was calculated for each calendar day. For validation purposes, the volume of messages per day was compared with the available statistics of player activity in *CryptoKitties* openly available as recorded on blockchain, in this case, sourced from KittyExplorer [41]. Evaluations of correlation were all made by using the corresponding Excel Data functionality. Message volume is calculated as the number of total lines of messages per day in the #selling channel.

Correlation between message volume and total players interacting with the game: 0,9249.

Correlation between message volume and the number of sales per day: 0,8976

Correlation between message volume and the volume of sales per day in ETH: 0,8246.

This demonstrates that activity in the #selling channel on Discord is a fairly adequate indicator of player activity in *CryptoKitties* in general, even if it is slightly less representative in terms of actual sales. Two possible factors that are relevant to this particular study are many repeating messages about selling the same inventory, and inability to find buyers, which leads to palpable desperation in many selling messages.

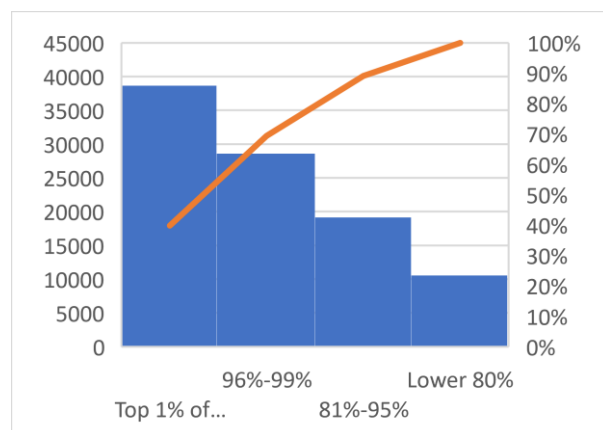
Table 1Four clusters of NFT sellers in the #selling channel of the *CryptoKitties* Discord servers

Cluster	Label	Lines	Total share	Sellers	Total share	Average mess. per seller
Top 1% of sellers	(Robo-)pumas	38688	40 %	25	1 %	1547.52
96%-99%	Bobcats	28588	29 %	101	4 %	283.05
81%-95%	Jungle cats	19147	20 %	379	15 %	50.52
Lower 80%	Sand cats	10594	11 %	2021	80 %	5.24

Still, the trades went on, according to the statistics on blockchain [30], [41]: but who would benefit from such unsustainable ecology? In order to identify particular strategies of most active participants, *CryptoKitties* sellers were categorized into four clusters according to their relative activity (see Table 1).

In our case, the top 20% of sellers generated 89% of messages in the #selling channel, and there were significant differences in activity within these top 20% users, as well. This data aligns with the study on NFT trades (including *CryptoKitties*) by Matthieu Nadini et al.: in their data, the top 10% of traders performed 85% of all transactions [15]. Generally, activity of sellers on Discord can be represented as a variety of an extreme Pareto distribution (Figure 1). These four clusters are used as a heuristic for player typology and are not absolute: the differences between the second and the third clusters are not as radical, although still significant.

Figure 1: A Pareto-style graph that shows distribution of messages. The left Y axis is the total number of messages per cluster (blue columns), the right Y axis is the cumulative share of the corresponding cluster (orange line).



Further application of mixed methods in WordStat identified significant quantitative and qualitative differences in communication strategies of different clusters. Four ‘fursonas’ were created on the basis of this data, as described below.

- **Sand cats**

‘Sand cats’ represent the 80% of participants in the #selling channel, excluding the top 20% most active ones. This is the ‘silent majority’ that also includes the wealthiest buyers (so-called ‘crypto whales’), as they rarely talk and mostly read offers. What unites the casual and the rich in this category is their lack of intent, perseverance or desperation to sell. They negotiate about the value of tokens elsewhere, most likely, in personal communication.

- **Jungle cats**

‘Jungle cats’ represent relatively active players (as opposed to the 80% of casual players above), who are somewhat engaged in trading but not invested in it to the degree when it may become profitable. Unlike the top 5% of sellers, ‘jungle cats’ share their negative experience in the game more willingly and generally communicate in a more diverse and less bot-like style. They also tend to overuse the word ‘rare’ in their selling messages, which shows that they believe in the idea of ‘artificial scarcity’ in a more literal way.

- **Bobcats**

‘Bobcats’ represent hardcore crypto gamers who are wealthy enough to enjoy the game, and sometimes make profit in it. In their efforts to sell, this category demonstrates more attention to the in-game attributes of ‘kitties’, and the value that emerges from playing the game and studying its rules. ‘Bobcats’ make more emphasis on ‘cheap’ and generally demonstrate more desperation in their advertising messages. For example, ‘bobcats’ more often express (not necessarily genuine) intention to sell out and leave the game.

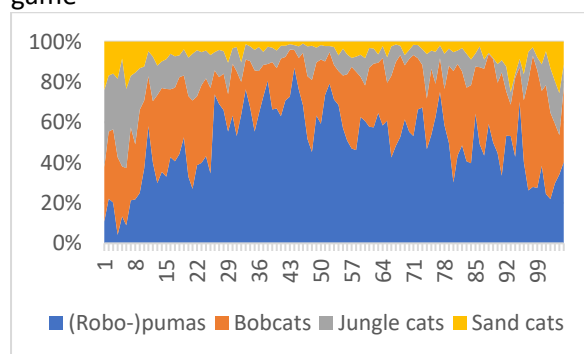
This also distinguishes them from ‘pumas’, who act as if they are here to stay.

- **(Robo-)Pumas**

‘Pumas’ dominate the conversation on Discord. They put a lot of effort (and probably other investments, e.g. market research, bots and hired workforce) into pumping up the interest of potential buyers. ‘Pumas’ do not make as many ‘cheap’ offers as other categories, because selling cheap is not profitable. Instead, they offer what sells best, which, in the analyzed period, was ‘fancy’ ‘kitties’. ‘Pumas’ represent 1% of the participants of the channel, but they have generated 40% of the total message lines in it, reaching 85% at the end of the first year (see Figure 2), with the highest share of repeating advertising messages (which suggests that they used Discord bots for posting).

Participation of these four categories of sellers changed with time as the game market matured and declined. Casual ‘sand cats’ participated more willingly during the initial peak of activity on Discord. The top 1% ‘(robo-)pumas’ started dominating the conversation after this initial peak flattened, and their relative share of messages exceeded 80% in autumn 2018 when the core player base has been established. Participation of all categories, and especially of top sellers, gradually declined in 2019 (see also [29], [30]) presumably because there was much less money to be made in the game.

Figure 2: Relative activity of different categories of sellers throughout the first 105 weeks of the game



3.2. Dimensions of value

Although *CryptoKitties* is mainly a game of chance [28], the skill of playing it requires expert knowledge of the vocabulary of traits, or ‘attributes’, as players call them, - and their

classification in the game. To integrate this implicit knowledge of the game’s rules into the analysis, a complete vocabulary of ‘traits’ was sourced from the fan-made resource Kotobaza [42] and fed to WordStat’s Categorization tool. This vocabulary was complemented with relatively frequent words and terms that were used to describe ‘kitties’ on Discord, in addition to the official terminology that came from the developers of the game. Such attributes, divided into several sub-categories, formed the category labeled *Appearance* in the categorization vocabulary.

After several rounds of coding, the categorization model produced three main categories that described the value of ‘kitty’ NFTs. These categories were discovered inductively, by coding contextually meaningful terms in the data and sorting them under categories and subcategories. The extended *Appearance* section now encompassed words and phrases that described visual qualities of tokens. The *Positive value* section contained qualities that made tokens valuable in the game system, and the *Marketing communication* contained functional words and phrases used to ascribe value to the tokens. The fourth auxiliary category *Negative value and experience* was added for the purposes of comparison and quick qualitative analysis, although negative value and experience were usually discussed in other channels on Discord.

The resulting systemic vocabulary in WordStat revealed three main dimensions of value that were constructed in the discussion on Discord.

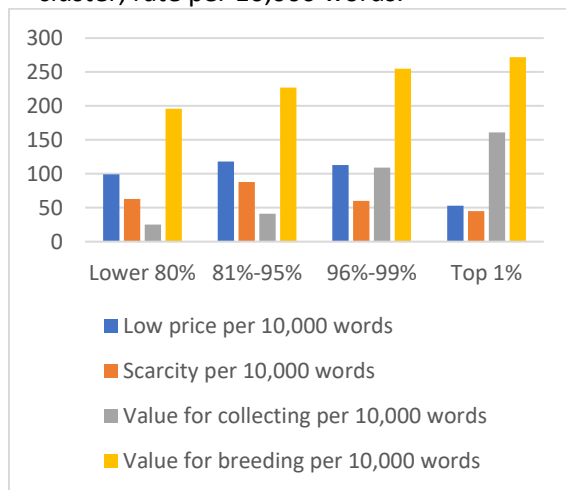
1. Value assigned by the developers (such as appearance traits);
2. Value discovered by the players in the process of play (such as value for breeding and value for collecting);
3. Value assigned by the sellers to make tokens more desirable to buyers (such as superlative expressions of scarcity (e.g. ‘rare, super rare and ultra rare’) and general ‘awesomeness’).

These three dimensions do not exclude each other, and certain terms can be hard to categorize unambiguously. However, there are certain trends concerning linguistic structures and origins of different descriptors, albeit also not absolute. Such as, the basic value assigned by the developers is typically described by single unambiguous keywords that characterize particular attributes of tokens (e.g. ‘gold’). Value assigned by players emerges as metaphoric descriptors and short phrases suggested by the

community (e.g. ‘vintage kitties’). Value assigned by the sellers emerges in complete utterances with the unambiguous intent to sell (e.g. ‘cheapest on the market’). Simple and literal descriptors acquire game specific nuances, as well, - such as, for instance, in discussions of scarcity. As we discussed above, artificial scarcity is presented as the basis for the game economy by its developers and fans. On the one hand, this leads to radically stretching it into abundance [40]; on the other hand, scarcity becomes a value of its own, more as an ideological concept rather than the actual state of things.

Moreover, usage of different categories and subcategories of words noticeably differs between different clusters of players. In our sample, the top 5% of sellers mention scarcity-related words relatively less frequently than ‘silent’ and ‘casual’ players. Besides, the top 1% does not mention ‘cheap prices’ that much: the rationale behind it is most likely that selling cheap is not profitable. While all types of sellers pay attention to utility value of kitties such as value for breeding, actually rare collectibles are mostly offered by the top 1% sellers.

Figure 3. Occurrence of terms that describe selected particular types of value, by seller cluster, rate per 10,000 words.



To sum it up, *different clusters of sellers use different language means, which correspond to their broader selling strategies*. The winning strategy appears to be multiplication of rather homogenous messages in order to receive more attention in the chat, and the sellers who benefit from it are the ones who have considerable resources and big inventories. In the end, the main difference between different types of sellers appears to be quantitative. As it can be seen from Table 1, 80% of sellers (‘sand cats’) posted less than 6 messages on the average during their lifetime on the server. At the same time, 25 top posters - ‘pumas’ – generated around 1,500 lines of messages on the average. It may be that all sellers start with natural and diverse interpersonal communication, but the composition of their messages at large changes as they move from interpersonal communication and peer to peer trade to spam-like, bot-like automated mass scale advertising.

The phrase extraction functionality of WordStat has appeared particularly useful in identifying repeating messages. Phrases of no less than three words that appeared no less than five times were extracted and categorized under *Advertising*. The main criteria were occurrence of 5 or more times in the exact same form (one particularly desperate 12-word phrase occurred in 181 instances), making sense in the human language, and a clear intent to sell. Some of these phrases point at particular dimensions of value, mostly low price, value for breeding, value for collecting, and scarcity, but the largest share of them simply amplifies the intention to sell, sometimes relying on ‘the fear of missing out’. Such phrases were filed under the subcategory ‘Seller really wants to sell’. In general, the more active the poster is on the #selling channel, the more frequently he or she will use such phrases. Besides, the relative rate of such phrases has increased dramatically as the market stagnated: the less players remain in the game, the more intensive the intent to sell becomes.

Figure 4.1. Occurrence of words and phrases included in the larger *Advertising* category, by date, per week, rate per 10,000 words. The graph is generated by WordStat.

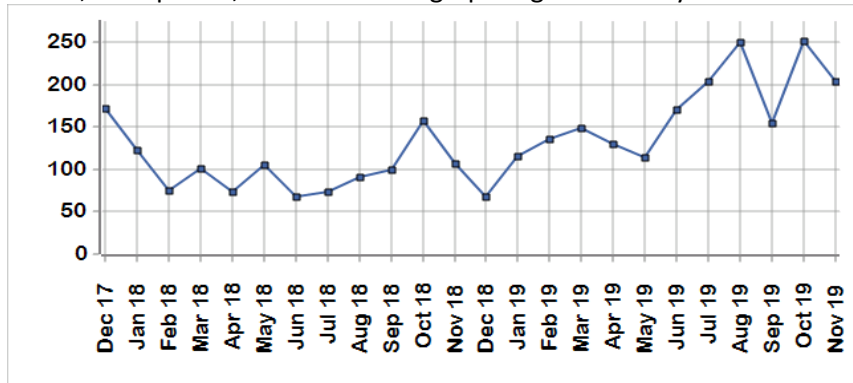
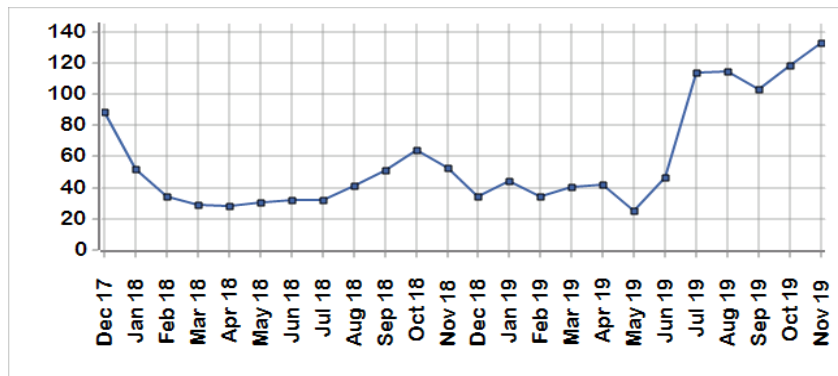


Figure 4.2. Occurrence of seller intent-focused phrases from the *Advertising* category, by date, per week, rate per 10,000 words. The graph is generated by WordStat.



One last observation from the *Marketing communication* section indicates potential exploitation of the blockchain platform: many recurrent phrases invite the buyer to contact the seller directly. This would seem redundant in the idealistic model of a blockchain-based marketplace [1], [3], [23], where sellers list items and adjust the price until they achieve the consensus with the buyer, collaboratively constructing a fair market price in the process. In practice, according to observations, the seller often lists items at inflated prices, or does not even list them at all. He or she may also advertise some prices as ‘floor prices’, even though this ‘market floor’ has been artificially inflated. In fact, the seller is ready to sell at a much lower price, and sometimes at any price, if he or she wants to exit (which is the typical ‘bobcat’ pattern). This is why we see so many invitations to negotiate the prices directly in private messages: the seller may not want to disclose the acceptable price, to prevent ‘the floor’ from falling. Such practices demonstrate that transparency of blockchain-based trade and marketing is easily bypassed in order to preserve information asymmetry.

4. Conclusion

The presented mixed methods content analysis has provided a meta-description of the process of value construction on the *CryptoKitties* market, represented by the #selling channel on the official Discord server of the game. The resulting vocabulary of *CryptoKitties* traders [39] serves as an answer to *Q1: What constitutes the value of a ‘kitty’ NFT based on its selling description?* Three important dimensions emerge from the data: intentional construction of value by game designers; novel utility value discovered by users in the process of playing, and appreciation of value by traders, with the primary intention to make profit in the game.

Altogether, the discourse on Discord appeared much more valuable to characterize the sellers, rather than the tokens that they trade. Two distinct strategies for success are maximization of presence in the communication channel (e.g, overflowing it with many repeating messages) and amplification of emotions in these messages

(sometimes to the level of sheer despair). This answers *Q2. What linguistic strategies do sellers use to establish the value of tokens?* Most likely, the content of marketing messages becomes less and less important, as their main function switches from justifying the value of tokens to pumping up ‘investor interest’ in novice players [43]. At the same time, individual sellers and even smaller entrepreneurs are being flushed away by the constant flow of presumably automated monotonous posting on Discord.

This brings us to *Q3. Who benefits from these strategies of value creation and manifestation in a blockchain-based game?* Do these strategies benefit collaborative creation of value for different groups of participants? As the data demonstrates, ‘robo-pumas’, who represent the top 1% of sellers, have been dominating the conversation for the most time. If we assume that all sellers are competing for the limited attention of buyers, then the communication platform is being exploited by their most active and invested minority. The observed process can be characterized as re-centralization of a peer-to-peer market in the hands of most wealthy and dedicated sellers, which corresponds to processes of centralization that have been already observed in cryptocurrencies in general and on the market of NFTs in particular [15], [18], [44].

Limitations of this study stem from a very particular method applied to a single, even if typical, case. The next step is to find out whether other NFT projects produce similar typologies and vocabularies, not just on Discord, but also in other social media. This may reveal the most influential actors in these projects, as well as the state of things for the ‘silent majority’. Decentralization does not automatically mean equal access to resources, neither does it distribute the resulting value in a fair and transparent way, as we already know from earlier digital platforms and virtual worlds.

As we know, the current state of virtual economies, including decentralized finances and gaming, is best described by the concept of multisided platforms [20]. From the technological perspective, blockchain platforms, such as Ethereum on which *CryptoKitties* run, are the ultimate cases of such decentralized non-hierarchical platforms. They were initially specifically designed to afford horizontal networks of stakeholders in the collective process of value co-creation [23], [24]. Blockchain technologies were meant to ensure further transparency in relations between buyers and

sellers, but it may be that they have worked in the opposite direction. Although digital technologies are meant to reduce information asymmetries on the market [45], unregulated blockchain-based marketplaces seem to provide more or less the same opportunities for exploitation as proprietary platforms [22].

It appears that the market does not regulate itself in a way that is beneficial for all stakeholders, as long as there are financial incentives and technical possibilities to exploit and manipulate it. Based on linguistic data, it may look as if public discussions of the value of NFTs do more to conceal the ‘true value’ of tokens than to establish any reliable criteria for its creation. What we see instead is most reminiscent of a ‘bazaar economy’ described by Clifford Geertz [46]. In his words, "in the bazaar information is poor, scarce, maldistributed, inefficiently communicated, and intensely valued" [46, p. 29], which is also the common state of an NFT marketplace. Future research on blockchain platforms will be more productive if they are treated as ‘bazaar economies’, rather than ‘sharing economies’, as they are currently presented in marketing literature [23].

5. Acknowledgements

This work was supported by the Evald and Hilda Nissi Foundation (Grants 68/2.52/2020, 132/2.52/2021) and the Graduate School of the University of Vaasa.

6. References

- [1] J. Hargrave, N. Sahdev, and O. Feldmeier, “How Value is Created in Tokenized Assets,” in *Blockchain Economics: Implications of Distributed Ledgers*, vol. 01, 2019, pp. 125–143. doi: 10.1142/9781786346391_0007.
- [2] L. Kugler, “Non-fungible tokens and the future of art,” *Commun. ACM*, vol. 64, no. 9, pp. 19–20, Sep. 2021, doi: 10.1145/3474355.
- [3] I. R. R. da Silva and N. Omar, “Real and Virtual Token Economy Applied to Games: A Comparative Study Between Cryptocurrencies,” in *Intelligent Computing*, vol. 284, K. Arai, Ed. Cham: Springer International Publishing, 2021, pp. 869–880. doi: 10.1007/978-3-030-80126-7_61.
- [4] D. Vidal-Tomás, “The new crypto niche: NFTs, play-to-earn, and metaverse tokens,”

- Finance Research Letters*, p. 102742, Feb. 2022, doi: 10.1016/j.frl.2022.102742.
- [5] OpenSea, “OpenSea, the largest NFT marketplace,” *OpenSea*, 2018. <https://opensea.io/> (accessed Oct. 09, 2022).
- [6] J. Hamari and V. Lehdonvirta, “Game Design as Marketing: How Game Mechanics Create Demand for Virtual Goods,” *International Journal of Business Science and Applied Management*, vol. 5, no. 1, pp. 14–29, 2010.
- [7] V. Lehdonvirta, “Virtual Consumption,” *Publications of the Turku School of Economics*, vol. A-11, 2009, Accessed: Mar. 29, 2017. [Online]. Available: <http://vili.lehdonvirta.com/files/thes3988/Virtual-consumption-thesis.html>
- [8] V. Lehdonvirta and E. Castronova, *Virtual Economies: Design and Analysis*. MIT Press, 2014.
- [9] CryptoKitties, “CryptoKitties: Collectible and Breedable Cats Empowered by Blockchain Technology. White Pa-Purr.” 2018.
- [10] R. F. Ciriello, R. Beck, and J. Thatcher, “The Paradoxical Effects of Blockchain Technology on Social Networking Practices,” presented at the Thirty Ninth International Conference on Information Systems, San Francisco, CA, USA, 2018.
- [11] B. L. Frye, “How to Sell NFTs Without Really Trying,” *Harvard Journal of Sports and Entertainment Law*, Sep. 2021.
- [12] X.-J. Jiang and X. F. Liu, “CryptoKitties Transaction Network Analysis: The Rise and Fall of the First Blockchain Game Mania,” *Front. Phys.*, vol. 9, Mar. 2021, doi: 10.3389/fphy.2021.631665.
- [13] J. Lee, B. Yoo, and M. Jang, “Is a Blockchain-Based Game a Game for Fun, or Is It a Tool for Speculation? An Empirical Analysis of Player Behavior in Crypokitties,” in *The Ecosystem of e-Business: Technologies, Stakeholders, and Connections. Lecture Notes in Business Information Processing*, vol. 357, Springer, 2019, pp. 141–148.
- [14] K. Sako, S. Matsuo, and S. Meier, “Fairness in ERC token markets: A Case Study of CryptoKitties,” *arXiv:2102.03721 [cs]*, Feb. 2021, Accessed: Apr. 12, 2021. [Online]. Available: <http://arxiv.org/abs/2102.03721>
- [15] M. Nadini, L. Alessandretti, F. Di Giacinto, M. Martino, L. M. Aiello, and A. Baronchelli, “Mapping the NFT revolution: market trends, trade networks, and visual features,” *Sci Rep*, vol. 11, no. 1, Oct. 2021, doi: 10.1038/s41598-021-00053-8.
- [16] L. Ante, “Non-fungible token (NFT) markets on the Ethereum blockchain: Temporal development, cointegration and interrelations,” *SSRN Electronic Journal*, 2021, doi: 10/gn8dr8.
- [17] O. J. Scholten, N. G. J. Hughes, S. Deterding, A. Drachen, J. A. Walker, and D. Zendle, “Ethereum Crypto-Games: Mechanics, Prevalence, and Gambling Similarities,” in *Proceedings of the Annual Symposium on Computer-Human Interaction in Play*, Barcelona Spain, Oct. 2019, pp. 379–389. doi: 10.1145/3311350.3347178.
- [18] C. Ducuing, “How to make sure my Cryptokitties are here forever? The complementary roles of the blockchain and the law to bring trust,” *European Journal of Risk Regulation*, vol. 10, no. 2, 2019, doi: 10.1017/err.2019.39.
- [19] K. F. K. Low and E. Mik, “Pause the Blockchain Legal Revolution,” *ICLQ*, vol. 69, no. 1, pp. 135–175, Jan. 2020, doi: 10.1017/S0020589319000502.
- [20] A. Hagi, “Strategic Decisions for Multisided Platforms,” *MIT Sloan Management Review*, vol. 55, no. 2, pp. 70–80, Winter 2014.
- [21] G. M. Eckhardt, M. B. Houston, B. Jiang, C. Lambertson, A. Rindfleisch, and G. Zervas, “Marketing in the Sharing Economy,” *Journal of Marketing*, vol. 83, no. 5, pp. 5–27, Sep. 2019, doi: 10.1177/0022242919861929.
- [22] Q. (Kris) Zhou, B. J. Allen, R. T. Gretz, and M. B. Houston, “Platform Exploitation: When Service Agents Defect with Customers from Online Service Platforms,” *Journal of Marketing*, vol. 86, no. 2, pp. 105–125, Mar. 2022, doi: 10.1177/00222429211001311.
- [23] T. M. Tan and J. Salo, “Ethical Marketing in the Blockchain-Based Sharing Economy: Theoretical Integration and Guiding Insights,” *J Bus Ethics*, Dec. 2021, doi: 10.1007/s10551-021-05015-8.
- [24] V. Buterin, “Ethereum White Paper. A Next Generation Smart Contract & Decentralized Application Platform.” 2013. [Online]. Available: <https://ethereum.org/en/whitepaper/>
- [25] L. A. Sparrow, M. Gibbs, and M. Arnold, “Ludic Ethics: The Ethical Negotiations of Players in Online Multiplayer Games,” *Games and Culture*, vol. 16, no. 6, pp. 719–

- 742, Sep. 2021, doi: 10.1177/1555412020971534.
- [26] K. Gabriels, J. Bauwens, and K. Verstrynghe, “Second Life, Second Morality?,” *Virtual Worlds and Metaverse Platforms: New Communication and Identity Paradigms*, pp. 306–320, 2012, doi: 10.4018/978-1-60960-854-5.ch020.
- [27] A. Serada, “Cryptomarkets Gamified: What Can We Learn by Playing CryptoKitties?,” in *DiGRA Proceedings*, 2020.
- [28] A. Serada, “Why Is CryptoKitties (Not) Gambling?,” in *International Conference on the Foundations of Digital Games (FDG '20), September 15--18, 2020, Bugibba, Malta*, Bugibba, Malta, 2020. doi: 10.1145/3402942.3402985.
- [29] KittyHelper, “KittyHelper,” 2022. <https://kittyhelper.co/> (accessed Jul. 02, 2021).
- [30] DappRadar, “CryptoKitties,” *DappRadar*, 2023. <https://dappradar.com> (accessed Mar. 01, 2023).
- [31] A. Serada, “Fairness by Design: The Fair Game and the Fair Price on a Blockchain-Based Marketplace,” in *Disruptive Technologies in Media, Arts and Design*, A. Dingli, A. Pfeiffer, A. Serada, M. Bugeja, and S. Bezzina, Eds. Cham: Springer International Publishing, 2022, pp. 63–75.
- [32] A. Serada, “Vintage CryptoKitties and the Quest for Authenticity,” in *Proceedings of IEEE CoG*, Copenhagen, Dec. 2021. doi: 10.1109/CoG52621.2021.9619106.
- [33] C. Coberly, “Discord has surpassed 250 million registered users,” *TechSpot*, May 13, 2019. Accessed: Mar. 01, 2023. [Online]. Available: <https://www.techspot.com/news/80064-discord-has-surpassed-250-million-registered-users.html>
- [34] L. Ceci, “Discord top gaming servers worldwide by members count 2023,” Statista, Jan. 2023. Accessed: Mar. 01, 2023. [Online]. Available: <https://www.statista.com/statistics/1327143/discord-top-gaming-servers-worldwide-by-number-of-members/>
- [35] T. Zaucha and C. Agur, “Newly minted: Non-fungible tokens and the commodification of fandom,” *New Media & Society*, p. 14614448221080480, Mar. 2022, doi: 10.1177/14614448221080481.
- [36] N. Péladeau, “Mixing Beyond Mixed Methods: QDA Miner, SimStat, and WordStat,” in *The Routledge Reviewer's Guide to Mixed Methods Analysis*, Routledge, 2021.
- [37] D. N. Bengston and Z. Xu, “Changing National Forest Values: a content analysis,” *Research Paper NC-323*. St. Paul, MN: U.S. Dept. of Agriculture, Forest Service, North Central Forest Experiment Station, vol. 323, 1995, doi: 10.2737/NC-RP-323.
- [38] O. Holub, “Discord Chat Exporter.” May 15, 2021. Accessed: May 15, 2021. [Online]. Available: <https://github.com/Tyrrrz/DiscordChatExporter>
- [39] A. Serada, “Wordstat Categorization for CryptoKitties Chats.” Mar. 01, 2023. doi: 10.13140/RG.2.2.22273.94566.
- [40] A. Serada, T. Sihvonen, and J. T. Harviainen, “CryptoKitties and the New Ludic Economy: How Blockchain Introduces Value, Ownership, and Scarcity in Digital Gaming,” *Games and Culture*, vol. 16, no. 4, pp. 457–480, Jun. 2021, doi: 10.1177/1555412019898305.
- [41] KittyExplorer, “Kitty Explorer,” 2021. <http://www.kittyexplorer.com/stats/?generation=0&timefilter=> (accessed Jul. 01, 2021).
- [42] KotoBaza, “CryptoKitties cattributes and mutations in one table.” 2021. Accessed: Jan. 16, 2021. [Online]. Available: <https://blog.kotobaza.co/trait-chart/>
- [43] A. Serada, “Happier than Ever: The Role of Public Sentiment in Cryptocurrencies, Meme Stocks, and NFTs,” in *Activist Retail Investors and the Future of Financial Markets*, Routledge, 2023.
- [44] V. Gladyshev and Q. Wu, “Design for the Decentralized World: Democratization of Blockchain-Based Software Design,” in *Design, User Experience, and Usability. Design for Contemporary Interactive Environments*, Cham, 2020, pp. 74–86. doi: 10.1007/978-3-030-49760-6_5.
- [45] P. K. Kannan and H. “Alice” Li, “Digital marketing: A framework, review and research agenda,” *International Journal of Research in Marketing*, vol. 34, no. 1, pp. 22–45, Mar. 2017, doi: 10.1016/j.ijresmar.2016.11.006.
- [46] C. Geertz, “The Bazaar Economy: Information and Search in Peasant Marketing,” *The American Economic Review*, vol. 68, no. 2, pp. 28–32, 1978.