Vintage CryptoKitties and the Quest for Authenticity

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Vintage *CryptoKitties* and the Quest for Authenticity

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Abstract

This paper presents the case of the blockchain-based game *CryptoKitties* (Axiom Zen, 2017), more specifically, one particular way of making game tokens potentially more valuable by labeling them 'vintage'. Firstly, I show how the meaning of 'vintage' was collectively constructed by the community of players and negotiated online until it was acknowledged by the owners of the game. Secondly, I measure the influence of the 'vintage' label on the game market in the first six months of 2018. I base my measurements on open market data available through such services as KittyHelper, Etherscan and the Chrome plug-in CKBox. I conclude that 'vintage kitties' did not acquire surplus market value even after they became a publicly recognized part of the game: breeding them resulted in losses for the majority of players. However, their retro aesthetics inspired creativity of many players and signified the social status of "the new rich".

1 Introduction

Blockchain technologies have enabled a new way to design scarcity of digital goods [1] and, potentially, construct new forms of market value based on it. This idea has found practical realisation in a number of digital media projects, from *Cryptopunks* [2] to *Care Bears* on blockchain [3] and initiated the current boom of NFTs on the art market [4] [5]. In these projects, game

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assets and collectible items exist as non-fungible tokens (NFTs) on blockchain and can be traded for cryptocurrency. *CryptoKitties* [6], the subject of this study, is the first game of this kind that saw considerable popularity and even larger media attention at the end of 2017.

CryptoKitties is a browser game about breeding and trading digital pets. Players purchase NFTs, visualised as cute-looking kitties, and breed them with each other with the purpose to obtain new, potentially rare and beautiful cats and sell them to other players. *CryptoKitties* have many blockchainless predecessors such as *Neopets* [7] (currently also experimenting with blockchain [8]), *Ovipets* [9], as well as popular monster breeding simulators such as *DragonVale* [10] and *My Singing Monsters* [11]. Despite scalability problems that has put the Ethereum platform to halt in 2020 [12] and particularly high volatility of cryptocurrencies in 2018 and 2021, the game still goes on, functioning as a relatively successful experiment in gamification of blockchain [13].

The innovative aspect of the game lies in its open peer-to-peer marketplace where players can trade their collectable pets for the cryptocurrency Ether. To be fair, the same can be done e.g. in *OviPets* with in-game currency, but there is no built-in possibility to cash out earnings. Cashing out in traditional virtual worlds is usually limited due to potential money laundering [14], player-organised gambling [15] and hardly manageable in-game economic crises [1]. What makes *CryptoKitties* truly different from its predecessors is the opportunity to turn in-game value into real-world value by using cryptocurrencies. Since 2018, other 'play-to-earn' blockchain games have entered the market, such as *Axie Infinity* [16]. These games claim to empower their players [17] and are even recommended to children [18]. Such claims call for investigation of already matured blockchain-based marketplaces and typical practices of their players.

Blockchain-base games exist in the environment of ubiquitous speculation that is characteristic for cryptocurrency markets [19] [20]. Upon closer look, NFT markets demonstrate the same type of player behavior, asset 'flipping' being the most common practice [21]. Besides, most 'crypto games' are predominantly games of chance, which invites comparison to gambling [22]. Finally, the sheer abundance of various NFTs puzzles the newcomers: it is very difficult to understand which ones are valuable, and which are not (which often benefits more experienced traders). However, such games can provide enjoyable leisure time to responsible and well-informed players [23], and many gaming practices are indeed collective initiatives of their active and pro-social players, rather than top-down decisions made by game publishers. In this article, I analyze one such communal practice of collecting 'vintage kitties' in the puzzling virtual world of *CryptoKitties*.

2 What constitutes 'vintageness'?

2.1 The rules of the game

Following the common heuristics of virtual economies [1], the initial project of *CryptoKitties*' economy was based on artificial scarcity. Its material realisation can be found in the complicated 'genetic makeup' of digital cats. Particular snippets of computer code work as different 'genes' associated with certain attributes in the appearance of the 'kitty'. The full genetic composition of *CryptoKitties* has been deciphered within the first year of the game's existence: its technically knowledgeable core players treated the code of the game as just another puzzle [24]. By breeding 'kitties' with different attributes, the player can achieve a mutation - a 'kitty' with a new attribute of a higher level. Higher level traits are derived from lower level traits with decreasing probability: the chance of mutation is 14% for levels 1 and 2 and 7% for levels 3 and 4 (Fig. 1). Such a complicated breeding system was created to ensure that traits of higher levels would remain relatively scarce, to varied results (Table 1). For instance, there is a 7% chance to breed a 'kitty' of the rare color 'firstblush': its parents have to possess color attributes 'hotcocoa' and 'shamrock', as well as optimal sets of corresponding 'genes' (Fig. 1). Playing the game requires a solid understanding of probabilities and can be compared to the practice of professional gambling [25]

Generally, the palette of computer-generated 'kitties' is limited: there are 31 color options for each variable trait, and some colors are much more common than others. Same as with other traits, these 31 options are hierarchically organized into four levels based on the logic of breeding and mutation. This particular study only deals with the color of 'kitties', represented by four variable traits: eye color, base color (body), highlights and accents.

The hierarchical system of attributes is not the only method to make some 'kitties' more valuable by the others. Another way for developers to control scarcity is to limit the issue of particular tokens, and it remains the most influential tool as of 2021. Despite the commonly repeated marketing message, blockchain-based games are not completely decentralised: their developers have sufficient control over the processes of value creation and extraction [26]. In the case of *CryptoKitties*, such 'artificially scarce' resources were best represented by the early Generation 0, or Gen 0 'kitties'. These tokens were created by the automated 'smart contract' named Kitty Clock, executed by the account that belongs to the owners of the game. All other 'kitties' in the game descend from these 'generation zero kitties' and are bred by players. It is important to note that the price of tokens drastically

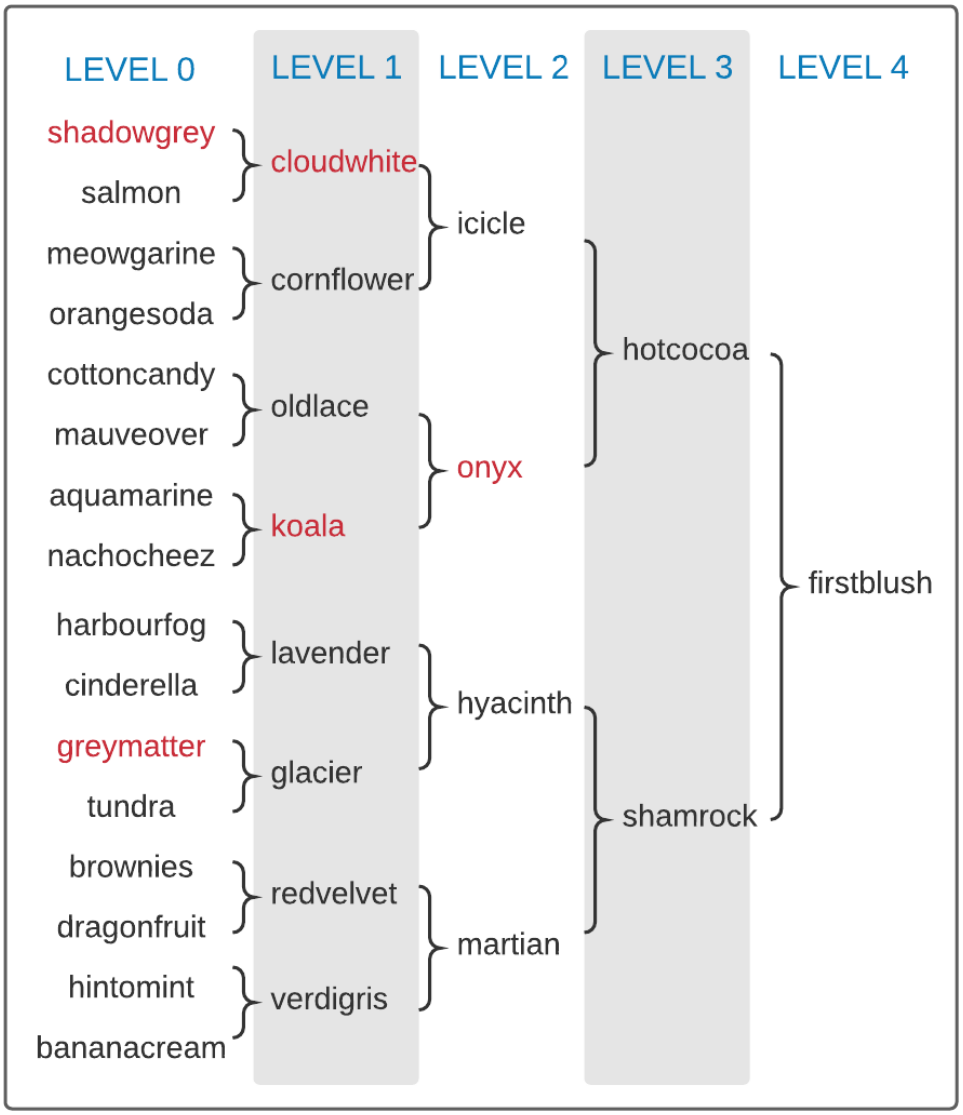

Figure 1: A breeding scheme for base color attributes. Keywords stand for particular colors and shades of the body of a 'kitty' that can be inherited with the corresponding 'genes'. Attributes marked red are 'vintage': *shadowgrey, greymatter, koala, cloudwhite* and *onyx* are different shades of grey. Similar charts can be compiled for eye color, highlights and accents, as well as for all other attributes.

decreased with every next generation; eventually only Gen 0 'kitties' have retained their initial value.

Gen 0 tokens were limited issue tokens: they were only generated during the first year of the game's existence. The developers publicly sold them to players by the descending clock auction (the buyers would wait until the price of the token would decrease enough to correspond to their perceived value). Initially, 50,000 of such tokens were planned for distribution, and this number is hardcoded into the smart contract of the game [27]. However, according to the developers, only around 38,000 Gen 0 'kitties' have been generated and sold to players between November 23, 2017, and November 30, 2018, when the metaphorical Kitty Clock stopped [28] [1]). To be fair, the limit of 38,000 tokens does not make them particularly scarce in the game, which has consistently had only a few thousands of monthly active players throughout most of its lifespan [13]; still, as we will see, these tokens hold relatively high value and are still resalable on the second hand market.

The idea of so-called 'vintage kitties' is of particular interest in this regard, because it goes against the rational logic of artificial scarcity. It embodies a playful, rather than calculated, attitude, which originated from the community of players as opposed to the official game design implemented by the developers. The only condition for 'vintage' is that the 'kitty' should look more or less monochrome: all four possible different colors in its design should be black, grey or white, regardless of level or other secondary characteristics.

2.2 The origins of vintage

According to the definition collectively established by the game community on Discord, 'vintage kitties' are 'kitties' only colored in different shades of black, white, and grey, sometimes with slight tints of other colors, which makes them look like characters in a black and white film. Monochrome 'kitties' existed, sometimes distinguished for their aesthetic qualities, long before the concept of 'vintage' was established. As of January 31, 2021, there were at least five monochrome kitties that were born or traded before April 11, 2018 and renamed "Shades of Grey", and two monochrome kitties renamed "Greyscale" because of their appearance before the idea of 'vintage' took off. There were also hundreds of less appealing monochrome tokens in the game, mostly treated by their owners as not particularly valuable.

The idea of 'vintage' as a recognized part of the game took its shape in the discussion on the chat platform Discord on April 11, 2018. This day was established as the official date of birth of the 'vintage kitties'. One of

[1] The actual number may be even smaller, according to KittyHelper.com [29]

the most active members of the community even bought a special 'kitty' and renamed it after this memorable date: this 'kitty' is still available in the game as of 2021, symbolically valued 4.11 Ether [30].

The idea of a perfectly monochrome 'kitty' initiated sometimes heated discussions about the exact attributes and colors that should be considered 'true vintage'. The community remembers one particular person who was the first to systematically describe and codify the attributes that 'vintage' kitties should have, in a shared Google document [31]. This player's identity was known to some players; however, I will further refer to them by a random made up name Judy. The first definition of 'vintage' was not complete: the game had been online for only four months at that time, and developers of the game were still introducing new attributes, some of which appeared to be monochrome later (see Table 1).

Today, the indicator of 'vintageness' can be seen in the community-made Chrome extension CKbox used by most players to enhance the official game interface. Table 1 lists all 'vintage' attributes, according to this semi-official extension. If all four colored traits of a 'kitty' are from this list, CKbox labels the token in the game as 'Community fancy' - 'Vintage'. To illustrate distribution and relative scarcity of 'truly vintage' attributes, the total number of 'kitties' with each trait has been calculated as of January 31, 2021. The total number of 'vintage' kitties at that time was 3031.

Table 1 demonstrates that 'vintage' involves attributes of varied scarcity, from very common 'thundergrey' eyes to rather rare 'koala' and 'cyborg' base colors. Also, this classification preserves the evidence of a typical community dispute: the 'lilac' secondary color was initially rejected because of its vibrant shade. Nevertheless, it became a part of the 'vintage' canon later and is recognized as 'vintage' now by CKBox [32]. Other traits that were absent from Judy's canon only started appearing in the game after April 11, 2018, gradually introduced by the developers of the game.

The players have put considerable effort into making 'vintage' tokens a meaningful part of game experience. But did it translate into other forms of value, such as market value? After exploring the origins of 'vintage', I collected the market data to answer the following research questions:

Q1. What effect did the concept of 'vintage' have on the supply and the prices of the corresponding tokens?

Q2. What kind of value did the concept of 'vintage' generate?

Table 1: Recognized attributes of 'vintage' kitties

Colored attribute	Keyword for the color	Level of the trait	First introduced	Present in Judy's definition	Total as of 31.01.21
Eyes	thundergrey	1	03.01.18	yes	2494
	eclipse	2	7.04.18	no	537
Base color	greymatter	1	23.11.2017	yes	1393
	shadowgrey	1	23.11.2017	yes	683
	cloudwhite	2	23.11.2017	yes	184
	onyx	3	14.01.18	yes	716
	koala	2	14.01.18	yes	55
Secondary color	wolfgrey	2	23.11.2017	yes	439
	lilac	1	14.01.18	no	633
	egyptiankohl	1	09.02.18	yes	1858
	pearl	3	11.05.18	no	78
	cyborg	1	09.08.18	no	23
Accent	granitegrey	1	23.11.2017	yes	315
	purplehaze	1	23.11.2017	yes	890
	icy	1	31.12.17	yes	1027
	shale	1	19.04.18	no	422
	cashewmilk	1	09.06.18	no	377

3 The state of the 'vintage' market

This study is based on the data related to 766 NFTs - playable and collectable blockchain-based *CryptoKitties* tokens ('vintage kitties') and the transactions that involved them between January 11, 2018 and July 12, 2018. This period of time was selected to adequately compare time periods before and after the introduction of the concept of 'vintage' on April 11, 2018. January 11, 2018 is the day when the first monochrome token appeared in the game.

Altogether, 455 'vintage kitties' appeared in the game within the period from its very beginning to April 10, and 311 new 'vintage kitties' appeared between April 11 and July 12, 2019. This suggests that active discussions in the community may not have translated into the regular practice of breeding and trading 'vintage' kitties in the game soon enough (Fig. 2). To further investigate this issue, I obtained market data on each individual 'vintage' token within the observed period. The data used in this paper includes the date when each token appeared in the game, dates of the sales involving these tokens across the mentioned period, the value of each transaction in ETH, and all sellers' Ethereum wallet addresses. All this data is available as open data on Ethereum and can be accessed through a variety of Ethereum analytics.

The data used for this research was obtained from the free open service KittyHelper.co [29]. I manually went through the history of transactions for each 'vintage kitty' via the CKBox Chrome plugin [32] and double-checked dubious cases on Etherscan [22]. By collecting the data manually, I was able to obtain additional qualitative data and sometimes observe meaningful off-chain events, such as transactions on the external market OpenSea, use of 'wrapping' services, and changes in the names of tokens. Principal data collection was finalised on January 31, 2021, and minor corrections were added on June 30, 2021.

The initial inspection showed rather active second hand market: the most resold token in the sample changed hands six times. However, only 226 of 689 (33%) of the 'kitties' bred by players in the sample have been sold at least once. Of 77 Gen 0 tokens generated and sold by the game developers, all have been sold at least once (from developers to players - this is how these tokens entered the game), and 31 of these 77 (40%) have been sold at least twice, thus entering the second hand market.

At the cleaning stage, I excluded several dimensions from my data to focus on my research questions, which also delineates the limitations of my study. Two most important areas of uncertainty are transaction fees and multiple accounts. Transaction fees complicate calculation of net profits on just any blockchain-based market, while shared and multiple accounts prevent us from

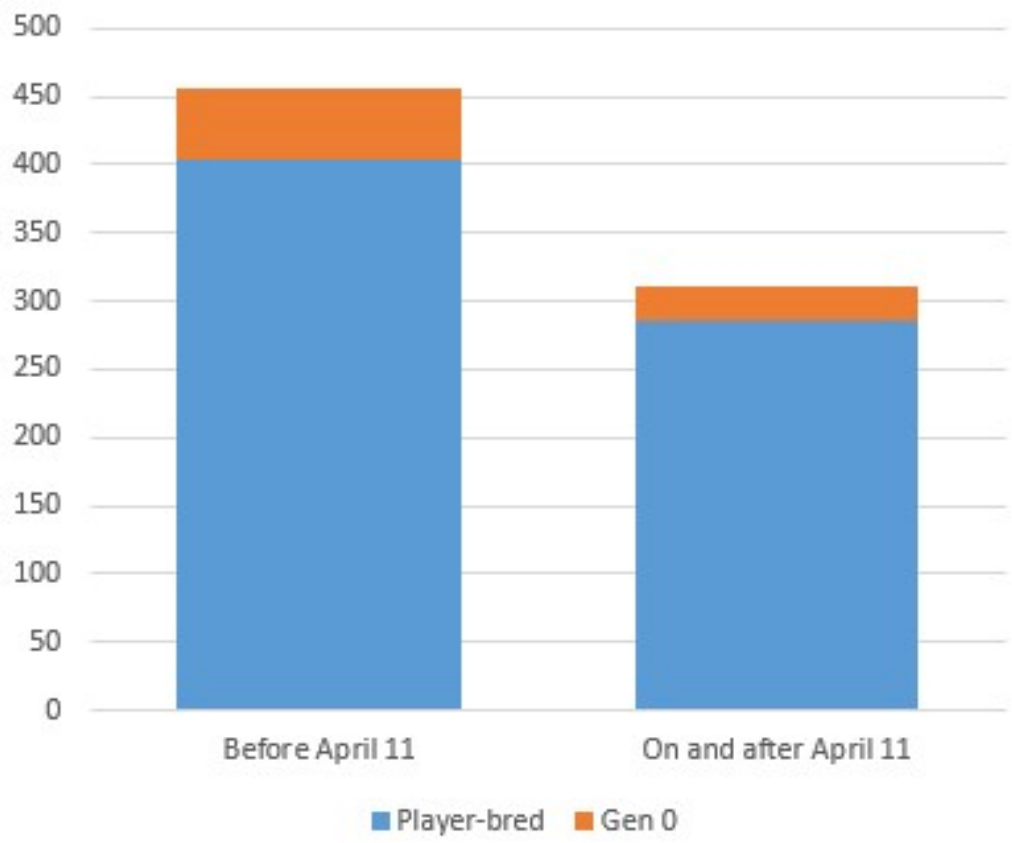

Figure 2: The total number of new 'vintage kitties' that appeared in the game before and after the official establishment of the concept. Gen 0 'kitties' are the tokens that were not created by breeding, but generated by the core smart contract of the game. Visualization by Excel 2016.

attributing these profits to particular traders.

3.1 Transaction fees

Every transaction on Ethereum is accompanied by a fee in Ether paid from the wallet that initiates the transaction. The fees are calculated case by case and can range from an equivalent of several US cents to practically limitless amounts of Ether as a result of trader's mistake [33]. The data about all factual transaction fees can be obtained from the analytical platform Etherscan; they are excluded from this paper because of the technical limitations and the additional level of complexity it would add. For the needs of this article, I acknowledge existence of fees but do not calculate them. The fees are, at least, partially in control of traders, assuming that they are acting rationally: the traders can make decisions about preferred transaction fees based on the estimation of future profits. As we will see in the described case, a rational trader would not get involved with 'vintage kitties' at all: in most cases, the profit would hardly cover transaction fees.

3.2 Multiple accounts

Based on the transactional data alone, the economy of 'vintage' looks almost like a gift economy (Mauss, 2000): many gift transactions can be observed [34]. In actuality, it is usually the same person transferring tokens between multiple accounts. Accessing the game through multiple wallets is the most common way to manage the identity of a trader online. Different wallets can be used for different purposes of play and communication, such as organising tokens into collections, building a separate 'brand' on the marketplace, and, in rare cases, market manipulation and deceptive behaviour. Sometimes a gift transaction between two natural persons signals that the actual trade happens elsewhere to minimise transaction fees on the Ethereum platform. Finally, some players actually give their assets away for free for a variety of reasons (and contributing to the case of 'vintage' may also be one of such reasons). I excluded gift transactions from my data, because they are not relevant to the economic value created on blockchain, which is the main subject of my study.

Existence of multiple and shared wallets affects data collection, as contextual knowledge is required to find out whether two or more wallets in fact belong to the same natural person. In case of multiple wallets (and potentially owners), I only refer to the addresses of the wallets that received the payment for the token, ignoring any gift transactions that happened in between. This is sufficient for my goals here, because we can only measure the

surplus value when it is already in the wallet of the seller. In the words of the crypto personality Lark Davis, "The moneymaking only happens in crypto when you press the 'sell' button" [35]. This also means that I focus on tokens instead of individual players. In this way, I utilise the natural affordances of blockchain: according to them, each token is unique and presumably indestructible, and all blockchain transactions that involve it are recorded in the immutable ledger. We may say that each token has its own 'digital destiny', which can be easily reconstructed from the open data on blockchain; similar tokens may have collective 'shared destinies'. In this regard, 'vintage kitties' are a very particular class with shared aesthetic properties, similar trajectories on the market and, potentially, comparable value.

3.3 Are 'vintage kitties' a worthy investment?

If 'vintage kitties' are valuable in the community, is it possible to gain profit by trading them? Do their aesthetic qualities translate into higher prices on the market? If true, this would mean that the concept of 'vintage' can generate market value in the simplest financial terms (Q2). Theoretically, the tokens would be resold for higher prices on the second market after they had been labeled 'vintage', and we would be able to measure, or at least, register surplus value in the market data.

Unfortunately, the market data appeared to be far too irregular for statistical analysis (Fig.3). However, it could be easily clustered into two distinct categories. Firstly, the 'kitties' bred by players should be separated from Gen 0 'kitties' that were generated by Kitty Clock and sold to players by the developers. Distribution of sale prices for these two categories is radically different. Generally, Gen 0 tokens constitute a separate category of game assets that are mostly traded with much higher profit than any other tokens in the game, although their average price has slowly declined with time (Fig.4).

In the current sample, the average price of a Gen 0 'vintage' kitty sold between January 11 and July 12, 2018, was 0.2487, and the median price was 0.1976. According to the statistics preserved at the community-built service KittyExplorer [36], the average price of a regular (not necessarily 'vintage') Gen 0 within the same period of time would be ETH0.2463. The median price of all 23,202 Gen 0 tokens sold within the period of 6 months is not meaningful in this context.

My data demonstrates once again that Gen 0 'kitties' are about ten times more expensive than player-bred 'kitties' with similar attributes, and distribution of prices within the category of 'vintage kitties' is not much different. For comparison, the average price of a 'vintage kitty' bred by players (Gen 1 and later) within the same period was 0.0393 (6.33 times cheaper), and

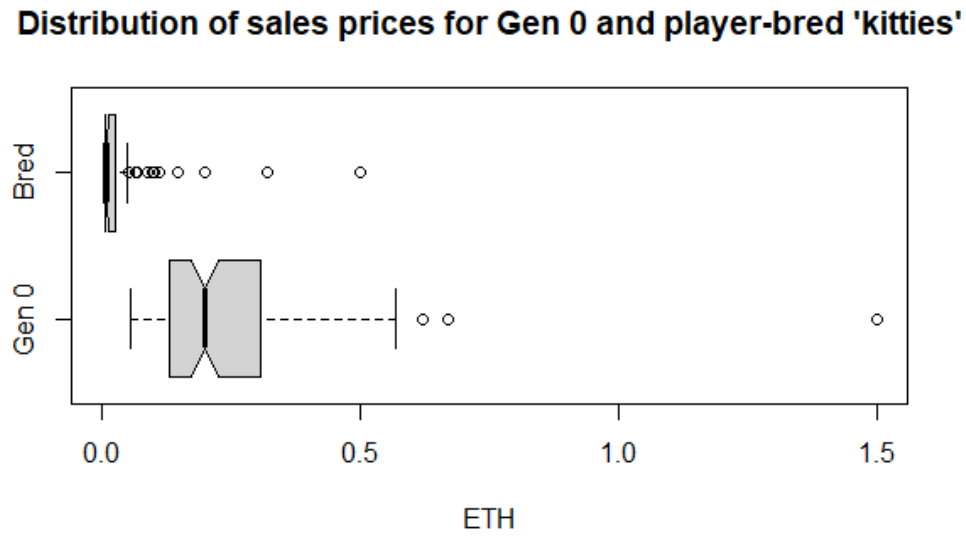

Figure 3: Differences in distribution of sale prices for Gen 0 and player-bred 'kitties'. Visualisation by RStudio.

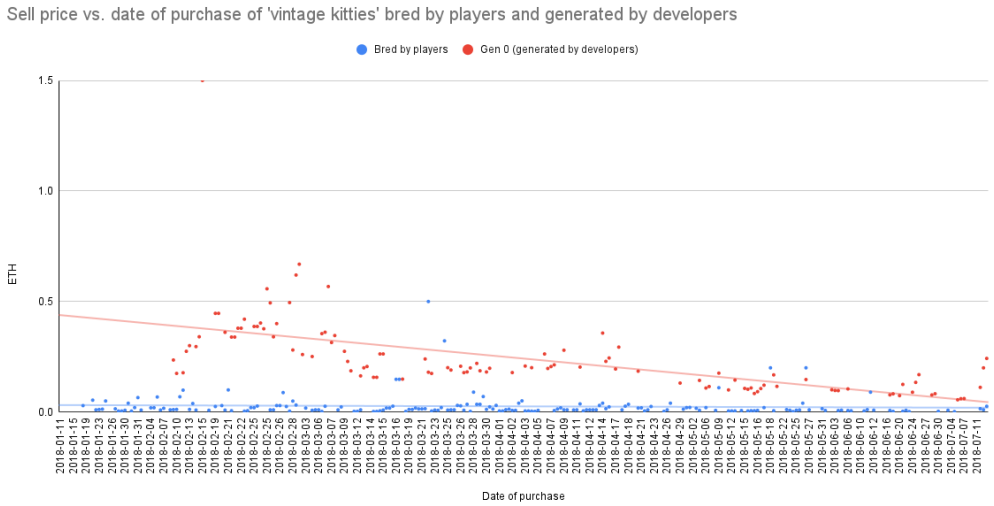

Figure 4: Prices of regular tokens (blue) and Gen 0 tokens (red) sold between January 11 and April 12, 2018. Visualisation by Google Sheets.

the median price was 0.0129 (15.32 times cheaper). Paradoxically, 'vintage' tokens are in fact much more scarce than Gen 0 tokens. Only 0.15% of all tokens were 'vintage' (3,031/1,993,821) as of January 31, 2021, while around 1.8% (36,260/1,993,821) were Gen 0. The historical reason for the relatively high price of Gen 0 *CryptoKitties* is their fixed supply. Potentially, it is possible to breed an endless number of 'vintage kitties', but it is technically impossible to breed another Generation 0 'kitty' (unless the developers start releasing more of them).

3.4 The concept of 'vintage' and the market prices

Did the concept of 'vintage' influence the market, and especially the market of 'kitties' bred by players? Observable differences in prices of 'vintage kitties' before and after their acknowledgement by the community could help locate the potential surplus value of 'vintage kitties'. However, the numbers tell the opposite: before April 11, 2018, the average price of a player-bred (non-Gen 0) 'vintage kitty' was ETH0.0333, and the median price was ETH0.012. Starting from April 11, 2018, the average price would *decrease* to ETH0.0262, and the median price to ETH0.01. On average, 'vintage kitties' surprisingly became cheaper after their idea had been approved by the community, which, most likely, reflects the general downward trends in the prices in the game [37], unrelated to the idea of 'vintageness'.

Another possible indicator of surplus value could potentially be found in increased revenue per transaction. For the needs of this article, revenue per transaction is calculated as the difference between the sale price and the birth fee or the buy price in the previous transaction with the same token. Transaction fees were ignored. Negative revenue represents a loss. [2]

For all sales of all player-bred 'kitties', average revenue per transaction was 0.0024 across the entire observed period, which would hardly cover the fee for one transaction on Ethereum in 2018. The median revenue equals the birth fee and is actually the loss of -0.008 Ether, because most kitties bred by players were never sold. Calculated for the period of time between January 11 and April 10, the average revenue from a transaction that involved a player-bred 'vintage' kitty amounted to approximately ETH0.0043 per token. Average revenue since April 11 was actually the loss of -0.0006 Ether after the 'vintage' kitties were introduced. Median revenue was -0.008 in both cases, because the majority of transactions in the sample can be described as breeding a kitty, paying the birth fee of ETH0.008 and never getting

[2]The breeding fee remains ETH0.008 across my sample, although it changed several times later, reaching 0.032 as of January 31, 2021

any returns on this investment. One possible explanation of sinking profits may be the game's resemblance to gambling: even more people would breed 'kitties' without realising the odds, ending up with the 'kitties' that they did not want (the players who were not on Discord might not even know about the concept of 'vintage' back then). Even more likely, this is yet another sign of market stagnation in general: the supply of 'kitties' by far outgrew the demand at this point [37] [38].

However, the second hand market of Gen 0 'vintage kitties' generated sustainable revenue per transaction - comparably to 'flipping' Gen 0 tokens in general. The average revenue per transaction on the second hand market involving a Gen 0 'kitty' was ETH0.0583, and the median revenue per transaction was ETH0.0282. In comparison, the average revenue for any other 'kitty' within the same period would be 25.35 times less (ETH0.0023) and the median revenue would be a loss of -0.008 Ether. There are not enough sales of Gen 0 'vintage kitties' to observe a statistically meaningful change in their prices before and after the introduction of 'vintage', but these prices were most likely in line with the state of the market of Gen 0 tokens in general.

3.5 Whose profits are these? Developers vs. players

A closer look into revenues per transaction can reveal how revenues are distributed between different types of transactions and, eventually, traders. The most privileged category is the developers themselves: they seem to be the only actors on the virtual marketplace who managed to generate considerable and consistent revenue during the observed period. As it has been described in Section 2.2, Gen 0 'kitties' were the 'kitties' sold by the developers themselves, and this is also true for 'vintage' Gen 0 tokens. When players bought Gen 0 tokens from the Kitty Clock, they generated revenue for the game owners and developers (see [27], p. 7 Section 2.4 *A sustainable revenue model*). As the address of the Ethereum wallet is public, it is possible to calculate that, in total, 'vintage' Gen 0 kitties born between January 11 and July 12 generated the revenue of ETH18.3853 for the game developers. It must be noted, though, that the developers cannot fully control The Kitty Clock. The combinations of colours and other attributes of the tokens that it produced were fairly random, as well as their value in the market.

The second largest total volume of revenue per transaction was generated by re-sellers of Gen 0 'kitties', particularly those who managed to 'flip' these tokens, or sell them quickly enough before the prices went down. The total sum of all revenues (and also, losses) on the secondary market of Gen 0 specifically amounts to ETH2.3337, with considerably higher revenue per

transaction, as we have already seen. However, trading on this segment of the second hand market requires much larger investments, as well as perfect timing, which can be achieved, for example, by using trading bots. Almost all of the revenue was made by the traders who bought Gen 0 tokens from the 'smart contract' for a particularly low price and then quickly resold them for a higher price. Approached in such a way, the game becomes a profit-oriented 'play-to-earn' enterprise rather than an intrinsically playful and joyful activity.

The least profitable occupation in the observed period appeared to be breeding and reselling player-bred 'kitties'. The sum of all revenues and losses by all players who participated in market transactions with player-bred 'vintage kitties' (Gen 1 and higher) during the observed period of six months amounts to 1.7254 Ether. On the average, substantial losses of many players were compensated by rare but high revenues of other players who used speculative strategies. Eventually, 'vintage kitties' did not generate any profits for regular amateur traders, apart from the revenue from the common 'flipping' of Gen 0 'kitties' that went on regardless of 'vintageness'. This is in line with other studies on profitability of *CryptoKitties* in general [37].

4 'Vintage' as 'symbolic capital'

It is almost impossible to list all potential factors that influence the prices of 'kitties'. After all, *CryptoKitties* is a game, with its own unique player culture, regular seasonal and promotional marketing campaigns, as well as random occurrences and 'black swan' events. Apart from regular players, the game community includes a number of rich and famous 'crypto celebrities' who are also the biggest spenders in the game. One such player is of particular importance to this study: a so-called 'crypto whale' - the wealthiest player in the game back in 2018. He was not affiliated with the game developers and owners; other active players on Discord generally knew his identity, but, normally, he did no harm and refrained from using his enormous stake in the game against the community. He also had an unrestrained spending habit and tended to over-indulge in chance mechanics. I will further refer to this player by a random made up name Silver Mustang.

Having public access to all transactions in one's Ethereum wallet, we can see that Silver Mustang has spent ETH1.3341 specifically on 'vintage kitties' within the observed period of time. This sum was spent on breeding 150 'kitties' (ETH0.008 each time), and also, buying one 'kitty' for ETH0.1341. His revenue within the studied period of time came from selling six 'kitties' for

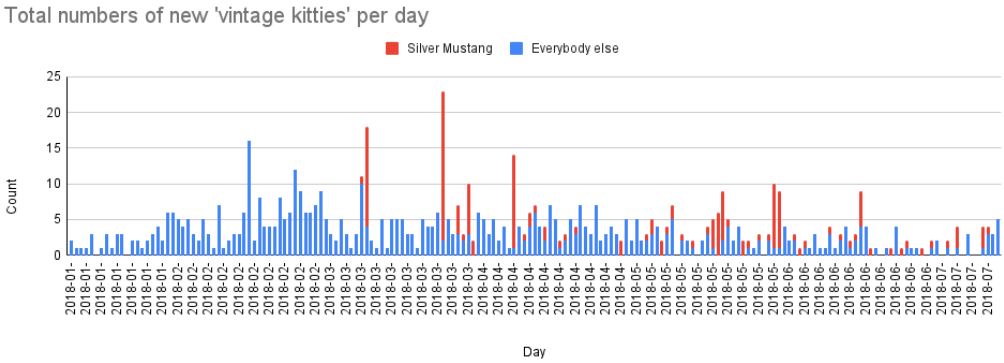

Figure 5: The count of births of 'vintage' kitties born between January 11 and July 12, 2018. The 'kitties' bred by Silver Mustang are marked red. Visualisation by Google Sheets.

a total ETH0.0765, which leaves him with the loss of just -1.2576 Ether. [3] It was often speculated in the Discord chat that Silver Mustang owned at least 20 % of the game assets in general. Indeed, from 689 'vintage' kitties born between January 11 and July 12, 150 were bred by Silver Mustang, which equals 22 %. And even more, his active participation in the game coincided with the peaking 'birth rate' among 'vintage kitties' both before and after establishment of the concept. As it can be seen from Fig.5, his sudden interest alone influenced the birthrate in the 'vintage' population much more than the introduction of the concept of 'vintage': 64 'vintage kitties' were born in his estate before April 11, and 86 such 'kitties' on and after April 11. Based on this, Silver Mustang might have put at least some effort into breeding this particular type of 'kitties' after the community gave them a name. However, he only sold 6 out of 150 'vintage kitties' that he bred, he was not even trying to sell the rest, and he rarely engaged in playful activities described in Section 4.1. His motivation seems to have been aesthetic in the first place, with very little regard to both the financial and the social aspect of the game.

[3]We may speculate that the same player also bought a second Gen 0 'vintage' for ETH0.0827 when he was logged in through his other wallet, and immediately transferred it to his main wallet, but we do not have a hard proof that these two wallets belong to the same person, apart from a single weird gift transaction of an item worth $111.67 at the time, according to Etherscan.com [22]).

4.1 The price of being a 'vintage' collector

Are 'vintage' kitties essentially worthless? Or is it just a different form of value (Q2)? Based on my qualitative observations obtained while collecting the quantitative data, I suggest that the gain was creative, not financial. Of course, 'kitties' were not created by players themselves. Their unique sets of attributes were algorithmically generated in a randomised manner, based on the computer code of their 'parents'. Nevertheless, the resulting tokens only obtain their value in circulation between human players who ascribe meaning to them (and there are also non-human players, e.g. breeding and trading bots). After the meaning of 'vintage' was established, some players invested a lot of their time and creativity, not just money, into collecting, 'breeding', describing and organising these tokens into custom collections. This part of the game can be described as a collective playful practice that generates value outside of the marketplace.

The first example of such playful activity is the account by the name of Vintage Kitties that supposedly belonged to Judy. Two first 'vintage' tokens were transferred to this account in a gift transaction on March 17, 2018, three weeks before the community caught up with the idea. The account was actively trading 'vintage kitties' with other members of the community during the following year. For instance, on April 12, 2018, Vintage Kitties bought 3 kitties for ETH0.01 each, renamed them Vintage and later sold them for ETH0.0059, ETH0.0067 and ETH0.0069, with total loss of ETH0.0105 not counting the fees. Within the observed period, this account bred 15 vintage kitties and cumulatively gained ETH0.0578 in sales. Meanwhile, their investments into the idea of 'vintage' by far surpassed the revenues: Vintage Kitties bought 10 'vintage' kitties on the second hand market for a total of ETH0.0949. All but one purchase were made before the community recognized the concept of 'vintage'. They also bought three vintage Gen 0 kitties for a total of ETH0.5847: however, these tokens can be sold with profit regardless of their 'vintageness' and should not be written off as losses in the long term. More importantly, the idea of 'vintage' kept this player active for a considerable amount of time, and initiated many transactions on the market and discussions on Discord. Even if the idea did not generate profits, it connected the player with some of the notable buyers such as the 'crypto celebrities' Jimmy.Eth, Alan Falcon and Queen Cryptoria, well known in the blockchain community.

Another notable case is the account named RareKitties Vintage. It only became active in March 2019, which technically makes it out of scope of this particular paper. This player accumulated a wealth of 'vintage kitties' in 2019 and 2020 (180 as of June 30, 2021). Most of these 'kitties' were given

Figure 6: HaCKatao Vintage Black Edition. A custom 'vintage' CryptoKitty decorated by Hackatao. Owned by RareKitties Vintage. Sale price: ETH0.39. [41]

custom names and carefully arranged into collections. Their latest collection, Vintage HaCKatao [39], was mostly assembled at the end of 2020, following the collaboration between CryptoKitties and the artist duo Hackatao from Milan [40]. The tokens in this collection are both 'vintage' and decorated by Hackatao (Fig. 6).

4.2 The meaning of 'vintage'

'Vintage' kitties do not differ from all other 'kitties' by their origin or age: the only difference is aesthetic. Their appearance seems to satisfy a particular need of players who embellish their accounts with monochrome collections.

The multi-colored world of *CryptoKitties* is, for the most part, rather ugly, as the colours and other features of *CryptoKitties* are generated and combined in a random manner. The accidental monochrome of 'vintage' subverts the tawdry palette of this algorithmically generated world. It provides a visual remedy against 'digital weariness' that repetitive virtual worlds cause with their "finitude and banality" [42].

This unintentional effect of authenticity and exclusiveness is conveyed by appealing to pre-digital, black and white photography and cinema - 'the silver screen'. This metaphor was picked up by the owners and developers of the game [43] and inspired several players who renamed their 'kitties' after film stars of the past. As of January 31, 2021, there were at least two most prominent 'cinematic' collections, owned by Jimmy.Eth and by CryptoKitties Vintage.

However, are contemporary 'crypto gamers' really nostalgic about the classic black-and-white movies of the 40s? Making the distinction between nostalgia and retro, Veronika Pehe uses the term 'retro' to designate 'a memory regime devoid of affect or lived memory' [44]. It allows trendsetters to freely mix and reinterpret the aesthetics of the past for contemporary cultural consumption.

I suggest that the value of 'vintage kitties' can be best explained through the concept of cultural capital and taste proposed by Pierre Bourdieu. According to Bourdieu, a class structure of society postulates itself through systematic differences in lifestyle and taste. Representatives of higher classes are expected to share exquisite taste for cultural products, including art, literature and cinema. Moreover, they counterpose their 'ascetic' aesthetic preferences to the hedonistic pop culture of the masses [45]. Signifiers of belonging to 'high culture' may change as new cultural oppositions emerge: for example, although black and white Hollywood films were considered 'low culture' at the time of their production, they became associated with realism and artistry after color television took over the USA and Europe in the late 1960s (Thompson, 2010), thus becoming a sign of exquisite taste. Remixing the references to black and white cinema and treating it as 'high art', 'vintage kitties' embody this 'ascetic' trend in the high society of 'crypto celebrities' such as Queen Cryptoria or Jimmy.Eth.

5 Conclusion: Empowering the high society

'Vintage kitties' can be described as a collective art project. At the first stage (January 11 - April 10, 2018), they come into being as 'found objects': these tokens exist before the definition of 'vintage', and they acquire new

meaning after the definition of 'vintage' is established, as it happened in the community on April 11, 2018. At the next stage, these tokens may or may not obtain surplus value on the market: the data demonstrates no significant changes or trends that are specific to 'vintage', apart from occasional trades within a limited group of players, sometimes brought together by the very idea of 'vintage'. During this period, players start rearranging tokens into collections and renaming them to highlight their newly assigned symbolic properties. Meanwhile, the market for 'vintage kitties' stagnates, leaving behind the 'digital traces' of precious activities, such as authored collections and descriptions. The third stage is signified by the comebacks of 'vintage' kitties in 2019-2020, when players start reusing them in new contests and activities. It happens because of their aesthetic qualities and symbolic connection to 'high culture', not because of the market value of 'vintage'.

This takes us to the larger question of value construction on markets of NFTs. The quantitative part of this study aimed to answer two research questions: "What effect has the concept of 'vintage' on the game market?" (Q1) and "What kind of value did the concept of 'vintage' generate?" (Q2). The results proved to be counterintuitive, but we may expect similar processes on the larger market of NFTs, which certainly does not operate as advertised. In our case, basic market analysis demonstrated that 'vintage' tokens have generated losses rather than profits in the first six months of their existence. The only actors on the market who made a substantial revenue of ETH18.3853 on 'vintage' Gen 0 alone were the owners and developers of the game. Meanwhile, the players who bred 'kitties' for sale found themselves in a much more vulnerable position: they paid the breeding fee of ETH0.008 and, in most cases, never sold the resulting tokens. Some profits have been made by early and quick speculation with Gen 0 tokens, even though such tokens are still much less common than Gen 0 tokens. In other words, relative (but not artificial) scarcity of 'vintage' kitties did not contribute to their value on the market, unlike less scarce Gen 0 tokens whose supply was artificially limited by the developers.

To sum it up, the concept of 'vintage' did not make a positive impact on neither supply nor the prices of the corresponding tokens (Q1). The strong negative trend in the prices can be explained by external factors such as the general supply and demand dynamic, as the novelty factor was wearing off. As for the supply, it appeared that casual participation of a single extremely wealthy player influenced the supply of 'vintage' tokens more than anything else - and had almost no effect on the market as well, because this particular player did not have the intention to sell his tokens. Even if the idea of 'vintage' has made an impact on the market, it was most likely obliterated by other factors and events on a larger scale.

The second research question concerns the nature of value created by the concept of 'vintage'. In my qualitative observations, I have connected 'vintageness' to the notion of 'cultural capital' in a playful environment of 'crypto games'. There is a widening gap between 'the rich' and 'the poor' in 'crypto gaming', and, as quantitative research by Jiang and Liu has shown, the game of *CryptoKitties* has been dominated by 'the rich' since 2018 [37]. The 'ascetic' look of 'vintage kitties' and their association with classical Hollywood cinema corresponds to the exquisite taste that the members of a high society are expected to have. In contemporary conditions, cryptocurrencies are a new form of financial capital, and its holders express their status through new forms of cultural capital, such as NFTs and 'crypto art' in general. Most likely, we are observing the birth of 'the new rich' from the community of cryptocurrency traders, and collectable NFTs, as well as other forms of 'crypto art', may be seen as expensive, and somewhat eccentric, signifiers of their 'crypto wealth'(Q2). This fascinating new world, however, is neither democratic nor empowering for those who cannot afford the most expensive leisures of blockchain.

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