

# DELab

# DIGITAL RESEARCH STUDIES

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## ROBLOX AND THE MARKET FOR VIRTUAL EXPERIENCES

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## ABSTRACT

Digital entertainment moves away from one-time events and games towards sustainable experiences that can be shared with others. These types of virtual ecosystems also support their own economies with exchange of virtual currency, digital items and user-generated content. One such platform is Roblox, which as of April 2021 had more than 200 million unique users monthly. Roblox is a platform for virtual experiences built by the participating community. It also facilitates events ranging from in-platform concerts of established artists to fashion shows with branded items. We provide the first quantitative study of this ecosystem, analysing the determinants of virtual experiences' popularity using data on thousands of in-platform titles, and tracking some of them over time. We build upon the literature on success of and engagement in video games and the much debated metaverse concept. Our results show that frequent experience updates and incentives in the form of badges or in-game items are crucial for a virtual experience to grow and sustain an active player base. Interestingly, the maximum number of players in an experience instance and the often-discussed interoperability of experiences are less important than expected.

## INTRODUCTION

Virtual worlds and markets have been developing dynamically and are likely to further grow in importance – both for social life and the economy as a whole. The trend is hotly debated in the context of the metaverse, broadly envisioned as an immersive evolution of the Internet hosting an unlimited number of individuals in its interconnected virtual environments. Nowadays, it is the gaming industry that provides glimpses into what is possible – with, for example, Fortnite and Roblox hosting millions of players in their virtual experiences and events, such as concerts or fashion shows.

The gaming industry is currently the most rapidly growing and largest across creative sectors. It is estimated to reach almost \$203B of revenues in 2022, after a pandemic-accelerated growth in the last two years (Wijman, 2022). Importantly, almost a \$100B in 2021 came from in-game microtransactions involving payment for various types of virtual goods, skins, extra lives, etc. (Ball, 2022a). In contrast, the box office and music revenues in 2021 reached, respectively, \$21B and \$25B (Loria, 2022; IFPI, 2022). These trends highlight the increasing importance of virtual worlds and goods in the global economy.

Roblox is currently one of the largest gaming platforms, having reached 200 million unique monthly players in April 2021 and denoting rapid growth over the last 5 years (1900% - Dean, 2022). It is an open platform with a flexible game engine and a toolset that allows anyone to contribute their own content. In fact, the amount of flexibility and variety of the user-created worlds made Roblox change its naming from “games” to “experiences”. The platform also provides its own currency (Robux), which can be purchased with traditional currencies, and also exchanged back after obtaining a sufficiently large amount. Participants in the virtual experiences can use their virtual money to purchase server space for their participation, access to experiences, additional in-experience goods and services (game passes) or various virtual gear involving, inter alia, changes to avatar’s appearance, weaponry or vehicles.

The Roblox ecosystem is different to that of other platforms or complex video games, as the experiences are interconnected. An individual experience can host several different inner worlds, with different mechanics, that a player can easily switch between with the same avatar. The avatars can also access different experiences with the same custom-made character model, sometimes taking the items from one experience to another. This specific feature is why Roblox is often

mentioned in the context of the metaverse, a concept for the future of virtual realities that relies on interoperability (i.e. the interaction between all of its components). In this study, we strive to position Roblox within the current metaverse framework proposed by Matthew Ball (2022b).

Our general aim is to identify the main dimensions of the ongoing trends in gaming and the virtual ecosystems, and to analyse whether they are driven purely by technological possibilities (supply-side changes) or whether they also reflect demand-side factors that actually contribute to user engagement and retention. To do so, we quantitatively investigate the massively popular but largely unstudied virtual economy of Roblox. We gather data on the various virtual experiences directly from the Roblox API and platform. We define the popularity of an experience as, firstly, general engagement and, secondly, sustained interest. We then analyse what experience features determine these two factors. Our rich dataset allows us to consider factors such as the maximum number of players in an experience instance (a server size), interconnectedness with other experiences, update frequency, types of monetization (including in-game purchases) or badges reflecting players' achievements. We study the data from a general view of all the games played at a particular moment and from the view of new experiences and their survivability over time.

Our analysis shows that the ability to collect badges corresponding to one's achievements as well as providing a wide variety of in-experience offerings (game passes) consistently drive engagement in virtual experiences. Secondly, updates are significant for enlarging and sustaining new experiences' player bases. The server size and between-experience interoperability do not seem to play a significant role in an experience's popularity.

# I. LITERATURE REVIEW AND HYPOTHESES

## 1.1. Roblox and its place in the current trends

The recent years have seen a growing discussion around the direction of digitalization trends. In particular, the concept of the so-called metaverse has gained prominence (Park, Kim, 2022), especially with the recent rebranding of Facebook to Meta. The name originates from a science fiction novel *Snow Crash* (Stephenson, 1992), but was a recurring feature under different guises across books and more recently in cinemas (e.g. in the *Ready Player One* blockbuster based on the novel of the same name - Cline, 2012). Metaverse is imagined there as a highly immersive successor of the Internet, a universal virtual world in which users interact with each other using AR/VR technology as avatars.

Despite the largest technology firms taking active interest in the metaverse and largely agreeing on its coming, there is no consistent definition of what exactly it will be - either in academia or industry (Duan et al., 2021). However, there is a growing number of efforts aimed at identifying its core principles (Ball, 2020; Radoff, 2021; Park, Kim, 2022). In particular, Ball (2020), whose essays have been cited by, i.a., Mark Zuckerberg of Meta (Newton, 2021) and Tim Sweeney of Epic Games (Sweeney, 2021), describes seven key features of the metaverse:

1. Persistence – i.e. the continuous, always on-going nature of the metaverse.
2. Synchronisation – i.e. same version for everyone and everywhere.
3. No cap on concurrent users – no limits on who can enter and when.
4. Functioning economy – all aspects of traditional economies (creation, ownership, investment, selling, remuneration, etc.).
5. Digital and physical – i.e. connecting both the physical and digital worlds in all networks and platforms.
6. Interoperability – i.e. the full compatibility, recognition and interaction between any content from one part of the metaverse and any other part.
7. Wide array of contributors – metaverse will be built on content created by a wide range of individuals – from regular users, through teams and firms.

Most Metaverse enthusiasts argue that reaching these goals will be a natural next step from the technological trends that are already taking place. Ball (2022) highlights the road ahead for, e.g., the hardware, internet infrastructure, communication standards, payment systems, algorithms, etc. Perhaps naturally, the key candidates for metaverse pioneers are usually identified from among companies dominating social media (Meta), virtual meetings (Microsoft, Zoom) and gaming (Roblox, Epic Games – see e.g. Bobrowsky, 2021).

Indeed, gaming seems especially suited to live up to the hype of metaverse having already reached (or partially reached) some of the features tied to the concept of Metaverse. Second Life - a popular 2003 Massively Multiplayer Online Role-Playing Game - has been considered a metaverse prototype for years (Duan et al., 2021; Mystakidis, 2022). Roblox is seen as its successor based on the social values of generation Z, which does not differentiate between online and offline selves (Park, Kim, 2022). Within the platform, users can participate in a wide variety of 'experiences', created by both individual contributors and professional teams of developers. Roblox also allows for a much higher degree of creative flexibility than Second Life, allowing the user-creators to change everything from settings to mechanics of their Roblox experiences. Notably, Roblox executives explicitly position their company as a metaverse enabler and stress the role of the user-generated content in the creation of metaverse - "We think of ourselves as shepherds of this [metaverse] idea" (Takahashi, 2021).

Possibly owing to these features, Roblox evidenced unprecedented success, especially in the last few years, having grown from around 9 million monthly active users in 2016 to more than 200 million by April 2021 (Dean, 2022). With 12 million developers, the platform hosts about 32 million experiences in which players have spent circa 11 billion hours (up to 30.06.2022; Roblox, 2022). The massive scale of participation placed Roblox 4th in terms of the number of concurrent players - just behind Fortnite, League of Legends and Cross-Fire (Twinfinite, 2021). Consequently, Roblox is often named as a point of reference for the future of virtual experiences.

## 1.2. Determinants of video game success

Gaming in itself received some scrutiny from academic literature, especially in terms of the determinants of sales and player retention. Yet, it remains unclear which of the trends leading the virtual worlds towards metaverse can be directly linked to higher consumer engagement in gaming.

As with most products, video games popularity is largely driven by their quality (proxied with ratings) and brand. Tang and He (2021) find that mobile game downloads are positively affected by consumer ratings, number of reviews, position in within-genre rankings, as well as the number of publishers' prior games. For traditional video games, Cox (2014) reaches similar conclusions with quality, publisher and reviews playing a key role as determinants of success. Finally, Nam and Kim (2020) show that a mobile games' initial success is positively affected by both the market strength of a publisher and related intellectual property awareness (for games based on e.g. books or movies), even though it is again the user opinions' that affect the popularity at later stages of game's life.

Online gaming increases engagement by facilitating social interaction and relationship development (Cheung et al. 2015). Social interactions seem to be valued by players both in cooperation and competition (Cheah et al., 2022). Hence, providing an environment enabling communication and working together on game tasks can increase engagement and incentivise gamers to continue playing (Choi, Kim, 2004). Furthermore, a study on Massively Multiplayer Online Role-Playing Games players revealed that three-quarters of surveyed individuals developed important relationships within the game, of which every second believed that they are equally valuable to those established in the real world. Hence, a game can also be a socialising facilitator (Cole, Griffiths, 2007).

In terms of individual engagement, some video games develop incentive systems to retain players. A system of prizes and achievements may "drive in-game behaviour as well as mark the progress of the player" (Johnson et al., 2018, p. 66). Whether in the form of a leader board or badges, achievements bring enjoyment, perception of competence, improve self-esteem, and heighten social status, thus positively impacting the game experience and lengthening time dedicated to playing (Johnson et al., 2018; Cruz, Hanus, Fox, 2017). However, a prize system must also be designed in a way that does not introduce frustration due to inability to achieve (Cruz et al., 2017).

Players are also more likely to retain interest if they identify with their virtual selves. Cheah et al. (2022) stress that games allowing to fulfil self-definitional needs build a player's continuance intention. Furthermore, games provide space for individuals to construct their identities without the burden of the outside world's judgment or expectations (Cole, Griffiths, 2007). Teng (2019) highlights the positive relationship between avatar identification (defined as the scope to which a player finds an avatar the extension of self) and customer loyalty. Marder et al. (2019, p. 74) also show that avatar customization by addition of non-functional but cosmetic virtual items can fur-

ther increase identification. The authors suggest that the League of Legends players purchase virtual items to differentiate themselves from other players' avatars and to show dedication to a character. Similarly, Cheung et al. (2015) find out that allowing avatar customisation translates to increased players' engagement and in-game spending.

Microtransactions, which enable i.e. avatar customisation, are one of game monetisation options that may drive players' engagement. Looking at the most popular games on Steam, Zendle et al. (2020) highlight that almost 86% of players engage in games which enable cosmetic microtransactions. Such non-functional items play a significant role in certain free-to-play games, such as Fortnite, for which microtransactions for cosmetic virtual goods (skins, costumes) constitute a majority of revenues (Ganti, 2020). However, when an individual player purchases items affecting more than just aesthetics, leading e.g. to functional advantage, the gaming community may negatively look upon such player (Evers et al. 2015). Hence, the impact of in-game purchases options on players' engagement is not straightforward.

Nowadays, digital games rarely stay a static product, being subject to updates which may positively affect the intention to play. For example, Hyeong et al. (2020) documented that online game updates, which change the game environment, increase the involvement of low- and high-ranked players, not affecting the gameplay of middle-ranked individuals. Zhong and Xu (2021) did not find such a differentiation, but they confirmed the positive impact of a game update among the collected sample of DOTA 2 players. Updates go beyond changing the storyline, adding new mechanics or fixing bugs – games introduce also events, such as concerts, to increase engagement of players community. For example, Fortnite and Roblox have invited music stars to collaborate, attracting millions of players to participate in concerts simultaneously (Nishijima, 2021; Rao, 2022). Travis Scott's concert in Fortnite ranked the second event by total hours streamed (Gilbert, 2022). Furthermore, one of the largest gaming companies EA has reported that only about a third of its revenues comes from sales of full games, with the rest driven by 'live service'. The live service in this case involves updates to the already sold games, extensions, cosmetic gear, etc. (Totilo, 2021). These trends show the growing importance of living experiences rather than one-time products.

### 1.3. Roblox in the context of gaming and the metaverse



In the following section we present how Roblox fits in within the larger gaming developments and the core concepts of the metaverse (as formulated by Ball, 2020) outlined in the previous sections. While Roblox already achieves some of the discussed metaverse features, it is only partially incorporating others.

### *Persistence*

There is no beginning or ending to most of the Roblox experiences. While most experiences have been long abandoned both by the players and developers, it is still possible to enter and explore them. As a broader ecosystem, one can view Roblox as continuously evolving with new experiences arriving and players using the avatars they have already had, to explore new content. Many of the individual experiences have been also around for many years, with their developers continuously introducing new content and modifications to their creation, contributing to their live nature. One can join these experiences at any point of the day. Still, despite massive investments in data centres, Roblox's always-on access is challenged by recurring outages leaving millions of its users offline (Miller, 2022).

### *Synchronisation*

Roblox experiences all happen in a synchronous and real-time manner. This means that each experience evolves as players participate or developers introduce changes. Regardless of the time and location, the players can only enter the one – ongoing – version of the experience.

### *No cap on concurrent users*

There is no general cap for players in the general Roblox ecosystem. However, while Roblox allows for numerous concurrent users per experience, its servers do not allow for unlimited space. Instead players participate in separate instances of the experiences – named servers – with the user cap picked by the experience developers. At the time of this writing the majority of developers can choose a server size going from one player to a hundred, with few developers also having the privileges to set the limit to up to 700 users per server.

### *Functioning economy*

Roblox includes many elements of traditional economies and markets. Experience developers can sell access to server instances, to experiences, or in-game bonuses (called passes). Additionally, creators can sell items in the official Roblox store, that can be later used for avatar customisation and across the experiences that allow particular types of items. All developers can advertise their content within the Roblox service. All of these transactions rely on the Roblox virtual currency –

Robux, with almost 2 million developers having earned some Robux (Roblox, 2022). Robux are purchased for 'real-world' money and after accumulating a certain amount can be exchanged back to US dollars at a current exchange rate. Beyond the official store, exchanges of limited items are made possible in user-driven marketplaces – hosted independently from Roblox, but requiring in-Roblox interaction for the actual exchange to take place (see e.g. PlayerAuctions or Rolimon's<sup>1</sup>).

### *Digital and physical*

The connection with the physical world is low in Roblox, with only some experiences supporting a limited VR mode (Park, Kim, 2022).

### *Interoperability*

While Roblox allows for interoperability and connection between experiences, the features have been criticised. The concept of metaverse assumes that particular parts of the metaverse will not function as separate entities but rather that everything will be interconnected, allowing to interpret data, items, assets and other content carried from one space to another. In Roblox, this is facilitated by gear options, whereas experience developers may choose different settings as to what kinds of gear (in terms of genre and usage) can be taken over to the experience. However, gear functionality has been criticised by users as being broken due to Roblox updates (Roblox Wiki, 2022).

### *Wide array of contributors*

Finally, Roblox relies entirely on the work and contributions of its user base. In its essence, Roblox remains a platform populated by content created by independent developers, more casual players and sometimes brands. As of this writing (June 30, 2022), Roblox comprised 32 million experiences created by 12 million developers.

## 1.4. Hypotheses

Drawing from the literature on games and the key metaverse concepts highlighted in the debate, we investigate, which of these factors drive the popularity of virtual experiences. Digital games especially thrive on enabling social interaction, avatar customisation and a system of prizes and

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<sup>1</sup> <https://www.playerauctions.com/>; <https://www.rolimons.com/> (accessed: 27.10.2022)

updates. Hence, similar factors may affect Roblox experiences, including the number of people allowed to enter an experience simultaneously, experience updates, available badges and game passes. In relation to the conceptualisation of metaverse and building self-identification, allowing a player to access multiple experiences with the same customised avatar could positively affect an experience's popularity.

We measure the popularity of an experience in two ways:

1. the general engagement, proxied by the average number of daily active players,
2. the sustained interest expressed in the indications of an experience being a favourite one.

Regarding the impact of social interactions on player engagement and the metaverse characteristic of 'no cap on concurrent users', we suggest that allowing for larger groups of people participating simultaneously contributes to the experience popularity. Thus:

**Hypothesis 1:** larger experience servers contribute to an experience's popularity.

We also suggest that continuous updates to an experience are crucial to enlarge and sustain its player base:

**Hypothesis 2:** experience updates contribute to an experience's popularity.

We hypothesize that systems of achievements (badges in Roblox) and in-experience offerings (game passes in Roblox) contribute to the popularity of the experience:

**Hypothesis 3a:** number of badges implemented in the experience contributes to its popularity.

**Hypothesis 3b:** number of game passes implemented in the experience contributes to its popularity.

Interoperability of virtual experiences has been recently discussed as a growing trend across digital entertainment (Parkkila et al., 2015). Within a virtual ecosystem it translates into the ability of different user experiences to interact with each other - at least in the terms of the users' ability to transfer some part of content between them (Ball, 2020). In terms of Roblox, this could translate

into allowing for different kinds of ‘gear’ (i.e. digital goods) to be carried between different experiences, contributing to their attractiveness. Thus:

**Hypothesis 4:** allowing to bring purchased ‘gear’ to an experience contributes to its popularity.

To the best of our knowledge, no research has been done on the role of the ability to interact with growing numbers of people, updating or interoperability on the attractiveness of virtual experiences. However, these factors seem fundamental for the concept of metaverse and are often mentioned as the next stage of development of online experiences. We provide a first empirical investigation into their actual effects on digital content popularity.

## II. DATA

We collect data directly from the Roblox API and supplement it with the available information from the Roblox experiences pages. In general, we consider two perspectives of analysing the data – first, using a broad sample of old and new experiences that have active players; second, using a smaller sample of new experiences observed daily with a broader range of variables. Finally, we also collected daily information about in-platform advertising of experiences. The following subsections describe the data in more detail. Table 1 summarises the collected data, while sections 2.1.-2.3. provide the details.

**Table 1. Data collection details**

Data	From	Period	Information
Core dataset	API	50 days	number of current players, number of total plays, number of up and down votes, entrance fee
Additional data	Roblox.com	Once	created, updated, gear allowance, server size, genre, number of favourites, number of badges, number of passes
Data on ads	Roblox.com	80 days	experience share in advertisements on Roblox website, creator share in advertisements on Roblox website
Panel data (new experiences)	API Roblox.com	80 days	number of current players, number of total plays, number of up and down votes, entrance fee created, updated, entry price, private server price, gear allowance, server size, server type, genre, favourites number, number of badges, number of passes, price of passes

### 2.1. Top 10,000 experiences

For the core dataset, we have collected information on the top Roblox experiences using the Roblox API<sup>2</sup>. The collection took place over a period of 50 days between 11.11.2021 and 30.12.2021, with new API call issued every 15 minutes. Each call returns information on 10,000 most popular (in terms of current active players) experiences at a given moment along with metadata (e.g. number of total plays, number of up and down votes, entrance fee). We refer to such a list as *the top 10,000 list*.

We calculated daily averages of active players for the collected experiences, ascribing 0 players for times when an experience did not make it to *the top 10,000 list* in a certain API call. By doing so, we

<sup>2</sup> See Roblox API documentation: <https://api.roblox.com/docs?useConsolidatedPage=true> (accessed: 30.11.2021).

created *daily top lists* for the entire period of data collection (50 days). We observed, on average, over 85 thousand unique experiences daily. Notably, on average app. 70% of experiences on a *daily top list* were played by at least one person at each API call.

In the end, we observed more than 1.2 million unique experiences, of which almost 70% were visited at least 10 times throughout their whole life. Close to 1% of experiences appeared on each of the 50 *daily top lists*, and nearly 3% appeared on at least half of them.

After the initial period of data collection, we have additionally gathered information on experience characteristics including the number of favourites indications, server size, genre, release date and gear allowance. Furthermore, for the previously mentioned 1% of experiences, we obtained data on the number of badges and game passes available in an experience.

Then, we averaged 50 *daily top lists* with respect to the number of active players, server size and entrance fee. We took the maximum values of total up and down votes, favourites indication and the cumulative number of visits to an experience. Along with the remaining qualitative characteristics, those measures constitute our core dataset for further analyses.

## 2.2. New experiences panel

Some of the variables of interest (e.g. on updates, server prices, badges or game passes) are difficult to track over time. Moreover, calculating their relationship with the popularity of older titles would result in the omission of prior experience-related factors (e.g. the history of updates, prior states of the experience). As such, we collect additional data for a subset of the experiences identified in the core data collection, focusing on new experiences and their performance. At three points of time of the core data collection, we identified the experiences that were no older than one month. We then collected additional information on these titles every two days. In the end, we followed 92,287 experiences released between September and November 2021, for a period of over 80 days. This panel data includes information on gear allowance, game passes, badges and updates, as well as any of their changes. After collecting the data, we have removed any experi-

ences that had never evolved beyond the initial template or that were deleted<sup>3</sup> to eliminate any titles that were not actually playable experiences. This reduced the number of experiences to 92,255. We matched these data with the information from the core dataset to assert mean numbers of daily concurrent players.<sup>4</sup>

## 2.3. Advertisements data

Roblox website acts as a front page before accessing any of the experiences. It also hosts advertisements related to Roblox content – primarily experiences and creators or creator teams. While collecting data for individual titles in the new experiences sample, we also collected information on advertisements displayed on the Roblox pages. The Roblox website displays randomly selected advertisements from all the adverts purchased by Roblox users. The chance of having your ad displayed is affected by the amount of Robux paid for advertising, i.e. the share of Robux paid for advertising your content among all Robux paid for adverts translates into the probability of your ad getting displayed. For each day and each advert, we calculate its share of displays among all displayed adverts. We then match this information to the relevant experiences, creators and time frames in our sample.

## 2.4. Descriptive statistics

Our dataset covers a variety of experiences, including superstars, old and new ones, emerging and those rather unsuccessful. We treat the number of visits, to which we will refer also as ‘plays’ using Roblox API terminology, as a proxy of historical popularity of a given experience. Some experiences which are present on the platform for a long time have accumulated enormous numbers of plays. For example ‘Adopt Me!’ created in 2017 was visited more than 30 billion times<sup>5</sup>. However, the popularity of Roblox experiences varies significantly. We illustrate this in Fig. 1 which shows

<sup>3</sup> Roblox experiences are initiated with a default name (“username’s place”), terrain and description. We eliminated any experiences that never added a description, never changed their name and added no passes or badges. Moreover, an experience can get deleted but still appear in the service, with the “deleted” word in the name or description (we removed such cases as well).

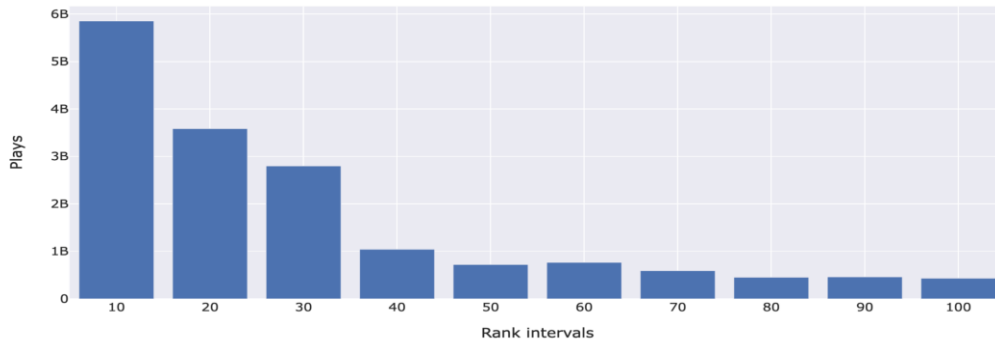
<sup>4</sup> Not all of the new experiences in the panel appear every day in the top 10,000 lists. However, since the top 10,000 lists include all of the experiences with any active players, we input 0 daily concurrent players for all days where experiences were missing from the charts.

<sup>5</sup> <https://www.roblox.com/games/920587237/Adopt-Me> (accessed: 26.10.2022).

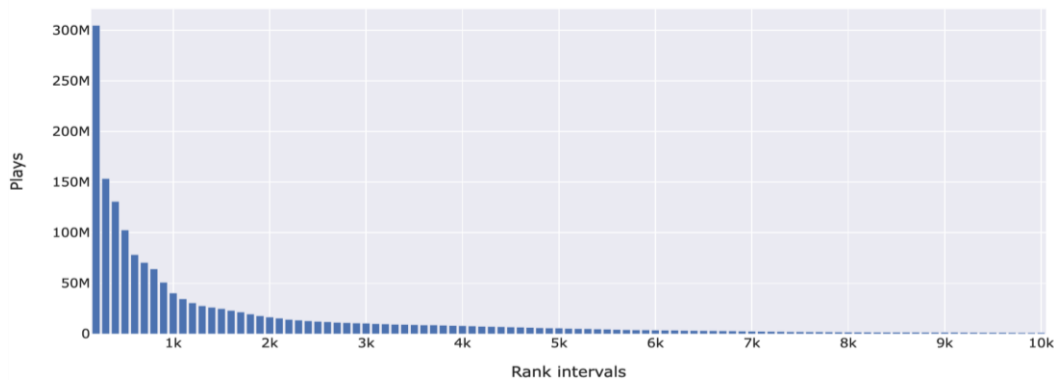
the long tail of mean number of plays per rank interval of popular experiences. Part A of Fig. 1 presents means for the top 100 most popular experiences while part B focuses on the remaining 9900. Ten experiences listed in the top of the most popular category were visited almost 6 billion times on average, while the bottom hundred around 1 million times.

**Fig. 1 Mean number of plays vs experience’s popularity rank.**

**A: Top 0-100 experiences (intervals of 10)**



**B: Top 100-10000 experiences (intervals of 100)**



### 2.4.1. Top 10,000 experiences

Almost two thirds (63.4%,  $n = 794K$ ) of the popular experiences appear only once in our sample. The top 1% ( $n = 11,924$ ) is present on each *daily top* list. It shows that the popularity of Roblox experiences is diverse.

The number of active players ranges from none to more than 353 thousands. With a median of 1.2 and a mean of 4.7, the statistics reinforce our previous statement of the extreme variability of collected experiences’ characteristics (see Table 2.). On average, 316.3 players enter the most established experiences daily (the top 1% - see Table 3). Similarly – the number of favourite indica-



tions spreads extensively between 0 and more than 23 million, with the highly popular experiences dragging the mean to 1246. On average, an experience from the top 1% is favoured over 512 thousand times (see Table 2. and Table 3.).

It is unlikely for developers to create more than one experience which appears among the top 10 thousand ones. In this category 77% of developers have created one popular experience. However, there are circa 4000 (0.5%) developers who succeeded in producing more than 10 such experiences.

Almost no experiences and creators have been advertised on the Roblox page. However, the maximum share of advertisement for an experience reaches 30% and 25% for a creator, indicating that some Roblox users invest Robux in promotional activities (see Table 2.).

The server size varies between hosting 1 and 700 players, while the mean size equals 41.7 for all experiences and 28.6 for the top 1% (see Table 2. and Table 3.).

Roblox allows for different types of content monetization. First, the experience accessed might be given a price (the entrance fee). Second, creating a private server in an experience can be paid. Third, game passes with additional content in an experience can be purchased. According to our data, almost all experiences are free to visit (99.8%). Paid experiences constitute less than one percent of all collected experiences. The share is similar in the case of the top 1% (see Table 2. and Table 3.).

**Table 2. Descriptive statistics for all experiences in the sample, n = 1,252,501**

Statistic	Active players	Favourites	Server size	Ads (exp, %)	Ads (creator, %)	Days since release	Entrance fee (Robux)
Mean	4.7	1,246.8	41.7	0.001	0	377	0.2
St. Dev.	452.9	52,900.7	29.3	0.1	0.03	631.4	10.7
Min	0	0	1	0	0	2	0
Median	1.2	1	50	0	0	157	0
90th perc.	3	47	50	0	0	963	0
Max	353,114.7	23,051,722	700	30	25	5,778	1,000

Source: Own calculations.

**Table 3. Descriptive statistics for the top 1%, n = 11,924**

Statistic	Active players	Favourites	Server size	Ads (exp, %)	Ads (creator, %)	Days since release	Entrance fee (Robux)
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Mean	316.3	97,940.4	28.6	0.03	0.004	772.9	0.6
St. Dev.	4,620.1	512,715.6	50.6	0.3	0.1	798.4	16.4
Min	0.1	3	1	0	0	51	0
Median	9.1	8,581.5	17	0	0	515	0
90th perc.	206	179,421.5	50	0	0	1671	0
Max	353,114.7	23,051,722	700	16	6	5,520	1,000

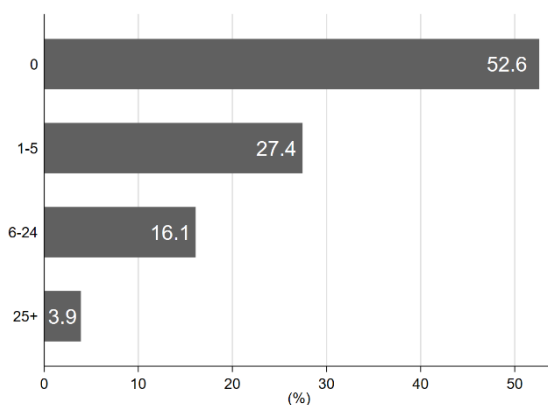
Source: Own calculations.

Entering an experience with own gear is not a popular feature among Roblox experiences. Only 3.2% allow joining an experience with a customised avatar, even less in the case of the top 1% of experiences – 2.5%. Hence, the interoperability between experiences is not that common, possibly due to the reported problems regarding Roblox updates (Roblox Wiki, 2022).

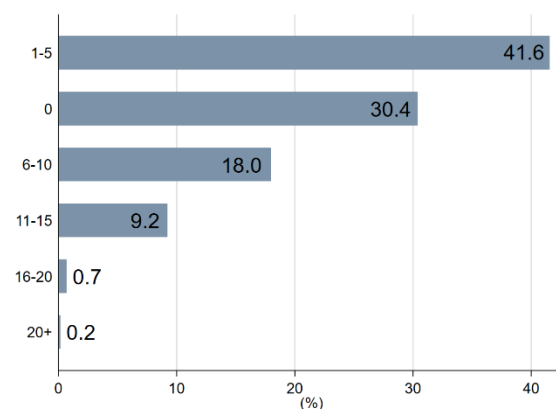
Data on game badges and passes is available for the most established (the top 1%) and new experiences. Half of the top 1% experiences do not offer any badges to win, but among the rest – the majority offer up to 24 badges. Only 30% of the most established experiences do not provide players with any passes to buy in-game. 10% offers more than ten types, while the majority offer 1 to 5 passes (see Fig. 2. A. and B.).

**Fig. 2. The share of top 1% experiences offering a certain amount of:**

**A. game badges**



**B. game passes**



For correlation matrices for the mentioned variables and sample, please see Appendix 1.

The majority (86.3%) of the established experiences (the top 1%) has been available on the platform for at least a year, while 17% - for more than three years. Notably, the oldest experience in the top 1% group was created 16 years ago – when the platform emerged.

## 2.4.2. New experiences

New experiences also vary significantly within the sample. The number of concurrent players of new experiences ranges between 0 and 30,190, with a mean value of 2.9 (see Table 4.). In a sample restricted to non-zero players in all days in the panel, the mean reaches 181 (see Table 5.). The number of active players in the 90th percentile suggests a significant difference between an average new experience and the top 10%. The number of favourites indicates that the samples cover some new but already popular experiences, with the mean measure in the restricted sample exceeding the median value of favourites among the established experiences - the top 1% (see Table 5. and Table 3.). The dispersion in the favourites number is smaller among new experiences with non-zero players in all days in the panel (see Table 4. and Table 5.).

The average server among new experiences hosts 47 users. Regarding experiences with non-zero players only – the mean server size equals 36. The new experiences and their creators are, in general, barely advertised. There are some exceptions, for which the maximum ad share reaches 57% for an experience and 5.2% for a developer. All new experiences were updated on average a month earlier, and those with non-zero players – 10 days earlier. The number of badges and passes available within an experience outstretch to, correspondingly, 25 and 30. The mean number of badges and passes is higher among the restricted sample (see Table 5.). 1.3% of the new experiences ever allowed any own gear within the data collection period. The share is same for sample restricted to non-zero players.

The private server mean price is higher among new experiences with non-zero players in the entire period of collection and reaches 18.3 Robux. The value for all new experiences equals 6.7.

**Table 4. Descriptive statistics for all new experiences in the panel**

	Active players	Favourites	Server size	Ads (exp, %)	Ads (creator, %)	Days since update	Badges	Passes	Private server price (Robux)
Mean	2.9	125.5	46.8	0.00	0.00	31.8	0.1	0.4	6.7
St. Dev.	131.5	9276.9	23.2	0.00	0.00	15.2	0.7	1.4	32.3
Min	0	0	1	0	0	0	0	0	0
Median	0	1	50	0	0	33.2	0	0	0
90 perc.	2.7	7	50	0	0	48.1	0	1	10
Max	30,190.4	1,614,362	700	57.0	5.2	86.3	25	30	500

**Table 5. Descriptive statistics for new experiences with non-zero players in all days in the panel**

	Active	Favourites	Server	Ads (exp,	Ads (creator,	Days since	Badges	Passes	Private server price
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	players		size	%)	%)	update			(Robux)
Mean	181.1	9868	36.4	0.2	0.0	10.8	1.3	2.5	18.3
St. Dev.	1207.7	85972.8	37.3	2.1	0.1	12.8	3.9	3.6	45.0
Min	0.2	1	1	0	0	0.1	0	0	0
Median	12.1	320	30	0	0	4.8	0	1	0
90 perc.	186.9	8455.5	250	0	0	31.8	3	7	75
Max	30,190.4	1,614,362	700	57.0	2.3	60.3	25	27	500

## III. RESULTS

Due to data collection limitations (large samples) and the previously mentioned challenges regarding updates history, we test our hypotheses on particular subsamples. We use OLS for cross-sectional data and fixed effects model for the panel. See Table 6. for details.

**Table 6. Subsamples and tested hypotheses**

Sample	Hypotheses	Method
Established experiences (the top 1%)	H1, H3a, H3b, H4	OLS
All new experiences	H1, H2, H3a, H3b, H4	Fixed effect model
New experiences with non-zero players	H1, H2, H3a, H3b, H4	Fixed effect model

### 3.1. Established experiences (the top 1%)

The size of the server is statistically insignificant for the number of active players. Furthermore, it correlates negatively with the number of favourites. Similarly, interoperability in Roblox does not appear to boost popularity. The relationships between allowing players to enter an experience with their gear and both measures of popularity are negative. However, game badges and passes are significantly and positively related to the number of active players and favourites. Advertising experiences and creators matters and relates positively to the popularity. So does the share of up votes and a creator's number of previous experiences. The number of days since release is positively related to to the number of people who have decided to follow the experience - the older the game, the higher the number of favourites. The entrance price is insignificant.

**Table 7. OLS regression on the number of active players (1) and favourites (2), top 1%.**

	Log(Active Players+1) (1)	Log(Favourites+1) (2)
Server size	-0.0001 (0.0002)	-0.001*** (0.0003)
Any gear allowed - yes	-0.387*** (0.065)	-0.735*** (0.099)
(base: 0 badges)		
Badges: 1-5	0.328*** (0.036)	0.624*** (0.041)
Badges: 6-24	0.668*** (0.049)	1.133*** (0.050)
Badges: 25+	0.923*** (0.102)	1.216*** (0.094)
(base: 0 passes)		
Passes: 1-5	0.385*** (0.034)	0.613*** (0.042)
Passes: 6-10	0.763*** (0.047)	1.090*** (0.052)
Passes: 11-15	1.015*** (0.063)	1.566*** (0.062)
Passes: 16-20	1.228*** (0.238)	1.258*** (0.210)
Passes: 20+	1.136*** (0.350)	0.681* (0.372)

Ad share (in %) (experience)	0.534*** (0.128)	0.447*** (0.096)
Ad share (in %) (creator)	0.2178* (0.130)	0.178* (0.097)
Log(No of creator's games – 0.99)	0.096*** (0.006)	0.138*** (0.006)
Share of up votes (%)	1.221*** (0.081)	2.741*** (0.097)
Log(Entrance price + 1)	0.003 (0.074)	0.086 (0.069)
Days since release	-0.00004* (0.00002)	0.001*** (0.00003)
Constant	1.291*** (0.060)	4.936*** (0.071)
Observations	11,924	11,924
Adjusted R <sup>2</sup>	0.165	0.418

Note: *Robust standard errors in parentheses*; \*p<0.1; \*\*p<0.05; \*\*\*p<0.01; controlling for genres.

## 3.2. New experiences panel

Considering all new experiences, the server size and gear allowance are not significant factors in explaining the number of active players and favourites. While the number of days from the last update is significant (and negative in most cases), the estimator's magnitude is close to zero. The number of badges is positively associated with the dependent variables. Regarding passes – they are significant for the number of favourites. The more badges or passes an experience offers, the higher the number of active players or favourites.

Ads, especially promoting creators, are positively related to the number of active players. For the number of favourites, they do not play any significant role. The server price is positively associated with favouring an experience. The share of up votes of an experience from preceding period increases its number of active players.

**Table 8. Results of fixed effects models on the number of active players and favourites, all new experiences.**

	Log(Active Players+1)	Log(Active Players+1)	Log(Favourites+1)
Number of people per server	0.00 (0.00)	0.00 (0.00)	-0.00 (0.00)
Any gear allowed	-0.02 (0.02)	-0.01 (0.02)	-0.01 (0.03)
Days since last update	0.00* (0.00)	-0.00*** (0.00)	-0.00*** (0.00)
Number of badges	(base: 0 badges)		
1-5	0.09** (0.04)	0.09** (0.04)	0.45*** (0.05)
6-24	0.27** (0.12)	0.32*** (0.12)	0.94*** (0.15)
25 or more	0.97*** (0.37)	0.99*** (0.38)	1.67*** (0.31)
Number of passes	(base: 0 passes)		
1-5	0.01 (0.01)	0.02** (0.01)	0.13*** (0.01)
6 or more	0.01 (0.03)	0.02 (0.03)	0.36*** (0.04)
Days since release	-0.00*** (0.00)	0.00*** (0.00)	0.00*** (0.00)
Log (server price)	0.00 (0.00)	0.00 (0.00)	0.02*** (0.00)
Ad share (experience)	9.69* (5.17)	9.40* (5.20)	0.46 (0.75)
Ad share (creator)	45.81*** (11.92)	52.49*** (15.89)	-0.15 (4.57)

Share of up votes (lagged)		0.03*** (0.01)	
Constant	0.07*** (0.01)	0.03** (0.02)	0.61*** (0.01)
Observations	1795787	955453	1795763
Experiences	92255	52606	92254
R2 (within)	0.01	0.01	0.10
R2 (between)	0.05	0.07	0.19

More recent updates positively correlate with the number of active players when restricting the sample of new experiences to those with non-zero players. Badges and passes reveal similar relationships to the case of all new experiences. Advertising creators loses significance in each model and promoting experiences matters for the number of active players only. Surprisingly, higher shares of upvotes do not translate to an increasing number of active players.

**Table 9. Results of fixed effects models on the number of active players and favourites, all new experiences with non-zero players.**

	Log(Active Players+1)	Log(Active Players+1)	Log(Favourites+1)
Number of people per server	-0.00 (0.00)	-0.00 (0.00)	-0.00* (0.00)
Any gear allowed	0.05 (0.08)	0.20 (0.14)	0.11 (0.07)
Days since last update	-0.01*** (0.00)	-0.01*** (0.00)	-0.00*** (0.00)
Number of badges	(base: 0 badges)		
1-5	0.24* (0.13)	0.23* (0.14)	0.21*** (0.08)
6-24	0.70** (0.35)	0.72** (0.36)	0.58*** (0.22)
25 or more	1.71*** (0.58)	1.67*** (0.59)	1.38*** (0.31)
Number of passes	(base: 0 passes)		
1-5	0.15 (0.10)	0.15 (0.10)	0.27*** (0.08)
6 or more	0.16 (0.12)	0.15 (0.12)	0.36*** (0.11)
Days since release	-0.00 (0.00)	-0.00 (0.00)	0.03*** (0.00)
Log (server price)	0.04 (0.02)	0.04* (0.03)	0.03 (0.02)
Ad share (experience)	4.44* (2.68)	4.14 (2.62)	0.82 (0.58)
Ad share (creator)	14.83 (16.59)	15.97 (16.80)	-0.12 (1.73)
Share of up votes (lagged)		-0.44* (0.25)	
Constant	2.62*** (0.16)	2.90*** (0.24)	4.19*** (0.10)
Observations	13760	12700	13760
Experiences	1060	1060	1060
R2 (within)	0.15	0.16	0.60
R2 (between)	0.07	0.07	0.23

## IV. CONCLUSIONS

Digital markets are growing dynamically, with virtual content, apparel and other merchandise constituting an increasing share of revenues for brands, games and platforms. Indeed, the number of users engaged in purely online activities and creation is continuously rising, contributing to the expansion of platforms for virtual experiences such as Roblox. These places are, subsequently, often talked about as some of the stepping stones towards the broader concept of a metaverse.

We aim to understand what drives the above-mentioned processes and which of them can be described as driven by consumer demand. To this end we draw our hypotheses from the literature on video games and the debated metaverse framework. To test them, we collect extensive data on digital experiences hosted by the Roblox platform. We both analyse a set of established experiences, and do a focus analysis on a subsample of new experiences and their progress in the platform over time. We are interested in two measures of experience success: its daily active player number (i.e. general engagement) and the number of favourites (i.e. sustained interest, as favouriting is used to follow specific experiences).

Our findings on bonus features like badges or in-game content are mostly in line with the literature on video games, despite the Roblox experiences coming from less professional developers. We find that achievement badges relate to both the engagement and sustained interest. More specifically, among the top experiences, larger numbers of achievements and available game passes are characteristic for experiences with larger daily active players and the sustained interest. Among the new experiences, those that add badges increase their player counts and sustained interest; however, game passes do not increase the daily active player numbers but succeed in locking in those who played. The effect of in-experiences purchases in the form of passes can be likely linked to the existence of switching costs – once a player invests in a given experience by paying for the passes, they may be more reluctant to switch to different experiences as it would involve losing the acquired benefits (see e.g. Burnham et al., 2003 for benefit loss costs of switching). In a similar vein, we also found that more players favoured an experience that required paying for a server access – again likely by making the players reluctant to leave an experience they have invested in.

In general, older experiences have larger numbers of favourites, consistently with players having more time to try the experience and then move on to others without necessarily unfavouriting it.



More importantly, experiences require frequent updates to support an active and engaged player base. As the time since last update grows, the experiences have both a decreasing active player base and lower favourite gains (or, conversely, when experiences introduce updates their engagement factor grows and more players decide to stay). This finding is in line with the current trend of continuous support and development of digital experiences instead of their abandonment after release. It also shows that consumers are interested in the *persistence* and *synchronisation* of the digital experiences.

Interestingly, we find no support for general interest in the *interoperability* and high *user limit caps* in the digital experiences. Experiences allowing for more players interacting with each other or allowing to bring a larger variety of own equipment and apparel from 'outside' of the experience do not evidence higher player engagement or sustained interest. On the contrary, larger groups of people seem negatively related to the level of sustained interest, and interoperability seems to be negatively related to the engagement in new experiences. One possible explanation for the former is that players might be more likely to create bonds and meaningful social interactions in smaller groups, which would lead them to more often return to the same experiences. An explanation for the latter might be the previously cited problems with the gear allowance feature, which might lower its attractiveness to the players. As such, this feature should be studied further in the future.

Finally, as in real world, advertisements seem to carry a direct influence on the popularity factors and especially the engagement (less so sustained interest). Interestingly, experiences benefit both from direct advertising and the advertising of their creators, meaning that due to the developers coming directly from the user pool, they experience high returns from adverts that distinguish them from other developers.

To the best of our knowledge we are first to analyse the Roblox platform as an evolving link between the existing gaming industry and the much-debated metaverse. Our findings shed light on what are the current trends in virtual worlds, and which are the most likely to capture consumers' attention, increase their engagement and bolster player retention. Interestingly, our findings suggest that players may not particularly care about the interoperability of experiences and may prefer smaller groups of concurrent players to develop sustained interest in particular experiences. As the digital trends progress, more studies will be needed to understand the interaction between technology and its users.

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## APPENDIX

**Table A1. Correlation matrix for the characteristics of all experiences**

	Active Play- ers	Favourites	Server size	Ads (%, exp)	Ads (% crea- tor)	Days since release	Entrance fee
Active Players	1						
Favourites	0.5059*	1					
Server size	-0.0036*	-0.0129*	1				
Ads (% exp)	0.0229*	0.0372*	-0.0032*	1			
Ads (% creator)	0.0002	0.0006*	0.0048*	0.0075*	1		
Days since release	0.0059*	0.0471*	-0.2547*	0	-0.0002	1	
Entrance fee	0.0026*	0.0010*	0.0027*	0.0001	0.0005	0.0012*	1

**Table A2. Correlation matrix for the characteristics of top 1% of experiences**

	Active Players	Favourites	Server size	Ads (%, exp)	Ads (%, creator)	Days since release	Entrance fee
Active Players	1						
Favourites	0.5238*	1					
Server size	-0.0049	-0.003	1				
Ads (% exp)	0.0230*	0.0446*	0.0157*	1			
Ads (% creator)	-0.0017	-0.0044	0.0124*	0.0069*	1		
Days since release	0.0157*	0.1962*	-0.0296*	-0.0099*	-0.0047	1	
Entrance fee	0.005	0.0011	0.0669*	-0.0018	0.0006	0.0219*	1