THE HISTORY & EVOLUTION OF VIDEO GAMES

< BACK

SECTION 1: THE HISTORY OF GAMING

Given our focus on investing in businesses that are changing the 'World of Play' we thought it would be appropriate to look back on the history of the Video Games industry and to understand where it came from, as well as where it is going.

Turing's Chess

The story begins way back in the 1940s when Alan Turing invented an AI-informed chess game. Essentially it assigned points to each potential move and the algorithms resembled a 'logic' to the play. The algorithms Turing and David Champernowne wrote were

too powerful to be run by computers at the time, so instead was 'executed' by Turing manually. Unfortunately, Turing died before they executed the game on a real computer, but his work laid the foundations for decades to come.

MIT and Spacewar!

The next significant event was when MIT professor Steve Russell built '**Spacewar!**' in 1962 on a giant University computer. This advancement was significant to the early history of video games as it became prevalent within the small programming community in the 1960s. The public domain code was widely shared and recreated across other computer systems at the time.

Spacewar! in the 1960's

The Arrival of the Arcade

At Stanford University in 1971, **Computer Space**, the first commercial arcade game was invented. Nolan Bushnell and Ted Dabney were the pioneers, taking the basic concept of **Spacewar!** and making a dedicated,

coin-operated machine and in the process founding **Atari**. Bushnell and Dabney followed their success of **Computer Space** with the help of Allan Alcorn to create a table tennis game Pong, released in 1972. Pong was a huge success, and this led to a flood of other coin-operated arcade manufacturers entering the market and creating the arcade game industry; Namco, Atari, Williams Electronics, Stern Electronics, and Nintendo.

The Console: Act I

Around the same time that the arcade scene took off (or even earlier in 1966), some people were looking at how games could be played on existing television sets. In 1972 German Video-Game Inventor, Ralph H. Baer, released the Magnavox Odyssey which was the worlds first commercial console. Atari took this idea and ran, and achieved mass-market success with **Pong** and other video game consoles. Consoles of this time were built to come pre-loaded with whatever game you purchased, and 'cartridges' weren't introduced for a few more years.

The Magnavox Odyssey Console

The Video Game Crash

"In 1983, the North American video game industry experienced a major “crash” due to a number of factors, including an oversaturated game console market, competition from computer gaming, and a surplus of over-hyped, low-quality games, such as the infamous **E.T.**, an Atari game based on the eponymous movie and often considered the worst game ever created." History.com. Atari paid $25 million for the license to produce the **E.T.** game, which further contributed to a debt of $536 million (equivalent to $1.42 billion today). The company was divided and sold in 1984.

This crash lasted a few years, and the industry slowly began to piece itself back together. By the turn of the decade, Japanese developers had begun to make their mark and Nintendo’s products began to land on Western shelves.

Gaming On the Go

In 1989 the first major handheld games console to reach the homes and hearts of consumers arrived. With interchangeable cartridges, gamers could play what they wanted, whenever they wanted, wherever they wanted - and this ultimately led to the success of the Gameboy which, combined with the Gameboy Colour, remains to be the 3rd best-selling console of all time (118m unit sales).

The games industry was back, and following the crash of the 80's, gaming was back on the rise. By 1988 global games revenues returned to over $20bn/yr globally.

The popularity of consoles amongst the young, emerging audience of gamers led to the cultural proliferation of games within the 1990s and beyond. Some iconic games IP (that are still thriving 30 years on) hit the shelves - **Mario**, **Crash Bandicoot**, **Zelda**, **Street Fighter**.

The Nintendo Game Boy

PC Nation

By spring 1994, an estimated 24 million US homes (27% of households) had a personal computer. 48% played games on their computer; 40% had the 486 CPU or higher; 35% had CD-ROM drives; and 20% had a sound card. This saw incredible distribution amongst consumers, most likely due to the fact that PC's had the added utility of web browsing and document processing.

The first popular 3D game, **Doom**, launched on PC in 1993, and really pushed the boundaries for what thought was possible.

"Doom has been considered the most important first-person shooter ever made. It was highly influential not only on subsequent shooter games but on video gaming in general, and has been available on almost every video gaming system since. Multiplayer gaming, which is now integral to the first-person shooter genre, was first successfully achieved on a large scale by Doom." First-Person Shooters.

The early PC and Console communities formed around respective platforms prevail today, and remain a hotly contested debate.

The Console: Act's II & III

The race was on for manufacturers to capitalise on the re-established opportunity the games industry presented. Companies such as Sega, Atari, Nintendo and for the first time, Sony, scrambled to launch their

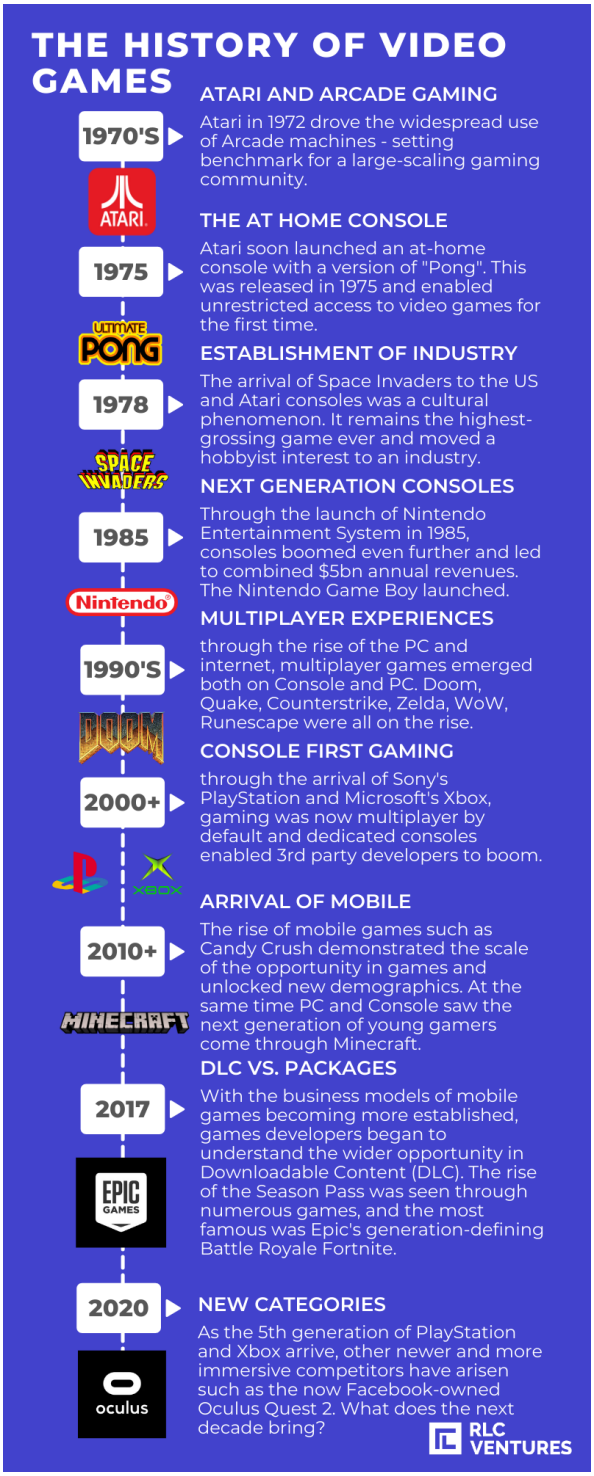
flagship consoles.

In late 1994, Sega beat Sony to market by a month, launching their Sega Saturn in November. Ultimately it made little difference as the Playstation One outsold the Sega Saturn 10:1, becoming the most sold console of the 1990's (not including the GameBoys). Due to the 3rd party support that Sony offered, gamers had a far greater selection of titles, something the others could not.

The Playsation One sold in excess of 100m units throughout the 90's. This dominance ultimately led to Sega tapping out of the race with its final console, the Dreamcast which launched in 1998. The success Sony saw (and acted upon with the release of the PS2) courted further attention from hardware producers such as Microsoft - who entered the market with the original Xbox in 2001. Already the famous Xbox / Playstation rivalry had begun, but Nintendo and their Gamecube console also sold around 20m units in the early 2000's.

In 2005 and 2006, Microsoft's Xbox 360, Sony's Playstation 3, and Nintendo's Wii arrived as the next generation of high-definition gaming. Each console launched exclusive titles in order to attract new players to their ecosystem - Sony offered **Gran Tourismo**, **Little Big Planet**, **The Last of Us** whilst Microsoft offered the legendary **Halo**, **Crackdown**, **Gears of War** and more. The console wars raged on.

The Playstation 2



A timeline of the History of Video Games

Mobile

In the background, another piece of technology was quietly on the ascendance. The concept of mobile games was not really there in the early 2000's and generally limited to single-player experiences such as **Snake**.

In 2007, the original iPhone was released and this really changed everything. Although the device was fairly limited and lacked an App Store or 3G capabilities, it was the 'MVP' that largely represented the future of the mobile internet as we know it today.

The Original App Store Interface

Upon the launch of the App Store (July 10, 2008), an initial 500 iOS applications were available. Over the coming decade millions more apps were developed and launched, and amongst these some of the most widely played games in history (Candy Crush has had over 500 million players).

Due to the relative infancy of the App Store, the majority of early mobile games were premium. **Angry Birds**, one of the most iconic mobile games went to market with a $0.99 price point. By 2010, Rovio (the team behind Angry Birds) had launched on Android and begun to explore other revenue models. The team soon foresaw an opportunity in offering a free game with adverts, and an option to pay to remove them. This eventually unlocked multiple new revenue streams and

led to $40m+ revenue a month.

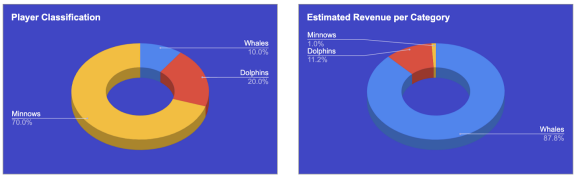
FTP Games

By 2010 the success of countless free-to-play mobile games had validated alternative revenue streams for consoles, which by now were dominated by Sony, Microsoft and Nintendo. **Minecraft** was a global phenomenon and one of the most iconic games ever built. The open-world sandbox game developed by Mojang is still played today, despite being acquired by Microsoft in 2014 for $2.5bn. (Note, PS4 and Xbox One launched in Autumn 2013).

Instead of charging a fixed cost to access and play a game indefinitely, mobile players were able to try the game for free and enjoy a typically restricted but fully playable experience. This led to the creation of some extremely popular games such as: **Clash of Clans**, **Boom Beach**, **Candy Crush Saga**, **Temple Run**, **Fruit Ninja**, **Plants vs Zombies, Tap Tap Revenge**.

The in-game purchases of digital goods quickly saw strong revenues and interesting spending behaviours emerge. As outlined in the pie-charts below, the majority of FTP revenues typically come from a group of power-users typically referred to as Whales.

- minnows (lowcore, low spend),
- dolphins (midcore, medium spend)
- and whales (hardcore, highest spend)



Minnows, Dolphins and Whales - Gaming Revenues

Consoles soon saw the opportunity and games such as **Team Fortress 2**, **Counterstrike** and **Overwatch** offered microtransactions in the forms of loot boxes (which were highly controversial in some cases). The move was commercially successful, but the real innovation came with the arrival of ‘Live-service’ games.

The Live-Service Model

Often also referred to as Games-as-a-service (GaaS), the live-service model is the concept of releasing a game and continually adding content over the lifetime of the game. It is typically free to download and access, with the progression mechanics being locked behind a paywall or ‘Season Pass’ as the subscription is typically referred to.

The GaaS model has existed for some time, popularised through games such as **World of Warcraft** (WOW) and **Runescape** back in the late1990’s/early 200’s, but only in the last 3-4 years has it really taken off through the rise of **Fortnite**.

Epic Games launched **Fortnite** in 2017, following suspiciously closely behind the success of Player

Unknown Battlegrounds (PUBG). The Battle-Royal game has been a social and cultural phenomenon, reaching over 350m all-time players. The player base definitely skews younger, but that hasn't impacted revenue generation which was reported at $2.4 Billion in 2018. This staggeringly high number came from a mixture of Microtransaction such as V-Bucks and their Battle Pass offering.

Console Innovation

The arrival of the PS5 and Xbox Series X in Autumn 2020 signalled the next generation of consoles. Given the surging demand for games consoles due to the Coronavirus Pandemic, coupled with a chronic shortage of semiconductors (as they were stockpiled early by Apple and Huawei in anticipation of covid-related factory closures).

Next Gen: The Xbox Series X & Playstation 5

These consoles (for anyone lucky enough to get their hands on them) really pushed the experience further, boasing 120hz refresh rates, 8-core AMD Zen 2 CPU's and 18gb of RAM. With the recent success of the Oculus Quest 2, Playstation have also optimised their consoles for Virtual Reality (VR) hardware support with their PSVR offering (sold separately).

Virtually a Reality

In late 2020, a new console arrived on the scene from a name that hadn't traditionally seen mainstream games popularity, Oculus (now owned by Facebook). According to a Tweet by a **Rec Room** employee (**Roblox** for VR), Oculus has sold between 2-3 million Virtual Reality headsets. If these figures are true, we could be on the cusp of seeing mainstream uptake of VR as a gaming medium.

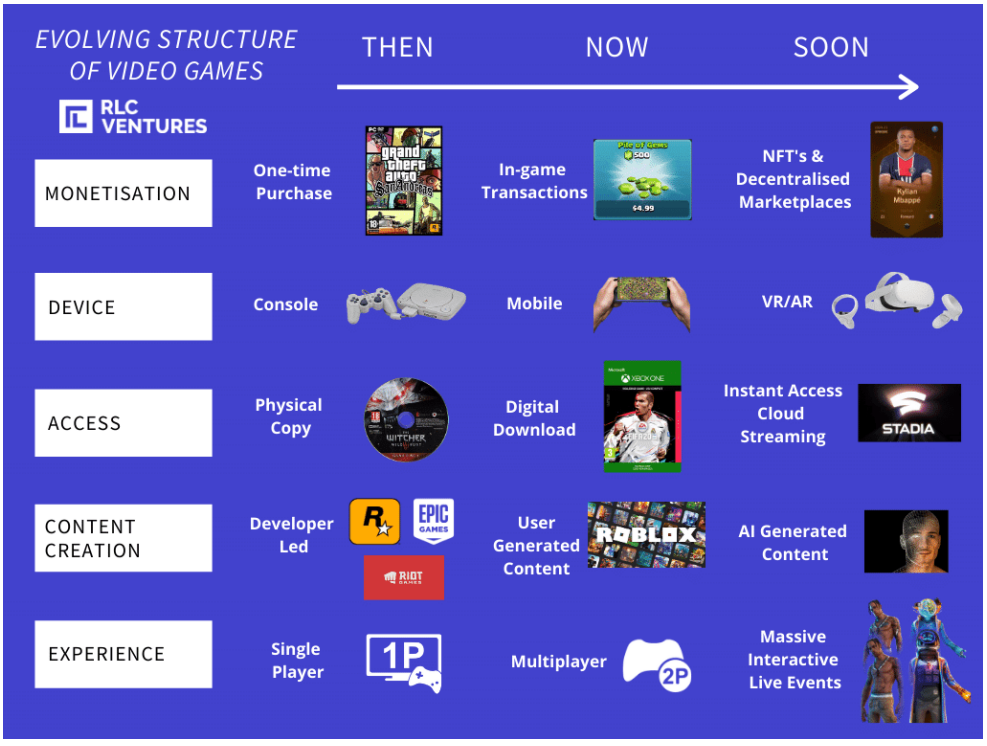
*Please note this timeline is definitely missing large parts of the story, such as **PokemonGO**, **Zynga** and numerous others. We have tried to make the story as condensed as possible.

Section 2: How Gaming has Evolved

The Evolution of Gaming

From pixelated aliens to talk of the Multiverse, gaming has evolved significantly since the days of Atari and Arcade machines which characterized the nascent games industry.

In 2020, the global video games industry was valued at an eye-watering $159.3 billion, primarily driven by the innovations we have seen in the way we play over the last 2 decades; from console-first gaming to the widespread adoption of mobile games. However, at RLC, we believe the best is yet to come. We anticipate the next decade will give rise to richer experiences across next generation platforms, consoles and business models.



The Ever-Evolving Structure of the Video Games Industry

The graphic above is a snapshot overview of some of the developments that have and are continuing to take place across the games industry. It is worth noting that as each structure 'evolves' it does not mean the discontinuation of the previous formats, and each will continue to co-exist. For example, the arrival of multiplayer games does not signal the end of Single Player games by any means.

We will be exploring each of these in the coming sections.

Platform innovation: Cloud Gaming

> ***Cloud-enabled features accelerate the network effects inherent in multiplayer games.***

One of the key drivers of the new age of gaming is platform innovation. The vast majority of today's games rely on hardware platforms i.e. inserting a physical disk in your games console, or downloading a game onto a drive. This means that everything from the game logic, the physics, audio, and imagery are run locally, and as such, are constrained by the strength of your hardware's processor. This is why, for example, you must still install several gigabytes of data to your local machine even for online-only games such as Fornite.

Cloud-based gaming, however, moves content processing away from the consumer's local machine (console or PC) and instead processes gameplay using remote servers in data centers, which is then streamed to the player's device via content delivery networks (CDNs). This process is similar to how video is streamed via platforms such as Netflix and Amazon Prime, but with an extra layer of complexity given the requirement of real-time input and latency.

The Cloud Wars: Stadia vs. Luna.

Credit TechRadar.

Cloud gaming is expected to go through a number of iterations of development before gaining widespread adoption. As of today, the most common form we can see are ports of existing games that have been developed for PC or Consoles, and are being distributed through the cloud; such as the ~150 Xbox titles that can be played on Microsoft's cloud gaming platform, xCloud (think Games as a Service GaaS). This current phase of cloud gaming has introduced two primary benefits to consumers: (1) **convenience** of, and (2) **access** to gaming.

Firstly, gameplay processing being executed remotely (i.e. not on a local machine) allows for instant game launch - long gone will be the days of waiting 7+ hours for your game to download - and in doing so, alleviating a prominent pain point for the majority of gamers who are frustrated by the need for continuous updates and tedious download times. (Even next-gen consoles such as PS5 take significant time to 'copy' downloads to the console).

Furthermore, the cloud also promises to untether consumers from specific console ecosystems by providing the opportunity to access and play games using any capable device; eliminating the need to silo players based on the hardware they own, and removing the pressure to buy next-gen consoles or purchase high-end PCs. This also opens up more interoperability and cross-play functionality (something many games communities continue to call for).

The combination of these factors is likely to convert previously infrequent/casual gamers who viewed these download and compatibility restraints as barriers to entry and spur the proliferation of cloud-based games.

Looking further, cloud-based gaming is poised to not only transform the way we play, but also the content we play with by playing a part in revolutionising the storytelling capabilities of games.

Content innovation: User-Generated

Content and Artificial Intelligence

> ***Roblox have 36.2 million active daily users as of Feb 2021, and Minecraft's community has grown to 131 million active monthly users | UGC-centric games and platforms are immensely successful***

The next logical iteration for cloud-gaming is the move to cloud-native games - those which are built to be playable only within a cloud infrastructure. This promises to be an exceedingly exciting phase of development given the innovation in content creation that such a platform can enable, especially through user-generated content (UGC) and the application of artificial intelligence. Although a great simplification, we believe this will generally take place over two phases.

The first phase of innovation in content creation is already underway, currently driven by UGC; which is any form of content that is created and published onto a platform by its users as opposed to developers. In the old-generation of gaming, content creation was primarily led by developers. However, as players demand updated and larger volumes of content, the need for developers becomes a bottleneck. UGC, however, firmly addresses this issue; offering a cost-effective solution to scaling content creation with the players themselves at its core. Look no further than Roblox, who raised $520 million

earlier this year, for the best example of the meteoric rise of UGC. Now valued at $29.5bn, a 7x increase from Feb 2020, Roblox is an online platform that allows its users to play games - all of which are created by other users. It's value proposition combined with monetisation, in the form of in-game transactions, neatly woven into the platform provides a fantastic incentive for users to continuously generate their own content to enrich the platform and its experiences, alongside the potential to make money. And its stats speak for itself. The platform boasts a community of 150 million monthly active users, who have spent 1.5 billion hours on the platform (as of Feb 2020). Unsurprisingly, given its UGC-centric model, Roblox has a strong developer community who are rewarded well; with Roblox paying out $328.7 million to it's army of content creators - an increase of ~200% from 2019. However, vast quantities of content does not ensure quality, and despite gaming communities on the scale of millions, not all players will have the skill-level to create their own content.

Roblox is built heavily on its community and their User-Generated Content (UGC)

As the challenges such as the above become more persistent, the second phase is likely to garner more speed - the role of AI content creation. This is likely to take its first form as AI-assisted content creation; with the key opportunity here being a lack of a technical understanding of content creation will likely no longer pose a barrier for any player to create their own content. As Andressen Horowitz notes, this opens up the opportunity for players and creators to focus on high-level game design, and leave AI to figure out its deployment. For example, using natural language processing to describe what content to create, and using machine learning to render a 3D model of what was described. This stage ultimately democratises the process of content creation. Beyond this however, the next iteration is likely to see AI-generated content; using procedural content generation (PCG) as a way to automatically create new characters, landscapes etc. for games, with little to no human contribution. In fact, progress in this realm is already underway. The 2016

title No Man's Sky used PCG to create an infinite virtual universe, where its algorithms created new planets in real-time as its players discovered them. One thing to note here, and specifically relevant to No Man's Sky, is that scale does not always equal quality. Strong game design and replayability will easily trump an endless boring, buggy experience (see the long-term success of GTA V, World of Warcraft, Runescape, Age of Empires).

Overall, these strides in AI-generated content and the resulting transformation of game worlds are fundamentally enabled by cloud-native gaming; offering endless data collection, storage, and processing that is not possible on local machines. This ultimately sets the scene for AI to become co-creators, or even the sole creators, of the content we interact with - but this may be a long way off still.

Business model innovation: CDs to NFTs

> ***"The emergence of blockchain-based NFTs has enabled true ownership of virtual assets, indefinitely, and outside the control of the creator."***

For the old-generation of gaming which saw consoles as the primary form of distribution, the likes of Microsoft and Sony employed a razor and blade approach; selling consoles at cost, and their games at high prices. However, the growing digitisation of gaming, as well as

trends such as UGC growth, have already opened up new business models and revenue sources.

As the micro-transaction model has continued to pay dividends, the underlying business models of games have shifted causing gravitational changes across the industry. Free-to-play (F2P) subsidised by micro-transactions now accounts for 78% of digital game revenue (2020) and this appears to be the default model even more traditionally established studios are adopting (Epic, Supercell, King, Respawn, Activision Blizzard). Battle Passes (now prevalent on both mobile, PC and Console) are typically purchased through in-game currency (V-Bucks, Gems or others) and cosmetic items are sold separately, typically for in-game conspicuousness.

"Take Fortnite for example which in 2018 at the height of its popularity earned $2.4 billion, the vast majority of which was driven by one-way transactions for in-game cosmetics with exactly zero in-game utility beyond aesthetic appeal" Piers Kicks - Into the Void: Where Crypto Meets the Metaverse.

Fortnite's variety of skins and collaborations with other IP's

And this change really appears to be working for developers and players alike. The virtual goods market is estimated to be worth around $50B/yr, and is expected to grow to $190B per annum by 2025. These virtual goods can be anything from Twitch 'Bits' to GS:GO weapon skins. Interestingly, 3rd party marketplaces exist for the transfer of some of these assets - often to the detriment of the developers themselves. As rare knife skins trade for tens or hundreds of thousands of dollars each, the studios will not be seeing any of that secondhand marketplace revenue themselves… enter NFTs.

You've heard the acronym and most likely added it to your list of muted words on Twitter - but there is some real utility to come here. As the F2P model permeates more corners of the ecosystem, people will grow tired of fragmented and isolated in-game achievements and digital goods. Any in-game items that are limited edition, hard/expensive to obtain or signals of skill will naturally be valuable within a games marketplace.

NFT's or Non-Fungible Tokens are built on blockchains, where a distributed ledger (such as Ethereum) enables items to exist independently of company or ecosystem control. This decentralized, universal digital representation and ownership layer enables 'digital scarcity' (i.e. limited availability), uniqueness, and authenticity that can be transparently managed.

With this vision in mind, NFTs will be more than the

current hype - they will offer both digital and physical utility that exists within and around games ecosystems, and they will retain and accrue in value depending on their type (see Beeple, Sorare etc.).

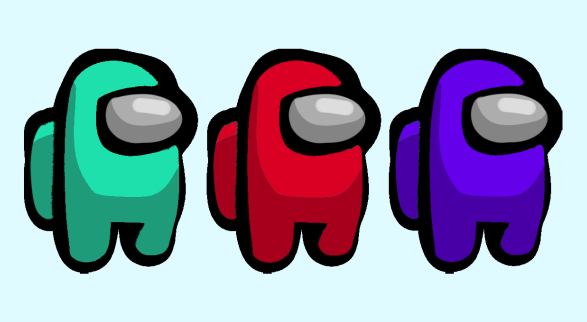
Ultimately, these will be transacted via marketplaces and original creators (games studios perhaps) can indefinitely retain a portion of their future resale value, fundamentally transforming how they may think about microtransactions.

Product Innovation: The Future of Gaming is Social

> ***Fortnite, 350 million users (May 2020) - eSports, a global market value estimated at $1bn - PokemonGo, 1 billion cumulative downloads by March 2019 | Some of the biggest gaming sensations in recent years have been social-centric***

This generation of games are segmented by the type of hardware the consumer owns, which means network effects are effectively dampened as players are limited to socialising with gamers using the same platform. Moreover, the current versions of social gameplay are inherently constrained by poor matchmaking rules and server restrictions - all of which increase the difficulty of

making in-game friends, and a sense of community regardless of skill-level - resulting in churn for new users as a result of sub-par experiences.



The 2020 Social Games Phenomenon, Among Us

These barriers to entry are, however, quickly fading with the help of cloud-based gaming, streaming services, and other 3rd party infrastructures. Cloud-based multiplayers games are cross-platform by nature - enabling gamers to engage in collaborative gameplay regardless of device; while the successes of Twitch and Discord have shown the potential for large games communities to thrive regardless of platforms. This combination of a fresh approach to ensuring all players can engage with the game and its community, alongside reinvigorating the network effects in MMOs, is likely to see the growth curve and stickiness of MMOs mimic that of social networks.

These strides, however, are only the beginning relative to the grand visions for social experiences in the future of gaming.

The Metaverse: Bringing it All Together

> ***A persistent and live virtual space providing all potential users with a sense of presence and a multitude of social experiences, alongside a fully-functioning virtual economy***

While a version of the metaverse that is true to the definition above is years, or even decades, away from realisation, the innovation we have currently seen across platform, content, product, and business models indicate that we are heading in the right direction. In the meantime, we are likely to see the intersection of cloud-gaming, UGC, and Artificial Intelligence, and innovation across them, spawn the creation of a minimum viable metaverse; with hyper-personalised content and socialised gaming at its core.

Popular metaverse-esque depiction within 'Ready Player One'

The proliferation of UGC is likely to accelerate the potential for increased social experiences enabled by cloud-gaming, by allowing users to not only create but also socialise in their own spaces. The ability for players to then buy and sell the virtual assets created amongst themselves poses another novel layer to one's social experience; offering the opportunity to interact with each other via marketplaces for virtual assets. This naturally opens the door to the creation of virtual economies (see Axie Infinity and Sorare). Going a step further, the dawn of the Metaverse is likely to see IPs no longer act as a barrier to interoperability, and we are already seeing this happen (See Fortnite and their avatar skins); players may be able to bring their virtual assets across games and platforms - something which used to significantly limit the in-game experiences for some games (See EA and PES). Developers will be incentivised to follow-suit, with the fear of missing out on the growth of a new era of gaming being a powerful motivator. Beyond these, AI also has the potential to offer players a sense of agency, whether that be by creating NPCs that are able to recall your previous actions (as opposed to your typical canned responses), fundamentally changing your interactions with NPCs, or using PCG to create new game worlds and levels based on your behaviour.

Potential Challenges

Overall, the new era of gaming as well as the visions for

its future appear to be driven by the transformations in content creation and access to gaming, presenting ample opportunity to reinvent how consumers play games, as well as how games studios and developers monetise. However, the growth of the current phase, and indeed the development into the next iteration, is not without challenges. Earlier in this article, we mentioned that cloud gaming is likely to go through a range of iterations before reaching widespread adoption - it is crucial to remember how the technical demands of these iterations are likely to differ vastly amongst the various gamer segments.

For example, the technical demands of mobile gamers are likely to be at odds with those of immersive gamers. With more than 2 billion people playing mobile games globally, mobile gaming is a key driver of the video game industry; however, these titles are often simple, casual and likely to be single-player only. Whereas the immersive gamer segment, who are relatively more loyal and have lower churn rates, are likely t more complex technical capabilities from the cloud to support immersive, realistic gameplay with complex narratives. Even more, this type of consumer may find it tify using subscription models for cloud platforms, which are likely to work very well for the casual mobile games, given the next-gen consoles and PCs soon to be released will no-doubt be able to meet the technical requirements.

We need to not jump as far to gamer segments to

identify potential challenges either; poor bandwidth and internet connection are likely to be as strong an entry barrier to cloud gaming as hardware requirements are/were for the old generation of games.

Despite these challenges, the plethora of opportunities presented by cloud gaming is undeniable. Incumbents are already responding to these seismic industry shifts by forging partnerships with cloud gaming disruptors and telcos (e.g. Microsoft x Bango, BT x Google), while disruptors themselves are eager to pioneer unique solutions themselves (We explore this in-depth in the next part of our Future of Gaming Deep Dive)

The Next Step

While it is a while until we reach something even remotely Metaverse-eque, it is worth acknowledging just how far we have come. From playing pixelated ping pong by yourself on arcade machines, to creating and exploring virtual worlds with your friends on your phone, the industry's progress is undeniable - and this is only set to evolve rapidly. As we have seen throughout the history of gaming, any advancement in adjacent or apparently linked technologies (See smartphones and the age of mobile gaming) have potential to trigger a wave of hardcore innovation which could spawn a new chapter for gaming. Ultimately, providing a world of new opportunities for entrepreneurs to pioneer these transformations in the way we play, and investors to

back tomorrow’s disruptors.