



# THE NEW REALITY FOR MOBILE GAMING

The VR/AR Opportunity



arm



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### Virtual Reality

VR immerses users in an artificial environment from a first-person perspective and typically incorporates additional sensory elements, such as sound or haptic feedback. VR aims to create a simulated experience that is indistinguishable from a live experience.

### Augmented Reality

AR alters or adds virtual elements to a live view or current reality, often through the use of a camera. It is frequently used as an umbrella term to describe any combination of real and virtual worlds.

### Mixed Reality

Traditionally, MR describes virtual objects anchored in the real world. However, like AR, it is increasingly used to describe any combination of real and virtual worlds.

### XR

Abbreviation for AR/VR/MR.

# ARE VIRTUAL AND AUGMENTED REALITY GAME CHANGERS?

## Foreword

VR and AR are the next steps toward truly immersive gaming, with mobile technology the driving force behind both.

AR and VR are some of the hottest topics in gaming, both showing huge potential across countless industries. Gaming has always been a trailblazer when it comes to new tech and monetization models. The sensors that now power Microsoft's HoloLens mixed-reality headset, for example, were first used in Kinect for the Xbox 360 and Xbox One.

While gaming is currently at the forefront of VR and AR, B2B and enterprise applications will also drive the growth of both platforms. Immersion is a key reason why many consumers love engaging with media, with AR/VR making this even more compelling and interactive in ways that were never before possible. Blockbuster games like Red Dead Redemption 2 and Skyrim already let gamers immerse themselves in worlds different from our own, and a VR headset enables you to be one step closer to the experience. For this reason, VR experiences will tilt toward PC/console. In fact, 61% of U.S. gamers prefer VR to AR.

Yet, high-end VR is held back by a cumbersome setup and the need for other hardware in addition to a VR headset. To get around these barriers and make VR more accessible, headset-makers have been developing all-in-one cordless solutions featuring cost-efficient mobile processors.

AR, on the other hand, has boundless potential on mobile. AR phenomenon Pokémon GO captured the hearts of millions across the world. Even though AR was only a small part of what made the game so popular among millions of consumers, it has introduced the technology to the mainstream. With both Apple and Google investing heavily in AR—through ARKit and ARCore, respectively—it's just a matter of time before the AR revolution kicks off on mobile.


In this report, we will look at AR and VR in depth, delving into both technologies' landscapes, future potential, consumer interactions, and what they mean for mobile.

# 25%

of people we surveyed in the U.S. have experienced AR in the past 6 months and 28% have experienced VR.



**Jelle Kooistra**  
Head of Market Analysis



“Year over year, consumer and enterprise VR and AR demands rise and we continue to refine our mobile architectures with these requirements in mind. This, alongside the dawn of 5G, creates a new era of mobile computing that will indefinitely impact consumers’ and workers’ daily lives and enable huge opportunities for the mobile industry.”

Hugo Swart, Head of AR/VR, Qualcomm

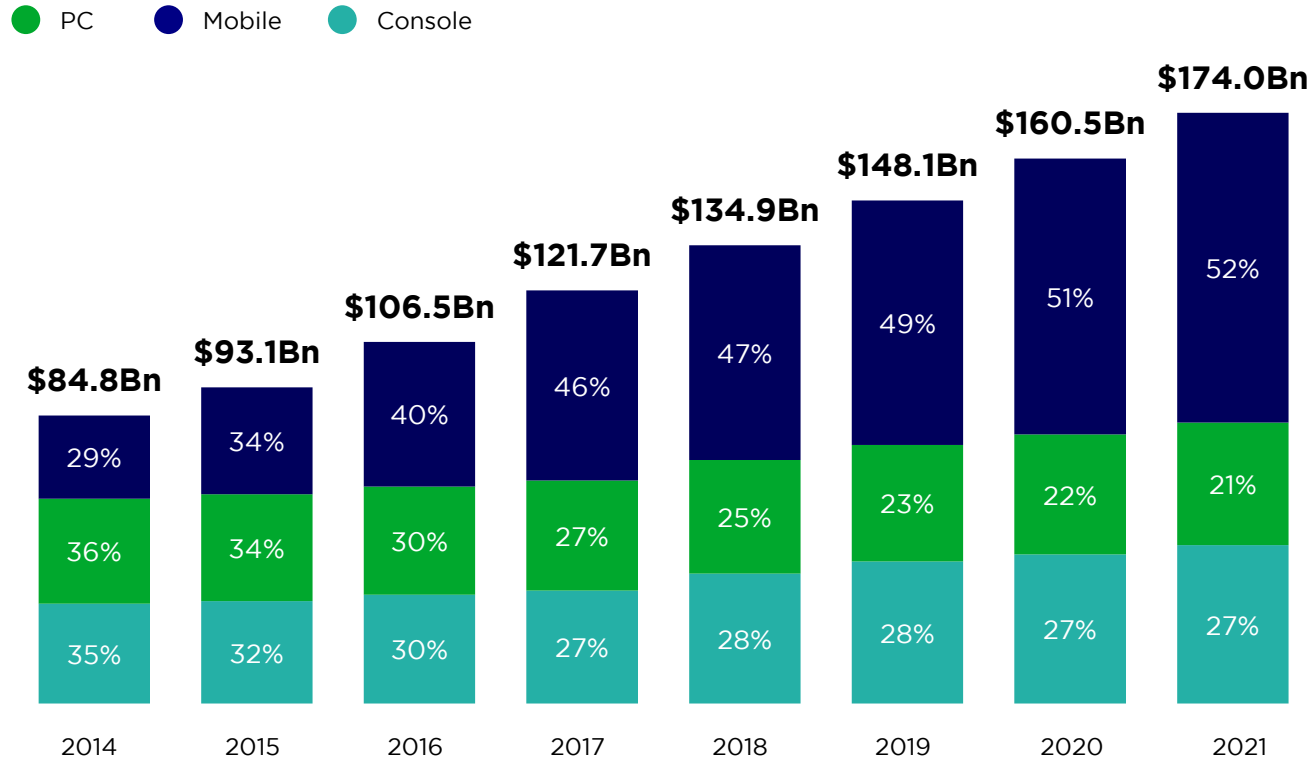


# 1. THE GAMES MARKET

At the forefront of new  
innovations

# MOBILE GAMING IS THE LARGEST, MOST POPULAR SEGMENT

Growth of the total market will continue toward 2021, fueled by mobile games



## \$90Bn

Consumer spend on mobile games in 2021.

Since 2016, mobile has been the biggest segment in gaming. It will continue to grow at a faster pace than PC or console, driven by an increase in average spending as well as an increasing installed base as more and more consumer get access to smartphones.

# MOBILE GAMERS ARE SEEKING MORE IMMERSIVE EXPERIENCES

The notion that mobile gaming is limited to casual gaming has been shattered



## 150M+

downloads of PUBG Mobile and Fortnite Mobile occurred on iOS since their global release, including PUBG: Exciting Battlefield in China.

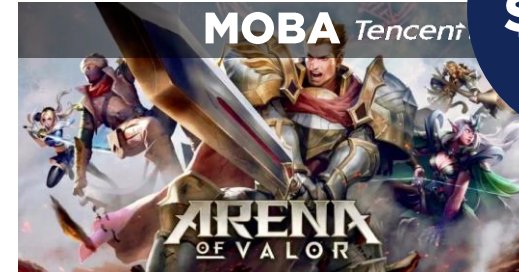


#7  
Downloaded iOS game in Q3

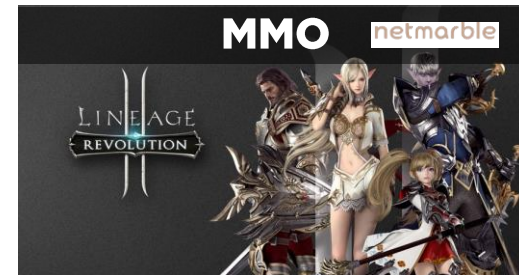


#5  
Downloaded iOS game in Q3

### CORE GENRES TAKE MOBILE BY STORM



\$1.1Bn+



## 69%

of PC gamers play mobile games at least once a week.\*  
Lineage Revolution, a mobile adaptation of PC MMO Lineage 2, grossed over \$924 million in its first 11 months of release.



# VR AND AR HAVE MASSIVE POTENTIAL

Games are at the forefront of this innovation

## VR AND AR CAN ADD A NEW LAYER OF IMMERSION TO GAMES

VR and AR have massive potential in the games market and beyond. For many consumers, immersion is a key factor in their enjoyment of games, movies, TV series, and more. Both AR and VR help ground virtual experiences in reality, adding a layer of immersion and interactivity not possible from other types of media.

The consensus about VR game experiences (from consumers and critics) has been generally positive. However, due to the high cost of high-end VR headsets, consumer adoption has been slower than expected. What's more, many high-end devices, such as the HTC Vive and Oculus Rift, require the user to own a games console or high-spec PC in addition to the headset itself. However, powerful standalone VR headsets, such as the Oculus Quest, are starting to hit the market. Mobile also has a big part to play in this development, as these standalone headsets are powered by mobile tech.

## AR HAS MORE POTENTIAL FOR MAINSTREAM SUCCESS

While VR's gaming potential will come from immersive experiences that core gamers typically enjoy, AR has far more potential for mainstream success—especially on mobile. In November 2018, we conducted research on the online population in the U.S. Of the people we surveyed who have played AR games more than once, 53% play on mobile. Meanwhile, only 28% of those who play VR games play on mobile. What's more, due to mobile's large installed base, it is far easier for AR to catch on. This is exemplified by the meteoric rise of AR phenomenon Pokémon GO. Once again, gaming was first in line to introduce the tech to consumers.

What's more, both Apple and Google are doubling down on their respective AR platforms, laying down the foundations for the imminent golden age of AR on mobile. It is not unreasonable to think that AR will one day be as important to consumers as smartphones themselves—and all this will be fueled by innovations within the mobile market.

# VR AND AR IN THE 2019 CONSUMER ELECTRONICS SHOW

This year's event was packed with announcements related to VR and AR technologies

**What is CES?** CES (Consumer Electronics Show) is the world's largest technology event, held every year in Las Vegas. Up until the 2019 edition, CES was dominated by the Internet of things (IoT), increasingly larger TV screens, and everything related consumer robotics. However, the 2019 edition in early January featured an impressively high number of VR- and AR-related announcements.

## HTC VIVE ANNOUNCEMENTS

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**Two new VR headsets:** Vive Pro Eye, which turns eye tracking into a core feature, and Vive Cosmos, an "easy-to-set-up" device. More details will emerge in the coming months.

**A new subscription service:** Viveport Infinity, which gives users access to the entire Viveport game catalog for a monthly fee.

**The Vive Reality System:** HTC Vive's take on VR in-game interfaces.

**Partnerships** with Mozilla, for a new Virtual Reality Web Browser, and Amazon Sumerian, to support developers building VR-optimized websites.

## OTHER VR NEWS

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**Qualcomm** announced its first VR headset, stating that the device will set the standard for the VR headset market. Qualcomm claims the headset will have double the pixel count of the Vive Pro.

**Pimax's** 8K VR headset is the result of a successful Kickstarter campaign. At CES, the company revealed the headset was ready to ship after missing its 2018 release goal.

**Pico** also announced a new standalone headset: the Pico Goblin 2 4K.

**3dRudder** is the first officially licensed foot-motion controller for PSVR, enabling players to move by tilting, spinning, or applying pressure with their feet—all while seated.

## AR NEWS

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**Nreal** revealed its own AR glasses: Light. These glasses will weigh less than 100g and can be connected to a wireless controller and a separate dedicated computing unit.


**Rokid** used Fortnite Mobile to demo its new Project Aurora AR glasses. The glasses will utilize the computing power of mobile devices via a USB-C connection.

**Realmax's** Qian is a standalone AR headset boasting an impressive 100.8-degree field of view. It can also be used as a VR headset.



## 2. VIRTUAL REALITY

The landscape and consumer  
experience



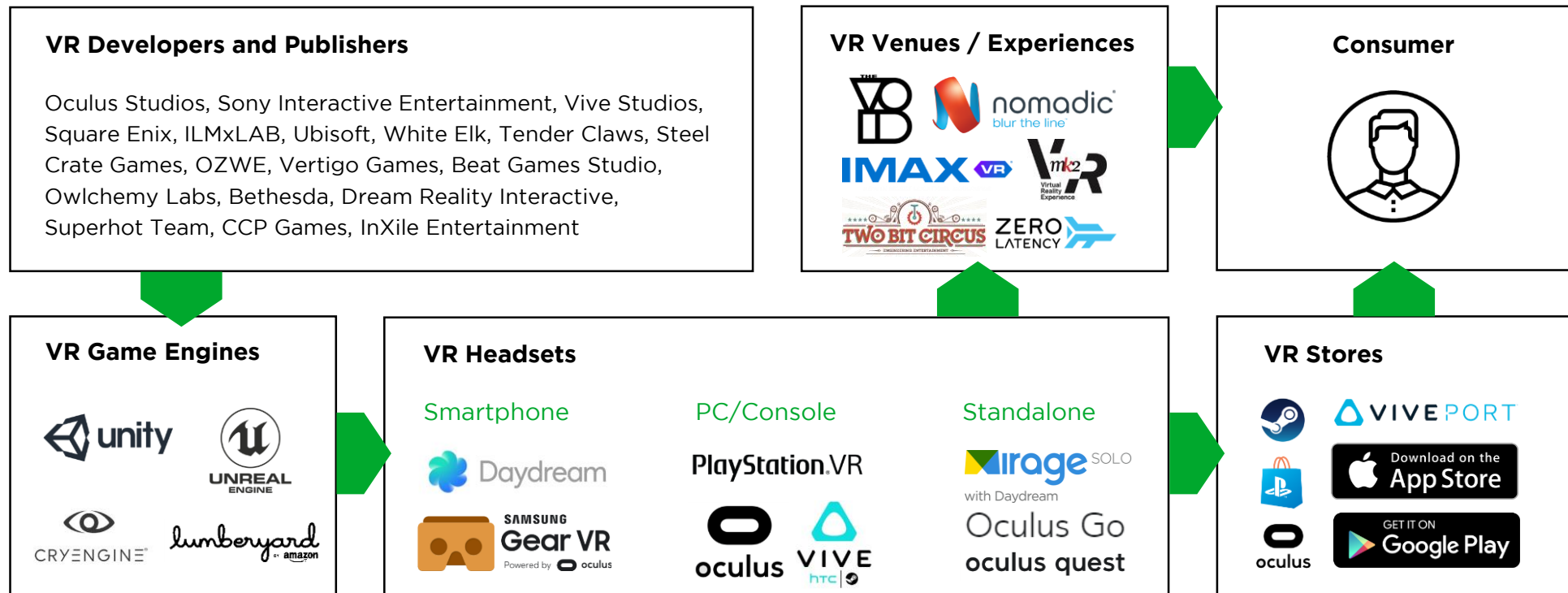
“As the dust settles after the initial storm created by VR, AR is rising and of huge value to the top-tier tech companies—watch this space. Who can resist the temptation of releasing mass-market eyewear with the tagline “2020 vision”? As for VR, the consumer base is steadily growing. I believe the tipping point will be when we have enough users for significant concurrency so that online play is available to everyone.”

Dave Ranyard, CEO Dream Reality Interactive

# THE VR LANDSCAPE: MAIN PLAYERS AND PLATFORMS

## THE VR LANDSCAPE SHARES SIMILARITIES WITH TRADITIONAL GAMES

The home VR experience requires the purchase of both headset (e.g., Oculus, Daydream), hardware (e.g., PC, VR-capable smartphone), and content (e.g., Superhot) via the associated platform (e.g., Oculus store). VR headset makers are heavily involved in publishing content, as seen with Oculus Studios and Vive Studios. The primary VR game engines are the same in the traditional game world; Unity and Unreal. 360° cameras are also used to create VR content (e.g., Insta360). Outside the home, VR experiences are found at arcade-style venues such as The Void, with exclusive content from media partnerships. Note that Apple's App Store is primarily responsible for passive video VR experiences.



# UNDERSTANDING CONTENT CREATION IN XR

## FOR GAME DEVELOPMENT AND BEYOND

Creating VR worlds uses the same fundamental game engines used to make normal games—primarily Unity, Unreal, and CryEngine—though the support varies per platform. 3D modeling can also be done with the same toolsets used for other media, chiefly 3ds Max and Maya. However, this is not the only way to make content for VR; there are multiple creator platforms that aim to make VR creation more accessible, such as InstaVR or VeeR Experience, which don't require any coding knowledge.

The fastest way to create VR content is via a 360° camera, such as one from Insta360, GoPro, or Kodak. The video can then be edited with software and options are available for both iOS/Android and desktop. Again, the primary video editing tools for desktop are similar to traditional media: Adobe Premiere Pro, Final Cut Pro. However, there are also a number of mobile options for video editing, such as VeeR, V360, and Theta+.

For AR, the standard engines are used for 3D object creation, along with an AR toolkit plugin, such as ARCore, ARkit, or Vuforia (built in with Unity), depending on the target platform. Developers can choose to create a marker-based application, which uses image recognition to identify “markers” in the real world to show AR content, or a location-based application, which uses the phone's internal sensors like GPS to trigger the augmented reality.

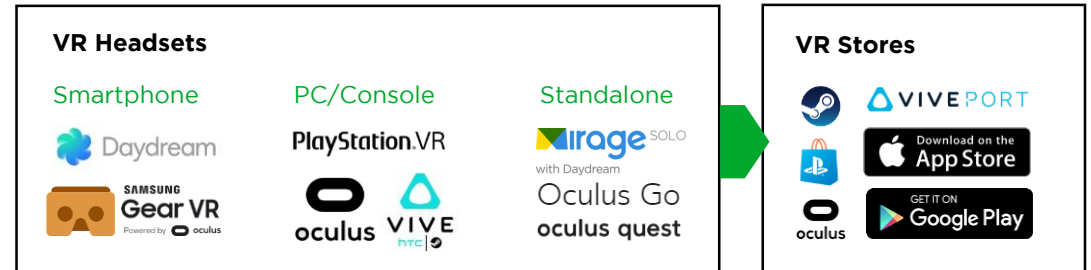
While the creation of 3D assets may be familiar to game developers, there are a host of new challenges to overcome, primarily in VR. These include not only new design challenges (e.g., no longer being able to direct the user's POV in VR), but also stricter technical requirements around latency/lag, the possibility of user nausea, user interaction/feedback from the real world, movement tracking, video quality, resolution, etc.

VR movies have similar conceptual challenges—what does a narrative look like when the viewer's attention can shift at any time to any place?

# VR: A MIX OF PLATFORMS AND DISTRIBUTION CHANNELS

## THERE ARE MANY WAYS TO PLAY VR GAMES

First, a consumer has to choose between multiple VR headsets. Depending on the choice, the cost of the headset alone ranges in price from \$129 to \$499. The more expensive headsets also require more elaborate PC hardware, with a set-up for the HTC Vive Pro easily costing more than \$1,000. Next, the consumer has to find content to use and games to play. Some headsets are locked into a specific platform (Oculus, Daydream, and PlaystationVR), while others are compatible with multiple stores. Steam has the biggest library of VR software and is particularly catered to games. The mobile headsets (Daydream, Oculus Go, and Gear VR) are more frequently used for video and more passive interactive experiences.



## AN OVERVIEW OF VR HEADSETS | KEY METRICS AND SHARE OF APPS THAT ARE GAMES

HEADSET	MANUFACTURER	SEGMENT	COST	REQUIREMENTS	COMPATIBLE WITH STORES	GAME APPS (%)	NON-GAME APPS	TOTAL*
Go	Oculus	All-in-one	\$199	Smartphone required for setup only	<b>Oculus Store</b>	690 (68%)	319	1,009
Rift	Oculus	PC	\$399	PC (>\$800)	Oculus Store, <b>Steam</b>	2,014 (93%)	151	2,165
Vive	HTC	PC	\$499	PC (>\$800)	<b>Steam</b> , Viveport	2,945 (93%)	230	3,175
Vive Pro	HTC	PC	\$799	Advanced PC/Laptop (>\$1,000)	Steam, <b>Viveport</b>	270 (61%)	176	446
Daydream	Google	Mobile	\$99	Compatible Android Phone (\$600-\$1000)	<b>Play Store</b>	256 (62%)	160	416
Gear VR	Oculus/Samsung	Mobile	\$130	Compatible Android Phone (\$600-\$1000)	<b>Oculus Store</b>	741 (69%)	333	1,074
PlayStationVR	PlayStation	Console	\$299	Playstation 4 (\$200-\$400)	<b>PlayStation Network</b>	358 (87%)	52	410

\*The store in bold serves as the base for the number of games and apps in the respective columns.  
 Source: Oculus, Steam, Play Store, Wikipedia



# 28%

of people we surveyed  
in the U.S. have  
experienced VR in the  
past six months.

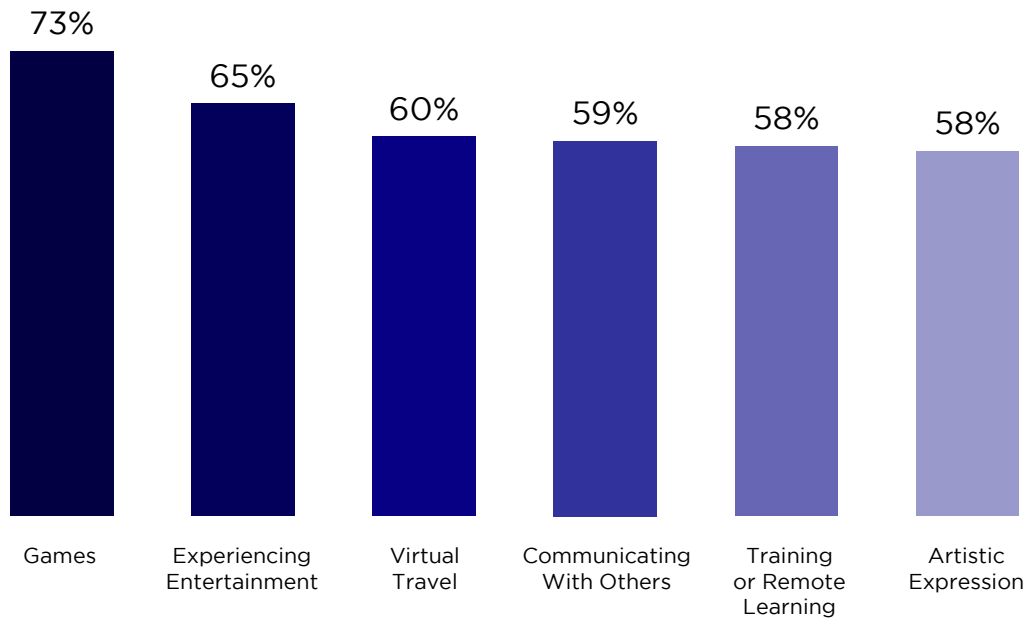
Source: Research conducted among the online  
population in the U.S. (2,521 people) in Nov 2018



# GAMING IS THE MOST COMMON USE OF VIRTUAL REALITY

Based on those surveyed in the U.S. who have used VR in the last six months

## MOST COMMON WAYS PEOPLE HAVE USED VR



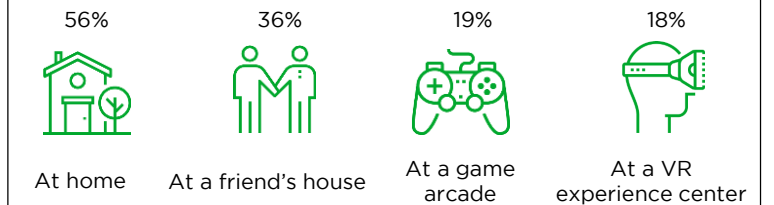
# 73%

of the Americans we surveyed who experienced VR in the past six months used it to play games.

Many use a VR headset to experience entertainment (65%), travel virtually (60%), and communicate with others (59%). Around 13% of VR users play VR games five times per week or more.

Social VR experiences/games include Facebook Spaces, Sansar, Rec Room, Playroom VR (free with PSVR), and Star Trek: Bridge Crew.

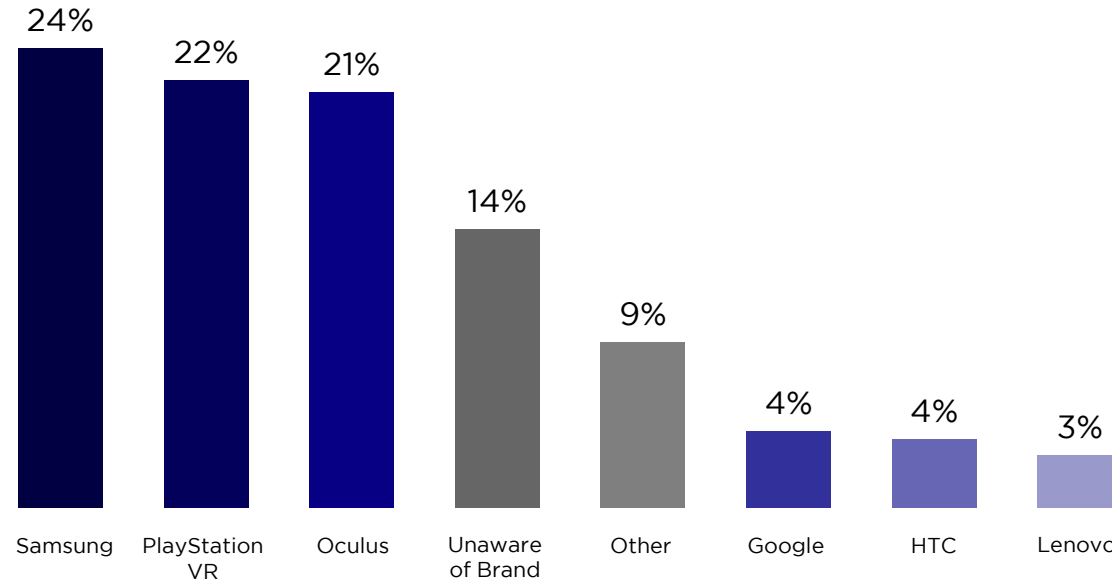
## WHERE PEOPLE HAVE EXPERIENCED VR



# SAMSUNG IS THE MOST-OWNED VR BRAND

Based on those surveyed in the U.S. who own a VR headset

## BRANDS OWNED TO USE VR



**17%**

of the people we surveyed in the U.S. own a VR headset.

Almost a quarter (24%) of VR owners own a headset made by Samsung, making it the most popular VR brand. PlayStation VR (22%) and Oculus (21%) are the #2 and #3 brands, respectively. Of VR owners, 14% are unaware of their headset's brand.



# 76%

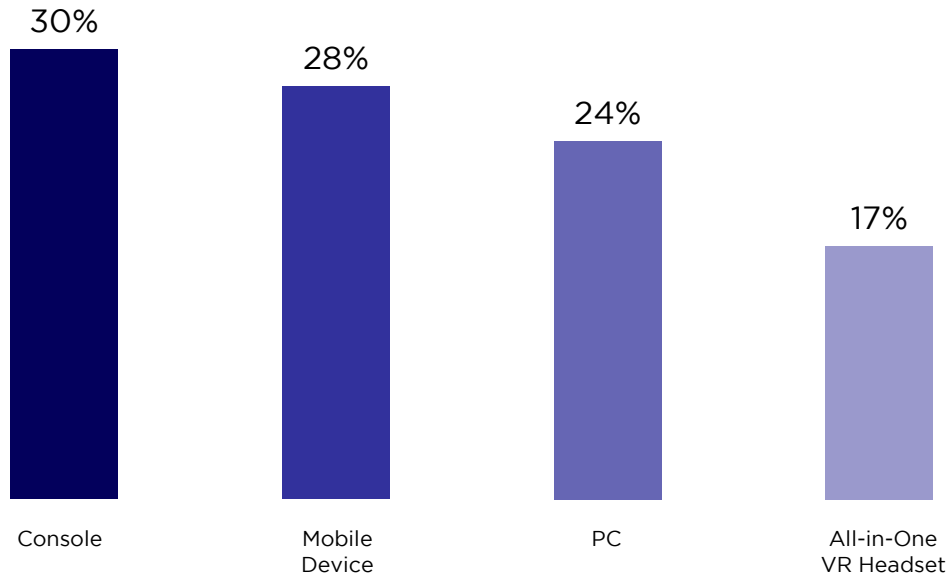
of the U.S. gamers we surveyed have used VR to **play games** more than once.

Source: Research conducted among the online population in the U.S. (2,521 people) in Nov 2018

# CONSOLE IS THE MOST-USED PLATFORM FOR VR GAMING

Based on people in the U.S. who play VR games at least once a month

## PLATFORMS USED TO PLAY VR GAMES



# 30%

of VR gamers we surveyed (gamers who play VR games at least once a month) play on a console, 28% play on a mobile device, and 24% play on a PC.

Seventeen percent play on a standalone VR headset, such as Oculus Go or Lenovo Mirage.

## VR NET PROMOTER SCORE\*



\*The willingness to recommend something to others

# FEATURED VIRTUAL REALITY GAMES



## **Virtual Virtual Reality**

**Platforms:** Vive, Oculus Rift, Oculus Go, Gear VR, and Daydream

**Launch Date:** March 2017

**Publisher:** Tender Claws (Independent)

**HQ:** Los Angeles, USA



Tender Claws' Virtual Virtual Reality takes place in the far future. The player takes control of a newly hired employee in a company at an AI company. As the player performs tasks, a darker side of the company and the game universe is uncovered. One of the most successful mobile VR games, it is often compared to Valve's beloved Portal series and has earned several distinctions.



## **End Space**

**Platforms:** Gear VR, PSVR, Oculus Rift, Vive, and Oculus Go

**Launch Date:** April 2016

**Publisher:** Orange Bridge Studios (Independent)

**HQ:** Nelson, BC, USA

Space-combat VR game End Space is an interesting VR case study, highlighting how a successful VR game can make its way to several platforms. The original version was developed for the Google Cardboard, acting as a proof-of-concept. After initial success, the game was renamed and launched exclusively on Gear VR. Due to popular demand, the game was subsequently launched on more platforms, including PSVR and Oculus.

# 360° VIDEO WILL CONTINUE TO GROW ALONGSIDE VR

Get a front-row seat to every concert or travel the world from the comfort of your own home



## National Geographic

### Viewing Platforms:

YouTube (multi-platform)

**HQ:** Washington, DC, USA



Using a Vuze VR camera, astronaut Paolo Nespoli filmed the first 360° video in space aboard the International Space Station. National Geographic has released a number of 360° videos available to view via YouTube, most recently a series called “The Okavango Experience” charting a course in the Botswana wilderness.



## LiveXLive

### Viewing Platforms:

SamsungVR Video app,  
Samsung GearVR

**HQ:** Los Angeles, USA



LiveXLive Media, Inc. delivers live-streamed and recorded experiences from top music festivals and concerts, such as EDC Las Vegas. It announced a 360° video to be streamed for the Rolling Loud concert in December 2018, viewable via Samsung VR.

# PC AND CONSOLE ARE THE FUTURE OF VR GAMING

## VR AND GAMING: A MATCH MADE IN HEAVEN

Gaming and VR are a great fit. After all, 3D environments have been the mainstay of the games industry since the late-90s. Many of the biggest games are played from a first-person perspective, including Call of Duty, Skyrim, Overwatch, and more. Consequently, many existing titles can be adapted for VR, as seen with Doom, Fallout 4, Skyrim, and Borderlands 2. What's more, franchises that were traditionally played from a third-person perspective, including Grand Theft Auto and Resident Evil, now feature first-person options. VR can make games more immersive. Horror games compatible with VR, such as Resident Evil 7, make the player feel like they are actually *inside* the game's world, heightening the experience. The same goes for fast-paced action games (Superhot), exploration-focused titles (Skyrim VR), and games with artistic visuals (Tetris Effect).

Consumers who have already tried high-end VR have reacted positively, which is backed up by VR titles' overwhelmingly positive user reviews on Steam. The last year, in particular, has seen critics lauding VR experiences, especially PSVR's Tetris Effect and Astrobot. The more consumers are exposed to the technology, the better chance it has of catching on. Similarly, many who are on the fence about VR are waiting for the platform's killer app—a must-play game that can only be experienced through VR. Movies have just as much potential as games, but the ideal format for cinematic experiences hasn't been settled on yet.

## THE IDEAL VR HEADSET IS BECOMING A REALITY

With the newest generation of VR headsets, we are already seeing the evolution toward the "ideal" headset in terms of comfort, accessibility, and performance. These headsets will feature inside-out tracking, no wires, full degrees of movement, and high-resolution displays. However, one of the biggest issues for VR games is that players' expectations for VR can exceed the realism found in current AAA games.

High-end VR experiences require a separate headset and expensive hardware to handle the intense processing and power required. Newer all-in-one headsets, such as the Oculus Go and Quest, remove the need for extra hardware and wires compared to the first wave of VR headsets. This comes at the expense of visual quality, which will become less of an issue as mobile processors continue to improve, driven by the gigantic and fast-moving smartphone market. Meanwhile, HTC has hinted that their upcoming Vive Cosmos has cross-platform (PC and mobile) capabilities.

The Void is one experience that comes close to delivering on consumer expectations. This location-based experience combines interactive sets, real-time effects, and the latest VR technology to simulate full immersion. Even though the experience requires the player to visit a physical location, its mechanics are a good indication of the kind of immersion that will be possible with a standalone headset 10 years from now.

# BARRIERS TO GROWTH

What will limit VR's growth in the coming years?

1

## LACK OF SOCIAL VR GAMES

Right now, VR gaming is a solitary experience that is not easy to share with others. However, Facebook envisions that Oculus will one day be a means for its users to virtually “hang out” with one another. There is also the VR version of Second Life, which provides a similar service.

Competitive gaming—as well as headset use among gamers—is becoming more popular, in no small part due to the success of Fortnite. Going forward, VR gaming faces the challenge of making the platform more social.

2

## ACCESSIBILITY

VR headsets are expensive, require a dedicated space, and have a long set-up time. It also takes time to learn how to properly use a VR headset.

Most consumer technology these days are intuitive in that they are easy to pick up and use. VR, on the other hand, is less accessible in this respect.

There are some headsets, like Google Cardboard, that are more accessible, but the platform currently lacks content.

3

## NOT ENOUGH VR CONTENT

Content for VR is currently too limited, with many developers waiting for VR to pick up more steam before they enter into the fray.


Demand for VR game content is less than the demand for console/PC games, as these platforms have a far larger installed base. Big publishers are therefore unlikely to risk investing in a VR game from the ground up. Consumers want content to justify a headset purchase. And the content creators are waiting for a bigger installed base to develop new VR content. Due to this catch-22 situation, innovation is likely to come from smaller studios.





## 3. AUGMENTED REALITY

The landscape and consumer  
experience



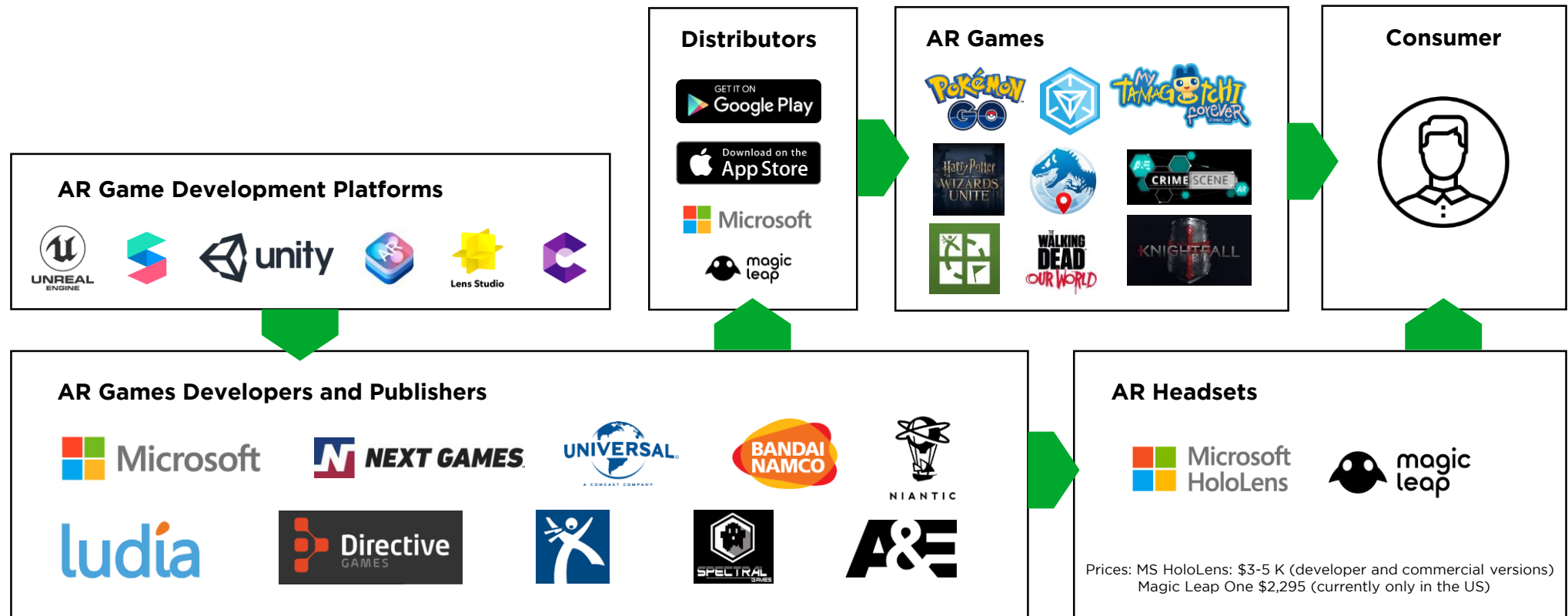
"Augmented reality has the unique possibility of blending our physical environment with the digital world. It allows fictional worlds and other timelines to exist in parallel to our sometimes mundane environment. Games will be at the forefront of exploring and gamifying our close surroundings, completely transforming our daily commutes, walks, and exercise."

Jelle Kooistra, Newzoo Head of Market Analysis

# THE AR LANDSCAPE - MAIN PLAYERS AND PLATFORMS

## THE AR LANDSCAPE PRIMARILY CONVERGES AROUND IOS AND ANDROID GAMES AND APPLICATIONS

For headsets, HoloLens and Magic Leap (coming soon) are the two options with traction, but their high cost positions them as a better fit for enterprise applications. Meanwhile, AR consumer devices are simply AR-capable smartphones. Games or apps with AR features are distributed in the same fashion as traditional apps—via Google Play or the App Store. On the next page, we dive a bit deeper into the AR and VR development platform options.



# AR AND VR DEVELOPMENT PLATFORMS

Unreal and Unity are the gaming standards, but new platforms drive experiences beyond gaming



**HoloLens** and **Magic Leap**, the most notable AR-only headsets, are still in the early tech phases and developers are focusing more on enterprise applications. Recently, HoloLens signed a deal with the U.S. Army to deploy advanced training.



While holding a smaller market share, Epic's **Unreal Engine** is known for being the platform of choice for premium, high-end titles. There is a \$5-million grant fund to reward developers for using Unreal Engine in creative ways, including AR/VR titles.



About 60% of XR games are developed on **Unity** (self-reported), with AR supported by a Vuforia engine. A 2018 Unity questionnaire of emerging game studios revealed that 40% of those surveyed were developing for AR/VR, signaling continued growth.



**ARKit** is Apple's AR development kit and experiences created with it are compatible with any Apple mobile devices running iOS11+ and powered by A9+.



**ARCore** is the Google flavor dev kit, which runs on Android devices with Nougat OS (7.0) or later. Integration with other services, such as Lens and Search, will allow for exciting combinations of AI and AR. ARCore works on at least 80 different devices.



Owned by Facebook, **Spark AR Studio** was renamed from Camera Effects Platform in October 2018. It allows delivery of AR experiences to fans on Facebook and Instagram, mimicking Snapchat's filter feature.



Lens Studio

More than 30% of Snapchat users interact with its AR filters created via **Lens Studio**. Snapchat recently launched Lens Creative Partners program, which pairs AR creators with businesses that want a custom filter.



The platform-agnostic Amazon response to Google's and Apple's kits, **Sumerian** aims to make XR accessible by enabling developers and enterprises to build applications without prior experience. Available as an AWS-hosted service.

# FIRST-PARTY APPLE AND GOOGLE AR APPS

Google has been more prolific than Apple in terms of the number of AR functionalities developed for apps



## Google Playground (a.k.a. AR Stickers):

This camera app features stickers and other ways of digitally interacting with the world, much like Instagram and Snapchat filters. However, going beyond these, it makes smart suggestions as to which elements to use based on what the app observes. It requires ARCore to be installed.



## Google Lens:

This image-recognition mobile app builds upon the older **Google Goggles** app. When the user points a smartphone camera at an object or landmark, the app will identify it. It can also read labels to locate relevant search results and information. It relies on advanced deep-learning algorithms. Initially launched as a Google Pixel-only app, it has since been released on many high-end devices. It is also now integrated into Google Photos and Google Assistant.



## Google Translate:

In 2015, this translation app added a feature allowing users to translate a foreign language using their phone camera. If the user points their phone camera at some real-world foreign text, it appears on screen in a language the user understands. It currently supports around 50 languages.



## Google Maps:

Google recently announced a new feature for its popular Maps application. Soon, when the user scans their surrounding with their camera, the app will pinpoint their location and display virtual directions on their smartphone screen. Especially useful for places that are hard to navigate, this feature is not intended to be used while driving.



## SwiftShot:

Apple developed this app as a proof of concept for how its ARKit 2.0 can be used. It was shown to developers and media during WWDC18. In the game, the player uses a slingshot to destroy virtual constructions. It responds to the player's movements and angle adjustments, which directly affects the game world. The base code has been made available to developers as a sample of the program's capabilities.

# AR'S CURRENT USES ACROSS THE APP STORES

AR as an extra feature versus AR as the way to play

## AUGMENTED REALITY CAN BE FOUND IN ALL KINDS OF APPS

AR is a feature in many apps, from games that bring the digital world into the physical to apps that allow the user to try new glasses before buying them.

More often than not, AR brings an extra feature to an existing app or game. The most notable example is Snapchat, which uses AR to allow users to take unique pictures by overlaying their faces with digital additions. Although the extra feature is well used, it is not the main way to use Snapchat.

In gaming, the most well-known examples do not make use of AR all of the time, but rather in specific gameplay elements. In Pokémon GO, for instance, AR is only used when players are capturing new Pokémon. Even then, it is an optional feature.

Games that use AR fully do exist. The Machines, for instance, has players fight against each other in fully AR-powered arena. The challenge for these games and apps is that, similar to VR, constantly holding a phone in specific positions and moving around can be cumbersome, making extended play sessions more difficult to justify.



**Ikea Place** allows people to see what new furniture looks like in their house before they buy it.



**The New York Times** uses AR to give an interactive experience to featured stories.



**CSR Racing 2** allows players to view their cars in AR.



**Shadows Remain** is a interactive thriller fully based on AR.

# 2,043

apps mention ARCore or ARKit in their description on iOS and Google Play (as of Dec 2018).

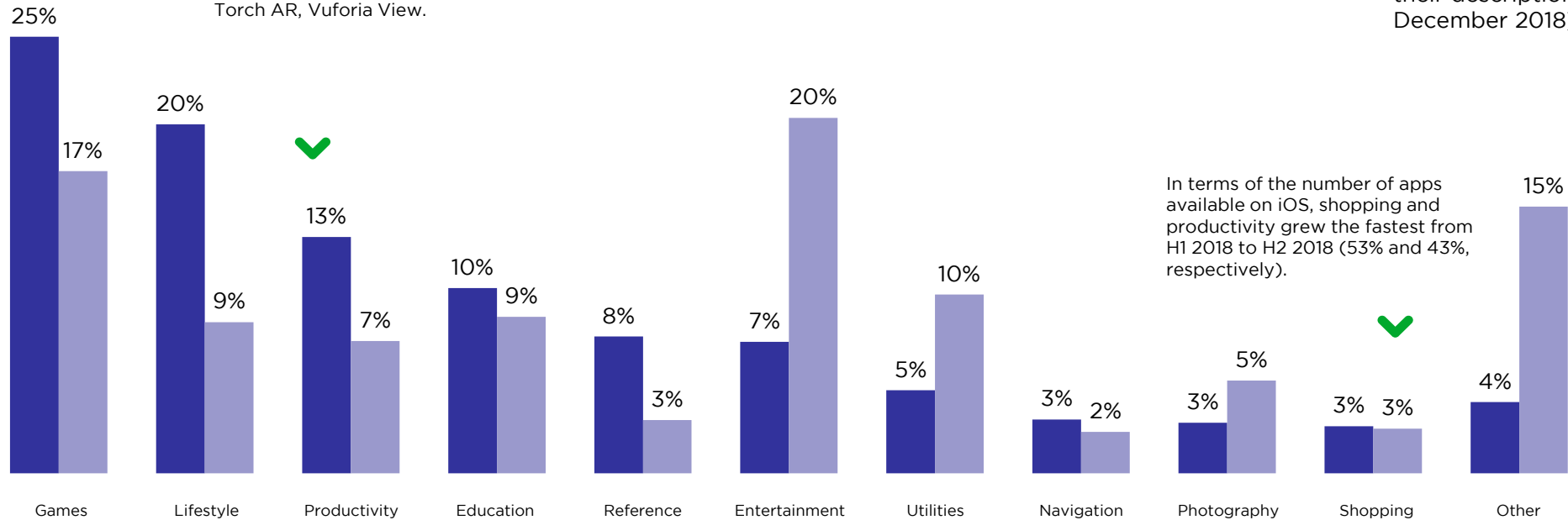
# BREAKDOWN OF TOP AR CATEGORIES | iOS

Based on all of apps that include ARCore or ARKit in their description | App Store | 2018



● Downloads ● Number of apps

Productivity apps are very popular with iOS users. Their main purpose is to help facilitate people's daily life with for example, keeping track of tasks, communicating with others, and accessing and share information.  
Examples: Google Translate, Mind Map AR, AR Plan 3D, AR Ruler, Torch AR, Vuforia View.



**1,035**

apps on the Apple App Store mention ARCore or ARKit in their description (as of December 2018).

In terms of the number of apps available on iOS, shopping and productivity grew the fastest from H1 2018 to H2 2018 (53% and 43%, respectively).

# MOST DOWNLOADED AR APPS ON IOS IN 2018

Based on all of apps that include ARCore or ARKit in their description | App Store



#	APP	PUBLISHER	CATEGORY
1	Night Sky	iCandi Apps	Education
2	Home Design 3D	Anuman	Productivity
3	Dead Island: Survivors	FISHLABS	Games/Strategy
4	My Tamagotchi Forever	BANDAI NAMCO Entertainment Europe	Entertainment
5	Decor Matters: Design & Shop	DecorMatters, Inc.	Games/Family
6	Yahoo! MAP	Yahoo Japan Corp.	Navigation
7	Roomle 3D & AR room planner	Roomle GmbH	Productivity
8	IKEA Place	Inter IKEA Systems B.V.	Shopping
9	家居3D設計DIY - Home Design 3D	Transmedia Creative Lab	Productivity
10	AirMeasure - AR Tape & Ruler	Laan Labs	Entertainment
11	RC Club - AR Motorsports	Abylight S.L.	Entertainment
12	轮回诀-吉香如羿	完美世界游戏	Games/Role Playing
13	Zombie Gunship Revenant AR	Limbic Software	Games/Action
14	PartyNow	Xiamen Meitu Technology Co., Ltd.	Utilities
15	TheParallaxView	Algomystic AB	Entertainment
16	Measure - AR	Shoichiro Takaki	Education
17	Drilla: Idle Gold Miner Game	Oleg Kapitonov	Games/Simulation
18	SketchUp Viewer	Trimble Inc.	Productivity
19	Holo	8i	Entertainment
20	Lightstream Racer	Virtual Arts Limited	Games/Racing



# BREAKDOWN OF TOP AR CATEGORIES | GOOGLE PLAY

Based on all of apps that include ARCore or ARKit in their description | Google Play | 2018

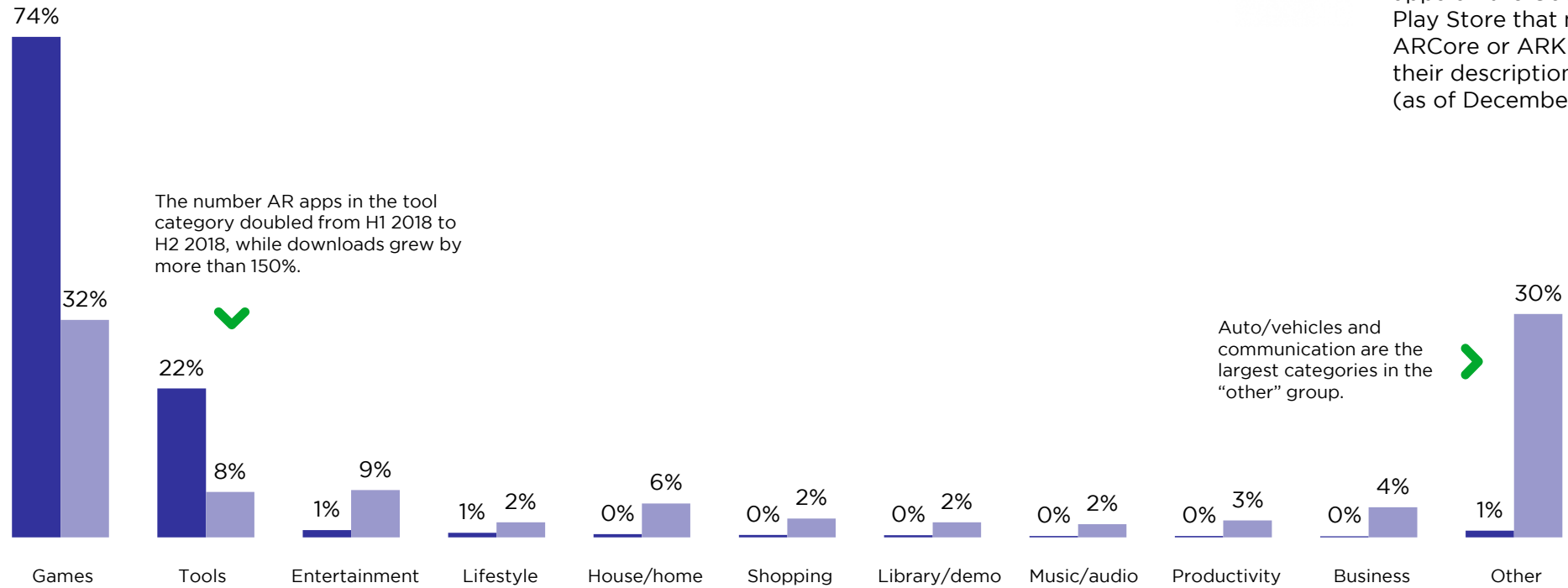


● Downloads ● Number of apps



## 212

apps on the Google Play Store that mention ARCore or ARKit in their description (as of December 2018).



# MOST DOWNLOADED AR APPS ON GOOGLE PLAY IN 2018

Based on all of apps that include ARCore or ARKit in their description | Google Play Store

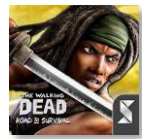


#	APP	PUBLISHER	CATEGORY
1	Guns of Boom - Online PvP Action	Game Insight	Games/Action
2	ARCore by Google	Google	Tools
3	Sky Whale	Nickelodeon	Games/Arcade
4	Ruler App – Camera Tape Measure	Grymala	Tools
5	Egg Inc.	Auxbrain Inc	Games/Simulation
6	聖域對決	JFI Games	Games/Strategy
7	Balanced Tower AR	MASC	Games/Casual
8	Food Network In the Kitchen	Television Food Network G.P.	Lifestyle
9	AR Ruler App – Tape Measure & Camera To Plan	Grymala	Tools
10	Brickscape	5minLab	Games/puzzle
11	IKEA Place	Inter IKEA Systems B.V.	House and home
12	Playground: The Last Jedi	Google	Entertainment
13	Playground: Winter	Google	Entertainment
14	AR Stickers: Blocks	Google	Tools
15	ARCore GR	Giuseppe Romano	Libraries and demo
16	vTime XR: The AR & VR Social Network for Cardboard	vTime	Social
17	Playground: Food	Developed with Google	Entertainment
18	PORORO World - AR Playground	Anipen Inc.	Games/Casual
19	Knightfall™ AR	A&E Television Networks Mobile	Games/Strategy
20	Qlone - 3D Scanning & AR Solution	EyeCue Vision Technologies LTD	Productivity

# HIGHEST REVENUE AR GAMES FEATURE MAINSTREAM IP

Pokémon GO is still king, with almost \$2 billion in total revenue since its release in July 2016

## TOP 3 AR GAMES ON MOBILE BY TOTAL NET REVENUE SINCE RELEASE\*

				
<b>1.</b>	<b>\$748M</b>	<b>\$1.2Bn</b>		<b>Pokémon GO</b> Niantic, Inc.
<b>2.</b>	<b>\$94.2M</b>	<b>\$124.7M</b>		<b>The Walking Dead: Road to Survival</b> Scopely
<b>3.</b>	<b>\$7.7M</b>	<b>\$12.8M</b>		<b>Jurassic World Alive</b> Ludia

# LARGEST INVESTMENTS IN AR COMPANIES IN 2018

Deal Value	Target	Date	Investor(s)	Comments
\$1,250M	<b>Epic Games</b>	Oct 2018	KKR, ICONIQ Capital, Smash Ventures, aXiomatic, Vulcan Capital, Kleiner Perkins, and Lightspeed Venture Partners	Although the main focus of this investment is likely Epic's Fortnite, the company is also the owner of the Unreal Engine, which competes as a leading development platform for AR apps.
>\$460M	<b>Magic Leap</b>	March 2018	Saudi Arabia's Public Investment Fund (PIF)	This AR unicorn has raised more than \$2.3 billion in total, not including AT&T's strategic investment (an undisclosed amount) raised from Series D funding.
\$200M	<b>Niantic</b>	Dec 2018	IVP, Samsung Electronics, and aXiomatic Gaming	This investment spanned from Niantic's renowned location-based AR games and the development of its new AR cloud platform, the Niantic Real World Platform.
\$100M	<b>Rokid</b>	Jan 2018	Temasek Holdings, Credit Suisse, IDG Capital, and CDIB Capital	This investment followed Rokid's CES 2018 announcement about the company's new consumer-centric smartglasses, Rokid Glass. It will help the company expand into the U.S. market.
\$80M	<b>WayRay</b>	Sept 2018	Porsche, Hyundai, Alibaba Group, China Merchants Capital, JVCKENWOOD, and a consortium of sovereign wealth funds, which includes interests from Russia, Japan, Saudi Arabia, Kuwait, the United Arab Emirates, and Bahrain.	WayRay is an automotive AR display maker.
\$50M	<b>Mojo Vision</b>	Nov 2018	Shanda Group, Khosla Ventures, NEA, Fusion Fund, Liberty Global Ventures, 8VC, Dolby Family Ventures, AME Cloud Ventures, and Open Field Capital	The company has promised hands-free AR that does not require a smartphone, tablet, or other device. It is powered by Mojo Vision's innovative "invisible computing" technology.

>\$6Bn

Total amount raised by startups in the AR/VR business in 2018.



# 25%

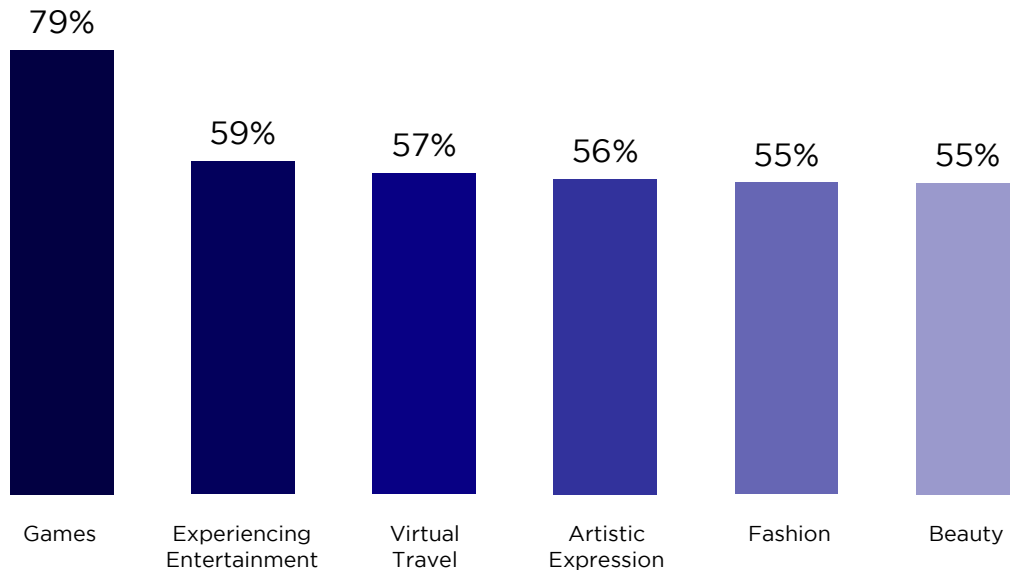
of Americans we surveyed have experienced AR in the past six months.

Source: Research conducted among the online population in the U.S. (2,521 people) in Nov 2018

# GAMING IS THE MOST COMMON USE OF AUGMENTED REALITY

Based on those surveyed in the U.S. who have used AR in the last six months

## MOST COMMON WAYS PEOPLE HAVE USED AR



**79%** of Americans we surveyed who have experienced AR in the past six months used it to play games.

AR users also use the technology for experiencing entertainment (59%), virtual travel (57%), and artistic expression (56%). Almost a fifth (19%) of people play AR games on one or two days a week.

## AR WEARABLES

42%



Share that is aware of them

61%

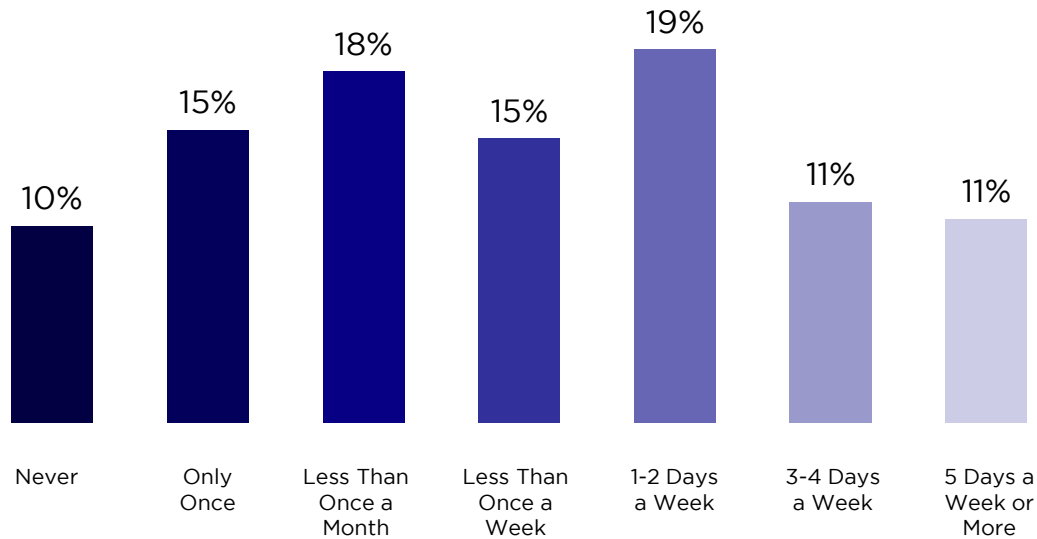


Share that would consider using them

# 56% USE AR-BASED APPS MORE THAN ONCE A MONTH

Based on those surveyed in the U.S. who have used AR at least once a month in the past six months

## FREQUENCY USING AR-BASED APPS ON SMARTPHONE

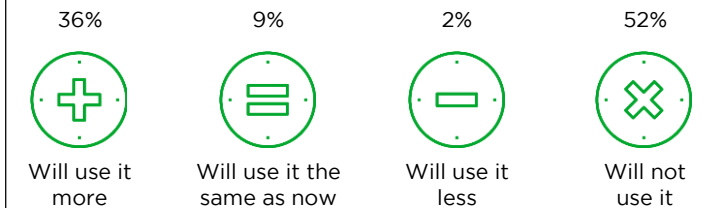


# 90%

of AR users in the U.S. who we surveyed use AR-based smartphone apps.

Of those who used AR once or more in the past six months, 19% used AR smartphone apps on one or two days per week, while 11% used them on five days a week or more.

## HOW WILL YOUR AR USE LOOK IN THE FUTURE?





# 81%

of U.S. gamers we surveyed have used AR to play games more than once.

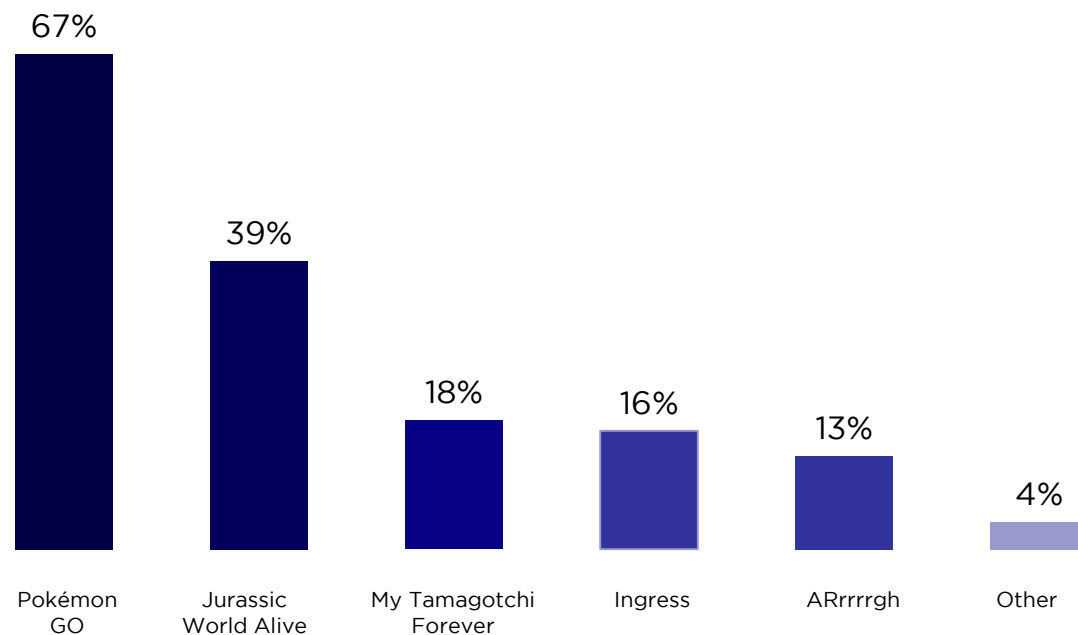
Source: Research conducted among the online population in the U.S. (2,521 people) in Nov 2018



# OVER ONE-THIRD OF AR GAMERS PLAYED POKÉMON GO

Based on those surveyed in the U.S. who have played AR games more than once

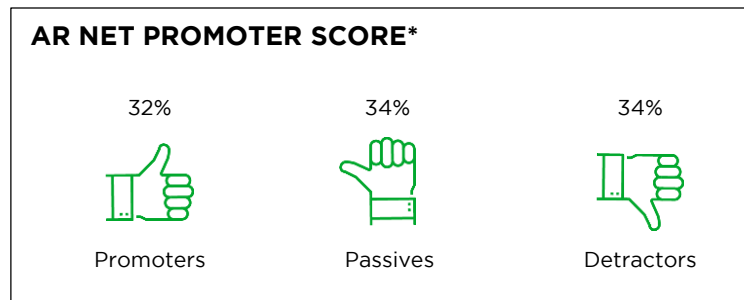
## MOST COMMON AR GAMES PLAYED



# 67%

of the AR gamers we surveyed (those who play AR games more than once a month) have played Pokémon GO.

39% have played Jurassic World Alive, while 18% have played My Tamagotchi Forever.



\*The willingness to recommend something to others

# FEATURED AUGMENTED REALITY GAMES ON MOBILE



## Pokémon GO

**Platforms:** iOS, Android  
**Launch Date:** July 2016  
**Publisher:** Niantic  
**HQ:** San Francisco, USA

Pokémon GO is one of the most successful mobile games ever released. It consists of an AR game in which players roam the real world in search of the virtual fictional creatures of the Pokémon universe. In June 2018, a new patch that introduced several social features brought the game back into the spotlight. Moreover, the franchise is set to continue growing, following the release of Pokémon: Let's Go, Pikachu! and Let's Go, Eevee! for Nintendo Switch.



Game App worldwide in Q3 2018 in terms of revenue generated



## Tendar

**Platforms:** Android  
**Launch Date:** Nov 2018  
**Publisher:** Tender Claws (Independent)  
**HQ:** Los Angeles, USA

Tender Claws' most recent app Tendar is the company's first experiment with AR. It goes beyond merely placing virtual objects on top of real-world surfaces. Instead, Tendar incorporates surrounding objects and people's emotions into the app, which contribute to the development of the main character, a virtual pet fish named Guppy. It is powered by TensorFlow, an open-source, machine-learning framework, and Google's ARCore.



"IndieCade 2018"  
Winner: *Innovation in Interaction*



# MOBILE INTRODUCED THE WORLD TO AR, BUT WHAT'S NEXT?

Boundless potential for game and non-game apps

## **GAMING: JUST THE BEGINNING FOR AR**

Gaming has always allowed players to experience new worlds, environments, and realities, and AR is a new way to enhance them. While combining reality with virtual locations and avatars is aesthetically pleasing, it is not at the core of why many people play games. A key example of this can be found in Pokémon GO's most dedicated players. Everyone began playing the game with the AR functionality turned on, but many players now switch it off, which makes it simpler to catch Pokémon and is less taxing on the smartphone's battery. The key component of Pokémon GO's success wasn't AR. Rather, it was what made the original Pokémon games such a hit: exploration, collecting Pokémon, and—most importantly—sharing the experience with others. Still, mobile gaming has successfully exposed consumers around the globe to the world of AR. Going forward, publishers must utilize AR to enhance their games' core mechanics. It is worth noting that emerging AR technology, such as depth sensors, is required for immersive AR on smartphones to become a reality. Naturally, this impacts short-term adoption, as it would require some users to upgrade their devices.

Outside of gaming, AR's potential is even more promising, and this will be driven by mobile. Eventually, AR technology will be contained within the frames of glasses—something that is becoming increasingly clear thanks to innovations such as HoloLens and Magic Leap. The majority (61%) of people in the U.S. who used AR in the past six months would consider an AR wearable in the future. Therefore, it is not unreasonable to imagine a future in which we cannot live without AR in our day-to-day lives, similar to how smartphones are central to 21<sup>st</sup>-century life. Use cases for AR include on-the-fly translations of text in foreign countries, being on location at a live event and getting real-time text updates, and instant calendar notifications. All of these day-to-day conveniences may not seem like much individually, but together they are more than the sum of their parts. As more and more AR-capable smartphones hit the market, business use cases and the market size will justify the allocation of developer resources to AR. Gaming has historically been at the forefront of new technologies; the first smartphone apps were games, much like the first VR and AR apps were games. But use cases beyond the realm of current possibilities—ones nobody has thought of yet—are coming for non-game and game apps alike. It's just a matter of time.

# BARRIERS TO GROWTH

Potential barriers

1

## AR TECH IS STILL DEVELOPING

AR software development kits are young and are being heavily and continuously updated. This means developers are still learning how to best develop for AR. The key AR platforms are ARKit, ARCore, and Unity. Right now, Android's ARCore is not available on all devices. However, Google is working with smartphone manufacturers to include the functionality on more Android devices.

AR hardware is also still in early-stage development. Magic Leap One: Creator Edition, for example, is a development kit. Meanwhile, Microsoft's HoloLens is currently only intended for developers and businesses. For consumers, true wearable AR glasses are still several years away.

2

## LACK OF INNOVATIVE CONTENT

AR is a means for gamers to interact with their physical environment. Back in 2016, Pokémon GO showed that the platform can give way to a fresh new genre—one that resonated with many consumers, encouraging them to explore their local environments.

More than two years after Pokémon GO's release, gamers are still waiting for AR's next big phenomenon. For the platform to continue to grow, more innovative new game types are required that make AR an integral part of the overall experience.

3

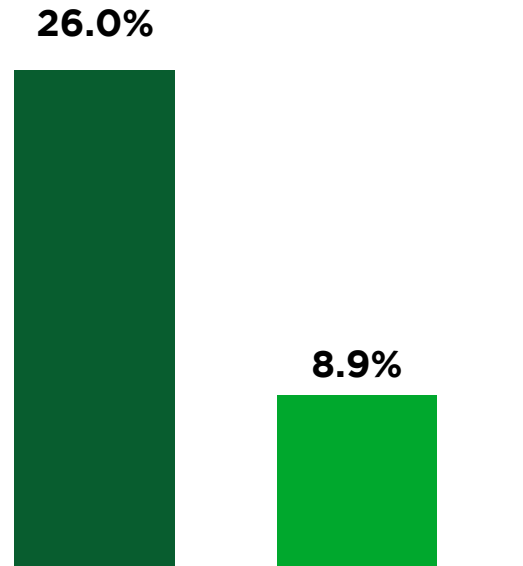
## MONETIZING AR

Monetizing AR is still under exploration and growth, particularly in gaming. But by bringing a game to life in ways not previously possible, AR ultimately enhances consumer engagement in a game and can lead to increased LTV. Developers could create AR game features as part of a "premium" model for users, or try out in-game AR ads (similar to Snapchat Sponsored Lenses). Additionally, developers could partner with retail brands for location-based AR activations.

Retail applications are also experimenting with monetizing AR, such as "try before you buy" features which allow you to visualize products (e.g. see how a pair of new glasses would look).

# AUGMENTED REALITY SUPPORT ON PHONES IS STILL LIMITED

But already vastly exceeds VR



- Phones supporting ARkit & ARCore
- Phones supporting Daydream & GearVR

The high-end VR headsets all require peripherals to enter the virtual space as they are vital to the feeling of immersion. On mobile, while there are plenty of low-cost options to turn your phone into a VR headset (e.g., Google Cardboard), interaction with the environment is limited. Daydream and GearVR are the two of the best immersive smartphone-conversion options with peripherals, but they are available for a smaller piece of the smartphone market; only 9% of smartphones in use are compatible (based on September 2018)\*. However, many new mobile devices released going forward will have AR/VR support.

AR has far higher potential, but support for the official development kits from Apple and Google (ARKit and ARCore, respectively) is still limited. In September, 26% of active devices were able to use either SDK. Google, in particular, has to optimize the kit for specific devices and currently supports a set of more than 100 devices. That might seem reasonable, but there were more than 7,000 Android models in use\*\* in that same time period. However, Google has been steadily adding new device support each month, slowly expanding ARCore's reach within the world's most-used mobile operating system.

\*Cardboard and other third party headsets are not included as they allow access to only a small share of virtual reality content. Oculus Go is also not included as it is platform-agnostic.

\*\*Includes models with at least 1,000 users globally.



## PHONES COMPATIBLE WITH AR AND VR:

### **Fully compatible with Daydream or GearVR (base models):**

Pixel/XL, Nexus 6, Moto Z/Force, Mate 9 Pro, Axon 7, Zenfone 3 Deluxe, SS Galaxy S6, LG V30.

### **Phones supporting ARCore or ARkit (base models):**

iPhone SE, iPhone 6, iPad Pro, iPad 2017, Nexus 5X, Pixel, Nokia 6, Huawei Honor 8x, P20, Mate 20, Nova 3, LG G6, Moto G5S, OnePlus 3T, SS Galaxy A3, SS Galaxy S7, Galaxy Tab S3, Xperia XZ Premium, Vivo NEX A/S, Xiaomi Mi Mix 25, Mi 8.

# CONCLUSION

Though the tech and applications have grown, we are at least 5-10 years away from “peak VR/AR”

VR experiences are still best on high-end PCs/consoles, but power-efficient mobile processors are driving the latest standalone headsets forward. AR has broader potential than VR, though content shortages affect both.

For the next few years, the most compelling VR experiences will be largely found on PC and console, where there is already a proven appetite for immersive experiences. Many PC/console VR titles released in the past year—including Tetris Effect, Astrobot, and Beat Saber—were acclaimed by critics and consumers alike. VR ports of already-established games, including Fallout, LA Noire, and Hell Blade, have also been well-received. However, the latest models of standalone VR headsets are enabled by mobile processors, which optimize power efficiency and performance-per-watt.

AR, powered by the same mobile processors, has lower requirements for entry and sees wider use cases outside of immersive entertainment (though Pokémon GO and Snapchat filters remain the biggest success stories). Most smartphones are already equipped to handle AR games and experiences, and due to the larger installed base, many traditionally VR-focused companies are even shifting their focus to AR.

One such company is Jaunt, one of VR’s earliest proponents. In October 2018, Jaunt announced that it was restructuring the company toward AR. Dream Reality Interactive, founded as a VR company in 2016, also changed its focus and now works on AR, VR, and AI projects. In 2017, developer Tender Claws released VR game Virtual Virtual Reality, while its 2018 game (tendAR) was powered by AR.

AR-capable devices are abundant, but the content offering is still sparse, with many games leveraging features similar to those popularized by Pokémon GO in 2016. The next killer mobile app could be Niantic’s next release, Harry Potter: Wizards Unite, which is launching in 2019. The title, also based on a huge franchise, ticks many of the boxes that make Pokémon GO such a success. Outside of gaming, the next AR push may come from Facebook, where Spark AR allows AR content to be distributed to the massive userbases on Instagram and Facebook. Either way, we are still in the early stages of fulfilling the potential of both platforms.

# THE NEW REALITY FOR MOBILE GAMING

The VR/AR Opportunity

