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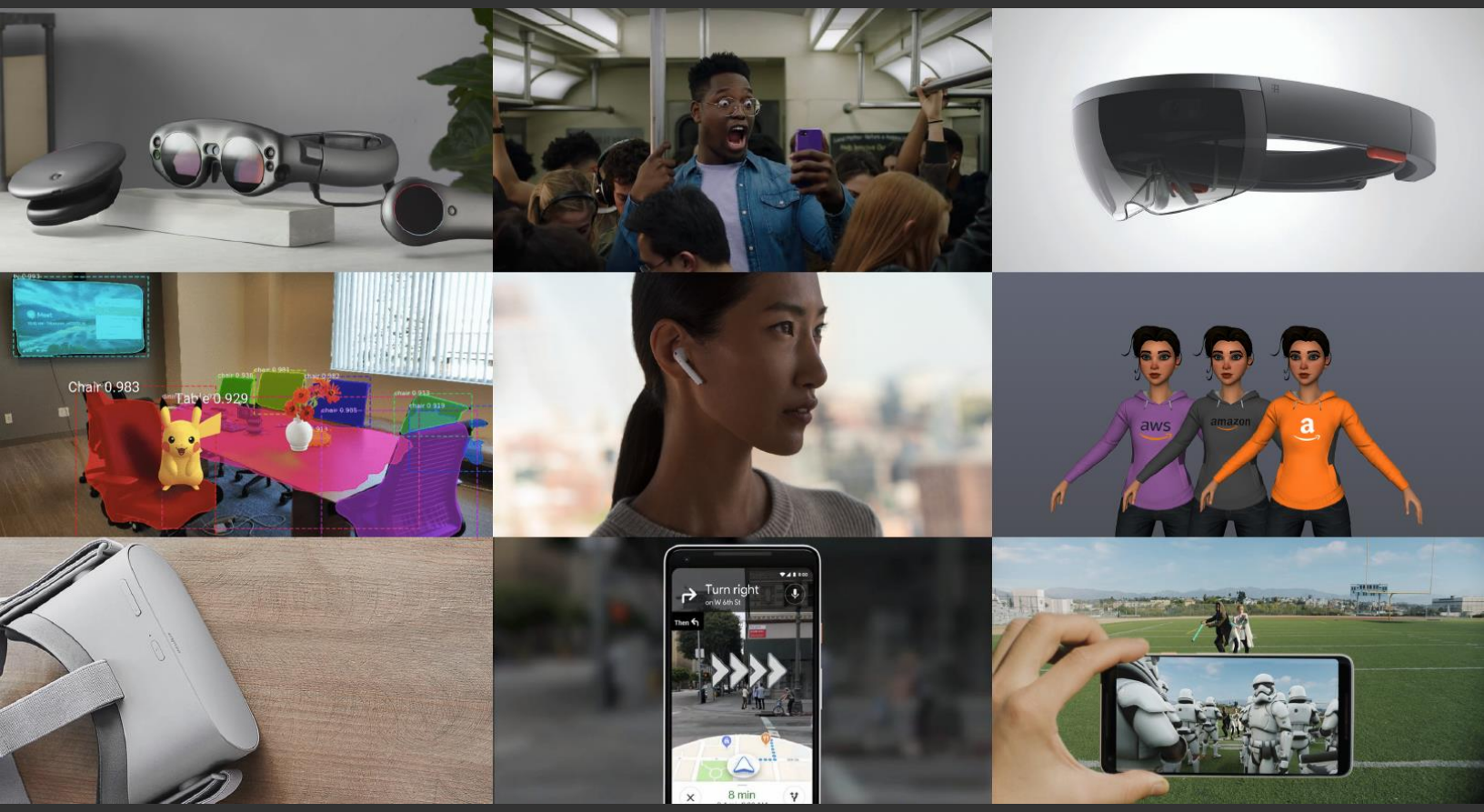

ARTILLRY INTELLIGENCE BRIEFING

AR BUSINESS MODELS: THE TOP OF THE FOOD CHAIN, PART I

SEPTEMBER 2018

ARtillry

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Executive Summary

One of the factors that gives us confidence in the future of AR and VR (collectively XR) is the amount of investment being made by influential tech giants. That includes most of the major platforms and more notably, tech's "four horsemen." This group consists of Apple, Google, Facebook and Amazon.

But an important question is "why?" What are their motivations? The answer is different for each of these players, but one theme persists: They're each motivated to protect or grow core businesses. And they're finding ways that XR – especially AR in the near term – accomplishes that goal.

For example, Google has a vested interest AR-based visual search to boost monetizable search query volume. Facebook wants to keep us in its walled garden through visually-immersive content sharing like AR camera effects. It also sees VR as a prominent future modality for social interaction.

Similarly, Apple wants to make iPhones — where it makes most of its money — more attractive through AR apps and features. And Amazon has AR features that let shoppers visualize products in-home to boost e-commerce and reduce returns. It's all about more informed purchases through AR.

Why is all of this important? Answering the question of "why" can inform the "what" and "how," which have implications for the rest of us. Knowing where these players are headed and what their motivations are can help XR startups and investors align their strategies and product road maps.

With those strategic implications in mind, we set out to analyze and unpack the XR moves of tech's biggest players. In addition to those mentioned above, we'll cover key influencers such as Snap, Niantic and Microsoft. The end goal is a clearer picture of the top of XR's food chain.

In order to maintain focus, the scope of this report is primarily AR, and within consumer contexts. VR's has a different place on the immersive computing spectrum and a longer-term horizon to consumer scale. Still, we'll touch upon VR as it relates to tech giant investments and implications.

The following pages will examine these tech leaders' XR ambitions and actions, one by one. For each, we'll look at what they've done recently and where they're pointing next. More importantly, what does it mean for you, and what clues does it provide for XR opportunity spotting?

We'll start with Google and Apple in this first installment, followed next month by Facebook, Amazon and others.

Key Takeaways

Key takeaways are also highlighted throughout the main body of this report.

- XR's trajectory can be examined through the lens of tech giants' investments and initiatives
  - Further, examining their motivating factors can inform their directions and larger market trends.

- A common thread is to protect or pave the way for the future of their core businesses.
  - Google is all about visual search to cement search's position in an immersive computing era.
  - Apple wants to make iPhones sexy again, and seed content for an upcoming smart glasses era.
  - Facebook wants to keep us in its walled garden longer, with compelling and immersive multimedia.
  - Amazon wants AR product visualization to boost e-commerce and decrease returns.
  - Microsoft, Magic Leap, Niantic and Snapchat similarly position AR to drive future revenues.

- Starting with Google, AR is a natural extension of search, triggered through the camera versus text.
  - Visual search can boost query volume and quality, given commercial and proximity-based intent.
  - Offline/Local commerce is driven by proximity and mobile influence, both of which align with AR.
  - VPS can influence last-mile (in-store) consumer behavior including trackable advertiser ROI.
  - Google mapping assets and imagery will support the AR cloud's optical and mapping needs.
  - Google supports social AR (network effect, viral growth) through multi-player support in ARCore.
  - All of these products are millennial-friendly (camera based) which cultivates future affinities.

- Apple sees several ways that AR will boost core revenue streams and developing ones.
  - Though maturing iPhone growth compels it to diversify into services, hardware remains core.
  - In the short term, Apple needs to find ways to make the iPhone sexy again and boost sales.
  - It also has the potential for app store revenue from AR premium apps and in-app purchases.
  - In the long term, iPhone-based AR is cultivating users and developers for a glasses-dominant era.
  - AR Glasses (again hardware) will be a horse that Apple bets on as a post-iPhone flagship.
  - To avoid past wearable device fails (Snap Spectacles, Google Glass), it must sell the world on AR.
  - That will happen in the near term with mobile AR experiences (users) and app training (developers).
  - Apple has 2-3 years to cultivate those two constituencies to pave the way for its next cash cow.
  - Meanwhile, in addition to mobile, audible AR (via AirPods) could be another revenue-generator.

- Google and Apple's divergent AR paths represent the latest iteration of the longstanding OS wars.
  - Google's web-based DNA drives its support of WebXR as a delivery vehicle for AR experiences.
  - Apple's app orientation drives its App Store structure for an AR marketplace.
  - Apple's dominance of the smartphone era positions apps as the heir apparent modality for AR.
  - But several signals indicate that apps will be an inferior vessel for AR, due to download friction.
  - Apps & web will coexist, as in the smartphone era, but WebXR could have a greater standing in AR.
  - Consumer & developer adoption of each will determine Apple and Google's fate in the AR era.

- Beyond Apple & Google, Facebook and Amazon loom large in their AR potential (next installment).

Introduction: Follow the Leader

What are the leaders in today's technological landscape doing in AR & VR (collectively, XR)? More importantly, what does this mosaic of investment and innovation tell us about the trajectory and velocity of immersive computing? There are patterns and strategic takeaways materializing.

One place to start such an analysis is with the simple yet multi-dimensional question of "Why?" In other words what are the motivating factors that drive deep-pocketed tech giants to chase XR ambitions? Answering that question can reveal insights about aligning with XR market trajectory.

The answer to that question interestingly differs for most major tech companies. But on another level, the answers for each are similar. When looking at tech's "four horsemen," for example, each has XR motivations to protect or grow their core businesses and primary revenue streams.

For Google, it's all about search. Its "version" of AR is visual search such as Google Lens and Visual Positioning Service (VPS), which boost search query volume, albeit visually instead of text-based. This positions the increasingly popular and millennial-favorite smartphone camera as a search input.

Consider Facebook's core business: Its primary ad revenue correlates to the time we spend in its walled garden. So AR is a means to keep us in that environment longer through more compelling – and advertising-conducive – content to share with friends. Its "version" of AR is Camera Effects.

On to Apple, though it's increasingly diversifying into software and services, its core business is selling hardware. So most moves it makes are to make iThings more attractive to consumers. AR is no exception, as more immersive and visually-compelling apps, via ARkit, make iPhones sexy again.

The fourth horsemen, Amazon, is likewise making big XR moves, though perhaps the most shrouded in mystery. Its AR product visualization features engender more informed shoppers who buy more and return less: big factors for the margin-obsessed giant. And its Sumerian platform looms large.

And it doesn't end with the four horsemen. Microsoft, which could justifiably be a horseman, is making big moves in enterprise AR (Hololens) and consumer VR (Windows Mixed Reality). Snapchat is an early mover in mobile AR, as is Niantic which is in the midst of an ambitious AR platform play.

Altogether, this landscape has discernable patterns when viewed at different focal ranges. Our goal in the following pages is to do just that. We'll examine each of these players up close and by zooming out to examine macro-trends. The goal is a more informed perspective of the landscape.

In this first part of a two-part series, we'll cover Google and Apple. Next month, we'll pick up where we left off with an analysis of Facebook, Amazon as well as a bonus section that examines other key players. Those include Microsoft, Magic Leap, Niantic and Snapchat. There will be lots to discuss.

I: Google

One key question when examining tech giants' motivations for, and influence on, XR is to ask how they will monetize it. Asking that question of Google yields several answers – some explicit by the company and some extrapolated from the moves it's made. In either case, there are key implications.

Just as prefaced above, Google's AR initiatives support its core business model. For example, its visual positioning service (VPS) ties to its core mapping and search functions. Visual search similarly aligns with Google's core mission to provide information to answer users' search "queries."

In other words, Google sees AR as a way to boost search query volume and quality – its biggest source of revenue. AR is inherently a form of search, but instead of typing or tapping queries in the traditional way, the search input is your phone's camera and the search "terms" are physical objects.

"Think of the things that are core to Google like search and maps," said Google's Aaron Luber at ARIA. "These are things we're monetizing today that we see added ways we can use [AR]… All the ways we monetize today will be ways that we think about monetizing with AR in the future."

As background, Google has a longstanding goal to boost query volume and search performance since the smartphone's introduction. The app-heavy use case and declining cost-per-click from mobile searches are negative forces that Google is challenged to counterbalance in other ways.

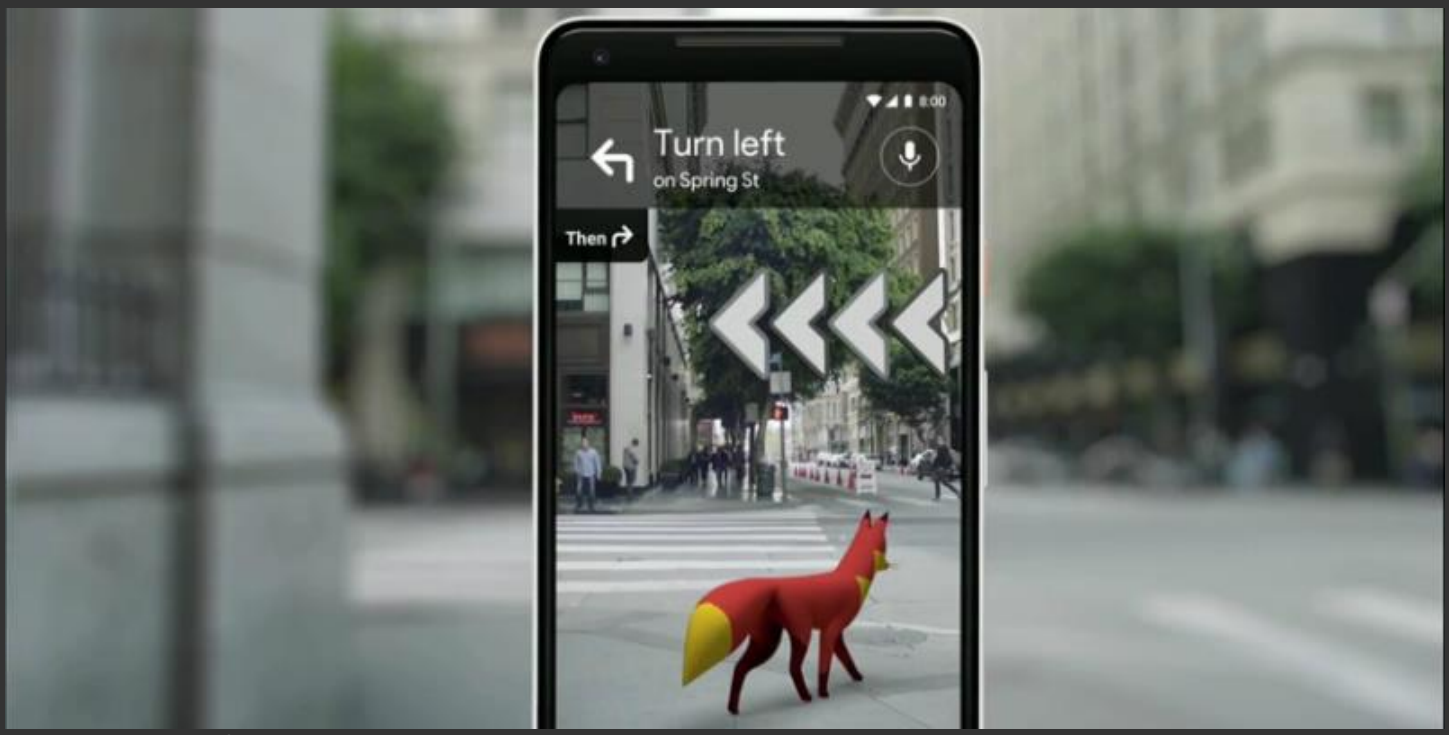


Image Source: Google

Those ways have involved things like voice search. Now, as we enter a new era of visually-immersive computing, Google wants to position the increasingly-popular smartphone camera as a search input. Visual search and VPS are ways to ensure its positioning in the next era of monetizable search.

“A lot of the future of search is going to be about pictures instead of keywords,” Pinterest CEO Ben Silberman said recently. His claim also underscores another key factor that indicates visual search’s potential appeal: millennials. The buying-empowered generation has a high affinity for the camera.

Visual Search: The Internet of Places

Represented best by Google Lens, visual search lets users point their phones at items to retrieve information, or potentially transact. Its use cases and product categories will materialize over time (think: electronics and apparel) but could end up being almost as broad as search itself.

For example, point your phone at a store or restaurant to get business details overlaid graphically. Point your phone at a pair of shoes you see on the street to find out prices, reviews and purchase info. All of these use cases will apply Google’s vast image database and knowledge graph.

One feature of Google Lens is “Style Match,” which searches for items similar to apparel users point their cameras at. That has clear shopping and commerce tie-ins, and the next step will be to integrate visual searches into transactional functionality through Google Shopping or partners like Pinterest.

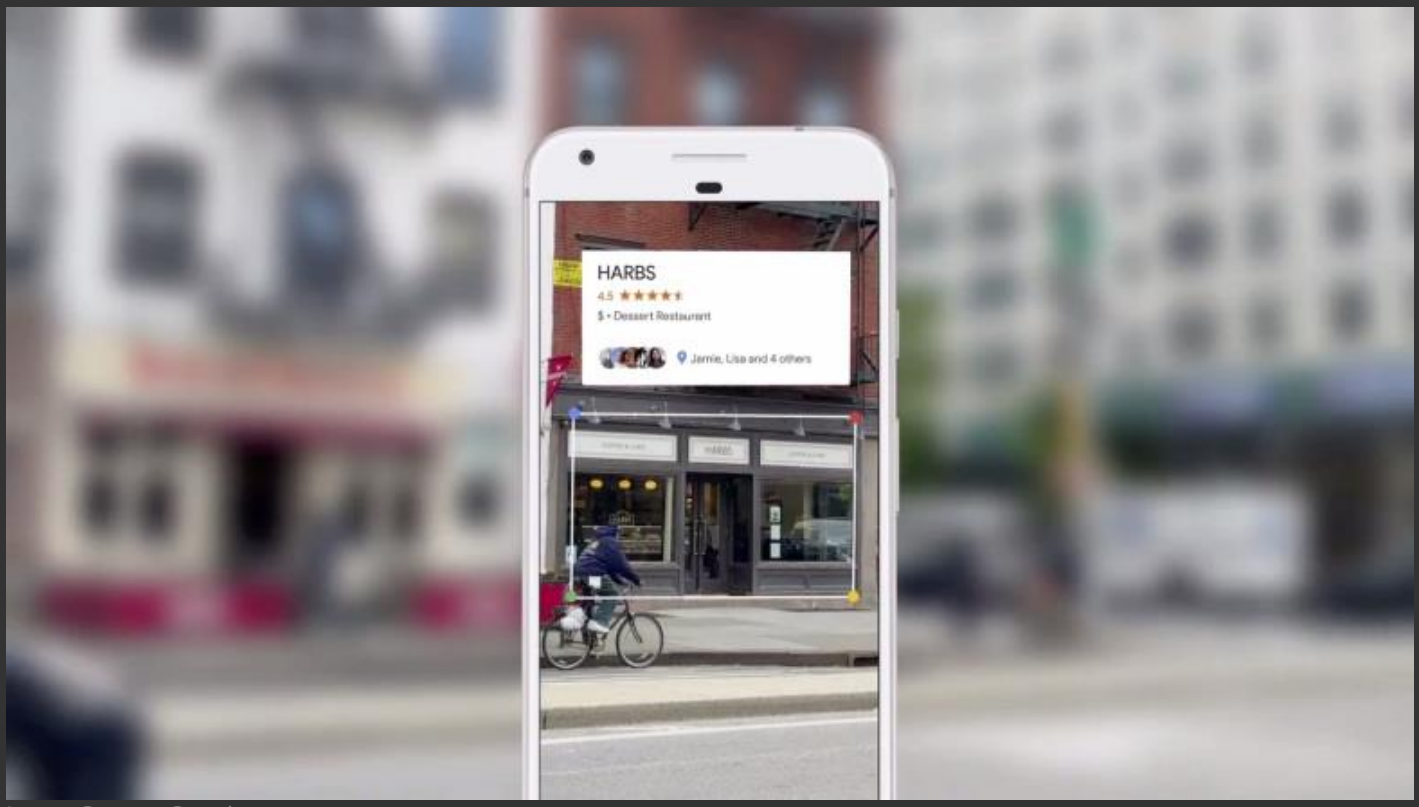


Image Source: Google

Google Lens will also use computer vision and machine learning to ingest and process text. For example, it will scan restaurant menus to let users search for the ingredients in a dish. It will do the same for street signs and other use cases that develop in logical (and eventually monetizable) ways.

This can all be thought of as an extension to Google's mission statement to "organize the world's information." But instead of a search index and typed queries, local AR delivers information about an item *on that item*. And instead of a web index, this works towards a sort of "internet of places" (IOP).[i]

"The camera is not just answering questions, but putting the answers right where the questions are," said Google's Aparna Chennapragada at May's Google I/O. Just like search, these activities have the magic combination of frequency and utility, which could make them the first scalable AR use case.

VPS: The Last Mile

Google's visual positioning service (VPS) is another manifestation of IOP. It helps shoppers navigate and obtain product information in retail stores like Lowes. Using point-cloud based 3D mapping data within retail partners' locations, it will help consumers find the aisles and products they're looking for.

"GPS can get you to the door, and then VPS can get you to the exact item that you're looking for," said Google's VR/AR lead Clay Bavor at last year's VPS unveiling at Google I/O. "Imagine in the future your phone could just take you to that exact screwdriver and point it out to you on the shelf."

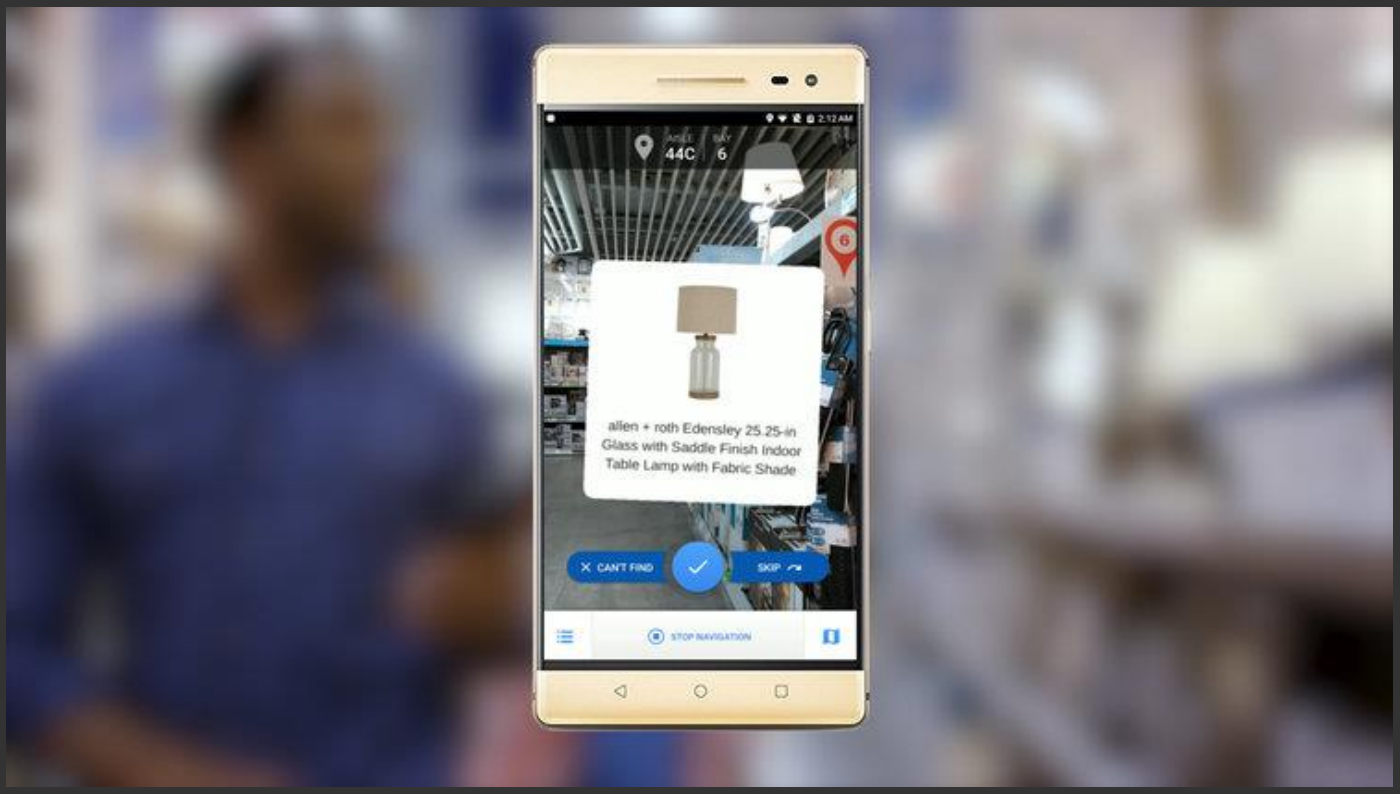


Image Source: Lowes

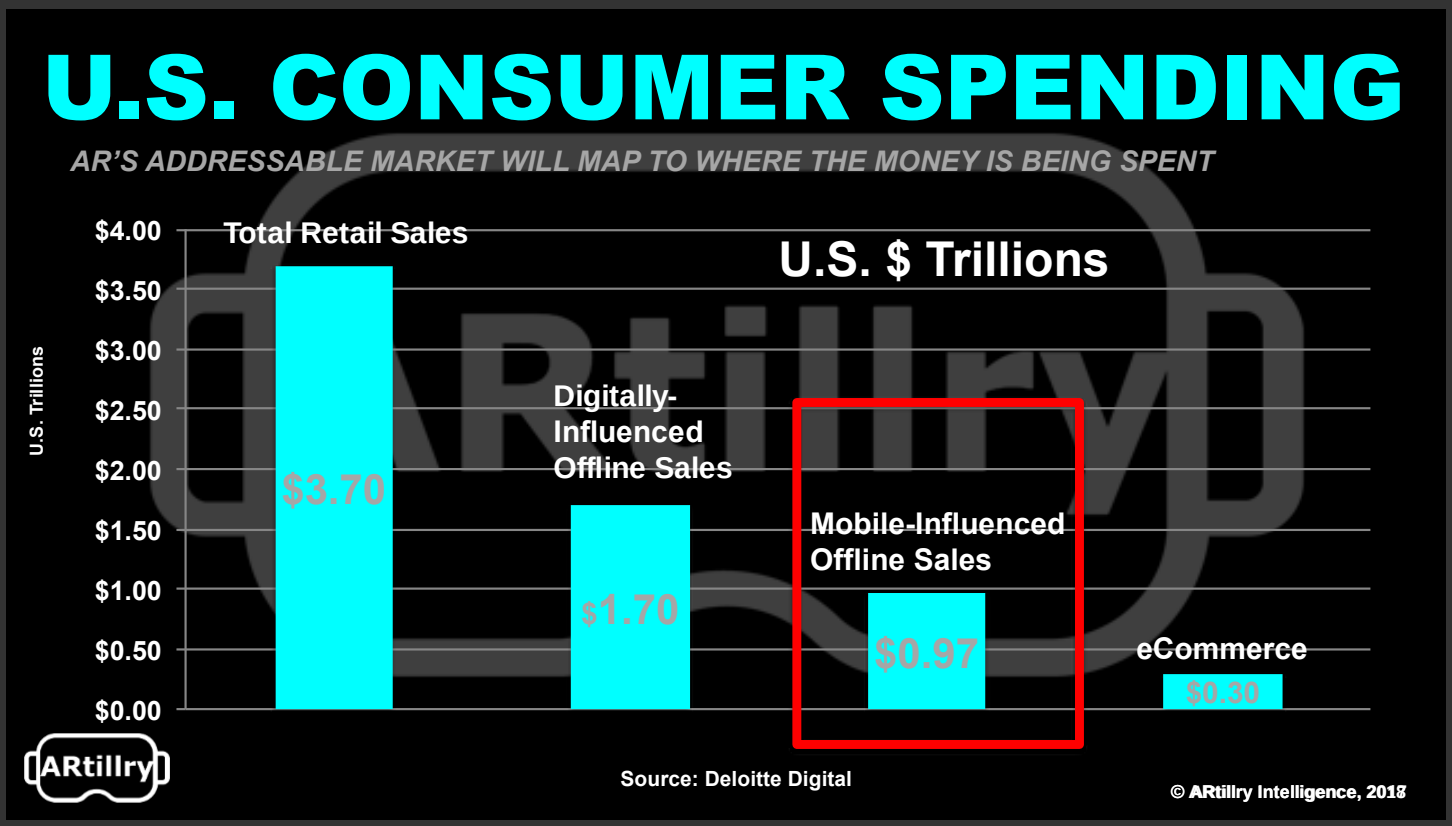
Like visual search, this will help Google serve monetizable information to consumers. But it also ties nicely into Google's existing search ad business with "last-mile" attribution data to report ROI to its advertisers. It knows the best way to do that is to track dollars where they're spent in retail stores.

As background, 92 percent of the $3.7 billion in U.S. retail commerce is spent offline in physical stores. Mobile interaction (such as search) is increasingly influencing that purchase behavior, to the tune of $1 trillion in spending. This is where AR could take the biggest bite and Google knows it.

Furthermore, commercial "intent" – a key factor for Google – is high when someone is in a physical store. And attributing ROI and conversions – another key factor – is a longstanding holy grail, of online and mobile advertising. These add to the list of motivating factors for Google's AR vision.

We believe this "local AR" opportunity will eventually be applied to lots of monetizable search such as retail and local discovery. But first it's taking form in utilitarian products that will attract and grow a user base. That includes most notably AR navigation for street walking, built on Google's VPS.

"Just like when we're in an unfamiliar place, [we] look for visual landmarks — storefronts, building facades, etc." said Chennapragada at Google I/O. "It's the same idea: VPS uses visual features in the environment [to] help figure out exactly where you are and where you need to go."



Social AR

One projected “killer app” of AR will be social interaction (covered in part 2 on Facebook and Snapchat). AR can add new dimension to the ways that people interact socially and play games. Social features also help AR apps grow virally and through social-graph driven network effect.

Google recognizes all of this and is developing ways that AR apps can have more multi-player support. This basically means that social apps and games can be experienced “synchronously” between users so that they interact with the same graphics at the same time (image persistence).

“I think the real unlocking potential of AR rests in two things,” said Google’s Aaron Luber at ARiA. “One is sharing and multiplayer: Your ability to do things in AR with multiple people at the same time… And then of course persistence and being able to leave places and come back to them.”

This concept has since manifested in Google’s AR Cloud Anchors. They standardize tools for ARCore developers to achieve image persistence. And they’ll notably operate across apps built on ARCore and Apple’s ARkit, which should enable more social app sessions to occur.

“We know Cloud Anchors will enable many new AR experiences that combine the power of your device, your creativity and the people around you,” said Google’s Nathan Martz at I/O. “But because these experiences are so powerful, they should work regardless of the kind of phone you own.”

Image Source: Google, Apple

Back to this report's core topic of monetization, there are use cases Google has in mind beyond fun and games. As Amazon and IKEA have already done, AR will be a practical and monetizable tool for in-home product visualization. Multi-player functionality can add new dimension to such scenarios.

"If I'm placing a speaker system here, I can have my wife also look at [it] from her phone," said Google's James Birney at I/O. "There's a feeling of consistency and trust if you're the advertiser or ecommerce site if you have two users looking at it, and it shows up consistently for both of them."

Mapping & The AR Cloud

As discussed in ARtillry's May Intelligence Briefing,[ii] the AR Cloud is critical for AR's future. It creates 3D spatial maps of physical places that AR devices can dynamically tap. This provides an intelligent layer to AR apps' ability to overlay graphics that are relevant, persistent and dimensionally accurate.

Google is in tune with all of this. In fact, we like to say that the AR cloud is like Google's search index, but for the physical world. And Google's existing data assets such as Street View imagery will assist Google Lens (examined above) through object recognition to identify local storefronts.

Going one level deeper, Google has taken active steps to support the construction of the AR Cloud. Its Maps API for XR lets developers utilize the underlying data in Google Maps as a foundation to build virtual worlds. That can be extensive gamescapes in VR, or geo-relevant overlays in AR.

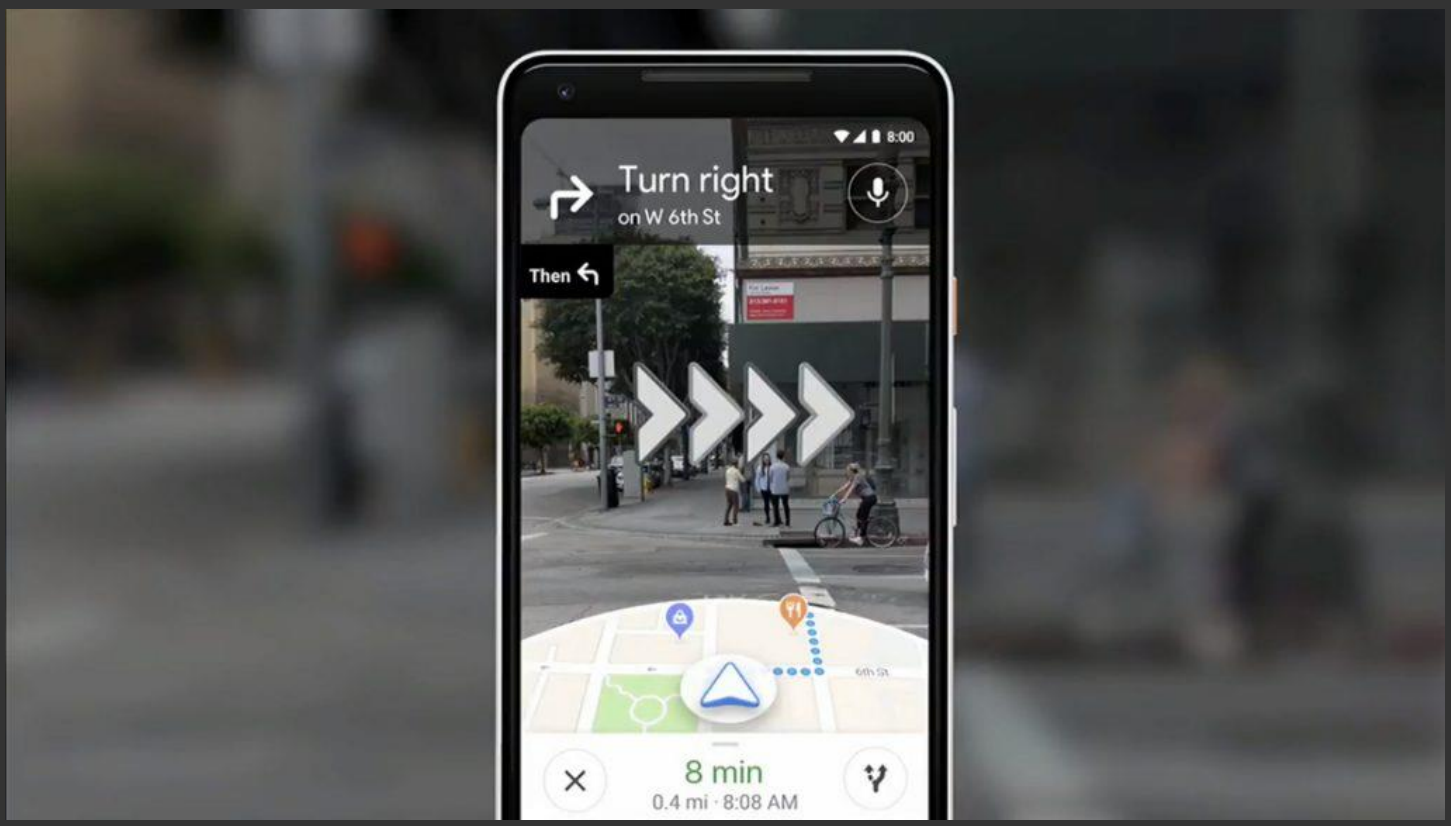


Image Source: Google

In other words, rather than reinvent the wheel and build virtual worlds for gaming, mapping or other XR apps, developers can “reskin” the graphical data that Google has assembled over years for its mapping engine. That includes 2D lat-long mapping, but also 3D structures and buildings.

Using that data as a framework for virtual worlds, developers can focus instead on other parts of the user experience. And the worlds they build can have additional relevance because they sync with the real world. We’re talking Pokemon Go-like experiences or scavenger hunt games.

But beyond easier world-building, this could have another benefit object recognition for AR. Given that Google’s map data contains real world geography and structures, it could be an image database that helps AR devices identify objects – again, like a search index for the physical world.

Once it has that index in place, the visual search-based monetization can follow a familiar playbook for Google, with modifications of course. We must point out here that this is a logical and evidence-supported move, but it is our analyst speculation rather than anything Google has announced.

Video Companion: AR Cloud and the Internet of Places

(click URL to open)

https://youtu.be/_UTq8K_wbSM

Scale Driven

Speaking of business models, Google is all about things that scale. And on that measure, mobile AR currently has more scale than VR, given an installed base of half a billion smartphones. Google's Aaron Luber stresses that it's pursuing both AR and VR, but the former has nearer-term returns.

"We're very focused in both areas but when we look at that total addressable market, it's obvious that one represents something that is vastly bigger," he said. "We're very focused on things that get us into hundreds-of-millions types of numbers, so that's a huge opportunity."

And it's not just the number of users, but frequency, as we mentioned above in light of visual search's "magic combination" of frequency and utility. On that measure, AR wins over VR due to more eligible hours per day for active usage — where VR is disadvantaged by technological invasiveness.

"VR is something that we hope that people will do once per day if we're lucky," said Luber at ARiA. "The use cases are fundamentally different. VR, we're learning, is very focused on entertainment… AR is more focused in utility and things that people are going to do multiple times per day."

Lastly, Google shows interest in standalone VR, where its Daydream platform will power the Lenovo Mirage and other headsets that compete with Oculus Go. And like the above factors, standalone VR feeds Google's hunger for scale, as reduced friction and price will bring VR to greater numbers.

"I look at all the barriers to entry in VR that have existed today." Added Luber. "What hasn't existed today is a purpose-built, purposely-purchased standalone headset and the ability to pick that up and be in VR in five seconds. That's a big deal. That's a big opportunity for consumers."

Image Source: Lenovo

II. Apple

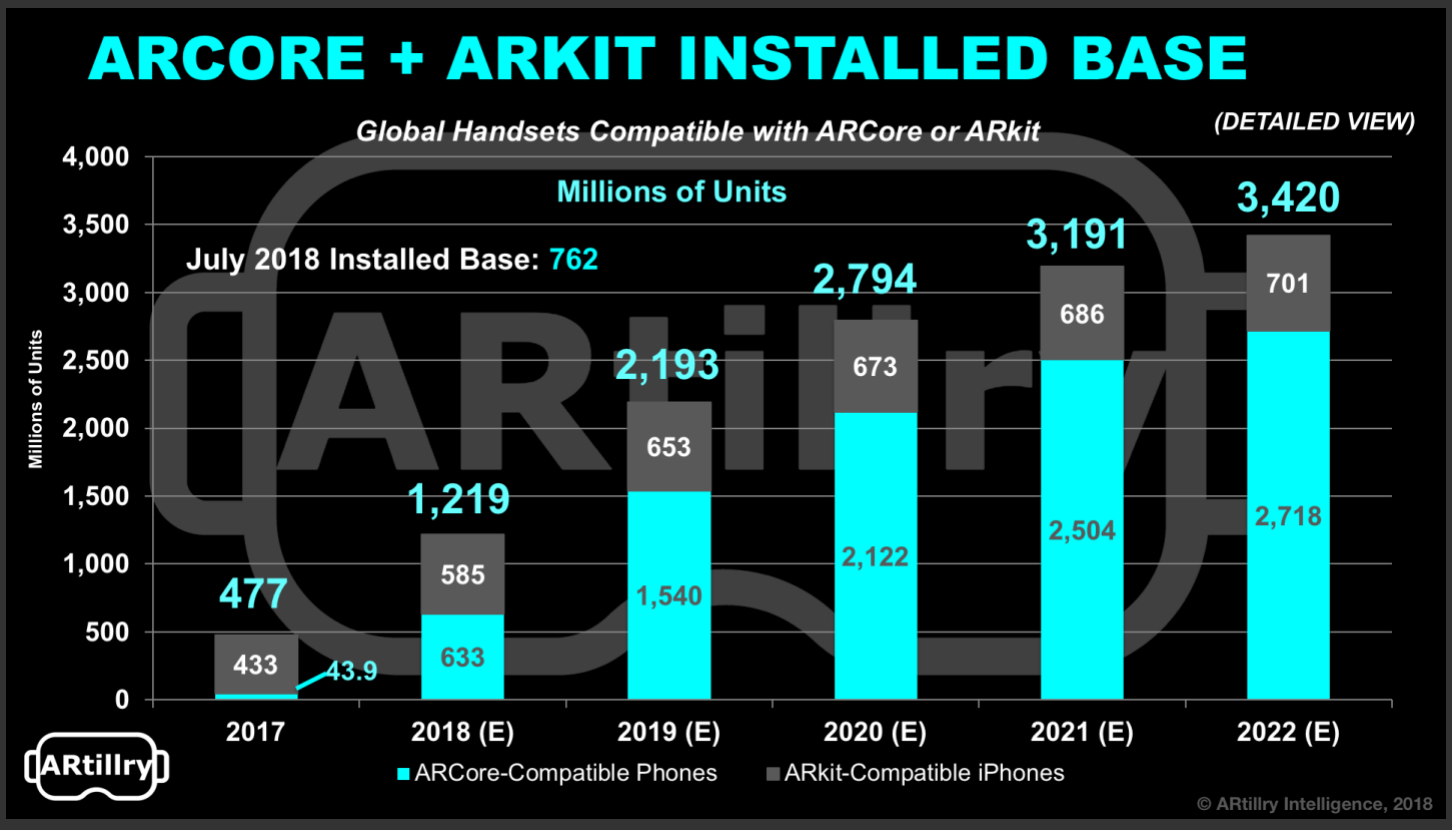
On to the world's most valuable company, Apple has exhibited equal or greater levels of excitement in AR than the other tech giants ARtillry Intelligence tracks. As we've done with those, we'll invoke a core theme of this report and ask the question "why?" Why is Apple investing so heavily in AR?

But before getting to the *why*, let's level set on the *what*. Apple's AR moves include launching an AR development kit for iOS apps, tuning its hardware design for AR optimization, a 3D mapping initiative with AR implications, and rumors of forthcoming smart glasses. We'll go into each of these below.

As for the *why*, it's a similar answer heard throughout this report: to protect, grow and pave a future path for its core business. Though its maturing iPhone business has compelled Apple to diversify into services like iTunes, the core product remains hardware sales, where it derives the most profit.

Here, Apple has a short and long-term vision. In the short term, maturing iPhone sales compel Apple to find ways to make the product sexy again, boost unit sales and justify premium pricing on higher-end models like the iPhone X. AR can also boost app store revenues, including in-app purchases.

"We believe AR can enable profound experiences and Apple is uniquely positioned to provide the best AR experience because of the seamless integration of our hardware and software," said CEO Tim Cook in Apple's third quarter 2018 earnings report in July, invoking AR's "limitless potential."



The Long Game

Apple's longer-term plan involves rumors of smart glasses circa 2020. These could be its post-iPhone "hero device." But Apple knows it has to get over the adoption humps that have plagued face-worn hardware like Google Glass and Snap Spectacles. Mobile AR's job is therefore cultural acclimation.

In other words, Apple will have several challenges in selling smart glasses. One is style and cultural acceptance for face-worn hardware. The other is convincing consumers that AR in general is magical. That second job is where ARkit has two to three years to wow the world on AR's appeal and utility.

Beyond consumers, Apple incentivizes developers with a large mobile AR marketplace, thereby creating a training ground for AR. So it's hoping that developers master AR in time for the smart-glasses era. Their apps will make or break the device's must-have status and iPhone-like penetration.

This brings Apple closer to answering the question of what comes after the iPhone as its next cash cow. Interestingly, this strategy involves refining the software (apps), before the hardware's launch. Given AR glasses' many potential challenges, this strategy pre-empts at least one of them: content.

Meanwhile, Apple will also continue to make moves to democratize AR app creation and the use of ARkit for developers. The recently-launched USDZ file format offers drag and drop functionality and is compatible with prevalent creative tools such as Adobe's Creative Cloud (think: Photoshop).

Image Source: IKEA

“You’ll be able to bring in images, videos, text, any object from Creative Cloud directly into a native AR environment,” said Abhay Parasnis, EVP and CTO of Adobe at Apple’s WWDC. “In fact, for the first time with Creative Cloud and iOS, you’ll have ‘what you see is what you get’ editing in AR.”

What and When

As for the types of apps and use cases that could drive smart glasses’ value and utility, those will vary and be determined by third party developers who run with it. But they could be seeded by Apple’s own batch of apps, just like the iPhone 1 was (think: maps, photos, weather, messaging, etc.).

For example, Apple is currently in the process of generating its own mapping data for its Apple Maps app. As part of that mission, it’s gathering 3D spatial maps of the world which could be a move towards AR cloud[iii] data that supports AR app functionality on smartphones and, eventually, glasses.

Image Source: Apple

It's also seeding social experiences. As examined above with Google's Cloud Anchors, Apple likewise supports multi-player "synchronous" AR experiences. This lets developers create AR graphics that are synced across several users, thus unlocking new social and gaming possibilities.

Lego for example demo'd an AR game at Apple's WWDC that utilizes multi-player functionality. It's a Sim City like UX with tabletop 3D graphics that bring static Lego buildings to life. Some combination of live multi-player play, plus networked play with remote players could create an AR sweet spot.

And of course, there's the pastime of tracking acquisitions to paint a picture of functionality we may see in prospective Apple Smart Glasses. That growing batch of companies includes Metaio, Primesense, Flyby Media, and Akonia, which develops waveguide lenses for AR glasses.

One thing is for fairly certain, which is that the use cases will be consumer-oriented to stay true to Apple's DNA. That compares to Microsoft — likewise staying true to its DNA — which continues to position its Hololens AR headset as an enterprise-geared device (stay tuned for Part II of this series).

As for timing, 2020 rumors could be optimistic, given the engineering feats required to make smart glasses consumer-friendly and stylistically-marketable. Given the cycles of Moore's Law required for meaningful leaps in size, cost and power efficiencies, we believe it will be in the 2021-2022 range.

Frequently-accurate Apple analyst Ming-Chi Kuo of TF International Securities predicts 2020, while longtime Apple watcher Gene Munster moved his prediction from 2020 to 2021. "Services, AR, and Apple Car will create Apple's next trillion-dollar market cap," said Kuo in a recent research note.

Image Source: Apple

Nearer-Term Viability

In addition to graphically oriented AR — the modality in which it's mostly discussed and visualized — we have a longstanding prediction that Apple could be developing the nearer-term viability of another AR format: sound. This involves informational overlays that are sound waves instead of photons.

In other words, it's about getting informed about your surroundings through an ambient whisper instead of graphics. First, Apple has to condition the use case through an all-day wearable. But fortunately, it's already doing that with one of its most successful products in years: AirPods.

Then it has to seed the content marketplace with enough substance to make it worthwhile. Right now that means Siri, which isn't going to cut it. But third-party developers could populate an audio app marketplace. And those apps, like ARkit examined above, could have a headset-based endgame.

Logical apps include local information (think: audio tours and Yelp reviews), or background information about people you meet (think: LinkedIn). We call it "AR Audio" and one advantage is discreetness, which sidesteps smart glasses' style hurdles and could mean nearer-term viability.

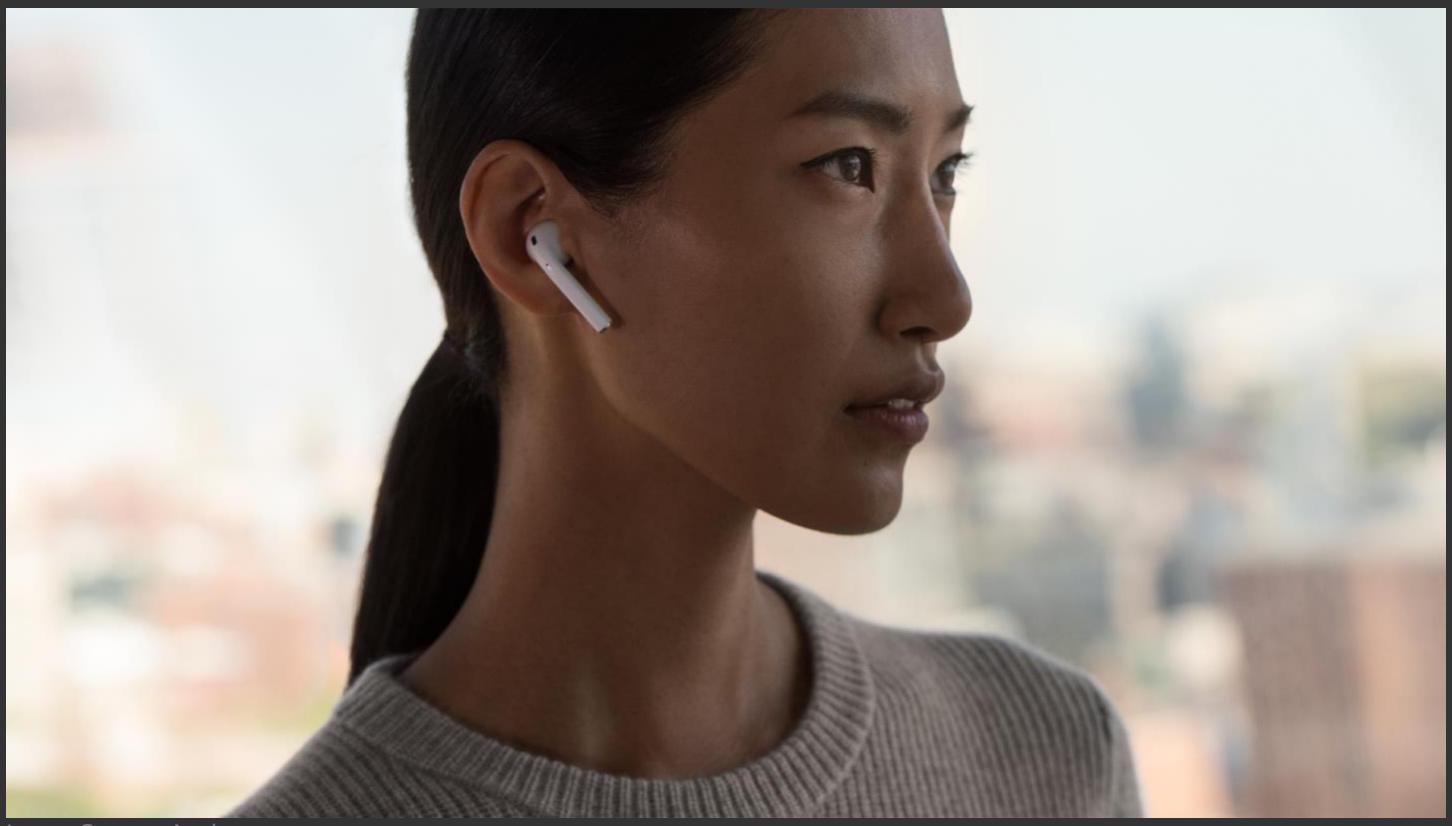


Image Source: Apple

History Repeats: The OS Wars

The mobile OS wars between iOS and Android occupied the past decade. Now a component of those operating systems could reignite the competition: their respective AR development kits. We're of course talking about ARkit and ARCore, which will compete for developers and users.

Going one level deeper, the DNA of these two companies impacted their positioning in the smartphone era, and could do the same in the immersive computing era. For Apple, it's all about apps. For Google, the web. The question is which company is better positioned for AR market share?

Starting with the Google, it has spent 15 years as the world's search engine, including building a knowledge graph and search index. This will play into an AR strategy that includes WebXR, in which users don't have to download apps, but rather visit mobile websites to summon AR experiences.

This of course contrasts Apple's content architecture that's rooted in apps. But there's evidence that an app-centric approach to AR could be disadvantaged. The thought is that AR's early adoption challenges could be exacerbated by the friction finding and downloading disparate apps.

Beyond friction for users, apps are disadvantaged by their lack of interoperability compared to the link-structured web. This has always been the case in the app era, leading to movements like deep linking, but it could really handicap AR functionality by forcing it into non-linked silos.

Of course, Google's strategy with ARCore will involve apps. But just like it's done with Android, it will simultaneously push web standards to make it a more attractive and functional place for mobile users to spend their time. In the shift to immersive computing, it will push even harder on WebXR.

This is just the latest version of a decade-long apps vs. web battle. And the winner could determine the vessel of choice for AR (and VR). It won't be a winner take all game -- just as iOS and Android have co-existed -- but will determine the fate of Google and Apple's relative XR dominance.

Image Source: Google, Apple

Video Companion: ARCore vs. ARkit, History Repeats

(click URL to open)

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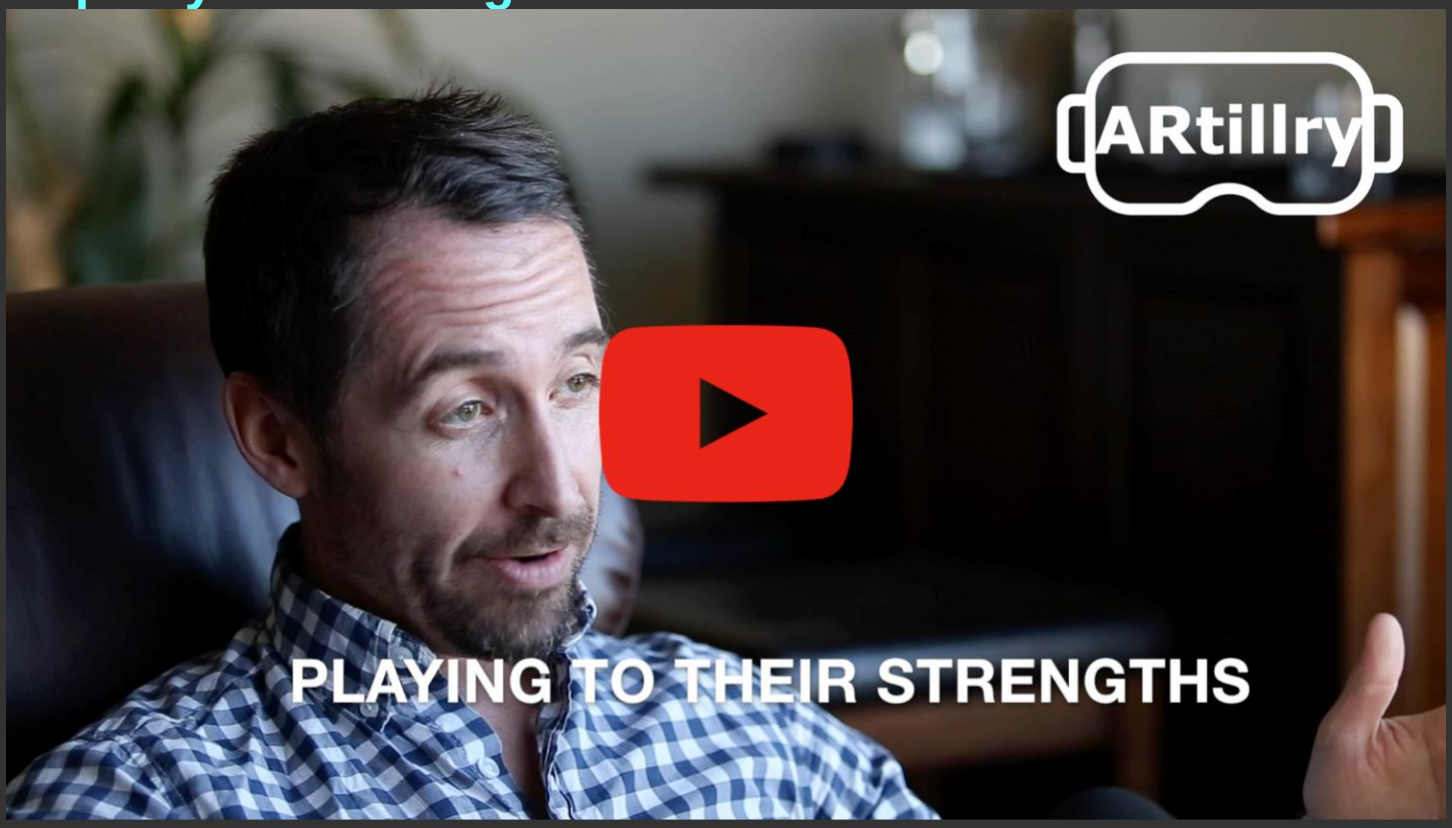

Preview: The Rest of the Field

To maintain focus and deliver a digestible analysis we've broken up examination of tech leaders' AR initiatives into a two-part series. Next month, we'll pick up where we left off: with an analysis of **Facebook**, and **Amazon**. They're each building AR businesses around advertising and commerce.

We'll also include a bonus section that examines other key players such as **Microsoft**, **Magic Leap**, **Niantic** and **Snapchat**. Though on a smaller scale, they're each making impactful moves that have individual takeaways, and align with our overall premise about why tech companies embrace AR.

As we've done above for Apple and Google, we'll answer that question of *why* as an entrée to analyze the *how* and *when*. How is Facebook developing AR ad revenue? How is Amazon using AR to drive its core e-commerce business? And what will Microsoft, Niantic and Magic leap teach us?

We'll circle back next month to answer those questions and more.

Key Takeaways (redux)

Key takeaways are also highlighted throughout the main body of this report.

- XR's trajectory can be examined through the lens of tech giants' investments and initiatives
  - Further, examining their motivating factors can inform their directions and larger market trends.

- A common thread is to protect or pave the way for the future of their core businesses.
  - Google is all about visual search to cement search's position in an immersive computing era.
  - Apple wants to make iPhones sexy again, and seed content for an upcoming smart glasses era.
  - Facebook wants to keep us in its walled garden longer, with compelling and immersive multimedia.
  - Amazon wants AR product visualization to boost e-commerce and decrease returns.
  - Microsoft, Magic Leap, Niantic and Snapchat similarly position AR to drive future revenues.

- Starting with Google, AR is a natural extension of search, triggered through the camera versus text.
  - Visual search can boost query volume and quality, given commercial and proximity-based intent.
  - Offline/Local commerce is driven by proximity and mobile influence, both of which align with AR.
  - VPS can influence last-mile (in-store) consumer behavior including trackable advertiser ROI.
  - Google mapping assets and imagery will support the AR cloud's optical and mapping needs.
  - Google supports social AR (network effect, viral growth) through multi-player support in ARCore.
  - All of these products are millennial-friendly (camera based) which cultivates future affinities.

- Apple sees several ways AR will boost core revenue streams and developing ones.
  - Though maturing iPhone growth compels it to diversify into services, hardware remains core.
  - In the short term, Apple needs to find ways to make the iPhone sexy again and boost sales.
  - It also has the potential for app store revenue from AR premium apps and in-app purchases.
  - In the long term, iPhone-based AR is cultivating users and developers for a glasses-dominant era.
  - AR Glasses (again hardware) will be a horse that Apple bets on as a post-iPhone flagship.
  - To avoid past wearable device fails (Snap Spectacles, Google Glass), it must sell the world on AR.
  - That will happen in the near term with mobile AR experiences (users) and app training (developers).
  - Apple has 2-3 years to cultivate those two constituencies to pave the way for its next cash cow.
  - Meanwhile, in addition to mobile, audible AR (via AirPods) could be another revenue-generator.

- Google and Apple's divergent AR paths represent the latest iteration of the longstanding OS wars.
  - Google's web-based DNA drives its support of WebXR as a delivery vehicle for AR experiences.
  - Apple's app orientation drives its App Store structure for an AR marketplace.
  - Apple's dominance of the smartphone era positions apps as the heir apparent modality for AR.
  - But several signals indicate that apps will be an inferior vessel for AR, due to download friction.
  - Apps & web will coexist, as in the smartphone era, but WebXR could have a greater standing in AR.
  - Consumer & developer adoption of each will determine Apple and Google's fate in the AR era.

- Beyond Apple & Google, Facebook and Amazon loom large in their AR potential (next installment).

About ARtillry Intelligence

ARtillry is a publication and intelligence firm that examines augmented reality and virtual reality, collectively known as XR. Through writings, data and multimedia, it provides deep and analytical views into the industry's biggest players and opportunities. It's about insights, not cheerleading.

Run by career analyst and journalist Mike Boland, coverage is grounded in a disciplined and journalistic approach. It also maintains a business angle: Though fun and games permeate VR and AR (especially the former) long-term cultural, technological and financial implications are primary.

Learn more at **https://artillry.co/about**

About Intelligence Briefings

ARtillry Intelligence Briefings are monthly installments of VR/AR data and analysis. They synthesize original and third-party data to reveal opportunities and dynamics of VR and AR sectors. In addition to data, a layer of insights is applied to translate market events and raw figures into prescriptive advice.

More information, past reports and editorial calendar can be seen at:

https://artillry.co/artillry-intelligence/

About the Author

Mike Boland was one of Silicon Valley's first tech reporters of the Internet age, as a staff reporter for *Forbes* (print) starting in 2000. He's been an industry analyst covering mobile and social media since 2005, and is now Chief Analyst of *ARtillry Intelligence*, and SF president of the *VR/AR Association*.

Mike is a frequent speaker at industry conferences such as AWE, VRLA and LeadsCon. He has authored in-depth reports and market-sizing forecasts on the changing tech & media landscape. He contributes regularly to news sources such as *TechCrunch*, *Business Insider* and the *Huffington Post*.

A trusted source for tech journalists, his comments have appeared in A-list publications, including *The New Yorker*, *The Wall Street Journal* and *The New York Times*.

Further background, history and credentials can be found at:

http://www.mikebo.land/

Methodology

This report highlights *ARtillry Intelligence* viewpoints, gathered from its daily in-depth coverage of the XR sector. To support the narrative, data are cited throughout the report. These include *ARtillry Intelligence* original data, as well as that of third parties. Data sources are attributed in each case.

For market sizing and forecasting, *ARtillry Intelligence* follows disciplined best practices, developed and reinforced through its principles' 15 years in tech sector research and intelligence. This includes the past 2.5 years covering AR & VR exclusively, as seen in research reports and daily reporting.

Furthermore, devising these figures involves the "bottom-up" market-sizing methodology, which involves granular ad revenue dynamics such as campaign pricing and spending. For more on *ARtillry Intelligence's* market sizing and forecasting methodology, see the explanations at the following link.

https://artillry.co/artillry-intelligence/forecasts/methodology/

Disclosure and Ethics Policy

ARtillry has no financial stake in the companies mentioned in this report, nor was it commissioned to produce it. With respect to market sizing, ARtillry remains independent of players and practitioners in the sectors it covers, thus mitigating bias in industry revenue calculations and projections.

ARtillry's disclosure and ethics policy can be seen in full at:
https://artillry.co/about/disclosure-and-ethics-policy/

Contact

Questions and requests for deeper analysis can be submitted at:
https://artillry.co/contact/

References

[i] See ARtillry Intelligence Briefing, *AR Cloud and the 'Internet of Places'*: **http://artillry.co/artillry-intelligence/ar-cloud-and-the-internet-of-places/**
[ii] See ARtillry Intelligence Briefing, *AR Cloud and the 'Internet of Places'*: **http://artillry.co/artillry-intelligence/ar-cloud-and-the-internet-of-places/**
[iii] See ARtillry Intelligence Briefing, *AR Cloud and the 'Internet of Places'*: **http://artillry.co/artillry-intelligence/ar-cloud-and-the-internet-of-places/**