



ARTILLRY INTELLIGENCE BRIEFING AR BUSINESS MODELS: THE TOP OF THE FOOD CHAIN, PART II

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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 inhome 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?

Continuing from Part 1 of this two-part report, which examined Google and Apple, we'll pick things up with Facebook, Amazon and the rest of the field of competitors.





Key Takeaways

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

R'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.

Beyond Apple & Google (examined in Part I), Facebook and Amazon loom large in their AR potential.

Starting with Facebook, AR is a natural extension of its social engagement and advertising models.

- AR lenses have become a popular format for social expression, status updates and shared media.
- Beyond popularity in user penetration, lenses also boost per-session engagement metrics.
- Strong usage and time spent within Facebook correlates to its ad monetization.
- Beyond correlation, AR lenses directly monetize as a native and increasingly popular ad format.
- AR News Feed and Messenger activations let advertisers demonstrate products in immersive ways.
- Branded Lenses also increasingly flow into transactional functions, demonstrating advertiser ROI.
- Facebook invests heavily in VR with Oculus, a trojan horse for a direct (hardware) user touch point.

Amazon sees several ways AR will boost core revenue streams and developing ones.

- Amazon was one of the first companies in visual search with its FLOW app, eight years ago.
- Starting with a Snapchat partnership, Amazon will re-activate visual search as a commerce driver.
- e Product visualization (view how products look in your home) is another commerce-driving AR mode.
- AR visualization also reduces margin-depleting product returns in categories like flat screen TVs.
- Amazon is the poster child of "AR as a feature," with AR visualization features within its main app.
- Amazon Sumerian meanwhile is an XR creation enabler that seeds business for AWS.
- Sumerian-built products like customer service avatars increase reliance on AWS compute needs.

Beyond the big four, XR lessons and directional market signals can be seen in other innovators.

- Microsoft is cultivating a vertically-integrated enterprise play (its core business) with HoloLens.
- It's also covering bases with a consumer-geared licensing model with Windows Mixed Reality.
- Magic Leap is the wild card, also vertically integrated, as a rogue innovator with many uncertainties.
- If Google Glass was AR's Apple Newton, Magic Leap One is its Palm Pilot, pursuant to its iPhone.
- Niantic is developing an ambitious platform play, built on the architecture of Pokémon Go.
- Doubling down on its AR momentum, this will represent and validate the first "AR as a service."
- Snapchat is AR's early success and revenue driver (AR lenses), continuing to innovate formats.
- AR is positioned as one saving grace from its slowing user growth, revenue and stock performance.
- Unity is a powerhouse in VR as the prevailing game engine, increasingly expanding into AR.
- make This notably includes AR advertising, such as immersive campaign creation and optimization.



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 "where the puck is going."

The answer to the question interestingly differs for most major tech companies. But on another level, the answers for each share a common thread. 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.

After having examined Google and Apple in Part I of this two-part report series, we'll now pick up where we left off. We'll start with Facebook's unique AR initiatives, followed by Amazon and then a bonus section that contains other influencers like Snapchat, Niantic, Magic Leap and Microsoft.



III. Facebook

Picking up where we left off in the first part of this report series (covering I. Google and II. Apple), how will Facebook make money from AR?

Like with Google and Apple, this question begins to reveal factors that signal the rest of the industry for strategic positioning. Carrying a key premise of this report series, Facebook's AR initiatives support its core business, and its AR product investments are driven to support that model.

With that backdrop, consider Facebook's core business. Its primary ad revenue correlates to the amount of time we spend in its walled garden. AR brings more ammunition to keep us in that environment through visually immersive – and advertising-conducive – content to share with friends.

As further background, Facebook's News Feed ads have grown stale and overcrowded so it's motivated to innovate new forms of user engagement. That could happen in two areas, both of which build on the smartphone camera's vaunted status among millennials: AR and Instagram.



Image Credit: Facebook



Up Close & Personal

With prime positioning on ubiquitous smartphones, Facebook has followed Snapchat's lead in making AR lenses a currency in social sharing. Its Camera Effects platform opens that development to brands or individuals that want to build AR experiences across Facebook's mobile properties.

With that Camera Effects foundation — which is under-utilized given Facebook's scale — it's been rolling out new formats that make AR easier to digest. These are targeted especially at brand advertisers who are famously slow to adopt new technologies, and especially so with AR.

For example, AR in Messenger brings Camera Effects to 1.2 billion monthly active users. This offers a massive audience for brands to deliver AR graphics that spotlight products. More importantly, these experiences can drive towards real e-commerce transactions like buying advertised products in-app.

Nike utilized this channel with an AR virtual podium that unveils its latest shoe release. It includes 360-degree product visualization that flows right into a transaction thread (see below). This brings immersive product views to an app where consumers and fans already engage with brands.

"You can actually walk to the shoe, get up close and personal, take photos and videos and share them with friends," said Facebook's David Marcus at F8. "When you're done and close the camera, you're back in the experience where you can buy the shoe right then and there."



Image Credit: Facebook



Full Funnel

Other AR integrations in Messenger include ASUS' ZenPhone 5 virtual unboxing which saw 10x greater engagement compared with its non-AR campaigns. Kia likewise saw a 46 percent boost in dealer inventory searches, and phone calls from its car visualization campaign.

But more recently, AR was brought directly to the News Feed. Similar to standard News Feed ads, AR ads are placed programmatically based on social signals. But with an additional AR kick, News Feed AR ads let advertisers apply Camera Effects, including virtual product try-ons.

For example, launch partner Michael Kors built a campaign that lets users quickly go from a targeted News Feed ad to a front-facing camera activation that virtually tries on sunglasses. Videos of those usually-boisterous try-ons can also be captured and shared for an additional viral kick.

More importantly, like the above examples, these ads flow into a transaction thread on Facebook or advertisers' sites. This makes AR a rare "full funnel" ad format including awareness and direct-response. The latter explicitly demonstrates advertiser ROI through real conversions.



Image Credit: Facebook



'Gram It

Facebook is facing disruptive times when it's losing advertisers due to data privacy issues, and hundreds of millions in market cap. On top of, or related to that, several advertisers have begun to doubt the ROI of news feed ads as the feed becomes more crowded. Enter Instagram.

Given Instagram Stories and its 400 million active users, it's becoming a popular place for advertisers seeking premium ad inventory. And it's coming together with AR, given that Camera Effects were recently made available to developers to build on Instagram — a logical extension.

Connecting several dots, we believe that AR-driven e-commerce is coming to Instagram next, similar to the Messenger and News Feed AR campaigns mentioned above. We say that because Facebook quietly announced that deeper native payments (and thus e-commerce) are coming to Instagram.

The bottom line is that AR is expanding throughout Facebook's products, and increasingly offering transactional functionality for AR-spotlighted products. This will expand Facebook's "full-funnel" capabilities and should boost its standing in the AR advertising landscape of the coming years.

Loss Leader

On to VR, Facebook's long-awaited Oculus Go could be a boon for the company and for the larger VR industry's consumer penetration. As we and others have written, Go could jolt VR adoption, given its highly-competitive pricing that hits a consumer sweet spot, and its frictionless user experience.

As background, Oculus Go is priced at \$199 to bring higher-end VR to a greater swath of the mainstream public, and to better seed a VR marketplace. Oculus has the luxury (Facebook) of treating VR hardware as a loss leader to build market share and a longer-term platform strategy.

But that long-term approach comes at a cost: to sacrifice margins for market share. The latter is motivated by the fact that platform wars are won through momentum set in early days to attract users. Then there's a virtuous cycle of developer interest, incentive, content creation... and then more users.

Put another way, it's all about attracting users by any means to seed a marketplace and establish an installed base. That economically attracts developers who create content, which attracts more users. Those users in turn attract more developers... and the virtuous cycle commences.

Meanwhile, consumers win by receiving a strong value on hardware from Oculus. But not everyone wins: companies reliant on short-term hardware margins (Samsung, HTC, etc.), will find it harder to compete with such pricing. HTC Focus already delayed U.S. distribution plans for this reason.

Overall, it's a lesson in loss-leader economics, and strategic positioning in early days of platform wars. We saw the same thing in the smartphone OS wars. And like we saw then, consumers benefit most. Prices should continue to drop, along with an arms race for VR quality and content libraries.





Content is King

Speaking of content, this is where Oculus Go holds another key advantage. This helps overcome chicken and egg challenges and fragmentation issues that have dampened VR adoption. There are 1000 games and apps available for Go, thanks to the Oculus-compatible library from Gear VR.

Doubling down on this advantage, Facebook has invested in content creation and user experiences such as lean-back entertainment (Oculus TV), social interaction (Rooms) and live sports (Venues). The latter is interesting in that live sports is a saving grace for broadcasters, so they're embracing VR.

To do this, Facebook is working with prominent content partners like Hulu, Netflix and NextVR (for live events). These types of content make sense, given that Oculus Go's lower-end specs make it optimized for lean-back entertainment and casual games, as opposed to graphics-intensive gaming.

But the real endgame for Facebook's VR initiatives is to lead and own the next generation of hardware where highly immersive social interaction happens. And like Apple, if it owns the hardware – and thus the user touch point – It gains vertical integration to better control its destiny.

This is something Facebook missed by not launching a smartphone as a direct consumer touch point. It instead has to reach consumers through apps that operate on devices that Google and Apple control. It therefore lacks vertical integration and the ability to optimize and tune hardware.



Given Mark Zuckerberg's vision of a VR future, that's not a barrier he wants to face again. Though smartphones are highly conducive to social engagement and connectivity, Facebook sees VR as an even greater bedfellow for the future of digital social interaction... but it could take a while.

Noble Quest

Meanwhile, Oculus' latest move is to launch the Quest headset at its OC5 event in September This is its attempt for a mass-market tier-1 headset. It features high-end VR specs such as hand presence and full (six degrees of freedom) positional tracking, but in an untethered package like Oculus Go.

All of this comes at a \$399 price tag. At \$200 more than Oculus Go, there's a big enough delta to avoid cannibalization, but strong enough value in feature upgrades. Those include most notably inside-out positional tracking for headset and hand controllers, unlocking Rift-like gaming capability.

And like Oculus Go, the price is strategically set at a margin-neutral or loss-leader approach to seed a market and longer-term platform play. But the question remains if it's too high above the "magic price" of \$200 that's been revealed in ARtillry researchⁱ as an inflection point for consumer demand.

Panning back to the full product line, there's economic optimization around three tiers — Go, Quest & Rift — to capture demand across market segments. This could help inch closer to Zuckerberg's lofty goal of one billion VR users, though he admits we're less than one percent of the way there.

"From here, we're going to make some big leaps in both tech and content for the future generations of each of these products," said Zuckerberg. "It's still early but this is the basic roadmap. This is what we need to do for VR to succeed, and to get to the future that we all want."





IV. Amazon

Among tech giants making moves into augmented reality, Amazon has probably been the least discussed in the tech media and analyst corps. Its AR moves have indeed been the quietest of the bunch, but potentially massive. They're also potentially the most logical and easy to understand.

AR has clear implications for supporting e-commerce and boosting Amazon's ability to sell things and improve margins — core organizational priorities. This could play out in a few ways, mostly orbiting online shopping, increasing the probability of purchases and decreasing the probability of returns.



Image Credit: Amazor

Cash FLOW

At a basic level, Amazon's AR play will involve visual search, which we examined in Part I for Google. It's about contextualizing items using the smartphone camera instead of text queries. This builds from Amazon's decade-old FLOW app that let users buy any book by taking a picture of its cover.

But with advancements in computer vision and object recognition, the proposition is now to search for a broader range of products, as Amazon's catalogue has likewise broadened. The idea is to find matches for products or complimentary products – a longstanding tradition on Amazon.



Based on AR's current surge, and Amazon's proven interest, ARtillry Intelligence believes the company will re-activate the path it once initiated with FLOW. Evidence can already be seen in its visual search partnership with Snapchat (explored below), in which it's testing the current waters.

Beyond using the smartphone camera to search and discover products, AR will take the next step in qualifying products. That will involve virtually placing furniture, appliances and electronics in one's home to make sure they fit. By "fit," we mean style, dimension and other qualifying factors.

"For big ticket purchases, historically you would try to visualize what it would look like in your home," said Lenovo's Carter Agar who worked with Amazon on an early AR integration on Lenovo phones. "Amazon thinks a lot of that can be simplified through allowing consumers to visualize that product."

There are other places Amazon is applying this principle, such as the Echo Look. Meant to snap mirror-length pictures of users, it's a play towards virtually fitting, overlaying, and suggesting apparel. And the endgame there, as always, is driving orders. This concept will apply across lots of hardware.



Image Credit: Amazon

Margin Obsessed

But it's not just about orders. Amazon's success is based on razor thin margins executed at massive scale. That makes maintaining and improving margins an organizational obsession. And to that end, AR can help with a key piece of the puzzle: returns. And it's particularly fitting for large items.



"From Amazon's perspective, they can improve conversions significantly," said Agar. "And one of the big issues that Amazon encounters is returns for big products like TVs because they don't fit or they don't look right. So anything they can do to reduce the return rate is potentially huge cost savings."

In fact, one of the biggest margin-depleting factors facing Amazon is large-order shipping and returns. That drove the company to work with Google Tango and Lenovo in the ways suggested above. Now that Tango has been discontinued by Google, Amazon works with other AR platforms such as ARkit.



Image Credit: Amazor

AR as a Feature

In fairness, Amazon isn't the only company taking this image-based approach. Wayfair and IKEA have launched AR features that let shoppers visualize furniture placement. And Pinterest lets users take pictures of products to search for similar items. But Amazon's scale may give it a natural lead.

Furthermore, Amazon's work in machine learning and AI for voice (Alexa) positions it well against competitors. Those parallel efforts with voice indicate Amazon's interest in using alternate forms of search to increase the levels of interaction — and ultimately order volume — from online buyers.

Another big differentiator for Amazon's AR visualization is that it doesn't require a standalone app. Given that Amazon's flagship mobile app is highly used, the company decided to include AR features with several launch points in the shopping flow, including the home screen and product pages.



This exemplifies a strategy we call "AR as a feature." The idea is that AR's early days compel "training wheels" for potential AR users. And one way to train them is to ease them into the experience by meeting them half way. That means delivering AR within the apps they already use.

Though AR should be designed in a native way, rather than porting existing apps into AR, the opposite can be true: delivering AR within existing apps. And in early days, that's best done through AR that piggybacks on popular apps versus relying on separate/dedicated app downloads.

Seeding a Market

In Amazon's continued diversification, e-commerce isn't the only endgame. AWS continues to rise in financial performance and standing within the company. And like many of the businesses examined in this report, AR and VR could find a logical and business-supporting home at AWS.

Specifically, Sumerian is AWS' platform that lets developers and brands create and run VR, AR and 3D apps. It boasts relatively-little friction, such as not requiring specialized programming nor 3D graphics expertise. But what's AWS' motivating factor behind such an XR creation platform?



Image Credit: Amazon

Like many examples in this report, it's a logical integration. Given XR's graphical and computeintensive needs — which AWS caters to — it makes sense to seed the market. This includes tools to not only create 3D assets but to host and stream them in a web-based manner through AWS.



Sumerian GM Kyle Roche acknowledges the seeding strategy, but admits it isn't necessarily the master plan. It's more about supporting the shift towards visually immersive computing and helping AWS customers get there. That can be good business for AWS in several potential ways.

"AWS gets lots of credit for those types of coordinated efforts across different dimensions," he told ARtillry. "Sometimes it's simply that we have a lot of customers that want to get into that space so we're trying to break down barriers to entry. Sumerian came out of a lot of those discussions."

Drag & Drop

One example is an early prototype built on Sumerian by Fidelity Labs, a division of Fidelity Investments. It's a 3D virtual persona that provides voice-guided visualization for investment data. In fact, virtual hosts are one of Sumerian's early and demonstrative use cases, says Roche.

"Hosts are probably the biggest building block of Sumerian that's obvious right now," he said. "Having a character that you can make eye contact with, set up in the same way you'd set up an Alexa skill, just drag and drop in a browser, is super attractive for some customers."



Image Credit: Amazon

The drag & drop aspect is key to expanding XR's addressable market to enterprises that don't have 3D development muscle. If XR is to scale to projected levels, it will have to cater to that larger universe. We're talking non-technical verticals like retail, finance and media & advertising.

For example, in functions like customer service and brand marketing, XR creation is only going to happen in some cases if it can be built in house. Or even in the case of outside help from creative agencies, they're going to need tools like Sumerian to build XR apps for clients.



"A lot of enterprises or smaller shops want to get into XR," said Roche. "As they see it come to life, they're thinking 'Okay, I need to get a 3D game engine, learn how to sculpt, animate, rig and all these complex things.' They just want something that's easy to use in a familiar environment."

Yin & Yang

As for use cases, Sumerian recommends a handful of them, such as employee education, training simulations and field service. Roche believes this will start with host-guided experiences, then grow into deeper internet of things (IoT)-based integrations as developers gain their footing.

"Things that can go from concept to production quickly include any sort of guided experience like education, training, or news narration," said Roche. "Visualization around AR sensor data for IoT applications seems to be a pretty quick win for customers too."

IoT integrations could include oil & gas or mining scenarios, where remote field workers need to visualize equipment assembly through a hands-free headset. A lot of that sensor and IoT data are already integrated with AWS for existing customers, making it a natural extension.

IoT generally could be promising for and symbiotic with AR. All that IoT data from the equipment and consumer products around us can provide content for AR. AR in turn can provide an intuitive visual front end for all that data... a nice yin & yang relationship between the two.

"AR is the counterpart to IOT," said PTC CEO Jim Heppelmann at AWE 2018. "AR isn't very interesting without content to augment. And IOT isn't useful if it produces complex information that people can't interpret. But if you connect them... things happen in a circular flow of information."

Follow the Money

There are also consumer-oriented use cases for Sumerian, such as media and publishing. Online publishers could monetize through ads that feature products in 3D. And though AWS and Amazon are separate entities, there are potential synergies in utilizing the latter's immense product library.

"If you look at 2D click-through ads, if things move into 3D, Web XR becomes a new medium to drive ad revenue for content producers," posed Roche. "They can build scenes and publish them and earn some of that referral credit and open up a new way to think about online advertising."

Meanwhile, the goal for Sumerian is really to get the platform out there. And like most platforms, the range of use cases will evolve as developers run with it and build things. That includes commerce, entertainment, industrial applications and several other roads that lead back to AWS.

"We want to see what we can do to make this tool more accessible for customers to build things," said Roche. "We're going to see a lot of new areas of monetization open up, whether that's 3D-based advertising or voice-driven experiences, and we're very excited to just be a part of that."



V. The Field

In addition to the "four horsemen of tech" whose AR visions and ambitions were outlined in the preceding pages and in part I of this report, there are other influential companies working in AR. To close this report, we've decided to profile the AR efforts of a representative sample of four of them.

Microsoft

Though this report focuses mostly on consumer-based AR initiatives, Microsoft has placed its chips on an enterprise approach with HoloLens. This isn't surprising given that its DNA is very much tied to enterprise software and computing, such as its ubiquitous office software for enterprise productivity.

As further background to Microsoft's motivation, it has enjoyed decades of dominance in the PC era, followed by a decade of inferiority in the smartphone era. It now sees AR (or mixed reality in its terminology), as a way to return to grace and dominance with an emerging field.

This can also be compared to Facebook: Driven to not miss the boat again with hardware that's the dominant consumer touch point (smartphone), Facebook invested heavily for the next era (Oculus). Microsoft has done similar by building rather than buying. And its vessel is HoloLens.

This positions it with not only hardware but a software platform (Windows Mixed Reality) licensed to other headsets manufacturers; and tied into its foundational desktop operating system. Altogether, it achieves vertical integration — the same strategy by which its longtime nemesis Apple rose to power.



Image Credit: Microsoft



Mixed Metaphors

Carrying the above strategy, Microsoft has branded its approach as Mixed Reality. And with the aforementioned enterprise focus, Windows Mixed Reality will be anchored in Windows' installed base. Enterprise overall will be a strong early market for AR, before consumers adopt en masse.ⁱⁱ

That early adoption is mostly due to the ROI story in functions like design and assembly. That in turn results from increased productivity, reduced mistakes and overall cost savings. And cultural resistance to glasses-based AR adoption (style, privacy, etc.) isn't present in enterprise contexts.

One example is the HoloLens-assisted refinery management at Chevron. The energy giant uses HoloLens for maintenance and inspections. There, it utilizes HoloLens' Remote Assist feature to empower on-site workers with remote expert assistance, thus improving operational efficiencies.

But even though AR has adoption and market size advantages, Microsoft isn't ignoring VR. In fact, one component of Windows Mixed Reality (WMR) is a leading positional tracking system that's inherited from HoloLens. This is valuable IP which Microsoft will continue to utilize across XR efforts.

As background, WMR (and HoloLens) has inside-out positional tracking, which eliminates the setup and cord-laden orientation of outside-in tracking systems like HTC Vive's Lighthouse. It achieves this through mesh-based scene mapping, which scans room contours to better localize and track motion.

Microsoft has intelligently decided to utilize that asset by licensing WMR to third party hardware manufacturers to build sub-\$500 VR headsets. Starting with partners like Acer and HP, this will accelerate VR consumer adoption with price competition for capable mid-range headsets.

Vertical Challenge

Altogether, Microsoft is pursuing many paths to immersive technology. It's vertically integrated by owning the hardware (HoloLens), OS (Windows) and application layer (WMR). As shown historically by Apple, that approach can engender an elegant linking of hardware and software.

At the same time, it's pursuing the traditional Microsoft model that licenses software to third party hardware manufacturers (think: Windows-based PCs). That misses out on the quality control and product design of vertical integration, but it has economic advantages in high margins and scale.

While pursuing both of these strategies, WMR all the while stays true to Microsoft's DNA by playing to its strengths in enterprise applications. And the whole thing will utilize and stem from the massive installed base — in both consumer and enterprise worlds — of the Windows operating system.

Altogether, Microsoft is in a position to own the technology stack, accelerate its market penetration, and lower costs through economies of scale. This could place it in an advantageous position among tech giants pursuing AR. In the 'Four Horsemen' construct, it just might be the dark horse.



Magic Leap

It's hard to discuss influential and promising AR players without invoking Magic Leap. The AR innovator has received perhaps more mainstream attention than any other company in this report, partially due to its \$2.3 billion in funding and lots of chatter of world-changing optical innovations.

Compared to Microsoft's HoloLens' enterprise-focus, Magic Leap's is targeting consumer markets with its headset. The upside is an eventual market size that exceeds enterprise, though enterprise will scale first. But the downside is that it will butt heads with Apple at some point in that consumer play.

Also like Microsoft's HoloLens (but more extensive), Magic Leap is vertically integrated and develops the entire technology stack for its AR headset. It's also similar to Microsoft in that it tries to control the language, using terms like "mixed reality." For consistency, we'll continue using the term AR.



Image Credit: Magic Leap

Mixed Reviews

The long-awaited release of Magic Leap's first headset, Magic Leap One, was met with mixed feelings. Interestingly, most negative reviews come from tech publications with non-technical and formal product reviewers. Positive response has come from developers with less "formal" reviews.



We believe this is due to developers' intimate knowledge of AR's current deficiencies, which has tempered expectations. Formal reviews from tech writers conversely can't get past the divergence between two years of hype and what they now perceive as an unspectacular product.

As for common threads across most of the reviews, the field of view is a fairly universal gripe. And the lack of launch content was notable for some, given that there's only so much that can be done on the device before the app library is exhausted. Then again, this is a developer release.

One of Magic Leap's challenges is that it's a victim of the hype that surrounded it — a metaphor for XR's current stage. Magic Leap One, released in August, is an impressive piece of technology that's achieved sizeable technical feats in the past 3-4 years. But has it come short of mind-blowing status?

"I don't want to condemn it just because it can't meet the absolutely impossible hype that it's created. That wouldn't be fair," said The Verge's Adi Robinson in her video review of Magic Leap One. "But Magic Leap just doesn't have the kind of breakthroughs we've all been waiting for."

The Palm Pilot of AR?

Another challenge that will continue to face Magic Leap is the same challenge we've examined for AR experiences in generalⁱⁱⁱ: you can't really capture it through 2D video or verbal descriptions. The only way to truly get "sold" on the experience is to try it first-hand, which can be expensive.

This represents a marketing challenge for Magic Leap. In addition to pushing against classic price elasticity — rampant in something that is new/non-vital and pricey — it has to sell new users directly through experience. And that's a logistical/distribution challenge (think: retail installations).

Marketing challenges aside, Magic Leap One is a key milestone in AR's evolutionary path. But it shouldn't be viewed as an end-point; that will only further industry "disillusionment." If Google Glass was the Apple Newton of AR glasses, could this be the Palm Pilot on the way towards the iPhone?

The other question is who will bring us that eventual device? Magic Leap? Apple? It could be some combination if Apple acquires Magic Leap (though Magic Leap's current valuation is way outside of Apple's typical M&A range). Meanwhile we'll get lots of good stuff along that evolutionary path.

"The currently available apps don't use most of the input modalities of the device," said AR developer Lucas Rizzotto of Magic Leap One. "[Its] developer community will outmatch Magic Leap creatively by utilizing everything that's available, and become the real metric of what this device can do."



Niantic

One of XR's key accelerants examined in ARtillry Intelligence's 2018 predictions^{iv} was 'unifying technologies.' Also known as building blocks, these work towards democratizing advanced XR capability for developers. Examples include Google Blocks, Amazon Sumerian and Adobe Aero.

The most recent company to go down this road is Niantic, but in a slightly different way. The Pokémon Go and Ingress creator has turned its AR architecture into a platform on which others can build apps. This represents a possibly-opportune model we're calling "AR as a Service."

"Our mission is about getting people outside and exploring the world around them," said Niantic CTO Phil Keslin at AWE. "To achieve this requires the creation of a plethora of experiences, not just our own. And that requires many contributors which means a platform is needed to make it a reality."

Known as Real World Platform, it productizes the underlying code base for Niantic's popular AR games. This not only achieves democratization but does so in a way that's similar to the biggest democratization tool the tech world has probably ever seen: Amazon Web Services (AWS).

In other words, just like AWS, Niantic built its engine primarily to drive its own product. But a byproduct was the realization that it can be its own platform. And like AWS, it could be a highly scalable revenue stream, making it opportunistic for Niantic and transformative to the industry.

"AWS and GCP [Google Cloud Platform] weren't built as compute platforms for everybody," said Kelsin at AWE in May. "They were built to support the applications of Amazon and Google. Then they decided 'we have excess capacity, let's turn it into something that our users can use."

Doubling Down

Of course, all of the above is conceptual: The real value of Niantic's Platform will lie in its execution and functionality. One thing you may be thinking is that Pokémon Go is a primitive form of AR, so will it spawn a valuable platform? That's where Niantic's acquisition spree comes in.

Real World Platform is strategically timed to incorporate IP that Niantic has been scooping up and adding to its already-scalable infrastructure. That includes Escher Reality (multi-player & social AR) and Matrix Mill (occlusion and computer vision), which contribute to its "Planet Scale AR."

The idea is to have more robust computer vision and machine learning to contextualize real world items. Then, scene mapping IP from Matrix Mill can infuse graphics in dimensionally accurate ways, and Escher's social AR capabilities bring collaborative features. And it won't stop there.

Niantic is in a strong position with momentum, Pokémon Go's brand and lots of cash. It's now using that to double down on IP and positioning as an AR tech leader. The platform approach also lets it diversify, adding Saas-based licensing revenue to its ads and in-app purchases business model.



But before developers get the chance to build spatially-oriented AR apps and games using the Real World Platform, we'll get to see its first proof of concept: *Harry Potter, Wizards Unite*. Niantic's follow-up to Pokémon Go will be an important test for this platform, and for AR's continued mass appeal.

"One of the things we had to do along the way was respond to player behavior and things that happened in the game," said Keslin. "Network problems, system problems, and fixing those in real time. We're going to take all of that and we're going to pour it into Harry Potter Wizard Unite."



Image Credit: Niantic

Snapchat

Like Niantic, Snapchat is one of mobile AR's early leaders. Social lenses and selfie masks have become synonymous with AR. And though Snapchat and Pokémon Go get flak for not being "true AR," it doesn't matter: they've done AR a favor by acclimating the world as its "gateway drug."

Snapchat has intelligently treated that AR engagement as a monetization opportunity, such as branded AR Lenses. This has vaulted Snapchat as an early leader in AR monetization, in addition to penetration and usage. In fact, it currently holds a large share of mobile AR advertising revenues.



Segmenting our figures by company and going back to our bottom-up forecasting methodology (which calculates industry revenues based on current spending and company revenues), we estimate Snapchat's AR ad revenue to be \$236 million of the \$428 million spent on AR ads this year.



Similar to Facebook, examined earlier, Snapchat's AR play works on two levels. The first, is to boost its ad revenues by giving advertisers a more engaging format to capture user interest and conversions. And those campaign performance indicators are proving out (explored below).

The second level involves using AR to engage its user base to both attract new users and to grow session lengths for existing users. Those goals lead back to ad revenue, but focus directly on its usage metrics at a time when Snapchat's user growth continues to slow, due to Facebook.

Though Snapchat is an early leader among social networks integrating AR, it's subject to continued competition from Facebook. In the same style that Facebook copied key Snapchat formats like Stories, it's already beginning to do the same with AR lenses, such as its Camera Effects.

Snapchat has answered this call by opening up its own AR platform for developers known as Lens Studio. Previously, it limited AR lens development to its own in-house development team. But now with more of an open platform, more users, developers and advertisers can participate in AR lenses.

Snapchat will have to maintain such an open attitude if it's to gain the volume of AR content assets and user engagement that Facebook is capable of. Just like Facebook's copying of other Snapchat formats, it has the potential to then gain market share quickly based on its two billion global users.





Image Credit: Snap, Inc.

Playing the Long Game

Snap added to its AR strategy in September with a new feature that will let users scan physical items or barcodes with Snapchat's camera. It then overlays a card that shows information about that item or similar ones. That can include price, reviews and a purchase button, all of which flow from Amazon.

That last part is key (examined earlier), as Snapchat has intelligently partnered for better e-commerce functionality. But beyond just ability to transact, it also taps into Amazon's vast product image database for better object recognition, which means a more functional user experience.

This brings Snap into visual search, which is a logical extension. The company is already an early AR leader which has conditioned AR behavior within a younger user base that already has a high affinity for the camera. Fashion is also in its DNA, making the style/product-hunting use case a natural one.

But more importantly, it's a natural move because of its monetization potential. Driving commerce is something Snapchat continues to develop such as transaction-enabled AR lenses, and is central to its ability to grow revenue amidst volatile and sometimes-troubled stock performance.



Snapchat's AR-based revenue so far has been from branded AR lenses, a quickly-growing form of brand advertising as explored in our August Intelligence Briefing^v. But as shown above, visual search will begin to outpace AR lenses and other display-based AR ad formats in terms of revenue growth.

The longer-term play could also be glasses-based. Like Apple, Snapchat is likely planning for that time horizon. Also like Apple, it's mobile efforts could be a training ground for AR glasses, for both users and developers. Though not AR, Spectacles could have a similar "conditioning" effect.

"That's the secret strategy or the Trojan horse: How do you get enough sensors in people's hands at a cheap price or on their face," Ubiquity 6 CEO Anjney Midha said recently. "That sets them up for very immersive AR experiences or any kind of VR experiences a year or two years from now."

Video Companion: AR Advertising

(click URL to open)

https://youtu.be/naJ9MEeb0Ws





What's Next?

AR is a blessing and a curse to any analyst due to its excitement and uncertainty. Among other things, this means that the list of formidable players will evolve. New entrants and startups could have a native advantage in battling incumbents... the same way those incumbents once rose to power.

And other powerful players deserve to be on the list of AR innovators in this report. We'd like to acknowledge Unity for one, which we'll soon profile for its ongoing expansion into AR. That includes AR advertising creation and optimization. There's also the emerging batch of AR cloud startups.

For these and other players deserving of standalone treatment, look forward to coverage in the many months that lie ahead in ARtillry Intelligence's editorial calendar. It will be a busy but exciting time to capture the pulse, best practices and strategic implications of the impending immersive era.



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.

Beyond Apple & Google (examined in Part I), Facebook and Amazon loom large in their AR potential.

Starting with Facebook, AR is a natural extension of its social engagement and advertising models.

- AR lenses have become a popular format for social expression, status updates and shared media.
- Beyond popularity in user penetration, lenses also boost per-session engagement metrics.
- Strong usage and time spent within Facebook correlates to its ad monetization.
- Beyond correlation, AR lenses directly monetize as a native and increasingly popular ad format.
- AR News Feed and Messenger activations let advertisers demonstrate products in immersive ways.
- Branded Lenses also increasingly flow into transactional functions, demonstrating advertiser ROI.
- Facebook invests heavily in VR with Oculus, a trojan horse for a direct (hardware) user touch point.

Amazon sees several ways AR will boost core revenue streams and developing ones.

- Amazon was one of the first companies in visual search with its FLOW app, eight years ago.
- Starting with a Snapchat partnership, Amazon will re-activate visual search as a commerce driver.
- Product visualization (view how products look in your home) is another commerce-driving AR mode.
- AR visualization also reduces margin-depleting product returns in categories like flat screen TVs.
- Amazon is the poster child of "AR as a feature," with AR visualization features within its main app.
- Amazon Sumerian meanwhile is an XR creation enabler that seeds business for AWS.
- Sumerian-built products like customer service avatars increase reliance on AWS compute needs.

Beyond the big four, XR lessons and directional market signals can be seen in other innovators.

- Microsoft is cultivating a vertically-integrated enterprise play (its core business) with HoloLens.
- It's also covering bases with a consumer-geared licensing model with Windows Mixed Reality.
- Magic Leap is the wild card, also vertically integrated, as a rogue innovator with many uncertainties.
- If Google Glass was AR's Apple Newton, Magic Leap One is its Palm Pilot, pursuant to its iPhone.
- Niantic is developing an ambitious platform play, built on the architecture of Pokémon Go.
- Doubling down on its AR momentum, this will represent and validate the first "AR as a service."
- Snapchat is AR's early success and revenue driver (AR lenses), continuing to innovate formats.
- AR is positioned as one saving grace from its slowing user growth, revenue and stock performance.
- Unity is a powerhouse in VR as the prevailing game engine, increasingly expanding into AR.
- This notably includes AR advertising, such as immersive campaign creation and optimization.



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/artillryintelligence/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: VR Usage & Consumer Attitudes
- ⁱⁱ See ARtillry Intelligence Briefing, *Enterprise AR: Impacting the Bottom Line.*
- ⁱⁱⁱ See ARtillry Intelligence Briefing, Mobile AR Usage & Consumer Attitudes.
- ^{iv} See ARtillry Intelligence Briefing, 2017 Predictions; 2018 Outlook.
- ^v See ARtillry Intelligence Briefing, *The Camera is the New Search Box: Ads in AR.*