ARtillery Intelligence

ARtillery Intelligence Briefing

Mobile AR Strategies and Business Models

October 2019

ARtillery Intelligence

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Executive Summary

AR's early stages are defined by lots of experimentation to see what works natively in this new medium. That goes for product design as well as business models. What do consumers want and how much are they willing to pay for it? These questions continue to be a moving target.

Questions are also being answered by AR pioneers like Snap and Niantic, who are operating at scale. And by "scale" we mean occasionally Superbowl-sized audiences, and revenue to go with it. But the key word is occasional, as these AR exemplars are the exception rather than the rule.

But there are still valuable lessons to gain from these leading indicators. Though the AR sector will twist around and take shape over the next few years (as historically seen in tech), there are early lessons to learn in what product and business models are working so far.

Some of these signals are already evident in ARtillery Intelligence's consumer survey with Thrive Analytics.[i] There, we see lots of explicit sentiments from consumers about how they're using AR, how that's changing (over three waves of existing research) and what they want to see next.

Takeaways from that survey include the continued popularity of AR gaming (Pokémon Go) and social experiences (AR lenses). But there's also growing interest in emerging forms of AR such as visual search (Google Lens), navigation (Google Live View) and in-store retail commerce.

But what are the business models that are developing around this evolving consumer behavior? Though varied, we've begun to segment these models into three main categories (and several sub-categories). They include AR advertising, in-app purchases and AR-as-a-service.

The first two are fairly well known, though they're developing in nuanced ways examined in this report. But the third category is a less-discussed revenue category where brands, retailers and app developers pay for tools to build AR experiences for *their* customers.

This carves out a new category we're calling *B2B2C*, which includes software such as Unity, Amazon Sumerian, Adobe Aero and other tools to create AR experiences. Though enterprises are buying and deploying the technology, the AR experiences end up in consumers' hands.

Adding up all three categories mentioned above and examined in this report, it's a $1.44 billion market, growing to $20.3 billion by 2023. The common thread is AR technologies where the end users are consumers on mobile devices as opposed to industrial enterprises and/or headworn AR experiences.

The following pages examine each of these revenue categories and how they're evolving. What are their business models, best practices and strategic takeaways? The goal, as always with ARtillery Intelligence Briefings, is to empower you with a knowledge position.

Introduction: 3 Models

In AR's early stages, a common question continues to be asked: where's the money? There have been oscillations in excitement and doubt over AR, but the ultimate proof point will be revenue. Though aggregate revenues have disappointed, there are glimmers of hope.

So we've decided to examine the three biggest revenue categories for consumer-based mobile AR. We'll examine them on qualitative and quantitative levels. Qualitative analysis entails product models, leading companies and best practices. Quantitative analysis entails market sizing and revenue projections.

But before we dive into these models, what are they? We categorize them as follows:

1. Advertising (brands pay)
2. In-app purchases (consumers pay)
3. AR-as-a-service (enterprises pay)

Of course, there are more business models for AR such as hardware sales (AR glasses). But since smartphone-based AR provides greater scale today, we're focusing this report on software-based models in mobile AR. We'll tackle other AR subsectors separately.[ii]

You may notice each of the above models has a different revenue source. In AR advertising, brands pay to create and distribute ads. With in-app purchases, consumers pay for enhanced experiences. And with AR-as-a-service, enterprises pay for tools to develop AR.

Starting with advertising, brands are increasingly learning that AR has inherent capabilities to demonstrate products in immersive ways. And it can span the consumer purchase funnel including reach-driven product/brand exposure as well as direct-response product conversions.

Ad campaign examples continue to build, and there's momentum in the brand advertising world. Seeing revenue and doubling down on it, Facebook and Snap are increasingly catering to these brands with tools to lower barriers for AR lens creation and capability.

Moving on to the second business model, in-app purchases (IAP) are fitting for lots of AR experiences, especially gaming. This stems from the model's success in mobile gaming, and its ability to maximize ARPU through the behavioral economics of micro-transactions.

But moreover, it's fitting because AR is too early and unproven for consumers to pay upfront for premium apps. Our survey data with Thrive Analytics supports this. And if you need any more evidence, just look at the roughly $2.65 billion in IAP that Niantic has generated.

Lastly, there's AR-as-a-service (ARaaS). This involves enabling tech that lowers friction or boosts capabilities. ARaaS democratizes advanced AR capabilities like graphics creation and includes tools such as Unity, Adobe Aero, Amazon Sumerian and 8th Wall.

As an additional caveat, some of the above revenue categories are technically "enterprise AR" as defined in ARtillery's revenue forecast (enterprises are the source of spending). That applies here but the AR experiences examined in this report end up in consumers' hands, versus those built for industrial productivity.[iii]

That makes a few of the spending categories outlined above fall into a new category we call *B2B2C*. This is the case for AR advertising, as well as AR-as-a-service. In both cases, enterprises are the AR buyer/adopter but consumers are the target or end user.

Part I: Advertising

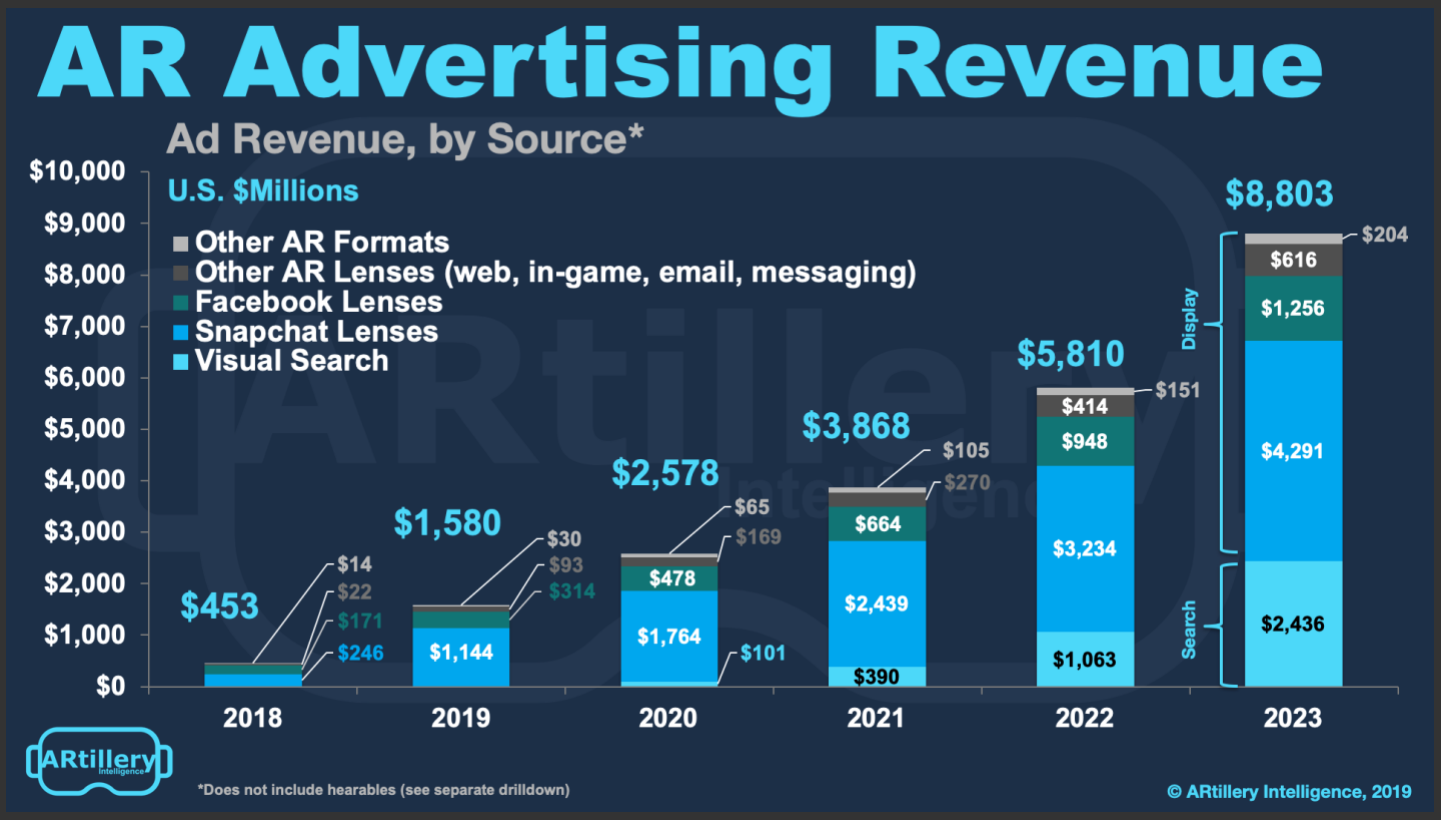
Starting with advertising, it's currently the largest source of spending in AR. Specifically, it derived $453 million in 2018 according to ARtillery's annual global AR Forecast.[iv] That's projected to grow to $8.8 billion by 2023. This leading revenue position is owed to the viral appeal of social AR lenses.

Led by Snapchat, usage has exploded around social AR Lenses. In fact, of all the mobile consumer AR formats and use cases today, social lenses dominate. Snapchat alone has reported that 142 million users engage with AR lenses daily. This is even greater than Pokémon Go's active user base.

High levels of engagement are a starting point for media formats that attract advertisers. Bringing that to the next level, AR lenses can demonstrate products in highly immersive ways. This has appealed to many advertisers that appreciate the creative capacity that 3D content now affords them.

Moreover, that level of engagement is proving out through ad performance metrics. YouTube for example recently reported that 30 percent of viewers of its campaign with L'Oréal chose to activate the AR lens option to virtually try on shades of lipstick. This led users down the purchase funnel.

This makes AR lenses a rare "full-funnel" advertising format. In other words, AR lenses can accompany ads in high-reach "upper-funnel" distribution channels like YouTube ads or the Facebook News Feed. But once activated, they engender "lower-funnel" behavior like try-ons and conversions.



AR Lenses: Naming Names

As for market share, Snap derived an estimated $246 million of the $453 million stated above. This makes it AR's revenue leader. Pokémon Go's $2.65 billion in in-app-purchases is greater, but that sum isn't directly-attributable to AR, depending on your definition of AR.[v]

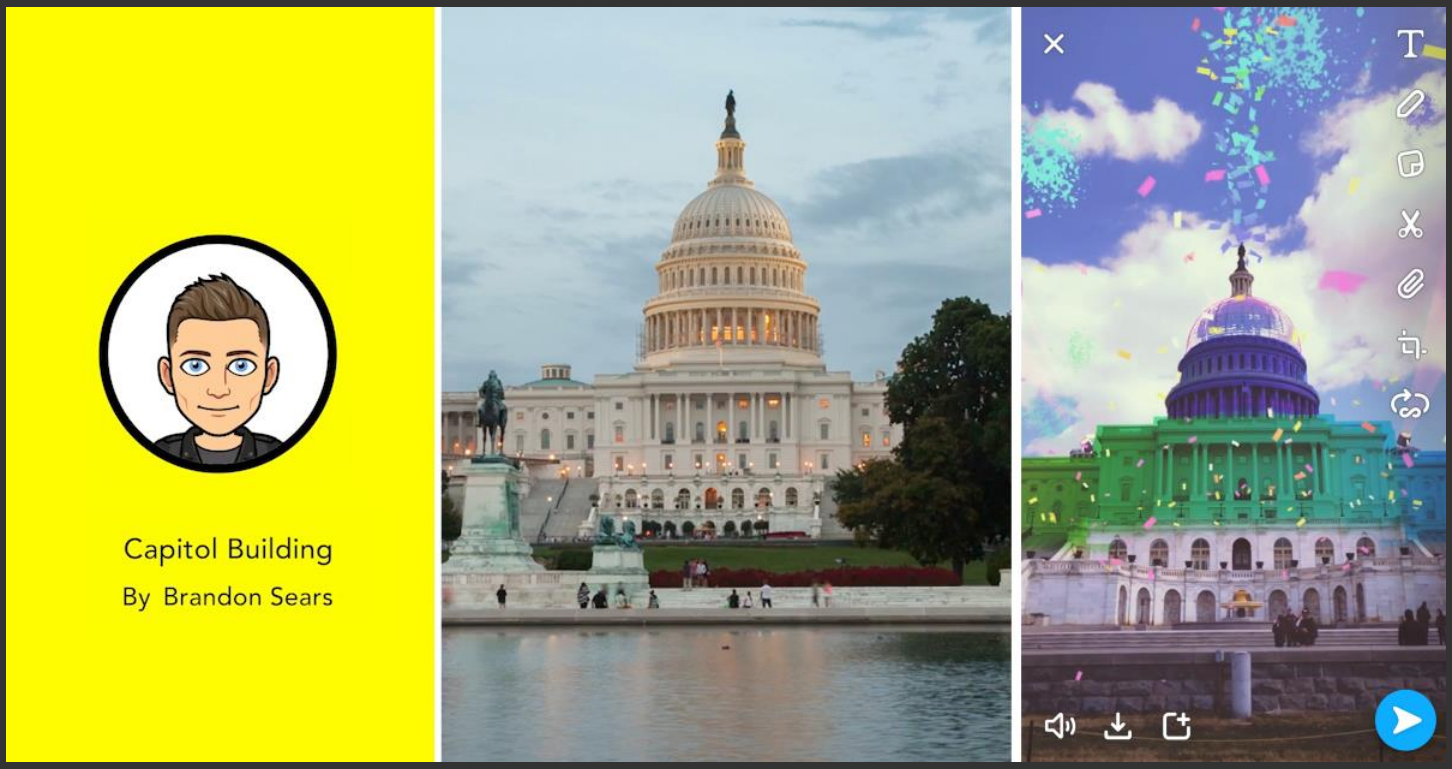
Furthermore, Snapchat continues to double down on AR lenses. It recently extended lenses from selfie fodder to rear-facing camera AR that augments the world. That includes more utilitarian and intelligent AR that overlays graphics based on scene awareness, or does things like solve math problems on the fly.

Adding up its current position, Snapchat has seen 15 million cumulative lens views from 500,000 lenses. Its lens developer community continues to grow – fueled by the above tools – to the tune of 20 percent during Q3 2019. And as mentioned above, it now reaches 142 million daily AR lens users.

But Facebook looms in Snap's rearview mirror with 1 billion lens views in the past year. It got a later start with AR lenses, but could gain market share as it blitzes AR ad spend from existing advertisers. Its installed base is larger than Snapchat's — 1.5 billion devices — and it likes to copy its closest competitors.

Facebook is also motivated to AR in order to diversify revenue, as diminishing News Feed ad inventory forces it to find other pastures. That includes Messenger (covered below) and, notably, Instagram. The latter is the sleeping giant, with an aligned use case and recent AR integration.

The opportunity also extends beyond these social walled gardens. Broader cross-platform reach could come from Web AR, where capabilities are limited but catching up. That's being led by innovators like 8th Wall, which is already working with advertisers like Miller Coors and Sony Pictures (explored later).



AR Ad Formats

AR advertising is starting just as the digital ad world did, with display ads (in this case, lenses) out of the gate first. Visual search will follow, led by Google, Pinterest and Amazon. It will bloom later due to greater technical complexity but will likely carry more "high-intent" value… just like search itself.

AR ad formats will then evolve into several formats that mirror – and extend beyond – the digital ad formats we know today. Here's a breakdown of the main AR ad formats ARtillery Intelligence projects.

Search

Google is highly motivated to visual search in order to "future proof" it's core business. This plays out through Google Lens (visual search) and Live View (AR mapping/navigation). This "search what you see" use case involves using your mobile phone interface to contextualize the world.

This will start with general-interest search categories like pets and flowers, but eventually move to products and packaged goods (monetizable). In all cases, it will utilize Google's robust image database for object recognition. Google is also advantaged in that can "incubate" AR in search.

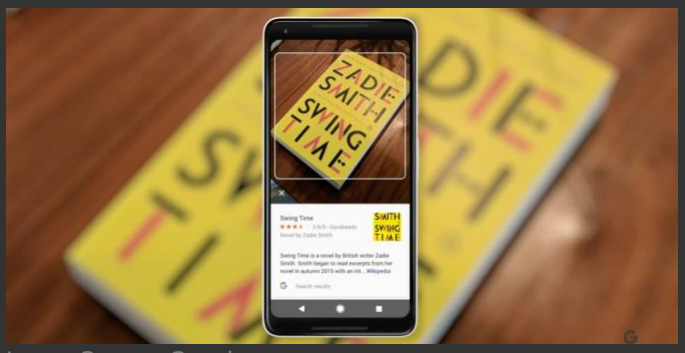


Image Source: Google

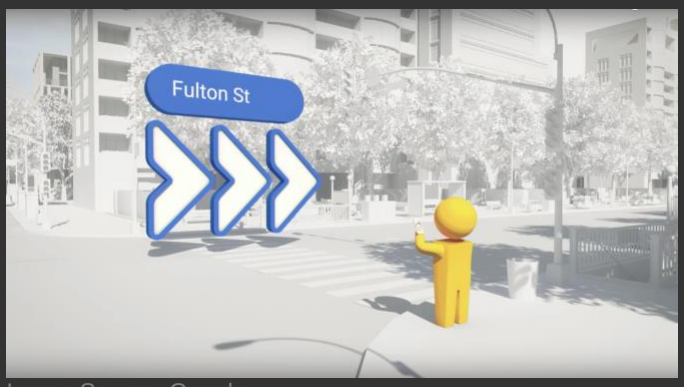


Image Source: Google

For example, at the Google I/O developer conference in May, it showed how it's positioning AR within search results for users to see 3D visual representations of search results. This will be like training wheels or a "gateway drug" to acclimate large audiences to AR in a trusted environment.

The first step, as always, will be growing users and engagement levels in these ways. But then monetization will follow. We believe Google will start to monetize things like Google Lens, given that it has a natural use case to identify commercial products or local storefronts with one's smartphone.[vi]

Once it flips the monetization switch, we believe growth will come quickly. That will be a function of Google's reach as a mobile search engine (95 percent market share) as well as the global penetration of Android OS. Specifically, we project visual search to grow to $2.44 billion by 2023 (see earlier chart).

Messaging

As stated above, the AR advertising landscape will evolve in ways that are similar to online and mobile advertising. Display ads (lenses) are out of the gate first, just like display ads were the first prevalent format on the web. Then formats splintered into other areas like search and messaging.

The latter is where we believe AR advertising could be headed next. This comes at a time when the act of messaging businesses ("conversational commerce") is growing. This is a function of millennial proclivities for messaging as a communication channel across personal and commercial contexts.

"We're calling this 'AR chat'," said NexTech's Paul Duffy at AWE "If you're a retailer and you're thinking about commerce ... the new battleground is not the website, it's actually the messaging app — the conversational commerce happening day-in and day-out between customers and brands."

Nextech AR Solutions is big on this fusion of AR and brand-consumer messaging. It has applied its ARitize platform towards this opportunity and has already tested it with a few consumer goods brands. The idea is that AR product visualization can launch directly from messaging apps.

The way this plays out is by infusing AR with customer messaging threads already underway. Live agents or bots (or both) can send users 3D product renderings to visualize in their immediate space. NexTech has already partnered with Live Person and shoe outfitter Tamara Mellon to do just that.

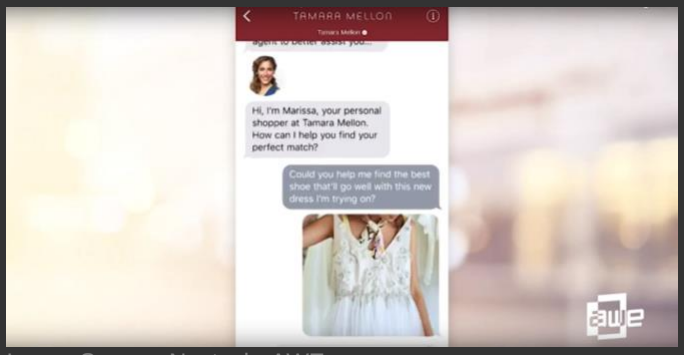


Image Source: Nextech, AWE

This plays to AR's strengths because these threads are already on a mobile device. Typed content can also signal agents to respond in optimal ways that lead consumers towards AR visualizations and, ultimately, conversions. And messaging is already transaction-enabled within most chat apps.

"Because they haven't left the messaging app, the purchase can be handled in this case by Apple Pay," said Duffy during a case study for Tamara Mellon. "The customer has taken the AR app, put it into their room, selected the product, and made the purchase all within that system."

This is a good example of AR's rare "full funnel" ability examined earlier. Besides being compelling to shoppers, brands are attracted to the high conversion rates and measurability. That's already the case per the performance data examined earlier, but bringing it to messaging could amplify the opportunity.

"In the spirit of removing friction in the customer journey and embedding yourself at those touch points where customers make decisions, this is one strong candidate for where AR makes a compelling difference," said Duffy. "We think it's going to be a great new battleground for AR."

Gaming

The mobile gaming world has evolved greatly in the past decade, including its revenue models. The go-to business model, as we'll examine later, is free-to-play games. That can involve either in-app-purchases or in-game ads. For the latter, AR is being integrated for more immersive ad experiences.

For example, during certain game milestones, ads are shown as a way for game makers to monetize their games. Instead of traditional banner ads or video, AR ads can take their place. This carries all of the advantages outlined above including higher engagement and a more compelling user experience.

"The belief is, and we're proving this out now through early pilots, that it's more engaging," Unity's Tony Parisi said on The AR Show podcast. "First, of all, it's interactive, not just linear video. Second, it's relevant and in context. I can get a product display out in front of me, and see what that looks like."

Unity so far is the leader in this emerging area. Though known more for its pervasive game engine, it parlayed that position into an ad network. It did this by offering a revenue-sharing monetization option to game developers. That gave it access to a large base of ad placement opportunities.

So an ad network was born, which now reaches 1.7 billion people. And though it preceded AR advertising, it's naturally become a fitting outlet for AR. We see this as a growth area for AR advertising, based on Unity's reach and the increasing comfort levels with AR among mobile gamers.

"We realized that with the magic of ARkit and ARCore, we could deliver interactive AR experiences into that same stream," said Parisi. "So instead of just a linear video ad, you can have an interactive experience and then if you turn the camera on, you get an AR version of that."

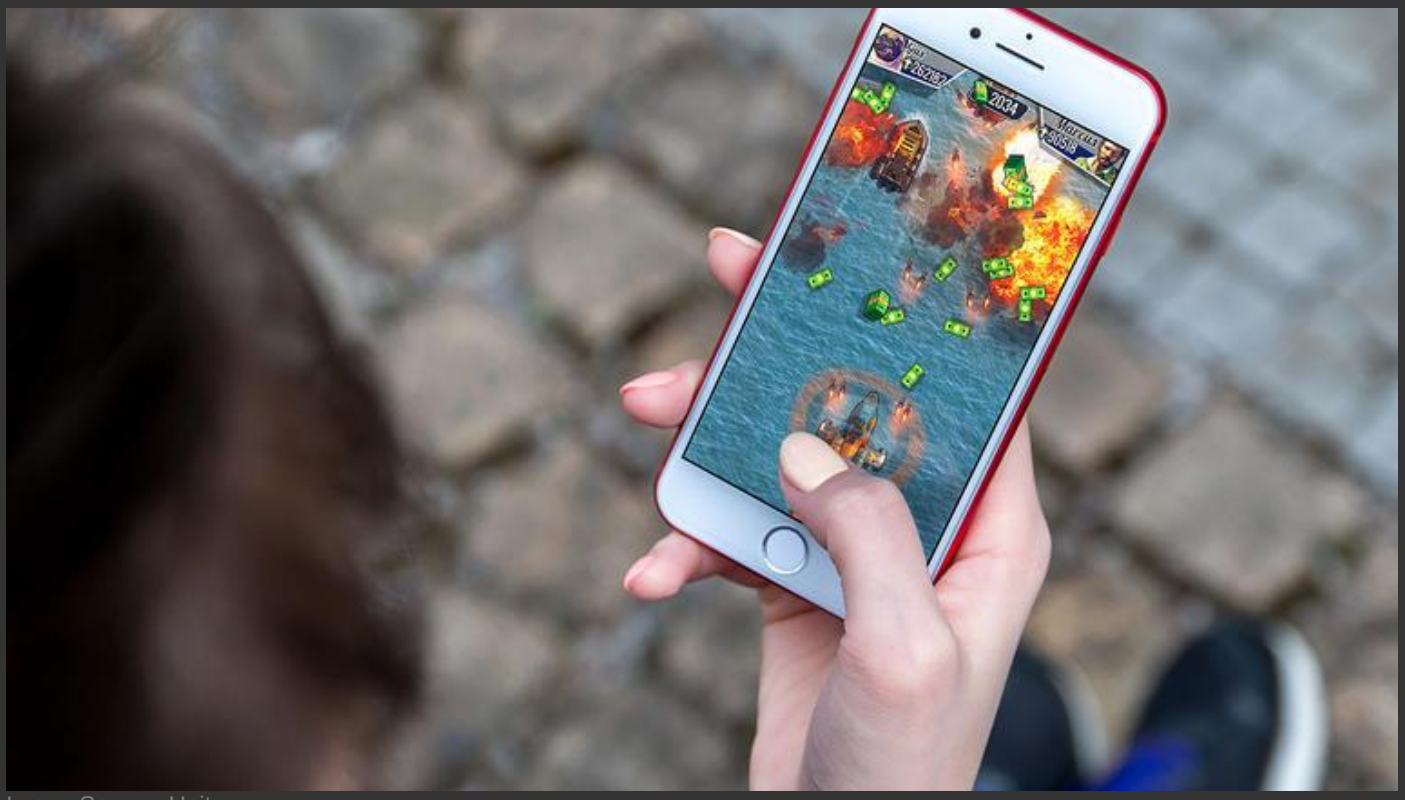


Image Source: Unity

Email

AR is being applied in all kinds of places as an engagement driver for brand advertising and commerce, per the above examples. So it was only a matter of time before it reached one of the oldest and most effective digital marketing mediums: email.

So what does the intersection of email and AR look like. Movable Ink is one example. The company lets marketers create emails that activate AR experiences. So clicking on an AR call-to-action activates the front-facing camera and launches AR interactions that involve the sender's product.

This can include style items, travel, and food. In these target verticals, the company is seeing open rates as high as 81 percent across the board. To put that into perspective, average open rates in email marketing and newsletters are about 21 percent according to figures from MailChimp.

In an individual email marketing campaign for Virgin Holidays, Movable Ink achieved a 40 percent boost in email open rates. Beyond open rates, post-open engagement was also favorable at 75 percent more than the benchmark for average campaigns. These are significant performance boosts.

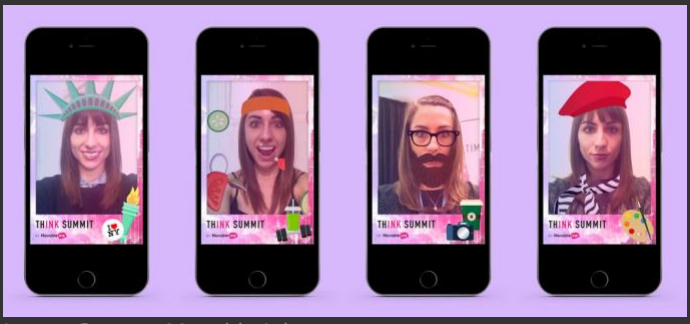


Image Source: Movable Ink

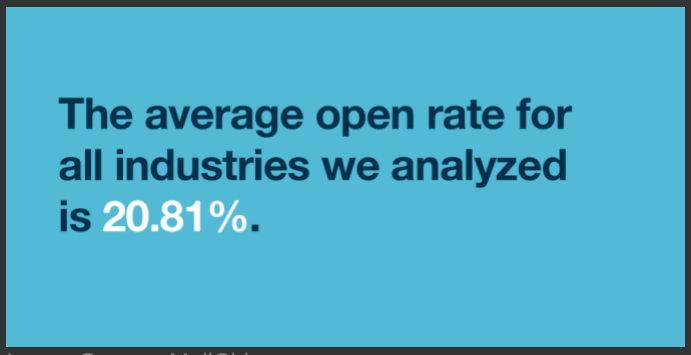


Image Source: MailChimp

Email marketing KPIs usually measure clicks, but an equally telling metric is time, where Movable Ink saw half of email opens lead to 1-minute+ AR engagement. 50 percent of opens also resulted in the recipient taking a selfie with the AR animation and 45 percent of those shared it on social media.

Of course, this means the opportunity is limited to recipients opening these emails on their smartphones, as opposed to desktop, but mobile email engagement continues to grow. Moreover, engagement metrics like open rates are higher on mobile, averaging 55 percent.

It's worth noting in the spirit of best practices that these favorable metrics are partly due to AR's inherent engagement, but also execution. Movable Ink's campaign tools involve drag & drop ways to develop AR animations. They're rudimentary (non-SLAM) interactions... but sometimes "simple wins."

In Perspective

Despite all this momentum, AR advertising has some challenges and weaknesses to acknowledge. First, there will be a long learning curve with respect to creating effective AR advertising that is native to the format. This is a common challenge with emerging technologies, such as smartphone ads.

The native challenge will apply to measurements as well. Just as new forms of immersive interactions are possible with AR (e.g. product try-ons), we'll need new metrics to accurately capture effectiveness. In other words, it won't grasp AR's value to measure performance in "clicks."

"With immersive technology, everyone's going to ask for the ROI," You Are Here Labs' futurist Kathy Hackl said at AWE last year. "Do we need to create new metrics… something like return on engagement or whatever that would translate to? There's definitely going to be new metrics."

Related to these challenges is the slow speeds at which brand advertisers adopt new technologies. Moreover, they're very reach-driven. Despite strong campaign performance outlined earlier, AR's perceived reach isn't enough to excite most brands outside of a small batch of early adopters.

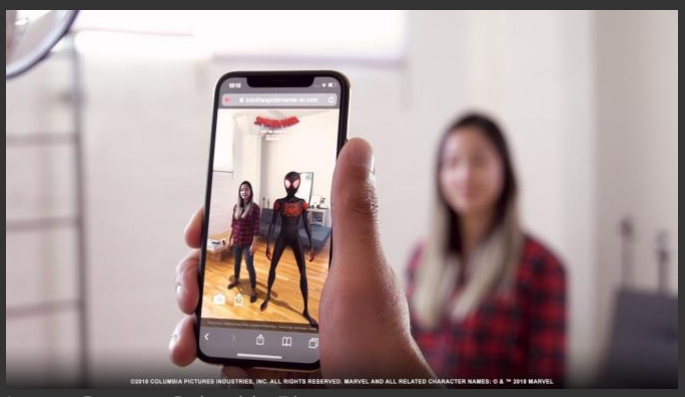
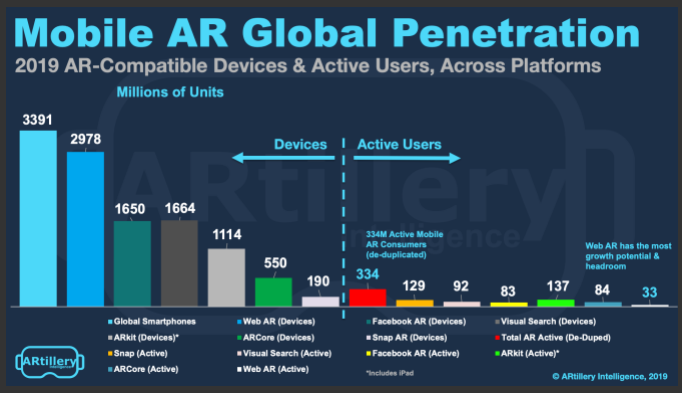


Image Source: Columbia Pictures



But the key word is "perceived." Potential reach exists, including audiences of up to 700-million people for single Snapchat lens campaigns.[vii] Despite that, prevailing sentiment from the laggard and comfort zone-bound Madison Avenue is that it's a low-reach play. So for them, it will be a learning curve.

The Madison Avenue disconnect also speaks to the need for education, which will take a while if history is any indication. Brand acclimation to smartphone advertising is still underway, ten years later. For example, mobile location targeting is still done ineffectively by many brand advertisers.[viii]

So if these challenges abound, why are we so bullish on AR advertising, per the $1.6 billion projection for 2019 AR ad revenues. The answer is that we're not... This figure is low compared to other projections, and about .3 percent of the $522 billion global ad spend. It will be an opportune but slow climb.

Part II: In-App Purchases

Second on our list of consumer AR software business models is In-App Purchases (IAP). This category has Pokémon Go to thank for its prominence and inclusion in this report. As mentioned a few times, the location-based AR game has derived an estimated $2.65 billion in IAP revenue to date.

Further validating IAP is the fact that it's an established revenue model in mobile gaming – the same soil from which AR gaming sprouts. That means that consumers are already acclimated to IAP. Premium apps are conversely untenable for AR because the technology is too early and unproven.

This notion is supported by ARtillery Intelligence's annual consumer survey data with Thrive Analytics.[ix] IAP is the most popular payment option among survey respondents.

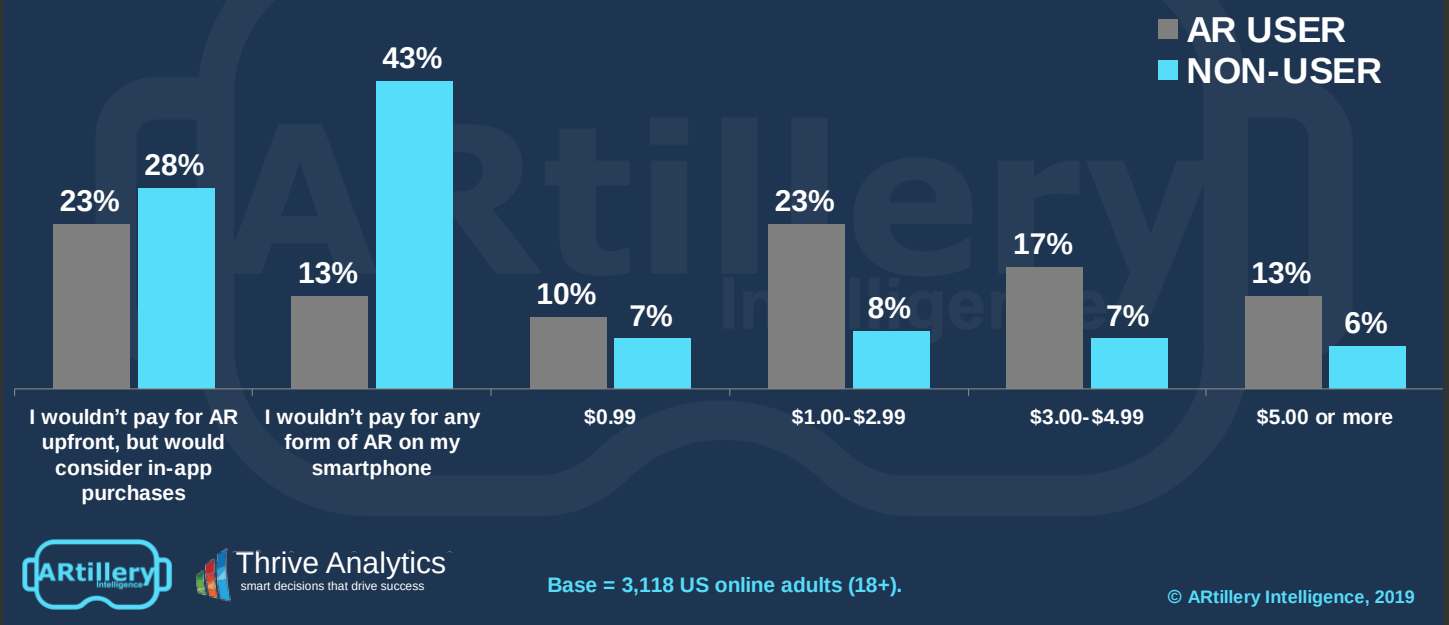
Along with the above evidence, this is a strong signal for IAP's strength as a near-term revenue model in AR gaming.

Based on these and other signals, ARtillery Intelligence has an optimistic outlook for IAP in its market sizing. In our Global AR Revenue Forecast 2018-2023,[x] IAP is a leading revenue source among all AR sub-sectors. Specifically it's projected to grow from $863 million in 2018 to $4.9 billion by 2023.

Beyond the quantitative assessment, what's the qualitative view on IAP. Who's showing best practices and what are the ways it will materialize in the coming months and years? The answer is mostly "Pokémon Go." As the leader in AR gaming revenue, there are several things it can teach us.

Mobile AR Price Sensitivity

What's the most you'd pay for a mobile AR experience?



Thrive Analytics
smart decisions that drive success

Base = 3,118 US online adults (18+).

Lessons From Pokémon Go

As we pass Pokémon Go's (PGO) third birthday on July 6, evidence emerges of its lifetime revenue total. Sensor tower estimates total revenues of $2.65 billion, on pace for $3 billion by the end of 2019. This notably ranks the game ahead of Candy Crush and Clash Royale – a sizable feat.

Further putting things in perspective, estimated 2019 year-to-date gross revenue is $395 million, up 19 percent year over year. Daily average revenue since launch is $2.4 million, and its average revenue per player (ARPU) is $5, corresponding to 521 million downloads.

But these are cumulative figures. What about the present? Despite falling from its Q3 2016 peak Pokémon Go has resurged in 2019. In fact, August 2019 was its biggest revenue month in three years and fourth-largest to date with $110 million in revenue according to Sensor Tower.

One lesson from the above figures is that Pokémon Go's usage and revenue have mostly sustained over time. This is rare for mobile games, given common play cycles. Games quickly lose novelty and their mechanics have to be refreshed to maintain competitive appeal among accomplished players.

Image Source: Niantic

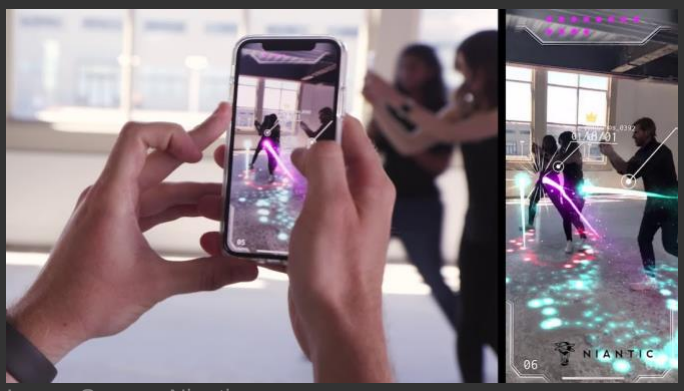


Image Source: Niantic

So what has Pokémon Go done to counteract these forces? There are several answers including updating catchable Pokémon in deliberate intervals to keep game challenges and accomplishments fresh. For example, its August surge is attributed to incorporating "Team Rocket" into gameplay.

Another feature it added in 2019 is a sort of fitness tracker. It tracks and gamifies players' steps in the background, which adds new dimensions of play and competitiveness. It's also "on-brand" and aligned with game maker Niantic's core mission to get people out of the house.

Niantic has also been successful in limiting AR to a feature rather than a primary function. Due to its new and unproven status, it's smart to ease users into AR. It also added AR where it natively fit, such as a feature that lets players pose with captured Pokémon for social shares.

These tactics join the underlying advantages such as strong IP and smart game mechanics. For example, the game balances challenging play with attainable accomplishments. And though the game is technically asynchronous (one-player), it's conducive to group outings and social activity.

Take Two: HPWU

Speaking of strong IP, Niantic's follow up title, Harry Potter Wizards Unite has been hotly anticipated due to its precursor's success. Its performance so far involves bad news and good news. It's tracking far behind Pokémon Go in usage and revenue... but it's still a strong contender in its own right.

For example, it's on pace to be the second highest-grossing location-based game of all time with $12 million in its first month, says Sensor Tower. And though it's pacing behind Pokémon Go, it exceeds other strong-IP titles in location-based AR such as Jurassic World Alive and Ghostbusters World.

As far as financial metrics, per-player spending (ARPU) during HPWU's first month is $.46. That trails Pokemon Go's $1.50 during the same period. But as noted above, Pokemon Go's lifetime ARPU rose to $5 in a cumulative timeframe, which indicates potential growth for HPWU as its momentum grows.

This begs the question of how other impending AR games will fare. Minecraft Go has lots of potential, given a massive engaged base of gen-Z players that demographically align with the camera forward use case. It's currently in the process of a slow rollout so we'll have to wait and see.

Panning back further, there are interesting things happening in China (as always). Tencent's Let's Hunt Monsters has actually outperformed HPWU in revenue if you zero in on just iOS. And other location-based AR games will continue to develop, some with very strong IP.

Sticking to the theme of bad news / good news, the bad news is that things are so early and undefined. The good news... things are so early and undefined. There will be lots of value creation as location-based AR gaming – and its revenue models – continue to grow into their own skin.

Image Source: Niantic

What's Next for IAP?

Speaking of evolving paradigms, where else could in-app purchases find a home. There are several areas that show potential, beyond AR experiences that fit the Pokémon Go mold. These signals mostly come from historical examples, such as successful models in non-AR mobile gaming.

The biggest of those is the revenue beast that is Fortnite. It has validated the fact that consumers will pay via in-app purchases and micro-transactions to personalize in-game characters. Not only is this validated in Fortnite but it's theoretically well-aligned with AR's current usage patterns.

For example, AR's most popular modality measured in active users (even more so than Pokémon Go) is social lenses. These are all about self-expression and whimsical selfie fodder to share with friends. So far, these experiences are free, as they're essentially subsidized by brand advertising.

That brings in the previous section of this report where brands have been compelled to develop immersive product lenses as a marketing vehicle. Beyond those branded AR lenses, Snapchat and Facebook have seeded lens libraries with free community-created lenses to maximize their traction.

Image Source: Facebook

Image Source: Unity

But once they reach a critical mass of traction and demand, Snapchat and Facebook could introduce consumer-pay options. The model is what Snapchat did with Geofilters, where consumers, for a nominal fee, create and unlock a lens around a geofence and timeframe (think: birthday party).

This will accomplish a few things for Snap. It will unlock a long tail of consumer spending for AR lenses – sort of like what it does currently for advertisers but higher-volume / lower-margin. It will also be another incentive to attract lens developers to its platform, given greater reach and monetization potential.

Longer term, this principle will apply to more advanced forms of AR. AR Cloud innovator Ubiquity6 is keen on the idea of a marketplace for AR-based expression and personalization. It could sit between creators, users and experience curators as a platform, collecting affiliate fees for digital transactions.

Other players such as Aura want to build a sort of "avatar as a service." This will be a turnkey avatar creation engine that AR game developers integrate. They can then share revenue for in-app purchases as players personalize avatars a la Fortnite. It could be a sizable AR revenue category.

Part III: AR as a Service

We ended the previous section talking about "avatar-as-a-service" which leads right into the third and final revenue model of this report: AR as a service (ARaas). Like Saas did in the broader enterprise software market, ARaaS will have a sizable impact on AR by democratizing its advanced capability.

This will include software that helps brands build the AR lenses examined earlier. It's helping retailers build in-store shopping visualization, and 3D models of their product inventory. It's helping consumer goods companies make AR user guides for their products, or AR tie-ins for movie studios.

Following in the footsteps of enterprise Saas, ARaaS offers recurring revenue to providers and cash-flow friendly pricing for buyers. This will be a key building block for AR developers, as well as consumer-facing enterprises (or their agencies) that don't have advanced in-house technical skill.

The key term is "building blocks." In fact, ARtillery Intelligence's 2019 predictions[xi] projected building blocks as a breakout AR category. We're at the point in spatial computing's lifespan when the proverbial gold-rush "picks & shovels" are needed to enable developers and to accelerate growth.

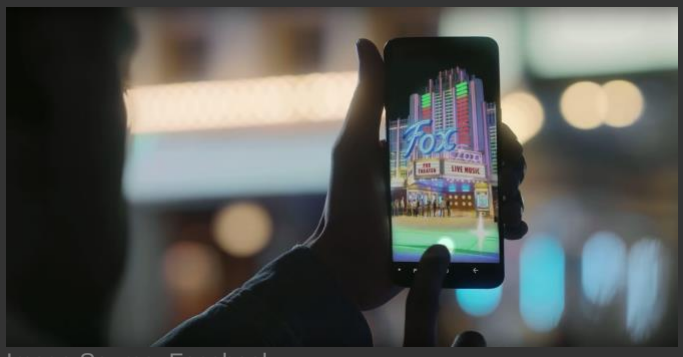
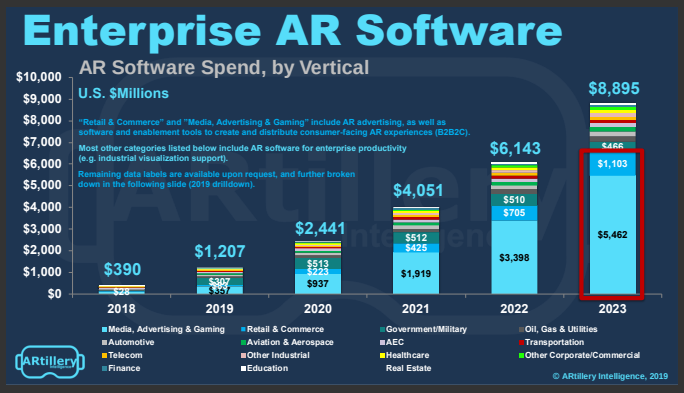


Image Source: Facebook



The opportunity can also be seen in ARtillery Intelligence's revenue forecasting. The biggest projected revenue sources in enterprise AR software will be ARaaS for media, retail, commerce and gaming. ARaaS revenue in these categories alone are projected to reach $6.57 billion by 2023 (see chart above).

The common thread in all of these ARaaS use cases we're spotlighting in this report is consumer outcomes. Differentiated from enterprise spending for industrial AR (visualization support, automation, etc.), we're talking here about enterprise spending on AR activations for *their customers*.

As mentioned earlier in this report, this is a new area of AR spending that we're calling *B2B2C*. It includes the examples above in that various enterprises are using AR tools to build things for their customers. That's usually to engage them in some way to stimulate purchases or cultivate brand loyalty.

Flavors of ARaaS

ARaaS is a broad category as the examples provided above indicate. And we've only scratched the surface of the category's potential breadth. It will eventually be a lot larger, per the above figures. But to provide color on how it's shaping up today, here are a few representative examples.

Creation Engines

An emerging sub-sector that constitutes ARaaS "building blocks" is tools that democratize the creation of 3D graphical assets for spatial experiences. Game engines like Unity have been doing this for a while with creation tools for 3D worlds.

Google Blocks lowered the barrier further for creating assets with limited programming skills. Google also launched Poly, an online library of Blocks creations. Sketchfab is another such tool for creators to display and sell 3D graphical assets, and for buyers to find them.

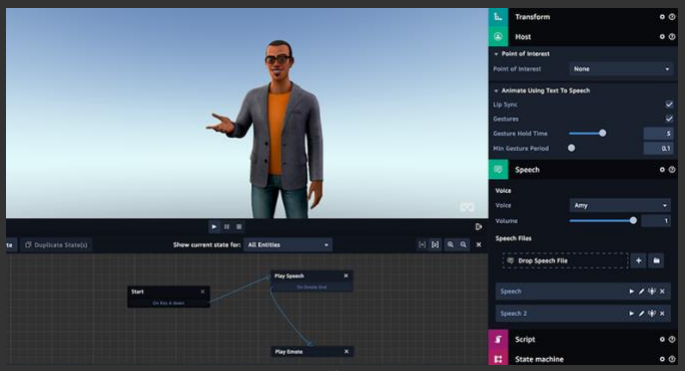


Image Source: Amazon Sumerian

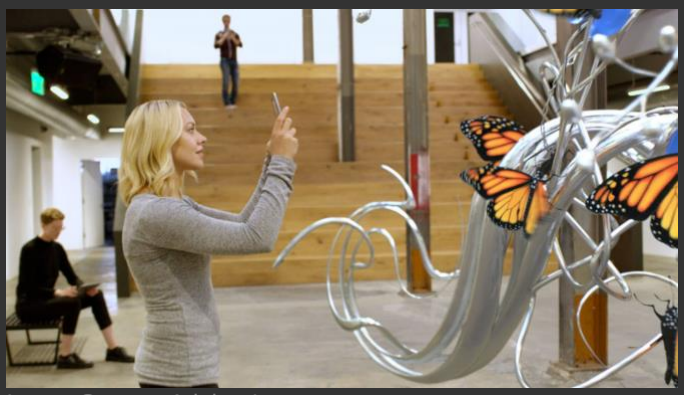


Image Source: Adobe, Inc.

Other creation tools include Amazon Sumerian. This is a platform that lets developers and brands create and run VR and AR apps, or 3D graphics. It boasts drag & drop functionality and not requiring specialized programming nor 3D graphics expertise. This is a key attribute for its intended audience of consumer-facing brands who want to build AR experiences.

There's also Adobe Aero, a tool to similarly provide a drag & drop creation environment for spatial computing. One of its biggest advantages is that it plugs right into Adobe Creative Suite, which is a ubiquitous platform for creative professionals, including tools like Photoshop and Premiere.

"Adobe has always embraced new mediums from print and PC to web and mobile," said CTO Abhay Parasnis at the Adobe MAX conference. "We've always looked around the corner to figure out the next creative medium. We truly believe that we're at a similar inflection point with AR."

Retail & Commerce

One prevalent use case for mobile AR so far is product visualization. This involves "try-before-you-buy experiences for everything from cosmetics to couches. It's been very popular with users and effective for consumer brands, as explored earlier in part I of this report. But there are also challenges.

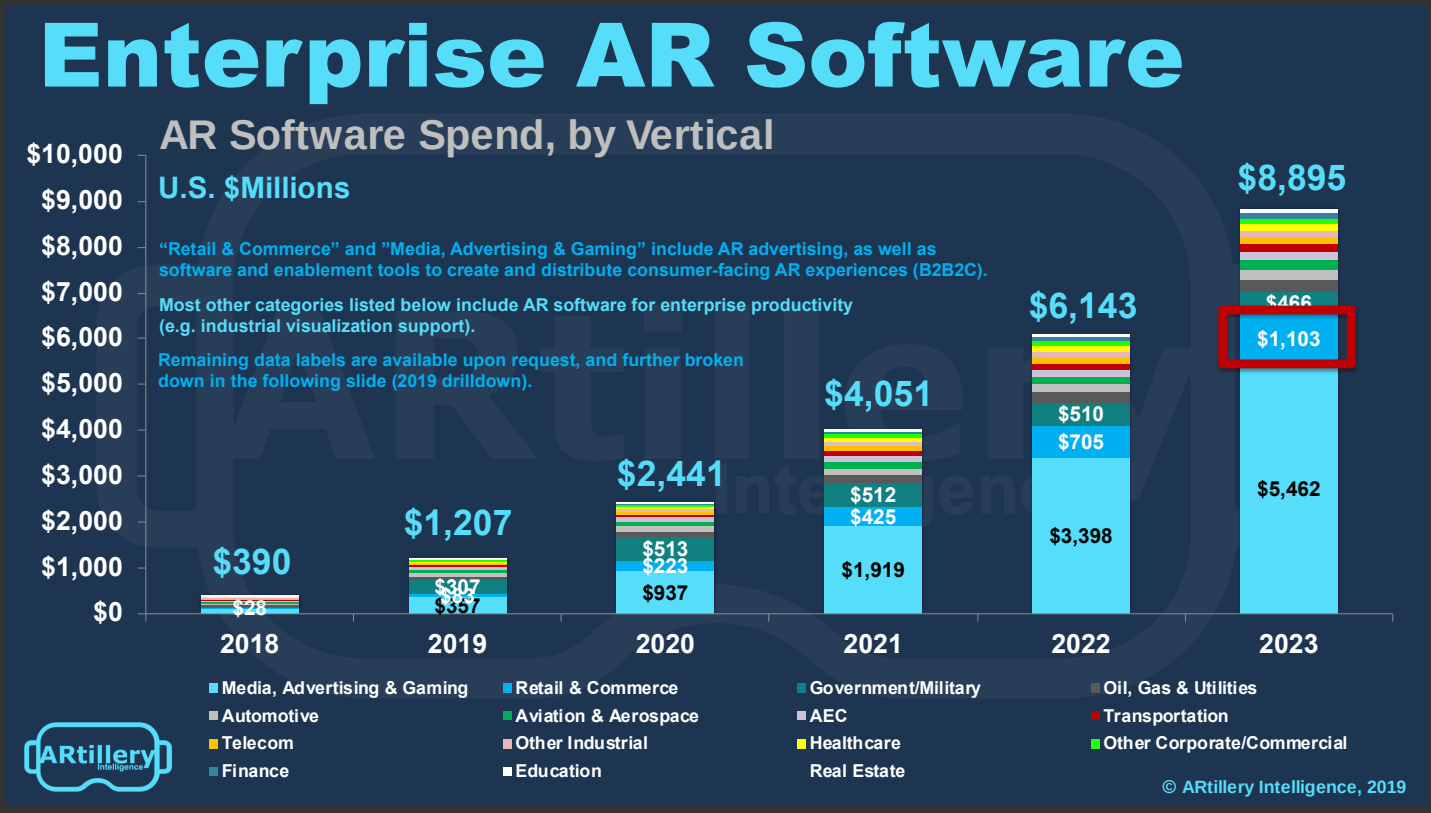
For example, product visualization first requires digitizing a given brand's products. This is relatively easy if there's a limited range of products, such as with BMW's iVisualizer app. But it gets more complicated with product catalogs with thousands or millions of models or color/size variants.

"Whenever anyone asks what they need to do to get ready for the future, I say make digital twins of everything in your inventory," Unity's Timoni West told us. "A lot of companies don't have that right now or they have CAD files for 3D printing that are way too big and won't work for mobile."

In the near term, IKEA, Wayfair and others offering AR visualization rely on individual solutions to scan products. But the real opportunity is for specialized and standardized methods that can help them scale up 3D image libraries; and bring the opportunity within reach of smaller down-market players.

E-commerce platform Shopify has done this by bringing AR product visualization to 600,000 businesses. Using the USDZ file format, Shopify merchants can create 3D graphics that are immediately usable in Apple's Quick Look AR feature. This is where ARaaS will shine.

"Wayfair and IKEA have their own means and methods they've created in-house, because there's nothing out there that's scalable, affordable and easy," said Super Ventures Partner Tom Emrich at a Cambridge House event. "These are startup opportunities that, as an investor, I'm looking at."



AR Cloud Startups

As examined in ARtillery Intelligence's report on the AR cloud,[xii] advanced consumer AR experiences will require a pervasive data layer that devices can dynamically tap into. The companies building different components of that AR cloud value-chain represent an important part of the ecosystem.

They qualify as ARaaS because they're providing software to AR app and experience developers to tap into the AR cloud. That includes companies like 6D.ai, which provides an API for apps to access AR cloud data. In return, they contribute spatial maps that are collected through the use of their apps.

Other AR Cloud startups include Ubiquity 6. Its Reality Editor platform is a low-friction developer tool to build web-based AR experiences that can be viewed through its AR-enabled spatial browser. As mentioned earlier, it also wants to be at the center of a marketplace of AR digital goods creation.

These are just a few examples and other notable AR cloud startups include Scape and YouAR. These business models are developing and will be packaged in various ways (not necessarily SaaS pricing), such as Ubiquity 6's potential affiliate marketplace revenues and 6d.ai's variable-use pricing.

Image Source: Ubiquity6

Location-based Gaming

Sort of an offshoot or subset of AR cloud companies is location-based gaming. This is a category with just one player so far: Niantic. The Pokémon Go and Harry Potter, Wizards Unite creator recently turned its AR architecture into a platform on which others can build apps: the Real World Platform.

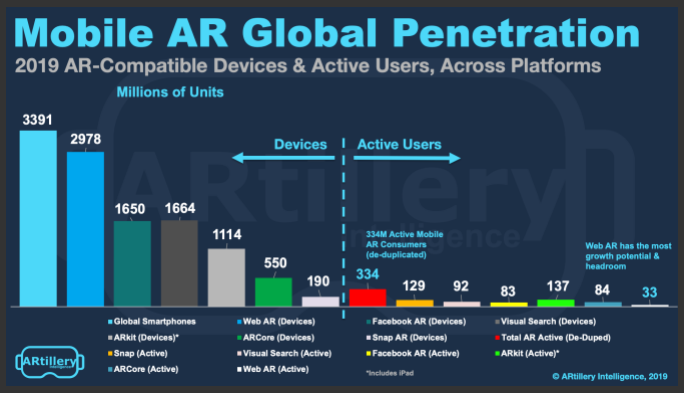
Similar to Amazon Web Services' (AWS) inception, Niantic built its engine primarily to power its own product. But then it realized that it can be its own platform. And like AWS, it could be a highly scalable revenue stream, making it opportunistic for Niantic and a valuable utility for the industry.

"AWS and [Google Cloud] weren't built as compute platforms for everybody," said Niantic CTO Phil Keslin at the AWE conference. "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'."

This could be a valuable toolset given that it will enable app developers to build experiences on top of the infrastructure that Niantic spent years building the hard way. That includes things like scaling up to surges in user behavior and creating the compelling game mechanics examined earlier.

Mapping is also an area where Niantic has developed aptitude. That's obviously core to location-oriented apps. And based on its ongoing IP development and acquisitions, Niantic should soon have an even firmer grasp on underlying mapping and the AR Cloud

"Pokémon are spawned because we know generally what's at a particular location," said Keslin. "There's a map that describes that for us. That's just one instance of the maps that you have to use to create these types of apps. It's an understanding of the world around you."



Web AR

Web AR is an important area of development, given that the smartphone's app paradigm may involve too much friction and not enough interoperability for AR. Web-based AR experiences can be launched from mobile browsers on a greater range of devices, and without a dedicated app download.

This could be critical for mobile AR's early days when adoption doesn't need additional points of friction. Beyond user friction, some of the consumer-facing enterprises discussed in this report (brands, retailers, etc) are very reach driven. Web AR has the potential to reach almost three billion devices (see chart above).

Companies like 8th Wall are founded on these principles to help consumer-facing enterprises create web AR experiences. Examples include movie tie-ins such as *Spiderman Homecoming*, where fans can activate and pose with character animations in their immediate space.

This will continue to evolve as web AR becomes apparent to more enterprises and consumers. Web AR capabilities will also continue to evolve and close the gap on the greater functionality currently seen in native apps. It's an area worth watching closely for ARaaS opportunities.

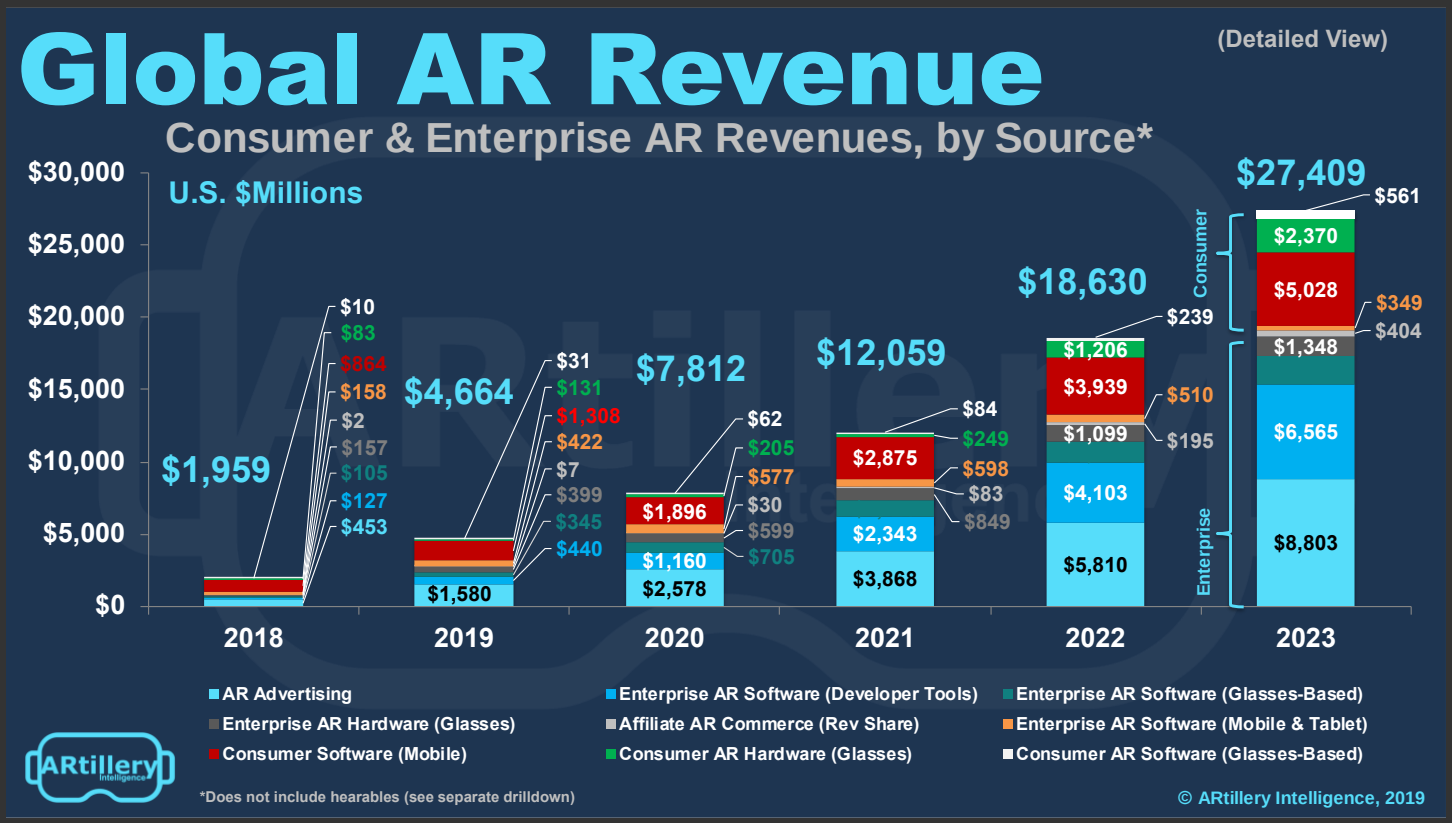
Jumping-off Point

The above ARaaS business models are just a representative sample. Many others will develop. Just as we touched on “avatar as a service” in an earlier section, the levels of specialty in the AR value chain will evolve with that same level of granularity.

There will also be supporting functions and entities that don’t necessarily follow a pure software or SaaS model, but will likewise be valuable to the ecosystem. These include creative agencies that specialize in AR for advertisers, or venerable AR game studios like Happy Giant.

Panning back beyond ARaaS, all three main business models examined in this report will likewise evolve. They represent a narrow band in the overall AR universe (software-based business models for consumer mobile AR), but will continue to evolve and sub-divide as AR takes shape.

We’ll be back to go deeper on each of these, and to track their progress. Consider this report a jumping-off point, as these business models each deserve their own report. We’ll commit to doing that, and to drill down on other business models in the expanding AR universe.



About ARtillery Intelligence

ARtillery Intelligence chronicles the evolution of spatial computing. Through writings and multimedia, it provides deep and analytical views into the industry's biggest players, opportunities and strategies.

Run by analysts and former journalists, coverage is grounded in a disciplined and journalistic approach. It also maintains a business angle: Though there are lots of fun and games in spatial computing, cultural, technological and financial implications are the primary focus.

Products include the AR Insider publication and the ARtillery PRO research subscription, which together engender a circular flow of knowledge. Research includes monthly narrative reports, market-sizing forecasts consumer survey data and multi-media, all housed in a robust intelligence vault.

Learn more **here**.

About Intelligence Briefings

ARtillery 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 **here.**

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 has been an industry analyst covering mobile and social media since 2005, and is now Chief Analyst of *ARtillery Intelligence* and Editor-in-Chief of *AR Insider.*

Mike is a frequent speaker at industry conferences such as AWE, VRLA and XRDC. He has authored more than 120 reports and market-sizing forecasts on the 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 read **here**.

Methodology

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

For market sizing and forecasting, *ARtillery Intelligence* follows disciplined best practices, developed and reinforced through its principles' 15 years in tech-sector research and intelligence. This includes the past 3 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 revenue dynamics such as unit penetration, pricing and growth patterns. More on ARtillery Intelligence market-sizing research and methodologies can be read **here.**

Disclosure and Ethics Policy

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

ARtillery Intelligence's disclosure and ethics policy can be seen in full **here.**

Contact

Questions and requests for deeper analysis can be submitted **here.**

References

[i] See ARtillery report: Mobile AR Usage & Consumer Attitudes (sign-in required)
[ii] See ARtillery PRO Reports Library (sign-in required)
[iii] See ARtillery report: Industrial AR: Benefits & Barriers (sign-in required)
[iv] See ARtillery report: Global AR Revenue Forecast, 2018-2023 (sign-in required)
[v] See ARtillery report: Hearables: Broadening the Definition of AR (sign-in required)
[vi] See AR Insider article: Test Driving Google Lens: The Strategic Take
[vii] See AR Insider article: 700 Million AR Lenses in One Day
[viii] See Street Fight Podcast Episode: Building Network Effect for Location Intelligence
[ix] See ARtillery report: Mobile AR Usage & Consumer Attitudes (sign-in required)
[x] See ARtillery report: Global AR Revenue Forecast, 2018-2023 (sign-in required)
[xi] See ARtillery report: 2018 Lessons, 2019 Outlook (sign-in required)
[xii] See ARtillery report: AR Cloud and the Internet of Places (sign-in required)