

ARTILLERY INTELLIGENCE BRIEFING

SOCIAL AR: SPATIAL COMPUTING'S NETWORK EFFECT, PART I
FEBRUARY 2019



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Executive Summary

One of the biggest questions nagging the Augmented Reality (AR) sector is, what will be its killer app? And when will it arrive? The medium needs such an accelerant to legitimize and bring AR into mainstream acceptance – something it's failed to do in the 18-months since Apple's ARKit launch.

We've speculated in past Intelligence Briefings that killer apps will likely extend beyond the novel and "sexy" attributes that have thus far driven the industry's speculation, imagination and design principles (e.g. games). It will rather be something more mundane that provides all-day utility, like visual search.

But another category will also vie for the position of AR killer app: social. Indeed, you could argue that a social AR killer app has already arrived and accelerated mass acceptance: social lenses. We see these as an important AR "gateway drug," but only a glimpse into social AR's true potential.

One thing missing from social AR lenses – though quite popular through Snapchat and Facebook – is meaningful social interaction. More "augmented media" than augmented reality, they're created in isolation then shared with friends to be consumed asynchronously at a different time or place.

But true social AR will combine this time/place-shifted paradigm – which will still be valuable to achieve scale – with *synchronous* AR. This will rely on technically complex multi-player functionality, a key tenet of the AR cloud. But when it arrives, it will unlock new possibilities and use cases.

Moreover, the multi-player use case inherently accelerates usage and adoption through viral growth. It also has the potential to benefit from the fundamentals of network effect. With each node (user) added to shared AR experiences, the value and appeal of those experiences can grow exponentially.

Beyond the multi-player angle, augmentation is generally a natural fit for social interaction. Extending from social lenses (face filters, etc.), next-generation graphical overlays will include real-time layers of information that people choose to share with others through live AR overlays as they walk around.


































These shared titbits could be everything from mood to relationship status to stylistic accoutrements. The latter opens the door for business models around the exchange of virtual style items. This builds on the concept of marketplaces for digital identity, manifesting today in communities like Fortnite.

Speaking of which, one construct for socially-oriented AR is – as Ubiquity 6 CEO Anjney Midha puts it – "an MMO for the real world." This envisions layers of virtual worlds all around us which can be dynamically activated by users through AR interfaces, while managed and permissioned by creators.

But questions remain. Who will build this? What will the ecosystem consist of? Will there be open platforms for developers to create shared spatial experiences? We'll tackle these questions in this report, and in Part II of the series which will drill down further into case studies and company profiles.

Key Takeaways

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

-  **Social engagement is an early leader among AR use cases, mostly through AR lenses.**
 -  Snapchat alone has 70 million daily active users for its AR Lenses.
 -  Active social AR users will grow to **468 million** by 2022 according to ARtillery Intelligence data.
-  **Along with Pokémon Go, this social use case has validated AR's mass appeal**
 -  Though not “true AR” these early AR successes have served as a key “gateway drug.”
 -  Snapchat has also validated an ad revenue model, with more than **\$400 million** in 2018.
 -  Though it has a later start, Facebook will eclipse Snapchat as a social AR powerhouse.
-  **ARtillery Intelligence survey data further indicate demand for social AR.**
 -  **45 percent** of AR users report that they actively engage with social AR, such as lenses.
 -  **One third** of AR users choose social as a top AR use case for the future.
-  **Social AR's potential is grounded in an innate human need to connect with others.**
 -  Historical evidence points to social infusion as a technology accelerant (e.g. web 2.0).
 -  Mobile AR could counteract social media isolation due to an upheld/outward focus.
-  **Social AR will also benefit from the principles of network effect.**
 -  Connections, value and utility grow with each person added to a given social graph.
 -  Social interactions fuel any technology's growth through virality.
-  **Social AR so far lacks meaningful interaction because it is asynchronous**
 -  Social AR lenses are recorded in isolation then shared for remote consumption.
 -  True potential will be reached with more synchronous (same time and place) interaction.
 -  This involves technical challenges of the AR cloud such as multi-player functionality.
 -  Google and Apple have built multi-player support into ARkit and ARcore.
 -  Focused startups like Ubiquity6, 6D.ai and YouAR are taking the technology further.
-  **Though synchronous AR will unlock new experiences, it's not a silver bullet.**
 -  Synchronicity in both time and space can limit scalability by forcing spatial presence.
 -  The magic formula will combine synchronous and time/place-shifted play.
 -  Apps will diminish multi-player interaction due to download friction. Look to WebAR.
-  **The AR Cloud will be the great enabler for building meaningful social AR**
 -  Multiplayer, image persistence and localization are all key tenets of the AR cloud.
 -  The AR cloud will be a “plurality” that maps to the strengths of participating companies.
 -  Social players like Facebook will build social identity layers for dynamic AR interactions.
-  **Tech giants could be disadvantaged by data collection conflicts and legacy business models.**
 -  Nimble startups could have an edge in native focus and lack of conflicts.
 -  We will profile these players and go deeper in Part II of this report.

Introduction: Gateway Drug

In the short history of augmented reality, social experiences came first... or at least they were the first flavor of AR to go mainstream. Validating widescale appeal, social lenses from Snapchat have been the first AR use case to truly scale (along with Pokémon Go). And they're fueled by social dynamics.

Before we continue, we must first address a key point of contention. Many AR purists argue loudly that Snapchat lenses and Pokémon Go aren't "true AR." And technically, they're right if weighed on the scale of AR's true potential for dimensional precision (SLAM) and context-aware interactions.

Our take, in general and in this report, is that it doesn't matter. These early and admittedly primitive forms of AR have done the technology a favor by validating its use cases, test marketing its appeal and warming up the world to its forthcoming "true" arrival. They are AR's gateway drugs.

"I think one of the craziest debates of the past year was whether Pokémon Go was augmented reality or not," Intel's Chris Croteau said from the stage at the AR in Action conference last January. "The [750 million] people that downloaded that app...none of them care."



Source: Snap, Inc.

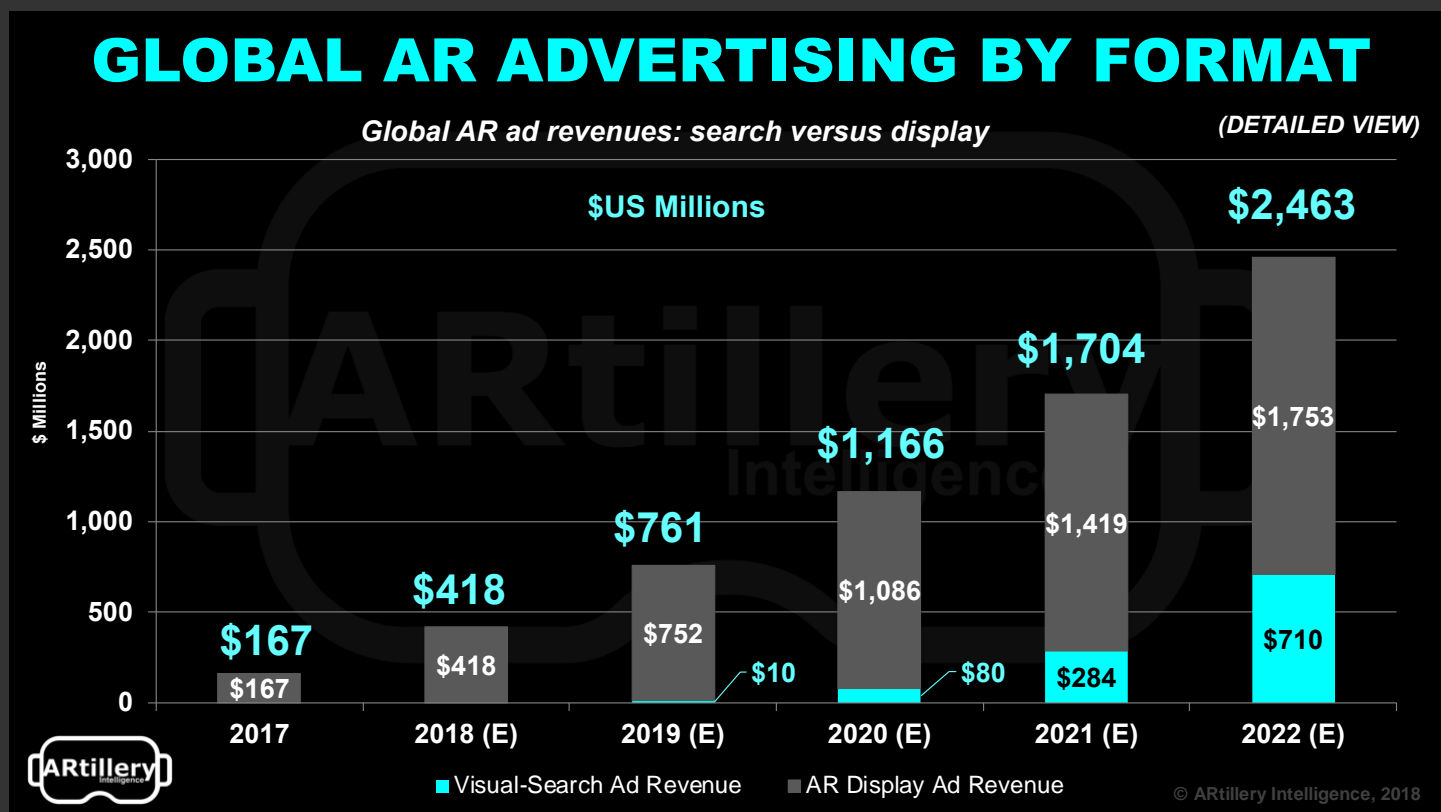
Follow the Money

Another thing these gateway drugs have done is begin to validate business models. What AR features do consumers want to use? And what will they pay for? Pokémon Go and Snapchat have already begun to answer these and other strategic questions with large-scale market adoption.

Along with that has come real dollars. Indeed, anyone pointing fingers at Snapchat Lenses or Pokémon Go as being lesser forms of AR should remember that they're the few AR formats to produce any meaningful revenue so far. In emerging sectors like AR, it's about following the money.

Pokémon Go (which is not social AR) for example has brought in more than **\$2 billion** in revenue to date. It did this through in-app purchases and brand-collaborations to drive local offline commerce.ⁱ These are a just a few potential business models that will develop and drive mobile AR revenues.ⁱⁱ

More to the social theme of this report, ARtillery Intelligence has projected **\$414 million in AR ad revenue in 2018, growing to 2.5 billion by 2022**. Almost all of that was from branded AR Lenses. Early leader Snapchat has the lion's share, but Facebook will catch up quickly given its larger global scale.

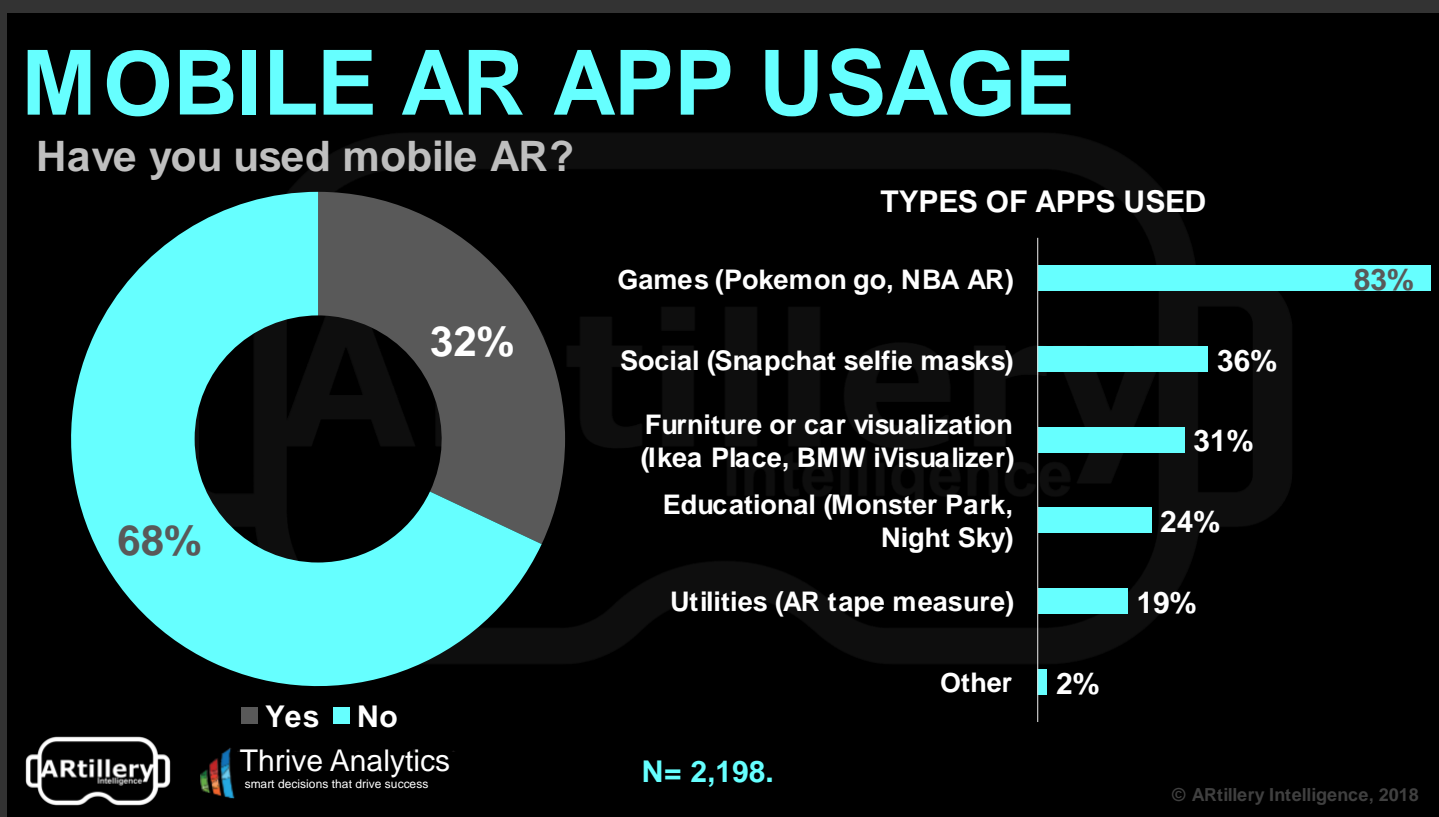


Proof Points

Beyond the dollars spent to reach AR users in social channels, how is that user behavior developing? For this question, we turn to the consumer AR survey that we co-produce with our data partner Thrive Analytics. Here, a large sample (n=2,198) is given the chance to report AR usage and sentiments.

Among all mobile users surveyed, **32 percent** have used AR. And within that sub-segment, the largest share of users have used games. This is due to the prevalence and popularity of Pokémon Go. Indeed, it represents most people's introduction to AR – the reason we call it AR's "gateway drug."

But second place in AR usage goes to Social apps (or social features within apps). This is due mostly to Snapchat selfie masks, which were named specifically in the survey question. **High usage is also validated by Snapchat's own figures, which report 70 million daily active users for AR Lenses.**ⁱⁱⁱ

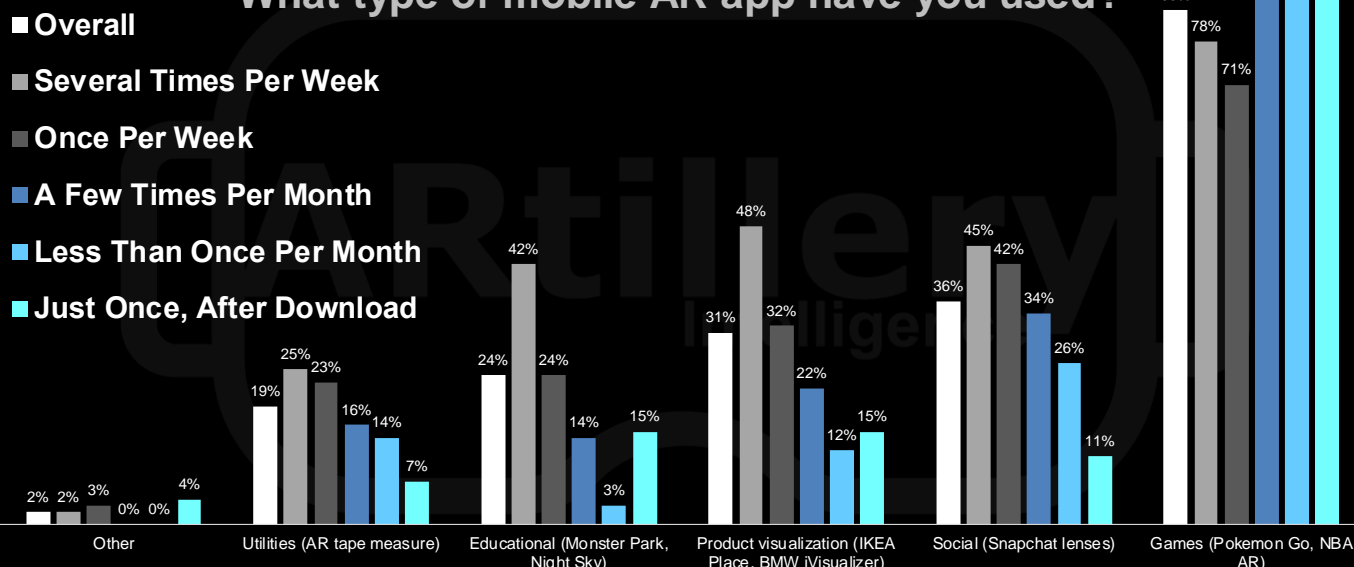


Drilling down into frequency of use, social AR users exhibit promising results. Specifically, among the categories of AR apps in the above survey, we asked the same respondents how often they use AR. **Games scored high in terms of weekly active users (78 percent), as did social apps (45 percent).**

Panning back to the overall market, the above figures have guided our market sizing, which includes total users of social AR (beyond just Snapchat). That number currently stands at **78 million**, growing to **468 million** by 2022. This is a subset of mobile AR compatible devices and active users.

MOBILE AR APP USAGE

What type of mobile AR app have you used?



Thrive Analytics
smart decisions that drive success

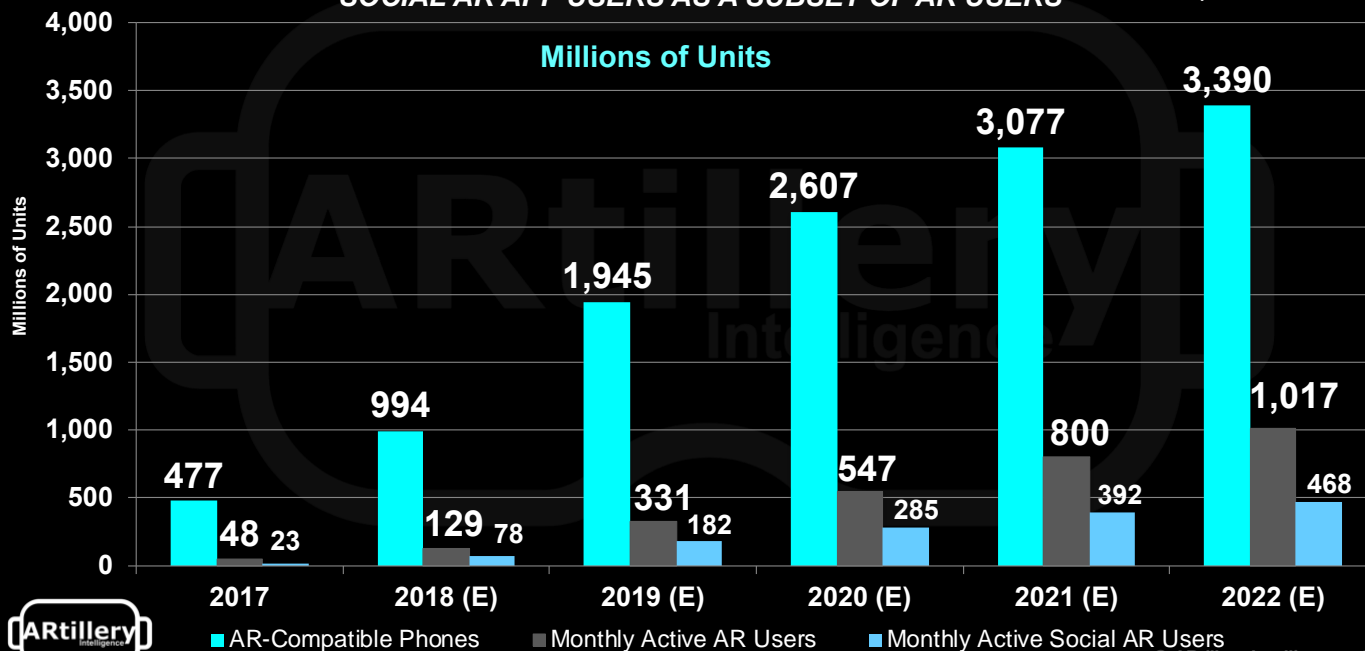
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© ARtillery Intelligence, 2018

MONTHLY ACTIVE SOCIAL AR USERS

SOCIAL AR APP USERS AS A SUBSET OF AR USERS

(DETAILED VIEW)



© ARtillery Intelligence, 2018

Social Creatures

Drilling down on the factors driving the above usage, social AR is underpinned by deep rooted factors of human psychology. Like many technologies, AR extends from and feeds on our inherent need to interact with other humans. So several (not all) successful forms of AR will build on this principle.

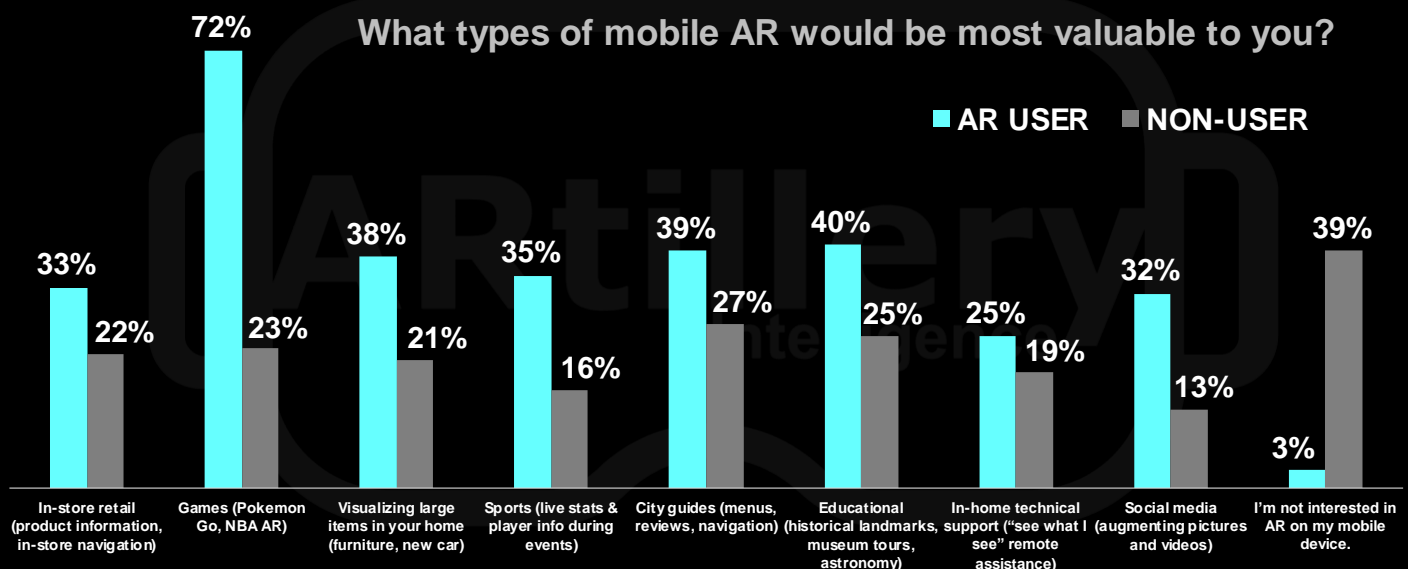
“The internet enabled Amazon and it became e-commerce, and e-commerce is a killer app,” said Charlie Fink during a presentation at VRLA last spring. “But the real killer app of all of our devices — of the smartphone in our pocket or the PC on our desk — is to connect us with other people.”

Another historical lesson that can help triangulate AR’s future is the web 2.0 movement circa 2005. It accelerated online value creation by connecting people. AR thought leader Ori Inbar reminds us that browsing the web before that point was a very one-dimensional and isolated experience.

Subsequent to that shift, most successful online players – Facebook, YouTube, Reddit, Slack, etc. – have been built on connecting people. AR will follow a similar path asserts Inbar. Many of its success stories will have strong social components that tap into our basic need to connect with one another.

Back to our AR survey, it’s clear that there’s budding demand for social AR. Beyond activity for current users, we asked the full sample of users and non-users what types of mobile AR experiences they see as most valuable. One third of AR users believe that social AR will be a top use case.

MOBILE AR APPS IN DEMAND



Isolation Reversal

One of AR's (and VR's) criticisms is that they further isolate an already digitally-distracted culture. Online social media has created a culture that exercises "social" urges through 2D screens. **But the counter argument, at least for AR, is that it raises our gaze up from smartphones that are held down.**

Apple CEO Tim Cook addressed this point during an earnings call last year, stating: "I see AR as being profound. I think AR has the ability to amplify human performance instead of isolating humans." This is telling about what's driving the company that in turn drives consumer technology.

This "heads up" concept for AR will be inherent in smart glasses, but what about the nearer-term reality of mobile AR? **Even there, use cases compel more of an outward focus — holding a phone up instead of down — as the physical world plays a greater role in the content and experience.**

"Millennials are statistically going to take 27,500 selfies," said Meta's John Werner at an AR in Action (ARiA) event last spring. "That says something about how they see the world. The next generation may be more Pokémon Go – using technology to look out as opposed to [in]."

This is what we call "isolation reversal" and it's been espoused by AR thought leaders such as Inbar. He sees this principle adding societal and altruistic value to AR, thus increasing its consumer appeal. **Tapping into this principle can also be a driving factor in AR's innovation and product design.**

"The reason I got into AR about a decade ago is I saw my kids constantly in front of a computer screen or mobile devices," he said at ARiA. "I felt I can't change that, but maybe we can extract some of the things that attract them to those computers and to the internet, and bring it into the real world."



Source: Snap, Inc.

Ready Player 3

Beyond historical and psychological evidence in support of social AR are technological and mathematical principles. Chief among them is network effect. And the father of network effect – Bob Metcalfe – is a big believer that success in AR will hinge upon the mechanics of social connection.

“It’s very likely that the killer app will be networked AR,” Metcalfe said from a live video feed at the AR in Action conference last year.” That is, the platform and the standards will very much involve networking, if the birth of personal computing and the internet are any guide.”

As background, Metcalfe invented Ethernet. But he also authored Metcalfe’s Law, which states that networks exponentially grow in value with each node added. For example, in a social network, value utility and connections grow exponentially when you go from one person to two to three and so on.

Metcalfe came up with the law in 1980 which was formalized in 1993. It has since defined local area networks, email, the commercial internet, content networks and eventually social media. Today, it defines lots of technology, including some of the most valuable companies in the world.



“The big app that follows Metcalfe’s law — although they’ve never heard of it — is Facebook,” he said at the same event. “Facebook came from nowhere based on the value of networking and it continues to grow. Their company is booming based on the value of connectivity.”

Back to AR, Metcalfe’s law will likely sustain as we evolve from the disconnected and isolated experiences of most AR apps today. To turn again to historical evidence, think of navigation: we had GPS, then Google Maps but new dimension was unlocked by the connected experiences of Waze.

“There’s been an evolution of killer apps on the internet and I suspect that the same thing is going to happen in AR,” Metcalfe added. “I keep hearing that AR and VR are useful for gaming, and training. Somewhere in there is going to be the killer app and I’m confident it will be networked.”

Synchronicity

Though all of the above is true, there’s an elephant in the room: Social AR experiences so far aren’t very meaningful. By that we mean that the social and immersive elements of AR lenses are fairly rudimentary, including sharing photos of ourselves decorated with dog ears or rainbow vomit.

Returning to the question of whether or not Snapchat and Facebook social lenses are “true AR,” there’s another attribute we’d like to examine. We believe they aren’t true AR, but not for the reasons espoused earlier (sophistication and dimensional accuracy). They’re not true AR for another reason.



Source: Apple

Social Lenses are more accurately described as “augmented media.” The moment of augmentation is when something is being recorded such as a selfie mask in a picture or video. It is then shared through a direct message or social feed, then consumed by friends at a different time and place.

This makes social lenses asynchronous. **This is not necessarily a bad thing, but it should be acknowledged that greater dimensions of social interaction will be unlocked through social AR experiences that are synchronous.** That is, they are experienced together in the same time & space.

And we’re getting closer to that vision. Snap’s Snappables feature synchronizes AR in *time* but not in *space*. It infuses real-time augmentation within two-player games, where selfie lenses are applied to players faces. Though they’re in different places, the augmentation happens in real time.

Similarly, Facebook Portal offers AR video-chat. Known as Storytime, remote adults can narrate stories to children while their faces are augmented in the style of the story’s plot and characters. Super Ventures’ Partner Tom Emrich rightly heralds this as the Trojan Horse for AR in the home.

Moving on to the other main variable of synchronous AR, space, things get more complicated. **Time is the easy variable to sync. With space, we start to get into the complexities of spatial computing and multi-player functionality.** This allows several people to see the same thing from different devices.

Because of the challenges in device syncing, localization and computational load to accurately process spatial geometry, this will take longer to perfect. Google and Apple have begun to tackle this issue in their respective AR developer kits, ARCore and ARkit, which will accelerate things a bit.



Source: Ubiquity6

Persistence Pays

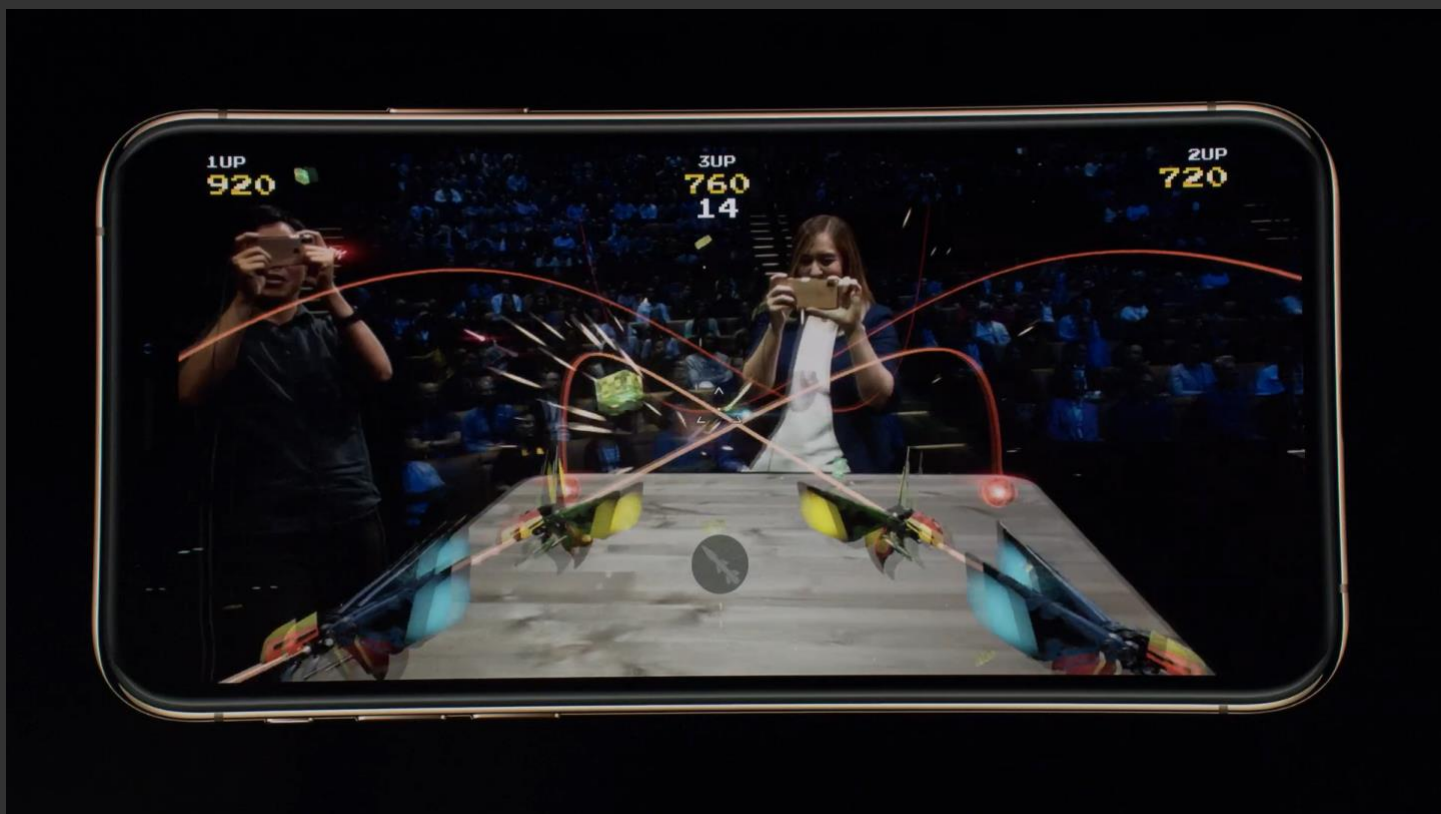
Google's Cloud Anchors are a step towards multi-player AR by letting developers build apps that have synchronous gameplay. [They work similar to ARcore and ARkit's scene mapping in that they establish anchor points for graphics, but now also sync anchor points between multiple devices.](#)

"The way we would do it in an AR app today is plant [graphics] as relative offsets from an anchor and that becomes your reference frame," said Google's James Birney at Google I/O. "Anchors can't talk to each other so this is what a cloud anchor solves...We can have a common anchor in the middle."

Google also has use cases in mind beyond socially-oriented gaming (as "multi-player" would imply). As Amazon and IKEA have already done, AR will be a practical and monetizable tool for in-home product visualization.^{iv} [Multi-player functionality can add new dimension to such scenarios.](#)

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

Apple is doing something similar with multiplayer support in ARKit. It demonstrated the capability at June's WWDC conference in which a 3D reboot of the classic arcade game Galaga allowed several players to shoot enemies that fly in front of them – positionally tracked and synchronous for all.



Source: Apple

This utilizes ARKit 2.0's multiplayer support to power the synchronous play, as well as the four-core GPU of the newly-announced batch of iPhones. The latter renders higher-quality graphics which adds to the AR immersion of the game, along with the stereo sound of the iPhone Xs and Xs Max.

The functionality this unlocks could represent compelling use cases when put into the hands of developers. It's still open season for the first AR killer app, and the stakes are high given mobile AR's potential market size.^v We believe it could involve synchronous social and gaming experiences.

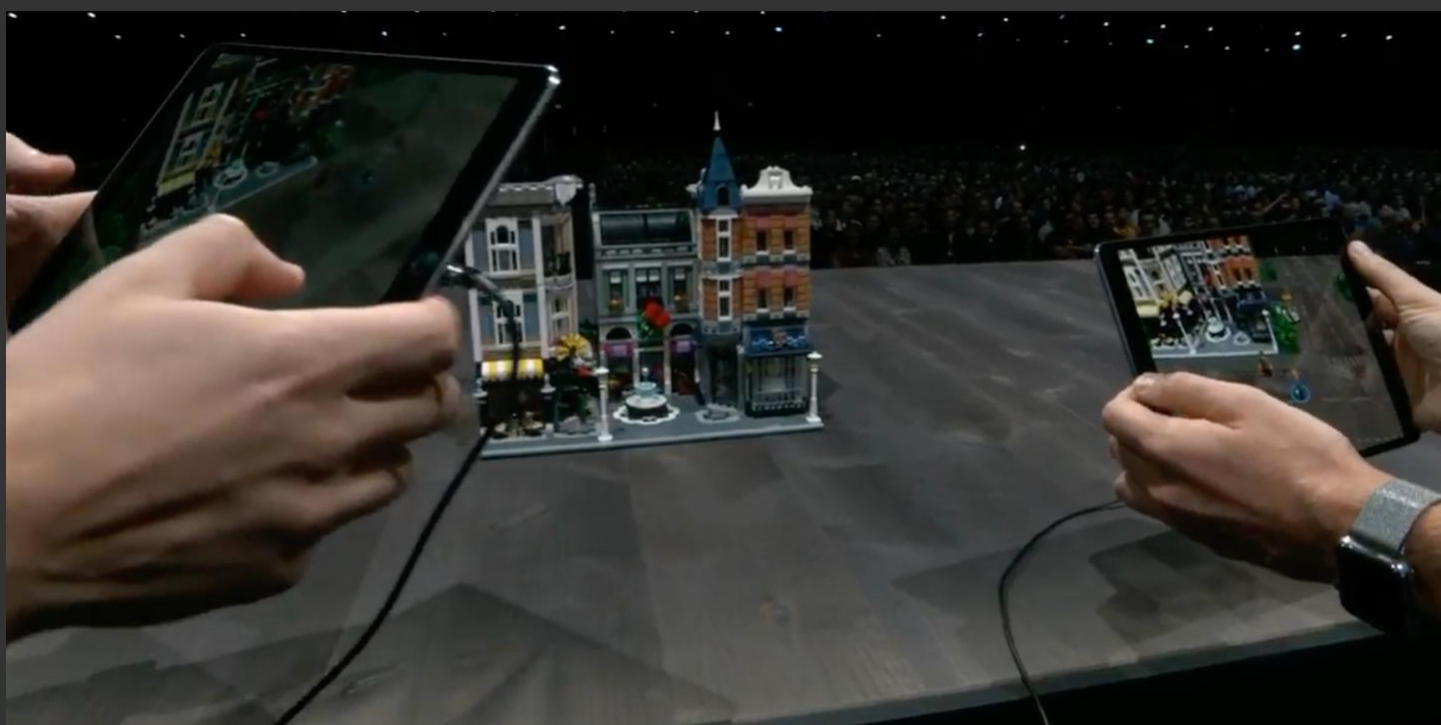
"This delivers true, multiuser augmented reality," said Apple's Craig Federighi at WWDC. "You and people around you will be able to see your own perspective on a common virtual environment."

Devil's Advocate

Here we must stop to point out that multiplayer AR isn't a silver bullet. The requirement for another player in close proximity could be limiting, compared to place-shifted play. The best example of the latter is an older game like Words with Friends, which thrives on the ability to unite remote players.

"[With] mobile AR, you're probably somewhere random in the house, at the office or on the move," said Tony Parisi at last June's AWE event. "Requiring someone to be in a specific place is damn inconvenient – unless the whole point is to get you there, such as Niantic's location-based titles."

So greater operability could come from a combination of synchronicity and accommodating faraway participants. This could maximize the serendipity and appeal of synchronous multi-player AR, while not inhibiting scale and true network effect by imposing the physical requirements of time and space.



Source: Apple

With the above pros and cons, the onus is on developers to tap into multi-player advantages while avoiding its scale-reducing tendencies. [For example, is there potential for synchronous, on-site interaction plus place-shifted play to tap into the best of both worlds?](#) This could be the magic combo.

Another layer to this challenge is the AR delivery vehicle. As we've examined,^{vi} apps dominated the smartphone era but aren't an optimal AR vessel. In social AR, they could hobble multi-player experiences or "pick-up" sessions with the need for all players to stop and download the right app.

[Web AR could be the answer to this challenge, and is evolving in parallel.](#) Another key point of evolution will be developers gaining native footing with multi-player AR. Social AR will take a few development cycles to create experiences that are compelling enough for killer-app status.

Here again, we point to historical evidence. After the iPhone launched in 2007, it took a few years before we started to see killer apps in the 2010 timeframe (Uber, Waze, Foursquare). [AR will likely be the same in terms of the elapsed time – two to three years – from ARKit's Spring 2017 launch.](#)



Source: Snap, Inc.

AR Cloud: The Great Enabler

One of the most valuable areas of AR today is enabling technologies or “building blocks.”^{vii} By democratizing AR creation, they include things like 3D graphics tools, a la Adobe Aero. And they importantly include companies building the AR cloud.^{viii} This will be a key puzzle piece for Social AR.

For those unfamiliar, The AR cloud is a data resource that feeds AR devices remotely. That can include 3D spatial maps or object recognition blueprints that let AR devices geometrically and semantically understand surroundings. This enables them to infuse graphics accordingly.

Indeed, social use cases throughout this report involve multi-player functionality. This is a key tenet of the AR cloud that enables several devices to localize in space and to each other, involving common anchor points. Image persistence between players and over time is also a key AR cloud outcome.

These are the underpinnings of the AR world we envision, or that you may have seen in concept videos of AR interactions with the real world. The mainstream expectation was that AR “just works” that way. But in reality, it needs AR cloud support for all of these social (and non-social) interactions.



Source: Google

The Plurality

One misnomer is the singularity of the term AR Cloud. Sort of like “the internet” is singular tense, the AR cloud will comprise a web-like collection of entities that coexist and compete with each other. There will be proprietary networks and open ones, just like the web. Social AR will require both.

Without getting into a philosophical discussion about how the AR cloud should be gated and governed, there will be venerable consortiums for standards and interoperability across AR clouds. For example, Magic Leap envisions thematic layers that are open and interoperable across platforms.

There’s also the Open AR Cloud Initiative,^{ix} started and managed by augmentedreality.org’s Ori Inbar among others. It’s establishing several standards for interoperability, including the construct of a “Spatial Wikipedia.” Like wikis operate, the AR cloud could have open standards and authorship.

Meanwhile, parts of the AR cloud will inherit the walled garden structure that’s present in parts of today’s web and app ecosystems. This will be the case in enterprise security, and with tech giants who are paving the roads for AR, incentivized by their own different versions of an AR future.^x

For example, among tech giants tackling AR, the most “walled garden,” is Facebook. It will need secure data in a closed system for social information to be presented in 3D space. It’s everything from social status to facial recognition — a sort of 3D identity layer for the immersive web.



Source: Ubiquity6

Playing to Their Strengths

AR clouds will map to the tech companies creating them. For example, as the world's search engine, Google has assembled several cloud assets including physical world geometry (maps), object recognition (images, Street View), and predictive data of what we want (knowledge graph).

Amazon's AR cloud is a commerce layer. It has object recognition for billions of products, which makes it potentially the most directly-monetizable AR cloud of all. And it's assembling lots of valuable intelligence of the things we as consumers want, given its longstanding blitz of AI and voice search.

Speaking of voice and AI, that's Apple's Achilles heel. But it's building 3D spatial maps for the Apple Maps app, and it owns the greatest portion of the tech stack. So it may be happy to cede AR cloud dominance to others (like it did with the web) while it accumulates massive wealth selling hardware.

But back to the social theme of this report, players like Facebook and Snapchat will employ AR clouds that are a sort of 3D identity layer that builds from the ability to recognize faces. That could be a foundation to display permission-based layers of info about oneself in AR (e.g. relationship status).



Source: Ubiquity6

The Field

Beyond tech giants, emerging players could also be advantaged. **Not only do they have a native edge in product design, but they aren't tied to legacy businesses, so they're more nimble.** They're also not incentivized to walled gardens nor data collection, and can operate across platforms.

A data-collection conflict is present for anyone with ad revenue (Google, Facebook). Hardware players like Magic Leap and Apple are less conflicted. Going smaller, AR cloud startups like 6D.ai YouAR and Ubiquity6 are aligned with AR end-user needs and will find lots of room to add value.

The data collection conflict is also a seminal issue with anything that involves personal information, which social experiences certainly do (just ask Facebook). Privacy and data security are scrutinized to even greater degrees when combining social dynamics with location, as AR will do.

So smaller players could have a more impactful role in building the AR cloud, given a non-conflicted and native focus. For example, the technology for AR image persistence and multi-player support is more advanced at 6D.ai than the corresponding efforts explored earlier from Google and Apple.

Similarly, Ubiquity 6 has an ambitious vision and strong technology to replicate socially-oriented online communities in physical space. This creates a sort of “MMO for the real world,” as its founder & CEO Anjney Midha explains it. We will profile several of these players in Part II of this report.

For now, as our industry colleague Charlie Fink says, the world will be “painted with data” — also the title of his upcoming book.^{xi} There are lots of colors and styles of paint needed, especially in socially-fueled personal expression. And there's lots of room for innovation. The world is a big place after all.



Source: Google

Part II Preview: Case Studies

This first installment of our analysis of social AR is meant to lay the groundwork, and to establish definitions and principles. [Part II will dive deeper into demonstrable examples of Social AR.](#) Who's doing what? What are best practices to learn from? And where is social AR headed next?

This will be built around case studies and best practices. [We'll explore tech giants like Facebook and Snapchat.](#) And [we'll go deep on smaller players like Ubiquity 6, 6D.ai and even smaller players like Snaapy and Meo.](#) We'll build this around real discussions we've had with these startups.

Stay tuned...



Key Takeaways (redux)

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 - 📖 We will profile these players and go deeper in Part II of this report.

About ARtillery Intelligence

ARtillery Intelligence chronicles the evolution of augmented reality (AR) and virtual reality (VR). Through writings and multimedia, it provides deep and analytical views into the industry's biggest players, opportunities and strategies. It's about insights, not cheerleading.

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 AR & VR, long-term cultural, technological and financial implications are primary.

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

Learn more at <https://artillery.co/intelligence>



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 at:

<https://artillery.co/about/>

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 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 *ARtillery 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 *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 ad revenue dynamics such as campaign pricing and spending. For more on *ARtillery Intelligence*'s market-sizing methodology, see the explanations at the following link.

<https://artillery.co/artillery-intelligence/forecasts/methodology/>

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 at:

<https://artillery.co/about/disclosure-and-ethics-policy/>

Contact

Questions and requests for deeper analysis can be submitted at:

<https://artillery.co/contact/>



References

- i <https://artillery.co/artillery-intelligence/ar-commerce-monetization-comes-into-view/>
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- xi *Disclosure: This report's author is writing a chapter for Fink's book.*