# LOCAL'S VISUAL FUTURE

The Rise of AR and Visual Search

# **STREET FIGHT INSIGHTS**

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# **EXECUTIVE SUMMARY**

"The camera is the new search box." This has been the rally cry from companies like Pinterest and Google that are embracing "visual search." This emerging area is defined by apps that let consumers hold up their smartphones to identify and get information about physical world items.

As you might imagine, this has lots of use cases – both whimsical and practical. For the latter, there are local commerce opportunities, such as being able to better identify local storefronts and business attributes (reviews, menu items, hours of operation, notes from friends, etc.).

Though still nascent, visual search builds on a few key trends. Smartphones have increasingly powerful optics; AI and machine learning support "computer vision" to identify items; and there's behavioral alignment with millennials who use the smartphone camera as a communication tool.

These drivers make visual search a close cousin to an equally opportune and emerging area: Augmented Reality (AR). It similarly uses computer vision to identify surroundings, then goes one step further in overlaying graphics... with equally whimsical and practical applications.

AR can overlay game-like graphics for fun a la Pokémon Go, or practicality such as arrows that lead you to a store. The more practical end of that spectrum presents opportunity for local media providers to add AR as a component to their local search and discovery products.

If any of this sounds familiar, it's because it was the unfulfilled promise of Google Glass. But smart glasses – the modality in which AR is often envisioned – are several years from meaningful consumer adoption. That's mostly due to cost, bulkiness and cultural/stylistic resistance.

This has caused the AR world to shift attention to the smartphone as the vessel for AR experiences. The installed base already exists in 3.2 billion smartphones, many of which possess the optics and graphical processing to run AR apps.

This realization has culminated over the past year in major tech giants planting their stake in the mobile AR soil. Facebook, Google, Apple, and Amazon have each launched varying degrees of mobile AR efforts. And smaller players like Pinterest and Wayfair are blitzing the opportunity too. Each of these players take a different approach aligned with their strengths and goals. Facebook wants AR to boost multimedia social sharing. Apple wants it to sell more iPhones. Google wants to drive (visual) search. And Amazon wants you to order more goods.

But most exciting and timely are the recent app development kits released from Apple and Google. ARkit and ARCore democratize AR app creation by putting it into the hands of millions of developers, and hundreds of millions of consumers. The result could be an explosion of AR apps.

But how will this play out? How long will it take? What does it mean for local media and commerce? What will be best practices in developing AR apps? And how will apps best integrate with existing media or search products? These questions are tackled throughout this report.



## THE GATEWAY DRUG

After lots of excitement in 2016, the tech sector has dialed back its feelings on glasses-based augmented reality (AR). This includes realigned expectations on an extended time horizon to consumer ubiquity. But in the meantime, the AR world is keeping busy with another opportunity: mobile AR.

Beyond specs (battery life, field of view, etc.), AR glasses' detriment is form factor. It needs to be sleek and cheap enough to sway consumers to reconcile a key point of friction: personal style. The bar is set high for anything people are asked to put on their face, as Google Glass taught us.

The good news is that the stepping stone — or gateway drug as we like to call it — is mobile AR.

There are 3.2 billion global smartphones today. Those aren't all AR compatible in terms of optical and processing components, but most will be over the next phone replacement cycle (2.5 years).

Meanwhile, Apple and Google have released software development kits to further democratize AR. ARkit and ARCore put advanced AR capability – working out some of the harder programming challenges in the background – into the hands of everyday mobile app developers.

And the apps they create will be compatible with past generations of iPhone and Android devices, meaning they're compatible out of the gate with hundreds of millions of existing devices. They do this by accomplishing advanced AR through software instead of hardware.



ARCore and ARKit apply simultaneous localization and mapping (SLAM) through a surface detection approach that doesn't require a depth sensing camera. They utilize the RGB camera, found in most smartphones, and require only a certain processing speed to run AR graphics.

That makes ARKit compatible with 434 million iPhones this year, reaching 673 million by 2020, according to ARtillry's forecast illustrated in the figure above. And ARCore will become compatible with 3.9 billion global android devices during this time frame. Together they'll cover about 93 percent of global smartphones by 2020.

The result is an overall democratization of advanced AR capability. This starts with a massive installed base, which incentivizes developers with a larger addressable market. Then the content those developers create entices more users to engage – altogether a virtuous cycle.

Looking forward, we can expect several AR apps as ARKit and ARCore gain footing. But more impactful will be years of third-party innovation with both SDKs. That could rival in creativity and advancement the app economy itself, kicked off ten years ago with the first iOS SDK.

#### WHAT ABOUT LOCAL?

"Localization" is the "L" in SLAM – the technique described above that represents the quality standard for AR graphics. Localization refers to the smartphone's ability to position itself (using GPS and accelerometer) in relation to AR graphics so that angles and perspective appear realistic.

But localization is also important to AR in a broader sense of the word: Many AR use cases will be location-relevant. That will represent opportunities for an additional modality to local search and discovery. We'll refer to this specific local application of AR herewith as "local AR."

We're already seeing local AR manifest through the ARKit apps showcased so far. We expect these to evolve and for Google's ARCore to likewise produce local apps -- iit's a few months behind ARkit). To get a sense of what we've seen so far and where it's headed here's one example.



Several more examples are in the Appendix.

More such apps will be built as developers gain footing with ARKit and ARCore. As in the early days of iPhone apps, there will be misfires. But the eventual utility will be discovered and much of it will be locally relevant, such as qualifying purchase decisions with visual aids.

"As far as AR apps and consumer-based products, I think you're going to see a lot of crap over the next year or two," Niantic (maker of Pokémon Go) CTO Phil Keslin said at TechCrunch Disrupt. "But you'll see some nuggets of creative genuine things that will spark something that will truly be amazing."

The opportunities with local AR will be varied, and touch many parts of the local ecosystem. Publishers can achieve audience extension and growth through AR interfaces, while advertisers and ad-tech players can find new inventory and attribution opportunities (explored below).

But the sub-sector of local that potentially has the most to gain in the coming age of local AR is local data. We're talking name, address, place (NAP), reviews, product information, POS data, and validated lat-long readings. These will all define the placement and utility of AR graphics.



#### LOCATION DATA'S TIME TO SHINE

It's often said in the ad-tech world that "Content is King, but Data is God." This is increasingly true in local ad-tech and martech given the need for "ground-truth" conversions to attribute ROI. And it will equally apply in local AR.

Geo-relevant data will play an important – though often overlooked – part in the AR user experience. It's not widely recognized that Pokémon Go was built

on the architecture of Niantic's Ingress game, whose location tags were set over years and made the whole thing work.

Location data's importance to AR was also validated by Snap. The company recently acquired two location data companies – Placed and Zenly – that contribute to the company's continued product development around geo-relevant snaps and AR content like World Lenses.

Rudimentary AR such as Pokemon Go sometimes use geotagged data to position graphics. More advanced AR, such as ARkit, conversely use object recognition to map and "register" objects before applying relevant and dimensionally accurate graphical overlays.



Though the latter is a more advanced form of AR, it will still benefit from location data such as business/product details or coordinates. This one-two punch will especially be additive in apps for navigation, local discovery, tourism, retail, and several other location-relevant use cases.

Fortunately a few startups have built systems that collect, clean and optimize geo-data. Aisle 411 has store layouts and product data. Foursquare and GroundTruth (formerly xAd) validate business' lat-long coordinates, while Yelp and others hold valuable customer reviews, menu items, and operating hours.

These data will come in handy with local AR apps that let users point their phone at a storefront to get useful info. Google Lens (explored in the next section) accomplishes this through object recognition using Street View imagery, and local business data from Google My Business.

Google's visual positioning service (VPS) is another example (also explored below). It lets users navigate interior spaces, such as a Home Depot, using

graphical overlays on their smartphones to lead them. But it requires product and blueprint data, and 3D scans of hundreds of stores.

Google has the deep pockets and data assets to pull this off. But the question is whether or not local AR developers will have access to such product or location data. This could be a business opportunity for companies that currently collect, clean, index, and optimize local business data.

And the way this will likely play out is through SaaS-delivered access to location databases that give developers the tools they need to build functional location-relevant AR apps. This could breathe new life into already-valuable location data from publishers and vendors in local.

#### **DRILLING DOWN ON GOOGLE: VISUAL SEARCH**

Google is taking AR in slightly different directions more aptly described as "Visual Search." Like AR, they utilize computer vision to identify surroundings, but it's less about graphics and more about information.

Google Lens allows users to point their smartphone camera at any physical world item to launch a search for qualifying or purchase information. One promising use case is identifying storefronts and other key business details when exploring a new neighborhood.

This of course aligns with Google's mission and the protection of its core search business, where it makes the majority of its \$95 billion in advertising revenue. Visual search for Google is a way to broaden its touch points to continue serving consumers information in a lean forward "pull" manner.

This all goes back to Google's challenge in the mobile era: people are searching less because they're spending more time in apps and less time in the browser... where Google is the front door. So its goal is to counterbalance that decline in search query volume through other means.

This was the principle behind Google's "Micromoments" – to inspire content snacking moments when Google can deliver you things through Google Assistant (formerly Google Now). The latest embodiment of that principle has been voice search (the topic of another report) and Visual Search.

"A lot of the future of search is going to be about pictures instead of keywords," Pinterest CEO Ben Silberman told CNBC in April. Pinterest since launched several feature updates that let users search for items on its mobile app by pointing their smartphone cameras at physical world items.



## LAST MILE TO THE CASH REGISTER

VPS is a related "visual search" technology that applies computer vision to scan interior spaces and form a point cloud. That unique digital fingerprint then becomes the basis for positional tracking, indoor navigation and overlaying practical information for shoppers in physical stores.

The go-to example is overlaying positional data for store shelves and the items they carry. As pioneered by interior mapping companies like Aisle411, shoppers can then find obscure items in retail spaces – like the above Home Depot example – solving a consumer pain point.

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



This is not necessarily a new message; beacon proponents have been saying this for years. VPS is a superior technology, but its optical and sensory components have been cost prohibitive for smartphone integration. But ARCore's technology described earlier changes that.

But it goes beyond the utility of finding things. The real angle here is the ad attribution potential, given that it tracks the "last mile" to the cash register. This once again ties to Google's search ad business, and is just the latest move to embolden search marketing ROI with better attribution.



# **INFORMED PURCHASE**

AR-assisted shopping models can be studied by looking at the biggest player of all: Amazon. Though more about online shopping than local, Amazon's moves could be indicative of AR opportunities and impactful due the sheer scale of its business.

As discussed in the previous section, Google sees AR as a way to boost "visual search" and user engagement towards supporting its core search business.



To that end, AR will boost Amazon's core business of selling you stuff. This could play out in a few ways, mostly involving AR-assisted shopping to boost conversions and informed purchases. For example, virtually placing items in one's home to make sure they fit (in both style and size).

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, as it often is with Amazon's hardware products, is driving orders.



But it's not just about orders. Amazon's model in general 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.

One of the biggest margin-depleting factors facing Amazon is large-order shipping and returns (think: flat screen TVs). That's driven it to work with Google Tango and Lenovo to help consumers visualize furniture placement for a more informed (and less return-prone) purchase.

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. We'll see several more versions of this play out from online retailers, as well as local businesses.



#### WHAT ABOUT FACEBOOK?

Covering the AR strategies of tech giants like Google, Apple, and Amazon wouldn't be complete without Facebook. In fact, Facebook jumpstarted the current wave of VR/AR excitement by acquiring Occulus in 2014. And that headset-based delivery is where the market will end up.

But Facebook has also recently come to the same realization as Google and Apple: smartphones represent the near-term opportunity. At Facebook's F8 conference last October, Mark Zuckerberg warned the industry to temper its expectations on VR/AR headset ubiquity. That cautionary messaging built up to Facebook's new mobile AR focus. Though VR will drive its long-term plan, mobile AR will be a key stepping stone that builds on a larger base of existing hardware. And meanwhile it will have a key role in driving Facebook's core advertising business.

Facebook has built its ad business rather quickly by innovating with "native" advertising. That essentially means that ads are merged in elegant ways with the scrolling mobile news feed that's a core engagement point of its product.

And to keep users coming back to the news feed, Facebook has discovered that frequent sharing of multimedia between friends is a major engagement driver. To that end, Facebook believes that AR graphics will represent the next feature to boost multimedia appeal and engagement.



At the center of Facebook's new mobile AR efforts is the Camera Effects Platform. This is a toolset for developers (AR Studio) and non-developers (Frame Studio) to create AR graphics. It includes stickers, geofilters and other media overlay formats that developers will build.

Facebook hopes that brands will get creative with these tools in the spirit of the native advertising that's become Facebook's bread and butter. Nike for example can offer selfie-adorning graphical overlays for fitness milestones that people are self-motivated to share.

For local AR, we could see apps that let friends leave each other notes or menu suggestions at SMB locations. SMBs themselves can virtually adorn their physical spaces with messaging and graphics, thus extending their "ad inventory" to their own physical spaces, viewable in AR.

Snapchat already offers Geofilters, which are geo-relevant overlays that small businesses can create for users to apply to snaps when at or near their businesses. But Facebook's open approach will let developers concoct even greater AR tools for individuals and local merchants.



## WHERE TO BUILD

One question arises from all of the above: For local media players and startups interested in building AR apps, where do you begin? There are a few platform options in this report, which represent a key choice of where to apply development resources for AR products.

This will be like the mobile OS wars between iOS and Android over the past decade that forced a similar choice of where to build apps. And Facebook looms as a developer platform, with some advantages (viral social engagement) and disadvantages (closed "walled garden" network).

All of these platforms will be moving targets. Each AR developer kit is in version 1.0, and their evolution could expand rapidly in the coming months and years. For many, it will be a wait and see approach, but will still be important to watch opportunistically as these AR platforms evolve.

# **ARKIT VS. ARCORE**

Zeroing in on ARKit and ARCore, their common value is democratizing advanced AR. Developers and app publishers don't have to build AR technology from scratch nor rely on physical barriers like depth cameras. They can focus instead on end-user experiences and business models.

They also employ similar computer vision technology for mapping, which is the process of scanning areas on which to infuse graphics. That includes horizontal plane detection, localization, motion tracking, and light metering for realistic shading. These work in tandem to achieve AR.

But perhaps more important than their similarities is their differences. That applies to technical strengths, as well as go-to-market strategies and positioning. On both counts, ARCore and ARKit differ in that each carries its parent's DNA, and each advances its parent's core business.

For example, Apple's app-centric paradigm is reflected in ARKit's delivery, while Google's web-orientation will shape ARCore's stated web delivery goals. Google has a technical head start with the years of work it's invested in Tango, but Apple has more control over the hardware.

Apple's software/hardware integration has always been its strength. In this case it can directly govern the camera optics and sensor calibration that support ARKit apps. But Google has an edge in its open hardware approach that creates a lot more scale in the Android universe.

Though ARKit has a head start and a near-term advantage in today's volume of compatible iPhones, ARCore will quickly catch up and exceed, given a larger overall Android base. It will reach 71.5 million devices by the end of the year and 3.6 billion by 2020.

In short, much like the mobile OS wars of the past decade, Apple (iOS) has lots of quality advantages as an app developer platform and Google (Android) has a quantity advantage its reach. Ultimately platform choice will come down to individual goals of app publishers.

The answer will often be "both," but finite resources will at least require a decision of where to develop first. The criteria for that decision should be platform capability (what do you want to achieve?), reach (platform scale), and audience alignment (platform demographics).

# FINAL THOUGHTS: NOT QUITE THERE YET

AR and visual search (along with virtual reality) haven't yet penetrated local commerce to a meaningful degree. In fact, Street Fight's recent survey of brands interested in exploring new local marketing technologies showed 12 percent interest in virtual or augmented reality.



#### Brands' near-term interest in exploring new local marketing technologies

#### **STREET FIGHT INSIGHTS**

Source: Street Fight Enterprise Local Marketing Survey, Q2 2017

SMBs showed slightly more interest (18%). Many of the AR and visual search opportunities outlined in this report potentially have more inherent appeal and applicability to SMBs.

#### Local merchants' interest in exploring new technologies



AR's relatively low interest level in this research is telling. Though AR and visual search aren't here yet, they will evolve rapidly, much like mobile apps and other tech transformations have done in recent history.

This holds two key lessons for local media players, or anyone serving local marketers. First, there hasn't been a "missing the boat" moment (yet) and there is still plenty of time. Second, now is the time to experiment to gain footing, perspective and an early-mover advantage.

The second lesson is more important, especially given local media's track record of being late to new technology transformations. It's happened through many successive waves, including traditional media's latent adoption of the desktop web and then the smartphone.

Sticking with this historical perspective, things are accelerating. Innovation cycles were faster with the smartphone (i.e., app development) than the desktop (building websites), which were faster than print. With each new revolution, response time seems to shrink while opportunity cost grows.

History has also taught that local startups are more agile and experimental than larger media companies. The latter often face cultural inertia and innovator's dilemma. One way around this is to build physically separated innovation labs.

We can look around to see that local AR's day hasn't arrived. But that doesn't mean that local media companies shouldn't prepare for it. There are lots of ways to gain perspective of VR's opportunity by experimenting with ARCore and ARKit. Local AR could be here before we know it.

# **KEY TAKEAWAYS**

There are several factors causing multimedia capture and sharing to become a prevalent consumer use case: better camera optics, mobile broadband, and millennial behavior.

- This is causing the smartphone camera to become the next app development platform.
- We've seen this principle validated on a mass scale by Snapchat Selfie Lenses and Pokémon Go.
- These trends lead to opportunities in smartphone-based augmented reality (AR) and visual search, given the device's technical capability (viewfinder, graphical processing, etc.).

AR and visual search both use computer vision to identify objects or surroundings, then apply information accordingly.

- AR applies dimensionally relevant graphics to enhance a mobile viewfinder with recreational or practical graphics.
- Visual Search applies a traditional search function based on the input (visuals) captured by a smartphone's camera. It can return search-like results such as product reviews or purchase info.

Both AR and Visual search hold opportunities for local, given that they often involve information about surroundings that can influence local commerce and purchase decisions. We're referring to this as "Local AR"

Tech giants have responded to the above opportunities with major AR investments. Each strategy mirrors the positioning and core priorities of that company.

- Google sees AR as a way to boost visual search and user engagement, towards supporting its core search business.
- Amazon wants to get you to buy more stuff, using AR to qualify purchases and visualize product placement in home.
- Facebook wants to boost multimedia sharing through AR lenses, supporting its core ad business and setting a foundation for an immersive media future.
- Apple launched ARKit to breathe new life into waning iPhone sales and generally position its future hardware for continued dominance.

Recognizing these giants' goals can inform decisions about the market's trajectory, filling necessary gaps in the AR value chain.

- For developers, the opportunity starts with AR app toolkits that these giants provide.
- Startups can triangulate areas where greatest demand and valuations lie, especially if interested in market exits or partnerships with tech giants setting this course.
- Non-developers and media companies, should watch the approaches and market shares of these AR platforms to target opportunities for audience extension, user engagement and monetization.

For companies keen on building AR apps, the best bets are ARKit and ARCore

- Just like the mobile OS wars of the past decade, AR development will force an Apple vs. Google platform choice.
- ARKit has some quality advantages, while ARCore excels in quantity.
- Ultimately, platform choice will be an individual decision based on capability, reach, and audience alignment.

#### **ABOUT STREET FIGHT**

<u>Street Fight</u> follows the dynamic disruption taking place in the local marketing ecosystem.

Startups and legacy companies alike have emerged with offerings from local search and mobile marketing to the increasingly important back-office operations. These options have steadily displaced print media, yellow pages and coupons as important channels to reach consumers, and have provided opportunities for more trackable ROI and attribution.

Street Fight tracks this evolution in local marketing through its daily website and newsletter; guides the industry with white papers and reports; and hosts must-attend conferences.

Street Fight will evolve its coverage with the varied directions of this industry. We will cover this "Street Fight" underway as these solutions providers battle for the most successful ideas and the most market share.

# **ABOUT STREET FIGHT INSIGHTS**

Street Fight Insights is the research division of Street Fight, the leading source of news, information, analysis and conversation for the local marketing technology industry.



## **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 local, social and mobile media since 2005; and is currently Chief Analyst of ARtillry, covering emerging tech. He is also Street Fight Analyst-in-Residence, and San Francisco President of the VR/AR Association.

Mike is a frequent speaker at industry conferences such as VRLA, ad:tech and Leads Con. He has authored in-depth reports on the changing tech & media landscape including social networking and mobile. He contributes regularly to highly read online 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. Mike was previously a San Francisco-based journalist for business and technology print publications, such as Red Herring, Business 2.0, and Mobile Magazine.

# **APPENDIX I: VIDEO PRESENTATION**

See below for the on-demand version of the author's virtual presentation on the local AR opportunity. Consisting of slides and audio voiceover it is hosted on an unlisted YouTube page for readers of this report. It further unpacks the findings and themes explored in the previous pages.



## **APPENDIX II: LOCAL AR EXAMPLES**

Aggregated recently in a Street Fight column by this report's author, below are links to examples of local AR apps. Built mostly on ARkit, they demonstrate local commerce and discovery capabilities, and are meant to inspire thinking on possible local AR products and opportunities.

Visualize menu items. Find items in a grocery store. Configure your Tesla, place it in your driveway. See if the new couch fits. Navigate to the closest coffee shop. House hunting. Check out the newest Mercedes. Measure your kitchen dimensions.