Evolution of the Virtual Landscape

Index

Introduction

Reality is the world we see when we look around us. Augmented Reality (AR) is when we can visualize inanimate objects that are virtually present, using a camera or a pair of AR glasses. Augmented reality adds virtual objects to a live view or current reality, while Virtual Reality (VR) is an immersive environment that the user “enters” through a Head Mounted Device (HMD). Mixed Reality (MR) is a concept which is based on the idea of adding virtual objects to the real environment.

Augmented reality can contain multiple modalities, including visual (display), auditory (sound), haptic (touch), and olfactory senses (smell). Augmented reality can be comparatively less immersive compared to virtual reality, as you can still picture the real-world environment. You can try on products or services through it, and then make an informed decision. Virtual reality simulates situations which could be useful in cases such as training law enforcement and army professionals for potential stress-inducing situations or in healthcare, where doctors can practice different types of treatments on virtual patients. Moreover, drivers can be trained for traffic situations, and pilots can be trained for flying aircrafts. [1]

[1] AIE (2017). When games get serious – Other industries using games and VR. Retrieved from https://aie.edu.au/articles/when-games-get-serious-other-industries-using-games-and-vr/

4 Challenges of Implementing Augmented & Virtual Reality

1. Components

Augmented and Virtual Reality are currently available to use on smartphones and head-mounted displays (HMD).

As it evolves, we may see augmented reality on windows, windshields, televisions and cinema screens.

2. Costs

There are costs involved in developing a user experience design that will account for issues with user orientation and immersion with the environment.

Startups are more likely to attempt developing this technology, as giants are waiting for the market to grow.

3. Network

Current networks are barely enough in addressing the massive data transfers in streaming augmented/virtual reality,

The arrival of 5G might help technology scale to newer applications as latency will reduce and bandwidth will improve.

4. Regulations

AR/VR will need to tackle the idea of “geofencing” which would help protect property owners from trespassers.

Moreover, AR/VR headsets will have to be tested for protection against disorientation, nausea and other illnesses due to usage.

Section 1-7 Key Points to Picture the Augmented & Virtual Reality Global Market

1. The Augmented Reality Industry

Augmented Reality market is benefiting from the wide range of smartphones that already have AR capabilities now being in everyday use.

Users have access to applications like Pokémon Go, Ingress and other popular games, due to the accessibility of the technology.

2. The Virtual Reality Industry

Virtual reality is currently focused on gaming, as it requires the users to undergo occlusion.

Sony, HTC, Oculus and Google have produced various HMD's with the intent of taking the first mover advantage and giving users a whole new range of experiences.

3. The Augmented & Virtual Reality Industry

Augmented Reality market is expected to gain from the variety of uses across industries.

Whereas Virtual Reality market is expected to benefit majorly from the gaming industry, while other applications develop.

4. Augmented & Virtual Reality outlook and forecast

Augmented Reality market was valued at USD 11.14 billion in 2018 and will grow at a CAGR of 40.29 percent for the next 5 years.

Virtual Reality market was valued at USD 7.9 billion and is expected to grow at a CAGR of 33.95 percent ~~for~~ in the next 5 years.

5. Augmented & Virtual Reality market share

The US remains one of the most powerful leaders regarding the adoption of Augmented & Virtual Reality. It is anticipated to retain its position as the market leader during the period between 2020 and 2024.

6. Competitive landscape

The major global players in the global Augmented & Virtual Reality market are Google, HTC, Microsoft, Oculus (acquired by Facebook), Samsung, and Sony

7. End use insights

Augmented reality is being used for applications in numerous industries such as gaming, entertainment, retail, healthcare and automotive.

The primary focus of virtual reality will be gaming, although there is potential for other applications, if there is supportive infrastructure, network bandwidth and latency.

Section 1-7 Key Points to Picture the Augmented & Virtual Reality Global Market

1. Augmented Reality

Augmented Reality, at the present stage, has numerous opportunities for mainstream applications. The technology seamlessly blends digital/virtual objects into our real-world environment. The prime example for augmented reality's success would be attributed to Pokémon Go. The application which relies on users walking across the nearby areas in hunt of digital "pocket monsters" , had captured the imagination of millions when it was first released. The experience was so immersive that there were millions of adults and kids walking across cities looking for virtual trophies. Due to the attention, various companies began developing AR applications which could offer similar experiences. ARCore (Google) and ARKit (Apple) are two AR-development platforms released to permit developers to build high-detail AR experiences.

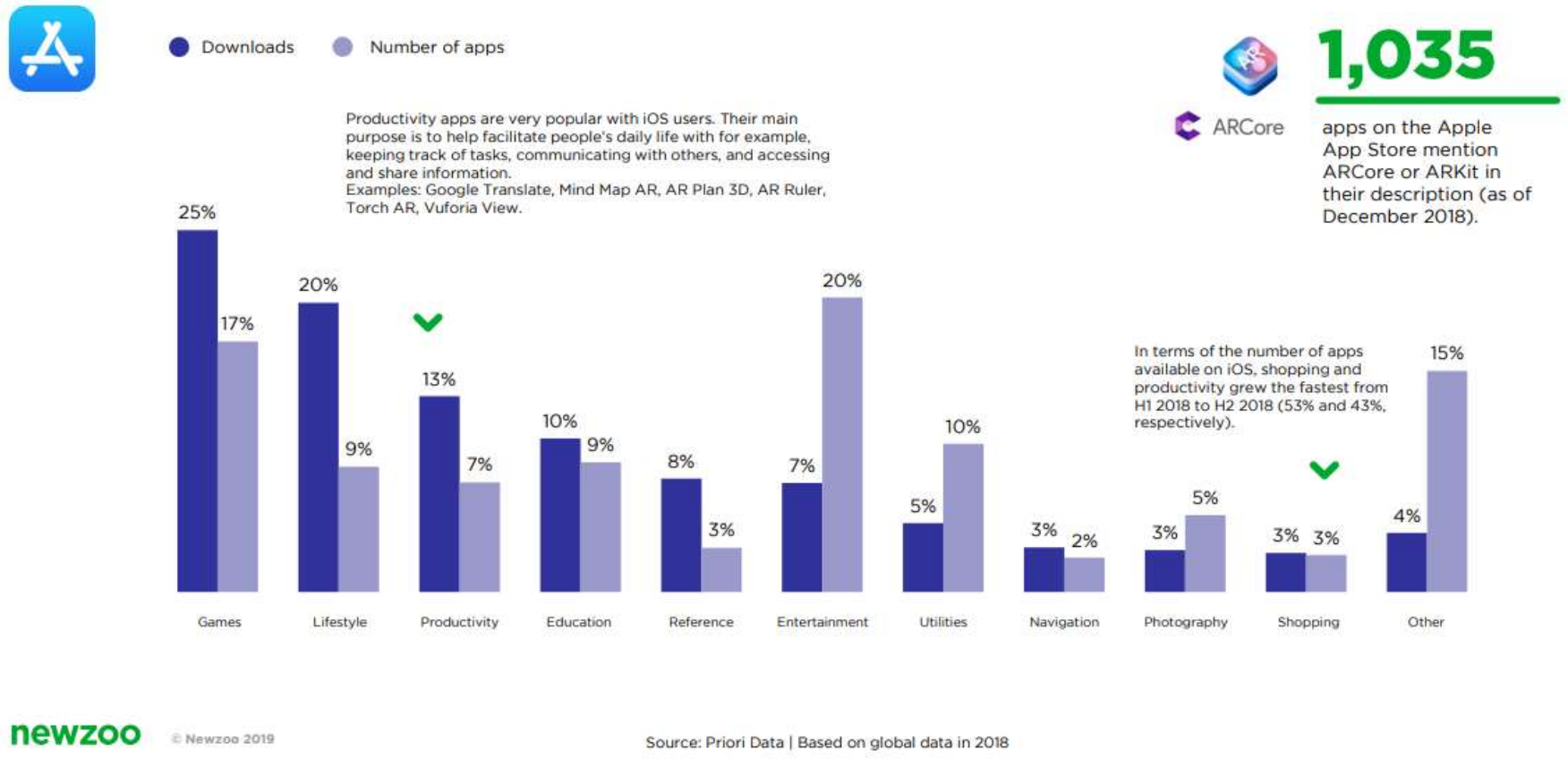
Based on a report by Dutch market research firm Newzoo, there are over 2000 applications that mention ARCore or ARKit on the Play Store and App Store, as of 2019.

In Google Play, 32 percent of these applications are gaming experiences, that also account for 74 percent of the downloads. Meanwhile, the remaining 68 percent of applications account for 26 percent of the downloads.

However, there is more balance among the iOS applications, where gaming experiences account for 17 percent of applications and 25 percent of the downloads. It can be noted that there are more entertainment applications at 20 percent of applications, however at 7 percent of the downloads. [2]

[2] Artillery Intelligence (2019). Newzoo ARM The New Reality for Mobile Gaming. Retrieved from https://artillry.co/wp-content/uploads/2019/04/Newzoo-VR-and-AR-in-Gaming.pdf

Figure 1.1 AR Apps on the App Store. Artillery Intelligence (2019). Newzoo ARM The New Reality for Mobile Gaming. Retrieved from https://artillry.co/wp-content/uploads/2019/04/Newzoo-VR-and-AR-in-Gaming.pdf

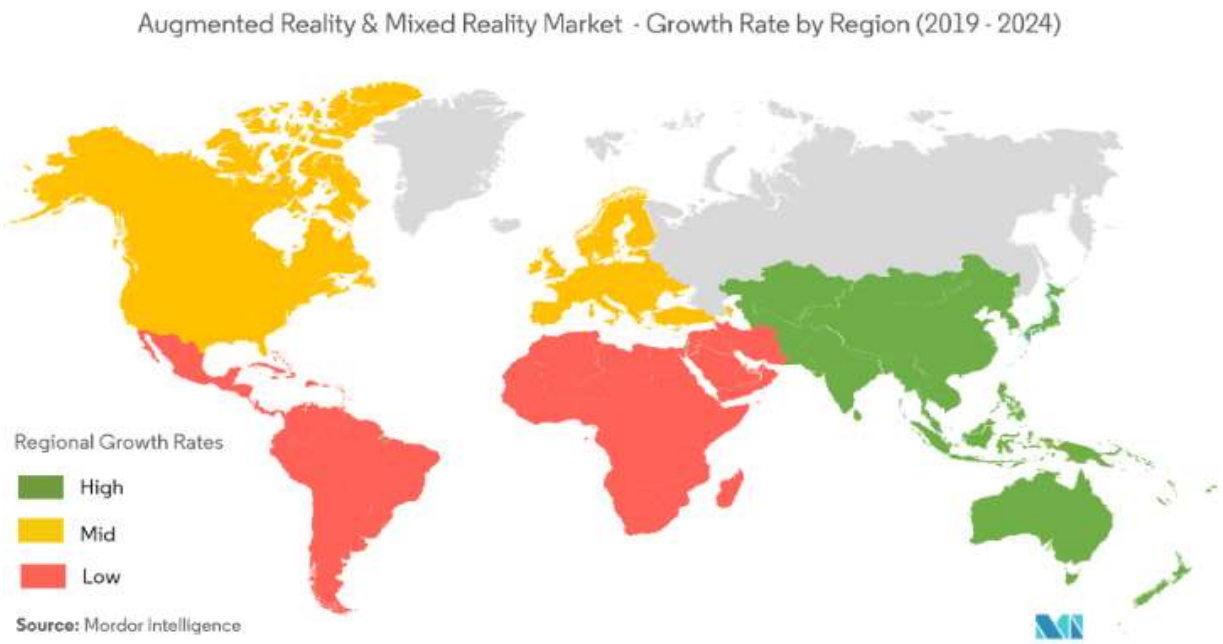


[3] Artillery Intelligence (2019). Newzoo ARM The New Reality for Mobile Gaming. Retrieved from https://artillry.co/wp-content/uploads/2019/04/Newzoo-VR-and-AR-in-Gaming.pdf

This page is intentionally left blank

Section 1-7 Key Points to Picture the Augmented & Virtual Reality Global Market

Figure 1.6 Augmented Reality & Mixed Reality market – Growth rate by region (2019 – 2024).
Mordor Intelligence (n.d.). Augmented Reality & Mixed Reality Market: Growth, Trends, and Forecast (2020 - 2025).
Retrieved from https://www.mordorintelligence.com/industry-reports/augmented-reality-mixed-reality-market



[16] Mordor Intelligence (n.d.). Augmented Reality & Mixed Reality Market: Growth, Trends, and Forecast (2020 - 2025). Retrieved from https://www.mordorintelligence.com/industry-reports/augmented-reality-mixed-reality-market

Section 1-7 Key Points to Picture the Augmented & Virtual Reality Global Market

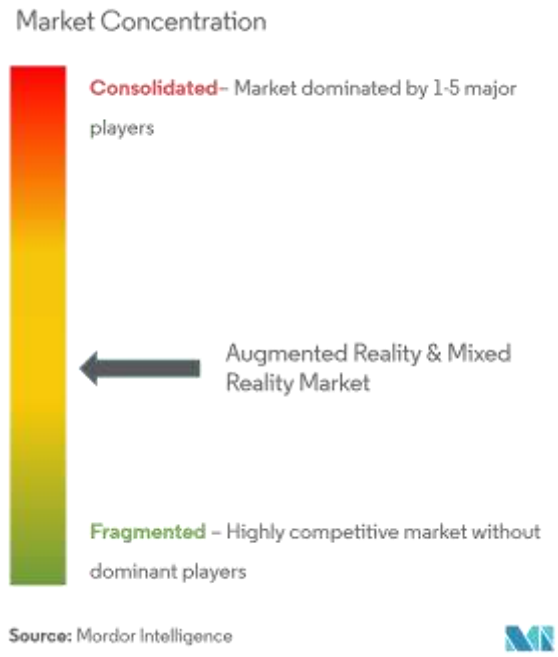
6. Competitive Landscape

The major global players in the global Augmented & Virtual Reality market are Google (US), PTC (US), Microsoft (US), HTC (Taiwan), Oculus (US), Sony (Japan), Samsung Electronics (South Korea), Wikitude (Austria), DAQRI (US), Zugara (US), Blippar (UK), Magic Leap (US), Osterhout Design Group (US), Upskill (US), Continental (Germany), Visteon (US), EON Reality (US), Vuzix (US), Zugara (US), and MAXST (South Korea).

The global augmented & virtual reality market is greatly competitive, without any dominant players. There are potentially many companies investing in AR & VR experiences that have yet to be launched. Many companies have also been acquired by tech giants such as Facebook and Google. [17]

The rising amount of players is going to support the virtual reality market's overall growth in the coming years, while, augmented reality will benefit from the various professionals who will undergo job training through AR/VR-enabled experiences.

Figure 1.7 Global Augmented & Virtual Reality Concentration
Mordor Intelligence (n.d.). Augmented Reality & Mixed Reality Market: Growth, Trends, and Forecast (2020 - 2025). Retrieved from https://www.mordorintelligence.com/industry-reports/augmented-reality-mixed-reality-market



[17] Mordor Intelligence (n.d.). Augmented Reality & Mixed Reality Market: Growth, Trends, and Forecast (2020 - 2025). Retrieved from https://www.mordorintelligence.com/industry-reports/augmented-reality-mixed-reality-market

Section 1-7 Key Points to Picture the Augmented & Virtual Reality Global Market

7. End use insights

Augmented & virtual reality will have many types of applications. Initial interest is currently driven through gaming and entertainment experiences. However, as more developers use gamification on everyday situations, there will undoubtedly be numerous experiences to train a user.

Retail companies that use AR will receive a substantial boost, due to people appreciating the opportunity to try virtual products before purchase. This will bring in customers who have specific targets over those who prefer to shop and figure out what they want to purchase.
Healthcare organizations will also benefit from these as they will train young surgeons without any consequences, while also safeguarding the use of lab equipment. Moreover, doctors could consult AR for identifying medication for various illnesses. There are potential opportunities that are being tested in the water, like real estate and automotive, where employees can be involved in the production process without costly consequences. [18]

Virtual reality has a lot of potential, if the location-based restriction is realized as a strength, rather than a weakness. Organizations can incorporate VR rooms, which are designed so that users can immerse themselves in training. [19] Training law enforcement is a useful addition, which should help professionals prepare for stress-inducing situations. Students can learn about and connect with historical events through virtual reality, while also learn about environmental issues and conservation.

Moreover, geofencing (creating virtual geographic boundaries), if incorporated will change the industry in many ways. People will have the option to purchase an office space, with optional virtual features. Similarly, a homeowner can be the owner of the digital space that is covered by his/her home.

[18]SmartTek (n.d.). AR and VR in the entertainment industry: five practical uses. Retrieved from https://www.avrspot.com/ar-vr-entertainment-industry-five-practical-uses/
[19] Artillery Intelligence (2019). Newzoo ARM The New Reality for Mobile Gaming. Retrieved from https://artillry.co/wp-content/uploads/2019/04/Newzoo-VR-and-AR-in-Gaming.pdf

This page is intentionally left blank

Section 2 - 2 Major Disruptors in Augmented & Virtual Reality Global Market (AR/VR Components, Regulations)

1. AR/VR Components

Hardware

- HMD
- HUD
- Smartphone

Software

Based on usage

- Personal
- Enterprise

Based on user-base

- Single user
- Shared

2. Regulations

- Geofencing
- AR/VR wearables
- AR/VR Data & Copyright

Section 2 - 2 Major Disruptors in Augmented & Virtual Reality Global Market (AR/VR Components, Regulations)

1. AR/VR Components

AR/VR can be accessed through the combination of two components i.e. hardware and software. Hardware consists of the different types of headsets or screens which display the digital components of the environment, while software is the program/application.

Hardware

- Head-mounted Display (HMD)

Head-mounted Displays (HMD) are the primary available hardware devices to view or interact with the digital components. When a user can seamlessly immerse themselves into the experience and enjoy it. Head-mounted displays can be sophisticated in the meaning that they be operated without the use of any gear, or could require the user to connect a PC/smartphone/console (like the PlayStation 4)

There are three types of head-mounted displays, being optical see-through HMD (for AR), closed (for VR) and video see-through (for MR). [20]

Figure 2.1. Oculus Rift HMD. Behnke, S. (2015). Upper-body operator interfaces: Left: Oculus Rift DK2 HMD. Right: Razer Hydra 6 DoF controllers. Retrieved from https://www.researchgate.net/figure/Upper-body-operator-interfaces-Left-Oculus-Rift-DK2-HMD-Right-Razer-Hydra-6-DoF_fig7_282673050

Figure 2.2. Sony PlayStation VR HMD. PlayStation®VR. (n.d.). Retrieved from https://www.playstation.com/en-ae/explore/playstation-vr/

[20] Rutz, D. A. (n.d.). AR with Head-mounted Displays. Retrieved from https://www.medien.ifi.lmu.de/lehre/ws0607/ar/AR-W06-05-HMDs-klein.pdf
[21] Behnke, S. (2015). Upper-body operator interfaces: Left: Oculus Rift DK2 HMD. Right: Razer Hydra 6 DoF controllers. Retrieved from https://www.researchgate.net/figure/Upper-body-operator-interfaces-Left-Oculus-Rift-DK2-HMD-Right-Razer-Hydra-6-DoF_fig7_282673050
[22] PlayStation®VR. (n.d.). Retrieved from https://www.playstation.com/en-ae/explore/playstation-vr/

Section 2 - 2 Major Disruptors in Augmented & Virtual Reality Global Market (AR/VR Components, Regulations)

- Heads Up Display (HUD)

The potential of augmented & virtual reality in Heads Up Displays (HUD) remain largely untapped. Imagine the windshield of a car displaying navigation information and landmarks, on an updated version of Google Maps, or imagine data visualization on the window screen at an office. This will majorly benefit the automotive industry through numerous applications. Drivers can view which objects are near the vehicle and decide upon how to drive smoothly. Moreover, the navigating arrows on display will help drivers in large cities reduce the stress of navigating unknown paths or neighborhoods.

The usefulness of these displays brings a new dimension to presentations, whether in the office or in a conference. Advertising will have a new outlet when augmented HUD becomes mainstream. People may have to watch advertisements to avail discounts on items,

In 2015, Continental tested its augmented reality HUD in a KIA K9 sedan, which totally complimented its own HUD, and this shows the potential disruption in the automotive industry, that may make it easier for other emerging technologies like electric and self-driving vehicles. [23]

Figure 2.3. Continental AR HUD. Newcomb, D. (2015). Augmented Reality Head-Up Displays Point The Way Toward Self-Driving. Retrieved from https://www.forbes.com/sites/dougnewcomb/2015/10/15/augmented-reality-head-up-displays-point-the-way-toward-self-driving/#3958218f7c25

[23] Newcomb, D. (2015). Augmented Reality Head-Up Displays Point The Way Toward Self-Driving. Retrieved from https://www.forbes.com/sites/dougnewcomb/2015/10/15/augmented-reality-head-up-displays-point-the-way-toward-self-driving/#3958218f7c25

This page is intentionally left blank

Section 2 - 2 Major Disruptors in Augmented & Virtual Reality Global Market (AR/VR Components, Regulations)

2. Regulations

AR/VR regulations cover various aspects of the developers, owners and users of the technology. Some of these discussed are: Geofencing, AR/VR wearables and AR/VR Data.
It is important for the digital world the virtual landscape to be regulated, so that the potentially challenging situations are covered, and the aggrieved parties' rights are protected. As we are learning more about the technology, we are in the process to understand what businesses should and should not go. An adaptive model which learns from each problem, while maintaining actionable soft laws helps ease everyone into the use of this technology in our every-day lives. [29]

- Geofencing

A geo-fence is a virtual perimeter for real-world geographic area. It would prove useful in the current environment, if there were an established regulatory authority that controlled the areas that an application is permitted to function in.
For example, during the early days of Pokémon Go, lots of players would venture into restricted property in order to "catch" these virtual creatures. It is a questionable aspect of the software program, as people who break into private property would try to justify it on the basis of the game's instructions.
The Institute of Electrical and Electronics Engineers (IEEE) Standards Association and Consumer Technology Association (CTA) are attempting to build a consensus among the key players in the Augmented / Virtual Reality sphere, such as component manufacturers, software developers, government agencies and other relevant stakeholders. There should be active testing of places where the virtual world interacts with the real world, and identifying any potential threats resulting from the interaction.

In the future, would property owners own the right to the augmented/virtual reality content in the property's geographic area. This would address who owned the virtual content, after the sale of properties.

[29] Deloitte (n.d.).How to begin regulating a digital reality world. Retrieved from https://www2.deloitte.com/us/en/insights/industry/public-sector/regulating-digital-reality-augmented-spaces.html

Section 2 - 2 Major Disruptors in Augmented & Virtual Reality Global Market (AR/VR Components, Regulations)

Geofencing seems to solve a lot of problems. That said, businesses need to plan in more depth. How would geofencing work in office spaces, especially with different floors and constant changes applied to the real-world environment would have to be replicated in the augmented environment. If a person walks through an office with an augmented reality headset, and identifies all the objects through the technology, the introduction of something new like a printer, could obstruct the technology from detecting it.

Using identifiable landmarks as markers will also be a problem, as a headset could detect the poster of the Tower Bridge (London) or Washington Monument (US) and mistakenly assume that the user is currently in that location. Further, even if every floor is identifiable, the headset may fail to recognize the change if an employee walks from 23rd floor to 24th floor for instance. Geofencing will have to tackle a challenging task of uniquely identifying a location. [30]

- AR/VR Wearables

The HMDs and HUDs will need to be tested constantly to ensure that users are not disoriented or affected by illnesses such as motion sickness, nausea, dizziness, headaches, excess salivating, sweating and other possible issues. Manufacturers who do not address these issues will be prone to lose the competitive advantage in the market, and in the worst-case scenario, may be asked to recall their products from the shelves. If these devices can be useful during adverse weather conditions to help navigate, or whether they should not be used in such situations, should also be addressed.

HMDs and HUDs should also prevent information overload by identifying times a user could be stressed or advising the user to take breaks based on recommended settings. For example, smartphones offer to reduce noise in earphones after a short period of listening to music at high volume. AR/VR Wearables also need to be checked for basic wearable regulations that monitor noise regulation and headphone limiters.

Once all these regulations are addressed, the headsets can be freely purchased by multiple users (who are secured that the technology will not cause unintended harm), and applications can scale further.

[30] Deloitte (n.d.).How to begin regulating a digital reality world. Retrieved from https://www2.deloitte.com/us/en/insights/industry/public-sector/regulating-digital-reality-augmented-spaces.html

This page is intentionally left blank

Section 3 – 5 Use Cases of Augmented & Virtual Reality

Figure 3.3 Virtual tour of the British Museum. British Museum (2017). New Virtual Reality tour of the Museum with Oculus. Retrieved from https://blog-uat.britishmuseum.org/new-virtual-reality-tour-with-oculus/

Figure 3.4 [39] Virtual concert of Imagine Dragons

[38] British Museum (2017). New Virtual Reality tour of the Museum with Oculus. Retrieved from https://blog-uat.britishmuseum.org/new-virtual-reality-tour-with-oculus/ /
[39] Imagine Dragons Kick Off Citi and Live Nation's Virtual Reality Concert Series. (2017). Retrieved from https://www.presspassla.com/imagine-dragons-kick-off-citi-live-nations-virtual-reality-concert-series/

Section 3 – 5 Use Cases of Augmented & Virtual Reality

3. Retail

Augmented Reality will further impact the way products are purchased. These products will primarily belong to the household, automotive, fashion and cosmetics industries. For example, when people go furniture shopping, they may have decided on the ideal bed, couch or sofa, but when they bring it to their own house, it turns out that the product is taking too much or too little space, and that the color scheme is not blending with the rest of the house. Augmented reality entered the industry three years ago with the launch of several applications such as IKEA Place.

With an application like IKEA place AR, or Macy's AR Furniture App, people can now visualize their ideal furniture items in their homes, using just their smartphone device. After being able to tap into this avenue, there will be fewer transits and returns at these furniture stores, as well as ensuring that the customers entering these stores come with a focused mindset on what to buy. The whole process reduces time required for everyone involved in the transaction. [40]

Moving over to the fashion and cosmetics industry, people (primarily women) can try various virtual hairstyles, tattoos, lipsticks, nail polish, jewelry and other cosmetic products. This allows brands to engage customers, as well as save inventory, which would usually be provided as samples. This levels the playing field between local and worldwide brands, as they can bring more consumers through the utilization of augmented reality.

inVRsion is an Italian startup, that is allowing large retailers to recreate their stores virtually. It would allow users to walk through these virtual stores using their headset and visualize all the everyday products they wish to buy. Yet again, this gives local retailers a better chance at competing with large e-commerce giants like Amazon and eBay. Similarly, e-commerce giants who do not have physical stores could utilize virtual stores to attract customers. Virtual reality could also allow viewers to visit fashion shows and help them identify clothing they wish to purchase. [41]

[40] Besecker, B. (2020). The Definitive Guide to Augmented Reality in Retail - 40 Examples. Retrieved from https://www.marxentlabs.com/ar-in-retail-top-augmented-reality-retail-apps-guide/
[41] Create any retail space in Virtual Reality. (n.d.). Retrieved from https://invrsion.com/solutions/store-virtualization

Section 3 – 5 Use Cases of Augmented & Virtual Reality

Figure 3.5 [42] Using IKEA Place.
Lunden, I. (2017,). IKEA Place, the retailer's first ARKit app, creates lifelike pictures of furniture in your home. Retrieved from https://techcrunch.com/2017/09/12/ikea-place-the-retailers-first-arkit-app-creates-lifelike-pictures-of-furniture-in-your-home/

Figure 3.6 Visiting a Virtual store created by inVRsion.
Create any retail space in Virtual Reality. (n.d.). Retrieved from https://invrsion.com/solutions/store-virtualization

[42] Lunden, I. (2017,). IKEA Place, the retailer's first ARKit app, creates lifelike pictures of furniture in your home. Retrieved from https://techcrunch.com/2017/09/12/ikea-place-the-retailers-first-arkit-app-creates-lifelike-pictures-of-furniture-in-your-home/
[43] Create any retail space in Virtual Reality. (n.d.). Retrieved from https://invrsion.com/solutions/store-virtualization

This page is intentionally left blank

Unit No: OneJLT-06-112, One JLT, Plot No: DMCC-EZ1-1AB,
Jumeirah Lakes Towers, Dubai, UAE
vleginsky@arbitralis.com
info@goldmeritdmcc.com
www.goldmeritdmcc.com