

Virtual Reality: “Giving designers the platform to design a conceptual world”

*Diran Malatjalian, Ihsan Hammouri, Dr. Jehad Ameri, Dr. Haifa'a Bani Ismail,
Diala Al Daghli, Khaldoun Hijazin, Mutasem Azmi Alkarablieh
The University of Jordan*

➤ **Abstract**

Virtual Reality has always held the perception of a “dreamy escape” from reality. That is why the name stuck to the concept of virtually reality is somewhat in accurate; soother naming such as “alternative reality” or “computer simulation” might be better options for branding the term. It is practical technology that has been used by all whether scientists, engineers, architects, designers and many others, for longer than 30 years.

Virtual reality is the creation of a virtual environment presented to the senses in such a way that one experience it as if he was really there. It uses a host of technologies to achieve this goal and is a technically complex. Virtual reality has both entertainment and serious uses. The technology is becoming cheaper and more widespread. The aim is for a natural, free-flowing form of interaction which will result in a memorable experience. It is blocking oneself off from the real world and replacing it with a computer-generated alternative. It usually involves wearing a wraparound headset “head-mounted display”, clamping stereo headphones over the ears, and touching around an imaginary home using datagloves (gloves with built-in sensors).



Today, using design in VR is considered an accomplishment. For so long designers used mouse translated movements into 2 & 3 dimensional computer screens. And here this new technology reflected the merger of computer software capabilities with the natural movement of human body; this is definitely the path for the future of design, however the concept will only be unlocked universally when UX designers integrate AR with daily life to improve productivity & quality of experiences.

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➤ **Purpose of the Research**

The research is designed with defined objectives:

- Define the meaning behind Virtual Reality and its purposes.
- Introduce the entire experience of Virtual Reality (pros & cons).
- Explore how Designers play major roles in VR advancement.
- Get a glimpse on the types and equipment used in Virtual Reality.
- Understand how Design in VR is different in comparison to traditional design work.
- Explore how VR as a technology is changing the world of designers.
- Take a look at the future of VR, best practices and design patterns.

➤ **Virtual Reality**

The name “**virtual reality**” comes, from both ‘virtual’ and ‘reality’. The definition of ‘virtual’ is near and reality is what we experience as human beings. So the term ‘virtual reality’ basically means ‘near-reality’ “reality emulation”.

Its definition in technical terms... Virtual reality is the term used to describe a **three-dimensional, computer generated environment** which can be explored and interacted with by a person. That person becomes part of this virtual world in which he is able to manipulate objects or perform a series of actions.

Not one single person is really responsible for the creation of VR. In fact, many people contributed to the technology’s growth. There are at least five people who played major roles: Morton Heilig, Jaron Lanier, Douglas Engelbart, Ivan Sutherland, and Myron Krueger.

➤ **A Brief History of Virtual Reality**

The Term “Virtual Reality” was first used in mid 1980s when Jaron Lanier developed the gear, goggles and gloves used in the VR experience.

Virtual reality has a long and very rich history. Here are a few of the more interesting highlights... Year 1890 Thomas Edison with the help of his assistant developed the first one-person movie experience using a camera for recording pictures.



Edwin Albert Link: Inventor of the First Flight Simulator

Later on, in the year 1929, Edwin Link “called the pilot Maker” developed a mechanical airplane simulator, today his work pioneers the field of flight simulation. In the year 1957, Morton Hailing “considered as the true father of virtual reality” developed a machine that produced artificial sensory experiences, a pioneering 3D head-mounted display. And in 1962, he was granted a patent for a machine “Sensorama” which is an updated sophisticated Kinetoscope that immerses its users in artificial vision, sound and smell plus vibration. The observer sits on a rotating chair facing a screen, and then stereoscopic images would be reflected on the screen giving an illusion of depth and the ability to view things from different angles.



The Sensorama

And in year 1962 engineers at Philco Corporation developed the first head mounted display (HMD) that was used by helicopter pilots who needed to see their surroundings while flying at night. The first dataglove was introduced year 1977 by Dan Sandin, Richard Sayre & Thomas Defanti. Year 1980 virtual reality was used on projects for NASA and year 1983 writer William Gibson invented the related term “cyberspace”. In the year 1989 computer scientist & musician Jaron Lanier “referred to as the father of virtual reality” developed pioneering VR peripherals with an HMD and dataglove.



The visionary behind virtual reality Jaron Lanier

Virtual reality continued to be popular throughout the 1990's, still but the propaganda surrounding this technology decreased due to beliefs that VR did not deliver on its promises and by that it started losing interest. In the year 1991 Sega announced the launch of their headset designed for gaming. Year 2014, Samsung & HTC

produced rival VR systems that appeared in play stations and same year Google announced shipping 5 million head mounted displays for smartphones. In the year 2017, Sony reveals that it sold one million PlayStation VR headsets in less than 4 months.



Google Cardboard

➤ **Graphic Designers, becoming the “Design Architects” of VR**

The entire experience of virtual reality is simply a combination of sensory information. Experts explain how Virtual Reality (VR) as a technology plays with the senses in order to transport humans to another world, an imaginary world. The concept is using the past experience developed in the human brain to develop “rules” by which to interpret the world. For example looking up is based on skies, and light is derived from shadows movement, and sizes depend on distances among elements layers and further elements are smaller, all these rules set standards for the brain to operate accordingly in a more efficient manner. VR architects make use of these rules and work on developing a virtual world derived from these rules and past experiences. In a virtual setting all moving objects follow methods of the law of physics, such as how shading determines depth and distance in set up scenarios.

This immersive environment is similar to the real world to an extent, yet it’s fantastical, creating an experience out of this world, not real and very creative that is almost impossible to happen in real life. When people use VR equipment they get to look around and move in an artificial dimensional world of layers, interacting with virtual features in an artificial world. The experience is developed through VR headsets and a display screen facing the eyes, or it can be created within specially designed rooms with multiple huge screens to enlarge the actual experience.

Once we go beyond the technical aspects of VR, the need arises for those designers with creative eyes to develop amazing out of this world settings, take people to another world, a world of pure imagination. This follows the exact path of the simplicity of web development with underwhelming design pace, websites evolved into a creative medium on their own. The ones to be thanked for that are graphic designers, who played major roles in webs and today are playing even bigger roles in VR development, such as their roles in gaming and set ups of creative designs, in Gaming, designers shine in developing a dreamful world that is truly fascinating. Another example is the role of graphic designers in designing amazing and creative virtual environments and set ups for Movies, not to forget the finishing touches that designers add up graphically to the movies which take the viewers to another world, living unreal experiences.

➤ **Why Virtual Reality?**

Virtual Reality is useful and will become even more admired and valued in the future because it has clear potential in changing the future. Immerse films and Video games are living proofs, besides the fact that consumers are so keen on novelty which brought the entertainment industry into a multi-billion dollar business. This is on the entertainment share, but again VR has many other serious applications in real life, especially in dangerous settings, such as; training pilots, training surgeons “medical field”, where Virtual Realty offers the

ability for virtual risks that help gain real world experiences.



Virtual Reality in Medicine

There are a wide variety of applications for Virtual Reality such as: Sports, ART, Entertainment, Medicine, yes Virtual Reality can and will lead to new amazing discoveries in different areas to impact day to day life.

1. **Types of Virtual Reality**

1. **Immersive:** to get a total real VR experience, one needs; a computer model For the complete VR experience, a powerful computer that can project the experience in its real time and a hardware. A head mounted display (HDM) with two screens and a surround stereo sound effect, with one or two sensory gloves. Or one go move within a room fitted with screens, on which images are projected and a surround system (loudspeakers) to reflect sound effects.
2. **Non-immense:** a non-immersive VR experience could be enjoyed at home such as a flight stimulator on a home PC with a wide screen, headphones or surround system, and a joystick. Another example of a non-immersive VR experience is that of an architect building a 3D model for a new construction building to show to clients interested to buy an apartment in that building by exploring the options and details on a desktop screen using simply a mouse. Giving a much better experience than that of a few drawings or power point presentation.
3. **Collaborative:** GAMES in general (interactive & computer driven) but not a complete immersive experience. It's something to share with others and expected to be an important feature in VR in the near future.
4. **Web-based:** a virtual world built on computers using VR language like (HTML). This opens new ways for ordinary people to find& publish information, shop or share ideas with others.
5. **Augmented reality:** through smartphones and other mobile devices people can wonder and get to see the world like go visit new cities or exciting places. The concept is developed as one point the tablet or smart phone at the landmark and exciting information pops up automatically. It's a;; about tying the real world with the vast virtual world of information.

➤ **Equipment Needed for VR**

Head – mounted displays

Looks like a motorbike helmet with two tiny screens, one in front of each eye, with a total block out from any other light or anything that distracts from the real world with stereo headphones. They all play different roles in creating a realistic 3D perception of the virtual world. They are somewhat too heavy to be worn for long times.

Immersive rooms

Instead of wearing the HMD one can stand inside a room and watch images reflected on the walls in a

stimulating experience.

Datagloves

Ordinary gloves with sensors wired to detect hand and figure motions. It depends on a fiber optic cables stretched to the length of each figure. it gives people more control over the VR experience.

Wands

It is a wireless stick that is used to touch to interact with the virtual world. It has built in motion sensors as well as mouse-like buttons or scroll wheels.

➤ How VR, AR & MR are Changing the Graphic Design World

Ever since the very beginnings of Virtual Reality designers got hooked, and their world changed totally in terms of design and this ever evolving techniques, some of which: **Conceptual Product Design and Prototyping:** Virtual Reality gives designers a platform to design conceptual products that are only in imagination. With the progress of technology designers will be able to skip the time-consuming prototyping process used. This will, in return, impact different design areas such as; cars, architecture, interior design, brands and products. **Immersive Branding:** Designers are grinding to develop an immersive branding experience where target audiences can fully engage in stimulating brand experience.

➤ How Virtual Reality Changes the Design Experience

Virtual Reality helps build imaginary experiences in ways not just to change the real life experience, but more of the way people create things. The creation of someone else's life and living it, in addition to the creation of an imaginary life, one gets to live it for real.

An amazing experience took place when a VR Video was launched by a non-profit organization raising money for poor African schools where donors sat in the desks of an African school. It was a strong effective Video and such a powerful experience that one can almost feel the heat off the mud brick walls in the class room of an African school kid.

➤ Pros of Virtual Reality

VR like any technology has good and bad sides to it. It will be fully good once people understand its real value, the truth is that VR isn't like what people say and fear, it is not meant to replace real life, it is meant to enhance it.



Facebook co-founder and chief executive, Mark Zuckerberg, speaks at an Oculus developers conference while wearing a virtual reality headset in San Jose, California on October 6, 2016 PHOTO: AFP

VR got real interest from audience when Facebook bought the virtual reality startup Oculus VR in the year 2014 as it had the idea of letting people from around the world to be friends and share things and interests over the internet, not only sharing photos or articles but an entire experience as well. **VR being young at age in**

terms of technology, made lots of businesses questions its benefits to the brands. The truth is that studies indicated that VR has high ROI in terms of brand awareness which drove about 75% of different brands to create more virtual reality communication with their target audience. A Better Than Reality Experience: VR is used in Games creating visuals that are far better in experience than reality. The use of sound and more of graphic design is what makes the experience extra ordinary. **Applied in different fields:** the variety of features made it used adding dimensions in different fields such as military, education, healthcare and much more... **Offering overwhelming experiences:** VR makes users enjoy real visuals created by designers and real sounds that they almost feel its reality and visualized by a creative designer. Disabled people benefit from that because with VR they can explore the real world. **Connects with people as they give detail views:** VR opens doors for people to connect with others they never knew before and are living somewhere else in this wide world, as they move around in detailed view of places and get to know more about people living around the world. **Effective communication:** One of the main pros of Virtual reality is effective communication. Users can communicate with each other and thus enjoy the conversation between them. It gives a new experience of communicating with the people.

➤ The Cons of Virtual Reality

High Cost of VR as it greatly depends on the project and people think it's overpriced to a point that they prefer to lose the experience than pay for it. **Escaping the real world**, is what some people feel when using VR which is somewhat dangerous at times. **Addiction** is another issue that people face when using VR which can cause psychic problems to some. **VR is not fully developed**, which means it's still under experiments as it's still not fully accepted by all. **VR is not accurate** as it's virtual and results in real life is not 100% guaranteed.

➤ About Design in VR vs. Traditional Design Work

Designers in a VR world don't want ever to lose sight of the main objectives when going after the next big thing; they must always tie their designs with the brand objectives, concentrating on outcomes to fit the set goals of the business. If the objectives are brand awareness connecting to mass, then VR is not highly used as it has a low adoption rate in that case. But when addressing a corporate training program, for example, it would be an amazing powerful training tool creating a great experience designed to fit the exact objective of the project. Again in comparison to traditional advertisement when creating AR or VR design we find that most clients have limited references when it comes to past experiences look or feel as AR & VR are is still somewhat new as a design trend, and people still need constructive feedback on such designs. In comparison when working in a traditional manner, such as; TV, print, outdoor even digital, clients have been interacting with such design formats for many long years, giving such mediums more strength in terms of trust on ROI. In addition, when designing for "first-person design" meaning that the viewer is the one control and creators should not try to control the viewer (target), while as in AR & VR designers become more philosophical than they are technical, not like designing for again similar yet traditional mediums such as; Plays & shows which occur in a more third person experience and the creator controls what the viewer hears, feels or sees.

➤ VR affecting the Marketing & Advertising world

Though VR still offers, although still in its early stages, immerse experiences which help brands tell their real stories in a more interactive appealing manner that engages the senses of a human being to a point that it becomes so real. It is estimated that VR could reach up to 171 million users by the end of year 2018, which is considered an immense growth from 43 million of that in the year 2016.

➤ When to Use VR in Advertising

The cost of developing a VR experience is quite expensive which make it unpractical. Studies prove that the best time to invest and use a full VR and out it into action is when the target audience needs to experience the same sensation of a certain activity in a fun, exciting yet safe way.

Again results of studies show that only **8%** of marketing gurus are actually using VR, while the rest are still contempt with the traditional techniques. Most marketing people stay a bit conventional when it comes to advertising, still they use more of video advertising and social media as people find them easy to access in comparison to VR. The projections show that VR will be on the leash very soon used by more professional people as attitudes of target audiences' change towards using VR.

➤ **Real Life Examples on Using VR in Advertising:**

For creative people working in branding and advertising, the use of VR makes target audiences fall for brands as the experience carry emotions and real sensation, pushing the target to love the brand and thus move to the purchase point. Research findings indicate that viewers have stronger feelings and higher interaction and engagement when using VR compared to watching a campaign or ad in a standard 2D film. Companies tend to create amazing memorable experiences for their customers, relating their products and services to real stories using VR techniques, thus portraying the customers as champions and putting them in the middle of action.

- **TRAVEL:** As people yearn to travel and explore the world, yet the high cost and the reality of not finding the time to do it, turn to VR as a real life experience that fulfills their passion. In the year 2015, Marriott Hotels launched an amazing campaign where they invited their target audience to participate in a VR well designed trip. The idea was to push people to get the inspiration of traveling using the Marriott experience, which led other Hotels like Hilton, Renaissance to follow the footsteps of the Marriott.



Marriott has created a 4D experience that takes participants to Hawaii and London

- **CARS:** Race Track lovers fell in love with this specific experience when Jaguar decided to immerse its audience with a VR expertise of test driving the Jaguar I-PACE in the launch campaign. REWIND joined forces with the creative agency Imagination and developed a multiuser VR experience for both press and VIPs around the world. They used 66 connected HTC Vive Business Edition headsets made it so real, as REWIND created an environment where users from LA to London and interact with each other, when a live video presenter was beamed in to tell them about car as an amazing invention. Designers demonstrated the design using Tiltbrush & more interactive elements to reflect the running engine. The PR Buzz was so huge to a point that people kept talking about it and sharing it for quite some time. Mercedes did the same when they introduced the 5360-degree VR video for EQ.



First Jaguar electric vehicle revealed through a world first virtual reality experience.

- **FOOD:** McDonald's invented a creative idea to reuse their Happy Meal boxes as Happy Goggles and then transform childrens' smartphones into a vehicle to a new world as they enjoyed more fun games. So did Coca-Cola with dream big as a campaign. They designed an immerse locker room experience for the 2014 world cup in Rio, where attendees were given the opportunity to play football thus getting thirsty to drink Cola.



McDonald's Happy Goggles

- **IKEA** also designed an immersive IKEA home design experience, where customers got the chance to add their items to the scanned space.



IKEA VR Experience

➤ **How VR will Change Our World**

Virtual Reality will be able to take people to places they have never been before and get them interested in going there in real life by using VR thus allowing remote tours of cities, museums and famous landmarks. This will definitely elevate the entertainment industry and ultimately VR will touch and influence our everyday lives with more virtual experiences in different domains such as: Games, it is very much expected that designers will excel in this field bringing gamers to more unique experiences. Again Moves is another industry that will flourish in VR and designers will get more room to be more creative in creating effects and unlimited possibilities of fabricated sets and locations by which movie making as we know it will change forever. Fabricating new Job Opportunities is another major change that VR will introduce to the world, as work opportunities will change due to automation and new technologies such as VR which will drive HR departments, in the coming years, to fill different types of Jobs that are more creative in a technical manner. Medication and surgery will also become fully interactive through VR real live designed experiences, which will introduce better trained and better performing surgeons. Over all, VR will surely improve the quality of life, for those out there who for some reason or another, are not able to experience the amazing wonders of the world, disabled people for example, and that will be truly amazing.

➤ **Predictions - The Future of Virtual Reality**

Virtual Reality is ready to move to the next phase, going mainstream, but surely it will not look the same way it does today, changing the way we live and learn about the world, but surely it will not look the same way it does today, with big heavy headsets that we are used to seeing.

A rush of new consumer experiences will arise and another rise of customer experience on design level, today people get to check their smartphones every couple of minutes to check social media informatics, imagine tomorrow when people will not need to go online any more to check pc or mobiles, what if they get to use AR glasses for the future drive immersive experiences without blocking out “real reality” from around as VR does today, that would be quite amazing, and yes we are heading there.

Statistics prove that VR industry is growing in number of users pretty fast, whether in games, healthcare, tourism, sports, education, manufacturing and advertising and mostly design. Tiltbrush is a main virtual tool offering 3D design capabilities and soon they will be available to all with the growth of HTV Vive. In a few years down the line, there will be no longer artworks in museums but rather an immersive experience that we will indulge in. Again statistics indicate that users doubled from 90 million in 2017 to 171 million in 2018 worldwide. Figures imply that the VR market will grow in size to \$30 billion USD in the year 2020 going up from \$7billion in the year 2018 opening the room for designers to grow and excel in this field. Virtual Reality and augmented technologies are drawing millions of dollars in investments, and are expected to reach \$150 billion by the year 2020.

➤ **Conclusion**

The Virtual Reality of the near future will involve more than what we know today, of headsets and other tools used, it will become more physical, and quite sensory oriented by introducing better control techs catering to all the senses not just the touch and see but also to the smell, the reality factor will become more real in VR soon, making VR more immersive, full expressive, thus moving people from the information age to the experimental age as it unlocks the potentials for creativity and imagination for all designers opening opportunities for a lot of designers to excel in the next few years.

In general, people tend to worry about any new technology that arises, and in regards to VR critics fear that people will spend time on the media and new technologies and they will be connecting to others through cold technology which somewhat will isolate them from the real social life. But what they are overlooking is the truth that human beings are very much emotional and social, so any technology that will not bring them closer and help them connect will definitely not succeed and eventually, fade out, just like Internet existed for so many years before it became social and connecting people. It is a fact that when technology is headed towards space, and brings space to living rooms, it's something quite big, so is the case for NASA who is using AR & AR today.

It is another fact that technology comes to people with unknown future, thus it creates need to create best practices and design patterns. This is why it is presumed that UX designers will have secured jobs in the coming future; everyone will need designers who will use design techniques that will inject warmth into products. The best part is that these technologies are still at the beginning stages, and a lot needs to be designed and developed by the creative community. So much exciting things await the world of design.

➤ **References**

1. Erickson, S. (2018). *What Does the Future Hold for Virtual Reality?*. [online] The Motley Fool. Available at: <https://www.fool.com/investing/2018/03/26/what-does-the-future-hold-for-virtual-reality.aspx> [Accessed 2 Oct. 2018].
2. INDVSTRVS. (2018). *Virtual Reality Set for Exponential Growth by 2020*. [online] Available at: <https://indvstrvs.com/virtual-reality-set-for-exponential-growth-by-2020/> [Accessed 2 Oct. 2018].
3. Shah, N. (n.d.). *16 Experts Predict the Future of Virtual Reality*. [online] Arkenea. Available at: <https://arkenea.com/blog/virtual-reality-expert-roundup/> [Accessed 4 Oct. 2018].
4. Brooke, S. (2018). *How Will VR Change Marketing and Advertising?*. [online] Virtual Reality Pop. Available at: <https://virtualrealitypop.com/how-will-vr-change-marketing-and-advertising-1ebb4c91ede1> [Accessed 7 Oct. 2018].
5. Lynch, M. (2018). *What is the Future of Virtual Reality?*. [online] The Tech Edvocate. Available at: <https://www.thetechedvocate.org/what-is-the-future-of-virtual-reality/> [Accessed 12 Oct. 2018].
6. Frausto, A. (2018). *Infographic—The Future of VR (virtual reality) by 2025 | Architosh*. [online] Architosh.com. Available at: <https://architosh.com/2018/06/infographic-the-future-of-vr-virtual-reality-by-2025/> [Accessed 14 Oct. 2018].
7. Brown, R. (2018). *How will VR and AR impact our lives in the future?*. [online] IT Pro Portal. Available at: <https://www.itproportal.com/features/how-will-vr-and-ar-impact-our-lives-in-the-future/> [Accessed 17 Oct. 2018].
8. Gill, B. (2016). *7 things to know about designing for virtual and augmented reality*. [online] Invisionapp.com. Available at: <https://www.invisionapp.com/inside-design/designing-for-vr-ar/> [Accessed 17 Oct. 2018].
9. The Franklin Institute. (2018). *History of Virtual Reality*. [online] Available at: <https://www.fi.edu/virtual-reality/history-of-virtual-reality> [Accessed 21 Oct. 2018].
10. Chevalier, E. (2018). *Experts Predict the Future of Virtual Reality - VRScout*. [online] VRScout. Available at: <https://vrscout.com/news/2020-vision-experts-predict-the-future-of-virtual-reality/> [Accessed 22 Oct. 2018].
11. BT.com. (2018). *7 ways virtual reality will change the world*. [online] Available at: <http://home.bt.com/tech-gadgets/future-tech/7-ways-virtual-reality-will-change-the-world-11363913841925> [Accessed 24 Oct. 2018].
12. Virtual Reality Society. (n.d.). *What is Virtual Reality?*. [online] Available at: <https://www.vrs.org.uk/virtual-reality/what-is-virtual-reality.html> [Accessed 27 Oct. 2018].
13. C, J. (2015). *A brief history of virtual reality*. [online] lowdown.carphonewarehouse.com. Available at: <https://lowdown.carphonewarehouse.com/detail.aspx?channel=smart-tech&articleid=29235> [Accessed 1 Nov. 2018].
14. Reuters.com. (2017). *Global Virtual Reality Market Forecast 2020 by Major Players such as Sony, Microsoft, Facebook, HTC, Google, Samsung Electronics, GoPro, etc - Reuters*. [online] Available at: <https://www.reuters.com/brandfeatures/venture-capital/article?id=4975> [Accessed 1 Nov. 2018].

15. Bharadwaj, H. (2017). *New Realities: VR, AR, MR, and the Future of Design*. [online] Toptal Design Blog. Available at: <https://www.toptal.com/designers/product-design/vr-ar-mr-the-future-of-design> [Accessed 29 Nov. 2018].
16. Knight, C. (2018). *A Brief History of VR Games ~ Digital Dream Age: Virtual Reality*. [online] Digital Dream Age. Available at: http://www.digitaldreamage.com/virtual-reality/vr-games/brief-history-of-vr-games/?gclid=EAIaIQobChMIj-v2ndeP3QIVzRXTCh03jgu2EAAYASAAEgIQSfD_BwE [Accessed 2 Dec. 2018].
17. Artworkabode.com. (2017). *The Essential Quality Graphic Designers Bring to the Virtual Reality Table*. [online] Available at: <https://www.artworkabode.com/blog/role-of-graphics-designers-in-vr/> [Accessed 3 Dec. 2018].
18. Holger, D. (2017). *This Is the First 360 App to Combine Graphic Design and VR*. [online] VRScout. Available at: <https://vrscout.com/news/360-app-vr-graphic-design/> [Accessed 4 Dec. 2018].
19. Fast Company. (2016). *Why Virtual Reality Will Change Design Forever*. [online] Available at: <https://www.fastcompany.com/3058756/why-virtual-reality-will-change-design-forever> [Accessed 7 Dec. 2018].
20. Slenske, M. (2018). *Will Virtual Reality Change the Design World? | Architectural Digest*. [online] Architectural Digest. Available at: <https://www.architecturaldigest.com/story/virtual-reality-augmented-reality-apps-oculus-vr-design-world> [Accessed 18 Dec. 2018].