Will Augmented Reality change the future of Interior Design?

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Abstract

Simulated reality, such as virtual reality (VR) and augmented reality (AR), is particularly helpful for people such as clients or prospective occupants, as it allows them to firsthand experience an unbuilt interior space to provide design input without the requirement of spatial expertise. However, as the experience of space depends on the holistic interplay of a wide variety of atmospheric aspects that cannot be easily simulated, it is still unclear how simulated reality influences people when making design decisions. Technology has changed the face of interior design, as more people build smart homes, become sustainable, and adopt the latest trends, Designers are becoming more aware of how they may use resources and techniques to support these efficient living environments and the use of augmented and virtual reality. AR is revolutionizing many industries around the world. One of the issues with interior design without these new technologies is that clients cannot visualize how new furniture or spaces will look in their homes until a lot further along in the construction process. But this is not the case anymore with Augmented reality becoming more mainstream, as it allows Interior Design to become more advanced and have greater visual fidelity. This essay will analyse several AR and VR applications face-to-face interior design industry by looking into methodology, case studies, and research into businesses that use AR such as Ikea, and highlight its pros and cons. Based on the analysis, this dissertation will show how AR and VR will affect the future of Interior Design through the way they will communicate with clients, save on construction costs, be more time saving and overall change the design process of Interior Design not only for face to face designers but also for remote designers over the nation.

Keywords: Augmented Reality (AR), Interior Design, Virtual Reality (VR), Simulated Reality

Introduction

Home Furnishing with new furniture in a space is often a challenging task due to several pitfalls between a selection of furniture from commercial shops and its composition in a target room. Unfortunately, in big cities such as Hong Kong, the population is increasing, and apartments are becoming smaller in size and utilizing the space as efficiently as they can be with storage solutions and certain furniture.[1] Consequently, it may be difficult to pick a piece of furniture that fits the dimensions of the available space. One of the pitfalls of home furnishings is the lack of imagination regarding the target room and other furniture when an item is seen in a shop. Selecting multiple furniture items may look good in the shop but it isn't until they are added into a space you can visualize how the space and furnishing flow together. Another problem with home furnishing is that the selected furniture has the correct dimensions for the target room. Additionally, once furniture is purchased, a homeowner or interior designer may want to try multiple special configurations in the target room which is physically demanding and time-consuming. These issues can be addressed using augmented reality (AR) technology. AR allows the visualization of the desired furniture directly at home with the correct dimensions. Consequently, AR supports imagination and aids size measurements in real space. A remaining issue in home furnishing with AR technology is the lack of advice concerning furniture composition and its special configuration. In a consummate case, the user's space may be empty, yet the complexity can be significantly increased if the space has already got furniture pre-existent and must stay.[2]

Professional Interior Design for home furnishing is costly and time-consuming. Due to this complication, numerous homes are designed by the homeowners themselves without the help and guidance from professional interior designers. Various companies have designed AR systems that can provide users with automatically generated interior design configurations tailored to their personal preferences. Many systems use AR visualization to enable the try-out of new furniture directly into the target room. Users can then manually tweak the furniture positions. In recent years, virtuality techniques have been applied in interior design applications. IKEA, a furniture enterprise, developed an app for customers to decorate a virtual room with 3D virtual furniture that is available for purchase. These apps are useful; however, users still never know whether the designed outcome is correct for their environment. To further research the virtual world and real-life environment, AR technology enables us to overlay virtual furniture into real space. But is this effective enough? Will AR and VR technologies affect the future of interior design for the better or worse? This essay will explore these questions.[3]

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[1] *ieeexplore.ieee.org. (n.d.). AR interior designer: Automatic furniture arrangement using spatial and functional relationships | IEEE Conference Publication | IEEE Xplore. [online] Available at: https://ieeexplore.ieee.org/document/7136652.*

[2] *Kán, P., Kurtic, A., Radwan, M. and Rodríguez, J.M.L. (2021). Automatic Interior Design in Augmented Reality Based on Hierarchical Tree of Procedural Rules. Electronics, 10(3), p.245. doi:https://doi.org/10.3390/electronics10030245.*

[3] *ieeexplore.ieee.org. (n.d.). AR interior designer: Automatic furniture arrangement using spatial and functional relationships | IEEE Conference Publication | IEEE Xplore. [online] Available at: https://ieeexplore.ieee.org/document/7136652.*

Figure 1:Anon, (n.d.). Immersive Interiors: Impacts of Virtual and Augmented Reality on the Design Industry – Design Dash. [online] Available at: https://designdash.com/2023/09/24/immersive-interiors-impacts-of-virtual-and-augmented-reality-on-the-design-industry/.

Main Text

Augmented Reality (AR) allows virtual objects to be combined with real-world representations. The three key characteristics of AR have been identified to be: 1; combining real and virtual images 2; the virtual imagery is registered with the real world, and 3; real-time interaction of both virtual and real objects.[4] Augmented Reality in interior design makes it possible for the other side of the story. The primary value of Augmented reality is the way components of the digital world blend into a person's perception of the real world, not as a simple display of data, but through the integration of immersive sensations, which are perceived as natural parts of an environment. Today we live in a period in which the interest in these technologies and their uses are on the rise, and this is because of the large adoption of smartphones.[5] The first product that made AR popular all over the world was the smartphone game Pokémon Go, which uses a phone camera during the game to add different characters to the surrounding environments. The compelling part of Pokémon Go is that the games use both GPS and a camera so that players must move in the real world to reach meeting points to interact with the game. The problem with this type of application is that the placement of objects in the virtual world is not good. However, as interest in AR rose, big tech companies started to invest more in these technologies and created libraries with which developers could create applications. One area on which augmented reality could have a huge impact is interior design. Everyday life is full of choices that designers must make regarding living space; from the colour of walls, and materials, to what furniture to place in spaces. This makes mistakes possible because of the incorrect measurement of space. Another problem previously in design is not being able to see the new space designed until it is constructed and built, but AR applications provide a lot of potential for these problems to be solved.[6]

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[4] *Botden, S.M.B.I., Buzink, S.N., Schijven, M.P. and Jakimowicz, J.J. (2007). Augmented versus Virtual Reality Laparoscopic Simulation: What Is the Difference? World Journal of Surgery, 31(4), pp.764–772. doi:https://doi.org/10.1007/s00268-006-0724-y.*

[5] *apps.dtic.mil. (n.d.). The Use of Virtual Fixtures as Perceptual Overlays to Enhance Operator Performance in Remote Environments. [online] Available at: https://apps.dtic.mil/sti/citations/ADA292450 [Accessed 18 Dec. 2023].*

[6] *niantic.helpshift.com. (n.d.). Catching Pokémon in AR+ mode — Pokémon GO Help Center. [online] Available at: https://niantic.helpshift.com/hc/en/6-pokemon-go/faq/28-catching-pokemon-in-ar-mode [Accessed 18 Dec. 2023].*

Figure 2:Nextgov.com. (n.d.). Pokémon Go Wants to Make 3D Scans of the Whole World for 'Planet-Scale Augmented Reality Experiences.' Is that Good? [online] Available at: https://www.nextgov.com/emerging-tech/2020/06/pokemon-go-wants-make-3d-scans-whole-world-planet-scale-augmented-reality-experiences-good/166232/.

Related Work

Virtual Reality (VR) has been Widley used in 3D modelling. Technical virtual reality (VR) display solutions were first proposed in the late 1950s. For instance, a young cinematographer named Mort Heiling invented the sensorama simulator, which was a one-person demo unit that combined 3D movies, stereo sound, mechanical vibrations, fan-blown air, and aromas. [7](Oliver Bimber and Ramesh Raskar, P. 3) But going forward to today, VR technologies have been extensively developed and are now much faster and more efficient for industries such as interior design. IKEA has developed a 3D kitchen planner that provides a VR interface for users to design a space through the Internet. Customers are invited to a playful interior app where they can be inspired and visualize their own personal solutions. The application brings IKEA to life with the virtual home experience through its interactive showrooms that use the immersive power of VR for a new approach to product exploration, which revolutionizes how customers engage in interior decoration. This can be found through simple interactions, as visitors can configure furniture items and room features by photo realistic 3D renderings and a high-definition audible sound to ensure a captivating 360-degree experience. Customers can combine different fabrics, swap the wall colour and change the time of day. This virtual home experience not only positions IKEA as an inspiring and innovative company, but it also sets the customers free to think beyond their visual means and help the creativity of interior design Bonardi et al, proposed an iPad application that allows users to arrange furniture in a virtual room space.[8] These applications provide a virtual environment that does not require real-world information. By contrast, Augmented Reality (AR) is more powerful because it displays overlaid information, such as virtual objects, onto a real space. In 2017, IKEA also introduced IKEA Place, (an augmented reality application for iPhone users. This has enabled millions of users to have AR capabilities. Because of this, IKEA Place quickly became one of the most popular apps, with nearly 8.5 million downloads. The idea is that customers can take a picture of their rooms in a house and virtually place IKEA furniture in the space to see how it fits into the room. The way that this use of AR works is by people can start by selecting a piece of furniture from IKEA in the provided catalogue, users are then asked to place the chosen furniture on the floor, which acts as an anchor where the 3D version of the furniture is projected. The use of AR has had a positive impact on the growth of IKEA, as it helps increase user engagement rates by providing features that grant consumers the ability to accurately measure room dimensions (with a report of 98% accuracy) and visualizing how light and shadows impact the exact textures of furniture that cannot be done as quickly as other technology applications. AR does not just help with the visual side of designing, but also with companies and customers' time and money. IKEA Place has helped several furniture companies lower their return rate by 30% because AR allows furniture to be easily visualized and virtually placement tested without customers trying them out in the flesh. Most AR furniture arrangements and home design tools are marker-based. (Oliver Bimber & Ramesh Raskar P. 4) Virtual and Augmented reality are also being widely used by other sectors, which shows how well these applications are going to improve interior design. People are using VR in medicine, which has helped reduce the effects of Parkinson's disease in patients by applying a treatment that uses VR. The UK Ministry of Defence also uses Virtual Reality for training in simulated combat environments. The reason that Industries like interior design, as well as these a treatment that uses VR. The UK Ministry of Defence also uses Virtual Reality for training in simulated combat environments. The reason that Industries like interior design, as well as these important jobs such as doctors and the military are using VR is because it is virtual and without risking your life in some scenarios, as organisations can recreate, test, and simulate real world activities without risking themselves and time. These examples show how much the use of VR and AR is impacting our lives; however, studies have shown that these technologies can cause side effects such as blurred vision,

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[7] *Scribd. (n.d.). SAR | PDF. [online] Available at: https://www.scribd.com/document/55149980/SAR [Accessed 10 Jan. 2024].*

[8] *] ieeexplore.ieee.org. (n.d.). Design and evaluation of a graphical iPad application for arranging adaptive furniture | IEEE Conference Publication | IEEE Xplore. [online] Available at: https://ieeexplore.ieee.org/abstract/document/6343768 [Accessed 18 Dec. 2023].*

nausea, headaches, and queasiness. [9]These problems are being tested and imp headset but virtual reality headsets will hopefully bet at their best by 2033, which we can see is already happening as Apple is releasing an Apple Vision Pro wearable cordless headset device that offers a mixed reality experience that will let you use the headset as a normal VR headset, but can also be used in everyday life with its clever technology that will still show the existing environment around us.

[9] *] Souchet, A. (2023). Virtual reality has negative side effects – new research shows that can be a problem in the workplace. [online] The Conversation. Available at: https://theconversation.com/virtual-reality-has-negative-side-effects-new-research-shows-that-can-be-a-problem-in-the-workplace-210532#:~:text=Some%20negative%20symptoms%20of%20VR.*

Figure 3:IKEA (2017). Launch of New IKEA Place App – IKEA Global. [online] IKEA. Available at: https://www.ikea.com/global/en/newsroom/innovation/ikea-launches-ikea-place-a-new-app-that-allows-people-to-virtually-place-furniture-in-their-home-170912/.

Methodology

Experiencing Simulated Realities Compared to 2D drawings and desktop renders, VR provides a better spatial perception of unbuilt designs in terms of distances, lighting, materials, and colours. To determine whether VR and AR will impact the future of interior design, it is important to know if designers prefer to produce their work with the help of VR and AR or from the skills of drawn reality and physical reality.

	P1	P2	P3	P4	P5	P6	P7	P8	Total
Drawing Reality	5	5	5	5	3	5	5	1	34
Tabletop AR	3	4	4	3	4	4	4	4	30
Mobile AR	4	2	3	2	2	3	3	5	24
VR	2	3	2	4	1	1	1	2	16
Physical Reality	1	1	1	1	5	2	2	3	16

Table 1 shows the ranking of the five different simulated realities according to each participant, with 1 as the most preferred, and 5 the least preferred. (Binh Vinh Duc Nguyen1, Stijn Demolder2, Andrew Vande Moere3)

(Binh Vinh Duc Nguyen1, Stijn Demolder2, Andrew Vande Moere3) As shown in Table 1, physical reality and VR are the most preferred options when designing a space. Physical reality did not win over VR. The participants found that manually moving furniture required much more effort. VR was the most efficient for layouts, as it requires little manual effort, while also providing a sense of being close to a cardboard google viewer where they place their phone inside like the expensive VR headsets and receive a 3D tour with ease, sustainability and costly efficient.[10]

Decorilla is a great example of how the use of VR can impact interior design efficiently, as not only can it be used in companies such as IKEA face to face, but it can also open up opportunities for online interior designers from all over the world. Designers, such as Decorilla, use VR and AR to minimize human error. Precise planning is paramount in interior design and architecture, and designers can employ AR apps to accurately measure spaces, visualize different layouts, and arrange virtual objects with precision. Homeowners and clients can also actively engage in the planning process by moving virtual objects around and experimenting with different layouts in real-time. These interactive approaches foster a sense of co-creation and empower clients to make informed choices about their living spaces. AR allows clients to "move" around each layout, which ensures that the flow reflects the ways in which clients navigate and enjoy their spaces. Augmented and virtual reality also allow designers to expand their client base internationally. As AR allows designers and their work to transcend geographical barriers, it enables remote collaboration between design teams, partners, and clients. Designers can then share 3D models and designers through AR platforms- which allows stakeholders to review and discuss projects from different locations. This is extremely valuable when working on projects for designers when teams or clients cannot visit the site physically. AR streamlines the design process, reduces travel costs, and accelerates decision-making, making designing more feasible for international collaborations and clients worldwide. [11]

[10] *www.decorilla.com. (n.d.). Online Interior Design Services and Decorating Help | Decorilla. [online] Available at: https://www.decorilla.com/.*

[11] *Anon, (n.d.). Immersive Interiors: Impacts of Virtual and Augmented Reality on the Design Industry – Design Dash. [online] Available at: https://designdash.com/2023/09/24/immersive-interiors-impacts-of-virtual-and-augmented-reality-on-the-design-industry/.*

Augmented Reality apps are also extremely useful not only for interior designers, architects, and homeowners but also for students who are starting their design careers. As an interior design student, I remember starting my first term and struggling to visualize the space and dimensions of furniture. There were many AR devices available for professional work, but I remember stumbling across some great free apps that let me trial my ideas, such as Planner 5D. Planner 5D is an advanced and easy to use 2D/3D house design tool. It helped me correctly arrange all the elements I needed to design my space and add different textures, furniture and designs all in one programme that could be used on laptops or tablets. Apps such as Planner 5D are a great starting point for design students; however, they only had a limited number of options, such as furniture and décor items, which made it difficult to design in preferred styles. Designers and students also use virtual reality apps and software to visualize interior designs in three-dimensional environments, as they alter floorplans and furniture arrangements. VR applications are often only geared towards professionals rather than consumers, who are later shown once the visuals are complete. Some examples of VR applications are Sketchup viewer VR, Matterport VR, Planner 5D VR mode, and Enscape plugin for Revit, rhino, and SketchUp. I personally have trialled a handful of these VR Plugins and Enscape must be a preferred physical reality. However, an issue with the use of VR is that the participants sometimes feel dizzy after using the headset.[12] There are three main types of Virtual reality systems: video mapping, immersive, and desktop. These technologies are based on immersing into reality artificially, not naturally, and because of the artificiality of VR, this could be why some of the participants in the findings above felt some negativity. There are many advantages of using Virtual Reality headsets: they can be used in various fields of work, provide detailed views and users can have great experiences, and connect with people with effective communication. However, VR has several disadvantages. Virtual reality headsets, such as Oculus VR headsets, are very expensive compared to other simulated realities, such as drawing reality that costs next to nothing. VR can also be bad, as users, such as gaming, can become addicted to the virtual world and provide a feeling of worthlessness in the real world. Decorilla is one of many companies that uses Virtual reality to communicate in style with its clients. The company has a hand selected team of professional interior designers. Clients can obtain multiple design proposals 80% less than other traditional interior designers. The way Decorilla works is that customers fill out some questions, such as their room dimensions along with some photos of the space, along with the budget they are on. Decorilla designers then provide a range of concept previews to which customers can choose their preferred design. The chosen designer will then progress on the concept and help clients source the best deals for décor items, select paint colour palettes, position the furniture in the space with a professional floorplan, and finally provide a detailed 3D visualization of their space using VR technology. As Decorilla is an online company, customers can view their 3D visualization from being sent.

application for many reasons. Enscape allows you to see your rendered views from your modelling software in its own rendering window, which means there is no need to export or import files, which provides designers with a much more efficient and less time-consuming design and visualization process. Designers are no longer able to communicate their own ideas. The first and most important thing that any design industry must understand is that their clients do not think like designers do. Clients need guidance and, most importantly, be blown away with their work. This is where rendering software, such as VRay, comes in. VRay is a plugin similar to Enscape, where it is used with Rhino, 3DS Max, and SketchUp for 3D models. VRay is consistently faster than other rendering software, which means that designers can receive quicker rendering times, animations, and drafts. This rendering software also provides users with an extensive material library and resources that can help to represent the final touches on the designed spaces. The best part of VRay is that although it is a Virtual reality software, it is not designed in a real environment. The visualization looks so real with its real-world material

[12] *Nguyen, B.P., Stijn Demolder and Andrew Vande Moere (2022). How Lay People Design Interior Architecture Layouts in Virtual, Augmented, Drawn and Physical Reality. doi:https://doi.org/10.52842/conf.ecaade.2022.1.411.*

rendering, which also has light and shadow, which gives it an immersive feel that will help clients be blown away by the designer's work. These software programs are only going to improve as architectural rendering has been growing during the COVID-19 pandemic. One huge benefit of technology software for rendering is that you do not need to meet face-to-face, and this was a huge benefit for designers in COVID-19 as clients did not have to meet with their designers and could just do it over zoom. This meant that the design industry was not significantly affected by COVID-19, as they could discuss their projects and progress to their clients without any risks. [13]

[13] *www.easyrender.com. (n.d.). Why Architectural Rendering Is Growing During COVID-19. [online] Available at: https://www.easyrender.com/a/why-architectural-rendering-is-growing-during-covid-19 [Accessed 18 Dec. 2023].*

Figure 4:2G STUDIO CGI Creative Agency and Award Winning Architectural Visualization Studio from Bali Indonesia. (n.d.). V-Ray, Lumion, Enscape: Which is the Best Paired with SketchUp for Architectural Rendering? [online] Available at: https://www.2gs.co/blog-section/v-ray-lumion-enscape-which-is-the-best-paired-with-sketchup-for-architectural-rendering [Accessed 6 Jan. 2024].

Conclusions

The Market for Augmented reality applications has evolved significantly in recent years, and many companies have started offering services that could not have been imagined ten years ago. Interior design is going to be a huge area where AR and VR are going to make an impact in a good way by making the design as a whole and visualizing a lot more efficiently for the user and clients. The Augmented and virtual reality markets will see 48.8% growth between 2020 and 2025, which will reach 161.1 billion in revenue by 2025. These statistics show the increasing acceptance of AR and VR as well as the responsiveness of technology from the world. I personally think that the development of VR and AR will change the future of technology and is only going to improve. There has been an increase in the number of headset manufacturers, such as Google, HTC, and Oculus, and they are developing to great accounts. Users can continue to download the content on their smartphones/tablets so that anyone with these devices can easily use these applications.[14] Coming back to this question, will augmented reality change the future of interior design? I think yes! As a user designing for a client, trying to portray your designs to clients can be tricky, as sometimes visualizing your thoughts can be difficult, which can be costly and time effective if it goes wrong. However, the development of VR and AR applications in interior design will result in users creating their renders/visuals whether they may be placed in a real or non-real environment, allowing interior design to be much more immersive and come to perspective. This won't only benefit the user, but the client can easily pick things out and change at an early stage which also helps with the construction.[15] As an interior design student, myself, and a future career in interior design, I think these applications will help me so much as a beginner in the industry. Since starting university, I thought interior design was a lot of hand-drawn sketches for visualization, which I was wrong about. I have learned that interior design is changing from what used to be lots of pencil drawings to now everything technological. When making my 3D models, renders and visuals I have picked up a few AR/VR applications, such as the use of the enscape plugin that I am going to take with me in the future, but I am excited to see how many more AR and VR applications will be used in interior design. Virtual reality is becoming more popular in sectors such as culture/art, military, medicine, media, entertainment, and architecture, which to me shows that one day the use of VR is going to be used everywhere like it is a whole new world. I think it will become the 'new glasses, ' as I think many people will always be wearing them when they are working, eating, watching a film, or gaming. I Think that the use of VR is beneficial for architecture/interior design and other industries; however, I feel that technology is going to become too familiar and could take over the natural world/environment. Technology is the future and will only get better, but I think we all need to remember that it is a fake world and try not to get stuck in this fake world when we have a beautiful real world that we have had around us for over five million years. In other applications, augmented reality is also changing the face of interior design as not only the designers use it but also anyone, such as homeowners who want to do some renovations/DIY themselves, can use easy enough for anyone to pick up and design their spaces by themselves and that the creative design side of interior design could be lost. Overall, I think that Augmented Design will help change the future of interior design for the better, but it is also risking that man made creative touch being lost.AR applications such as IKEA Place. This is going to help the manufacturers a lot more as the return rate will become much less and will help increase their sales if people can try out their furniture in their spaces before purchasing. However, as a whole, with the use of Augmented and Virtual reality, I think there is a risk that the technology could take over the designers, as I think one day it will be

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[14] *Software Testing Help (2022). Future of Virtual Reality - Market Trends And Challenges. [online] www.softwaretestinghelp.com. Available at: https://www.softwaretestinghelp.com/future-of-virtual-reality/.*

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[13]www.easyrender.com. (n.d.). Why Architectural Rendering Is Growing During COVID-19. [online] Available at: https://www.easyrender.com/a/why-architectural-rendering-is-growing-during-covid-19 [Accessed 18 Dec. 2023].

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[15] Software Testing Help. (n.d.). Future of Virtual Reality - Market Trends And Challenges. [online] Available at: https://www.softwaretestinghelp.com/future-of-virtual-reality/#:~:text=According%20to%20a%20report%20by%20Vnyz%20Research%2C%20the%20AR%20and.