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Virtual Reality and Interior Design

The opportunity and perceived value of virtual worlds for interior designers.

A research project submitted in fulfilment of the requirements for **Honours in Interior Design** at the Independent Institute of Education: Vega School Pretoria.

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Abstract

Virtual worlds have become increasingly relevant these days, with more and more people joining in platforms such as the Metaverse, a demand for more virtual world designers can be predicted to grow. The aim of this research proposal is to outline the potential opportunities for interior designers within virtual worlds, such as the metaverse. The research starts out by understanding virtual reality and the evolution of virtual worlds, and how this could potentially apply to the field of interior design. A gap has been identified as the basis for this research study. This gap can possibly create opportunities for interior designers to design 3D virtual buildings and spaces, by using computer software and improving digital technology, designers can create real simulated buildings. Understanding this phenomenon, a comprehensive analysis into design thinking and user experience was further explored.

Using applied design thinking theory as an iterative process with the outcome to seek to understand the users, challenge assumptions, redefine problems and create innovative solutions, interior designers can prototype and test solutions. By applying UX design principles as well as interaction design principles interior designers can implement a good user experience for users. The purpose of this research was to qualitatively explore the use of VR technology, understanding user experiences within virtual worlds, and how VR can be applied to interior design. The qualitative data was analysed by means of an inductive approach. The research study moves from specifics to generals and applies the findings to more abstract and broad theoretical constructs. Upon analysing the data gathered, the researcher became aware that there is indeed a perceived value for interior designers within virtual worlds.

The perceived value was identified by means of sorting through the three groups, and the participants' answers were categorised into two themes. Through interpretation of the collected data, patterns emerged from participants acknowledging that there are opportunities available for interior designers within virtual worlds but user experiences are still limited in context of the identified phenomena. These patterns have been divided into two themes; (1) Virtual reality offers unique opportunities for interior designers and (2) User experiences within virtual worlds are still limited. As a qualitative researcher, numbers were not used as evidence, instead rather different criteria were used to determine the trustworthiness, or credibility of this research study. The aim of the qualitative research was to promote the understanding of the phenomenon of VR and interior design as well as a guide or starting point for future researchers looking into something similar.

Declaration

I, **Brenda Bianca Keevy** hereby declare that this dissertation submitted for Honours in Interior design to The Independent Institute of Education (The IIE) is my own work and has not previously been submitted to another University or Higher Education Institution for a postgraduate qualification.

Signature Date

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Chapter 1

Interior Design in the Metaverse

Virtual Reality and Interior Design: The opportunity and perceived value of virtual worlds for interior designers

Introduction

Virtual worlds have become increasingly relevant these days, with more and more people joining in platforms such as the Metaverse, a demand for more virtual world designers can be predicted to grow. These huge waves of improving technology will not only affect our everyday technological lives, but in our artistic and creative lives as well. One of the biggest challenges within interior design industries is showing clients what the finished results will look like. Interior designers have existing strategies for this, and these include the use of computer generated software that enables designers to create three-dimensional (3D) digital buildings. 3D data offers realistic access rather than more traditional two-dimensional (2D) perspective images often referred to as realistic renders.

This is where virtual reality becomes relevant, by using computer software and ever improving digital technologies designers can create ‘real’ simulated buildings, build entire cities, create communal spaces, the possibilities seem rather endless. Interior Design stands out as an essential element within the metaverse and other virtual worlds. Because virtual reality is such a universal technology, it can be applied into almost any industry. Interior designers can predict many perceived opportunities within the virtual worlds. The improvement of technology makes this possible. Combining interior design to the world of virtuality with a Design Thinking Approach (DT) will help in identifying the needs and wants of users, possibly creating opportunities for interior designers in the metaverse.

The Metaverse represents the virtual environment in which virtual worlds can exist, such as Decentraland, Sandbox, and Hyperverse (the following links have been attached for the reader to potentially explore virtual worlds; https://decentraland.org/, https://www.sandbox.game/en/ and https://thehyperverse.net/). Virtual platforms such as the metaverse can possibly create opportunities for interior designers to design virtual buildings and spaces. A challenge interior designers are predicted to face is what the potential users overall experience will be like as well as identifying the users needs and

wants. Virtual Reality (VR) is becoming more a part of people's daily lives, and this will become even more so in the future years to come. User Experience (UX) design focuses on the user’s experience of a specific platform, for example within the metaverse. This can include accessibility, usability, enjoyment, and the overall flow of the experience. UX design focuses on both on how users use digital tools and on how users inhabit digital spaces. UX Design Theory educates us as designers in how to set up effective systems for users.

Contextualisation

The aim of this research proposal was to outline the potential opportunities for interior designers within virtual worlds, such as the metaverse. The research started out by understanding virtual reality and the evolution of virtual worlds, and how this could potentially apply to the field of interior design. VR has become more relevant in today's world and provides a good user experience within virtual environments. Using applied design thinking theory as an iterative process with the outcome to seek to understand the users, challenge assumptions, redefine problems and create innovative solutions, interior designers can prototype and test solutions. By applying UX design principles as well as interaction design principles interior designers can implement a good user experience for users.

Rationale

A gap was identified as the basis for this research study. Interior design within virtual reality has rarely been explored in depth with previous published literature. For this research study a deep dive into the evolutions of virtual worlds and how virtual reality could affect interior designers was done. VR has an incredible ability to simulate real world environments as well as exploring fictional environments. Because VR is such a universal technology, it can be applied to almost any industry. Interior designers can predict many perceived values and opportunities within the virtual worlds. The improvement of technology makes this possible. Thus, VR can be used to improve processes across many industries. However, it is important to note that VR cannot simply replace reality, but rather be used as a tool within daily human experiences and functions. This research study aimed to gain more insight within virtual reality and interior design, the study acts as a guide or starting point for future researchers looking into something similar.

Problem Statement

Interior design stands out as an essential element within the Metaverse and other virtual worlds, yet this opportunity and perceived value for interior designers is not realised. This potential gap was identified within virtual worlds such as the Metaverse. This gap can possibly create opportunities for interior designers to design 3D virtual buildings and spaces, by using computer software and improving digital technology, designers can create real simulated buildings. Understanding this phenomenon, a comprehensive analysis into design thinking and user experience was further explored.

Purpose Statement

The purpose of this research was to qualitatively explore the use of VR technology, understanding user experiences within virtual worlds, and how VR can be applied to interior design. It is argued that new three dimensional modelling technology and VR technology may have the potential to offer many advantages and opportunities for digital interior design industries.

Research Questions

The questions for this study were as follows:

1. What is the opportunity and perceived value that virtual worlds may have for interior designers?
2. Can the presence of interior designers within virtual worlds improve the quality and experience for users?

Research Objectives

The objectives for this study were as follows:

- Gain a better understanding of the types of VR and 3D visualisation technologies that are available in virtual worlds.
- Explore how interior designers can use the technologies present in virtual worlds to create better design experiences for users and clients.

Chapter 2

Theoretical Foundation

Design Thinking Theory

Design thinking is used as a systematic approach for innovation that aims to identify customer dis-satisfactions and develop new innovative solutions through iteration (Torabi, 2020). It is safe to say design thinking is a problem solving approach. Design thinking is also considered a powerful approach in helping people envision new opportunities and become more comfortable with uncertainty. Design thinking is a human-centric methodology that requires a multidisciplinary team and can be applied by regular, ‘non-creative’ individuals. Brown identifies Design Thinking as an iterative process in which the outcome is to seek to understand your users, challenge assumptions, redefine problems and create innovative solutions that can be prototyped and tested. Design projects ultimately pass through three spaces,Inspiration, Ideation and Implementation (Brown, 2008:9).

Brown (2008:5) highlights three main spaces in the Design Thinking process:

1. **Inspiration:** In this step one should try to expect success, as well as develop implementation resources into the plan. Here one should ask questions such as; what’s the business problem? Where are opportunities available? What has changed or may soon change? Are valuable ideas, as-sets, and expertise hiding inside the business? How can new technology help? One should look at the world, observe what people do, how they think, what they need and want. Involve many disciplines from the start (for example interior design & marketing). Organise the information and synthesise the possibilities.

2. **Ideation:** After organising the information, the second step introduces brainstorming by method of sketches or put together scenarios. From this the order is found in the chaos and a creative framework is built by applying integrative thinking. Integrative thinking involves taking different ideas and examining the problem that needs to be solved, with the end goal of opening up to new thinking and innovations. Brown highlights the extreme importance of prototyping and testing during this step.

3. **Implementation:** After sufficient and successful prototyping and testing, executing the vision is the last step. Here marketing can take place and help

design a communication strategy as well as spreading the word. Now one can move onto the next project and repeat.

Brown's design thinking approach involves experimentation with the use of prototypes, sketches and testing new ideas, and the want to understand the users at the end result who will use the designs, it also helps develop empathy, enhances the ability to question more in order to understand more. "Design Thinking has been proven to be extremely useful to get to grips with the unknown or ill-defined" (Dam and Siang, 2021). Brown (2008:5) highlights three main spaces in the Design Thinking process.

Applying Brown's Design Thinking theory to interior design within virtual worlds can help unpack the problems at hand as well as provide possible solutions. In the 'Inspiration' space the research question asks if there are possible opportunities for interior design within the metaverse as well as what changes to expect in the future? How can new technology help make these opportunities realistic? Is there a demand for interior designers within virtual worlds? Observing the current literature there is evidence that virtual worlds need virtually designed spaces because there is a growing demand in users as well as the demand for users to personalise and customise their virtual environments. Within the 'ideation' space the end goal is opening up to new thinking and innovations, (Brown, 2008) Brown highlights the extreme importance of prototyping and testing. Interior designers can develop prototypes of virtual homes and test the users satisfaction. After sufficient and successful prototyping and testing, executing the vision is the last step, interior designers can fully build and upload the designed virtual home where users can access their home virtually within the metaverse. Here marketing can take place and help designers with a communication strategy to promote their skills.

Examples of virtual worlds within the metaverse include; Decentraland, Sandbox, Hyperverse and many more. Virtual worlds are simultaneously an environment for connection, community as well as transactions. Design Thinking Theory highlights that as researchers we should look at the world, observe what people do, how they think as well as to identify what they need and want. Using the Design Thinking Theory is beneficial because virtual worlds are still a relatively new concept to the majority of people but interior design is a well known industry.

User Experience Design Theory

In 1995 Donald Norman was the first person to give UX design a name, at this stage UX was already existing, but just had not been named yet. Norman is a cognitive scientist, and joined a team at Apple in the early 90s as their User Experience Architect, this was

the first ever person with the job title of UX. In Norman's book The Psychology of Everyday Things, he says that he invented the term because he thought that human interface and usability were too narrow and that he wanted to cover all the aspects of a person's experience with a specific system. These aspects include the industrial design, graphics, the interface, the physical interaction and the manual (Norman, 1988).

User experience (UX) design focuses on the user's experience of a specific platform, for example within the metaverse. This can include the accessibility, usability, enjoyment, and the overall flow of the experience (Dauchot, 2018). UX design focuses on both how designers use digital tools and how users can inhabit digital spaces. UX Design Theory can educate us as interior designers on how to 'build a community, communicate clearly, and set up effective systems as we design' (Spencer, 2019: n.p). UX is constantly evolving and improving as users change over time, with technological advancements UX design can and needs to adapt to the needs of the users From artificial intelligence to virtual reality to design without interface, UX designers face new challenges everyday (Stevens, 2021).

UX design highlights the need for a platform to have good usability. Usability is a qualitative aspect that evaluates how easy a user interface is to use (Nielsen, 2012). The word 'usability' also refers to methods for improving ease-of-use during the design process. Defining good usability can be difficult to define, but Jakob Nielsen (2012) seminal work on user experience, he proposed 'ten usability heuristics for digital interface design' (Dauchot, 2018). The below mentioned can act as guidelines for interior designers, and can be used to create better experiences for users on a virtual platform.

According to Nielsen (2012), good usability stems from the following:

- Visibility of system status
- Similarities between the system and the real world
- User control and freedom
- Consistency and high standards
- Error prevention
- Recognition rather than recall
- Flexibility and efficiency of use
- Aesthetic and minimalist design
- Help users recognize, diagnose and recover from errors
- Help and designed manuals

Understanding the usability of a platform is valuable, but the visual design element that users experience is essential. When looking at a visual, users can almost immediately indicate whether it is appealing or not. Visual-design principles consist of scale, visual hierarchy, balance, contrast. Examining design principles in visual communication acts as a foundation for VR users' experiences. VR is still a relatively new technology and the visual aspect still has a long way to go. Though, it is important to take visual design principles into consideration. Graphics that take advantage of the principles of good visual design can drive engagement and better the user's experience.

Taking one step further a look at the principles of Interaction Design is required to better understand how UX can apply to the virtual world. The process of interaction design involves studying the behaviour and structure of interactive systems and then implementing solutions and strategies for developing successful digital products. In other words, interaction design is the interconnection between user and product and the services they use (Mitra, 2020).

Ten of the most important interaction design principles (Mitra, 2020) are:

1. **UX:** Matching the user's virtual experience to their expectations
2. **Consistent design:** Maintain consistency throughout the application
3. **Functionality:** Follow functional minimalism, and avoid overly complicated systems that can rather be simplified.
4. **Cognition:** Reduce cognitive loads or mental pressure to understand the application
5. **Engagement:** Design interactively such that it keeps the user engaged consistently.
6. **User control:** Allow the user to control, trust, and explore virtual spaces
7. **Perceivability:** Invite interactions through intuitions and interactive media
8. **Learnability:** Make user interactions easy to learn and remember
9. **Error handling:** Take care to prevent errors, if they occur, detect and recover them.
10. **Affordability:** Simulate actions by taking inspiration from real world interactions to virtual interactions.

There are similarities between Nielsen's (2012), good usability guidelines and interaction design principles (Mitra, 2020). Acknowledging these similarities serves as evidence that by applying these guidelines and principles to virtual reality experiences and interfaces is beneficial. Interior designers can develop successful virtual environments by applying these principles and guidelines to virtual building designs.

Review of Previous Literature

Introduction

During the literature review process three steps were completed in order to obtain relevant information. According to (Du Plooy-Cilliers, 2014) the literature review process is divided into three stages. Firstly, finding relevant and approved databases to find published articles that contained key words and relate to the research topic. The second step involves eliminating literature that is irrelevant to the topic or that does not apply to the investigation at hand. The third step identifies the relevant literature and helps to form a clear understanding of the topic and thus allows clear research questions to be developed. These steps have been taken in the process of this literature review.

Many recent studies have focused on the development of virtual reality as well as the evolution of virtual worlds, as seen by Dionisio, Burns and Gilbert (2013:12). To examine various opportunities for interior designers, search terms such as “virtual reality” and “virtual worlds' were selected to ensure the identification of relevant literature for this paper. Only literature that was published in the last decade and has content that describes general applications of virtual reality in daily lives, were chosen to meet the objective of this review, which is to examine the current opportunities for interior designers within virtual worlds.

The Development of Virtual Reality

Louis Rosenberg is a pioneer in the fields of virtual reality (VR), augmented reality (AR), and artificial intelligence (AI). He is currently CEO of Unanimous AI, a company that amplifies group intelligence in shared environments. In 1992 he developed the first fully interactive AR system; this was called the Virtual Fixtures platform, he developed this platform for the U.S. Air Force. Virtual Fixtures was a highly complex robotic system created to compensate for the lack of high-speed 3D graphics processing power available in the early 1990s. ‘It allowed for the overlay of sensory data on a workspace in order to boost human productivity’ (Niel, 2022: n.p). ‘In the world of immersive media, VR and AR are the two pillars of the field metaverses’ (Rosenberg, 2022: n.p). Both terms have been around for about 30 years, with VR emerging in the late 1980s and AR in the early 1990s. Jaron Lanier is a computer scientist, composer, artist, author, and founder of the field of VR. In Lanier’s seminal work on virtual reality, he describes VR as ‘the substitution of the interface between a person and the physical environment with an interface to a simulated environment’ (Lanier, 2017: 9). VR is the use of computer

modelling software and specifically designed simulations that enable users to interact with an artificial three-dimensional (3D) visual environment, such as the metaverse. In order to fully understand virtual worlds a deep dive into the evolution of virtual world development is necessary.

The Evolution of Virtual Worlds

Today VR allows users to explore new places that need not be real in the physical world, users can experiment within the simulated environment. The simulated environment is known as a virtual world (VW). In the below table Dionisio, Burns and Gilbert (2013:12) identify the major 20th-century advances in virtual world technology.

Phase I	The completion of the first virtual gaming world is described and takes place in the late 1970s. 'Roy Trubshaw and Richard Bartle complete the first multi-user dungeon or multi-user domain; a multiplayer, real-time, virtual gaming world described primarily in text' (Dionisio, et al 2013: 12).
Phase II	Graphical interfaces were introduced commercially in the 1980's. 'The first commercial simulated multi-user environment using 2D graphical representations (Dionisio, et al 2013:12). The term "avatar" is used. Prototype virtual reality systems and even more immersive environments begin to escalate.
Phase III	User centred content is created with 3D graphics. Open ended socialisation is employed with integrated audio. In 1995 Activeworlds was launched and featured basic content creation tools to personalise and co-construct a virtual environment. Activeworlds is an online virtual world based entirely on Snow Crash, and 'popularised the project of creating an actual metaverse' (Dionisio, et al 2013:12).
Phase IV	This phase consists of the major expansion in commercially used virtual world user bases. In this post-millennial decade virtual worlds have enhanced content creation tools and made significant improvements in graphical content. The Virtual Economy is introduced for the first time. The 'virtual economy' is an emergent economy that exists in a digital virtual world, where virtual goods are bought, sold and exchanged using virtual currency, typically in the context of an online game or social platform' (Dionisio, et al 2013:12).
Phase V	In 2007 the first open-source decentralised virtual world system was introduced. Solipsis was the first open-source virtual world system, Solipsis is a free and open-source system for a massively multi-participant shared virtual world designed and created by Joaquin Keller and Gwendal Simon. Open-source development "theoretically allowed new server and client variants to be created from the original code base - something that would actually become a reality with systems other than Solipsis" (Dionisio, et al 2013: 13). In 2010 the Open Development of the Metaverse allowed users to fully and choose among virtual worlds without worrying about compatibility or authentication "just as today's Web runs multiple web servers and browsers with standards" (Dionisio, 2013: 13). The open-source decentralised virtual world system allows users to share virtual spaces in the Metaverse.

Table 1: Major 20th-Century Advances in Virtual World Technology (Dionisio, Burns and Gilbert, 2013:12)

Dionisio et al (2013:12) identifies that there are five phases of the virtual world developments; for the purpose of this review phase V is significant because it introduces the first open-source decentralised virtual world system. Open-source development 'theoretically allowed new server and client variants to be created from the original code base' (Dionisio et al, 2013:13). In 2010 the open development of the Metaverse allowed users to fully and choose among virtual worlds without worrying about compatibility or authentication 'just as today's Web runs multiple web servers and browsers with standards' (Dionisio et al, 2013:13). The open-source decentralised virtual world system allows users to share virtual spaces in the Metaverse.

The Metaverse

The term "Metaverse" was first used in Neil Stevenson's 1982 written novel, Snow Crash. Neil Stevenson's metaverse was a virtual place where characters could go to escape an unstimulating authoritarian reality. The word "metaverse" has recently become very popular all thanks to Facebook; now rebranded as Meta. Mark Zuckerberg, CEO and founder of Meta has said he wants to 'build the metaverse and with it a virtual world where people can do anything and everything, including work, game, and socialise' and therefore 'Meta will be building a VR social platform for users' (Ravenscraft, 2022: n.p). But the term "metaverse" has since raised some confusion; the metaverse can be defined as the internet's transition from 2D websites to 3D web spaces that are also known as cyberspaces (Matthieu, 2021).

Cyberspace has often been illustrated in movies and books as a 3D experience similar to how we would talk about it today as the metaverse. 'A metaverse is a persistent and immersive simulated world that is experienced in the first person by large groups of simultaneous users who share a strong sense of mutual presence' (Rosenberg, 2022: n.p). Meta's VR social platform will be featured within a cyberspace or metaverse, just one that has been designed and developed by Meta. The original vision and definition of the metaverse is when a user's interface is made up of hardware and software and blurs the distinction between the real world and virtual worlds (Burke, 2021). It is important to realise that the metaverse is not a destination but rather a journey or process into the future. As designers we need to address some fundamental design choices about the principles of how we want the metaverse to operate. Designers could on the other hand potentially replicate or deepen what is broken about the internet today (Burke, 2021: n.p).

If there is still any confusion on the term “metaverse” maybe the following example can help clear it up: Fortnite (Fortnite is a video game, developed by Epic Games and extremely popular) has virtual experiences like concerts and exhibits. Users can strap on an Oculus headset and take part in virtual concerts and exhibits within the comfort of their own home, or even their virtual home. But is that really what ‘the metaverse’ means? Just various new 3D video games but with a headset? This is difficult to answer. Saying that Fortnite is “the metaverse” would be similar to saying Google is ‘the internet’ (Ravenscraft, 2022: n.p). Think of it like; ‘The Metaverse vs metaverses''. Metavereses are not a new thing to us, we’ve just been familiar to know it as cyberspaces or virtual worlds.

Crypto Currency

To gain more insight as to how the virtual economy functions, a look at how crypto currency functions is taken into consideration. Cryptocurrency is a form of currency that exists digitally or virtually and uses cryptography to secure transactions. Cryptocurrencies don't have regulating authorities, instead crypto uses a decentralised system to record transactions and issue new units. Cryptocurrencies run on a distributed public ledger, this ledger is known as blockchain, and the blockchain holds a record of all transactions updated and held by currency holders. Units of cryptocurrency are created through a process called mining, which involves using computer power to solve complicated mathematical problems that generate coins. Users can also buy the currencies from brokers, then store and spend them using cryptographic wallets. Crypto currency is not tangible, what the user will own is the key that allows them to move a record or a unit of measure from one person to another without a trusted third party. One of the reasons virtual currencies have become so popular is because some people believe that it is promising and could be capable of replacing money from traditional form to a new form (Dumitru, 2021: 395).

An example of a virtual currency is Bitcoin. Bitcoin can be digitally traded between users and can be purchased or exchanged into Rands, Euros, and other real or virtual currencies. Even though Bitcoin could potentially be used as currency in a traditional sense, in reality most people are not using it as money, but rather as digital assets. Bitcoin can be seen as gold that is also perceived as an asset, rather than money (Dumitru, 2021). There are also disadvantages of virtual currency that need to be acknowledged, such as volatility, which is the main impediment preventing this type of payment to reach a new dimension and be adopted globally. Some of the main reasons for the high volatility of the virtual currencies are rather complex, prices can be

influenced by factors like media, social platforms, speculations, tweets from influential people. It is also hard to believe that in the near future there will be a complete switch from the current economic systems to virtual money. ‘However, there is a good chance that some of the benefits of the technology will be incorporated by the current global economic systems’ (Dumitru, 2021: 399) Nevertheless, the blockchain based virtual currencies can truly represent an interesting development in financial history, with a great impact on society.

There has been much research in virtual currency and worlds, but few researchers have taken interior design into consideration. (Bruner, 2022) has considered how the virtual economy and virtual buildings are evolving, highlighting the fact that investors are spending millions buying virtual properties within the metaverse. A ‘Miami-based venture capitalist and a group of associates calling themselves the MetaCollective DAO (a decentralised autonomous organisation) used a virtual real estate broker to buy 23 parcels in the Sandbox, a user-generated, virtually economic, virtual world, for prices starting at 1 ETH (Bruner, 2022) which is about R 47,776.95. ETH stands for Ethereum and is another example of a virtual currency, similar to Bitcoin. An entire variety of industry developers has already popped up: real estate brokers, 3-D architects and digital landlords say’s Jessica Peltz Zatulove, a MetaCollective member.

Thus, there is evidence that virtual worlds may have financial opportunities, currently there are existing virtual real estate brokers that sell virtual buildings. A gap is identified for interior designers within virtual worlds, because there is a demand for virtual environment designs, that are not only from large investors but for personal use too. ‘We’re in a gold-rush moment with virtual real estate where people don’t know what they’re gonna build or how they’re going to build it, but they’re acquiring land in the best possible locations to create an interesting financial future’ (Bruner, 2022:38). Interior designers have three dimensional modelling skills as well as knowledge on built environments, users of the metaverse that have acquired virtual land could potentially employ interior designers to build their desired virtual home, business or social space.

Conclusion

In conclusion of this literature review, it is evident that virtual worlds are becoming more relevant, with more and more people joining in on virtual platforms like the metaverse, a demand for more virtual world designers can be predicted to grow.

Key terms

Virtual reality (VR) is the use of computer modelling and simulations that enables users to interact with an artificial three-dimensional visual environment within a virtual world (Dionisio et al, 2013:12), such as the Metaverse. Virtual worlds are computer-generated environments where multiple users in various real life locations can interact within the virtual environment in real time for the purposes of work or play.

The Metaverse vs metaverses; The Metaverse is part of the technology company Meta, but metaverse represents the virtual environment in which virtual worlds can exist (Matthieu, 2021). Examples of virtual worlds within the metaverse include; Decentraland, Sandbox, Hyperverse and many more. Virtual worlds are simultaneously an environment for connection, community as well as transactions.

Design Thinking Theory highlights that as researchers we should look at the world, observe what people do, how they think as well as to identify what they need and want (Brown, 2008:6). Using the Design Thinking Theory is beneficial because virtual worlds are a relatively new concept to the majority of people but interior design is a well known industry. Combining interior design to the world of virtuality with a Design Thinking approach helps in identifying the needs and wants of users, possibly creating opportunities for interior designers in the metaverse.

User Experience (UX) Design allows interior designers to simulate better, more successful designs within virtual worlds. By studying Nielsen's (2012), good usability guidelines and interaction design principles (Mitra, 2020) interior designers can build a foundation of what the users need to have a better experience.

Chapter 3

Research Methodology

Research paradigm

The paradigm identified was an interpretivist approach. It is relevant to note that the paradigm is ‘important, because it determines what questions are considered worthy of investigation and what processes are required for the answers to these questions to be acceptable’ (Du Plooy-Cilliers, Davis and Bezuidenhout, 2014:27). The main idea on which an interpretivist approach is based is that people are fundamentally different from objects and therefore we cannot study humans in the same way in which objects would be studied, human beings change all the time and the environment in which they are in constantly influences them. Interpretivist theory leads to the understanding of the identified phenomena. It does not predict outcomes and is not based on generalisations.

Intepretivisim has been influenced by several intellectual traditions, for the purpose of this paper phenomenology is reviewed. Phenomenology looks at the way individuals make sense of their surroundings, this paper focuses on gaining a better understanding of human actions and helps describe from the point of the group being studied, in other words, how interior designers can make sense of their virtual surroundings such as the metaverse. Technology is ever advancing and virtual reality along with virtual worlds are becoming more and more a part of people's daily lives, and this will become even more evident in the future years to come. An interpretative approach rests on the foundation that there can be no absolute right or wrong answer for human behaviour. Understanding their point of view on virtual realities and how this as an environment could influence them. Interpretivists value the complex understanding of unique realities.

Research Design Approach

The qualitative data was analysed by means of an inductive approach. The research study moves from specifics to generals and applies the findings to more abstract and broad theoretical constructs. Inductive theorising is often referred to as a bottom-up approach. Hence, inductive theorising allows the building of an existing or new theory. In inductive theorising, the researcher inferred theoretical concepts from the data collected and analysed in a specific study. Research with an inductive approach is usually very concerned with the context in which the research takes place (Du Plooy-Cilliers et al, 2014:85). This research study falls into the microtheory category,

because it may be limited in terms of the time available for conducting the research. A visual diagram has been developed to better understand the research design.

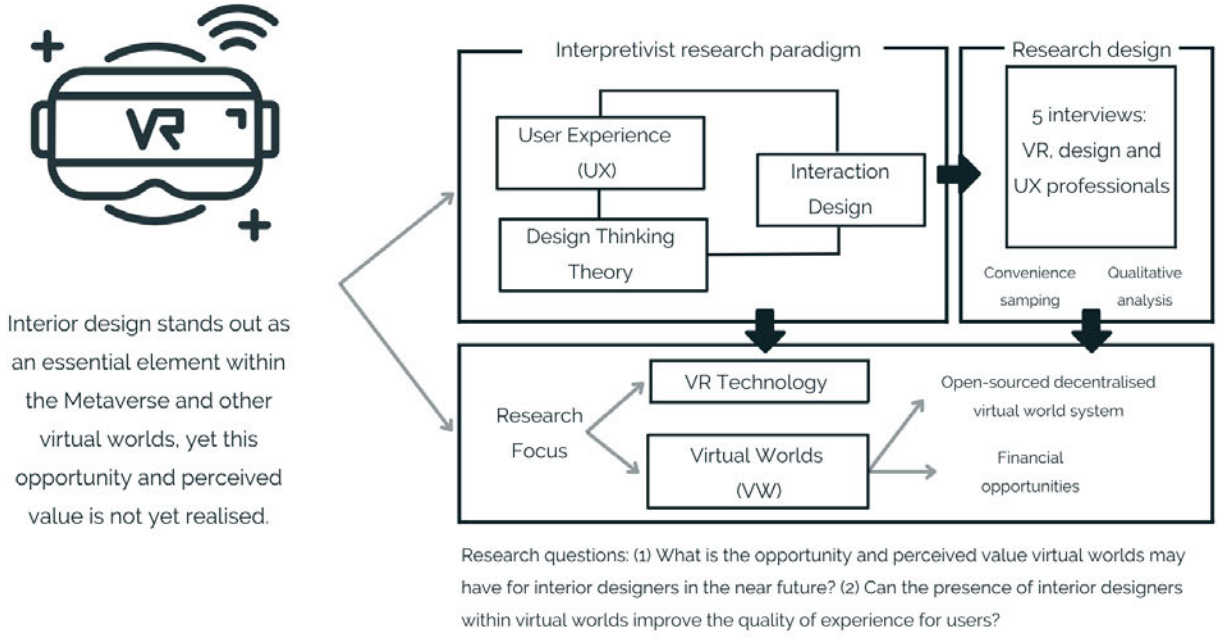

Diagram 1: Keevy, B. 2022. Research Design Diagram. [Personal diagram]. Pretoria. Unpublished.

Population

For the purpose of this study and to achieve a data saturation point three population groups were identified and later analysed:

- **Group 1:** Interior design specialists based in South Africa, with an undergraduate degree and are aged 30-35. This specific age group can be classified under the silent generation.
- **Group 2:** Virtual reality (VR) developers based in South Africa, with undergraduate and postgraduate degrees and are aged 28-34. This specific age group can be classified under the Y-generation.
- **Group 3:** Experienced user experience (UX) designers that are based in South Africa, with an undergraduate degree as well as three years minimum experience.

The 1-2 individuals per population group (5 in total) who were interviewed are as followed:

- One virtual reality developer

- Three interior design professionals
- One experienced UX designer

Main characteristics of the desired population:

- Specialised interior designers with experience in VR and 3D software were the most desired population.
- Individuals with a general interest in virtual reality and virtual worlds.
- Individuals with a general interest in interior design
- Individuals with knowledge of the virtual worlds.

Sampling

A non-probability sampling method was used, specifically convenience sampling. By using non-probability sampling the desired population is based on the researcher's subjective judgement rather than random selection. Non-probability sampling is often used when it is nearly impossible to determine who the entire population is or when it is difficult to gain access to the entire population. It is important to note that the findings from non-probability sampling are not often used to generalise results to the larger population (Du Plooy-Cilliers et al, 2014:138). Convenience sampling was used to interview individuals who are accessible within the proximity. Convenience sampling suggests that samples consist of elements that the researcher is aware of and gain quick easy access to.

From the start of the sampling process, there were a number of considerations that needed to be taken into account by the researcher (Du Plooy-Cilliers et al, 2014:145):

- Budget
- Time
- Resources
- Purpose
- Error allowance

The proximity was identified as South Africa. Individuals were recruited or scouted via the Linkedin social networking platform, from here the individuals were contacted and a background of the study was introduced. After individuals agreed to participate an interview was scheduled. The interview took place either via Zoom or in person. By using Zoom as the primary interview platform participants did not need to physically commute and thus increased the likelihood of individuals agreeing and participating.

Data Collection Method

Qualitative data was collected through five in depth interviews conducted with individuals by method of open ended questions. See attached Appendix A for the research instrument participant's questionnaire. Using in-depth interviews as a qualitative data collection method allowed the researcher to pose questions to participants with the aim of learning more about their views, opinions and beliefs about the identified phenomenon.

The researcher considered various aspects to gain the optimal advantages of conducting in-depth interviews, these include (Du Plooy-Cilliers et al, 2014:188):

- The questions move from a broad to a narrow focus. First general, broad questions were asked regarding the topic. The participant gives an answer which may contain cues indicating that there is more information to be obtained. More focussed follow-up questions stemmed from these cues and should be designed so as to get as much detail as possible from the participants.
- Ideally the researcher did not rely purely on pre-planned questions, but allowed the interview to progress and flow in a natural, conversational manner.
- The researcher formulated clear and simple questions and ensured that the participants knew exactly what was being expected from them with the questions that were being asked. The researcher avoided double-barrelled questions. The questions only addressed one aspect at a time. The researcher also listened for hidden and underlying subtext.
- The researcher avoided assuming they know exactly what participants mean; but rather prompt the participants to clarify what they meant with a specific answer.
- The researcher respected people's boundaries. If it was seen that the participant did not want to answer a question or elaborate on a statement, the researcher did not force him or her to do so.

Recording and accurately transcribing interviews was very important. The transcription software used to convert the audio into text is called Cockatoo. After the revised transcriptions of the interviews the data collected was documented. Transcriptions were analysed and links or connections were identified. Gaps as well as concerns were stated. Questions for the interviews were approved by the designated supervisors.

Data Analysis Method

The qualitative data was analysed by means of an inductive approach. Through a qualitative analysis and interpretation, data was transformed into findings. This

transformation allowed the researcher to be totally immersed in the data and help in identifying and describing the evident and dormant patterns of meaning emerging from the data. The goal of qualitative research was to gain an understanding of the subjective views and experiences of participants, but the processes of data analysis and interpretation were systematic and accurate.

Eight steps in the process of qualitative thematic content analysis adapted from (Du Plooy-Cilliers et al, 2014:235-242):

1. **Prepare the data:** Firstly the raw data obtained was organised and converted or transcribed into written text. This will include data derived from, for example, interviews and recordings. By transcribing the data, it will allow the researcher to know the data better.
2. **Define the coding unit** to be analyse: Researchers have to indicate whether they are going to use individual words, phrases, symbols, sentences or paragraphs as coding units. Coding units help in organising data into manageable chunks.
3. **Develop categories and a coding scheme** or conceptual framework: This step involves grouping related coding units together to form categories of codes. For the purpose of identifying the categories of codes, the researcher labels or names them. In describing the codes, themes and categories, the researcher ensures that they have the following characteristics; exhaustive, specific and mutually exclusive.
4. **Test the coding scheme on a sample text:** This step involves testing the clarity and consistency of the category definitions on a sample of the data. Coding definitions and rules need to be redefined if the level of consistency is low. During this stage, all doubts and problems related to the coding categories need to be resolved.
5. **Code all text:** Coding the data refers to the careful scrutiny of the data and taking note of all the relevant and meaningful sections. Thematic coding and line-by-line coding will be used in this research study. Line-by-line coding is a form of microanalysis and means that the researcher will read through parts of the text line by line while highlighting certain words and phrases that are relevant to the study. Thematic coding with an inductive approach allows codes to emerge from studying the text, this entails searching across the data set to identify, analyse, and report specific connections. The connections and similarities in the data will be mapped out.
6. **Assess your coding consistency:** Once all coding has been completed, it is important to recheck the consistency with which the coding was conducted.

7. **Draw conclusions** from the coded data (interpreting the data): This step involves the interpretation of the connections that have been mapped out. Before conclusions can be made, the researcher then interprets the data. Interpretation involves three steps: the researcher should be able to explain the relationships found, extraneous information must be taken into consideration as well as taking all relevant factors affecting the problem into account to avoid false interpretations.
8. **Report** the methods and findings: This final step involves reporting on the process that has been applied in the thematic coding, analysis and interpretation, as completely and truthfully as possible.

Validity and Reliability

As a qualitative researcher, numbers were not used as evidence, instead rather different criteria were used to determine the trustworthiness, or credibility of this research study. The aim of the qualitative research was to promote understanding of the phenomenon of VR and interior design. Although some researchers do not believe validity and reliability can be proven in qualitative studies, a preferred term has been identified as ‘trustworthiness’.

Trustworthiness can be divided into four terms (Du Plooy-Cilliers, 2014:258):

- **Credibility:** This will refer to the accuracy with which the researcher interprets the data that has been provided from the participants. Credibility can be increased if the researcher spends long periods of time with the participants to better understand and gain more insight. Triangulation can also be used to increase credibility by using more than one research method, such as in depth interviews combined with focus groups.
- **Transferability:** Is the ability of the findings to be applied to a similar situation and delivering similar results. This would allow for generalisation within an approach that does not generalise findings. In other words, the results and analysis could potentially be applied beyond VR and interior design but to a different research project.
- **Dependability:** This points out the degree of quality during the process of integration that sits between the data collection methods, data analysis and theory generated from the data.
- **Confirmability:** Indicates how well the data collected supports the findings and interpretation of the researcher, and how well findings logically flow from the data. It requires the researcher to describe the research fully in order to assist

others in scrutinising the research design, others should be able to look at the data and agree on similar conclusions.

Contribution, Ethical Considerations and Limitations

Anticipated Contribution

Because VR and virtual worlds (VW) are such universal technologies, they can be applied into almost any industry. Interior designers can predict opportunities within the virtual worlds. The improvement of technology makes this possible. By providing deeper research into the field of VR and Interior Design the research compiled in this paper can potentially pave the way for future researchers who are interested in virtual realities and the relations thereof to interior design. VR is a relatively new term especially within an interior design context, thus the research compiled in this study aims rather to create awareness and not to predict the future.

Ethical Considerations

Ethics are a matter of integrity on a personal level. In research, specifically, ethics are crucial, because they potentially affect all the stakeholders in research. A stakeholder is someone who has vested an interest in something. Stakeholders in this specific study includes; the researcher, the participants, the broader public, the academic institution (IIE-Vega), the community as well as the policy makers.

Ethical Considerations for this research study are as follows (Du Plooy-Cilliers, 2014:264):

- **Informed consent;** All potential participants have given written consent to partake in the research study. See Appendices C, E and F. Participants are allowed to withdraw from the study whenever they so decide.
- **Collecting data from participants;**Information such as name, location and personal statements etc made during interviews by participants are protected and remain confidential. The researcher provides feedback to participants that have agreed to participate in the study. An estimated date for results was also provided for the participants.
- **Avoiding harm;** Researchers should not harm participants in any way. For example, researchers should not ask / cause participants to recall emotionally painful memories, or ask questions in a group setting that may cause one participant to be embarrassed Researchers undertake that, even though they are

able to match the participants' identities to their research responses, that information will be known only to the researcher and available to no one else. This is often the case with in-depth interviews with participants or when participants complete a questionnaire where their names are recorded.

- **Dealing with anonymity;** Researchers can promise participants anonymity, by not recording their names at any stage of the research process, and not being able to match their identity to their research responses in any way.
- **Avoiding Deception;** The most common ways in which researchers deceive are; telling participants the research is about one thing when it is really about another or giving participants the general purpose of the research, but not indicating what specifically is being looked at. The researcher avoided falsifying information, distorting results, allowing bias to influence interpretation of results, misusing information or using inappropriate research methods. Avoiding bias and keeping an objective perspective.

Limitations

Limitations can be described as constraints or limits within a research study that are out of the researchers control, such as time, financial resources, access to information, and so on. A limitation may cause the scope of the research to be redefined. Limitations may also surface due to shifts in conditions during the study. 'Clearly identified limitations guide researchers in reporting of findings, and support the reliability and validity of research findings within the scope of a study' (Du Plooy-Cilliers, 2014:278). Limitations can be constraining, however, they are not signs of failure, just because the researcher does not have full control over every single condition within the scope of the study. The limitations within this study are acknowledged and demonstrate the researchers' awareness. By addressing these limitations researchers can contribute to the validity and reliability of the study.

The following limitations were identified as:

- Time restraints; there was a limited amount of time available to complete this study. The time limit was 8 months.
- Accessibility limitations; gaining access to specialised industry professionals might be difficult to find in a South African context.
- Limitations may also surface due to shifts in conditions within the AR and VR worlds during the study.
- As the only researcher; I was my own limitation in this study, I needed to remain objective when gathering and analysing the data.

- As the only researcher for this study, my own limited knowledge and experience was a limitation to consider.

Delimitations

All the decisions made by the researcher during the different steps in the research process determine, to some degree, the delimitations of the research study. Delimitations are the parameters that are set by the researchers. These parameters are essential in order for the researcher to focus on specific concepts, theories, literature, methods, delimitations ensure the research has a clear direction and emphasis.

Chapter 4

Data Analysis and Findings

Overview

The previous chapter identified the possibility of financial gain or potential job opportunities for interior designers. This chapter further explores these opportunities for interior designers by collecting data through in depth interviews to experts within the field of virtual innovation, user experience and interior design. The qualitative data collected through these five in depth interviews (see attached research instrument in the form of a questionnaire in Appendix A) was further scrutinised. Using in-depth interviews as a qualitative data collection method allowed the researcher to ask questions to participants with the aim of learning more about their views, opinions and subjective thoughts about the identified phenomenon.

Population

For the purpose of this study and to achieve a data saturation point three population groups were identified and later analysed:

Group 1: Interior design specialists based in South Africa, with an undergraduate degree and are aged 30-35. This specific age group can be classified under the silent generation.
Group 2: Virtual reality (VR) specialists based in South Africa, with undergraduate and postgraduate degrees and are aged 28-34. This specific age group can be classified under the Y-generation.
Group 3: Experienced user experience (UX) designers that are based in South Africa, with an undergraduate degree as well as three years minimum experience.

The 1-3 individuals per population group (5 in total) who were interviewed was as follows:

- One virtual reality and/or equivalent professionals
- One interior design professional
- Three experienced UX designers

Main characteristics of the desired population:

- Specialised interior designers with experience in VR and 3D software were the most desired population.

- Interior designers with industry experience, and/or a general interest towards virtual reality.
- Individuals with VR experience and technical knowledge in virtual reality and virtual worlds.
- Individuals with a general interest in interior design in the future.
- Individuals with general knowledge of the virtual worlds.

Population parameters:

- The target population consists mainly of individuals who already understand and have experienced virtual worlds, however in the accessible population some individuals may have a limited amount of knowledge within the worlds of virtual reality.
- The population identified is small, small sample size may make it difficult to determine if the particular outcome is a true finding.

Sampling

A non-probability sampling method was used, specifically convenience sampling. By using non-probability sampling the desired population is based on the researcher's subjective judgement rather than random selection. Non-probability sampling is often used when it is nearly impossible to determine who the entire population is or when it is difficult to gain access to the entire population, therefore applicable to this research study. It is important to note that the findings from non-probability sampling are not often used to generalise results to the larger population (Du Plooy-Cilliers et al, 2014:138). Convenience sampling is to interview individuals who are accessible within the proximity. Convenience sampling suggests that samples consist of elements that the researcher is aware of and gain quick and easy access to.

From the start of the sampling process, a number of considerations are taken into account by the researcher (Du Plooy-Cilliers et al, 2014:145):

- Time: A limited time consisting of two months was allocated to the collection of data.
- Resources: To correctly collect data the resources identified consisted of; access to Zoom Pro, Google Docs, Google Sheets, Google Forms and working internet connection.
- Purpose: The purpose for sampling in this research paper is to recruit enough individuals that can provide rich, in-depth data, in order to understand the phenomenon.
- Error allowance

The proximity has been identified as South Africa. Individuals have been recruited or scouted via the Linkedin social networking platform, from here the individuals were contacted and a background of my study was introduced in an email to the potential participant. After individuals agreed to participate, the interview was scheduled and confirmed via Google Calendar. The interview thereafter takes place either via Zoom or Google Forms. By using Zoom as the primary interview platform participants do not need to physically commute and therefore increase the likelihood of individuals agreeing and participating. For those participants who could not commit to a Zoom interview, a Google Form was created. The interviews varied between 30 to 60 minutes long and consisted of about 16 questions in total. These questions were formulated in order to answer the research questions and address the research objectives of the study.

The research objectives of this research study were set out as:

- Gain a better understanding of how interior designers can find value within the worlds of virtuality.
- Explore how interior designers can use virtual reality technology available within virtual worlds to create better design experiences for users and clients.

Data Collection

Qualitative data collection techniques are extremely useful for instances where the research is complex and cannot simply be encapsulated by a simple yes or no hypothesis. Qualitative data was collected through five in depth interviews conducted with individuals by method of open-ended questions. See attached Appendix A for the research instrument participant's questionnaire. Using in-depth interviews as a qualitative data collection method allowed the researcher to pose questions to participants with the aim of learning more about their views, opinions and beliefs about the identified phenomenon.

The researcher considered various aspects to gain the optimal advantages of conducting in-depth interviews, these include (Du Plooy-Cilliers et al, 2014:188). Questions for the interviews have been approved by the designated supervisors:

- The questions moved from a broad to a narrow focus. First general, broad questions were regarding their background, job title and interest in virtual worlds. The answers obtained from this contained cues indicating more information could be collected. More focussed follow-up questions stemmed from these cues.

- The researcher did not rely purely on pre-planned questions, but allowed the interview to progress and flow in a natural, conversational manner allowing more information to be collected.
- The researcher formulated clear and simple questions and ensured that the participants knew exactly what was being expected from them. The researcher avoided double-barrelled questions. The questions only addressed one aspect at a time.
- The researcher avoided assuming they know exactly what participants mean; but rather prompt them to clarify what participants mean with a specific answer.
- The researcher respected people's boundaries. If it was seen that the participant did not want to answer a question or elaborate on a statement, the researcher did not force him or her to do so.

Recording and accurately transcribing interviews was very important. The transcription was done through the Zoom platform. The interviews that took place on Zoom were recorded with the consent of the participants and the recording was converted into a document containing the text from the interview. This document included date and time stamps of everything that was said. Although most of the text was transcribed correctly, the researcher still ensured accuracy by re-watching the video recordings and following through the text, correcting and changing text where it was required. Gaps as well as concerns are stated, and links and connections are identified.

Data Analysis Method

The qualitative data was analysed by means of an inductive approach. Through qualitative analysis and interpretation, data was transformed into findings. This transformation allows the researcher to be totally immersed in the data and help in identifying and describing relevant patterns of meaning emerging from the data. The goal of qualitative research is to gain an understanding of the subjective views and experiences of the participants. This phenomenological research seeks to study the way participants make sense of their virtual surroundings and gain a better understanding of the participants point of view with regards to interior design opportunities within the worlds of virtual reality. With an interpretive approach the researcher rests on the foundation that there is no absolute right or wrong answer in the context of human behaviour, the researcher finds value in the complex understanding of unique realities. Technology is ever advancing and virtual reality stands out. Understanding the participants' subjective point of view on virtual realities and how this as an environment could influence them is beneficial to this research study.

Data Analysis Process

The process followed in analysing the data was systematic and accurate. The eight following steps were taken in the process of analysing the raw data collected from the participants are as follows (Du Plooy-Cilliers et al, 2014:235-242):

1. **Preparing** the data: Firstly the raw data obtained from the Zoom interviews was recorded, organised and converted/transcribed into text. The transcribed text was double checked for accuracy by re-watching recorded videos and making changes to the converted text where required. The raw data obtained from the Google Forms was text based. With all the data being text based it allowed the researcher to further define the coding units and categories for the conceptual framework.

2. **Defining** the coding unit used to be analysed: The coding units identified for this research study consisted of words, phrases and sentences/paragraphs, also referred to as ‘in vivo’ labels for codes. Examples of these are included in the below word cloud data visual but some examples included; virtual reality, 3D modelling, rendering, property, clients, real estate, opportunities etc. The concept of virtual worlds and the participants personal experience and knowledge is also used as a coding unit. The codes are applied to any text that represents a single theme or relevance to the identified research questions. Although the analysis of the data is thematic, coding allowed the researcher to divide the large amounts of text into manageable chunks. The research questions in this study are as follows; (1) What is the opportunity and perceived value that virtual worlds may have for interior designers? (2) Can the presence of interior designers within virtual worlds improve the quality and experience for users?

Diagram 2: Keevy, B. 2022. Word Cloud data Visual. [Personal diagram]. Pretoria. Unpublished.

3. Developing **categories**: This step involved grouping related coding units together to form the above word cloud. These categories represent the ‘in vivo’ coding groups.

   The three categories identified to group the codes are as follows:
   - Interior Design (ID)
   - Virtual Reality (VR)
   - User Experience (UX)

4. **Testing the coding scheme** on a sample text: In order to test the coding scheme accurately a coding manual was developed. The coding manual describes each category's names and requirements for those. Using the transcriptions from the interviews, a sample text was chosen to test the coding scheme. For example; any text that contained the word ‘client’ categorised within the Interior Design category. The level of consistency was high and the coding scheme was successful.

5. **Coding** all text: With all relevant codes and categories identified, all text/transcriptions were scrutinised by method of line-by-line coding. Line-by-line coding is a form of microanalysis and means that the researcher has read through all parts of the text line by line while highlighting certain words and phrases that are relevant to the study, making important notes of repeated codes, and categorising these codes accordingly. Thematic coding with an inductive approach allowed codes to emerge from studying the text. The coding process entailed searching across the data set to identify codes, analyse, and report specific connections. The connections and similarities in the data were mapped out in the form of a bubble diagram.

6. Assessing the **coding consistency**: Once all coding was completed, the researcher rechecked the consistency with which the coding was being conducted by re-reading through all text line-by-line and ensuring the identification of words and phrases relevant to the study. The consistency was high and minor errors that came about were then corrected.

7. **Drawing conclusions** from the coded data: This step involved interpreting the connections that have been mapped out. The research study moves from specifics to generals and applies the findings to more abstract and broad

theoretical constructs. Inductive theorising is often referred to as a bottom-up approach. With inductive theorising the researcher can build or create a new theory. In inductive theorising, the researcher infers the theoretical concepts from the data collected and analysed in the study. This research study falls into the microtheory category, because it is limited in terms of the time available for conducting the research.

8. **Reporting** the methods and findings: This final step involved reporting on the process that has been applied in the thematic coding, analysis and interpretation, as completely and truthfully as possible.

Findings

The research study thus far has discussed virtual reality and the evolution of virtual worlds, and how this could potentially apply to the field of interior design. VR has become more relevant in today's world and could potentially provide a good user experience within virtual environments. Interior design stands out as an essential element within virtual worlds, yet this opportunity and perceived value for interior designers is not yet realised. This potential gap has been identified within virtual worlds such as the Metaverse. This gap can possibly create opportunities for interior designers to design 3D virtual buildings and spaces, by using computer software and improving digital technology. In hopes to better understand this phenomenon a group of individuals were interviewed and divided into three groups in alignment with the research objectives; (1) Interior Design, (2) Virtual Reality and (3) User Experience. This chapter further unpacks the data collected from open-ended interviews administered to the sample group. The responses from these interviews were interpreted and discussed critically.

Findings Report

The data collected through five in depth interviews with participants has been categorised and summarised into tables. Below a table has been created in order to effectively visualise the decoded data obtained from the five in depth interviews. The below *table 1* reflects the summarised subjective understanding from participants on the identified phenomena.

Question:	**Group 1:** Interior Designers (ID)	**Group 2:** Virtual Reality professionals (VR)	**Group 3:** User Experience Designers (UX)

Have you experienced a virtual world?	No, no access to VR headsets or softwares. Would still like to experience a 3D virtual world. The only virtual world experiences have been 2D, unless you include 3D software as a virtual world.	Yes, the earliest 2D experience within a virtual world was a game called Microsoft Flight Simulator, Pub G and Fortnite. Another experience of the virtual world is a 360 degree video. Everyday work involves VR.	Yes, through a friend of a friend as well as close partners. Many positive experiences have emerged from playing around with VR.
What do you think are the main uses of virtual environments currently?	Virtual reality, gaming, movies, pc games	Provides opportunities for engagement, learning, work and play.	VR can be incredibly valuable for prototyping designs. Online workshops/meetings are great within virtual environments when working from home.
What interests you most about VR?	The endless possibilities of prototyping and testing. A general curiosity toward VR games and social platforms.	Transactions that can take place as well as giving people the ability to have new experiences regardless of their physical confines. The most interesting parts are also the things that people have not come up with yet.	Purchasing and exchanging virtual goods or services. There's a wonderful escapism in it. Interested in the adaptability of VR in the real space.
What do you think is or could impede the growth of VR?	Cost of headsets and technology required. Are there any health risks involved? Are people's personal identities protected? Users are still too unsure therefore slowing down the adoptability.	People are still unsure of what exactly VR is, communicating the intrinsic value to people properly could reduce the resistance.	There is a barrier to entry, where people are not quite sure how to engage with it or what it would necessarily entail. Accessibility in terms of cost, internet access and knowledge on how VR works.
How do you think VR will affect people in the future?	When VR becomes more accessible it can be used as a presentation tool. Marketing stands out.	The powerful possibility for creating immersive experiences within any field. Moving into a different medium can create new opportunities.	Allowing people to have experiences that we wouldn't otherwise be able to. VR is still exclusive to people that are financially secure.
Do you think that there is job potential for interior designers within VR?	Yes, these worlds still need to be designed and be used by users and an interior designer knows how to design	Yes, interior designers have been taught to approach spatial problems and it gives you quite a unique view	Yes, VR is a very powerful tool that allows people to imagine their space that they are used to and

	space at a human eye-level.	because you think about how people will physically experience a space.	can suddenly transform it into something completely different.
How do you think users are currently experiencing virtual worlds?	Many people are still unexposed to VR and have not experienced it.	Most people have not experienced a virtual world, majority of people still do not understand what it is and therefore cannot comprehend VR.	Those that have had the opportunity to experience virtual worlds find the graphic quality low. People experience physical side effects from wearing a VR headset for a large amount of time.
Do you think VR has the potential to create meaningful experiences for users?	Yes, VR has that possibility to create experiences for people that enhance their lives and to allow them to experience things.	Yes, most people that have had the opportunity to experience VR say it is “like dreaming with your eyes open”.	Yes, learning within a VR setting where it's much more engaging adding value, but only once users are able to understand VR.
How do you think VR can be used for testing a user’s experience/ satisfaction?	Allowing clients to see life-like designs before construction is completed, thus allowing clients to request changes or additions. Although this process can be time consuming it can reduce the carbon footprint of interior design.	Because there is still high resistance from people, showing users the end goal and allowing them to try a VR experience to explain and show them the benefits that it involves, including various user journeys, give users the option to do both to intrigue them and learn from their experiences.	Within a design thinking process, the quicker you can prototype things, the quicker you can get feedback from testing and the quicker you know if something's going to work or not.
What do you think virtual worlds are currently lacking in terms of satisfying users' needs and wants?	The difference between futuristic and realistic - so the VR world's are not at such a level yet where it is completely realistic, and most people have an expectation of a realistic world within VR.	The metaverse uses blockchain technology that tends to throw many users off. Haptic technology still has a very long way to go in terms of VR. Users seem to gravitate towards a more virtuous reality. Virtuous is the concept of something that makes its possessor good.	Security and legislation within virtual worlds. The quality of the graphics are still very low. The crypto space is not design friendly yet, it is very engineered based at the moment. As designers we are going to have to adapt to a new medium with effective storytelling design and try to meet the expectations of users.

Table 2: Summary of collected data. (Keevy, B 2022).

Upon analysing the data gathered, the researcher became aware that there is a perceived value for interior designers within virtual worlds. The perceived value was identified by means of sorting through the three groups, and the participants' answers were categorised into two themes. The below *table 2* indicates the themes that have emerged from the collected data and how these findings address the research questions of this study.

To further link the collected data, themes have been categorised, grouped and colour coded as follows;
Theme 1: Blue highlighted texts indicates a connection to how virtual reality can offer opportunities for interior designers.
Theme 2: Purple highlighted text indicates the group's subjective understanding & knowledge of user experiences within virtual worlds.

Main Findings:	**Theme 1: Virtual reality offers unique opportunities for interior designers**	**Theme 2: User experiences within virtual worlds are limited and complex**
Group 1: Interior Design	The built environment has seen benefits from VR technology, but the cost is high so fewer people are able to invest. Some industry professionals are not familiar with the new technology available to them.	The cost of VR technology is high and thus many people have had very little exposure to virtual worlds. Professionals in the industry have not mass accepted the use of VR.
Group 2: Virtual Reality	VR creates a powerful possibility for creating immersive experiences within any field. Moving into a different medium can create new opportunities. If interior designers adopt VR technology, they have a unique approach because they have been taught to solve physical spatial problems that can be translated to a virtual world.	People are still unsure of what exactly VR is, communicating the intrinsic value to people properly could reduce the resistance and educate more people about the benefits of VR. Users seem to gravitate towards a more virtuous reality, users also want to be assured personal data safety within virtual worlds.
Group3: User Experience	With UX Design Theory in mind, identifying what the users want and need within a specific virtual setting is fundamental. VR aids in the design process of prototyping and testing the users satisfaction.	The crypto space is not design friendly yet. As designers we are going to have to adapt to a new medium with effective storytelling through design and try to meet the expectations of users.

Table 2: Primary research findings. (Keevy, B 2022).

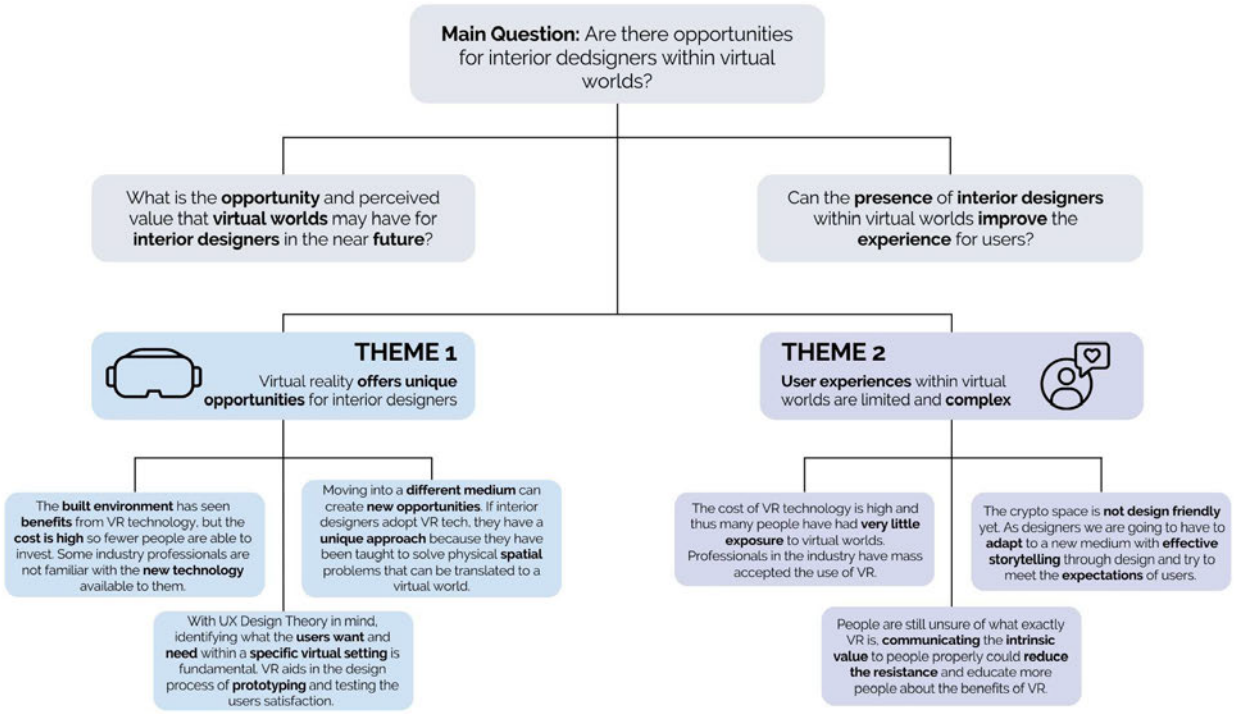

Diagram 3: Data Visual. [Personal diagram]. Pretoria. Unpublished.

Interpretation of the data

Through interpretation of the collected data, patterns emerge from participants acknowledging that there are opportunities available for interior designers within virtual worlds but user experiences are still limited in context of the identified phenomena. These patterns have been divided into two themes; (1) Virtual reality offers unique opportunities for interior designers and (2) User experiences within virtual worlds are still limited.

Theme 1:
VR offers unique opportunities for interior designers

Virtual reality is slowly becoming more and more a part of people's daily lives. There has been much research in virtual currency and worlds, but few researchers have taken the interior design industry into consideration. (Bruner, 2022) has considered how the virtual economy and virtual buildings are evolving, highlighting the fact that investors are spending millions buying virtual properties within the metaverse. A gap is identified for interior designers within virtual worlds, because there is a demand for virtual environment designs, that are not only from large investors but for personal use too.

The shift to virtual reality is still slow, because many people still do not have access to these technologies, the potential for established businesses to invest into a tool like a VR headset such as an Oculus Quest 2 could offer new marketing/presentation opportunities. As previously mentioned one of the biggest challenges within interior design industries is showing clients what finished results will look like. Although interior designers have existing strategies for this, immersive virtual reality is not yet fully adopted.

- Participant from Group 2 mentioned that:
  "*VR has been used within the built environment to reduce human error on site, lower their overall carbon footprint and showcase clients the final design. People within the built environment have seen the benefits of incorporating VR technology, they spend less time and money correcting mistakes or simply avoiding last minute changes at the client request. However many people in the industries of architecture and construction have only started engaging with this technology and smaller scale companies cannot afford VR yet*"

Interior designers can use a Design Thinking approach to further implement VR. Design thinking is used as a systematic approach for innovation that aims to identify customer dis-satisfactions and develop new innovative solutions through iteration (Torabi, 2020). As mentioned in the literature review chapter, Brown (2008:5) highlights three main spaces in the Design Thinking process; Inspiration, ideation and implementation. During the ideation space, designers have the end goal of opening up to new thinking and innovations, thus VR is suitable. The ideation space also calls attention to prototyping and testing. A participant from Group 3 noted the importance of testing and prototyping and how VR has the potential to alleviate existing problems such as client satisfaction.

- Participant from Group 3 noted:
  "*VR is a very powerful tool that allows people to imagine their space that they are used to and can suddenly transform it into something completely different" and "In a design thinking process, the quicker you can prototype things, the quicker you can get feedback from testing and the quicker you know if something's going to work or not*"
- Participant from Group 1 mentioned:
  "*Allowing clients to see life-like designs before construction is completed, allows clients to request changes or additions. Although this process can be time consuming it can reduce the carbon footprint in the building industry*"

Interior designers have three dimensional modelling skills as well as knowledge on built environments. When designers use a design thinking approach to create innovative solutions through rigorous prototyping and testing, users within the metaverse that have

acquired virtual land could potentially employ interior designers to build their desired virtual home, business or social space.

- Participant from Group 1 said:
  "Virtual worlds still need to be designed and be used by users and an interior designer knows how to design space at a human eye-level"

Theme 2:
User experiences within virtual worlds are limited and complex

A challenge interior designers have predicted to face is what the potential users overall experience will be like as well as identifying the users needs and wants. User Experience (UX) design focuses on the user's experience of a specific platform, for example within the metaverse. This can include accessibility, usability, enjoyment, and the overall flow of the experience (Dauchot, 2018). UX design focuses on both on how users use digital tools and on how users inhabit digital spaces. User experience design theory points out the user's experience of a specific platform, in this case a virtual world such as the metaverse. Interior designers could adopt VR technology and improve user experiences within these virtual worlds.

- Participant from Group 2 mentioned that:
  "*VR has the powerful possibility for creating immersive experiences within any field and moving into a different medium can create new opportunities"*

UX design focuses on both how designers use digital tools and how users can inhabit digital spaces. Few people have actually experienced a virtual world and users still seem to have a certain level of resistance to virtual worlds. It is presumed that users do not have access to VR because of the high cost and also have little understanding of what VR actually is or how it could add benefit to their lives.

- Participant from Group 2 noted that:
  "People are still unsure of what exactly VR is, communicating the intrinsic value to people properly could reduce the resistance"
- Participant from Group noted that:
  "Many people are still unexposed to VR and have not experienced it"

Intrinsic value highlights the core concept that potential investors and users understand that can help them uncover hidden opportunities. The intrinsic value or real value of VR can be better communicated to users in order to help reduce resistance and adaptability. The intrinsic value of VR is the compelling experiences available for users, and that these experiences are meaningful enough so that people will be willing to pay for them. Understanding good usability and implementing it successfully will help communicate the intrinsic value of VR.

- Participant from Group 2 mentioned that:
  “Because there is still high resistance from people, showing users the end goal and allowing them to try a VR experience before purchasing VR accessories. This trial experience should aim to explain and show users the benefits that it involves, including various user journeys consequently intriguing the users”

Interior designers can implement good usability throughout their virtual designs in order to ensure that they are successful. Good usability stems from user control and freedom as well as flexibility and efficiency of use for users (Nielsen, 2012). Many users are unsure of how VR works and how it could benefit them. Virtual currencies allow transactions in virtual environments, many people are uninformed about blockchain technology and therefore do not feel in control. This lack of control increases resistance in users.

- Participant from Group 3 notes that:
  “VR can add value, but only once users are able to understand and experience it” as well as “*The crypto space is not design friendly yet, it is very engineered based at the moment”*
- Participant from Group 2 mentions:
  “*The metaverse uses blockchain technology that tends to throw many users off”*

The process of interaction design involves studying the behaviour and structure of interactive systems and then implementing solutions and strategies for developing successful digital products. Applied in context interaction design can aid in studying user experiences within virtual worlds and developing successful strategies for digital products such as a personally designed home within the metaverse. Interaction design calls attention to the interconnection between users and digital products they use (Mitra, 2020). Important interaction design principles are; matching the users experiences to their expectations, avoiding overcomplicated systems and design interactively such that it keeps users engaged (Mitra, 2020).

- Participant from Group 1 notes that:
  “*VR world's are not at such a level yet where it is completely realistic, and most people have an expectation of a realistic world within VR.*
- Participant from Group 3 mentioned that:
  “As designers we are going to have to adapt to a new medium with effective storytelling design and try to meet the expectations of users”
- Participant from Group 2 notes that:
  “Haptic technology still has a very long way to go in terms of VR”

Summary

The main objective for this paper was to identify whether or not there are opportunities for interior designers within virtual worlds as well as how interior designers could in return create meaningful virtual experiences for users. Theme 1 validates that there are opportunities for interior designers in virtual environments. Using Design Thinking theory designers can adopt a new medium such as virtual reality to create new innovative solutions through prototyping and testing designs with VR headsets. Although virtual reality is still up and coming into the mainstream for users. Theme 2 substantiates that with good usability design and implementing interactive design principles, user resistance could potentially be minimised. For users that are familiar with virtual reality, interior design professionals have the skills to improve their experiences and offer unique digital design solutions.

The below table concludes this chapter and summarises the overall findings.

	Findings:	**Supported Theory:**
Theme 1: VR offers unique opportunities for interior designers	There are opportunities for interior designers within virtual worlds such as the metaverse.	Design Thinking Theory
Theme 2: User experiences within virtual worlds are limited and complex	Users familiar with VR can benefit from the presence of interior designers, but many users are still intimidated with the complexity of virtual worlds.	UX Design Theory, Interaction Design Principles

Table 3: Chapter summary. (Keevy, B 2022).

Conclusion

Virtual reality is considered a universal technology that can be applied into almost any industry. In conclusion to the research, interior designers can predict unique opportunities within the virtual worlds. The improvement of technology makes this possible. By providing a deeper understanding into the field of VR and Interior Design the research compiled in this paper can potentially pave the way for future researchers who are interested in virtual realities and the relations thereof to interior design. Many people have not yet had the privilege of experiencing virtual worlds, thus user experiences are still limited. The research compiled in this study aims to create awareness and not to predict the future.

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Appendix A

Research Instrument

Questions for participants

Group 1: Interior Design specialists based in South Africa.

1. In your view, how can virtual reality contribute to the daily lives of everyday people?
2. What do you think people still do not understand about virtual reality? Explain what it is that people don't understand.
3. How do you think virtual reality will affect approaches to interior design in the future?
4. Do you think there are ways in which interior designers can potentially contribute to virtual worlds, such as the metaverse?
5. Do you think that there is job potential for interior designers within the metaverse?

Group 2: Virtual Reality developers based in South Africa.

1. Are you currently working on hardware or software in regards to virtual reality?
2. What do you think could impede the growth of virtual reality? Explain your answer.
3. How do you think virtual reality and these 'new' technologies have evolved? Specifically with regards to the public perception?
4. Are there any lasting effects on users that use virtual reality that you are aware of? Describe these.
5. Explain how you think virtual reality could possibly affect today's technology?
6. What is your current job title?
7. What is your understanding of virtual reality and what does it mean to you in your daily work?
8. Describe how, in your view, virtual reality can be used for testing a user's experience?
9. How do you think virtual reality will affect people in the future, specifically with regards to interior design and simulated buildings? Explain your answer in detail.
10. Are there any lasting effects on users that use virtual reality that you are aware of? Describe these.

11. Are there specific headsets required for virtual reality? Describe what they are and how they function.
12. What do you think are the main uses of the metaverse currently? Explain your answer in detail.

Group 3: User Experience designers that are based in South Africa.

1. What interests you about virtual reality? Explain your answer in detail.
2. How would you test a virtual reality user's experience? Describe how virtual reality can be tested.
3. What do you think are the main uses of metaverse currently?
4. What do you think people do not understand about virtual reality? Explain what people don't understand in order to help inform them about virtual reality.
5. Do you think that there is job potential for interior designers within the metaverse? Describe in detail.
6. What do you think virtual worlds are currently lacking in terms of satisfying users needs and wants? Describe in detail.
7. Describe how, in your view, virtual reality can be used for testing a user's experience?
8. Are there ways in which UX can contribute to the daily lives of people? Describe in detail.
9. How do you think users are currently experiencing virtual worlds?
10. How do you think user experiences could be improved within the virtual worlds? Describe in detail.

Appendix B

Interview Consent Form

Explanatory information sheet and consent form for participants
To whom it may concern, My name is **Brenda Bianca Keevy** and I am a student at **IIE-Vega** (a brand of the Independent Institute of Education) I am currently conducting research under the supervision of (insert supervisor's name) about **Virtual Reality and Interior Design:** The opportunity and perceived value that virtual worlds may have for interior designers in the near future. I hope that this research will enhance our understanding of **interior design within virtual worlds.** I would like to invite you to participate in my study. In order to explain to you what your participation in my study will involve, I have formulated questions that I will try to fully answer so that you can make an informed decision about whether or not to participate. If you have any additional questions that you feel are not addressed or explained in this information sheet, please do not hesitate to ask me for more information. Once you have read and understood all the information contained in this sheet and are willing to participate, please complete and sign the consent form below.
What will I be doing if I participate in your study?
I would like to invite you to participate in this research **because your specific knowledge either in the field of virtual reality, interior design or user experience will be beneficial in gaining more insight into the perceived value virtual reality may have for interior designers**. If you decide to participate in this research, I would like **to conduct an interview via Zoom or in person physically. Ten to eleven in depth and open ended questions will be asked during the interview**. You can decide whether or not to participate in this research. If you decide to participate, you can choose to withdraw at any time or to decide not to answer particular interview questions.
Are there any risks/ or discomforts involved in participating in this study?
Whether or not you decide to participate in this research, there will be no negative impact on you. There are no direct risks or benefits to you if you participate in this study. You might, however, indirectly find that it is helpful to talk about **your experience and knowledge in virtual reality / user experience / interior design.** If you find at any stage that you are not comfortable with the line of questioning, you may withdraw or refrain from participating.
Do I have to participate in the study?
● Your inclusion in this study is completely voluntary; ● If you do not wish to participate in this study, you have every right not to do so; ● Even if you agree to participate in this study, you may withdraw at any time without having to provide an explanation for your decision.

Will my identity be protected?

I promise to protect your identity. I will not use your name in any research summaries to come out of this research and I will also make sure that any other details are disguised so that nobody will be able to identify you. I would like to ask your permission to record the interviews, but only my supervisor, I will have access to these recordings. Nobody else, including anybody at **IIE-Vega** (a brand of the Independent Institute of Education) will have access to your interview information. I would like to use quotes when I discuss the findings of the research, but I will not use any recognizable information in these quotes that can be linked to you.

What will happen to the information that participants provide?

Once I have finished all interviews, I will write summaries to be included in my research report, which is a requirement to complete my **Honours in Interior Design.** You may ask me to send you a summary of the research if you are interested in the final outcome of the study.

What happens if I have more questions about the study?

Please feel free to contact me or my supervisor should you have any questions or concerns about this research, or if there is anything you need to know before you decide whether or not to participate.

You should not agree to participate unless you are completely comfortable with the procedures followed.

My contact details are as follows:
Brenda Bianca Keevy
[redacted]

The contact details of my supervisor are as follows:
JD Eksteen
[redacted]

Participant or respondent consent

I, _____, agree to participate in the research conducted by **Brenda Bianca Keevy** about **Virtual Reality and Interior Design:** The opportunity and perceived value that virtual worlds may have for interior designers in the near future.

This research has been explained to me and I understand what participation in this research will involve. I understand that:

- I agree to be interviewed for this research.
- My confidentiality will be ensured. My name and personal details will be kept private.
- My participation in this research is voluntary and I have the right to withdraw from the research at any time. There will be no repercussions should I choose to withdraw from

the research.

- I may choose not to answer any of the questions that are asked during the research interview.
- I may be quoted directly when the research is published, but my identity will be protected.

Signature _____

Date _____

Appendix C

Concept Document

Project details:	**Research Concept Document**
Brenda Bianca Keevy	[redacted]
JD Eksteen	5 December 2022

Proposed Title:	
Title:	Virtual Reality and Interior Design: The opportunity and perceived value that virtual worlds may have for interior designers in the near future.

Research Details:	
Problem statement:	Virtual worlds have become more and more relevant these days, with more and more people are joining in on virtual platforms such as the metaverse, a demand for more virtual world designers can be predicted to grow. These huge waves of improving technology will not only affect our everyday technological lives, but in our artistic and creative lives as well. One of the biggest challenges within interior design industries is showing clients what the finished results will look like. This is where virtual reality becomes relevant, by using computer software and ever improving digital technologies designers can create 'real' simulated buildings, build entire cities, create communal spaces, the possibilities seem endless. Interior Design stands out as an essential element within the metaverse and other virtual worlds. Because virtual reality is such a universal technology, it can be applied into almost any industry. Interior designers can predict many perceived opportunities within the virtual worlds. The improvement of technology makes this possible. Combining interior design to the world of virtuality with a Design Thinking Approach (DT) will help in identifying the needs and wants of users, possibly creating opportunities for interior designers in the metaverse.
Purpose statement:	The purpose of this research is to qualitatively explore the application of virtual reality technology for interior design. Along with the dramatic improvements of digital technology, virtual information techniques that can be used within the interior design field. New three dimensional modelling technology and virtual reality may offer many advantages for digital interior design practice. The research for this article will be through conducted with an inductive approach

	by method of interviews and secondary data.
Research question/s:	The questions for this study will be as follows: 1. What is the opportunity and perceived value that virtual worlds may have for interior designers? 2. Can the presence of interior designers within virtual worlds improve the quality and experience for users?
Objectives:	The objectives for this study will be as follows: ● Gain a better understanding of the types of VR and 3D visualisation technologies that are available in virtual worlds. ● Explore how interior designers can use the technologies present in virtual worlds to create better design experiences for users and clients.
Research Rationale:	A gap has been identified for the purpose of this research study. Interior design within virtual reality has rarely been explored in depth with previous published literature. For this research study a deep dive into the evolutions of virtual worlds and how virtual reality could affect interior designers is done. Because virtual reality is such a universal technology, it can be applied to almost any industry. Interior designers can predict many perceived values and opportunities within the virtual worlds. Thus, VR can be used to improve processes across many industries. However, it is important to note that VR cannot simply replace reality, but rather be used as a tool within daily human experiences and functions. This research study will aim at gaining more insight within virtual reality and interior design.

Literature Overview:	
Key theories:	Design Thinking: Design thinking is a human-centric methodology that requires a multidisciplinary team and can be applied by regular, 'non-creative' individuals. Design thinking is considered a powerful approach in helping people envision new opportunities and become comfortable with uncertainty. Design thinking is a problem-solving approach. User experience (UX) design focuses on the user's experience of a specific platform, for example within the metaverse. This can include accessibility, usability, enjoyment, and the overall flow of the experience. UX design focuses on both on how we use digital tools and on how we inhabit digital spaces. UX Design Theory educates us as designers on how to build a community, communicate clearly, and set up effective systems as we design. (Spencer, 2019).
Seminal authors/ sources:	● **Jaron Lanier**, is identified as one of my seminal authors, he is the founder of virtual reality. ● **Louis Rosenberg** is a pioneer in the fields of VR, AR, and AI. In 1992 he developed the first interactive AR system (the Virtual Fixtures platform).

	● The term “metaverse” was first used in **Neil Stevenson**'s 1982 written novel, Snow Crash. Stevenson’s metaverse was a virtual place where characters could go to escape a dreary totalitarian reality. Neil Stevenson is a seminal author because he coined the term Metaverse. ● With the use of workplace computers in the early 1990s, user experience started to become a positive insight for designers. **Donald Norman**, a professor and researcher in design, usability, and cognitive science, coined the term "user experience," and brought it to a larger audience.		
Literature review themes:	<u>Theme 1</u> ● The development of virtual reality and virtual worlds. ● The concept of virtual worlds and the *Metaverse.*	<u>Theme 2</u> User experience design within virtual worlds.	<u>Theme 3</u> Interior design in the virtual worlds and applied Design Thinking.
Sources for themes:	- (Niel, P, 2022). - (Rosenberg, L. 2022). - (Dionisio, J. D. N., et al 2013). - (Matthieu, C. 2021) - (Burke, J. 2021). - (Ravenscraft, E. 2022.) - (Jingzhi, G and Zhiguo, G. 2011).	- (Spencer, J. 2019). - (Nick, D. 2018). - (Dumitru, A. 2021).	(Torabi, N. 2020). (Brown, T. 2008).
Key concepts:	<u>Key concepts to be identified and explored:</u> - Interior design - Virtual reality (VR) - Virtual worlds (VW) - Digital currency - Real world (RW) - Design thinking Theory (DTT) - User Experience Design (UXD)		

<u>Provisional Research Approach:</u>				
Paradigm:	<u>Paradigm</u> Interpretivisim with an inductive approach.	<u>Epistemology:</u> Intepretivist approach.	<u>Ontology:</u> Within a constructivist approach, the purpose of this study will be using	<u>Axiology:</u> The value of Interior design and the human experience.

			phenomena continually accomplished by researchers.	
Design approach:	An inductive, qualitative, cross sectional approach will be used for this study. An inductive approach involves beginning with a set of empirical observations, seeking connections and observations, and then theorising about these connections. The qualitative research relies on data obtained by the researcher from first-hand observation, interviews, questionnaires etc. For the purpose of this research interviews will be conducted in a cross-sectional approach because data will be collected from many different individuals at a single point in time.			

Provisional Research Plan:	
Population:	For the purpose of this study and to achieve a data saturation point three population groups have been identified and will be analysed: ● **Group 1:** Interior design specialists based in South Africa, with an undergraduate degree and are aged 30-35. This specific age group can be classified under the silent generation. ● **Group 2:** Virtual reality developers based in South Africa, with undergraduate and postgraduate degrees and are aged 28-34. This specific age group can be classified under the Y-generation. ● **Group 3:** Experienced user experience designers that are based in South Africa, with an undergraduate degree as well as 3 years minimum experience. The 5 individuals who will be interviewed will be as follows: - One virtual reality developer - Three interior design professionals - One experienced UX designer Main characteristics of the desired population: - Specialised interior designers with experience in virtual reality and 3D software will be the most desired population. - Individuals with a general interest in virtual reality and virtual worlds. - Individuals with a general interest in interior design - Individuals with knowledge of the virtual worlds.
Sampling:	A non-probability sampling method will be used, specifically convenience sampling. By using non-probability sampling the desired population is based on the researcher's subjective judgement rather than random selection. Convenience sampling will be used to interview individuals who are accessible within the proximity. The proximity has been identified as South Africa. Individuals will be recruited or scouted via the Linkedin social networking platform, from here the individuals will be contacted and a

	background of my study will be introduced. After individuals agree to participate an interview will be scheduled. The interview will take place either via Zoom or in person. By using Zoom as the primary interview platform participants do not need to physically commute and thus increases the likelihood of individuals agreeing and participating.
Data collection method(s):	Qualitative data will be collected through five in depth interviews conducted with individuals by method of open ended questions. See attached Appendix A the research instrument participant's questionnaire. Recording and accurately transcribing interviews is very important. The transcription software used to convert the audio into text is called Cockatoo. After the revised transcriptions of the interviews the data collected will be documented. Transcriptions will be analysed and links or connections will be identified. Gaps as well as concerns will be stated. Questions for the interviews will be approved by the designated supervisors. Secondary data collection methods will also be used to gain a better understanding, this will include data collected through analysing precedent studies.
Data analysis method(s):	The qualitative data will be analysed by means of an inductive approach. Through a qualitative analysis and interpretation, data will be transformed into findings. This transformation allows the researcher to be totally immersed in the data and help in identifying and describing the evident and dormant patterns of meaning emerging from the data. The goal of qualitative research is to gain an understanding of the subjective views and experiences of participants, but the processes of data analysis and interpretation are systematic and accurate. Eight steps in the process of qualitative thematic content analysis adapted from (Du Plooy-Cilliers, et al 2014:235-242).

Ethical consederations and limitations:	
Ethics:	Ethics are a matter of integrity on a personal level. In research, specifically, ethics are crucial, because they potentially affect all the stakeholders in research. A stakeholder is someone who has vested an interest in something. Stakeholders in this specific study will include; the researcher, the participants, the broader public, the academic institution (IIE-Vega), the community as well as the policy makers. Ethical Considerations for this research study will be as follows (Du Plooy-Cilliers 2014:264): - Informed consent - Collecting data from participants - Avoiding harm - Dealing with confidentiality - Dealing with anonymity - Avoiding Deception
Limitations:	Limitations can be described as constraints or limits within a research study that are out of the researchers control, such as time, financial resources,

	access to information, and so on. A limitation may cause the scope of the research to be redefined. Limitations may also surface due to shifts in conditions during the study. ‘Clearly identified limitations guide researchers in reporting of findings, and support the reliability and validity of research findings within the scope of a study’ (Du Plooy-Cilliers 2014:278). Limitations can be constraining, however, they are not signs of failure, just because the researcher does not have full control over every single condition within the scope of the study. The limitations within this study are acknowledged and demonstrate the researchers' awareness. By addressing these limitations researchers can contribute to the validity and reliability of the study. The following limitations have been identified as: ● Time restraints, there will be a limited amount of time available to complete this study. ● Accessibility limitations, gaining access to specialised industry professionals might be difficult to find in a South African context. ● Limitations may also surface due to shifts in conditions within the AR and VR worlds during the study. ● As the only researcher, I will be my own limitation in this study, I will need to remain objective when gathering and analysing data. ● As the only researcher for this study, my own limited knowledge and experience will be a limitation to consider.

Appendix D

Letter of Ethical Clearance

Date: *13 June 2022*
Student name: *Brenda Keevy*
Student number: [redacted]
Campus: *Pretoria*

Re: Approval of RESE8419/RMET8429 Proposal and Ethics Clearance

HONOURS/PGDip ETHICAL CLEARANCE LETTER

Your research proposal and the ethical implications of your proposed research topic were reviewed by your supervisor and the campus research panel, a subcommittee of The Independent Institute of Education's Research and Postgraduate Studies Committee.

Your research proposal posed no significant ethical concerns and your supporting documents and instruments are in order to proceed. We hereby provide you with permission to proceed with your research.

In the event of you deciding to change your research methodology in any way, kindly consult your supervisor to ensure all ethical considerations are adhered to and pose no risk to any participant or party involved. A revised ethical clearance letter will be issued.

We wish you all the best with your research!

GENERAL CONDITIONS TO BE FULFILLED IN RELATION TO RESEARCH

Permission is granted to proceed with the above study subject to the conditions listed below being met and may be withdrawn should any of these conditions be flouted.

Please note: The panel has not considered the merits, accuracy or ethical soundness of the research. The only merits examined are the use of The IIE as a sample.

Permission is granted subject to the following conditions:

1. The researcher(s) will need to obtain informed consent in writing from all of the participants in his/ her sample if the study is not anonymous.
2. The researcher(s) may only use the data collected for research purposes and in no other way.
3. Photographs of human subjects may only be taken if relevant to the research, informed consent was obtained, and even with informed consent, the photographs may not be published on any online platforms.

4. The researcher is responsible for supplying and utilising his/her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions and/or the offices visited for supplying such resources.
5. No names or identifying information of participants may be used within the research and the research must be voluntary.
6. Please make it clear that the information will not be used punitively in any way and participants may in no way be counselled/advised based on this.

Supervisor name: ***John Eksteen***

Signature: 

Campus Postgraduate Coordinator (CPC) name: ***Courtney Jade de Villiers***

Signature: 

Appendix E

Vega Ethics Checklist

Vega Ethics checklist: RESE8419/p/w

Student Details												
Title	Prof	☐	Dr	☐	Ms	✔	Mrs	☐	Mr	☐	Mx	☐
First name(s)	Brenda Bianca											
Last name(s)	Keevy											
Title of study	Interior Design											
Qualification	Honours											

Supervisor Details												
Title	Prof	☐	Dr	☐	Ms	☐	Mrs	☐	Mr	☐	Mx	☐
First and last names	JD Ekstern											

Co-supervisor Details (if applicable)												
Title	Prof	☐	Dr	☐	Ms	☐	Mrs	☐	Mr	☐	Mx	☐
First and last names	Riaan Hollenbach											

Explaining your research process						
Philosophical paradigm	Positivism	☐	Interpretivism	✔	Constructivism	☐
	Realism	☐	Objectivism	☐	Pragmatism	☐
	Functionalist	☐	Subjectivism	☐	Humanist	☐
	Other:					
Research design:	Interview	✔	Questionnaire (self administered)	✔	Focus group	✔
	Ethnography/ Observation	☐	Artefact analysis/website/ social media analysis	☐	Action Research	☐
	Case Study	☐	Design Research (Practice based)	☐		☐
	Other *(if so, state)*	☐				
Brief explanation of the population and number of participants/items	Group 1: Interior design specialists based in South Africa, with an undergraduate degree and are aged 30-35. This specific age group can be classified under the silent generation (three participants) Group 2: Virtual reality (VR) developers based in South Africa, with undergraduate and postgraduate degrees and are aged 28-34. This specific age group can be classified under the Y-generation (one participant). Group 3: Experienced user experience (UX) designers that are based in South Africa, with an undergraduate degree as well as three years minimum experience 9One participant).					
Target group sampling methods/artefact (No under 18's or vulnerable groups allowed)	Purposive		Random		Snowball	
	Convenient	✔	Stratified		Census	...
	Explain selection process		Click or tap here to enter text.			

Ethics		
Documentation submitted with proposal	Gatekeeper's letter (institutional consent)	✔

submitted with proposal	Completed Annexure E if you conduct research on IIE sites/students/staff	✔
	Instrument(s) (interview schedule or questionnaire)	✔
	Participant or respondent consent form	✔
	Audio-visual consent form (if applicable)	✔

Campus ethics committee recommendation

Proposal has been reviewed by the supervisor and necessary ethics considerations have been included.

Accepted as is and provide letter

Accepted with provisions: Nature of provision: e.g. Instrument is not sufficient / included and need to be signed off by the supervisor

Major issues: Student should not continue with fieldwork. Actions to be taken: Click or tap here to enter text.

Supervisor signature	
	Click or tap to enter a date.
Co-supervisor/Campus ethics panel member signature	
	Click or tap to enter a date.

Appendix F

Blurb for Self Administered Questionnaire

To whom it may concern,

I, **Brenda Bianca Keevy**, I am a student at **IIE-Vega** (a brand of the Independent Institute of Education). I am currently conducting research for my **Honours in Interior Design** in which I am investigating: **Virtual Reality and Interior Design:** The opportunity and perceived value that virtual worlds may have for interior designers in the near future.

Your inclusion in this study is completely voluntary;
If you do not wish to participate in this study, you have every right not to do so;
Even if you agree to participate in this study, you may withdraw at any time without having to provide an explanation for your decision.
Your participation will be anonymous.

The study has been approved by my supervisor and the IIE-campus ethics committee. I can be contacted at: [redacted] if you have any questions or concerns.

I hereby acknowledge and give my full consent to the participation in this study as stipulated above.

Signature _____

Date _____

Appendix G

Consent Form for Audio or Video Recording

Consent form for participants
I, _____, agree to allow **Brenda Bianca Keevy** to audio record my interviews as part of the research about **Virtual Reality and Interior Design:** The opportunity and perceived value that virtual worlds may have for interior designers in the near future. ● This research has been explained to me and I understand what participation in this research will involve. I understand that: ● My confidentiality will be ensured. My name and personal details will be kept private; ● The recordings will be stored in a password-protected file on the researcher's computer; and ● Only the researcher, the researcher's supervisor will have access to these recordings.
Signature _____
Date _____

Appendix H

Originality Report from Turnitin