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Department of Marketing, Operations and General Management

How the Implementation of Virtual Reality Technologies will Influence the Real Estate Market

Gonçalo Melo Ambrósio Silva Pinhão

Master in Marketing

Supervisor:

Prof. João Guerreiro, Assistant Professor, ISCTE-IUL Business School,
Department of Marketing Operation and General Management

October, 2022



**BUSINESS
SCHOOL**

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Abstract

Virtual Reality (VR) is a technology that has seen a growth in popularity over the last decade. Many industries have seen VR introduced into their processes, however, the introduction of VR in the real estate industry is still something very recent and that has gained some traction over these last few years. This study intends to clarify if, the introduction of VR in the real estate market will impact the intention to buy of potential home buyers by integrating the mediating role of telepresence, playfulness, usefulness, and perception of quality. Thus, this research explores the 226 potential home buyers that submitted themselves to two different questionnaires and utilizes the partial least squares structural equation in order to test the hypothesis. The results acquired appear to demonstrate that there is still some skepticism of potential home buyers in Portugal when it comes to implementing VR technology in their home buying process and that, they still prefer the current and most popular way of buying a house which is looking online at photos/videos of the homes they are interested in buying. It can also be seen that the increase of playfulness as a mediating factor is a promising investment that needs to be made in order to get the Portuguese consumers on board with the idea of implementing VR technology into their home buying process.

Keywords: real estate; virtual reality; telepresence; playfulness; usefulness; perception of quality; intent to buy.

JEL Classification System: Real Estate (R000); Marketing (M31); Technology (O300)

Resumo

A Realidade Virtual (RV) é uma tecnologia que tem tido um crescimento em popularidade na última década. Muitas indústrias viram a RV introduzida nos seus processos, no entanto, a introdução da RV no setor imobiliário ainda é algo muito recente e que ganhou força ao longo dos últimos anos. Este estudo pretende esclarecer se, a introdução da RV no mercado imobiliário terá impacto na intenção de compra dos potenciais compradores de casas, integrando o papel mediador da telepresença, grau de entretenimento, utilidade e perceção de qualidade. Deste modo, esta pesquisa explora os 226 potenciais compradores de imóveis que se submeteram a dois questionários diferentes e utiliza a técnica de equações estruturais baseada em partial-least squares para realizar este estudo. Os resultados adquiridos demonstram que ainda existe algum ceticismo dos potenciais compradores de casa em Portugal em relação à implementação da tecnologia RV no seu processo de compra de casa e que ainda preferem a forma atual e mais popular de comprar uma casa através da procura de fotografias/vídeos online das casas que estão interessados em comprar. Constata-se também que o aumento do grau de entretenimento do sistema é um fator mediador que poderá ser um investimento promissor que necessita de ser feito para que o consumidor português olhe de maneira diferente a ideia de implementar a tecnologia RV no seu processo de compra de casa.

Palavras-chave: mercado imobiliário; realidade virtual; telepresença; grau de entretenimento; utilidade; perceção de qualidade; intenção de compra.

JEL Sistema de Classificação: Mercado Imobiliário (R000); Marketing (M31); Tecnologia (O300)

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List of Acronyms

VR – Virtual Reality

AR – Augment Reality

CX – Customer Experience

TAM – Technology Acceptance Model

CRE – Commercial Real Estate

2D – Two Dimensions

3D – Three Dimensions

Q1 – Questionnaire 1

Q2 – Questionnaire 2

PLS - Partial Least Squares

MGA – Multi-Group Analysis

1. Introduction

Real estate has had a huge financial investment over recent years with over \$6.4 billion dollars in technological fundings since 2012 (CB Insights, 2018). Over the last few years, there has been an increase in the introduction of technological developments which also led to the increase of opportunities that different businesses from different industries have to implement experiential challenges. Recently, there has been a rise of the introduction of Virtual Reality (VR), which generates a virtual environment that is similar to a real-life experience, in different industries (Bruce, 2021). Xue et al. (2019) recently mentioned that with the world pandemic in 2020, real estate agencies shifted their approach towards the digitalization of houses using VR in order to facilitate house browsing. Consumers are becoming less skeptical to the introduction of disruptive technologies such as VR and Augmented Reality (AR), despite this, in purchases as large as properties, there still exists a large amount of skepticism when buying a house as it implies a large investment from the buyer himself. This can be seen through a study in 2019 which mentioned that only 20% of respondents mentioned that AR/VR would cause major disruptive changes in the development of real estate while 45% said the impact would be minimal. The rest said that there was a minimal chance of AR/VR having an impact Statista (2022). The real estate market has been hit by several crisis and the last one was the COVID-19 pandemic which led to a decrease of house prices and also a decrease of houses available on the market (Liu and Su, 2020; Tanrıvermiş, 2020).

The user/customer experience has been a topic of relevance over these last few years, companies (including real estate agencies) are more preoccupied with, not only the financial results of their businesses, but also with the joy and experience of the customer over the buying process as it tends to lead to a competitive advantage (Rawson et al., 2013). The real estate sector has shown to be a good industry to explore technological developments has there is a need to have a product equivalent to the experience, it can be said that they need to be accompanied by each other to provide. The introduction of VR in the buying process will create the need and opportunity for real estate agencies to provide relevant and ample information regarding the products (homes) they are offering. This can increase positive reactions from potential home buyers as they can see themselves in the house, they can interact in a different way than what they are used to.

However, as mentioned before, with the skepticism that still exists, there is the challenge to make sure that the experiences can be easy of use and actually improve the customer's perception of the houses they intend to buy.

This research will tackle all the issues and opportunities present with the implementation of VR in the real estate market with the influence of certain mediators such as telepresence, usefulness, playfulness, and perception of quality.

1.1 Relevance of the Topic

Today, with the increasing technological development, the way these new technologies are implemented has become a huge talking point as it needs to be done with prior research and experiences in order to better the customer experience and also their perception of the product. According to Calzadilla (2017), a large amount of home buyers tends to regret their investments due to the lack of information or the exhausting home buying process. These regrets can be eliminated with the implementation of a disruptive technology such as VR where the potential home buyers can access detailed information before they make their final decision. In recent years, there has been a boost in searches and interest for VR technology and its possible relation with real estate, according to Wang et al. (2018). Until then, the only research and interest demonstrated was when mentioning real estate and building design and the property construction process. Despite this growth in interest, the applications and effect that VR has on house transactions and intention to buy is still very unknown (Mukiri & Njeri, 2017). In short, the impact of VR in the real estate industry on the intention to buy has become a relevant topic to study as with the different changes that have occurred and will eventually occur in our world, it is of extreme importance to keep testing these new disruptive technologies not only to safeguard the future of real estate as we enter the new era of technology but also, to improve the buyer's experience as a whole which, as mentioned before, has become of great importance in the last few years. This topic is relevant because it helps real estate agencies understand if the introduction of VR in the buying process (and also, deciding which is the best way to introduce it) will lead to positive consequences in the user experience thus, increasing their profitability.

1.2 Problem Statement

This research has the objective of clarifying these same opportunities and challenges and to obtain a better understanding of the viability of this idea of implementing VR in the real estate industry. This topic began to gain more traction after the COVID-19 pandemic that affected the whole world and put it in a halt, creating shifts in marketing approaches and techniques (Sulaiman et al., 2020). Also, the conventional way of viewing a house is through physical representations of houses, 2D/3D plans on brochures or websites that market properties but as Andrew and Larceneux (2018) mention, that reduces the consumers capability of fully perceive the quality of the house and see themselves there. Because of this, it is believed that real estate is desperate for digital and technological innovation through the use of VR and AR to better the overall customer experience (CX), according to Elghaish et al. (2020). In order to achieve the goals set, it is important to understand if this technology can represent, in an adequate way, the real environment of a house.

Because of this it is important to also analyze the consumer behavior of potential home buyers when performing experiences with VR and AR to better understand what was said before and also, if there is any impact on intent to buy.

1.3 Research Purpose

The purpose of this study is to understand the viability of the introduction of VR in the real estate industry and the implications on the potential home buyers' intention to buy. This study proposes a research model which explains the mediating role of telepresence, usefulness, playfulness and perception of quality in the intent to buy real estate properties.

This study is distinguished from other existing literatures because of the fact that implements the mediator "perception of quality" which is not, yet a mediator studied in a great extent.

Thus, this research intends to explain and contribute to the VR application in real estate literature by introducing new variables and concepts to the ever-changing real estate industry.

1.4 Research Questions

1. To what extent is the relationship between the introduction of VR in real estate and the potential home buyer's intention to buy mediated by telepresence, usefulness, playfulness, and perception of quality?
2. How does the implementation of the VR technology in real estate impact the potential home buyer's intention to buy?

1.5 Research Outline

This master dissertation is composed by 6 main chapters.

The first chapter mentions the thesis topic, research problem, research purpose, and finally, the research questions that will be approached throughout this thesis.

The second chapter consists of the literature review of the topic where concepts of Real Estate, Virtual Reality, Telepresence, Playfulness, Usefulness, Perception of Quality are explained. Also, the concepts of the Technology Acceptance Model (TAM) and other different topics are briefly explored.

The chapter three is where the concept model of the research is presented and defined.

Chapter four defines the research methodology, including how the research was approached, how the data was collected and how the questionnaire was formulated. Information about the sample, the methods used to measure data, and the existing author scales.

Chapter 5 presents the results and the discussion of these same results, followed by tests that test the hypothesis validity.

Finally, chapter 6 presents the conclusions regarding research. More specifically, theoretical, and practical implications and the study's limitations and recommendations for future research.

2. Literature Review and Hypothesis Development

2.1 Real Estate

2.1.1 Concept

According to Brodeur et al. (2020), real estate is a web full of complexity where different parties such as investors, banks, households, and developers are interconnected. Real estate is the biggest form of capital stock there is, which makes the definition of what impacts it, a job of extreme importance (Ibeas et al.,2012). According to several authors, many factors have consequences on the real estate market and its prices. The real estate market is affected by the Veblen effect (Brzezicka & Kobylńska, 2021) which occurs when the demand for a certain product is increased only because the price increases as well (Creedy & Slottje, 1991). The buyer's perception of a property has changed over the last few years, as Brzezicka and Kobylńska (2021, p. 98) mention, "(..) The purchase and possession of property is a manifestation of the buyer's material status. These trends are influenced by changes in the perception of housing as a luxury good that is not affordable to everyone, despite the fact that housing is an essential commodity that meets the basic human need for shelter.". Also, according to Brzezicka & Kobylńska (2021), the Veblen effect applies to the real estate market as premium locations and houses with several high-end amenities and features have had an increase in demand, especially among buyers with high purchase power. Tomal (2021) also explained that what was mentioned above can create the Veblen price where better and higher-end locations with high demand will increase the prices of such locations and consequently, the houses in these same places. Also, accessibility is a key factor as the increase in prices in real estate has been a consequence of the increase in accessibility via roads, transportation, and others, according to Frago Januário et al., (2021). Bohman and Nilsson (2016) explain that the type of house the client is looking for, either a luxury house or a house that medium-income families look for, implies a change of necessities in terms of accessibility. They concluded that buyers interested in luxurious properties are more likely to be less affected by the lack of transportation methods while the complete opposite occurs with less luxurious properties. According to Holl (2004), the construction of motorways and thus, the increase of accessibility, especially in Portugal during the 1980s and 1990s led to an increase in the attractiveness of the locations studied.

2.1.2 Consumer Behavior in Real Estate

Consumer behavior is the study of the “acquisition, consumption and disposition of products, services, time and ideas by decision-making units” Jacoby (1975, p. 320). According to Gibling and Nelson (2003, p.63), “most real estate studies are based on neoclassical economic theory that assumes that people make rational decisions about renting and buying real estate as part of their attempt to maximize utility”. They also state that consumers are influenced by forces, either external or internal and that a final decision is made by the preference or taste of the consumer himself as every single human has a different mindset, which always makes the creation of a consumer behavior pattern hard and unpredictable. Real estate purchases involve a very high level of complex decision-making. This decision-making process is affected by several factors like (Grum & Kopal Grum, 2015) explain. They mention three different decision-making factors that influence the decision-making process. The first is the Personality of the consumer. A personality is the “overall pattern of our mental, behavioral and physical characteristics by which each of us differs from others” according to Musek (2010, p. 10). According to (Musek, 2010), this is the biggest factor as personality traits influence individual behavior. This is due to the fact that personality traits, once formed, do not change easily. Because of this, it is important to take a deep dive into the 5 Big Personality Traits. One of the Personality Traits is Extraversion where the person has a tendency to buy impulsively as he or she is a heavy user of the internet or even has a social media addiction (Blackwell et al., 2017; Kuss & Griffiths, 2011). The second personality trait that can be mentioned is neuroticism which when a person has a feeling of guilt, depression, anxiety, and pessimism. Agreeableness occurs when a person cooperates with others during a conflict. Conscientiousness occurs when a person has a tendency of planning and to seek high goals. Finally, the last personality trait is openness to experience which occurs when a person is willing or open to change (Mark & Ganzach, 2022). There is also the motivation to buy, which is the psychological process that is associated with the feelings, behavior, perceptions, and beliefs which lead a consumer towards a particular goal (Petri & Govern, 2013). It can also be said that the motivation to buy directly influences the intensity and persistence of the customer to achieve their goal which is to buy a certain product (Petri & Govern, 2013). They also mention that motivation is also a huge part of consumer behavior as it leads to the stimulation of consumers to identify and acquire certain products.

The third key factor is Emotion which, according to (Kobal Grum & Seničar, 2014), is the mental process and state that humans use to reflect their human values to the world. Feelings adjust to the environment the person is inserted in and act as a motive to do specific actions that create positive feelings. According to Grum & Kobal Grum (2015), people evaluate situations and attribute them a certain emotional value which makes feelings an evaluation of an object or person.

2.1.3 Real Estate Industry during and after COVID-19

The COVID-19 or Corona Virus started spreading in Wuhan in January 2020. The World Health Organization soon after declared this virus a pandemic as it had spread all over the world (Sun et al., 2020). This virus is hurting the CRE (Commercial Real Estate Market) market as everyone is trying to find the best strategy for paying rents and mortgage relief as the whole economy went into a worldwide halt (Ling, Wang & Zhou, 2020). Studies have proven that real estate sales would keep rising as they have been in the past decade, but it is clear to see the impact that this virus has had on the real estate market as a whole (Nicola et al., 2020). House sales drastically decreased in March 2020 compared to previous years, according to Tanrıvermiş (2020). This has increased poverty due to the higher fiscal capacity of governments and the fact that income per capita has decreased (Bonaccorsi et al., 2020). Virus outbreaks tend to lead to a decrease in prices as it has been seen with past virus outbreaks such as the SARS outbreak, Wong (2008) analyzed the decrease of prices during that time in Hong Kong and came to the conclusion that there was an average decrease of 1% to 3%. Also, Liu and Su (2020) analyzed where the decrease in prices was more intense and came to the conclusion that it occurred in more densely populated neighborhoods which can be explained due to the introduction of the concept of working from home which diminishes the need to find a house near the place of work. According to Statista (2022), half of the surveyed real estate professionals involved in real estate transactions saw a decrease in revenue compared to the years before the pandemic began. Statista (2021) also mentioned that despite the fact that the prices rose, the rents diminished on both an annual and a five-year basis in the third quarter of 2020 in the United Kingdom. Brokers are expanding their house tours to online tours via Skype and FaceTime by offering a preregistration alternative in order to keep the virus from spreading in the United States (Kaufman, 2022). Also, thousands of workers have been laid-off and consequently, lost their financial ability to pay rent, mortgage, or various household expenditures (Nicola et al., 2020). Because of the recent pandemic, virtual reality gained a lot

of traction in the Real Estate industry due to agencies digitalizing homes and using this virtual reality technology to facilitate house browsing through the creation of 3D tours (Xue et al., 2019).

2.2 Virtual Reality

2.2.1 Concept

Virtual Reality (VR) is “the environment in which the participant-observer is totally immersed in a completely synthetic world, which may or may not mimic the properties of a real-world environment.” Loureiro et al. (2019). In the early 2000s, VR gained traction as one of the most advanced technologies in the world mainly in retail and online shopping where it could help improve the customer experience (Pantano, 2015). VR technology has improved the customer-brand relationship since its introduction in the purchase process (Muller Queiroz et al., 2018). Many applications of VR have been studied throughout the years besides the introduction of VR in the real estate industry. Surgical simulation training is one of them, as (Ota et al., 1995) mention, the introduction of virtual reality technology in the process of training doctors to perform surgeries has developed their competence with no risk involved. Another application is also the assessment and rehabilitation of behavioral and neurological disorders, for example, (Strickland, 1996) explains the use of VR technology as a safe option to provide a learning environment for children with autism. This environment will allow them to experience a controlled distortion of the environment in order to improve the process. VR has also been proven to desensitize the fear of heights and other phobias or mental health problems, according to Martens et al. (2019). (Riva, 1997) researched that an immersive virtual reality environment would also improve body dysmorphia and other related conditions. Another application of VR is in cases of diagnosis, therapy, and rehabilitation of physical disabilities. (Kuhlen & Dohle, 1995) mentioned that virtual reality can benefit patients who suffer from motion disturbances and can improve the analysis and diagnosis of said disturbances. With the growth of technology at the beginning of this century, other non-medical uses have been given to this VR technology such as the implementation of VR in real estate.

2.2.2 The Role of Mental Imagery and Telepresence in the Use of Virtual Reality

The process of mental imagery is defined by MacInnis and Price (1987) as “a process [...] by which [...] sensory information is represented in working memory”. Mental imagery is a state that resembles the sense of visualizing an object, scene, or event that is not present nor happening at that exact time. According to Schifferstein (2009, p. 372), it is “an internally generated representation of an object, scene, or event” and the ability to imagine, to generate mental images that reflect products and experiences, is an essential skill during customer decision-making according to Pearson et al. (2015). According to Steuer (1992, p. 75), “VR facilitates the process of mental imagery. When pictures of destinations are presented in VR, rather than in a traditional 2D format, a feeling of being present at the destinations will increase (i.e., telepresence) and envisioning a trip to the destinations will evolve (i.e., mental imagery)”. The comparison of pictures in 2D and pictures in VR has been a common topic that has helped many decide which type is the best to better engage with the consumer. The feeling of being present somewhere where the consumer is actually not (i.e., telepresence) has gotten a better response from consumers as Hyun and O’Keefe (2012) mention. They also mention that telepresence is a critical mediator in the creation of mental images when shopping online.

The prior experience of a consumer with a certain product can also influence his or her future interactions with the product. It can also happen that when a consumer who is knowledgeable regarding the product, maybe distracted on the product itself and more on the experience, this will lead to the mental imagery not being accurate according to Buehler & McFarland (2001). They also mention that in-experienced consumers will be more influenced by the introduction of VR in their purchase process. It is said that mental imagery is divided into two different stages as Pearson (2015) and several other author’s mention. The first stage is imagery generation and the second is imagery transformation. Imagery generation needs to be maintained once it is obtained because these images can disappear in a fast fashion. Mental imagery can be quickly perceived in a different way and has a “rapid decay with an average duration of only 250 ms”, according to Pearson et al. (2013). Imagery transformation is a process where there is a transformation of a previously generated image. It “allows customers to transform (e.g., rotate) digital content, which in turn assists visual imagery processes during decision making.” according to Heller et al. (2019). A great example of this is IKEA’s Place App where customers can place, rotate, and resize furniture in their room to get a better understanding of how several options would fit their needs.

2.2.2.1 Telepresence

The term “experiential presence” or “telepresence” is “a mental state in which a user feels physically present within the computer-mediated environment.” Draper et al. (1998, p.40) highlights the common sense that presence is related to the feeling of being in a place other than the physical one, a place/world generated by virtual reality technology. Hollebeek et al. (2020) mention the importance of telepresence in order to gain an in-depth understanding of how it influences the behavioral intention of the user performing the experience. According to Biocca et al. (1995), presence is a user's subjective sensation when using virtual reality technology. It has been proven by several studies that virtual reality has a positive correlation with the increase in buying intentions, involvement, and enjoyment (Draper et al., 1998; Kim & Biocca, 1997). Pejić et al. (2017) also studied this concept by creating a VR and AR environment of house interiors and architectural projects where the user, with the usage of VR technology, could observe a 360° model of the house. They reached the conclusion that these applications were very positive with or without prior experience using VR/AR technologies. They also mentioned that it gives a better understanding of the space itself as the user can choose from which point of view, they wish to see the house. Studies have shown that there is a positive correlation between telepresence and product knowledge.

2.2.2.2 Perception of Quality

“Perceived Quality” is defined as a judgmental evaluation of, in the context of this research, a certain object, product, or service. It has been shown that system quality will lead to an increase in the customer's intention to buy and even repeat this same intention due to the fact that customers will buy products from sellers that provide a certain level of quality, satisfaction, and maximum value (Gupta & Kim, 2007). It has been generally agreed that the perception of the quality of a certain service is a cognitive response to this same service (Petrick, 2004). This service quality has also proved to be a key factor to form and increase customer purchase intentions (Taylor & Booker, 1994). It has been proven that interactivity can improve the system quality and the perceived quality of the user’s experience as mentioned by Klein (2003). This author also mentions that by enabling the user to zoom, change the point of view and rotate on a real-time basis, the experience itself becomes more effective and efficient. According to Tussyadiah et al. (2018), the sense of being present will be directly involved with

the increase of the intention to buy. If the perception of quality is higher, then the intention to buy will also be higher.

2.2.2.3 Usefulness

Perceived Ease of Use is defined as “the degree to which a person believes that using a particular system would be free of effort” according to Davis (1989, p. 320) while Perceived Usefulness is “the degree to which a person believes that using a particular system would enhance his or her job performance”, also according to Davis (1989, p. 320). Perceived quality in VR has related to the system quality of the technology used and it is a “system wherein the desired characteristics of both mobile devices and web browsing services are believed to be available to users” according to Chen (2013, p.27). The quality of the VR system will impact the user's response which means that there is a powerful correlation between VR quality and the user's response and experience (Kim & Hyun, 2016). Studies have proven the existence of a strong correlation between system quality, information quality, service quality, and the telepresence of the software based on the Technology Acceptance Model (Davis et al., 1989). Also, it has been proven that telepresence has a positive influence on purchase intention, especially on millennials (Willems et al., 2019). According to this study, customers or potential buyers increase their will to visit the location they have just seen. What was mentioned before can also be described as a behavioral intention which is “the degree to which a person has formulated conscious plans to perform or not perform some specified future behavior” according to Warshaw & Davis (1985). All these factors will have an impact on the introduction of VR not only in the real estate industry but also in retail as a whole, as many authors mentioned above proved. Due to the research mentioned above, the following hypothesis was formulated:

H1: Usefulness has a positive effect on perception of quality in a real estate environment

2.2.2.4 Playfulness

According to Alatalo et al. (2018), playfulness is defined as a key factor in order to better understand online retail. It represents an experience, felt by the users, that is short and focused only on the interaction with the experience and that provides enjoyment (Ben Mimoun et al., 2017; Han et al., 2020). Users can interact with a certain retailing website and become absorbed

in the environment and lose track of time, leading to a more pleasurable experience and an increase in the intention to buy (Mathwick et al., 2001). Kang et al. (2020) define “playfulness” as “a stimulus-driven perception, a shopping environment that provides enjoyment, entertainment, and escapism to perceivers”. Telepresence is a factor that influences the level of playfulness and as that happens, the user’s attitude toward a product becomes more positive (Klein, 2003; Oum & Han, 2011). Also, previous studies have mentioned that playfulness can become a key factor in the increase of product interest, user acceptance, and intent to buy (Ahn et al., 2007; Kim et al., 2018). This will lead to the formulation of the following hypothesis:

H2: Telepresence has a positive effect on playfulness in a real estate environment

H3: Perception of quality has a positive effect on the intent to buy in a real estate environment

H4: Playfulness has a positive effect on the intent to buy in a real estate environment

2.3 Virtual Reality as a Tool for Retail

Since the beginning of the century, new technological advancements have been made in order to keep up with the market trends, stores would slowly integrate self-service technologies into the retail process, such as self-scanning and self-checkout (Demoulin & Djelassi, 2016). “It has been proven that technology benefits both consumers and businesses, which ultimately influences the business profitability” according to Inman & Nikolova (2017). Retailers have noticed the necessity to integrate VR technology into their buying processes and that is why both the fashion and apparel industries have been so keen on this technology lately, this has been proven to enhance the overall customer experience and therefore, their competitive advantage, according to Pantano (2016). Then came the introduction of modern payment solutions such as Apple and Samsung Pay, digital wallets that would be crucial to link all the user's bank accounts to their own phone (Taylor, 2016). Then VR and AR started emerging and were labeled as disruptive technology (Rosedale, 2017). These new technologies have been useful in the gaming, retail, and real estate business and it has been found to create a sense of engagement in the users themselves to play, buy or visit the product that they are seeing (Jung et al., 2017). According to Zheng (2016), several retailers such as Alibaba and Carrefour are exploring VR as an opportunity to increase the experience of online shoppers all over the world.

“According to Alibaba, the lab's first project is to establish the world's largest three-dimensional (3D) commodity warehouse. The company's engineers have already created VR visuals for hundreds of products, and a standardization tool is expected to be developed for merchants to swiftly accomplish 3D modeling for their products.” according to Zheng (2016). This is due to the fact that VR has been considered to be one of the most innovative and promising new technologies to come up in the last decade in the business sector (Gartner, 2016). As mentioned by Pantano (2016) before, fashion retailers have been very interested in VR technology and Young (2016) corroborates it by mentioning that the introduction of this technology by retailers has led to a more memorable and innovative experience as a whole, for both in-store and at-home consumers. Li & Meshkova (2013) mentioned that if VR realism is increased there is a better chance that consumer behavior will be more consistent than it would be in a physical store. Studies have proven that is a need for retailers to invest in both VR and AR in order to increase their competitiveness by gradually teaching and educating potential users about this new tool and all its relevant information such as training the staff and the application of marketing strategies such as in-store posters and signs (Lee et al., 2012). A study conducted by Statista (2022) concluded that over 90% of Gen Z respondents, 90% of millennial respondents, and more than 85% of Gen X said that they would be willing to see how furniture or home decoration would look in a home. It is also estimated that the market value of virtual reality will be around 250 billion dollars by 2028 (in 2021, the market value was around 27 billion dollars), according to Statista (2022). Despite all the upsides, there is still a lot of skepticism from the customer's side as they do not feel as safe because of the possibility of the feeling that companies are obtaining too much information from them (Aguirre et al. 2015).

2.4 Customer Experience with Virtual Reality

Customer Experience is defined as “every aspect of a company’s offering - the quality of customer care, of course, but also advertising, packaging, product and service features, ease of use, and reliability.”, according to Meyer & Schwager (2007). Lemon and Verhoef (2016) also define customer experience as the “customer’s cognitive, emotional, behavioral, sensorial, and social responses to a firm’s offerings during the customer’s entire purchase journey”. Studies have proven the virtual experience of a particular product can improve the customers’ intent to buy and attitude toward the brand (Klein, 2003). (Loureiro et al., 2019) explain that over the last few years there has been an increase in research regarding the use of VR in marketing and the impact it has on customer experience. Hollebeek et al. (2020) mentioned that the

introduction of VR in the customer's journey can significantly benefit the overall experience of the customer and the relationship with the brand. This can be proven with an example that has been given before, Willems et al. (2019) demonstrated that VR would have a bigger impact on the customer experience and their purchase intentions. What was mentioned above has to be taken into consideration as there are not many studies on how this new technology will impact the users' behavioral emotions and their perception of quality, as stated by Suh & Prophet (2018). Because VR has had a very recent emergence into the spotlight, there is not a lot of consumer feedback and input, thus the perception quality needs to be understood in order to fully realize what can be done to improve the consumers' perception and intention to buy.

2.5 The Usage of Virtual Reality in Real Estate

These same authors also mention the term “telepresence” which is a key factor in why virtual reality exists and as efficient as it creates an experience with a greater sense of presence. According to Lee et al, (2013), VR is a form of immersive technology that creates a blur between different worlds (physical, virtual, and simulated). According to McGrady (2015), with the introduction of virtual reality in the purchase process of customers in real estate, homes sold 87% faster than normal. Also, VR has proven that it can create positive attitudes towards a certain product and consequently, improve the buying intention of potential consumers, according to Bleize & Antheunis (2019). The question that arises is the technological barriers that exist when people think about creating a 3D model of the house that can be used in virtual reality. In recent years, the advancement in technologies has become fewer which has made creating these models an easier task, according to Matterport (2021). According to Pagano et al. (2020), in order to create a “virtual tour” of a certain property, many factors need to be analyzed such as storytelling (ex: it must show images and videos that will match the expectations of the client once he or she visits the property in person), engagement (ex: it must contain the right content in the right place and time to keep users engaged), user-experience (ex: user-friendly interface) and accessibility (ex: the tour should be available in every platform so that everyone can access it). According to (Deaky & Parv, 2018), 360-degree VR has become more suitable for showing existing properties instead of new ones and is also much cheaper to create and develop and offers a complete experience for the user. Also, potential buyers, when using virtual reality when they are seeing a house, can shift between different environments, lights, and moods, giving them a more accurate view of all the alternatives as Wang, K., & Hu, Z. (2009) mention. Wang, K., & Hu, Z. (2009) also mentions that by using

virtual reality technology, not only can potential buyers see specific things inside the house, but they can also see the surroundings, either the neighborhood, the residential environment, or other prominent factors that are very important when buying a house. Recently, it has been proven that Augmented Reality (AR) and Virtual Reality (VR) will benefit the experience of buying a house for a potential buyer and can create great timesaving for both realtors and buyers (Sihi, 2018). Also, Juan et al., 2018, have mentioned that VR creates a positive difference in the buyer's intention when visualizing a project under construction. There is evidence that VR can have a negative effect on purchasing intentions but, it only occurs when the buyer is considered to have a high level of emotional-based involvement or a high-economical transaction involved (Jørgensen, 2015). Current studies are currently promoting the application of VR in the real estate industry in Malaysia, and it has shown that it can reduce the costs of staging and doing open houses and show houses and also improve the marketing strategy of realtor companies. Willems et al. (2019) compared 2D pictures with 360° degree VR. They concluded that the sample that used the virtual reality technology had a positive impact on the user's sensation of being present and intention to buy.

H5: Stronger effects will occur in the results of the above hypothesis (H1-H4) among the people who viewed a VR environment than those that viewed a video environment.

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3. Research Model

According to all the information collected in the literature review and the proposed hypothesis, the following research model was developed.

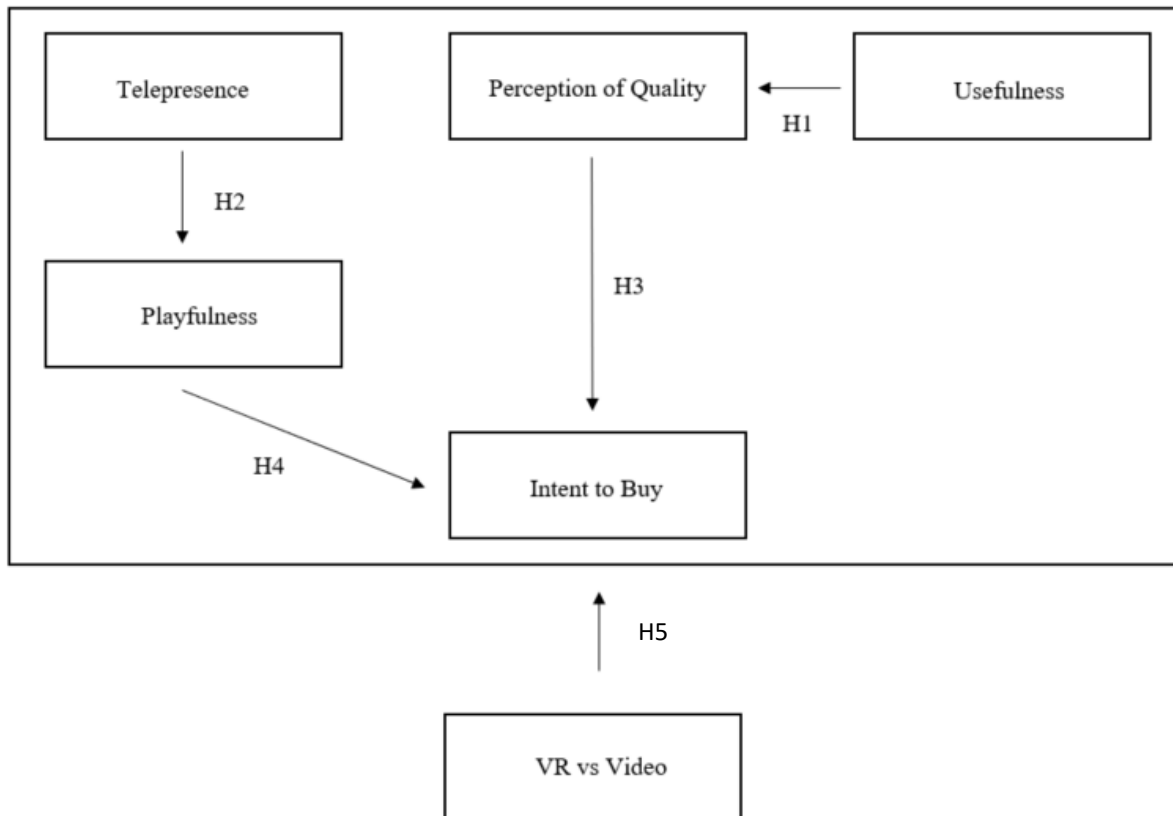


Figure 1 – Concept Model

This model illustrates all the potential relationships between variables that mediate the relationship between the use of VR and the purchase intention of a customer. This model has the objective to investigate and analyze the impact of VR technology on the buying process of a house and the implications on the customer's purchasing intentions through the use of variables such as telepresence, perception of quality, usefulness, and playfulness.

4. Methodology

4.1 Research Approach

The goal of this research is to understand better the impact of VR in the real estate buying process. In order to do this, several hypotheses have been formulated in order to test the effectiveness of this technological advancement in real estate. Not only this but to see if the overall experience of the consumer when going through the purchase process will also improve. A survey was conducted in order to determine the public's reaction to this innovation. The purpose of this research is to see if real estate agencies can invest in these types of technologies and come out on top with profits and positive consumer reviews of the experience.

4.2 Sample and Data Collection

4.2.1 Questionnaire Development

These questionnaires were developed using Google Forms Software and its purpose is to test the model using two different types of approaches to the purchase process of buying a house (looking at pictures vs looking at the house through VR glasses). Because of this, two different questionnaires were designed. The sample was acquired by using the method of convenience sampling which, according to Simkus (2022) is “a method of non-probability sampling where researchers will choose their sample based solely on the convenience.”. In other words, it means that the sample was chosen instead of randomly obtained because of the easiness of obtaining data due to geographic distributions, personal relationships, and other factors.

The first questionnaire (Q1) was related to the impact of watching pictures of a certain house (by viewing a 3-minute video with the pictures on it) on the user's experience and intent to buy while the second questionnaire (Q2) was done with the performance of a VR experience using VR glasses where the users would explore the same house for 3 minutes and then answer the survey questions based on what they experienced. The questionnaires and experiments were done only in Portuguese as the target audience was Portuguese, and the time frame where responses were accepted was between May 30th, 2022, and July 23rd, 2022. Also, this experience has been conducted in a within-subjects design as the respondents were divided into two different questionnaires.

The questionnaire was divided through the demographics of the sample, such as age, gender, total family income (monthly), and professional situation. Then the several variables that are meant to be tested and, in the end, users would answer several general questions regarding their consumer habits and views on VR where the questions asked evaluated their perception of VR nowadays and their online habits, such as their trust in online purchases. The variables that were dividing the questionnaire were the experience itself, how they felt when seeing it and if they were required to perform any physical activity. The next section mentioned telepresence and if the users would feel this same variable when viewing the video or using the VR glasses. After that, the variable tested was usefulness which explores the usefulness of both experiences and how they affect the efficiency of the buying process. Next up, the perception of quality was the variable studied where several questions regarding the impact of the quality of the video or the quality of VR experience were tested. The second to last variable was playfulness where the questions were meant to evaluate how enjoyable both experiences were to the user. In the end, the last variable, intent to buy was studied and the questions asked were meant to understand the buying intentions of users after completing the experience.

4.2.2 Data Measurement and Scales

The scales used in the questionnaire mentioned above were designed and developed based on the scales found in the literature review. The following exhibit (table 1) demonstrates the number of items each scale associates with each variable and the respective author.

Variable	Scales's Author	N° of Items
VR Experience	Brakus et al., 2009	12
Telepresence	Brengman et al., 2022	6
Usefulness	Juan et al., 2018	7
Perception of Quality	Lee et al., 2020	5
Playfulness	Kim et al., 2020	4
Intent to Buy	Kim et al., 2018	4

Table 1 - Scales of authors and number of items

4.2.3 Sample

The objective of this research is to understand if Portuguese potential house buyers are influenced by the introduction of VR in the buying process. As mentioned before, this is a convenience sample where the link to the questionnaire was shared through different social media channels and people close to the experience which created a snowball effect on the sample.

The sample has 226 respondents, divided into two different questionnaires. Q1 had a total of 121 respondents and Q2 had a total of 105 respondents. Among the totality of the respondents, 45.58% are Male and 54.42% are Female. Regarding the age of the respondents in the total sample, 3.5% are younger than 18 years of age, 46.5% have between 18 and 29, 25.2% have between 30 and 49, 23% have between 50 and 65, and, finally, 1.8% have 65 or more. The education level of the respondents was the following: 1.7% completed the 9th grade, 7.5% completed the 12th grade, 53.5% completed a bachelor's degree, 30.7% completed a Master's degree, and 6.6% completed a Ph.D. degree. Regarding the income, 6.6% earned less than 1000 euros per month, 24.8% earned between 1001 and 2500 euros, 42.9% earned between 25001 and 50000 euros, and 25.7% earned more than 50000 euros. The last demographic studied was the current profession of the respondents where 1.3% were unemployed, 24.3% were students, 12.8% were student-workers, 57.1% were full-time employees, 0.9% were part-time employees, and 0.9% were retired. The demographic information presented above is detailed in Table 2.

N=226	Demographic	%
Gender	Male	45.6
	Female	54.4
Age	< 18	3.5
	18-29	46.5
	30-49	25.2
	50-65	23.0
	65 +	1.8
Education	9th Grade	1.7
	12th Grade	7.5
	Bachelor's Degree	53.5
	Master's Degree	30.7
	PhD Degree	6.6
Income	< 1000	6.6
	1001-2500	24.8
	2501-5000	42.9
	> 5000	25.7
Profession	Unemployed	1.3
	Student	24.3
	Student-worker	12.8
	Full-Time Employee	57.2
	Part-Time Employee	0.9
	Retired	3.6

Table 2 - Total Questionnaire 1 and 2 Demographics

Regarding Q1, the percentage of male respondents is 40.5% while the percentage of female respondents is 59.5%. 3.3% of respondents have less than 18 years of age, 57% have between 18 and 29, 10.7% have between 30 and 49, 28.1% have between 50 and 65, and 0.9% have more than 65. Regarding the education level of respondents, 1.7% have completed the 9th grade, 9.1% have completed the 12th grade, 51.2% have completed a Bachelor's degree, 29.8% have completed a Master's degree, and 8.2% have completed a Ph.D. degree. Regarding the monthly income levels, 9.1% earn less than 1000 euros, 27.3% earn between 1001 and 2500 euros, 41.3% earn between 2501 and 5000 euros, and 22.3% earn more than 5000 euros. Finally, the last demographic analyzed was the professional status where 0.8% are

unemployed, 32.2% are students, 16.5% are student-workers, 46.3% are full-time employees, 0.8% are part-time employees, and 3.3% are retired. Q2 has a percentage of Male respondents of 51.4% and Female respondents of 48.6%. where 3.8% have less than 18 years, 34.3% have between 18 and 29, 41.9% have between 30 and 49, 17.1% have between 50 and 65, and 2.9% have more than 65 years of age. Regarding the levels of education, 2% have completed the 9th grade, 5.7% have completed the 12th grade, 56.2% have completed a bachelor's degree, 31.4% have completed a Master's degree, and 4.8% have completed a P.h.D degree. In terms of monthly income levels, 3.8% earn less than 1000 euros, 21.9% earn between 1001 and 2500 euros, 44.8% earn between 2501 and 5000 euros, and 29.5% earn more than 5000 euros. Finally, the last demographic analyzed was the professional status where 1.9% are unemployed, 15.2% are students, 8.6% are student-workers, 69.5% are full-time employees, 1% are part-time employees, and 3.8% are retired. The full demographic information can be found below in tables 3 and 4.

N=121	Demographic	%
Gender	Male	40.5
	Female	59.5
Age	< 18	3.3
	18-29	57.0
	30-49	10.7
	50-65	28.1
	65 +	0.9
Education	9th Grade	1.7
	12th Grade	9.1
	Bachelor's Degree	52.1
	Master's Degree	29.8
	PhD Degree	8.2
Income	< 1000	9.1
	1001-2500	27.3
	2501-5000	41.3
	> 5000	22.2
Profession	Unemployed	0.8
	Student	32.2
	Student-worker	16.5
	Full-Time Employee	46.3
	Part-Time Employee	0.8
	Retired	3.3

Table 3 - Questionnaire 1 Demographics

N=105	Demographic	%
Gender	Male	51.4
	Female	48.6
Age	< 18	3.8
	18-29	34.3
	30-49	41.9
	50-65	17.1
	65 +	2.9
Education	9th Grade	2.0
	12th Grade	5.7
	Bachelor's Degree	56.2
	Master's Degree	31.4
	PhD Degree	4.8
Income	< 1000	3.8
	1001-2500	21.9
	2501-5000	44.8
	> 5000	29.5
Profession	Unemployed	1.9
	Student	15.2
	Student-worker	8.6
	Full-Time Employee	69.5
	Part-Time Employee	1.0
	Retired	3.8

Table 4 - Questionnaire 2 Demographics

5. Results and Discussion

The analysis of the following results from the use of a partial least squares path modeling (PLS-SEM) with the help of the SmartPLS 3 software to help test the model. It can be considered that the use of PLS-SEM will lead to a more effective analysis that will provide a better understanding of cause-and-effect relationships among all constructs (Sarstedt et al., 2014). Several tests will be conducted using this software such as PLS Algorithm, MGA analysis, and bootstrapping.

5.1 Measurement Model

This research will consider three tests (convergent validity, internal consistency reliability, and discriminant validity) in order to evaluate and validate the measurement model (all results can be found in table 5). The outer loadings presented some values below the required 0.7 and are statistically significant ($p < 0.001$) which led to the consequent deletion of the indicators which proved to increase the composite reliability. The indicators removed were T3 from Telepresence, U7 from Usefulness, and P2 from Playfulness. Regarding the Cronbach's alphas and Composite Reliability, all indicators are higher than the required 0.7. The Average Variance Extracted has to be higher than 0.5 and it can be confirmed that all indicators meet these requirements. When determining the Discriminant Validity, it is possible to analyze that the Fornell-Larcker criterion and HTMT ratios are all within the required recommendations (Table 6). Also, all the indicators present in Collinearity Statistics (VIF) with values below 10, which meets the requirements.

	Intention to Buy	Perception of Quality	Playfulness	Telepresence	Usefulness
Intention to Buy	0.940				
Perception of Quality	0.617 (0.65)	0.800			
Playfulness	0.748 (0.80)	0.742 (0.83)	0.925		
Telepresence	0.768 (0.81)	0.607 (0.642)	0.745 (0.80)	0.895	
Usefulness	0.595 (0.66)	0.738 (0.848)	0.683 (0.78)	0.626 (0.70)	0.743

Note: HTMT ratios are in parentheses. The diagonal elements in bold are the square roots of the variance between the constructs and their measures (AVE).

Table 5 - Fornell-Larcker criterion and HTMT ratios

Constructs	Items	Outer Loadings	Cronbach's α	CR	AVE
Telepresence	T1	0.947	0.937	0.952	0.801
	T2	0.940			
	T4	0.898			
	T5	0.906			
	T6Inv	0.772			
Usefulness	U1	0.774	0.838	0.881	0.553
	U2	0.813			
	U3	0.711			
	U4	0.749			
	U5	0.715			
	U6	0.693			
Playfulness	P1	0.911	0.916	0.947	0.856
	P3	0.947			
	P4	0.918			
Perception of Quality	Q1	0.867	0.859	0.968	0.883
	Q2	0.912			
	Q3	0.714			
	Q4	0.719			
	Q5	0.767			
Intent to Buy	C1	0.896	0.956	0.898	0.639
	C2	0.962			
	C3	0.953			
	C4	0.947			

Table 6 - Reliability and validity test for the complete data

The R^2 in the variables intention to buy, perception of quality, and playfulness are 0.568, 0.545, and 0.554, respectively. All of the R^2 s are higher than the cutoff value of 0.1, according to Falk & Miller (1992). Also, according to Chin (1998), R^2 values above 0.33 and below 0.67, as is the case, are described as moderate prediction. With regards to the Stone-Gueissers Q^2 , all of the dependent variables are higher than zero (Henseler et al, 2009), with values of 0.495 (intention to buy), 0.470 (playfulness), and 0.338 (telepresence) which indicates predictive relevance. These values are all above 0.35 which also indicates that the predictive relevance is strong.

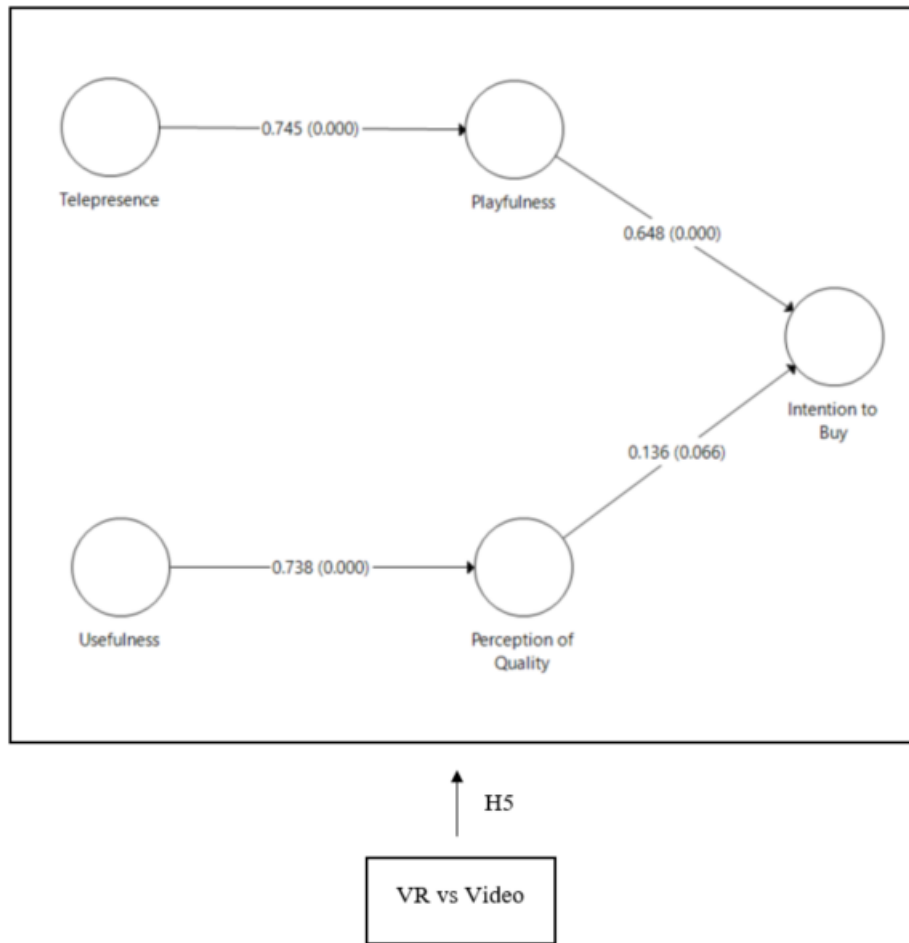


Figure 2 – SEM Results of Complete Data

According to the results in table 7, which shows the results of the SEM analysis, it can be seen that the effect of telepresence on playfulness in VR is significantly inferior to the effect of this same relationship in the case of the video. Also, the effect of playfulness on the intention to buy in VR is significantly inferior to the effect of this same relationship in the case of the video. The same can be said about the relationship between usefulness and perception of quality. Finally, the effect of perception of quality in the intention to buy is the only relationship present where it is not significant in both scenarios and between scenarios.

5.2 Multi-Group Analysis (MGA)

This study intends to perform a moderation analysis while using grouping variables. Its purpose is to test hypothesis 5. This research will be conducted using the Multi-Group Analysis (MGA) that will enable us to see the differences between the use of VR and the use of videos while in the process of buying a house and, consequently, its effects on the consumer's intention to buy. The use of the VR group has 105 participants while the use of videos has 121 participants. When performing an MGA analysis, it can be seen that there is a statistical difference between the following constructs: playfulness and intention to buy; and telepresence and playfulness, while the relationship between the constructs: perception of quality and intention to buy has no statistical difference between each group that was previously defined, as it can be seen in table 7. These results partially support hypothesis 5.

	β_{vr}	β_{video}	Permutation <i>p</i> -value
Telepresence -> Playfulness	0.238**	0.584***	0.001
Playfulness -> Intention to Buy	0.296**	0.580***	0.049
Usefulness -> Perception of Quality	0.364***	0.734***	
Perception of Quality -> Intention to Buy	0.267	0.043	0.181

Note: the p-values that are in bold indicate a significant difference on this path relationship. β_{vr} represents the path coefficients in the VR group while β_{video} represent the path coefficients in the Video group. The *** and ** indicate p-values less than 0.001 and 0.01, respectively.

Table 7 - MGA Results

The results mentioned in table 7 explain if the relationships between constructs are significantly different between VR and video. In the case of the relationship of telepresence to playfulness, there is a significant difference between these two scenarios. Also, regarding These findings complement what has been discussed above in the literature above and what was mentioned by Klein (2003) and Oum & Han (2011) where they mention that telepresence has a significant and positive impact on the increase of playfulness of the experience. It is the same for the relationship of playfulness and intention to buy where the results support Mathwick et al. (2001) when they mention that making an experience more enjoyable, increases the customer's intent to buy. The relationship of usefulness to perception of quality is also significantly different although with a p-value of 0.000. Finally, the only relationship that is not significantly different is the one that relates perception of quality to intention to buy which does not support

the research and findings of Tussyadiah et al. (2018). Thus, these results partially support hypothesis 5.

Also, while performing a bootstrapping test, it can be seen that the path coefficients for all construct relationships are higher in the video group than in the VR group, as can be seen in table 7. This indicates that there is a stronger correlation between the constructs when the consumer is viewing a video instead of performing a VR experience.

6. Conclusion

6.1 Theoretical Implications

VR is still a very recent technology thus, research on the introduction of VR into real estate is still very scarce. Although there have been promising results, it is still missing practical application and customer feedback. The results of this research show that the implementation of VR in real estate is still something that potential home buyers need to adapt to as the home buying process is something that has not changed for decades. There is a lot that can go wrong but also a lot that can go right.

Theoretically, this study had the goal to better understand the impact that VR technology could have if introduced in real estate, more specifically, the home buying process and the customer's intention to buy by taking into account the role of telepresence, playfulness, usefulness, and perception of quality. This study contributes to the existing but still scarce literature on this topic which will help real estate agencies decide if this introduction of VR is a well-defined and executable marketing strategy to implement in the near future. It can be said that although previous literature suggests an improvement in the intention to buy of potential home buyers, this study concluded that it might not be the case. An explanation for this is the skepticism that might still lurk in consumers when using VR technology.

With two questionnaires made, 226 respondents, mostly Portuguese, where 121 saw a video of a house and 105 experienced viewing the same apartment but with 360° VR glasses, they gave this study the answers needed to truly understand if VR in real estate a viable option is. Although promise was shown, consumers are still very skeptical about introducing VR into their home buying process. Telepresence, usefulness, and playfulness were not present in the potential home buyer's feelings when experimenting with VR. This can be due to the fact that the VR experience conducted was optimized to perform such an experience.

This research provides important information on how watching videos is different from a VR experience in real estate. Despite previous research, this specific sample values watching a video of a house higher than using VR. Although contrary to research, this sample believes that they would prefer watching a video of a house instead of performing a VR experience where they would also see the same house in 360° VR. This may be due to other factors that were mentioned before such as the low quality of 360° VR used in the questionnaire and the fact that the sample extracted was simply not the preferred one to test this theory.

6.2 Managerial Implications

This research can be valuable in order to understand the management obstacles that companies such as real estate agencies have to overcome in order to make the introduction of VR in the buying process a viable option for potential home buyers. The findings of this study concluded that potential home buyers are still not ready to invest their time and money into the introduction of VR in their home-buying process. These results indicate that it is necessary to improve the quality of the VR system to induce telepresence, playfulness, and usefulness. People still prefer to buy a house the traditional way (watching photos/videos of houses on a website and then proceeding to visit these houses).

The suggestions about to be made have the goal to improve the customer's view on VR in order to include this technology ideally as a pre-purchase tool. The suggestions recommended are improving the quality of the software and VR so that feelings such as telepresence and playfulness can arise and also, trying to facilitate the process of using this technology which would also increase the sense of usefulness. By applying these suggestions and with the necessary time to integrate this new technology into the customer's minds, there is no doubt that, in the future, potential home buyers will become more receptive to the idea of using VR as a tool to buy a house. The suggestions and findings of this research can also be applied to other sectors that are trying to implement VR in their practices. The skeptical concerns that potential home buyers might have regarding VR technology might and will probably oblige companies to focus on the quality of the software.

6.3 Limitations and future research

This study contributed to the ever-growing literature on this topic but, like several other studies, it had its limitations. One limitation that occurred is that this research did not use a specific company as an example to test the viability of the introduction of VR into real estate. Also, the population studied was almost composed of Portuguese people which means that the outcome could have been different under different circumstances. Because of this, the conclusions extracted are partially because of cultural aspects of this almost Portuguese population (Hofstede, 1986). The biggest limitation of this thesis is the lack of quality in terms of the VR

experience and, of course, the lack of diversity and number of respondents in both surveys conducted. This makes the spectrum become very narrow and difficult to extract precise conclusions. Also, due to budget constraints and not being able to extract the best VR quality in this research, users and potential buyers did not get to enjoy the VR quality that is to be expected of a real estate agency in case they do decide to implement VR in their home buying process. Another limitation is that this experience relied on the knowledge from the consumer's of properties such as layout of rooms and building materials. The visualization of only one type of property also presents itself as a limitation as customers may be affected by different types of properties such as houses, compounds etc., instead of a flat/apartment (which was the one used in the survey given to the respondents). The study

VR has the potential to create a specific customer experience for everyone and, according to Rosedale (2017), in the next 7 to 10 years VR headsets are going to be used on a daily basis. The level of customer care can skyrocket which makes concerns over the security or viability of the same, easy problems to solve (Piotrowicz and Cuthbertson (2016). Also, as mentioned before, improving the playfulness of the experience can greatly influence the consumer's point of view on the introduction of VR as the experience can become more enjoyable.

For future research, it is critical to continue studying consumer feedback and monitor the introduction of new technologies in order to limit companies from wasting their marketing budgets on technologies that do not impact the intention to buy of the customer. Also, testing these technologies physically on a big population with a diversity of age, race, income status and other demographics will lead to better results. Also, it can be said that the study of more than one property in every single experience can help differ the results. This comes from the fact that in this experience, just one property was analyzed by respondents.

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8. Annex

Annex A

Note: Both questionnaires have the same questions, the only difference is that in Q1 a video of a house is shown and in Q2, a VR experience is conducted.



O Impacto da Tecnologia no Mercado Imobiliário

No contexto de uma tese que relaciona a tecnologia nas intenções de compra do consumidor no mercado imobiliário, este questionário foi concebido.

Neste questionário, irá visualizar um vídeo de curta duração e responder a várias perguntas relacionadas com várias categorias que consideramos importantes para definir o papel da tecnologia no mercado imobiliário.

Este questionário tem a duração de aproximadamente 6 minutos e é totalmente anónimo e voluntário.

Obrigado pela sua participação.

 goncalo.pinhao@gmail.com (not shared) [Switch account](#) 

Dados Demográficos

Idade *

- Menos de 18
- 18 a 29
- 30 a 49
- 50 a 65
- 65 ou mais

Género *

- Masculino
- Feminino
- Prefiro não dizer
- Other: _____

Grau Académico *

- Ensino Básico
- 9º Ano
- 12º Ano
- Licenciatura
- Mestrado
- Pós-Graduação

- Mestrado
- Pós-Graduação
- Other: _____

Rendimento do Agregado Familiar (Mensal) *

- < 1000
- 1001 a 2500
- 2501 a 5000
- > 5000

Situação Profissional *

- Estudante
- Trabalho a Tempo Inteiro
- Trabalho Part Time
- Trabalhador-Estudante
- Desempregado
- Reformado

Vídeo Tour do Apartamento

Nesta fase do questionário, veja o vídeo-tour de um apartamento escolhido e depois responda às perguntas em baixo. Estas perguntas irão falar da experiência sensorial e emotiva que a visualização do vídeo lhe traz.



A visualização do vídeo cria uma impressão forte no meu sentido visual ou outros sentidos *

1 2 3 4 5 6 7

A visualização do vídeo cria uma impressão forte no meu sentido visual ou outros sentidos *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Eu acho a visualização do vídeo interessante numa perspectiva sensorial *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

A visualização do vídeo não apela a nenhum dos meus sentidos *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

A visualização do vídeo induz emoções e sentimentos *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Não tenho emoções fortes durante a visualização do vídeo *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

A visualização do vídeo é emocional *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Durante a visualização do vídeo faço ações ou comportamentos físicos *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

A visualização do vídeo resulta em ações corporais *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

O vídeo não requer qualquer ação corporal ou física *

1 2 3 4 5 6 7

O vídeo não requer qualquer ação corporal ou física *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Quando vejo o vídeo entro num grande processo de pensamento *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Quando vejo o vídeo não entro num grande processo de pensamento *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Este vídeo estimula a minha curiosidade e resolução de problemas *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Telepresença

Telepresença é o sentimento de estar num local diferente do que realmente está devido à experiência feita. Responda a estas questões com base no vídeo visualizado.

Quando o vídeo acabou, senti que voltei ao "mundo real" depois da experiência *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Durante visualização do vídeo, senti que estava num mundo que foi criado pela experiência *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Durante a visualização do vídeo, a minha mente estava na sala, não no mundo criado pela experiência *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Durante a visualização do vídeo, o meu corpo estava na sala, mas minha mente estava dentro do mundo criado *

1 2 3 4 5 6 7

Durante a visualização do vídeo, o meu corpo estava na sala, mas minha mente estava dentro do mundo criado *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Durante a visualização do vídeo, o mundo gerado pela visualização do vídeo era mais real para mim em comparação com o "mundo real" *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

O mundo gerado pela visualização do vídeo parecia apenas "algo que vi" em vez de "algum lugar que visitei" *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Utilidade

Nesta secção, tendo em conta o vídeo visualizado, responda às seguintes questões sobre a utilidade desta experiência através a da visualização do vídeo.

Acredito que a visualização do vídeo ajuda a perceber melhor o apartamento *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Acredito que ao ver o vídeo, a visualização do apartamento fica mais eficiente *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Acredito que seria mais fácil ganhar mais emoções pelo apartamento através a visualização do vídeo *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

A visualização do vídeo é simples e clara *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Acredito que o vídeo foi fácil de visualizar *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Os passos da visualização do vídeo são claros e fáceis de compreender *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Acredito que a visualização do vídeo pode ser ajustada ao gosto pessoal *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Percepção de Qualidade

Responda às questões sobre a percepção de qualidade da experiência através da visualização do vídeo

O vídeo deu-me uma ideia geral do do que estava a visualizar *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

O vídeo deu-me informação relevante em relação ao que estava a visualizar *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

A experiência através do vídeo foi fácil de utilizar e navegar *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

O interface desta experiência é user-friendly *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

A experiência através do vídeo foi fácil de utilizar e navegar *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

O interface desta experiência é user-friendly *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

A experiência através da visualização do vídeo é interativa *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Playfulness

Nesta secção, responda às perguntas e baseie-se no vídeo visualizado.

Visualizar o vídeo foi agradável para mim. *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Visualizar o vídeo não foi agradável para mim. *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Visualizar o vídeo foi divertido para mim. *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Visualizar o vídeo faz-me feliz *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Intenção de Compra

Responda às seguintes questões tendo em conta o vídeo visualizado.

Consideraria visitar o apartamento após ter visto o vídeo *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Tenho a intenção de visitar este apartamento após ter visto o vídeo *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Vou visitar o apartamento após ter visto o vídeo *

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

Tenho a intenção de investir o meu tempo e dinheiro para visitar o apartamento *
após ter visto o vídeo

1 2 3 4 5 6 7

Discordo Completamente Concordo Completamente

