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IS AUGMENTED REALITY GOING TO BRIDGE THE GAP BETWEEN ONLINE AND PHYSICAL STORES?

Francisco De Almeida Gaspar Freixo Nunes

Master in Management of Services and Technology

Supervisor:
Prof. João Carlos Rosmaninho de Menezes, Associated Professor,
ISCTE Business School,
Department of Marketing, Operations and General Management

September 2020

**BUSINESS
SCHOOL**

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Abstract

Title: Is Augmented Reality going to bridge the gap between online and physical stores?

Author: Francisco Freixo Nunes

The first appearance of Augmented Reality (AR), a technology that mixes the real and virtual world through a device, goes back to 1968. An increasingly impact of digitalization in our society lead to the change of many business models and it has had an impact on retail. Retailers are now experimenting new ways to meet customer needs and expectations to remain competitive in the digital environment. Market pressure lead companies to invest more in technologies such as AR to improve their websites and platforms and work as a differentiation.

This thesis seeks to investigate the impact of AR, through different devices, in bridging the gap between online and physical stores, since consumers are not able to experiment a product before buying it online. Through an online survey, it was possible to affirm that AR is a successful strategy to increment online performances even though the willingness to buy strictly online and purchase intention weren´t directly affected by AR. Only a product´s perceived informativeness increase due to the technology usage. Also, in fashion shopping the smart mirror had the best user acceptance and in furniture shopping the smartphone app took the lead.

Thus, AR is able to bridge the gap between online and physical stores, according to the study, and the collected data might help companies to reevaluate their next steps, especially in the fashion and furniture industry, to remain competitive in the digital world.

II

Resumo

Realidade Aumentada (RA), uma tecnologia que mistura o mundo real com o mundo virtual através de um dispositivo remonta a 1968. O aumento da digitalização na nossa sociedade levou a uma mudança de muitos modelos de negócio no mercado retalhista. Retalhistas estão agora experimentando novas formas de corresponder as necessidades do consumidor para se manterem competitivas no mundo digital. A pressão do mercado tem levado empresas a investir em tecnologias como a RA para melhorar as suas plataformas, como fator diferenciador.

A presente tese procura investigar o impacto da realidade aumentada, através de diferentes dispositivos, em diminuir o fosso entre as lojas físicas e online, uma vez que os consumidores não podem experimentar um produto, numa loja online, antes de o comprarem. Num questionário online, foi possível afirmar que a realidade aumentada é uma estratégia de sucesso online apesar da propensão de compra estritamente online e a intenção de compra não terem sido afetadas pelo uso da realidade aumentada.

Apenas a informação percebida do produto aumentou devido ao uso da tecnologia. Além disso, o espelho inteligente teve a melhor aceitação por parte do utilizador na compra de produtos de moda e na compra de mobiliário a aplicação móvel assumiu a liderança.

Assim, a RA é capaz de tapar o fosso entre as lojas físicas e online, de acordo com o estudo, os dados recolhidos poderão ajudar empresas a reavaliar os seus próximos passos, especialmente na indústria de mobiliário e moda, para se manterem competitivas no mundo digital.

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Chapter 1: Introduction

1.1 Background

Augmented Reality (AR) is an interactive technology applied to several fields and has been developed throughout the years, allowing an easy accessibility and proximity between customers and products. Smartphone applications, smart glasses, smart mirrors and other devices allows a connection between the virtual and the real world contributing for the growth of AR in online retail, especially in fashion and furniture industries. (Smink, Frowijn, van Reijmersdal, van Noort, & Neijens, 2019)

In the past, when a customer was interested in buying a new pair of shoes or a new pair of glasses, they tended to go to the nearest store to evaluate a specific product that would fit their needs. To help in the decision, the customer would ask for the store assistant to make the right choice.

Nowadays, with the internet expansion and, more specifically, with the e-commerce exponential growth (Lin, Li, Janamanchi, & Huang, 2006) people are now looking for the products online to help their purchase decision and then go to the store to buy it. On the other hand, an increase over online consumption has been a trend over the past years and the goal is to make the online customer experience as much real as it possible can be. (Smink et al., 2019)

Consequently, retail companies are forced to come up with new strategies to satisfy the new customers 'changing needs in the e-commerce environment (Srinivasan & Srivastava, 2010) and remain competitive in the market.

Therefore, AR is able to provide a real time quality experience to the end customer within the comfort of our houses (Younis, 2018) driving more sales in the online channel.

With e-commerce growth, the online consumption rate tends to increase so it is important to find strategies to make the most out of online stores to serve as key competitive advantages. (Scholz & Smith, 2016)

Little is still know about the application of AR through different devices and more in particular about how consumers respond to this new technology and the level willingness to use it on a daily basis as an assistant to their shopping, within different areas of retail. (Brannon, Mclean, Shah, & Mack, 2020)

1.2 Problem Statement

The problem this dissertation proposes to understand is if the use of AR is sufficient to make an online shopping experience similar to a shopping experience in a physical store. Also, this research has the goal of understanding the key factors that leads a person to buy a product in store and if there are any differences between the level of information perceived, willingness to buy and purchase intention between different AR devices and different retail industries.

Therefore, four research questions were formulated to address the information needed for this research study:

Research question 1: What are the key factors that drive people to buy a product in a physical store instead of purchasing it online?

The first research question aims to understand which factors has the most impact when choosing to buy a product in a physical or online store.

Research question 2: Will AR enhance the information perceived from the customer about the product?

With this second question, the aim is to understand if AR increases the information perceived about a product across the different type of devices like as smartphone, smart glasses and smart mirror, when shopping online.

Research question 3: To what extend are customers willing to buy all their goods online if they had an AR tool to help in their shopping?

Additionally, it is important to understand if a customer sees AR as a valuable technology in terms of shopping experience and if it is enough to switch from buying offline to exclusively buy online.

Research question 4: To what extent, the consumer would have a more impulsive shopping experience with AR, while shopping online?

Finally, this research question has the aim to understand if AR will provide a similar effect, in terms of purchase intention, when shopping online as in a physical store. If shown that there are differences between shopping online with AR and shopping in a physical store, we will try to assess what are the most effective characteristics to bridge the gap between both experiences.

1.3 Research Methodology

In this dissertation, both primary and secondary data were used to answer the research questions. The first part of the analysis was composed by secondary data to have a deeper understanding of the main topics studied (AR, Consumer engagement, Consumer behavior) through scientific articles, journals, books and journals from past research in this field. This helped as support to formulate the hypothesis.

After gathering all primary data needed, a qualitative research was conducted through in-depth and group interviews. The objective of the qualitative research was getting some in-depth analysis about the consumer behavior while shopping offline and online and to serve as a support of the quantitative research.

Finally, quantitative primary data was collected through an online survey where 77 responses were gathered from individuals between 15 and 65 years old. The questionnaire exposed some videos about AR application in two retail sectors (Fashion and Furniture) through different devices (Smartphone, Smart Glasses and Smart Mirror). The data retrieved was analyzed primarily with SPSS, and secondly with the help of Microsoft Excel, from a statistical point of view in order to answer the research questions and to derive meaningful managerial implications.

1.4 Academic and Managerial Relevance

The managerial implications of this dissertation relate mainly to the fact that retail companies may have a solid knowledge about how AR can benefit and leverage their businesses while knowing which type of devices and key factors consumers value the most when interacting with the AR technology, especially in the fashion and furniture industry. Also, it may help businesses with already implemented AR solutions to improve what they have and to increase their competitive advantages in the market.

Additionally, the results of this work may also help companies in other sectors to improve their work environment, like engineering factories, to increase productivity and decrease human errors.

1.5 Dissertation Outline

The proposed dissertation will be composed of five key chapters. Chapter 1 will start with an overview of the research topic´s background and its relevance for the proposed study. Also, the problem statement and research questions will be presented and will serve as a base of the dissertation. The Chapter 2 will include the literature review which will approach relevant topics like AR as the technology, the future of AR in retail and consumer behavior and consumer purchase intention. Chapter 3 will explain the methodology as well as the description of the data collection method. In Chapter 4, the results from the qualitative and quantitative research will be interpreted and in Chapter 5 will present the main conclusion from the study. Finally, limitations of the dissertation will be presented as well as some ideas for future research.

Chapter 2: Literature Review

2.1 Augmented Reality

AR is a technology that started to be developed back to 1968. (Kipper, 2013) During that time it didn't receive the attention deserved due to the lack of equipment to support and use this technology. Due to smartphones appearance, AR started to grow and get more attention. Besides AR being still emerging in the consumer market it is expected that investments in the technology reaches 120 billion dollars by 2020 (Scholz & Smith, 2016).

According to (Poushneh & Vasquez-Parraga, 2017): *"AR is a series of technologies that integrate real world and virtual information, thereby enhancing a specific reality."*

Nowadays, due to the increase of e-commerce, retailers face problems such as online shopping card abandonment, high returns and webrooming, which is searching for a product online and then purchasing it in a physical store. (Smink et al., 2019) Through AR, this webrooming issue might be bridged (Hyun Baek, 2018) enabling consumers to have direct product experience and be able to virtually try a specific product in real time providing enough product information. (Poushneh & Vasquez-Parraga, 2017)

This technology can offer a great competitive advantage by improving conversion rates, enhancing brand engagement, reduce return rates, increase persuasive shopping online and develop long-term relationships with customers (Sung, 2020) (Smink et al., 2019).

Sephora, L'Oréal, Nike, Adidas, Mini and Ikea have implemented AR in order to offer a more realistic customer experience. (McLean & Wilson, 2019)

In 2016, Pokémon Go, a mobile game with incorporated AR technology into the display graphics reached more than 500 million downloads in two months and generated revenues of $470 million in 82 days being called by the Media "the biggest mobile game in the U.S history" (Rauschnabel, Rossmann, & tom Dieck, 2017).

AR has benefits over Virtual Reality because with AR the consumer can view themselves trying and experimenting different virtual products without the need of going to a store to try what they are looking for. (Verhagen, Vonkeman, Feldberg, & Verhagen, 2014) The key competitive advantage over Virtual reality, said (M. Y. C. Yim, Chu, & Sauer, 2017): *"is the media power of*

generating a "mixed reality" wherein the surrounding environment is real but the objects portrayed in the environment are virtual."

The technology enables customers to have endless interactions, as a result of the 3D product information enhancing perception of reality, making the experience much more entertaining increasing product likeability and purchase intention (Smink, van Reijmersdal, van Noort, & Neijens, 2020).

On traditional online decision making, consumers tend to generate mental images of the product that tries to reflect with much precision as possible how the product is, but sometimes is disappointing. So AR, being able to help during decision making, by providing a clear representation of the product, makes room for more brand engagement and influence customer purchase intention. (McLean & Wilson, 2019).

Therefore, AR is a great e-commerce tool and with more advancements in technology the more we can take out of this technology. (M. Y. C. Yim et al., 2017)

According to (McLean & Wilson, 2019), to successfully provide an engaging experience to the online customer the AR technology needs to be interactive, vivid and novel.

The **interactivity** refers to the responsiveness and communication between the user and the technology. A high degree of interactivity, in an online environment, increases and activates the mental imagery of the product (Park & Yoo, 2020).

Vividness, often mistaken with interactivity, relates to the number of sensory dimensions, cues and senses presented complemented with the quality and resolution of a presentation. Enhanced vividness is correlated with a higher quality experience. (Fortin & Dholakia, 2005)

Novelty does not refer to the newness of AR, rather novelty refers to the new novel content experienced each time we go through the AR display, in other words, every time the user receives a new stimulus.

If there is a high presence of the three characteristics described above, users will have a much more clear image of the product, while being an effortless task, and it might reduce the number of online returns due to AR technology appliance. (McLean & Wilson, 2019)

Recent research shows that AR was more persuasive than non-AR experience by showing a much more informative and enjoyable experience caused by the use of the AR technology. (Hyun Baek, 2018) (Smink et al., 2019)

2.1.1 Interactivity

As mentioned in previous literature, the ability of producing a clear image mixing the real with the virtual environment is what distinguishes AR from virtual reality. (McLean & Wilson, 2019).

Interactivity is the system technological capacity allowing for an easy interaction with the product/content and a bigger immersion experience by enabling the user to personalize information in a 3D virtual model (Hoffman & Novak, 2009; Poushneh & Vasquez-Parraga, 2017). Being able to have endless interactions with virtual content projects the shopping experience to all new level. (Fiore, Kim, & Lee, 2005) Research also show that consumers have a higher level of enjoyment with virtual objects rather than with handling with tangible content. (Poushneh & Vasquez-Parraga, 2017)

According to (Kiousis, 2002) there are two perspectives of interactivity to simply understand the role of interactivity in AR effectiveness: *": (1) as technological outcome; and, (2) as user perception".* Because of a wide variety of human actions involving interactivity is not easy to have a unique definition. (S, Paul, Strong, & Pius, 2020)

Interactivity as a <u>technology outcome</u> comes from: *"the technology's ability to enable users to more easily interact with and be involved with content".* (M. Y. C. Yim *et al., 2017*)

The interactivity as a <u>user perception</u> may be influenced by a constitution of different elements: the *speed,* related with how quickly users can manipulate content; *mapping*, which represents the level of proximity between the virtual image and the real world; and *range*, related with how far the user can manipulate the content. (Steuer, 1992).

Taking speed as a practical example of the three sub-components, if we use a touch screen phone and we experience some delay or lagged response our level of immersion into the experience decreases so the level of interactivity decreases as well. (Cho & Schwarz, 2010)

To properly benefit from the utilization of AR and its interactivity, between the real and virtual world, we need to dive into the individual´s subjective perception of interaction. What the literature

says is that an individual's perception of interactivity cannot be experienced without an individual's motivation to participate with the interactive technology. So, being open and motivated in experiencing the new technology is key to benefit from a high level of interactivity and immersion.

If the user is willing to participate in the AR experience it will produce a higher user satisfaction and the willingness to buy increases. Was also found that users who experience a higher range level, such as playing video games, felt a greater sense of enjoyment. This level of enjoyment is explained by the level of interactivity and vividness of the experience. (M. Y. C. Yim et al., 2017)

However, if we present an over complicated or confusing technology the user might not benefit from the all experience. Nevertheless, (McLean & Wilson, 2019) says: *"interactivity within AR positively enhances customers' perceptions of ease of use."*

2.1.2 Vividness

According to (Steuer, 1992), vividness is: *"the ability of a technology to produce a sensorially rich mediated environment".*

Nowadays, companies focus on the effect of vividness to provide a better image quality to their display technologies to stimulate users in their cognitive elaboration processes. (M. Y.-C. Yim, Cicchirillo, & Drumwright, 2012)

A 3D visualization based on virtual imagery resembles a direct product experience, like having the real product in our hands, resulting in a better shopping experience and a higher level of enjoyment to the consumer.

In an e-commerce context, a display technology with the capability of generating a higher resolution will provide more clear images which will enhance consumers response to product promotion and increase the perceived usefulness of the shopping experience. (Kim, Baek, & Yoon, 2020)

With AR, by combining interactivity with vividness the consumer enters in an immersion experience, a real sense of being present in that generated image, increasing the shopping experience. (Steuer, 1992) Consumers can have this sort of experience with AR because consumer is not blocked with VR by computer generated virtual images and virtual generated environments.

Immersion is defined as the degree to which virtual systems make users feel absorbed in, involved with, and engrossed by virtual stimuli (Palmer 1995).

(M. Y.-C. Yim et al., 2012) found that interactivity and vividness generate a positive consumer experience and, consequently, a higher level of immersion. The level of immersion can also be increased when we interact with a new technology, concept described as novelty.

However, this state of immersion can rapidly go away if the user finds limitations with the technology such as low responses (less interactivity) and low-quality images (less vividness).

2.1.3 Novelty

Already referred in de sections above, AR novelty is a key factor to enhance the immersion state of a customer experience, but this concept is not reference to the newness of the AR technology.

AR novelty refers to the new, unique and personalized new content experience each time by using a AR display. (Brannon et al., 2020)

For example, when a user is shopping for a new pair of shoes and changes the type of color, logo or other feature through AR it is enhancing the experience and the novelty concept is present in the experience due to the new user stimulus. As (Berlyne, Craw, Salapatek, & Lewis, 1963) suggests: *"novelty is the combination of new and unusual stimuli."*

IKEA also developed a new app, where individuals through their smartphones could see how the furniture would look like in a physical room enabling the user to highly personalize their own space with their own interest and preferences, with this novel content. (Javornik, 2016)

This type of experiences can draw user attention leading to curiosity and becoming more enrolled with the experience leading to higher states of enjoyment and immersion. The novelty effect can provide a uniquely tailored experience. Important to mention that, the level of enjoyment during hedonic use, is most likely to have a higher impact in influencing brand engagement.

Finally, the study ran by (McLean & Wilson, 2019) show that AR products presentations, when interactivity, vividness and novelty content are present in the experience, are generally more superior than traditional web-based product presentations having a positive direct impact in the immersion state, enjoyment, usefulness and purchase intention. This is an opportunity for retailers

to strategically achieve differentiation and develop competitive advantages. (Romano, Sands, & Pallant, 2020)

However, if AR loses its newness, innovativeness and uniqueness the all immersion experience is compromised thus the overall effect of it would be weakened.

2.2 Future of AR in retail

2.2.1 E-commerce aligned with AR

The online market is increasing exponentially, and consumers are becoming more demanding in their online shopping experience, so companies are looking for innovative ways to gain competitive advantages.(Lin et al., 2006) Using those innovative technologies, it will ensure a more efficient and better online service and an increase in customer satisfaction. So, setting aside from competition is the big question that everyone is trying to answer. (Fan, Chai, Deng, & Dong, 2020)

In terms of price, choice and time the online market is the most convenient store for everyone because we can compare prices from different retailers at the same time, pick the best quality/price offer, while being in the comfort of our homes. Unfortunately, online consumers can´t touch, feel, or have a realistic expectation of the goods that are ordering. In some cases, the number of returns increases, and consumers end up visiting a physical store to change the ordered product resulting in a poor online experience. (Sylvia C. Mooy, 2002) (Amado, Minahk, Cilli, Oliveira, & Dupuy, 2019)

To address these disadvantages, major e-commerce platforms in China have invested in developing AR for online market. The goal is to bridge the gap of not being able to realistically feel or touch the product to simulate an actual experience of a real product. Alibaba was one of the big investors in 2016 with 200 million dollars. Alibaba is an intermediary connecting suppliers with final consumers which means the orders made are relatively big.

For this reason, if AR makes sure final consumers are buying the right product for their businesses it is a key feature for a successful online shopping experience, increasing purchase intention, and even more important when dealing with big supply orders.

According to (Jung et al., 2015), online customers have a hard time to imagine how products fit into their personal needs increasing their cognitive load. Research says people´s cognitive resources are limited, and when cognitive load is too high, it will affect those resources of consumers and, as consequence, it will affect the acquisition commodity leading people to a negative impression towards the product. (Smink et al., 2019)

Consumers suppose AR improve their service experience, reduces decision uncertainty and promotes a more environment-related interface consistent with the way consumers process information. So, AR technology enhances users´ visual, auditory and tactile information.

By associating abstract facts with real time scenarios, consumers can extract and learn more about the value of a specific product and make a more accurate decision.

AR, with the Simulated physical control (SPC) of online products, will help users to process product information closely linked to their body simulations and behavioral experience. Also, an environmental embedding (EE) can help customers making accurate purchasing decision integrating products in several usage scenarios. (Fan et al., 2020)

According to (Fan et al., 2020) a high EE and high SPC results in a lower cognitive load and a higher cognitive fluency which means AR enhances online service in online retailing. The two core capabilities, SPC and EE, aim to make the user process of retrieving product information easier, reducing the cognitive load and provide more fluent purchase decision.

In conclusion, AR adoption by online retailers can influence purchase decision and intention increasing positively the attitude towards a certain product. (Scholz & Duffy, 2018)

2.2.2 Consumer behavior, loyalty and emotion control

A new vision, from market pressure to innovate, on offline and online service experience is emerging. (Branstad & Solem, 2020) This vision focuses on extending the customer perception of an online product using technologies that overlays virtual and/or verbal information. The goal is providing such immersive experience to the consumer that he becomes loyal to that service provider. (Pekovic & Rolland, 2020)

To provide such immersive experience, new virtual reality and AR technologies are emerging with potential to provide that experience, stimulating the sensory system and provide in-depth information about a service/product. (Crofton, Botinestean, Fenelon, & Gallagher, 2019)

Scholz and Duffy (2018), after exploring the effect of AR on consumers with mobile shopping at home found that a close and intimate relationship can emerge which means more loyal customers due to a positive service experience.

Car dealers are introducing mobile apps for their customers to be able to customize cars, from changing wheels colors to see how air flow over the car´s body, to their preference. Also, in safety terms, when going for a test drive, it is projected in the mirror with relevant information for the ride.

In the food industry, companies are using AR technology to add interactive features to their packaging. Consumers can scan the food and see all details such as packaging, production, preparation methods and price comparisons with their device. (Crofton et al., 2019)

With more technology taking part of firm's interactions with customers the more difficult it will become to develop long lasting relationships with customers since consumer behavior is changing. (Rafaeli et al., 2017)

To counterattack, the technology needs to provide fluent product information to captivate customers and make the wanted purchase. As said above, cognitive fluency is key not only to provide an immersive experience to the consumers but also to increase the willingness to buy of a product. (Fan et al., 2020)

2.2.3 Customer and employee relationship

As technology becoming more and more part of our lives the interaction, the online market has suffered a lot of changes specially the relationship between customers and retailers. (Fan et al., 2020)

A study conducted by today.com found that 81% of people seek for a product online before making the purchase. Since the information online is often limited, lacking interaction with a salesperson, atmosphere of a store, touch or try on the product consumers, most of the times, don´t make the online purchase or go to a physical store to acquire the product. (Beck & Crié, 2018)

It has been studied that, the display of positive emotions by the frontline employees is essential for effective service satisfaction and quality. Companies need to understand the data provided by consumers online and integrate them to improve the service offered.

So, if frontline research is able to get those answers and process all data an increase customer satisfaction and purchase intention will raise exponentially.

Companies, to understand their consumers, should focus on feeling technologies that are tomorrow´s frontline technologies. They will be able do understand the consumer behavior enriching the purchase process and frontline interactions. As shown is the movie "her" the man is psychologically connected his digital assistant because she is able to process and mine all emotional big data fitting into that particular men. (Rafaeli et al., 2017)

In conclusion, consumers change their behavior of trust, immersion, purchase intention, satisfaction with website and positive emotions in the presence of a social new sales aid. A combination of AR, for a immersive experience and website satisfaction, with Artificial Intelligence (AI) can be the answer that online retailers are looking for. (Beck & Crié, 2018)

2.3.4 AR as service support

Nowadays, with the increase of virtual and AR technologies, companies are relying on these as a service support to be more productive.

These technologies can be applied in different areas. Engineering is one that would benefit the most through maintenance and repairing activities using overlaying methods and hardware providing virtual information to make inspection, repairing and other tasks in aerospace, automotive, industrial plants, military equipment, among others, a lot easier. (Dini & Mura, 2015)

Once an industry or a company implements such technologies in their working environment the procedure run at a faster pace. Since the operator does not detract the attention from the real environment, while consulting procedural instructions which minimizes the cognitive load of an employee. (Fan et al., 2020)

Other research, still aligned with engineering, proposes Intelligent AR (IAR) system which would help aircraft technicians with complex maintenance procedures. It would minimize errors and time-related costs by using this advanced tool.(Dini & Mura, 2015)

In the leisure sector, mobile AR apps can influence and reach out to more customers by delivering an enhanced travel experience. (Cranmer, tom Dieck, & Fountoulaki, 2020) The idea comes from using AR as a tool to guide tourists through unfamiliar environments and providing new information about them. The combination of using data from several sensors, such as GPS and accelerometer, and the information visualization through mobile makes the technology more enjoyable and easy-to-use leading to pleasing experience. (Kourouthanassis, Boletsis, Bardaki, &

Chasanidou, 2015) Also, a study conducted by (Do, Shih, & Ha, 2020) confirmed that using mobile AR apps increased to a greater extent user´s buying behavior when combining with a high level of interactivity.

In the food industry sector, people are becoming more aware of what they eat, the nutritional aspect of food and the portion of a meal. So, AR can superimpose digital information over the real food. (Saboia, Pernencar, & Varinhos, 2018) Study shows by visualizing the nutritional information, people tend to make healthier options. (Crofton et al., 2019) With AR, people with diabetes can control their glucose levels only by using their smartphone. The technology can help nutritionists to deliver a more accurate and successful service by controlling their patients' habits.

For these reasons, AR can have a huge impact in different industries by helping to minimize errors and provide a better overall service to the general population.

2.3 Technology and customer engagement

2.3.1 Brand engagement, Media Richness and Willingness to buy

Nowadays, consumers are more connected and informed, therefore companies need to create disruptive and innovative ideas to engage with their customers to be able to stay alive in the market. (Constantinos-Vasilios Priporas, Nikolaos Stylos, 2017)

Through AR adoption, companies can apply the technology to the online shopping environment. As said before, the implementation will influence positively the consumer experience by decreasing the cognitive load leading to a more comfortable experience when they shop online.

In order to decrease the cognitive load of information, the platform, where the consumer intents to buy a product, should be well designed to effectively process all information.

(Fan et al., 2020) Found that a more complicated website increases the cognitive load decreasing the willingness to buy.

Marketing professionals are focusing on selling to consumers an experience by stimulating each of the five senses: sight, smell, touch and hearing. This stimulation will, involuntarily, emotionally associate to a specific brand enhancing it. This area of research is called "sensory marketing" which is utilized a lot in the food industry.(Crofton et al., 2019)

Through virtual and AR technologies some of the five senses can be highly stimulated so it has opened a gateway of opportunity to improve the sensory marketing area by providing immersive and interactive experiences. (Rafaeli et al., 2017)

(Beck & Crié, 2018) demonstrated that providing a Virtual Fitting Room (VFR), allowing customers to try on clothes of different shapes, styles and sizes virtually not physically, would make the shopping experience much more pleasing and favorable increasing purchase intention.

Having, in the VFR, a social new sales aid such as a virtual agent in a 3D presentation makes a huge impact on the customer because the experience is filled with the novelty effect, interactive moments and vivid products. (Younis, 2018)(Smink et al., 2019)

For this reason, using online VFR on consumers online and offline increase the willingness to buy and a bigger and better brand engagement. Due to the curiosity of the experience the online

patronage intention grows exponentially. Implementing the technology across online stores will increase the probability of buying the product online as if we were shopping in a real store.

Aligning sensory marketing with AR, companies can decrease the cognitive load of consumers which will directly increase the purchase intention and enhance the online experience. Companies who implement those technologies are able to set aside from competition increasing consumer loyalty and satisfaction.

Chapter 3: Methodology

The methodology for the present dissertation was developed to collect primary data to reach conclusions that will help to confirm the hypothesis developed in the Literature Review.

By using both quality and quantitative data, there will be a complete analysis of all the factors that influence consumers´ behavior when purchasing online with AR, allowing a deeper understanding of each hypothesis through different points of view.

The present study studies which type of device (smartphone, smart mirror and smart glasses) is more effective in changing consumers 'behavior and purchase intention when shopping with AR technology. Also, to answer the research problem, it is important to identify what drives consumers to buy online instead of offline, where qualitative research is fundamental to achieve the results needed.

Three types of device were addressed, since they are the most relevant and easy to apply the AR technology into our daily lives.

The population of interest are individuals of both genders, with different levels of online shopping behavior, that either are high-frequency shoppers or not.

Qualitative Research Procedures

Qualitative research was essential to understand the target´s involvement with AR technology and consumers shopping behaviors. Qualitative data collection procedures were also crucial to inform the selection of shopping attributes to employ in the experiment to be conducted in the quantitative part of this study. Although it is more time consuming, it uncovers subconscious information to understand why certain answers were given (Birks, 2016).

Individual and group in-depth interviews were conducted to individuals between 18 and 26 years old. A total of five respondents were interviewed. The sample was composed by four participants aged 18-24 and one aged 25-34. The sample was gender balanced and the interviews took an average of 45 minutes to complete. Group in-depth interviews were conducted to discuss and debate different shopping opinions amongst different consumers.

The interviews were semi-structured. The first section referred to the respondents online and offline shopping behavior and consumption habits. Then, interviewees ´opinions regarding AR

technologies in retail were gathered. Respondents were not only asked to disclose which attributes they found most important while shopping online but were also presented with different videos regarding AR technologies in retail and questioned on the experience of using this tool while shopping clothes and furniture.

Additionally, in line with the major purpose of this study, interviewees were also asked their thoughts on the impact of online AR shopping in physical stores.

Lastly, respondents provided personal details and were thanked for their participation.

Quantitative Research Procedures

In line with the presented research questions, the purpose of the quantitative research procedures was to (1) understand what are the key factors that drive people to buy a product in a physical store instead of purchasing it online, (2) to understand if AR would enhance the information perceived from the client about the product, (3) to study if customers are willing to buy all their goods online if they had an AR tool to help their shopping and (4) to understand if a customers would have a more impulsive shopping experience with AR while shopping online.

Since a substantial number of responses was needed in the most timely and cost-efficient manner, an online survey was developed using *Qualtrics*. Since AR is a tool that online retailers may want to use in the near future a wide range of answers from individuals between 15 and 65 years old were considered. The study focusses on the Portuguese online market so, it was written in Portuguese, and, therefore, only fluent Portuguese have answered it. Pre-tests with 5 individuals were conducted to make sure that the all survey answered precisely all the hypothesis and research questions.

One of the most used methods in analyzing consumer preferences was the one-sample t test to analyze the mean and base our conclusions according to the rejection or not of the null hypothesis.

Additionally, several paired samples tests were run to understand the correlation between variables and their impact in the AR technology,

The questionnaire began with qualifying questions on respondents shopping online and offline habits and preferences. To understand what makes a customer use the online store or the physical store it was asked to organize (1 – what you value the most, 6 – what you don´t value at all) the

statements provided and the statement "I can experiment the product" stood out, which means customers still have the need to touch the product before they buying it.

Due to pandemic reasons it was impossible to have a real AR shopping experimentation. For this reason, several videos using AR through different devices were presented. Two categories of shopping were chosen (clothing and furniture). It was asked during the interviews to imagine themselves in the comfort of their home using the technology. To deeply understand the correlation of the technology with different devices three scenarios were presented. In each scenario, the user would use a different device to use the technology. The three devices were a smartphone, an intelligent mirror and a pair of virtual glasses. Besides the intelligent mirror, all devices had a video using the technology while shopping clothes and furniture.

The objective of each video shown using different devices was to understand and to answer almost all hypothesis mentioned above. To have a deep level on integrity and concise answers a Likert point scale evaluation was utilized. In this section, it was possible to answer how good was the information perceived about the product, if the shopping experience would be more immersive and impulsive, if the user would start to buy exclusively online for this two categories, if the value attributed to the brand would be superior and how involved in the shopping experience a user would be by using AR. After watching all videos related to this section it was asked which device would bring more value to use the technology. This is important because in further research, more experiments could be made to deeply understand how valuable the technology is with the chosen device.

A set of questions comparing website vs online with AR, website vs in-store and online with AR vs in-store were asked to analyze how value the technology is and provide answers to further research.

Finally, in the Demographics section it was asked age, gender and income, (which could be correlated with the price that a user would give for a device that is support with AR technology) with the aim of categorize the sample studied.

Chapter 4: Data Analysis and Results

The online survey was open for 15 days and recorded 146 responses. The target for this dissertation were individuals between 15 and 65 years old. All participants complied with this criterion, so no responses were eliminated. 69 were eliminated for not completing the survey. The final sample was left at 77 valid and complete responses.

The survey was only answered by Portuguese since the study focus on the Portuguese market. There was 54,32% of male and 45,68% of female respondents making the survey substantially balanced. Regarding annual income, 59,26% reported that receive less than 10.000 euros per year which is understandable because most respondents were aged between 18-24 years old, more specifically 75,31%, and fits in the Portuguese average annual income frame.

4.1 Sample Analysis

As previously said before, the online survey started with some brief questions to understand the respondents' behavior while shopping online and offline.

Regarding offline shopping, only 7,69% went 0-1 times per month to an offline shop which means respondents are an active online shopper or, since the big portion of the people interviewed might still live with their parents it is understandable to have a tiny but relevant percentage in the 0-1 choice. Additionally, 43,59% people agreed to go to a store/supermarket between 2-4 times per month, 26,92% go to the supermarket or a store 5-7 times per month and 21,79% go shopping more than 8 times per month. Taking into account all offline shopping information a normal Portuguese habitant goes shopping, at least, more than 5 times per month.
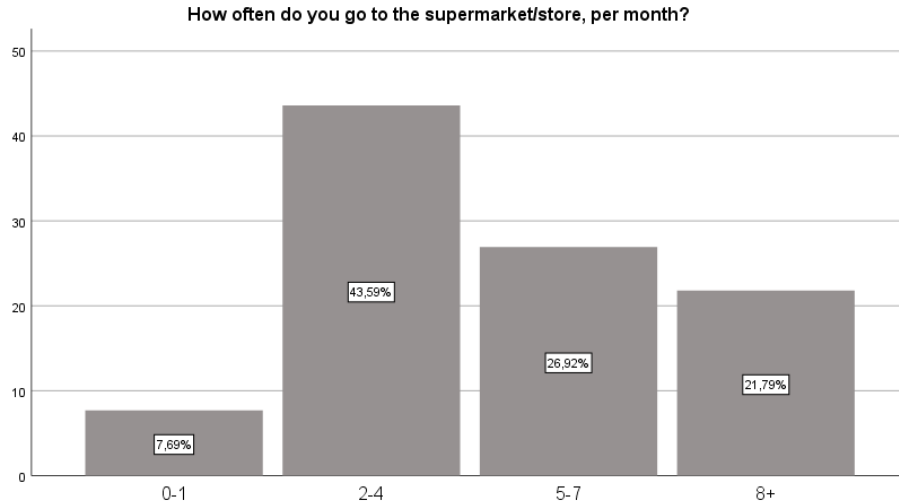
Chart 4 1 - Offline shopping frequency

Regarding online shopping, data shows the opposite of what was seen on offline shopping since 66,67% of respondents only shop online from 0 to 1 time per month which means that not a lot of people are still convinced that online provides more value to the end customer than a physical/offline store. Additionally, 29,49% reported shopping online 2-4 times per month, 1,28% shops online 5-7 times per month and only 2,56% does it more than 8 times per month. Since data is equally balanced between male and female would be interesting to see if any change would occur if we separate the two gender groups. By comparing the two gender groups not substantially changes were seen on their shopping behavior regarding the usage of offline or online stores.

Chart 4.2 - Online shopping frequency

Since online shopping is growing at a faster rate it was important to see in which categories respondents would mostly purchase their items. According to data, Clothing and Accessories had the biggest pie of the chart with 46,15%, secondly Technology with 28,21%, Food & Beverages with 12,82% and the remaining categories didn´t have any statiscal important performance for this study. Interesting to see that when the online category chart is split in gender, male and female, Clothing & Accessories takes almost 70% of the category chart and Food & Beverages 11,43%. The male audience has a preference in Technology with 46,51%, Clothing & Accessories 27,91% and Food & Beverages of 13,95%.

Considering the data retrieved a market opportunity is open in these three categories: Clothing & Accessories, Technology and Food & Beverages.

4.2 Key drivers for online and offline sales

4.2.1 Online

To study the influence of different drivers that may or may not impact the traffic and conversions of online and offline sales a One Sample Test was run to compare and analyze the different means extracted from the online survey. To simplify the analysis, the online drivers will be separated from the offline drivers.

To understand what make respondents buy online, six key drivers were shown, based on the literature review, and was asked to organize them on a descendent importance level. Since the neutral points of the survey question were 3 and 4, a hypothesis test was run to test the importance of the key drivers, so:

H1: A factor that has an average score below 2,5 has some significance to become a key driver for online sales.

Therefore, the first hypothesis was analyzed using a one Sample Test with each of the 6 possible key factors.

Table 4.1 presents the average mean for each factor, regarding online shopping, and also shows the value of the *t* test and the statistical significance. Since we don´t want a two-tailed test because our

null hypothesis is one tailed (μ > 2,5), we need to look in the t-student table values to determine the critical t.

	N	Mean	Std. Deviation	Std. Error Mean
Online - I can ask for help, online or on the phone, if necessary	78	4,73	1,439	,163
Online - I don't feel pressured or observerd by the store employees	78	4,90	1,295	,147
Online - I can compare different website prices and get online discount	78	1,79	1,242	,141
Online - I can make a more conscious purchase	78	3,22	1,345	,152
Online - I can get feedback and reviews from others regarding a specific product	78	3,32	1,334	,151
Online - I have a bigger organized vision of what a brand offers.	78	3,04	1,436	,163

Table 4.1- Key online potential factors to shop online

As seen in the table above, it is easy to see that only one out of six factors have an mean below 2,5 but before assuming that it is important to run the statistical test to be certain that the test is valid and the null hypothesis (H0 - A factor that has an average score above 2,5 doesn´t have some significance to become a key driver for online sales.) can be rejected. The critical t has 77 degrees of freedom, with α = .05 and since it is one-tailed its value is 1,6649. To reject the null hypothesis the critical t, needs to be higher than the t observed. Looking at the One Sample test values and the mean provided we conclude that, in this sample, people only value online shopping mainly because they can compare different website prices and get online discounts.

A t test succeeds to reveal a statistically reliable impact of the usage of online shopping to compare prices and get discounts: (MH1=1,79 s = 1,24) t (77) = -5.015, p < 0,05.

All other factors, the t test failed to reveal a statiscal reliable importance therefore, 5 out 6 factors doesn´t have a meaningful impact to become a key driver for online sales.

4.2.2 Offline

To understand what is missing in the online market it is crucial to analyze what people value in offline store to possibly take those insights and implement it in the online business. Therefore, the same One Sample Test was run to see the importance of four key drivers, based on the literature review, and was asked to organize them on a descendent importance level. Since the neutral points of the survey question were 2 and 3, a hypothesis test was run to test the importance of the key drivers, so:

H2: A factor that has an average score below 1,5 has some significance to become a key driver for offline sales.

From the sample statistics we can already see that only 1 out 4 factors seem to have some statistical significance to reject the null hypothesis which is: "I can try/test the product".
The critical t has 77 degrees of freedom, with $\alpha = .05$ and since it is one-tailed its value is 1,6649. To reject the null hypothesis the critical t, needs to be higher than the t observed. For this reason, the t test succeeds to reveal a statistically reliable impact of trying/testing the product before buying it. (H1=1,41, s = 0,80) t (77) = -12,08, p < 0,05.

Once more, the t test failed to reveal a statiscal reliable importance on the remaining 3 factors regarding the impact to become a key driver for offline sales.

4.3 Perceived informativeness

H3a: Online product presentation with AR elicits a more informative perceived shopping experience than online product presentation without AR.

4.3.1 Clothing

To analyze the third hypothesis, it was conducted an one sample test, using the information from the several devices tested in the online survey, more specifically the smartphone, smart mirror and the virtual glasses. To accept the hypothesis H3a we need to decompose it into the three devices tested. If each one them has statistical significance, we can conclude that our hypothesis is true.

Since the survey asks the respondents to answer on a Likert scale, from 1 to 5, if the perceived information mean of each device is higher than 3 it is a positive sign to indicate that the device with AR elicits more information perceived shopping experience than online product presentation

without AR. According to the one sample statistics table each of the three devices score more than 3 points on average. The smart mirror with AR had the best score with 3,86 points out of 5 which makes a valuable device to use with AR. The Virtual Glasses had a score of 3,15/5 which makes people less receptive to this device. To reach the right conclusions let us take a look at the value of the one sample test. Our critical t, from the t-student table, is 1,6649 with 77 degrees of freedom and $\alpha = .05$. To reject the null hypothesis our critical t needs to be less than the observed t. According to the table, respectively, $1,67 < 5,19$, $1,67 < 6,8$ and $1,67 > 1,12$, which means that a t test reveals statistically reliable difference between the use of Smartphone [(M = 3,62, s = 1,05), t (77) = 5,19, p < 0.05] and Smart mirror [(M = 3,86, s = 1,11), t(77) = 6,81, p < 0.05] with AR and failed to reveal a statistical difference with the Virtual Glasses with AR (M = 3,15, s = 1,21) than without AR, t(77) = 1,13, p < 0.05.

4.3.2 Furniture

In the online survey, not only the perceived informativeness was tested for the clothing category but also for the furniture category. This will give a more precise idea about the effectiveness of AR through different styles of shopping experiences. If the same devices provide sufficient statistical evidence, and through a correlation of the two categories, we are able to agree on our main hypothesis about the increase information perceived with AR.

Since the smart mirror doesn't have a meaningful impact, in the furniture category, while shopping with AR the device was removed. The other devices were tested in the same way.

Shopping furniture with a Smartphone with AR provided even higher scores than clothing, 3,92 out of 5, and the same happened with the virtual glasses with a mean of 3,69 out of 5. Therefore, both one sample tests reveal a statiscal reliable difference between shopping with AR than without it so we can reject the null hypothesis because the critical t value (1,67) is lower than the observed t. Smartphone with AR: M = 3,92, s = 0,96, t(77) = 8,46, p < 0.05 and Virtual glasses with AR: M = 3,69, s = 1,09, t(77) = 5,57, p < 0.05.

4.3.3 Correlation: Clothing vs Furniture

According to the analysis above, 5 out 6 t test were statistical reliable to agree on the positive impact of AR in the information perceived of the product but to see if our main hypothesis is valid a correlation through a paired samples test needs to be made between the two categories studied:

$$\begin{cases} H0: AR\ Clothing\ = AR\ Furniture \\ H1: AR\ Clothing\ \neq AR\ Furniture \end{cases}$$

A paired sample t test is made between clothing and furniture with the smartphone and another with the virtual glasses. From those results we can reject or not the null hypothesis.

From the paired samples test, the critical value, 1,67, is lower than the observed value (-1,99 < -0,31; -1,99 <-0,54). Additionally, the confidence interval doesn´t include the zero value. For this reason, a paired samples t test reveals a statiscal reliable difference between the usage of Smartphone or Virtual Glasses with AR through different categories, Clothing and Furniture. Considering all statiscal data the H3a hypothesis is valid: *"Online product presentation with AR elicits a more informative perceived shopping experience than online product presentation without AR."* Even though the paired sample t test didn´t fail to reject the H0 through the analysis of all means from the experience, since each one had a score higher than 3, a valid and positive conclusion can be taken from the impact of the usage of AR in the increase perceived information about product.

4.4 Willingness to Buy

To maintain a certain statistic reliability all procedures done to understand if AR impacts the information perceived of a product will be applied to test the willingness to buy with AR.

 H4: Online product presentation with AR impacts user´s willingness to buy exclusively online.

4.4.1 Clothing

As written in the point above, to accept the hypothesis H4 we need to decompose it into the three devices tested. If each one them has statistical significance, we can conclude that our hypothesis H4a is true.

H4a: Online product presentation with AR impacts user´s willingness to buy exclusively online in clothing.

To see if our hypothesis is true a one samples test was run. Since the survey question was based on a Likert scale if the mean value of the device usage with the AR technology is superior to three the H4a hypothesis is valid, therefore:

$$\begin{cases} H0: \mu \leq 3 \\ H1: \mu > 3 \end{cases}$$

Through SPSS, the one sample statistics table show that the smartphone, Smart Mirror and Virtual Glasses have an average mean of 2,31, 2,65 and 2,15, respectively. Only with this data is statistically clear that is impossible to reject the null hypothesis, or the critical t be higher than the observed t. Nevertheless, through the help of the t-student table our t value is 1,67 and the one sample test reports that the observed t of smartphone is -4,037, smart mirror is -1,980 and -4,913 from virtual glasses.

For this reason, a t test failed to reveal statistically reliable difference, in all three devices, between the impact of willingness to buy exclusively online with AR and without it, in the clothing category. : [M = 2,31, s = 1,51 t(77) = -4,04, p < 0.05] ; [M = 2,65, s = 1,54 t(77) = -1,98, p < 0.05] ; [M = 2,15, s = 1,52 t(77) = -4,91, p < 0.05].

4.4.2 Furniture

H4b: Online product presentation with AR impacts user´s willingness to buy exclusively online in furniture category.

The principles and the hypotheses used above will be applied equally since the only thing that is changed in the experiment is the type of product that the respondents were buying.

According to the data retrieved, the use of Smartphone with AR to shop furniture received a mean of 2,74 and the use the virtual glasses receive a mean of 2,79 out of 5. This value show, again, a negative impact of the technology on the willingness to buy exclusively online. Therefore, it seems easy to predict the outcome since the same happened in the clothing category. The one sample test showed that assumption. The observed t using the smartphone is -1,520 and using Virtual Glasses is -1,18 which is, in both experiments, less than the critical t, so we fail to reject the null hypothesis.

A t test failed to reveal a statistically reliable difference, in both devices, between the impact of AR willingness to buy exclusively online. : Smartphone AR [M = 2,74, s = 1,48 t(77) = -1,52, p < 0.05] ; Virtual Glasses AR [M = 2,79, s = 1,53 t(77) = -1,18, p < 0.05].

4.4.3 Correlation: Clothing vs Furniture

According to the analysis above, all tests present weren´t statistical reliable on the positive impact of AR in the willingness to buy exclusively online. Besides knowing the answers for the main

hypothesis that is related to the research question of the thesis it is also important to see if there is any correlation whatsoever:

$$\begin{cases} H0: AR\ Clothing\ = AR\ Furniture \\ H1: AR\ Clothing\ \neq AR\ Furniture \end{cases}$$

From the paired samples test, the critical value, 1,99, is higher than the observed t. (1,99 > 0,15; 1,99 > -0,05). Also, the confidence interval includes the value zero. To conclude A paired samples t test failed to reveal a statistically reliable difference between the two shopping categories.

Considering all statistical data, the H4 hypothesis is rejected: ": Online product presentation with AR impacts user´s willingness to buy exclusively online".

4.5 Impulsive Shopping

To test the impact of AR in impulsive shopping the same tests used in the previous chapters will be used to maintain the same congruency of the analysis. To summarize, there is one main hypothesis that responds to a research question, in this case is RQ4. To see if it is valid or not the hypothesis needs to be decomposed into two, regarding clothing and furniture, and if these two are valid then we can accept the main hypothesis. This procedure enables a more precise and in-depth analysis of AR´s impact across different shopping categories.

H5: Online product presentation with AR elicits a more impulsive shopping experience than online product presentation without AR

4.5.1 Clothing

H5a: Online product presentation with AR elicits a more impulsive shopping experience in clothing.

Since the Likert Scale was used to evaluate the level of openness to impulsive shopping the hypothesis test is:

$$\begin{cases} H0: \mu \leq 3 \\ H1: \mu > 3 \end{cases}$$

The use of the smartphone with AR didn´t perform well to elicit a more impulsive shopping to the respondents. Based on the Likert scale, the mean was 2,24 which is quite low for such disruptive

technology. The same happened with the smart mirror getting only 2,63 on average and still away from the minimal mean to have a significant impact. Virtual glasses with AR went on the same line as the smartphone with 2,21 out of 5. According to the One-Sample test, all had an observed t lower than the critical value which means that the null hypothesis can´t be rejected.

A t test failed to reveal a statistically reliable difference, in all devices, in the impact of AR in impulsive shopping in the clothing category. : Smartphone AR [M = 2,24, s = 1,34 t(77) = -4,98 , p < 0.05] ; Smart Mirror AR [M = 2,63, s = 1,49 t(77) = -2,19 , p < 0.05] ; Virtual Glasses AR [M = 2,22, s = 1,34 t(77) = -5,14 , p < 0.05].

4.5.2 Furniture

H5b: Online product presentation with AR elicits a more impulsive shopping experience in furniture.

According to the data retrieved, the smartphone and the virtual glasses didn´t have a good performance again. The smartphone had a mean of 2,59 and the virtual glasses of 2,83. Running the one-sample test both record lower observed t value than the critical value which is 1,67. For these reasons the impact of AR in the impulsiveness shopping in the furniture category was not positive. So, the null hypothesis can´t be rejected.

A t test failed to reveal a statistically reliable difference, in all devices, in the impact of AR in impulsive shopping in the furniture category: Smartphone AR [M = 2,59, s = 1,41 t (77) = -2,57, p < 0.05]; Virtual Glasses AR [M = 2,83, s = 1,42 t (77) = -1,04, p < 0.05].

4.5.3 Correlation: Clothing vs Furniture

The paired samples test shows that the 95% confidence interval of the difference in pair 1, correlating the smartphone with impulsiveness and the two categories, and in pair 2 doesn´t include the zero value which means the null hypothesis can be reject. So, there is no correlation between the impact using AR in shopping impulsiveness across the two categories.

To conclude, the H5 hypothesis is rejected: *"Online product presentation with AR elicits a more impulsive shopping experience than online product presentation without AR".*

4.6 Online vs Offline stores

According to the information studied above, enough data was collected to understand the impact of AR in the online market using different devices and exposing the technology into different shopping categories. But the central research question continues unanswered which is: *"Is AR going to bridge the gap between online and physical stores?"*. To answer this question a mean hypothesis test will help to discover is it is true or false. Since the survey questions were based on a Likert scale the hypothesis are:

$$\begin{cases} H0: \mu \leq 3 \\ H1: \mu > 3 \end{cases}$$

One question, in the survey, was directly asked to answer the main research question but other two were important to really see the customer behavior regarding AR. Therefore, the direct survey question will dictate if the null hypothesis is rejected but the other two survey questions serve the main one to reinforce, or not, the test. The two other questions are:

→ **Question 1: Do you feel that, by using AR, you will have a more enriching experience online than buying a product through a website?**

→ **Question 2: Do you fell that, by using AR, you will have an online shopping experience pretty similar to shopping in a physical store?**

Data shows a mean of 4,13 out of 5 for the agreement that AR can bridge the gap between online and physical stores. This information alone is really positive and it is a good indicator to possibly reject the null hypothesis. The t test was run and the observed t recorded a value of 15,776. Since the critical value is 1,67, which is way less than the observed t, <u>the null hypothesis can be rejected</u> without any doubts.

	Test Value = 3				95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Do you agree that augmented reality can be a techonlogy to bridge the gap between online and physical stores?	15,776	77	,000	1,128	,99	1,27

Table 4.2 - Is AR going to bridge the gap between online and offline stores?

So, a t test reveals a statistically reliable difference, <u>in the impact of AR to bridge the gap between online and physical stores:</u> [M = 4,13 s = 0,63 t (77) = 15,776, p < 0.05]

Additionally, question 1 and question 2 recorded a mean of 4,38 and 3,40, respectively, which helps to strengthen the impact of AR to bridge this online versus offline gap. Question 2 recorded a lower value because AR still needs to provide a much more real experience to the customer. With the increase development of the technology, this number will be much higher if proper investments and allocated to it. Regarding the t test, question 1 recorded an observed t of 16,47 and question 2 of 3,5. In each of them the observed t is higher than the critical value in both questions.

For these reasons, both questions analyzed above strengthen the idea that AR can be a solution to bridge the gap between online and physical stores.

4.7 Augmented reality devices

Considering that three devices were used to show the AR technology features it is also important to know what the respondent's preference is according to each category. Based on the 77 answers in the clothing experiment, 67,95% prefer using the smart mirror, 25,64% the smartphone and only 6,41% the virtual glasses. Respondents prefer the smart mirror, based on the interviews, because they could still see their real bodies and in the other products the person was an avatar. So, <u>the closer to reality the better</u>.

In the furniture experiment, the smartphone got 58,97% votes, the virtual glasses 35,90% and 5,13% said that no value was added. The smartphone preference is related to the ease of use of an app, provided by IKEA, that has the entire furniture catalog and it is fun to use at the same time.

To use AR through a smart mirror or virtual glasses the user needs to pay for the device, so it was important to see how much they are willing to pay for the devices. To understand if the willing to

| | | Annual Income | | | | |
| | | Annual Income | | | | |
		10.000€ - 20.000€	20.000 - 50.000€	50.000 - 100.000 €	<10.000€	Total
How much will you be willing to pay for the Virtual Glasses?	<100€	7	9	2	12	30
	100€-250€	5	0	1	17	23
	250€-500€	4	1	0	10	15
	500€-1000€	1	1	0	6	8
	1000€-1500€	1	0	0	1	2

Table 3.4 - Annual income versus willingness to pay (Virtual Glasses)

pay price had any correlation with the respondent's annual income the two variables were crossed as you can see below.

The majority of respondents agreed to pay between 100€ to 500€ for the smart mirror and less than 100€ to 500€ for the virtual glasses. The results didn´t show relevant differences between people that received an annual income of <10.000€ to 100.000€.

Finally, respondents agreed that new brands that are being created and advertised through social media would get more credibility if they invested in AR features. Also, when asked if there would be another category that people would benefit from using the AR technology a big portion said the automotive industry, decoration and for make-up.

4.8 In-depth and group interviews

The results from the interviews were informative in several aspects. First, the questions on online and offline shopping habits, involvement and respondents' views were important to understand the focus of the research

and provide quality quantitative analysis.

Second, the questions and the experience through videos of the different ways of applying augmented technology gave a good insight of which of them are more capable to be in the market and worth of investigation and future research.

Thirdly, even though the virtual glasses are the most expensive object utilized it doesn´t mean it is the one that provides more value through online shopping to the user. There was a tendency of the female audience to prefer the smart mirror and a preference of the smartphone app from the male audience.

Online and Offline Shopping habits and Involvement. The frequency of shopping in both channels, online and offline, varied a lot among respondents. Nevertheless, one interviewer reported to shop online at least once a week, and four interviewees reported to shop online once a month. In general, offline shopping is more predominant if we take into consideration shopping categories such as food and beverages. The predominant online shopping categories among all interviewees were clothing, health & beauty and technology. Some respondents mentioned that

they prefer to go to a physical store, to analyze the product, and then buy it online because of better deals/discounts, the comfort of delivery and less store pressure from employees.

When inquired about the pros and cons of buying in a physical store most value the ability of trying, comparing and analyzing the product before buying it. But they all refer that not all products need to be experiment à priori such as t-shirts, jackets and underwear. Trousers and jeans were the product that made them more skeptical to buy online due to specific waist/length sizes. Regarding shopping online, mostly agreed that comparing different website prices and watching other people' reviews makes shopping online safer. But, as a downside, not having some sort of product experimentation is what dictates going to a physical store, especially in the clothing industry.

AR in online stores. To understand the behavior of the interviewers with confronted with AR technologies to increase their shopping experience five videos were showed. Each video had a different gadget needed to use the technology and two types of shopping categories were tested: Clothing and Furniture.

AR with smartphone app. The first video was about using their smartphone to experience AR shopping. The smartphone would scan our body perfectly and provide an avatar image of ourselves. This way people can have the perfect idea how clothes would fit on them.

One out of five total respondents stated that an user friendly, intuitive and interactive app was key for using the smartphone to support the AR technology. Three out of five total respondents affirm the details on the app is the most important feature.

"If the app could provide my avatar with the highest resolution focusing 200% on details, I would experiment using the technology with my smartphone."

Only one of the respondents didn´t like the idea of being body scanned to an app due to too much exposure online and being compared to an avatar.

"It seems that I´m in a SIMS game."

The second video used AR through the smartphone and furniture shopping was tested. All respondents agreed on having some doubts about the viability of the app because it can provide an idea how a chair fits in the room, but it is difficult with the smartphone to understand if the measures and colors are accurate and congruent with reality.

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AR with smart mirror. Respondents were inquired about the experience of having an intelligent mirror in their bedroom that they could experiment different clothes, combine different outfit and save them for later.

Between men and women, the opinions diverge a lot with a tendency for an easy acceptance of the gadget from female audience. A female respondent agreed that having a smart mirror at home would provide a bigger proximity to shopping in a real store and the impulsive shopping would increase. And, due to the realness of the experience the amount of clothing returns would decrease which is a major problem of online shopping. The store model doesn´t show how a piece of garment fits on our body.

"The smart mirror with AR would be a game changer in online shopping."

Other female respondent agreed with the statements above but had some security problems because having a camera in her wardrobe feels like invasion of privacy. All male respondents were skeptical about how good the intelligent mirror could provide the right clothing size and didn´t find more value than having the smartphone app at their disposal.

AR with virtual glasses. Respondents were asked to see a video where a person was buying clothes through their virtual glasses. An avatar of the person was displayed. Like the smartphone but a more immersive experience.

Regarding the virtual glasses, only one of the five respondents affirm that this device would provide a better immersive experience and would distinguish from all other experiences. The rest of the interviewees didn´t find any value added and find it more difficult to work with.

Chapter 5: Conclusions

This study aimed at exploring the online market with AR among people aged between 15 and 65 years old. The goal was to understand if the introduction of AR would bridge the gap between online and physical stores. To reach desired conclusions it was tested if AR would affect positively users according to the willingness to buy exclusively online, purchase intention and perceived informativeness with different devices (smartphone, smart mirror, smart glasses), while furniture and fashion shopping. We set out to analyze consumers shopping habits online and offline. It was discovered that individuals belonging to this age range still buy mostly in physical stores with a growing tendency of shopping online. Then, we wanted to know which shopping categories people usually buy online and, results show that clothing, technology and food & beverages are the three most shopped categories. Additionally, according to the survey, and to answer the first research question: *"What are the key factors that drive consumers to buy a product in a physical store instead of purchasing it online?"*, the only key driver that had a statically importance to the study was the possibility of comparing prices between products and get discounts. Also, consumers only see as a key driver of physical stores being able to test and experimenting the product which is the goal AR wants to bridge.

Through the online survey and interviews, by showing several videos of how AR would interact in a possible online environment, we could extract the research questions regarding perceived informativeness, willingness to buy and impulsive shopping. To make the study more reliable the AR technology was tested in two different retail industries, fashion and furniture.

According to data, we can confirm that AR enhances the product´s information perceived by a user besides when using smart glasses. We expect that the poor performance of smart glasses was affected by the video itself and not by the experiment. The willingness to buy products exclusively online wasn´t statically valid since all devices in the two categories rejected the third research question: *"To what extend are customers willing to buy all their goods online if they had an Augmented reality tool to help in their shopping?"*. Additionally, the fourth research question: *"To what extent, the consumer would have a more impulsive shopping experience with AR, while shopping online?"* was also rejected since in every experiment none of the devices underperformed in both industries.

Taking into consideration the results from the online questionnaire, it seems that AR would not bridge the gap between online and physical stores. However, when asked: "*Do you feel that, by using augmented reality, you will have a more enriching experience online than buying a product through a website?*" and *"Do you fell that, by using augmented reality, you will have an online shopping experience pretty similar to shopping in a physical store?"* both questions over performed with a positive response of 4,38/5 and 3,40/5 respectively. The two positive responses shows that consumers have a valuable idea of what AR can bring to the digital world and companies can benefit from it.

Finally, the main question of the dissertation: *"Is Augmented Reality going to bridge the gap between online and physical stores?"* shows a positive response from users since, based on a Likert scale, the mean shows 4,13 out 5 points for the agreement of the question. Which means that AR might be a solution to bridge the gap between online and physical stores. This lead me conclude that the poor performance of three research questions was linked to the lack of involvement of the users doing the survey since the only contact they had with AR was through a video and not experiment by themselves. Also, the smart mirror was the best performing device in the fashion category and the smartphone app took the lead in the furniture category.

To conclude, it is now possible to say that consumers are open and see value in AR technology in the online market. For this reason, it should be something for companies to analyze, investigate and apply to become a competitive advantage.

5.1 Managerial Implications

There are potential managerial implications that should be taken into consideration by retailers, especially in the fashion and furniture industry, for the ones that want to invest in their online platforms. Even though the experiment was conducted focusing on the fashion and furniture market, all results are valid across any other shopping categories.

An AR implementation in a retailer´s website would definitely improve the perceived value of a consumer regarding a brand and a sales increase should be expected, only if the AR technology interface meets customer needs and expectations. Since AR is a still growing technology it should be implemented, side by side, with the traditional website in an online store to offer different possibilities for the user.

According to the research questions, the performance of AR didn´t seem as good as how people see AR technology, as a valuable tool in the digital world. For this reason, retailers need to pay close attention and think of ways to increase the AR quality and experience itself. So, a low investment in this area may not fulfill companies' expectations regarding an increase on sales. AR to succeed needs an immersive and engaging experience.

If the quality is in the AR experience, based on the qualitative and quantitative research, a very high percentage of the sample looks at AR as an innovative and disruptive tool to engage the user and possibly persuade him like in a physical store. More in depth in the female sample, in the fashion experiment, mostly everyone sees the smart mirror as the best new device that would reinvent online shopping and thus increase their consumption so stores may start to test this tool in physical stores first and then implement it online.

Finally, AR could be a successful tool to differentiate in the online market offering a unique way of presenting their own products and impact positively the brand reputation online.

5.2 Limitations and Future Research

This study faced several limitations. First, the collected sample is relatively small to extract a deeper analysis about the impact of AR in the online market. Future research with a high degree of responses would provide more certain conclusions.

Second, the study was limited to the Portuguese population. Different countries perceive AR technology in different ways. So, since the study focused in the online retail market, that can be accessed worldwide, a broader population study would benefit more online retailers about the research made.

Third, the quantitative and qualitative research conducted, due to low budget in the investigation and the pandemic situation, all experiments were tested through a video of other users testing and experiencing AR in different situations with different devices. This was the biggest limitation of the study since the results taken from the questionnaire could be completely different giving a better insight of how customers would interact with AR technology. Therefore, future studies should evaluate an investment for testing different AR devices or even make a partnership with a live online store to test the user engagement, purchase intention and willingness to buy with AR.

Fourth, this research was mostly focused in the fashion and furniture industry when other potential sectors would benefit from this research like eyewear and cosmetic industry.

Finally, the research focused in some variables that would benefit retailers about the appliance of AR in their stores. Thus, if more variables were added, would make a richer study and a more comprehensive application of the AR.

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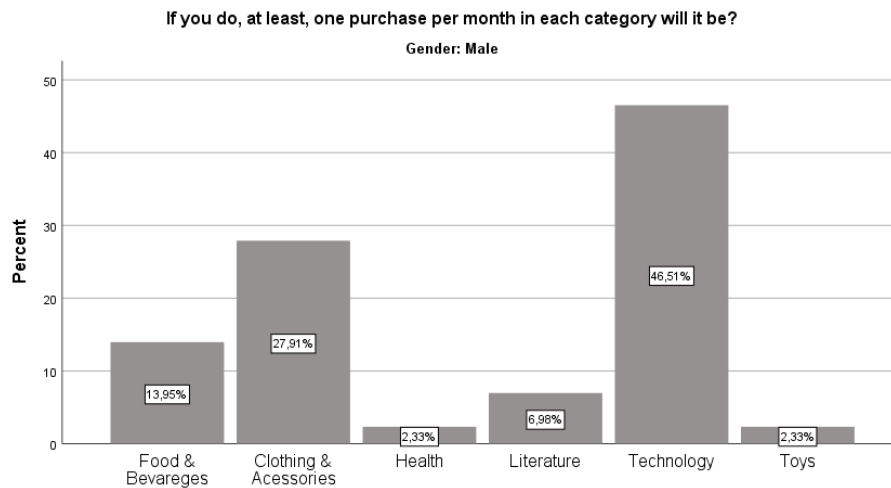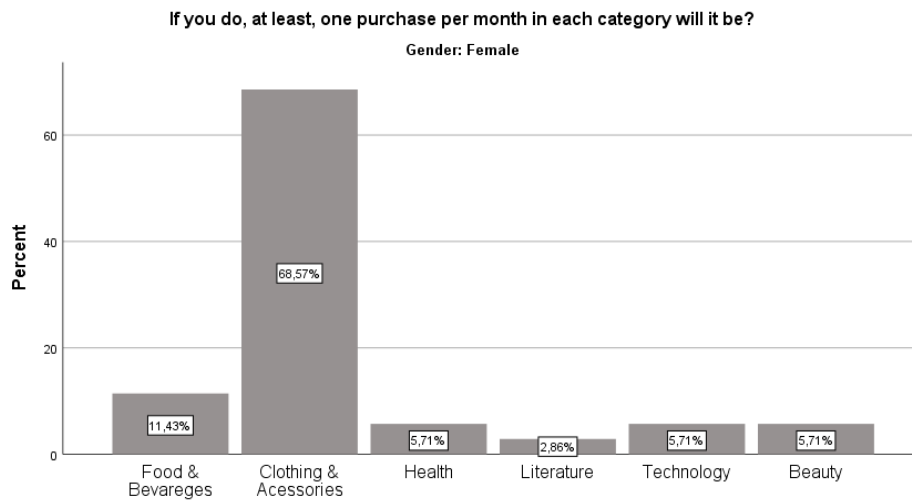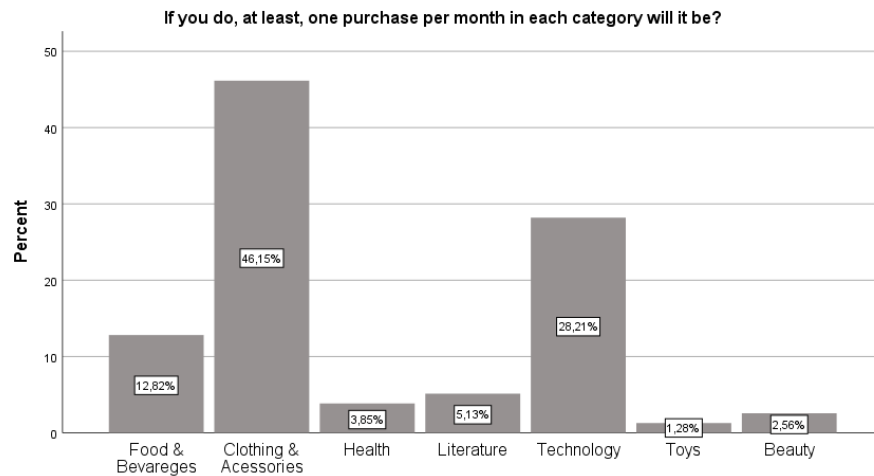
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Annexes
Annex A - SPSS Output – Sample Characterization

If you do, at least, one purchase per month in each category will it be?

If you do, at least, one purchase per month in each category will it be?
Gender: Female

If you do, at least, one purchase per month in each category will it be?
Gender: Male

Annex B - SPSS Output – Key online and offline factors statistics - online

One-Sample Test

Test Value = 2.5

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Online - I can ask for help, online or on the phone, if necessary	13,695	77	,000	2,231	1,91	2,56
Online - I don't feel pressured or observerd by the store employees	16,347	77	,000	2,397	2,11	2,69
Online - I can compare different website prices and get online discount	-5,015	77	,000	-,705	-,99	-,43
Online - I can make a more conscious purchase	4,714	77	,000	,718	,41	1,02
Online - I can get feedback and reviews from others regarding a specific product	5,433	77	,000	,821	,52	1,12
Online - I have a bigger organized vision of what a brand offers.	3,311	77	,001	,538	,21	,86

Annex C - SPSS Output – Key online and offline factors statistics - offline

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
In store - I can try/test the product	78	1,41	,797	,090
In store - I can ask for help from a store employee, if necessary	78	3,08	,908	,103
In store - I can deeply analyze the product before buying it	78	2,59	,829	,094
In store - I don't like to wait for the product to arrive to my house.	78	2,92	1,090	,123

One-Sample Test

Test Value = 2.5

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
In store - I can try/test the product	-12,081	77	,000	-1,090	-1,27	-,91
In store - I can ask for help from a store employee, if necessary	5,609	77	,000	,577	,37	,78
In store - I can deeply analyze the product before buying it	,956	77	,342	,090	-,10	,28
In store - I don't like to wait for the product to arrive to my house.	3,427	77	,001	,423	,18	,67

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Annex D – SPSS Output - Perceived Informativeness

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Clothing - Smartphone AR - Perceived informativeness	78	3,6154	1,04733	,11859
Clothing - Smart Mirror AR - Perceived informativeness	78	3,8590	1,11337	,12606
Clothing - Virtual Glasses AR - Perceived informativeness	78	3,1538	1,20687	,13665
Furniture - Smartphone AR - Perceived informativeness	78	3,9231	,96388	,10914
Furniture - Virtual Glasses AR - Perceived informativeness	78	3,6923	1,09672	,12418

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Clothing - Smartphone AR - Perceived informativeness	3,6154	78	1,04733	,11859
	Furniture - Smartphone AR - Perceived informativeness	3,9231	78	,96388	,10914
Pair 2	Clothing - Virtual Glasses AR - Perceived informativeness	3,1538	78	1,20687	,13665
	Furniture - Virtual Glasses AR - Perceived informativeness	3,6923	78	1,09672	,12418

One-Sample Test

Test Value = 3

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference Lower	95% Confidence Interval of the Difference Upper
Clothing - Smartphone AR - Perceived informativeness	5,189	77	,000	,61538	,3792	,8515
Clothing - Smart Mirror AR - Perceived informativeness	6,814	77	,000	,85897	,6079	1,1100
Clothing - Virtual Glasses AR - Perceived informativeness	1,126	77	,264	,15385	-,1183	,4260
Furniture - Smartphone AR - Perceived informativeness	8,458	77	,000	,92308	,7058	1,1404
Furniture - Virtual Glasses AR - Perceived informativeness	5,575	77	,000	,69231	,4450	,9396

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Clothing - Smartphone AR - Perceived informativeness & Furniture - Smartphone AR - Perceived informativeness	78	,228	,045
Pair 2	Clothing - Virtual Glasses AR - Perceived informativeness & Furniture - Virtual Glasses AR - Perceived informativeness	78	,389	,000

Paired Samples Test

		Paired Differences Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	95% Confidence Interval of the Difference Upper	t	df	Sig. (2-tailed)
Pair 1	Clothing - Smartphone AR - Perceived informativeness - Furniture - Smartphone AR - Perceived informativeness	-,30769	1,25157	,14171	-,58988	-,02551	-2,171	77	,033
Pair 2	Clothing - Virtual Glasses AR - Perceived informativeness - Furniture - Virtual Glasses AR - Perceived informativeness	-,53846	1,27608	,14449	-,82617	-,25075	-3,727	77	,000

Annex E – SPSS Output - Impulsive shopping

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Clothing - Smartphone AR - Impulsiveness	78	2,2436	1,34054	,15179
Clothing - Smart Mirror AR - Impulsiveness	78	2,6282	1,49553	,16933
Clothing - Virtual Glasses AR - Impulsiveness	78	2,2179	1,34500	,15229
Furniture - Smartphone AR - Impulsiveness	78	2,5897	1,40902	,15954
Furniture - Virtual Glasses AR - Impulsiveness	78	2,8333	1,41803	,16056

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Clothing - Smartphone AR - Impulsiveness	2,2436	78	1,34054	,15179
	Furniture - Smartphone AR - Impulsiveness	2,5897	78	1,40902	,15954
Pair 2	Clothing - Virtual Glasses AR - Impulsiveness	2,2179	78	1,34500	,15229
	Furniture - Virtual Glasses AR - Impulsiveness	2,8333	78	1,41803	,16056

One-Sample Test

Test Value = 3

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference Lower	Upper
Clothing - Smartphone AR - Impulsiveness	-4,983	77	,000	-,75641	-1,0587	-,4542
Clothing - Smart Mirror AR - Impulsiveness	-2,196	77	,031	-,37179	-,7090	-,0346
Clothing - Virtual Glasses AR - Impulsiveness	-5,135	77	,000	-,78205	-1,0853	-,4788
Furniture - Smartphone AR - Impulsiveness	-2,571	77	,012	-,41026	-,7279	-,0926
Furniture - Virtual Glasses AR - Impulsiveness	-1,038	77	,303	-,16667	-,4864	,1531

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Clothing - Smartphone AR - Impulsiveness & Furniture - Smartphone AR - Impulsiveness	78	,597	,000
Pair 2	Clothing - Virtual Glasses AR - Impulsiveness & Furniture - Virtual Glasses AR - Impulsiveness	78	,598	,000

Paired Samples Test

		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Clothing - Smartphone AR - Impulsiveness - Furniture - Smartphone AR - Impulsiveness	-,34615	1,23611	,13996	-,62485	-,06745	-2,473	77	,016
Pair 2	Clothing - Virtual Glasses AR - Impulsiveness - Furniture - Virtual Glasses AR - Impulsiveness	-,61538	1,24035	,14044	-,89504	-,33573	-4,382	77	,000

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Annex F – SPSS Output - Willingness to buy

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Clothing - Smartphone AR - Online shopping exclusiveness	78	2,3077	1,51450	,17148
Clothing - Smart Mirror AR - Online shopping exclusiveness	78	2,6538	1,54438	,17487
Clothing - Virtual Glasses AR - Online shopping exclusiveness	78	2,1538	1,52108	,17223
Furniture - Smartphone AR - Online shopping exclusiveness	78	2,7436	1,48967	,16867
Furniture - Virtual Glasses AR - Online shopping exclusiveness	78	2,7949	1,53199	,17346

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Clothing - Smartphone AR - Online shopping exclusiveness	2,3077	78	1,51450	,17148
	Clothing - Virtual Glasses AR - Online shopping exclusiveness	2,1538	78	1,52108	,17223
Pair 2	Furniture - Smartphone AR - Online shopping exclusiveness	2,7436	78	1,48967	,16867
	Furniture - Virtual Glasses AR - Online shopping exclusiveness	2,7949	78	1,53199	,17346

One-Sample Test

Test Value = 3

					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Clothing - Smartphone AR - Online shopping exclusiveness	-4,037	77	,000	-,69231	-1,0338	-,3508
Clothing - Smart Mirror AR - Online shopping exclusiveness	-1,980	77	,051	-,34615	-,6944	,0021
Clothing - Virtual Glasses AR - Online shopping exclusiveness	-4,913	77	,000	-,84615	-1,1891	-,5032
Furniture - Smartphone AR - Online shopping exclusiveness	-1,520	77	,133	-,25641	-,5923	,0795
Furniture - Virtual Glasses AR - Online shopping exclusiveness	-1,183	77	,241	-,20513	-,5505	,1403

Paired Samples Test

		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper	t	df	Sig. (2-tailed)
Pair 1	Clothing - Smartphone AR - Online shopping exclusiveness - Clothing - Virtual Glasses AR - Online shopping exclusiveness	,15385	1,17415	,13295	-,11088	,41858	1,157	77	,251
Pair 2	Furniture - Smartphone AR - Online shopping exclusiveness - Furniture - Virtual Glasses AR - Online shopping exclusiveness	-,05128	1,20494	,13643	-,32295	,22039	-,376	77	,708

Annex G – SPSS Output – Augmented Reality in online stores

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Do you feel that, by using augmented reality, you would have a more enriching online shopping experience than through the website?	78	4,38	,743	,084
Do you feel that, by using augmented reality, you would have a similar shopping experience as in a store?	78	3,40	,998	,113
Do you agree that augmented reality can be a techonlogy to bridge the gap between online and physical stores?	78	4,13	,632	,072

Paired Samples Correlations

|		N	Correlation	Sig.
Pair 1	Clothing - Smartphone AR - Online shopping exclusiveness & Clothing - Virtual Glasses AR - Online shopping exclusiveness	78	,701	,000
Pair 2	Furniture - Smartphone AR - Online shopping exclusiveness & Furniture - Virtual Glasses AR - Online shopping exclusiveness	78	,682	,000

One-Sample Test

Test Value = 3

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Do you feel that, by using augmented reality, you would have a more enriching online shopping experience than through the website?	16,467	77	,000	1,385	1,22	1,55
Do you feel that, by using augmented reality, you would have a similar shopping experience as in a store?	3,517	77	,001	,397	,17	,62
Do you agree that augmented reality can be a techonlogy to bridge the gap between online and physical stores?	15,776	77	,000	1,128	,99	1,27

Annex H – SPSS Output – Augemented Reality devices

After answering the questions above, in the clothing category, which of the three devices adds more value for you?
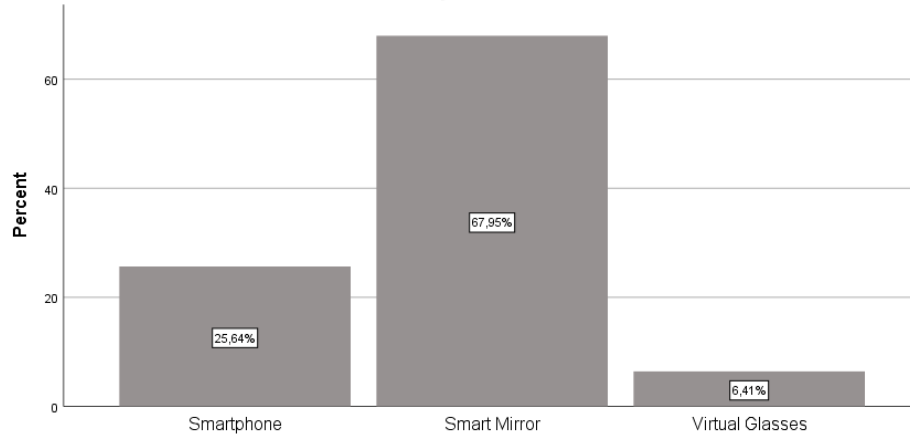
After answering the questions above, in the furniture category, which of the three devices adds more value for you?
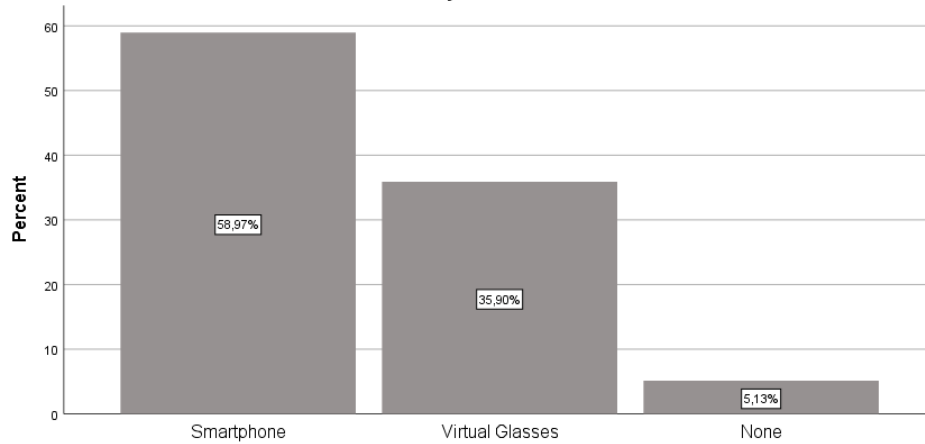
Annex I – Survey

Caro/a participante,

O meu nome é Francisco Nunes e gostava de convidá-lo a participar neste inquérito de forma a concluir a minha tese de mestrado.

O objetivo deste estudo é perceber se a tecnologia de realidade aumentada pode diminuir o fosso existente entre as lojas físicas e as lojas online.

Agradeço toda a sua colaboração e interesse por este protejo!

1 Por mês, em média, com que frequência se dirige a uma loja/supermercado?

- 0
- 2-4
- 5-7
- 8+

----

2 Em média, por mês, com que frequência compra produtos online?

- 0
- 2-4
- 5-7
- 8+

----

3 Se já faz ou se fizesse, pelo menos, uma compra online por mês em que categoria se inseria?

- Alimentação e bebidas
- Vestuário e acessórios
- Saúde e Bem-Estar
- Livros
- Tecnologia (Incluindo telemóveis e computadores)
- Mobiliário
- Brinquedos
- Beleza

----

4 O que mais valoriza ao fazer compras online? Coloque por ordem decrescente (1 - O que mais valoriza ; 6 - O que menos valoriza)

- Posso pedir ajuda, online ou por telefone, se necessário
- Não me sinto pressionado ou observado pela colaboradores da loja
- Posso comparar preços de diferentes websites e obter descontos online
- Consigo fazer uma compra mais consciente
- Posso obter feedback de outros utilizadores sobre determinado produto
- Tenho uma visão mais geral e organizada do que a marca oferece.

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5 O que mais valoriza ao fazer compras na loja? Coloque por ordem decrescente (1 - O que mais valoriza ; 6 - O que menos valoriza)

- Consigo experimentar/testar o produto
- Posso pedir ajuda a um colaborador, se necessário
- Posso analisar melhor o produto antes de o comprar
- Gosto de ter o produto na hora e não ter de esperar que este seja entregue em casa.

O presente estudo pretende analisar o impacto da tecnologia de realidade aumentada na experiência de compra. Assim, é importante referir em que consiste a realidade aumentada, para que serve e os seus diversos campos de aplicação.

- **Realidade aumentada** é uma tecnologia que permite sobrepor elementos virtuais à nossa visão de realidade.
- Esta tecnologia pode ser aplicada num vasto número de áreas desde a educação até à manutenção de máquinas por exemplo. <u>Em baixo encontra alguns exemplos práticos de aplicação desta tecnologia</u>.

6 Imagine que pretende comprar uma peça de vestuário online e tem à sua disposição uma aplicação móvel com realidade aumentada. A experiência de compra seria semelhante à que acabou de assistir no vídeo.

Numa escala de 1 a 5, seleccione o seu nível de concordância relativamente às afirmações abaixo. (1 - Discordo Totalmente; 5 - Concordo Totalmente)

	0	1	2	3	4	5
Consigo ter acesso a mais informação sobre o produto ()						
Com esta tecnologia, a experiência de compra seria mais imersiva ()						
A minha compra seria mais impulsiva ()						
O valor que atríbuo à marca é superior ao usufruir deste tipo de experiência ()						
Comprar roupa online seria mais divertido ()						
Comprar com esta tecnologia, iria envolver-me mais no processo de compra ()						
Seria capaz de começar a comprar exclusivamente online ()						
A tecnologia parece ser difícil de usar ()						

7 Imagine agora que tem uma espelho inteligente com realidade aumentada em sua casa. A experiência de compra seria semelhante à que acabou de assistir no vídeo.

Numa escala de 1 a 5, seleccione o seu nível de concordância relativamente às afirmações abaixo. (1 - Discordo Totalmente; 5 - Concordo Totalmente)

	0	1	2	3	4	5
Consigo receber mais informação sobre o produto ()						
Com esta tecnologia, a experiência de compra seria mais imersiva ()						
A minha compra seria mais impulsiva ()						
O valor que atríbuo à marca é superior ao usufruir deste tipo de experiência ()						
Comprar roupa online seria mais divertido ()						
Comprar com esta tecnologia, iria envolver-me mais no processo de compra ()						
Seria capaz de começar a comprar exclusivamente online ()						
A tecnologia parece ser difícil de usar ()						

8 Imagine agora que tem uns óculos com realidade aumentada. Os óculos têm a capacidade de projectar produtos ou até a sua imagem, como um avatar. A experiência de compra seria semelhante à que acabou de assistir no vídeo.

Numa escala de 1 a 5, seleccione o seu nível de concordância relativamente às afirmações abaixo. (1 - Discordo Totalmente; 5 - Concordo Totalmente)

	0	1	2	3	4	5
Consigo receber mais informação sobre o produto ()						
Com esta tecnologia, a experiência de compra seria mais imersiva ()						
A minha compra seria mais impulsiva ()						
O valor que atríbuo à marca é superior ao usufruir deste tipo de experiência ()						
Comprar roupa online seria mais divertido ()						
Comprar com esta tecnologia, iria envolver-me mais no processo de compra ()						
Seria capaz de começar a comprar exclusivamente online ()						
A tecnologia parece ser difícil de usar ()						

9 Depois de ter respondido as perguntas anteriores, e considerando ainda uma possível compra de um produto da categoria de vestuário, qual dos 3 aparelhos considera trazer maior valor acrescentado?

- Aplicação móvel
- Espelho Inteligente
- Óculos
- Nenhum

56

Por favor veja o vídeo abaixo:

Como é possível ver através do vídeo, através de uma **aplicação móvel com realidade aumentada**, *é possível visualizar a disposição de objetos* (e.g. móveis) *e distribuí-los no espaço sem que estes estejam presentes fisicamente.*

10 Imagine agora que pretende comprar um sofá para a sua casa, numa loja online, e tem à sua disposição uma aplicação móvel com realidade aumentada.

Numa escala de 1 a 5, seleccione o seu nível de concordância relativamente às afirmações abaixo. (1 - Discordo Totalmente; 5 - Concordo Totalmente)

	0	1	2	3	4	5
Consigo receber mais informação sobre o produto ()						
Com esta tecnologia, a experiência de compra seria mais imersiva ()						
A minha compra seria mais impulsiva ()						
O valor que atríbuo à marca é superior ao usufruir deste tipo de experiência ()						
Comprar online seria mais divertido ()						
Comprar com esta tecnologia, iria envolver-me mais no processo de compra ()						
Seria capaz de começar a comprar exclusivamente online ()						
A tecnologia parece ser difícil de usar ()						

Para efeitos da experiência, vamos supor que estaria a testar a disposição do seu novo sofá em sua casa em vez de numa decoradora (como acontece no vídeo acima).

11 Imagine agora que pretende comprar um sofá para a sua casa, numa loja online, e tem à sua disposição uns óculos com realidade aumentada.

Numa escala de 1 a 5, seleccione o seu nível de concordância relativamente às afirmações abaixo. (1 - Discordo Totalmente; 5 - Concordo Totalmente)

	0	1	2	3	4	5
Consigo receber mais informação sobre o produto ()						
Com esta tecnologia, a experiência de compra seria mais imersiva ()						
A minha compra seria mais impulsiva ()						
O valor que atríbuo à marca é superior ao usufruir deste tipo de experiência ()						
Comprar online seria mais divertido ()						
Comprar com esta tecnologia, iria envolver-me mais no processo de compra ()						
Seria capaz de começar a comprar exclusivamente online ()						
A tecnologia parece ser difícil de usar ()						

12 Depois de ter respondido às perguntas anteriores, e considerando ainda uma possível compra de um produto dentro da categoria de mobiliário, com qual dos 3 aparelhos considera trazer maior valor acrescentado?

- Aplicação móvel
- Óculos inteligentes
- Nenhum

58

13 Quanto considera justo e estaria disposto a pagar por um espelho interativo semelhante ao demonstrado anteriormente?

- (1)
- 100-250€
- 250-500€
- 500-1000€
- 1000€-1500€
- >2000€

14 Quanto considera justo e disposto a pagar pelos óculos de realidade aumentada?

- (1)
- 100€-250€
- 250€-500€
- 500€-1000€
- 1000€-1500€
- >2000€

15 Sabendo que, ao utilizar qualquer um dos aparelhos apresentados, tudo aquilo que encomendava vinha de acordo com a sua preferência, optaria por comprar online com mais frequência?

- Nunca
- Às vezes
- Muitas vezes
- Sempre

16 Sente que, utilizando a realidade aumentada, iria ter uma experiência de compra online mais enriquecedora do que comprando um produto através do website?

- Discordo totalmente
- Discordo
- Não discordo nem concordo
- Concordo
- Concordo Totalmente

17 Sente que, utilizando a realidade aumentada, iria ter uma experiência de compra online muito similar a uma compra em loja?

- Discordo totalmente
- Discordo
- Não discordo nem concordo
- Concordo
- Concordo Totalmente

18 Determinadas marcas que vemos online, através de anúncios nas redes sociais, podem ter dificuldades em obter credibilidade pretendida relativamente aos seus produtos. Acredita que uma aposta na tecnologia de realidade aumentada poderá ter um impacto positivo na credibilidade de uma marca embrionária?

- Discordo totalmente
- Discordo
- Não discordo nem concordo
- Concordo
- Concordo Totalmente

19 Para além das categorias estudadas (Vestuário e Mobiliário) haverá outra possível categoria/produto que, no seu dia a dia, poderia beneficiar do uso desta tecnologia? Se sim, indique-a em baixo.

_____

20 Concorda que a realidade aumentada poderá ser uma tecnologia que preencha o fosso existente entre as lojas físicas e as lojas online?

- Discordo totalmente
- Discordo
- Não discordo nem concordo
- Concordo
- Concordo Totalmente

21 Idade

- <18
- 18-24
- 31-40
- 31-40
- 41-50
- >50

22 Género

- Feminino
- Masculino

23 Rendimento Anual Líquido

- 10.000€ - 20.000€
- 20.000 - 50.000€
- 50.000 - 100.000 €
- >100.000€

Obrigado pela sua participação e espero que tenha aprendido algo de novo!

Annex J - In-Depth Interviews Guidelines

I. Introduction

"Thank you for participating in this research method. I would like to conduct an individual interview to explore how Augmented Reality can influence consumers and if the technology is able to bridge the gap between physical and online stores. You were particularly selected for this study so thank you for your collaboration. Everything you say will remain confidential."

II. General Behavioral Question

- Do you usually shop online? If so, in which categories or which type of products you buy?
- Do you know what is Augmented Reality?
- Do you enjoy shopping online? What do you like and dislike?
- Describe me a physical store shopping situation? What do you like and dislike?

III. AR online with different devices test

Brief presentation of the three scenarios: AR with smartphone, smart mirror and virtual glasses.

Video with smartphone app: https://www.youtube.com/watch?v=e8Wt2lJ51_M

- After watching the video what do you consider as pros and cons of using the AR technology through a smartphone?

Video with smart mirror: https://www.youtube.com/watch?v=rMUsVIB-anY

- After watching the video what do you consider as pros and cons of using the AR technology through a smart mirror?

Video with virtual glasses: https://www.youtube.com/watch?v=xPXGJErTMlQ

- After watching the video what do you consider as pros and cons of using the AR technology through the virtual glasses?

- What to you feel that is missing to use one of the devices on a daily basis?

- If you need to give a price to each one of the devices seen in the videos what would it be?

IV. Closing the interview and asking for personal details

Now, I kindly ask you to provide the following personal details:

- Age: under 18, 18-24, 25-34, 35-44,45-54, over 54
- Gender: male, female
- Highest educational level: Primary School, Secondary School, Professional Degree, Bachelor Degree, Masters Degree, PhD/Doctorate

Your personal details will only be used for the purpose of this thesis project. Thank you very much for your participation.