

# THE HAGUE

UNIVERSITY OF  
APPLIED SCIENCES

7 JANUARY 2020

## Augmented Reality in Online Shopping

Dissertation: How can Augmented Reality  
Transform the eCommerce Industry?



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*wordcount: 11.774*

## I. Executive Summary

**Introduction:** Augmented reality enriches online shopping with a new virtual aspect that offers customers the ability to try a product before purchasing it online. It superimposes digital information onto the physical environment which opens up opportunities for businesses involved in eCommerce (Sharma, 2018). Businesses will have the ability to give customers a completely new experience and interactivity during online shopping.

**Objective:** Presenting customers with the power of trying virtual products without going to 'real' stores creates interesting opportunities and can give a solution to the high abandoning of online shopping carts (87%) (formisimo, 2016). Although augmented reality is an emerging technology in eCommerce, it is still in its infancy. Little is known about how it can influence the customer experience and potentially decrease the abandoning of online shopping carts.

**Methods:** This dissertation quantitatively addresses the customer experience of 43 participants who completed a structured interview after experimenting with both of the shopping-oriented applications used for the purpose of this research (Ikea Place and SneakerKit). Millennials, and especially Generation Y, were chosen as an appropriate sample group to discover the effects augmented reality has on the customer experience divided into three variables: sensory, emotional and social experience.

**Results:** The applications using augmented reality were perceived more enjoyable than regular online shopping, it gave customers a better visualization of the products and it evoked a higher purchase intention due to an enhanced customer experience and perspective towards the product and an online store. However, participants agreed that the social experience was just slightly improving which could be enhanced by more personalisation options within augmented reality technologies.

**Conclusion:** This allows to conclude that adding augmented reality to a customer's journey in online shopping can positively influence a customer's product visualization and purchase intention. However, further research and statistical tests need to be conducted to fully utilize the potential of augmented reality in online shopping.

### KEYWORDS

Augmented reality; customer experience; customer journey; purchase intention; customer perspective;

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## 1 Introduction

With the emergence of eCommerce, the number of online shoppers has unsurprisingly risen along with it. As of today, the number of online shoppers is estimated at 1.92 billion, which is 26.8 percent of the global population. (statista, 2019) That means that one out of every four people occasionally shops online and it is expected to rise to 2.14 billion in 2021. Therefore, the potential for retailers operating in eCommerce markets is enormous and expected to grow every year. The main reasons customers choose online shopping is that it is more convenient and it gives you the ability to compare prices. The shops are open 24/7 and there is an unlimited range of offers and products to choose from, plus, it saves time as the customer does not have to wait in lines or travel to shops of their liking. eCommerce is an important part of today's market and more customers find their way to online shopping every day.

**Problem statement:** Despite this, companies in the eCommerce industry are falling behind in marketing innovation and need to rethink their strategy. An average of 87% of shoppers abandon their carts before completing a purchase (formisimo, 2016) (Barilliance, 2019). This shows that retailers need to do a lot more to persuade customers to go ahead with the items in their carts and make the payment. More than half (56%) of the customers still prefer shopping in-store because they cannot fully visualize products in online stores. The customer wants to see or touch the item first, they want to try the item on before purchase or the customer is concerned that products look different than initially shown online. (KPMG International, 2017)

**Purpose:** Removing the doubt that customers have when buying something online is key. Customers are looking for a richer online shopping experience with greater convenience. Such an online shopping experience can be achieved by enhancing eCommerce with technologies like augmented and virtual reality. These technologies have the potential to let online shoppers try out virtual products before purchasing. It will enhance customer experience and decrease the abandoning of online shopping carts. Therefore, the objective is to implement these technologies within the eCommerce industry to enhance the customer experience and compress customer journey for online shoppers and, in particular, millennials.

Millennials, and especially generation Y, are the group that are most engaged in online shopping as most have grown up with it. It is important to gain an understanding of this group's perception towards the use of virtual and especially augmented reality in eCommerce to potentially decrease the abandoning of shopping carts during online shopping. This will be achieved by collecting quantitative and qualitative data with structured interviews. The focus is put on this group as they are currently the most prominent online shoppers and will be so in perspective.

Millennials will determine the needs for the eCommerce market of the future. However, at this point augmented reality still needs high-speed capabilities of data streaming technologies and wireless networks to be a success. Limitations like bandwidth still prevents achieving a high quality of telepresence in, for example, a completely virtual fitting room. (Orlosky, Kiyokawa, & Takemure, 2017) This means that the use of augmented reality is still limited for companies as they are only able to offer customers these technologies when they are in their home networks connected to Wi-Fi, as it demands high numbers of data. Luckily, the approach of 5G networks might give the solution for this problem. Widespread deployment of 5G mobile networks can potentially accelerate the adoption of augmented and virtual reality. (Orlosky, Kiyokawa, & Takemure, 2017) It would allow for higher flexibility and a higher degree of quality. The new 5G network will give the ability to use AR in live situations when not having a Wi-Fi signal and, increase the spread of the technologies outdoors.

Therefore, it is important to look towards the perception of millennials, as they will determine the needs for the eCommerce market in the future with 5G environments. While there has been previous research on this topic, none has focused on using augmented reality to counter the abandoning of online shopping carts. Furthermore, as eCommerce is becoming increasingly more important in retail, it is key to decrease this number and innovate within this sector in general. Enhancing customer experience and compressing customer journey is the purpose of implementing these technologies which will both stimulate a purchase intention and decrease the abandoning of online shopping carts at the same time.

**To answer to the situation as described as above, the following research question has been composed: ‘How can Augmented Reality transform the eCommerce Industry?’.**

Subsequently, to help determine the outcome of the research question the following **sub-questions** will guide this research:

- What is the current application of Augmented Reality?
- What is the Customers’ Perspective towards the technology?
- What do customers think is the added value of Augmented Reality in Online Shopping?
  - Sensory experience, Emotional experience, and Social experience
- What possibilities does 5G innovation offer Augmented Reality in the future?

To gather the information needed, this dissertation will use desk research and qualitative research in combination with quantitative research.

Desk research will be used to research, describe and analyse the different theories and ideas of the theoretical framework and the current applications, limitations and future direction of augmented reality (Saunders, Lewis, & Thornhill, 2009). The desk research will focus especially on determining the variables and its theories within the customer experience when using augmented reality.

To answer the question of the customers' perspective and experience, this research will mainly use qualitative data. The qualitative research is conducted through structured interviews after participants agreed and experimented with one of the two applications used for this research, Ikea Place (Inter IKEA Systems B.V., 2019) and SneakerKit (City Computing Ltd. VykingAR, 2019). During the structured interview, participants were first asked about their perspective towards augmented reality and later about the experience with one of the applications. The applications gave customers the ability to try out products that could be bought through online retail stores.

## 1.1 Reading guide

This research is further divided into six chapters. The theoretical framework provides an overview of the main theories and models related to augmented reality in eCommerce. The methodology describes the research methods used and provides a justification of the relevance and reliability. In the results chapter, the findings from the field and desk research are presented. Subsequently, in the analysis the results are explained, analysed and interpreted, resulting in the conclusion and recommendations.

## 2 Theoretical Framework

The aim of this research is to obtain a thorough understanding of how AR can potentially reduce the abandoning of online shopping carts before purchase. The theoretical framework provides a critical examination and review of the most important ideas and models relevant to this research. Within the frameworks of this study, it is explained how these different ideas of augmented reality, strengthened with its interactivity and the new 5G innovation, will influence the customer journey and experience to strengthen the purchase intentions of the customer. The theories and conceptual ideas that are formed will create the theoretical framework needed for this research.

### 2.1 Augmented Reality

Augmented reality will place customers in a mixed environment of virtual and real-world aspects to interact with, this is also considered as telepresence. It will give companies the ability to offer customers an enhanced customer experience by trying products online before purchasing. As a result, it will consequently compress customer journey and improve the purchase intention by removing doubts they would normally have had by shopping online without the use of augmented reality. Therefore, it is also important to look at the customers' perspective towards using this technology as it will be a new experience for most. It adds interactivity to online shopping which according to Sicilia et al is responsible to generate "greater favorability towards the product and the website" (Sicilia, Ruiz, & Munuera, 2005). This, combined with the potential 5G innovation would offer possibilities for innovation within online shopping. Influences of customer experience, customer journey and customer perspective will determine the application, limitations and future direction of augmented reality in eCommerce.

Westphal describes augmented reality as follows: "augmented reality presents a virtual layer over the customers' perception of the real object, which combines both real and virtual objects in such a way that they function in relation to each other, with synchronicity and the needed depth of perception in three dimensions". (Westphal, 2017) And Westphal defines virtual reality as a place where the user is in a completely virtual environment with an identifiable set of rules and objects to potentially interact with, and where other participants might also be present. (Westphal, 2017) The difference between augmented and virtual reality can thus be found in placing something virtual in a real environment and being immersed in, with the ability to interact to, a complete virtual world.

### 2.1.1 Mixed Reality

This is where a mixed reality comes in. According to Koontz & Gibson, the combination of these two resulted in the emergence of Mixed Reality. Mixed reality can be seen as combining the best aspects of augmented and virtual reality together to enhance the customers experience while shopping online. It is a state-of-the-art technology that merges both the virtual reality as the augmented reality world together in real-time. (Koontz & Gibson, 2002) It tries to use the advantages of both realities and put them into one, to fully utilize the benefits of both technologies. Mixed reality connects both worlds and Milgram & Kishino (p. 2) further describe it as augmented virtuality. (Milgram & Kishino, 194) Mixed reality might offer a solution in the future when augmented reality and especially equipment for the virtual reality technology are more advanced.

### 2.1.2 Telepresence

This is the concept that refers to the ability to be present at a remote location in any form or fashion, an older similar historical innovation can be found in the telephone. However, this is a different kind of telepresence than augmented reality or virtual reality would offer. AR and VR basically describes the customers being in a completely or partially virtual fitting room. Telepresence is defined by Steuer (1992) as “the experience of presence in an environment by means of communication medium” (Steuer, 1992). It can be seen as an intermediate between augmented and virtual reality on the one hand, and consumer experience on the other hand. Telepresence leads to consumers perceiving that they are more informed about a product, and therefore feel more positively about it (Suh & Chang, 2016). This would influence how confident a customer is about purchasing a product and therefore strengthens purchase intention and improves a customers’ experience.

## 2.2 Customer experience

Meyer & Schwager define the customer experience as follows: “customer experience is the internal and subjective response customers have to any direct or indirect contact with a company”. (Meyer & Schwager, 2007, p. 118) Direct contact with a company is usually the use, purchase and service initiated by the customer. Indirect contact is mainly the representation of a company to trigger the need of recognition discussed in the paragraph above. The customer experience is linked with the customer journey. If the customer experience is enhanced, the customer journey will be optimized to.

An article written in the *European Management Journal* has a similar and related definition: “the customer experience originates from a set of interactions between a customer and a product, a company, or part of its organization, which provoke a reaction. This experience is strictly personal and implies the customer’s involvement at different levels”. (Gentile, Chiara, Spiller, & Noci, 2007) 2007, p. 118). Verhoef et al (2009, p. 32) further agree that the customer experience is not only created by what elements retailers can control in-store, but also elements that are outside of the retailer’s control. (Verhoef, et al., 2009) These elements can also be retraced to the indirect contact mentioned by Meyer & Schwager.

Gupta and Vajic (2000) provide a more comprehensive definition of customer experience and they argued that “an experience occurs when a customer has any sensation or knowledge acquisition resulting from some level of interactivity with different elements of a context created by the service provider” (Gupta & Vajic, 1999). Schmitt elaborates on this and says that there are three important dimensions of customer experience, sensory experience, emotional experience, and social experience. (Schmitt, 1999) All three of the dimensions can be triggered by the interactivity of augmented reality and enhance the customer’s experience.

These elements can also be retraced to the indirect contact mentioned above. Therefore, this research will mainly focus on the direct customer experience when purchasing something online and, the enhanced customer experience with interactivity. The need of recognition will not directly influence the abandoning of online shopping carts. Online shopping with augmented and virtual reality will enhance a customer’s attitude towards a brand and create a social connection. Additionally, it will trigger new sensory experiences by mixing the virtual world with the real world by trying products before purchase. Building trust and enhancing customer experience with interactivity in eCommerce are of high importance to strengthen purchase intention and resolve the issue of shoppers leaving their carts.

### 2.2.1 Interactivity

Interactivity in online shopping can be created by using augmented reality technologies. The interactivity will help keep customers interested and changes a customer's experience and perspective to compresses the customer journey. There has not yet been a clear definition of interactivity (Wu, 2006) as most studies differ in the perspectives through which interactivity is viewed. However, it is mostly described as a two-way kind of interactions characterized by the participant's sense of control and Steuer's definition of interactivity is often cited. Steuer's definition of interactivity is as follows: "interactivity is the extent to which users can participate in modifying the form and content of the mediated environment in real time". (Steuer, 1992) Interactivity causes customers to have greater favourability to a product or online shop which is important for this research. (Sicilia, Ruiz, & Munuera, 2005)

### 2.3 Customer journey

Stauss & Weinlich define the customer journey as follows: "it is the path customers usually follow when involved in a service process and what customers typically do during the service process in question". (Stauss & Weinlich, 1997) Professors from the University of Technology in Helsinki built on this definition and state that it can be seen as the cycle of a buying interaction between the customer and a service or product; "it is what we put our customers through if they wish to, and do, business with us". It is the customers' experience during all steps along the way of buying a product or service.

A slightly different definition was given by Engel, Blackwell & Miniard (1995): "The customer journey is the journey a customer follows to purchase products and services, starting from need recognition to the end of the purchase and even after-sales service." (Engel, Blackwell, & Miniard, 1995) The difference is that the customer journey, while taking the definition given by Engel, Blackwell & Miniard, starts when there is a need of recognition and does not end when obtaining the product or service as after-service is included.

The definition of Straus & Weinlich will be used in the current research, given that the emphasis of this research is on online shoppers abandoning their carts before buying, which makes the definition of Engel, Blackwell & Miniard of after service and need of recognition of non-importance (Engel, Blackwell, & Miniard, 1995). This research is focused on giving customers the right mix of information sources during, before and after the shopping experience. Changing the customer's experience with implementing augmented and virtual reality in online shopping might compress this customer journey and enhance a customer's loyalty. Building trust in eCommerce is of vital

importance to advance customer experience and would potentially resolve the issue of too many shoppers leaving their online carts.

#### 2.4 Purchase Intention

There is a variable of different components that influences a customer's plan to purchase a particular product or service. In the case of online shopping, most customers abandon their carts because of particular doubts which cannot be taken away online. Will the product be as depicted? And how will it fit me? Augmented and virtual reality could take this doubt away, it virtualizes the product into the real-time environment and it allows the customer to see it before the purchase. The customer will be able to interact with the product and experience it like in an actual store. The purchase intention is believed to be enhanced when the customer can see it in his or her environment.

One of every marketer's ultimate goal is to maximize sales. In order to generate profit maximization, means of sales increasing have to be implemented successfully. Generally speaking, companies need to innovate in order to survive (Altshuler & Behn, 1997). By making use of innovative technologies, salespeople can surpass the expectations that customers have (Jones, Roberts & Chonko, 2000) This decision-making process leading to a potential purchase completes the customer's journey from product and brand awareness up until the actual purchase. The process helps maintain the customer for the long term and turn them into a loyal regular of the brand.

In some way, augmented reality can act as a marketing tool for online shops to improve sales. According to Then & DeLong (1999), an attractive visual product representation can improve the purchase intention with customers (Then & DeLong, 1999). A visual representation can give product information that can influence purchase intention and online sales. It is important that augmented reality can give consumers a visual representation of a product in such a way that it strengthens their purchase intention (Park, Lennon, & Stoel, 2005). In an experiment conducted by Suh & Lee (2005), it was shown that the purchase intention for products shown in augmented reality was higher than the purchase intention for products given in static images (Suh & Lee, 2005). Additionally, studies have confirmed that virtual aspects combined with the real world can influence the consumers' purchase intention (Gabisch & Gwebu, 2011). The question that lasts is how augmented reality can achieve this in a customer's desired way.

## 2.5 Customer Perspective

The customer perspective measures the technology performance and overall accessibility through the eyes of the customer. The customer perspective is important to retain a focus on customer needs and satisfaction of different aspects in the customer's experience. To achieve the highest performance and most favorable outcome, the eCommerce industry should be innovated with the customer's needs and wants as a driver (United States Department of Agriculture, 2008). Winters adds that the emotional and social motivators, as well as the physical mechanism of the technology all directly effect the customer experience and the way customers make purchase choices and take decisions. (Winters, 2014) Researching all the variables addressed in *figure 2* will give a good insight into the customers' perspective towards the various aspects of using augmented reality in online shopping. Examining the total customer experience, the potential use of the technology and the purchase of a product from the customer's perspective gives all the information needed to determine how augmented reality will help eCommerce and what characteristics are the most important. It also shows the customer's attitude towards embracing the new technology and using it in their own online shopping experience.



Figure 1. | Customer Perspective model (Winters, 2014)

## 2.6 Conceptualization

The figure (1) below shows the framework model that resulted from reviewing relevant theories to this study. The different framework theories mentioned are visualized in the model to give a good understanding of how this research is build up. Additionally, It shows how augmented reality, combined with upcoming 5G innovation, gives the interactivity the customer needs and takes away the doubts of not being able to try on a product before purchase. This will influence a customer's purchase intention and ultimately reduce the high percentage of the abandonment of online shopping carts. The customer's perspective in this model is important to adapt to the future use of augmented reality to the needs of the customer.

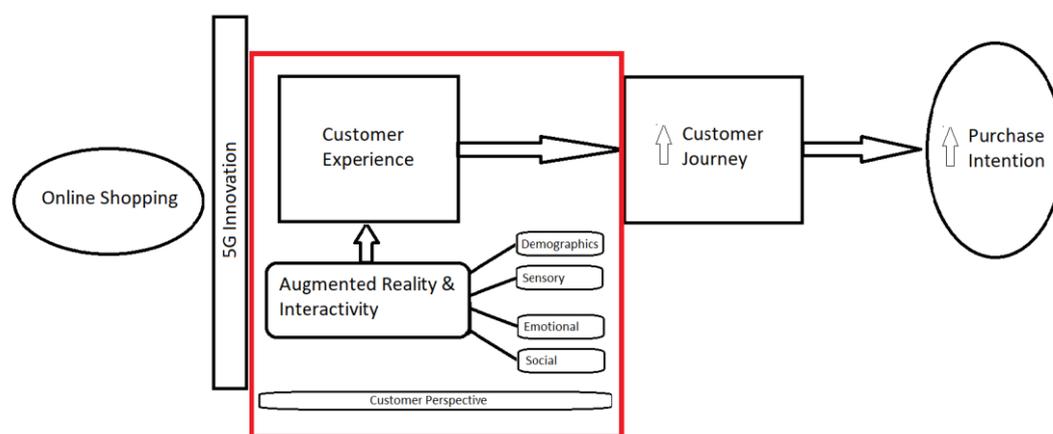


Figure 2. | Conceptual framework model

### 2.6.1 Variables

To address the potential of augmented reality in online shopping, this study proposes the conceptualization of a model where the strengthening of purchase intention serves as the main outcome variable. The outcome variable addresses how a strengthened purchase intention can lead to a decrease in the abandoning of online shopping carts. More specifically, it proposes that the use of augmented reality and more interactivity with online shopping will present a better customer experience and consequently an improved and compressed customer journey. These factors will all lead to the main goal of this research: decreasing the abandoning of online shopping carts and accordingly higher sales. The questionnaire will start with the demographic and preference questions which questions are shown in the conceptualization table (*chapter 2.7*) below. The table shows the exact questions per variable and the available answer options. The theory behind these options is further discussed and explained in *chapter 3.2*.

### Demographic and preference variables

First of all, there are the controlled variables within this research. The controlled variable is constant and unchanged within the course of this research and mainly based on **demographic aspect and preference**. This is to assess the results with increased model complexity and a variable of interest with the choice of two different applications. As this research is **focused on the millennials, and especially Generation Y**, the age and current study will both be a controlled variable as it will be focused on this specific group.

Then it will continue to the more general background information. Do they prefer in-store or online shopping? How often do they shop online and what is their preferred mobile device, for example, phone or computer. These are questions that show the customers' behaviour with online shopping and will influence the general outcome of the questionnaire.

### Sensory variables

Secondly, the variable of sensory experience changes the course of this questionnaire. These can mainly be seen as **preferences of the customer what benefits and experiences the technology should offer**. Does the customer like to visualize a product before purchasing and do they enjoy the more interactive environment augmented reality offers. Will this improve the way customers shops online and would it make shoppers more comfortable shopping online.

### Emotional variables

The third variable is the emotional variable, this measures the customers' experience and bond with augmented reality. The variable shows how augmented reality affects the customers' attitude towards an online shop using this technology and what the participant's position is towards the acceptance of the technology. Do they perceive it useful within the frameworks of online shopping? The technology acceptance and perceived usefulness of augmented reality are important factors for the outcome of this research. Both will determine if the online shopper will be prepared and wanting to make use of the enhanced technology as a first. **What is a participant's attitude towards the use of augmented reality for future purposes and what do they think is the added value of augmented reality during online shopping.**

Additionally, it is important to measure the change in brand attitude and improvement of customer experience if the technology would be used. These variables depend on the independent variables as they influence the outcome of the variables mentioned above.

### **Social variables**

The fourth and last variable is the social variable. This variable goes in-depth in how the participant has perceived using augmented reality in online shopping. **Would they spend more time in online shops with the interactivity it offers and would the participant recommend online shops using augmented reality to others?** Additionally, it is interesting to ask customers what their interaction environment is. In what places do they shop online? This, combined with 5G innovation and its higher data streaming capacities might change where customers shop online, as it offers improved capabilities to shop outside of your home with augmented reality.

2.7 Conceptualization Table

The answer options and the theory behind them are further discussed in the methodology (*chapter 3*).

	Indicator	Characteristics	Questionnaire	Answer Options	Application
Transforming online shopping with augmented reality.	<b>Demographics</b>	<i>Aspects and preferences</i>	Sex Age Education Application	M/V/Other 18-20/21-24/25+ MBO/HBO/WO SK / IP	- - - -
	<b>Background</b>	<i>General questions</i>	I prefer the use of AR over normal pictures.  Do you prefer in-store or online shopping  I would like to try a product with AR before purchasing online	Yes / No  In-store / Online  Yes / No	-  -  -
	<b>Sensory</b>	<i>Experience</i>	Visualizing a product with AR offers added value to an online shop  AR enhances my visualization of a product  I will be more confident in buying a product I have tried online  <i>AR offers advantages in comparison to normal online shopping</i>	DA/PA/A/SA  DA/PA/A/SA  DA/PA/A/SA  Yes / No	<i>SneakerKit &amp; Ikea Place</i>  <i>SneakerKit &amp; Ikea Place</i>  <i>SneakerKit &amp; Ikea Place</i>  <i>SneakerKit &amp; Ikea Place</i>

	<b>Emotional</b>	<i>Experience</i>	AR gives me the possibility to judge a product faster to my likings	DA/PA/A/SA	<i>SneakerKit &amp; Ikea Place</i>
			I would prefer an online store with AR than without	DA/PA/A/SA	<i>SneakerKit &amp; Ikea Place</i>
			I would come back more often to an online shop when it uses AR	DA/PA/A/SA	<i>SneakerKit &amp; Ikea Place</i>
			AR makes shopping online more enjoyable	DA/PA/A/SA	<i>SneakerKit &amp; Ikea Place</i>
	<b>Social</b>	<i>Experience</i>	I would tell others about an online shop offering try-before purchase with AR?	DA/PA/A/SA	<i>SneakerKit &amp; Ikea Place</i>
			I am willing to spend more time in online stores with AR due to its interactivity	DA/PA/A/SA	<i>SneakerKit &amp; Ikea Place</i>
			I would like to use a higher quality of AR in the future	DA/PA/A/SA	<i>SneakerKit &amp; Ikea Place</i>

### 3 Methodology

To study the impact of augmented reality on the customers' experience in online shopping, the variables of demographics, sensory experience, emotional experience and social experience are used and analysed on how it affects the customers' experience and attitude towards augmented reality in online shopping. It will give insight into the customer's perspective towards this technology and how the customer thinks it would benefit them in online shopping. This is done to examine the added-value for customers and to give online retailers advice on using AR to its full potential. The demographic variable is used to limit this research to a specific group and age category, students and millennials, and in specific, generation Z. Generation Z is a second generation of the millennial cohort, typically born in the 90s and raised in the 2000s during the big digital changes in the last century (Tulgan, 2002). This is also the generation who were approached for a structured interview as they are generally the dominant group in universities.

The sensory variable shows how the customer feels about the visualization and interactivity that augmented reality can offer in online shopping. The emotional variable will show if participants find augmented reality in online shopping enjoyable and if it would trigger a higher likableness towards a shop using it. Lastly, the social variable will show if customers would spend more time shopping online and if they would online shops with augmented reality to others.

These variables are distinguished to categorize a customers' experience with augmented reality in online shopping based on a conceptual theory of customer experience in the theoretical framework (*chapter 2.2*). The different variables will influence the outcome of this research and the questionnaire that will be taken. Consequently, a comparison is made that enhanced customer experience will lead to an improved customer journey which will drive customers to a strengthened purchase intention followed by the decrease of abandoned online shopping carts (*figure 2*).

The research method used, conducting structured interviews, ensures that each interviewee was presented with the same questions, in exactly the same order. It minimizes context influence and establishes a reliable accumulation of the answers which made it possible for comparisons to be made between subgroups. Therefore, a reasonable (controlled) balance between male and female participants was desired. The structured interview contained only closed questions to make gathering data more efficient and less time reliant.

### 3.1 Sampling and Procedure

In this experiment, a total of 43 participants completed the structured interview with a sample margin of 10%. This amount was needed to give this research a reliability level of 95%, which ensured the generalization and credibility of this research and gives a reliable outcome of the structured interviews (allesovermarktonderzoek.nl, 2019). The total population (20000) used to calculate the sample population are all millennials studying on a MBO, HBO or WO study in the Netherlands and the outcome (87%) was the shopping cart abandoning without using augmented reality (Figure 3).

**A. Vul hieronder de 3 kengetallen van de calculator in:**

**1. Hoe groot is de steekproefmarge die u wilt toelaten? (%)**   
Een steekproefmarge van 5% is gangbaar bij marktonderzoek.

**2. Wat is de omvang van de populatie?**   
Wanneer de omvang niet bekend is, vult u dan 20000 in.

**3. Welke uitkomst verwacht u in het onderzoek? (%)**   
Wanneer dit vooraf niet is in te schatten, vult u dan 50 in.

**B. Resultaat :**

Steekproefgrootte bij een betrouwbaarheidsniveau van: 90%

Steekproefgrootte bij een betrouwbaarheidsniveau van: 95%

Steekproefgrootte bij een betrouwbaarheidsniveau van: 99%

Figure 3 | Sample calculator (allesovermarktonderzoek.nl, 2019)

Of the 43 participants, roughly two-third of the total group were male and one-third were female. A little more than half of the participants were in the age category of 21-24, a quarter of the participants were between 18-20 and the remaining quarter was 25 or older. All participants were millennials of generation Z engaged in either MBO, HBO or WO educational level.

Participants who completed the structured interviews were randomly approached and mainly gathered on the Hague University of Applied Sciences and Leiden University between 13-12-2019 and 17-12-2019. The interested participants were approached and asked to try out one of the applications based on their likings and main shopping behaviour and were later questioned guided by the survey. The choice of preference in one of the two applications was uncontrolled and based on the interest of the approached participant.

Participants were required to meet some conditions to be a valid and useful participant for this study. These conditions were based on the participant's age (millennial and generation Z) and study. A valid participant was required to be at least 18 years or older and be enrolled in an education. This made the research less broad and generic. These conditions were also selected to make it easier to reach participants within the reach of this study. In this way, there will be a good delimitation of this research that is also practically feasible.

### 3.2 Used Scales

This research makes use of different variables, these variables are measured based on a four-point system (Likert scale) and a two-point system (yes and no) which are both explained in the paragraphs below. The first variable is a controlled variable and gives participants questions about demographics aspects and general preferences. These are questions to give a general introduction to the technology and to the next variable that will be questioned. It is important to know what a participant's attitude is towards augmented reality, its variables and online shopping in general to analyse the outcome of the structured interviews. The questions are based on a 2-point scale, also known as a dichotomous scale, which presents options that are opposite to each other (yes and no). (Sincero, 2019)

The three other variables (sensory, emotional, social) will be scored on a four-point Likert scale by Kim & Biocca (Kim & Biocca, 1997). This scale is based on the definition of telepresence and several self-reporting measures of telepresence used in past studies (Barfield & Weghorst, 1993) (Slater, Usoh, & Steed, 1992). It is a 4-point Likert scale with 11 items on which participants can give answers from 1 to 4 (1= Strongly Disagree – 4 = Strongly Agree). The questions are related to a participants' experience after and during the use of augmented reality technology with online shopping. This scale appeared to be applicable to a customers' experience and 'easy-to-use'. It is guided by the circumstances of the use of augmented reality which is still in its infancy. So it is an introduction to a technology that tries to enhance the customer experience and compress customer journey.

### 3.3 Applications

For the purpose to generate variances and to improve the generalizability of the findings, two different applications will be used. One application (*SneakerKit*) will allow the participants to try on virtual sneakers before purchase and the other (*Ikea Place*) allows placing virtual furniture in once own room. Both allow trying a product online before purchasing it.

Ikea place starts with a chat-screen were the application explains how it works. The customer has to give the application the It tells the customer that there are thousands of products in the online catalogue that they can virtually place in their house. A customer can select the virtual piece of furniture to their likings and position it in the real world room they are in. This presents customers with the ability to try a piece of sample furniture in their room before purchasing it. Besides that,

customers can make a photo of furniture and the application will search a product similar to it (Inter IKEA Systems B.V., 2019).

*SneakerKit* in its way gives customers the ability to try on virtual sneakers before purchasing online. It also asks for the permission of using the camera to depict the virtual sneakers on your feet, this can be with bare feet, socks or sneakers on your feet already. Additionally, it offers the customer a range of choices in sneakers that are updated regularly with new sneakers and collaborations between the company (VykingAr) and different sneaker brands. After choosing one of the sneakers the customer has the ability to move with virtual shoes on their feet to see if it is to their likings. The virtual sneakers automatically adapt to your shoe size to make it as realistic as possible and take pictures where needed (City Computing Ltd. VykingAR, 2019).

### 3.4 Limitations

Using structured interviews as a research method can also have its limitations as the participant is limited to what answers options were available. It could also make it more unreliable as the effect of an interview generally influences answers that are given. Additionally, a structured interview uses a smaller target sample as it is more complex and takes more time than a normal questionnaire which could influence reliability in either a positive or negative way. Due to smaller sample size, generalization of the outcome of the structures interviews may be difficult to repeat to test the reliability of the data. Lastly, the participants where mainly approached at the Hague University Of Applied Sciences and Leiden University. This may limit the data for other areas or schools outside of these limitations.

## 4 Results

The study was conducted over two months with participants from the Hague University of Applied Sciences and Leiden University. Out of the students who were approached for a structured interview, 43 completed the procedure. The results of the structured interview and its questionnaire are provided in the following chapter sections with an additional brief analysis of each of the questions and its results. The results of this chapter are described through the help of graphical statistics and percentages.

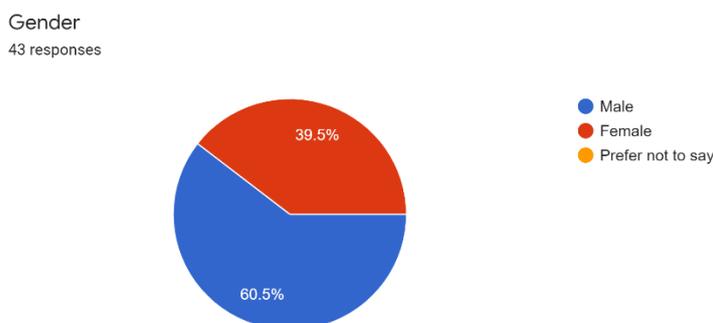
### 4.1 Demographics, Background and Preferences

The participants of this study differ in background characteristics and preferences. Therefore, it was important to identify the demographic characteristics, background and preferences of the participants in order to determine if these can be used to draw comparisons among participants later in this report. This section is on the basis of seven questions divided among the following three categories: demographic, background and preference.

The demographic characteristics questions were designed to identify the varied characteristics of the participant's such as age, gender, educational level. The background questions are designed to get insight into the participants shopping behaviour and attitude towards augmented reality. Finally, the questionnaire asked participants their preference of application, these were shown and explained in a structured interview before completing the questionnaire.

#### 4.1.1 Question DBP-1: Gender

The responses to the Questions DP-1 provided information regarding the gender of the participants. According to the information shown in *Diagram 4.1*, 60,5% (26 participants) were males, with the remaining 39,5% (17 participants) being females.



*Diagram 4.1*

4.1.2 Question DBP-2: Age

The responses to Question DP-2 provided information to determine the age groups of the participants in order to see if age was a factor in the participant’s attitude and opinion towards the subject matter. The results shown in *Diagram 4.2* indicate that the highest percentage of the sample was the age category of 21 to 24 at 53,5% (23 participants), followed by the age category 18 to 20 at 25,6% (11 participants) and then the remaining age category of 25+ at 20,9% (9 participants).

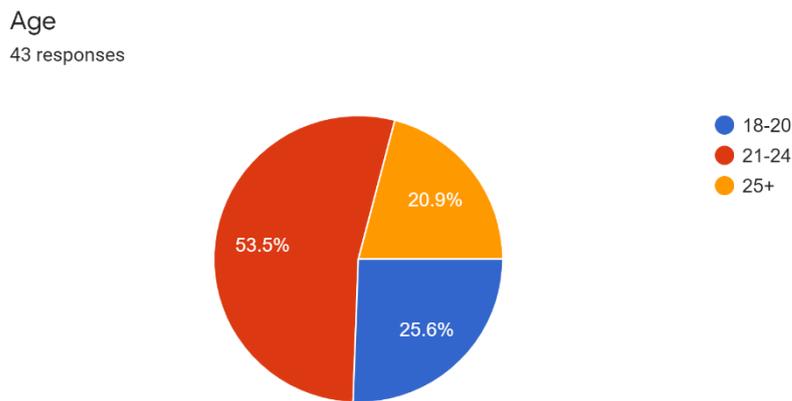


Diagram | 4.2

4.1.3 Question DBP-3: Educational level

The responses to Question 3 provided information regarding the educational level of the participants, based on the Dutch education system. According to the responses from the study as shown in *Diagram 4.3*, 76,7% (33 participants) were of HBO educational level while 11,6% (5 participants) were of MBO educational level and an identical 11,6% (5 participants) of WO educational level.

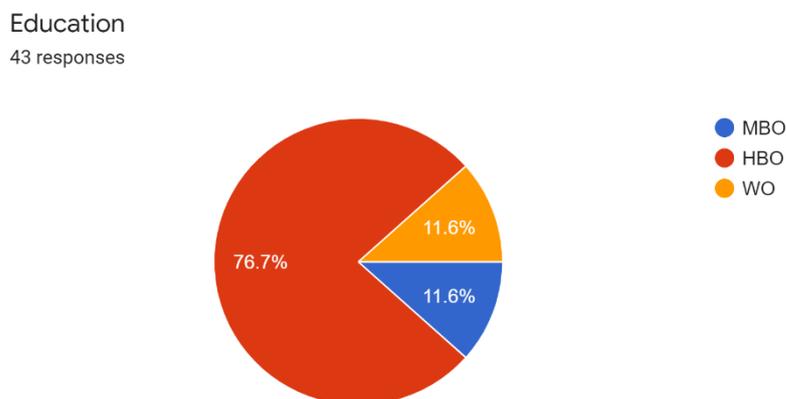


Diagram | 4.3

#### 4.1.4 Question DBP-4: Application

The responses to Question 4 provided information regarding the preference of application, based on the explanation and testing opportunity given to participants for both applications (*Ikea Place* and *SneakerKit*). According to the responses from the study as shown in [Diagram 4.4](#), 69,8% (30 participants) preferred *Ikea Place* and, 30,2% (13 participants) preferred *SneakerKit*.

Application  
43 responses

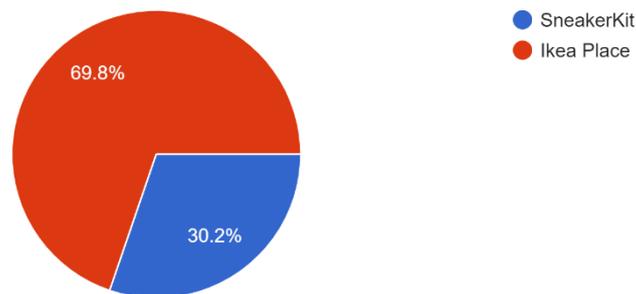


Diagram | 4.4

#### 4.1.5 Question DBP-5: Shopping preference

The responses to Question 5 provided information regarding the preferred way of shopping. Whether participants prefer the experience of going out for in-store shopping or online shopping as it is now. According to the responses from the study as shown in [Diagram 4.5](#), 51,2% (22 participants) prefer in-store shopping and 48,8% (21 participants) prefer online shopping. These results show a clear balance in preference between online and in-store shopping.

Shopping preference  
43 responses

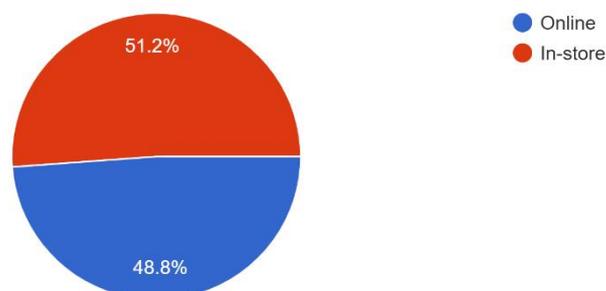


Diagram | 4.5

4.1.6 Question DBP-6: I prefer making use of Augmented Reality over normal pictures

The responses to Question 6 provided information regarding the preference of normal static pictures in online shopping or the use of augmented reality which they had tested before completing the questionnaire. According to the responses from the study as shown in *Diagram 4.6*, 62.8% (27 participants) prefer using augmented reality and, 37,2% (16 participants) prefer static pictures over augmented reality.

I prefer making use of AR over normal pictures  
43 responses

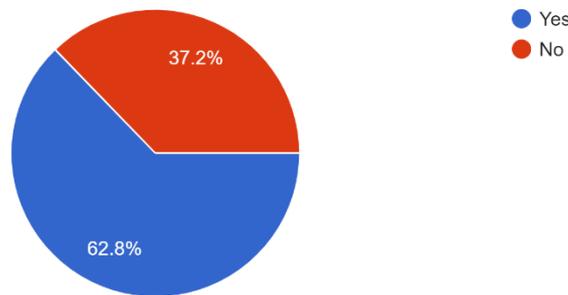


Diagram | 4.6

4.1.7 Question DBP-7: I would like to try a product with AR before purchasing online

The responses to Question 7 provided information regarding a participant’s attitude towards using augmented reality before purchasing something online. According to the responses from the study as shown in *Diagram 4.7*, a majority of the participants at 97,7% (42 participants) would like to try a product with AR before purchasing it and, 2,3% (1 participant) does not want to try a product with AR before a purchase.

I would like to try a product with AR before purchasing online  
43 responses

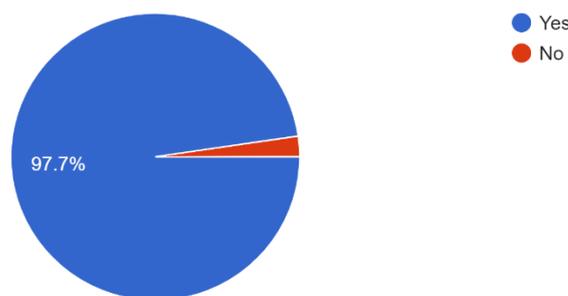


Diagram | 4.7

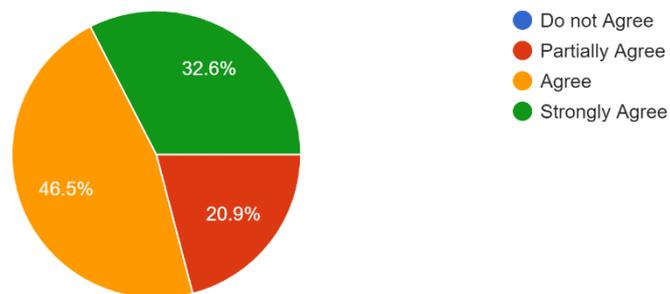
## 4.2 Sensory Opinion and Attitude

The questions about sensory experiences are carefully designed to assess the participant's personal views towards the use of augmented reality in online shopping. This section is on the basis of four questions with the purpose to define what the participant's opinion and attitude are towards the sensory benefits it could offer. The sensory experience chapter covers questions about visualization enhancement, a rise of confidence and, the comparison of the use of augmented reality to ordinary online shopping.

### 4.2.1 Question SE-1: Visualizing a product with AR offers added value to an online shop

The responses to Question 8 provided information regarding the added value of the visualization augmented reality offers in an online store. Participants had the opportunity to express their opinion based on a presented statement. Based on the responses shown in *Diagram 4.8*, 46% (20 participants) and 32,6% (14 participants) correspondingly agreed or strongly agreed with this statement, whereas 20,9% (9 participants) partially agreed and 0 of the participants disagreed.

Visualizing a product with AR offers added value to an online shop  
43 responses



*Diagram | 4.8*

4.2.2 Question SE-2: AR enhances my visualization of a product

The responses to Question 9 provided information regarding the enhancement of once visualization of a product during online shopping. Participants had the opportunity to express their opinion based on a presented statement. Based on the responses shown in *Diagram 4.9*, 62,8% (27 participants) and 30,2% (13 participants) correspondingly agreed or strongly agreed with this statement, whereas 7% (3 participants) partially agreed and 0 of the participants disagreed.

AR enhances my visualization of a product  
43 responses

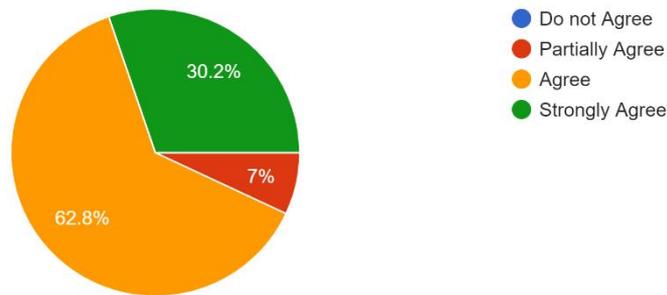


Diagram | 4.9

4.2.3 Question SE-3: I will be more confident in buying a product I have tried online

The responses to Question 10 provided information regarding a participant’s possible rise of confidence when buying a product online with augmented reality. Participants had the opportunity to express their opinion based on a presented statement. Based on the responses shown in *Diagram 4.10*, 67,4% (29 participants) and 9,3% (4 participants) correspondingly agreed or strongly agreed with this statement, whereas 18,6% (8 participants) partially agreed and 4,7% (2 participants) disagreed.

I will be more confident buying a product I have tried online  
43 responses

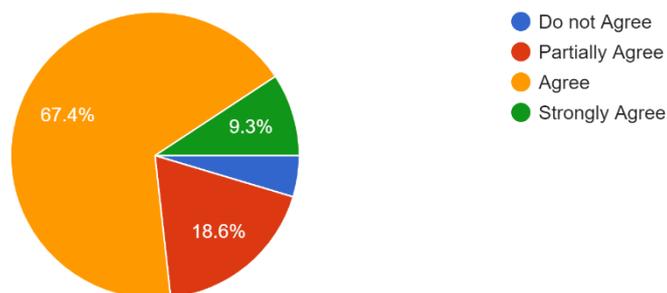
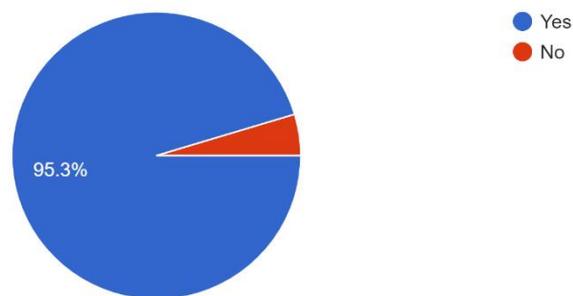


Diagram | 4.10

#### 4.2.4 Question SE-4: AR offers advantages in comparison to normal online shopping

The responses to Question 11 provided information regarding the participant's opinion about the comparison of augmented reality to ordinary online shopping. According to the responses from the study as shown in *Diagram 4.11*, 95,3% (41 participants) believe that augmented reality offers advantages in comparison to online shopping, 4,7% (2 participants) believe that augmented reality cannot offer an advantage to online shopping as it is now.

AR offers advantages in comparison to normal online shopping  
43 responses



*Diagram | 4.11*

#### 4.3 Emotional Opinion and Attitude

The questions about emotional experiences are carefully designed to assess the participants' emotional response to augmented reality in online shopping. This section is on the basis of four questions with the purpose to define what augmented reality changes in a participant's likings and engagement towards a product or online shop that uses augmented reality. The emotional experience chapter covers questions about the enjoyableness and commitment a participant might develop while using augmented reality.

4.3.1 Question EM-1: AR gives me the possibility to judge a product faster to my likings

The responses to Question 12 provided information regarding if augmented reality offers the opportunity to judge a product faster to once likings. Participants had the opportunity to express their opinion based on a presented statement. Based on the responses shown in *Diagram 4.12*, 62,8% (27 participants) and 11,6% (5 participants) correspondingly agreed or strongly agreed with this statement, whereas 25,6% (11 participants) partially agreed and 0 of the participants disagreed.

AR gives me the possibility to judge a product faster to my likings  
43 responses

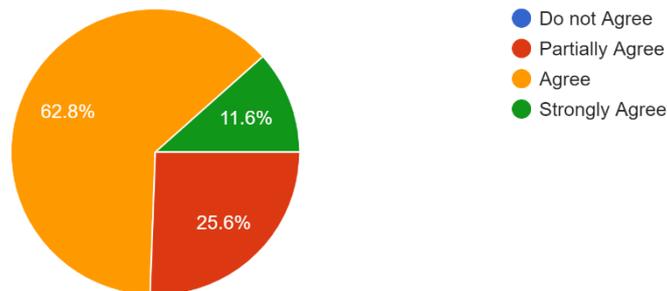


Diagram | 4.12

4.3.2 Question EM-2: I would prefer an online store with AR than without

The responses to Question 13 provided information regarding the likings of an online store with augmented reality or without. Participants had the opportunity to express their opinion based on a presented statement. Based on the responses shown in *Diagram 4.13*, 48,8% (21 participants) and 14% (6 participants) correspondingly agreed or strongly agreed with this statement, whereas 27,9% (12 participants) partially agreed and 9,3% (4 participants) disagreed.

I would prefer an online store with AR than without  
43 responses

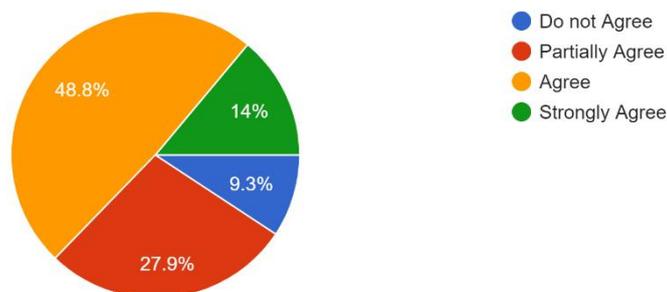


Diagram | 4.13

4.3.3 Question EM-3: I would come back more often to an online shop when it uses AR

The responses to Question 14 provided information regarding if a participant would come back more often to an online that uses augmented reality. Participants had the opportunity to express their opinion based on a presented statement. Based on the responses shown in *Diagram 4.14*, 46,5% (20 participants) and 2,3% (1 participant) correspondingly agreed or strongly agreed with this statement, whereas 41,9% (18 participants) partially agreed and 9,3% (4 participants) disagreed.

I would come back more often to an online shop when it uses AR  
43 responses

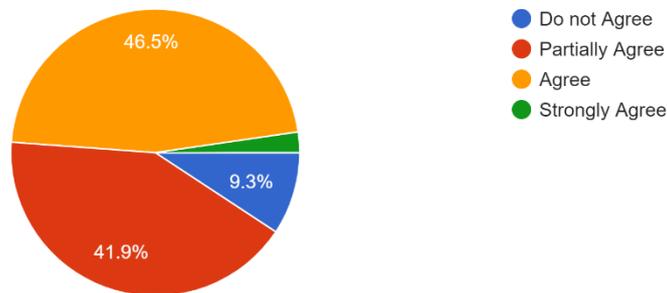


Diagram | 4.14

4.3.4 Question EM-4: AR makes shopping online more enjoyable

The responses to Question 15 provided information regarding if a participant finds its enjoyable to use augmented reality. Participants had the opportunity to express their opinion based on a presented statement. Based on the responses shown in *Diagram 4.15*, 53,5% (23 participants) and 25,6% (11 participants) correspondingly agreed or strongly agreed with this statement, whereas 18,6% (8 participants) partially agreed and 2,3% (1 participant) disagreed.

AR makes shopping online more enjoyable  
43 responses

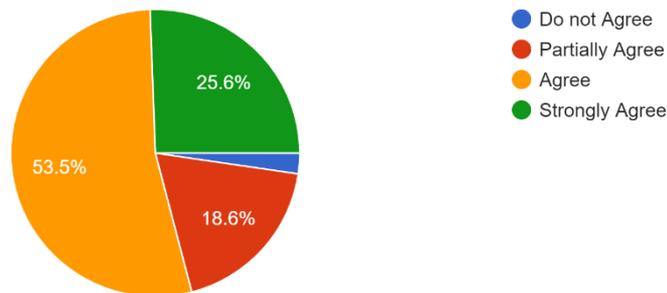


Diagram | 4.15

#### 4.4 Social Opinion and Attitude

The questions about social experiences are carefully designed to assess the participants' social response and interaction after using augmented reality in an online store. This section is on the basis of three questions with the purpose to define what augmented reality changes in a participant's engagement towards an online shop that uses augmented reality. The social experience chapter covers questions about word of mouth, commitment and the future direction of augmented reality with 5G innovations.

##### 4.4.1 Question SO-1: I would tell others about an online shop with try before purchase with AR

The responses to Question 16 provided information regarding the word of mouth phenomenon after using augmented reality. Participants had the opportunity to express their opinion based on a presented statement that asked if participants would tell others about an online store using augmented reality. Based on the responses shown in *Diagram 4.16*, 48,8% (21 participants) and 14% (6 participants) correspondingly agreed or strongly agreed with this statement, whereas 27,9% (12 participants) partially agreed and 9,3% (4 participants) disagreed.

I would tell others about an online shop offering try-before purchase with AR  
43 responses

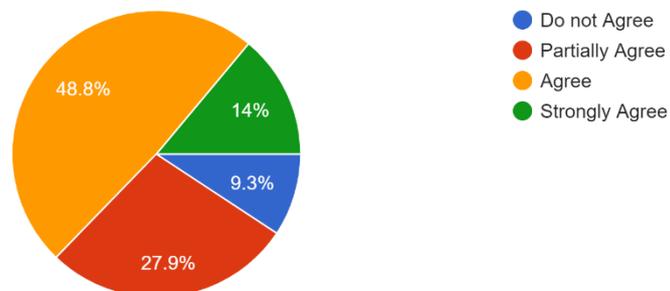


Diagram | 4.16

4.4.2 Question SO-2: I am willing to spend more time shopping online due to AR interactivity

The responses to Question 17 provided information regarding if a participant is willing to spend more time in online stores when shopping augmented reality, as the interactivity takes more time than regular shopping. Participants had the opportunity to express their opinion based on a presented statement. Based on the responses shown in *Diagram 4.17*, 51,2% (22 participants) and 20,9% (9 participants) correspondingly agreed or strongly agreed with this statement, whereas 18,6% (8 participants) partially agreed and 9,3% (4 participants) disagreed.

I am willing to spend more time in online stores with AR due to its interactivity  
43 responses

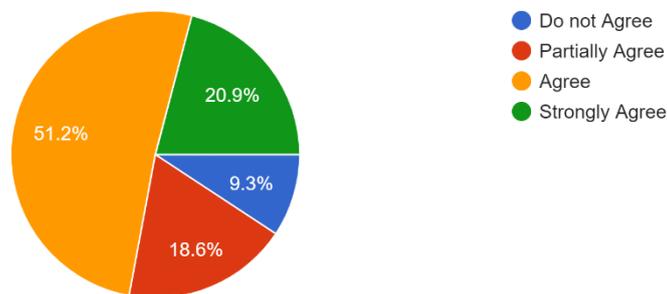


Diagram | 4.17

4.4.3 Question SO-3: I would like to use a higher quality of AR in the future

The responses to Question 18 provided information regarding the future of augmented reality. Participants had the opportunity to express their opinion based on a presented statement which hints towards the 5G innovations and the higher quality augmented reality will have in the future. Based on the responses shown in *Diagram 4.18*, 53,5% (23 participants) and 25,6% (11 participants) correspondingly agreed or strongly agreed with this statement, whereas 18,6% (8 participants) partially agreed and 2,3% (1 participant) disagreed.

I would like to use a higher quality of AR in the future  
43 responses

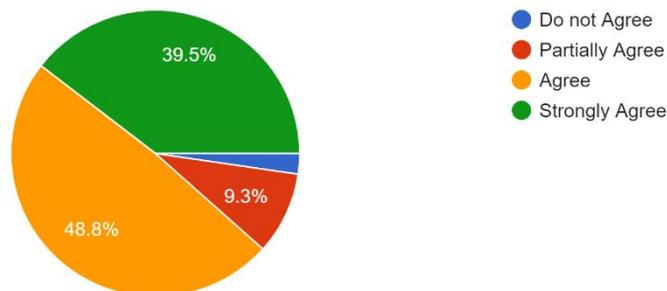


Diagram | 4.18

## 5 Data Analysis

This chapter will focus upon analysing the data of the questionnaire and it will show an interpretation of these findings, to demonstrate and integrate them into theories. The characteristics and background of participants will be analysed to give a general understanding of the participants who took the structured interview. Then their customer experience will be analysed within the remaining three variables; sensory experience, emotional experience, and social experience. At the end of this analyses, it will show a summary of the most noteworthy findings.

In total, 43 participants completed a structured interview which resulted in a reliability of 95%. This is considered a good and workable percentage of reliability for this research. However, the first thing that can be said about participants is that the reliability between male and female are not completely equal as more males (26) than females (17) respondents were questioned. This means that the generalization of female responses is less reliable. Additionally, most of the participants, both male and female, were enrolled in an HBO study who might have different views on future technologies and its uses than a participant from MBO or WO level which also influences reliability per educational level.

### 5.1 Characteristics and Background

The analysis is based on 43 participants within the age groups of 18 to 20, 21 to 24 and 25 and above. The most dominant group is male participants between the age of 21 to 24 (*Table 5.1*). A total of 33 of the participants were in a Dutch HBO educational level (*Table 5.2*) and 23 of HBO level participants were again in the most dominant age group of 21 to 24 (*Table 5.3*). Roughly, 2/3<sup>rd</sup> of participants preferred *Ikea Place* over *SneakerKit* (*Table 5.4*), and the diffidence between in-store and online shopping was surprisingly balanced (51,2% in-store, 48,8% online; *Table 5.5*).

#### 5.1.1 Demographics

As shown in *Table 5.1*, the majority of female participants were in the age group of 21 to 24 (9 participants, 52,9%). The same was true for the male participants (14 participants, 53,8%) which had a similar percentage of total participants in the same age group. However, the most difference was found in the second dominant age

*Table 5.1 | Gender and Age*

		Gender		Total	
		Female	Male		
Age	18-20	Count	7	4	11
			41,2%	15,4%	25,6%
	21-24	Count	9	14	23
			52,9%	53,8%	53,5%
	25+	Count	1	8	9
			5,9%	30,8%	20,9%
Total		Count	17	26	43

group for male and female participant’s. For female participants, the second dominant age group was categorized in ages 18 to 20 (7 participants, 42%), whereas the second dominant age group of male participants is in the age of 25 and above (8 participants, 30,8%). The smallest age group for female participants was in the age of 25 and above (1 participant, 5,9%) and for male participants the ages ranging from 18 to 20 (4 participants, 15,4%).

At the moment of the structured interview, participants were also asked to fill in their current educational level (*Table 5.2*). As most of the structured interviews were held on Dutch HBO universities it is not surprising that the highest percentage of participants, both male (18 participants) and female (15 participants), were of HBO level (F=34,9%,2%, M=41,9%). The remaining participants were studying at WO level (F=4,7%, M=7%) and there were five male participants at MBO level (19,2%). Besides that, it is interesting to note that most participants were of HBO level between the ages of 21 to 24 (17 participants, 39,%) and the other age ranges compared with the educational levels were fairly similar at (*Table 5.3*).

*Table 5.2 | Gender and Education*

			Gender		Total
			Female	Male	
Education	MBO	Count	0	5	5
		% of Total	0,0%	11,6%	11,6%
	HBO	Count	15	18	33
		% of Total	34,9%	41,9%	76,7%
	WO	Count	2	3	5
		% of Total	4,7%	7,0%	11,6%
Total	Count	17	26	43	
	% of Total	39,5%	60,5%		

*Table 5.3 | Education and Age*

			Education			Total
			MBO	HBO	WO	
Age	18-20	Count	1	9	1	11
		% of Total	2,3%	20,9%	2,3%	25,6%
	21-24	Count	2	17	4	23
		% of Total	4,7%	39,5%	9,3%	53,5%
	25+	Count	2	7	0	9
		% of Total	4,7%	16,3%	0,0%	20,9%
Total	Count	5	33	5	43	
	% of Total	11,6%	76,7%	11,6%		

5.1.2 Application

Prior to completing the questionnaire, participants were asked to test out both applications that were provided for the structured interview (*SneakerKit*, *Ikea Place*). Both applications differ from each other in use and quality which might alter the opinion and attitude of a participant towards one of the particular applications or augmented reality in general.

As seen in *Table 5.4*, most of the participants preferred using Ikea Place (IP= 69,8%, SK= 30,2%), possibly because this application was more developed and it had multiple augmented reality options to use. Both the largest group of male and female participants (M= 39,5%, F= 30,2%) preferred using it. Besides that, it is interesting to see that a higher percentage of male participants prefer the SK application more than female participants did. Maybe because female participants are a little more interested in decorating their room with fitting furniture than male participants.

*Table 5.4 | Application Preference and Gender*

			Application		Total
			SneakerKit	Ikea Place	
Gender	Female	Count	4	13	17
		% of Total	9,3%	30,2%	39,5%
	Male	Count	9	17	26
		% of Total	20,9%	39,5%	60,5%
Total	Count	13	30	43	
	% of Total	30,2%	69,8%		

5.1.3 Background and preferences

The shopping preference is another interesting variable, this is especially between different genders and age groups. As shown in *Table 5.5*, the preference for shopping is very well balanced (OS= 48,8%, IS= 51,2%). Furthermore, it is interesting to see that the majority of male participants indicated to prefer in-store shopping over online shopping (14 participants, 32,6%), whereas the majority of female participants preferred online shopping (9 participants, 20,9%). *Table 5.6* shows the comparison of age groups and shopping preferences. Within all the age groups, the diffidence between in-store and online shopping is balanced. The only noteworthy difference is in the age of 25 and above, as more people in this age group prefer online shopping over the in-store experiences (OS= 66,7%, IS=33,3%). This could be because participants in this group usually devote more time to work than the other age groups do and spend less time shopping.

Table 5.5 | Shopping Preference and Gender

			Shopping preference		Total
			Online	In-store	
Gender	Female	Count	9	8	17
		% of Total	20,9%	18,6%	
	Male	Count	12	14	26
		% of Total	27,9%	32,6%	
Total		Count	21	22	43
		% of Total	48,8%	51,2%	

Table 5.6 | Shopping Preference and Age group

			Shopping preference		Total
			Online	In-store	
Age	18-20	Count	5	6	11
		% within Age	45,5%	54,5%	
	21-24	Count	10	13	23
		% within Age	43,5%	56,5%	
	25+	Count	6	3	9
		% within Age	66,7%	33,3%	
Total		Count	21	22	43
		% within Age	48,8%	51,2%	

As the difference in shopping preference is fairly low, it is not a surprise that the balance between the shopping preference and the question of static images versus augmented reality is pretty balanced also, this is shown in *Table 5.7*. It is shown that participants whose shopping preference is online mostly prefer the use of augmented reality over normal static pictures when online shopping (Y= 66,7%, N=33,3%). However, the most interesting thing is that the majority of participants with the preference of in-store shopping do like to use augmented reality over static pictures (Y= 59,1%, 40,9%). In this case, it can be shown as an opportunity to give in-store shoppers a different experience and might convince them to shop online more often.

Table 5.7 | AR/Normal pictures and Shopping Preference

			I prefer making use of AR over normal pictures		Total
			Yes	No	
Shopping preference	Online	Count	14	7	21
		% within	66,7%	33,3%	
	In-store	Count	13	9	22
		% within	59,1%	40,9%	
Total		Count	27	16	43
		% within	62,8%	37,2%	

The last of the background questions (Q: DPB-7) was about the participant’s opinion about trying a product with augmented reality before purchasing something online. However, as shown in the *results* chapter. The difference in ‘Yes’ (42 participants, 97,7%) and ‘No’ (1 participant, 2,3%) is obvious. Therefore, analysing this particular question is not beneficial as the ‘No’ can be seen as neglectable.

5.2 Customer Experience Analyses

The following discusses the finding of this questionnaire across the variables which were defined earlier in the theoretical framework (*chapter 2*). The answers on the questions about sensory experience, emotional experience, and social experience will be analysed and compared on the basis of respondent characteristics, background and preferences. It is again on the basis of all 43 participants of the structured interview conducted for this research. The variable questions are measured based on a Likert-scale ranging from the minimum score of Disagree to the maximum score of Strongly Agree, as shown in *Figure 5.2*. This is done to show an average outcome of each question which will help determine the participant’s attitude and opinion about the different experiences of online shopping and augmented reality.

Figure 4 | Likert scale



5.2.1 Sensory Analyses

On the basis of the averages measured shown in *Table 5.8*, the averages in this table illustrate that the mean score (Q1= 2,12, Q2= 2,23) for the visualization of a product when using augmented reality is between *Agree* and *Strongly*. This says that participants of the structured interviews and questionnaire agree that the visualization of a product when shopping online is better when an online store uses augmented reality. The next question: *I will be more confident buying a product I have tried online*; this shows that the confidence level of participants just slightly rises when using augmented reality. The mean score (Q3= 1,81) is between *Partially Agree* and *Agree*, which is average and does not show a clear agreement of participants with this question.

Table 5.8 | Sensory Experiences Averages

		Visualizing a product with AR offers added value to an online shop	AR enhances my visualization of a product	I will be more confident buying a product I have tried online
N	Valid	43	43	43
	Missing	0	0	0
Mean		2,12	2,23	1,81

Now in comparison to normal ‘static’ online shopping, the majority (41 participants, 95,3%) agree that augmented reality does offer advantages. Only two of the participants do not agree with this statement and as shown in [Table 5.9](#); it can be seen that both genders have one participant who did not agree (5,9%). However, the majority still sees opportunities and advantages in the use of augmented reality. It can be concluded that the mean scores that sensory experience of augmented reality can offer in online shopping are highly positive. Most participants agree that it enhances the visualization of a product and slight the confidence rate of which participants would have to purchase a product.

**Table 5.9 | AR Advantages and Gender**

			AR offers advantages in comparison to normal online shopping		Total
			Yes	No	
Gender	Female	Count	16	1	17
		% within Gender	94,1%	5,9%	100,0%
	Male	Count	25	1	26
		% within Gender	96,2%	3,8%	100,0%
Total	Count		41	2	43
	% within Gender		95,3%	4,7%	100,0%

Additionally, as shown in [Table 5.10](#), it is interesting to see that the majority of participants (93,7%) who said ‘no’ on the following question: ‘I prefer making use of AR over static pictures’. Do agree that it enhances their visualization of a product. This could offer various opportunities for eCommerce retailers as participants who prefer static pictures do consider augmented reality valuable in the visualization of a product.

**Table 5.10 | AR/Static and Visualization**

			AR enhances my visualization of a product			Total
			Partially Agree	Agree	Strongly Agree	
I prefer making use of AR over normal pictures	Yes	Count	2	14	11	27
		% within	7,4%	51,9%	40,7%	100,0%
	No	Count	1	13	2	16
		% within	6,3%	81,3%	12,5%	100,0%
Total	Count		3	27	13	43
	% within		7,0%	62,8%	30,2%	100,0%

5.2.2 Emotional analyses

On the basis of the averages measured shown in [Table 5.11](#), the averages in this table illustrate that the mean scores of emotional experiences with augmented reality are exceedingly less than the mean scores in sensory experiences. The mean score of the first question: *AR gives me the possibility to judge a product faster to my likings* (Q1= 1,86), is between *Partially Agree* and *Agree*. This shows that most participants are still slightly doubting if AR offers the opportunity to judge a product faster to their likings. Additionally as shown in the next two questions, the mean scores are slightly less than with the first question (Q2= 1,67, Q3= 1,42). Both mean scores show that participants are agreeing slightly less with the statements. Question 2 shows that participants would not particularly prefer a store with augmented than without as the mean score is slightly above the median of the Likert-scale ([Figure 3](#)).

Question 3 shows a similar outcome as it is also a similar question about engagement to an online store. [Table 5.10](#) illustrates that the mean score is below the median of the Likert-scale, this means that the participants would not particularly return to a shop because it uses augmented reality. However, the mean score of the last question (Q4= 2,02) shows that participants do like using augmented reality and it makes shopping online more enjoyable. This can be a good perspective as augmented reality will be of higher quality in the future because of the upcoming 5G innovations. If participants already enjoy using it, augmented reality could be even more enjoyable in the future.

**Table 5.11 | Emotional Experiences Averages**

		AR gives me the possibility to judge a product faster to my likings	I would prefer an online store with AR than without	I would come back more often to an online shop when it uses AR	AR makes shopping online more enjoyable
N	Valid	43	43	43	43
	Missing	0	0	0	0
Mean		1,86	1,67	1,42	2,02

Additionally, [Table 5.12](#) shows that participants who preferred normal static pictures over the use of augmented reality do agree that augmented reality offers advantages in comparison to normal online shopping. This shows that participants who were still preferring static pictures over augmented reality see opportunities for AR to evolve to something they would like to use in addition to static pictures or a possible future alternative of normal pictures.

Table 5.12 | AR/Static and AR Advantages

			AR offers advantages in comparison to normal online shopping		Total
			Yes	No	
I prefer making use of AR over normal pictures	Yes	Count	26	1	27
		% within	96,3%	3,7%	100,0%
	No	Count	15	1	16
		% within	93,8%	6,3%	100,0%
Total	Count	41	2	43	
	% within	95,3%	4,7%	100,0%	

5.2.3 Social analyses

Based on the averages measured shown in Table 5.13, the means in this table illustrate that the first question: *I would tell others about an online shop offering try-before purchase with AR*, has a slightly higher score than the median (Q1= 1,67). This illustrates that customers in an online store using augmented reality will most likely not be too convinced about the technology, in order to tell others about it. The word of mouth is very important for the upcoming of new technology, as the more people know about it, the more people probably want to use it.

The mean score for question 2 (Q2= 1,84) illustrates that participants are willing to spend more time in online stores by making use of the interactivity that augmented reality offers. This is important for this research as it shows that customers are willing to stay longer in an online store which makes the probability of a purchase intention much higher.

The last question: *I would like to use a higher quality of AR in the future*, is about the future use of augmented reality which will be impacted by 5G innovations. The mean score of the final question (Q3= 2,26) illustrates that participants are very willing for augmented reality to develop and probably be more positive towards its enhanced use. This shows the future of augmented reality can change a lot in a customers' perspective in relation to augmented reality.

Table 5.13 | Social Experiences Averages

		I would tell others about an online shop offering try-before purchase with AR	I am willing to spend more time in online stores with AR due to its interactivity	I would like to use a higher quality of AR in the future (5G innovation)
N	Valid	43	43	43
	Mean	1,67	1,84	2,26

### 5.3 Discussion

After analysing, it can be noted that the reliability of the findings depends on the different subgroups and its participants. Most participants were male, most of them were of HBO level, and most of the participants were between the age of 21 to 24. A majority of the participants preferred the Ikea Place application over the Sneaker Kit application. This is probably due to it being of higher quality, more advanced and it had a broader variety of options available. Besides this, there was a clear balance between in-store and online shopping preferences which show that both channels are possibly used in general. This could imply that modern shoppers prefer shopping through multiple different channels at different times. More channels will be used to shop, whether it is online, through an application or in-store.

In addition, *Question DPB-7*: I prefer making use of AR over normal pictures; it showed a lot of noteworthy and interesting information about the participants who still preferred the normal static pictures over augmented reality. The majority of participants who said 'No' did agree with the statements that augmented reality enhances the visualization of a product during online shopping (*Q: SE-2*) and that it offers advantages in comparison to regular shopping (*Q: SE-4*). This probably implies that participants do see the possibilities and benefits of augmented reality. However, this partially answers the sub-question about the current application of augmented reality (*SQ-1*) in both applications. Most participants do see the use and advantages of it, but it has not yet advanced to the stage it could be generally applied and used to everyone's likings.

On the other side, the customers' perspective (*SQ-2*) towards the use of augmented reality in online shopping is still beneficial as even participants who preferred static images see advantages in the technology. Additionally, the analyses show that the sensory experiences generally achieve a high mean score, this implies that participants were positive towards the sensory experiences and the added value it offers to the applications. The sensory experiences can possibly be triggered even further through more enhanced technologies within the usage of augmented reality in general.

Emotionally, participants did not experience as many benefits as with sensory experience. However, participants do agree that augmented reality makes shopping online more enjoyable due to its interactivity. It implies that the emotional experience with the technology itself is favourable. Nonetheless, as *Question EM-2* and *Question EM-3* show; augmented reality only gives a slightly higher emotional experience towards a specific online store using this technology. Which shows that brand attitude probably barely changes when a store implements the technology.

This is also confirmed with the social experiences questions. Participants were not very likely to tell others about an online store with augmented reality which is important for word of mouth

marketing and potentially new customers (*Q: SO-1*). Besides, the mean score of the second social experience (*Q: SO-2*) question shows that participants just slightly agree that more time would be spent in an online store when it uses augmented reality. However, studies have shown that when customers spent more time in a store, they are more likely to get to a purchase intention (J, Gilbride, Inman, & Melville Stilley, 2015, p. 3). The summary of the findings of the above-mentioned experiences (sensory, emotional, and social) answers the third sub-questions (*SQ-3*).

Lastly, the last social experience question about 5G innovation and augmented reality shows that the majority of participants are willing to make use of a higher quality of augmented reality in the future. This is the case with the upcoming 5G innovations which will lower data usage out of home networks and it offers the possibility for the technology to be enhanced as the usage of data will not bring as many constraints as current applications have.

## 6 Conclusion and Recommendations

To conclude this research, the possibilities of augmented reality in online shopping will be discussed and recommendations towards future use and application will be given. Augmented reality itself can be seen as an emerging technology that is still in its infancy, which offers high potential for a wide range of different eCommerce businesses. As the results of the research show, online stores should be encouraged to make use of augmented reality technology. At first, retailers should consider offering both augmented reality with static pictures as customers generally like to shop through multiple channels. However, with future more advanced augmented reality or even a completely virtual reality, static images may become 'out-of-style'.

The dominant group of this research, male participants between the age of 21 to 24 following an HBO educational study, were mostly positive towards the use of augmented reality in the applications. Which was an interesting finding as the majority within this group preferred in-store shopping over online shopping. This group agreed that augmented reality enhanced the visualization of a product and it generally offered advantages in comparison to regular online shopping which makes shopping online more enjoyable. Additionally, the participants within this group were open to using a higher quality of augmented reality in the future. However, the social experience for this group was still lacking as most agreed to be less likely to tell others about shops using augmented reality in particular. This shows that the social experience with using augmented reality is something to research and improve for businesses that are considering using the technology in the future.

Future applications should also be fit towards the interests of the customer group a business is trying to approach. For example, the minority of female participants in this research were more likely to prefer the Ikea Place application as they were probably more interested in decorating their rooms with fitting furniture than male participants. Participants also preferred a mix of the mechanisms available on both applications that were used for the structured interviews.

Although this study mainly discusses the customer experience and the effects of augmented reality in a sensory, emotional and social way. The information can be used throughout all business areas as it focuses on the experience rather than a particular application. Therefore, to optimize the augmented reality experience, businesses should attempt to analyse their customer target group carefully and design the technology and its mechanics towards the needs of the customer in the same way a business would for the products it is selling. Especially in what options the application should offer the customer and how in-depth the application should be. For example, the applications that were used for this research could not be changed in the likings of colour,

measurements or options for indirect variables like jeans colour for SneakerKit and including 'product-on-product' for Ikea Place (adding a virtual television on a virtual tv stand). Options like these could offer the customers the extra convenience they are looking for and offer a more personalised experience with augmented reality.

**Now, to answer the main research question:** *How can Augmented Reality transform the eCommerce industry?*

This research has shown that a combination of static and dynamic with augmented reality is still the best option. However, this may change at some point in the future when technologies have advanced and a higher quality of augmented reality is available. Additionally, it is important for a business willing to implement augmented reality to personalize their application mechanics and add options for indirect variables to improve the personalization of augmented reality. Improving the personalization in augmented reality will also enhance the social experience which is still lacking in the current applications. Combining these aspects will enhance the customer experience when online shopping.

Enhancing the online customer experience with augmented reality will eventually decrease the abandoning of online shopping carts as customers spend more time in online stores and are offered a better judgement of the product they are buying. However, this research focuses on augmented reality which is a relatively new technology. Therefore, more research should be conducted towards the performance and the mechanics of augmented reality which can determine the underlying factors of its potential success in online stores. Different preferences of the use of augmented reality may be found in demographics and background characteristics of participants that can only be tested by additional statistical research.

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## 8 Appendices

### 8.1 Appendix A | Figures

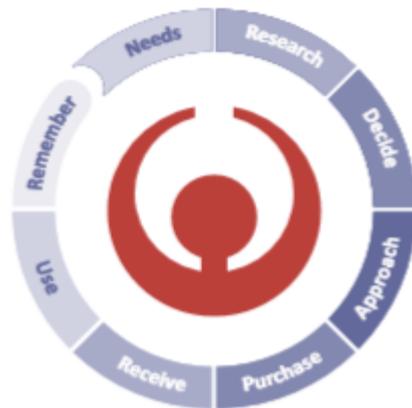


Figure 1. | Customer Perspective model (Winters, 2014)

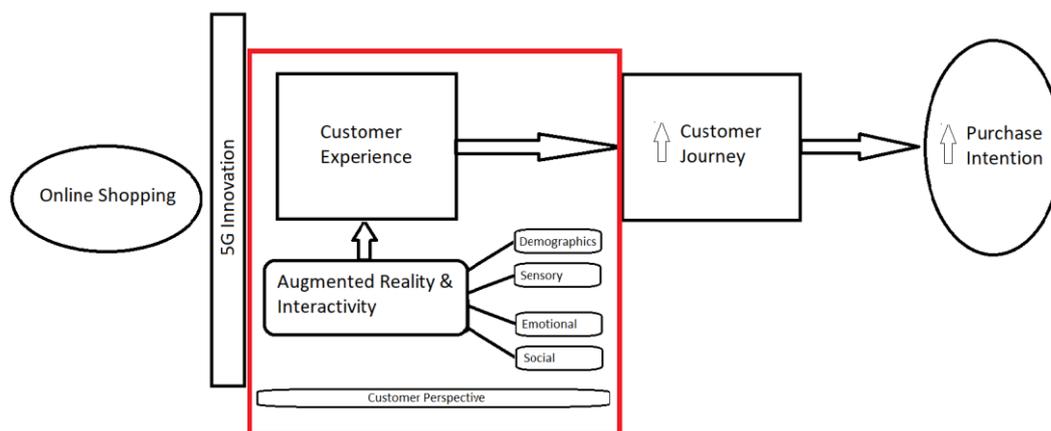


Figure 2. | Conceptual framework model

A. Vul hieronder de 3 kengetallen van de calculator in:

1. Hoe groot is de **steekproefmarge** die u wilt toelaten? (%)   
 Een steekproefmarge van 5% is gangbaar bij marktonderzoek.

2. Wat is de **omvang van de populatie**?   
 Wanneer de omvang niet bekend is, vult u dan 20000 in.

3. Welke **uitkomst** verwacht u in het onderzoek? (%)   
 Wanneer dit vooraf niet is in te schatten, vult u dan 50 in.

B. **Resultaat** :

Steekproefgrootte bij een betrouwbaarheidsniveau van: 90%

Steekproefgrootte bij een betrouwbaarheidsniveau van: 95%

Steekproefgrootte bij een betrouwbaarheidsniveau van: 99%

Figure 3 | Sample calculator (allesovermarktonderzoek.nl, 2019)

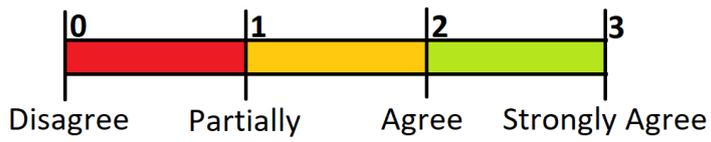


Figure 4 | Likert scale

8.2 Appendix B | Diagram

Gender  
43 responses

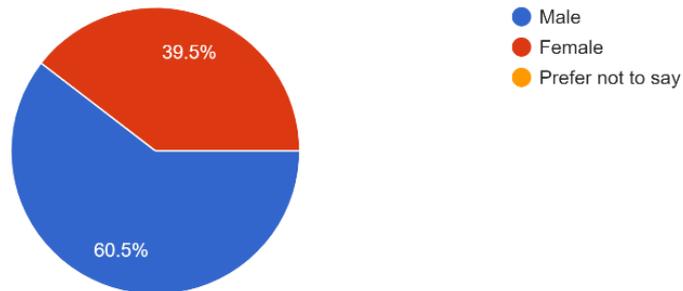


Diagram 4.1

Age  
43 responses

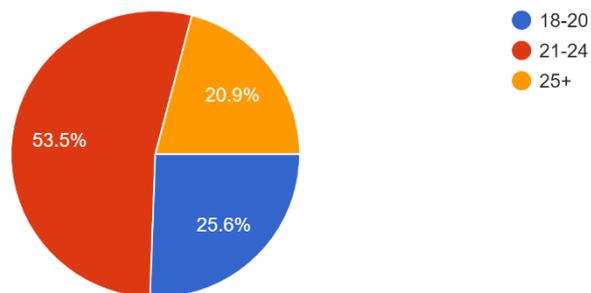


Diagram | 4.2

Education  
43 responses

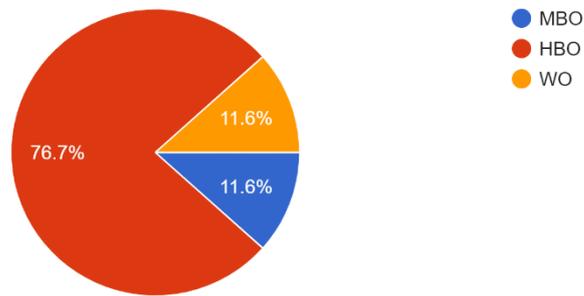


Diagram | 4.3

Application  
43 responses

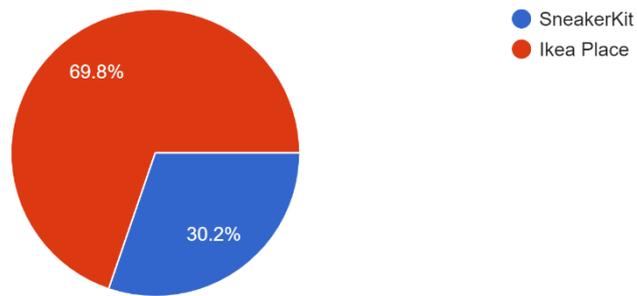


Diagram | 4.4

Shopping preference  
43 responses

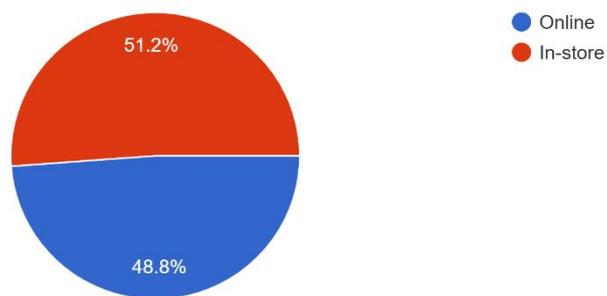


Diagram | 4.5

I prefer making use of AR over normal pictures  
43 responses

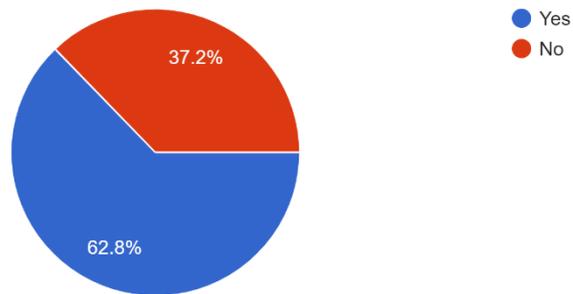


Diagram | 4.6

I would like to try a product with AR before purchasing online  
43 responses

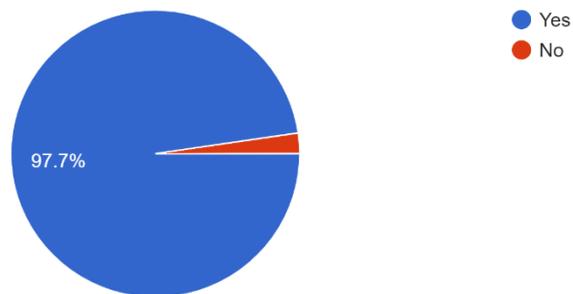


Diagram | 4.7

Visualizing a product with AR offers added value to an online shop  
43 responses

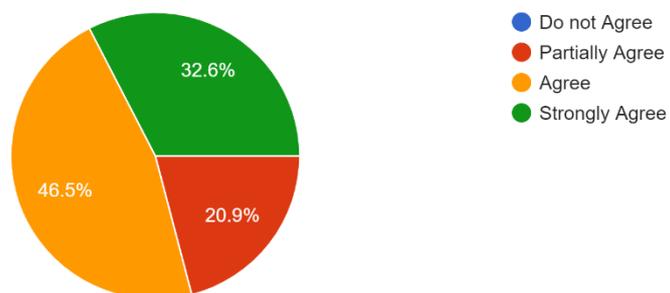


Diagram | 4.8

AR enhances my visualization of a product  
43 responses

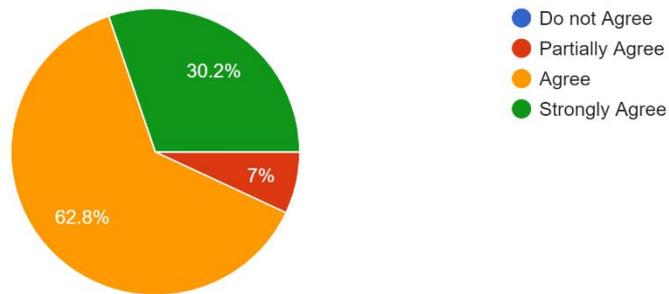


Diagram | 4.9

I will be more confident buying a product I have tried online  
43 responses

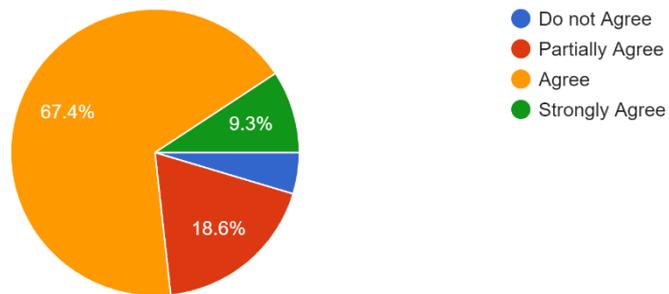


Diagram | 4.10

AR offers advantages in comparison to normal online shopping  
43 responses

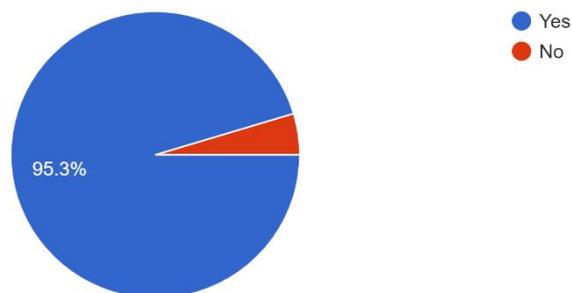


Diagram | 4.11

AR gives me the possibility to judge a product faster to my likings

43 responses

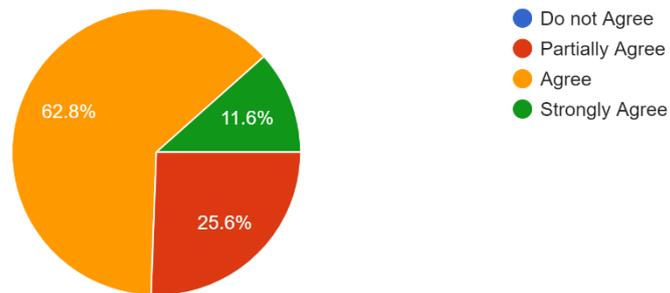


Diagram | 4.12

I would prefer an online store with AR than without

43 responses

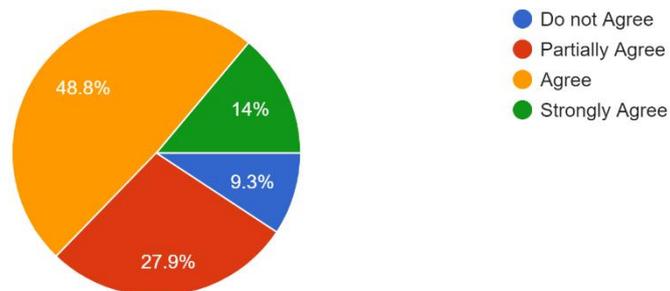


Diagram | 4.13

I would come back more often to an online shop when it uses AR

43 responses

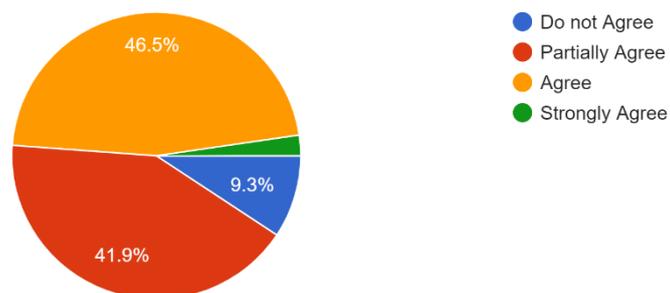


Diagram | 4.14

AR makes shopping online more enjoyable  
43 responses

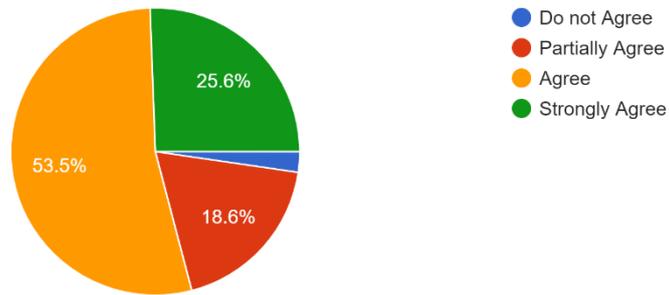


Diagram | 4.15

I would tell others about an online shop offering try-before purchase with AR  
43 responses

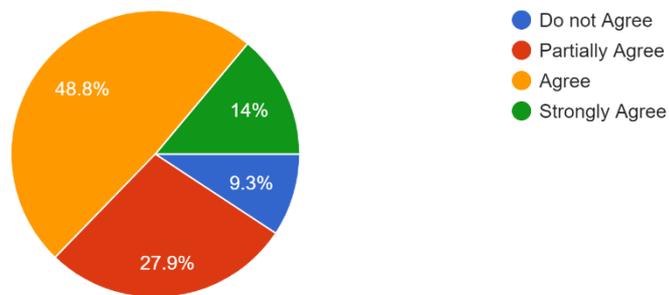


Diagram | 4.16

I am willing to spend more time in online stores with AR due to its interactivity  
43 responses

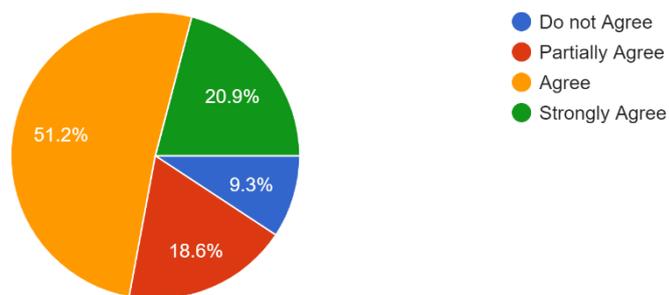


Diagram | 4.17

I would like to use a higher quality of AR in the future

43 responses

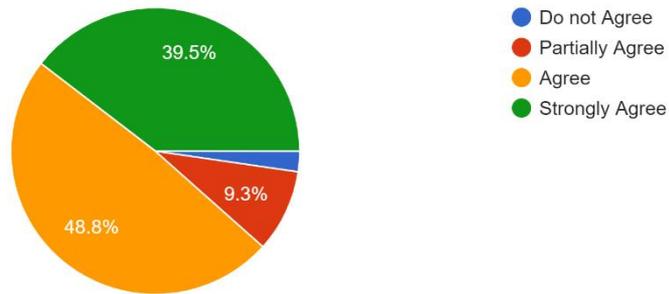


Diagram | 4.18

8.3 Appendix C | Tables

Table 5.1 | Gender and Age

		Gender		Total	
		Female	Male		
Age	18-20	Count	7	4	11
			41,2%	15,4%	25,6%
	21-24	Count	9	14	23
			52,9%	53,8%	53,5%
	25+	Count	1	8	9
			5,9%	30,8%	20,9%
Total		Count	17	26	43

Table 5.2 | Gender and Education

			Gender		Total
			Female	Male	
Education	MBO	Count	0	5	5
		% of Total	0,0%	11,6%	11,6%
	HBO	Count	15	18	33
		% of Total	34,9%	41,9%	76,7%
	WO	Count	2	3	5
		% of Total	4,7%	7,0%	11,6%
Total		Count	17	26	43
		% of Total	39,5%	60,5%	

**Table 5.3 | Education and Age**

			Education			Total
			MBO	HBO	WO	
Age	18-20	Count	1	9	1	11
		% of Total	2,3%	20,9%	2,3%	25,6%
	21-24	Count	2	17	4	23
		% of Total	4,7%	39,5%	9,3%	53,5%
	25+	Count	2	7	0	9
		% of Total	4,7%	16,3%	0,0%	20,9%
Total	Count	5	33	5	43	
	% of Total	11,6%	76,7%	11,6%		

**Table 5.4 | Application Preference and Gender**

			Application		Total
			SneakerKit	Ikea Place	
Gender	Female	Count	4	13	17
		% of Total	9,3%	30,2%	39,5%
	Male	Count	9	17	26
		% of Total	20,9%	39,5%	60,5%
Total	Count	13	30	43	
	% of Total	30,2%	69,8%		

Table 5.5 | Shopping Preference and Gender

			Shopping preference		Total
			Online	In-store	
Gender	Female	Count	9	8	17
		% of Total	20,9%	18,6%	
	Male	Count	12	14	26
		% of Total	27,9%	32,6%	
Total		Count	21	22	43
		% of Total	48,8%	51,2%	

Table 5.6 | Shopping Preference and Age group

			Shopping preference		Total
			Online	In-store	
Age	18-20	Count	5	6	11
		% within Age	45,5%	54,5%	
	21-24	Count	10	13	23
		% within Age	43,5%	56,5%	
	25+	Count	6	3	9
		% within Age	66,7%	33,3%	
Total		Count	21	22	43
		% within Age	48,8%	51,2%	

Table 5.7 | AR/Normal pictures and Shopping Preference

			I prefer making use of AR over normal pictures		Total
			Yes	No	
Shopping preference	Online	Count	14	7	21
		% within	66,7%	33,3%	
	In-store	Count	13	9	22
		% within	59,1%	40,9%	
Total		Count	27	16	43
		% within	62,8%	37,2%	

*Table 5.8 | Sensory Experiences Averages*

		Visualizing a product with AR offers added value to an online shop	AR enhances my visualization of a product	I will be more confident buying a product I have tried online
N	Valid	43	43	43
	Missing	0	0	0
Mean		2,12	2,23	1,81

*Table 5.9 | AR Advantages and Gender*

			AR offers advantages in comparison to normal online shopping		Total
			Yes	No	
Gender	Female	Count	16	1	17
		% within Gender	94,1%	5,9%	100,0%
	Male	Count	25	1	26
		% within Gender	96,2%	3,8%	100,0%
Total	Count		41	2	43
	% within Gender		95,3%	4,7%	100,0%

*Table 5.10 | AR/Static and Visualization*

			AR enhances my visualization of a product			Total
			Partially Agree	Agree	Strongly Agree	
I prefer making use of AR over normal pictures	Yes	Count	2	14	11	27
		% within	7,4%	51,9%	40,7%	100,0%
	No	Count	1	13	2	16
		% within	6,3%	81,3%	12,5%	100,0%
Total	Count		3	27	13	43
	% within		7,0%	62,8%	30,2%	100,0%

**Table 5.11 | Emotional Experiences Averages**

		AR gives me the possibility to judge a product faster to my likings	I would prefer an online store with AR than without	I would come back more often to an online shop when it uses AR	AR makes shopping online more enjoyable
N	Valid	43	43	43	43
	Missing	0	0	0	0
Mean		1,86	1,67	1,42	2,02

**Table 5.12 | AR/Static and AR Advantages**

			AR offers advantages in comparison to normal online shopping		Total
			Yes	No	
I prefer making use of AR over normal pictures	Yes	Count	26	1	27
		% within	96,3%	3,7%	100,0%
	No	Count	15	1	16
		% within	93,8%	6,3%	100,0%
Total		Count	41	2	43
		% within	95,3%	4,7%	100,0%

**Table 5.13 | Social Experiences Averages**

		I would tell others about an online shop offering try-before purchase with AR	I am willing to spend more time in online stores with AR due to its interactivity	I would like to use a higher quality of AR in the future (5G innovation)
N	Valid	43	43	43
	Missing	0	0	0
Mean		1,67	1,84	2,26

8.4 Appendix D | Structured Interview Questionnaire



### Augmented Reality in Online Shopping

Dissertation | Twan H. Wanders

Dear participant,

This questionnaire relates to the use of augmented reality in online shopping to enhance customer experience. Augmented reality is on the verge of a new breakthrough with the upcoming 5G innovations that will improve its quality substantially

The anonymity of your answers is guaranteed and its information is solely used as statistical information for this research.

The applications will be explained and tested by means of a structured interview, after downloading and testing, it will take approximately 2 minutes to complete this survey.

Your collaboration is very important for the purpose of my dissertation - Thank you in advance!

---

Gender \*

Male

Female

Prefer not to say

---

Age \*

18-20

21-24

25+

---

Education \*

MBO

HBO

WO

---

Application \*

SneakerKit



Ikea Place



Shopping preference \*

Online

In-store

I prefer making use of AR over normal pictures \*

Yes

No

I would like to try a product with AR before purchasing online \*

Yes

No

Visualizing a product with AR offers added value to an online shop \*

Do not Agree

Partially Agree

Agree

Strongly Agree

AR enhances my visualization of a product \*

Do not Agree

Partially Agree

Agree

Strongly Agree

I will be more confident buying a product I have tried online \*

Do not Agree

Partially Agree

Agree

Strongly Agree

AR offers advantages in comparison to normal online shopping \*

Yes

No

AR gives me the possibility to judge a product faster to my likings \*

Do not Agree

Partially Agree

Agree

Strongly Agree

I would prefer an online store with AR than without \*

Do not Agree

Partially Agree

Agree

Strongly Agree

I would come back more often to an online shop when it uses AR \*

Do not Agree

Partially Agree

Agree

Strongly Agree

AR makes shopping online more enjoyable \*

Do not Agree

Partially Agree

Agree

Strongly Agree

I would tell others about an online shop offering try-before purchase with AR \*

Do not Agree

Partially Agree

Agree

Strongly Agree

I am willing to spend more time in online stores with AR due to its interactivity \*

Do not Agree

Partially Agree

Agree

Strongly Agree

I would like to use a higher quality of AR in the future \*

Do not Agree

Partially Agree

Agree

Strongly Agree

