JÖNKÖPING UNIVERSITY
International Business School

Influence of Augmented Reality on Purchase Intention

The IKEA Case

MASTER PROJECT

THESIS WITHIN: *Major in Business Administration*

NUMBER OF CREDITS: *15*

PROGRAMME OF STUDY: *International Marketing*

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JÖNKÖPING May 2017

Master Thesis in International Marketing

Title: Influence of Augmented Reality on Purchase Intention: The IKEA Case

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Date: 2017-05-22

Key terms: augmented reality, purchase intention, attitude, product knowledge, interactivity, furniture, IKEA

Abstract

Augmented reality (AR) allows the enrichment of the physical world by adding virtual computer-generated digital information in real time to it (Furht, 2014). This provides marketers with previously unimagined options for reaching out and engaging with customers. Having the power to put the (virtual) products in the hand of customers, creates interesting opportunities for the users to engage with a brand, service or product (Yaoyuneyong et al., 2016). Although the AR market is expected to grow exponentially by the year 2020 (Digi-Capital, 2016) and several companies already tried to expand their business with the technology, little is known about whether AR is able to enrich the customers' shopping behaviour and thus yield favourable outcomes such as increased product knowledge, positive attitudes and higher purchase intentions. This thesis quantitatively addresses the research gap with an experimental method to determine the causal effect of the IKEA AR application on these customer dimensions in comparison to a product experience on the website. Generation Y has been chosen as an appropriate sample to experimentally discover effects on shopping behaviour. Finally, the shopping-oriented AR application is perceived as highly enjoyable and useful, and further evoked higher purchase intentions than its website counterpart. Moreover, the attitude towards the product was not found to be a main driver, but the engaging experience and the conveyed unique product knowledge itself.

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1. Introduction

A general introduction to the topic will be given in the initial part of the thesis. This establishes a foundational knowledge of the research study. The background information about the phenomenon of augmented reality is followed by problem discussion of the research gap. At last, the research purpose, definitions for understanding the topic, and delimitation of this thesis will be discussed.

1.1 Background

"I am excited about augmented reality because unlike virtual reality which closes the world out, it allows individuals to be present in the world but hopefully allows an improvement on what's happening presently."

Tim Cook, Apple CEO (Independent, 2017)

Nowadays, we experience the world where desktop-based interaction with technology gradually shifts towards mobile and wearable computing, happening anytime, anywhere (Satyanarayanan, 2001; Ware & Balakrishnan, 1994). Our personal devices are being transformed into artificial, external eyes and ears for sensing embedded information in the surrounding environment. The advantages of both real and digital world can be blended into a single interface, which enables new applications and services to be developed (Olsson, Lagerstam, Kärkkäinen, & Väänänen-Vainio-Mattila, 2011). The process of bringing the real and virtual closer together results into the origin of augmented reality systems.

Augmented reality (AR) is sometimes wrongly interchanged with the concept of virtual reality, or virtual environment as called by Milgram and Kishino (1994). Both of them belong to the contemporary trend in digital technology and are part of mixed reality, which refers to the integration and merging of the real and virtual worlds where physical and virtual objects complement, support and interact with each other (Ohta & Tamura, 2014). Despite being related to virtual reality (VR), AR enhances a user's interaction with reality through a computer-generated environment, while VR technology completely immerses people in a synthetic environment (Fuhrt, 2014). AR allows users to continuously see and hear the surrounding world but with additional sights and sounds that are synchronized to the exact location relative to a user's three-dimensional (3D) orientation to a geographic locale (Pavlik & Bridges, 2013). AR is considered as a part of the mixed reality continuum (Figure 1), focusing on augmenting the real world with add-on digital information, instead of implementing real-world information into virtual worlds (Azuma, 1997). Thus, AR aims to supplement the real world, rather than creating an entirely artificial environment

(Olsson et al., 2011) in which users lock themselves out and possibly lose the sense of time and space.

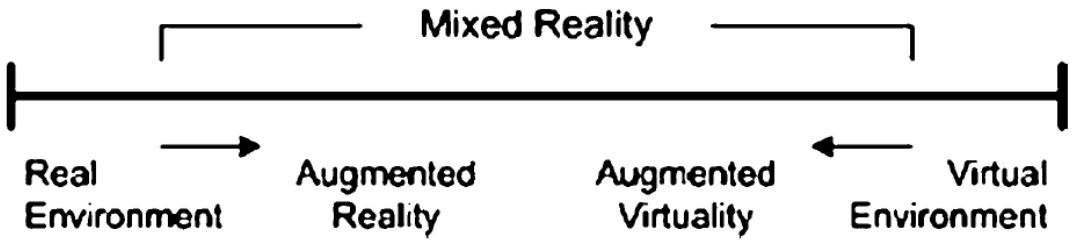


Figure 1. Mixed reality continuum adapted from Milgram & Kishino (1994)

The major starting point for AR came in the beginning of 1990s when scientists from Boeing coined for the first time the term "augmented reality". A technological advancement, decrease of related costs, worldwide spread of the Internet, existence of the Global Positioning System (GPS), increased mobility and portability of the technology have increased both the utility and subsequent relevance of AR (Javornik, 2016). The emerging trend of AR gets supported by Google Trend data that shows around a 400 percent increase of interest in the last decade (Figure 2). Furthermore, many technological giants such as Google, Microsoft, Snapchat and recently Facebook embark to develop their AR solutions (Constine, 2017; Robertson, 2017; Schroeder, 2015; Spence, 2017).

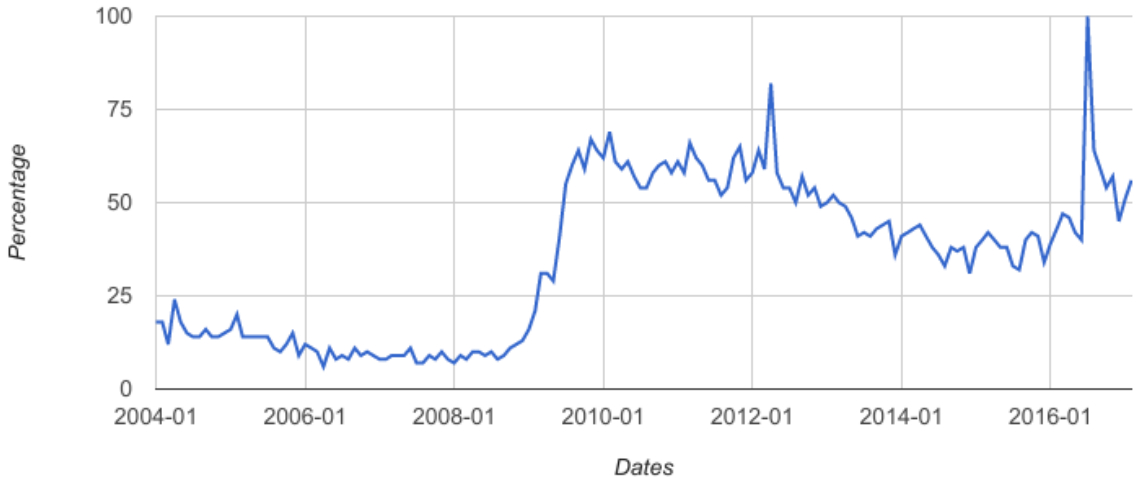


Figure 2. Augmented reality in Google Trends (Google Trends, n.d.)

1.2 Problem Discussion

Marketing, advertising or business-driven choices are inherently shaped by technological possibility. While technological development has often been led by the needs or vision of the marketing field, evolving technology has also given global marketers access to previously unimagined options for reaching out to their consumers and to engage with them (Yaoyuneyong,

Foster, Johnson, & Johnson, 2016). Thus, the toolbox available for marketers has continuously increased. Nevertheless, with the ever-accelerating tidal wave of advancing technology, there is often little to no information available regarding the efficiency of newer marketing mediums, leaving marketers to choose strategies based on instinct-driven guesses rather than evidence-driven theory (Yaoyuneyong et al., 2016).

To label an increasingly popular marketing strategy leveraging the full possibilities of smart devices and external digital computing, the term augmented reality marketing (ARM) has been recently introduced (Marshall, 2012). Via ARM brands have the power to put the product in the hand of the users, creating an interesting opportunity for customers to engage with a brand, service or product (Yaoyuneyong et al., 2016).

Although ARM has been proven to provide entertainment, promotional, and experiential value (Bulearca & Tamarjan, 2010; Chen & Hsieh, 2010), impacts for corporations in terms of customer attitude and purchase intention are still unclear. This arises uncertainty among marketers whether AR is just an entertaining gimmick (Owyang, 2010), or whether it can, as a marketing tool, contribute to favourable consumer outcomes, and thus lead to the consequent purchase of an augmented product. As every other new media format, it can be tempting to use it without considering a real value of an outcome. Some marketers have focused on the medium to the point that they forget about the core of the message they are trying to convey (Leslie, 2016).

Several AR applications were developed for e-commerce purposes, but many of them do not exist anymore. For instance, the virtual try-on applications of Tobi Fashion, JC Penney or Converse, which caught the attention of researchers and media, are no longer available (Accenture, 2014; Kang, 2014). This can imply poor acceptance of the technology by customers or poor business performance. In order to take advantage of the AR market, which revenue forecast is expected to be worth up to 120 billion dollars by the year 2020 (Digi-Capital, 2016), companies need to be aware whether these systems directly support and enrich customers' shopping behaviour, so they can expand their business via this particular technology. Moreover, it is unknown how consumers' interactions with AR change when they get used to it and the initial magic disappears (Hoffman & Novak, 2009).

Already conducted research studies focused more on technological aspects of how to develop AR solutions (van Krevelen & Poelman, 2010; Zhou, Duh, & Billinghurst, 2008), its feasible application in journalism (Pavlik & Bridges, 2013), education (Cabero & Barroso, 2016; Dunleavy, Dede, & Mitchell, 2008) or on usability by cultural organisations (Iancu, 2016; Noh, Sunar & Pan, 2009; Vlahakis, Ioannidis, Karigiannis, Tsotros, Gounaris, Stricker, & Almeida, 2002). From the

business perspective, the recent research mostly explored the effects of using "magic mirror" features to virtually try out apparel or make-up (Javornik, Rogers, Gander, & Moutinho, 2017; Schwartz, 2011), and usage intention or customer satisfaction of AR applications (Bulearca & Tamarjan, 2010; Huang & Liao, 2015; Kang, 2014; Olsson & Salo, 2011; Rese, Schreiber, & Baier, 2014).

1.3 Purpose

The purpose of our research based on the problem discussion is to close the gap within the augmented reality field of study. We especially focus on the business potential of the AR technology, as suggested to discover by Bulearca and Tamarjan (2010), Javornik (2016) and Yadav and Pavlou (2014) in their recent studies. Despite the fact that AR is not a new phenomenon, marketing managers still lack hints what kind of impacts the usage of shopping-oriented AR applications have on consumer behaviour. As Javornik (2016) in her research article states: "How exactly users are drawn into this new form of reality and what effects it has on them has not yet been exploited in consumer behaviour literature." (p. 259). Answers to that would expand upon the existing knowledge about consumer reactions to interactive technologies (Chen & Hsieh, 2010).

Yet, AR applications have not been quantitatively researched while using the experimental method, in which participants could actually interact with the new interactive technology (Bulearca & Tamarjan, 2010; Liao, 2014; Kim & Forsythe, 2008; Olsson & Salo, 2011; Scholz & Smith, 2016; Schwartz, 2011). This master thesis will make a contribution to the research field with this empirical methodology.

Hence, in summary, we are going to experimentally investigate the *purchase intention after experiencing an augmented reality application.*

Within the stated purpose, the following research questions will be addressed in our thesis:

- *RQ1: Does an augmented reality application affect customers' purchase intention?*
- *RQ2: If so, what can explain the possible increase of purchase intention when experiencing an augmented reality application?*

1.4 Delimitation

This study within the interactive marketing research focuses on purchase intention of AR applications on smart devices, not on usage intention which has been already explored. Our approach is to discover the effects of human-interface relationship and how they influence the purchase intentions. Other possible factors leading to the intent to purchase such as social

influence, trust and brand confidence (Bearden, Netemeyer, & Teel, 1989; Mayer, Davis, & Schoorman, 1995; Park & Lessig, 1981) are not being considered. Moreover, we are not investigating a utilization of AR in other marketing activities such as advertising. The target group of our interest are people belonging to Generation Y, and hence we are not able to generalise findings on any other demographic groups. Although there could be some cultural differences among European countries with respect to technology acceptance (Didero, Gareis, Marques, & Ratzke, 2008; Ng, 2013), the thesis is not discovering this issue either.

1.5 Definitions

APPLICATION

Mobile applications (apps) are software applications developed for small smart handheld devices, such as mobile phones, smartphones, and tablets. Mobile apps can come preloaded on the smart device and can be downloaded by users from app stores or the Internet (Viswanathan, 2016).

ADVERTISEMENT

Advertisement (ad) is defined by Oxford Dictionary as an attention-grabbing presentation in any communication medium which usually serves the marketing function of persuading consumers to purchase a product or service but which may also have a function to raise or maintain awareness of a brand. (Chandler & Munday, 2011).

AUGMENTED REALITY

Augmented reality (AR) is a real-time view of physical real-world surroundings that has been enhanced by adding virtual computer-generated digital information to it (Furht, 2014).

AUGMENTED REALITY MARKETING

Using augmented reality to create unique experiences in order to let customers engage with brand, product or service (Marshall, 2012).

ELECTRONIC COMMERCE

E-commerce is an electronic transaction which is the sale or purchase of goods or services between businesses, individuals, governments and other public or private organizations, conducted over computer mediated networks (OECD, 2011).

PURCHASE INTENTION

Purchase intention is a part of the decision-making process, and defines whether a customer plans to buy something from a business at some point in the future. (Dontigney, 2016; Shah, Aziz, Jaffari, Waris, Ejaz, Fatima, & Sheraz, 2012). It is a widely used conative measure in marketing

effectiveness research (Andrews, Akhter, Durvasula, & Muehling, 1992; Beerli & Santana, 1999).

QR Codes

QR codes are defined as two-dimensional barcodes that can be read by smart devices. The codes, which are visualized small squares with black and white patterns, are used to encode some sort of information, such as text or a URL. The "QR" in QR codes stands for "quick response," as the codes are designed to be read quickly (Cassavoy, 2017).

Smart Devices

Smart devices can be described as a personal communication medium. It includes electronic things such smartphones, tablets, e-Readers and smart wearable accessories. These devices are usually equipped with a wireless connection, operating system, GPS and third-party application support (Rai, Chukwuma, & Cozart, 2017).

User Experience

User experience (UX) encompasses all aspects of the end-user's interaction with the company, its services, or its products. It also relates to the human-interface interaction (Norman & Nielsen, n.d.).

Virtual Reality

A medium composed of interactive computer simulations that sense the participant's position and actions, providing synthetic response to one or more senses, giving the feeling of being present in the simulation (Sherman & Craig, 2003).

2. Literature Review

The literature review section presents references to augmented reality from historical, business and research perspectives. The second part is devoted to a discussion of theory of interactive product experiences and finally leads to our model and hypotheses development.

2.1 Overview about Development of Augmented Reality

The first mentions of AR date back to the 1950s when the cinematographic pioneer Morton Heilig thought of how to draw the movie audience into onscreen activity by addressing more senses apart from sight and hearing in an effective manner (Carmigniani, Furht, Anisetti, Ceravolo, Damiani & Ivkovic, 2011). In 1962, Heilig built a prototype of his vision called Sensorama simulator that was ahead of its time, but eventually ended up without a crucial investment (Turi, 2014). Nevertheless, the biggest milestone for AR occurred in the beginning of the 1990s when scientists Tom Caudell and David Mizell from the aeronautical company Boeing coined the term "augmented reality" and presented the advantages of usage (Carmigniani et al., 2011).

Over the years, researchers, scientists and developers found more areas that could benefit from the augmentation. The first applications focused on military, industrial and mostly medical purposes, but AR systems for commercial use, journalism, sports, marketing or entertainment began to appear more and more often throughout the last years (van Krevelen & Poelman, 2010). Besides the field and context of use, the AR applications also differ based on the specific entities they augment. AR is capable of enhancing the physical reality by overlaying virtual elements on: people, products or surrounding space (Carmigniani et al., 2011). So far, AR used on smart devices equipped with operating system, camera and location-based sensor or on large interactive screens, either privately or publicly in retail business, are among the most common ones (Javornik, 2014).

AR applications on smart devices allow a consumer to see a virtual product placed in the familiar environment, such as augmenting virtual furniture in the actual physical room, or an enhanced view of a self in the form of virtual mirrors or virtual try-ons, which are enabling the users to try virtual make-up, glasses or clothing. While digital try-ons already existed in the form that websites allowed to upload an own picture, the AR virtual mirrors deliver more interactive real-time experience (Javornik, 2016). In terms of public AR applications, Javornik et al. (2017) investigated "magic mirrors" which augmented the actual image of visitors with make-up of historical figures in a museum and a dressing room of an opera house. This study revealed that AR is more engaging if the user can control the experience, but for public spaces the automatized augmentation is contributing to create attention. Moreover, the usefulness of the AR application was differing depending on the kind of users. While make-up artists valued the potential to experiment with

looks, actors saw it as useful to get into the role and visitors of the museum as means to playfully learn about culture and history (Javornik et al., 2017). Moreover, major newspaper houses such as the New York Times or the Wall Street Journal experiment with embedding the AR content like videos or animated infographics to increase the interactivity of traditional storytelling (Pavlik & Bridges, 2013).

Aiming to achieve customer engagement or to positively affect customers' purchase intention, many of big brands from various industries such as Converse, Coca-Cola, Disney, Epson, IKEA, LEGO, Lacoste, L'Oréal and MINI are currently experimenting with AR either as part of their advertising or as a virtual trial of their own products (Banks, 2016; Csutoras, 2016; Duran, 2016). Apart from these more or less successful examples of using the emerging technology for commercial purposes, it has been empirically confirmed in year 2016 that consumers are ready to engage with AR, although they might have not been aware either of the technology or the term itself (Seitz, 2016). Pokémon GO became a global hit with millions of users downloading the mobile app to hunt virtual creatures in the real world (Parkin, 2016). The instant success story was also helpful in terms of awareness of AR among both consumers and a broader investment community (Seitz, 2016). Another story confirming users' fascination by AR and willingness to engage with it, is the social network Snapchat. The application with 300 million active users per month, which is mostly popular among the youthful generation under 24 years old (Aslam, 2017), is mainly known because of the feature called "lenses" (Kar, 2016). It allows people to overlay their faces with amusing graphics and filters. According to Kar (2016), "Snapchatters" spend 20 seconds a day on average playing around with augmented lenses. Moreover, Snapchat has started to monetize this function, and offers companies to take advantage and upload their branded masks (Kar, 2016). In the future, the technological company promises that it could visualize images - and consequently advertisements - onto variety of real-world objects and not only on human faces (Dalton, 2017).

Furthermore, leaders of IT sector aim their focus to wearable computing which might move the relevance and importance of AR even further (Munro, 2013). Wearable devices such as glasses, goggles or contact lenses allow a much closer association with the user (Starner, 2004). The sensors inside such gadgets allow them to see what the user sees, hear what the user hears, and sense the user's physical state. If this information is combined, an intelligent interface may be able to analyse what the user is doing and try to predict the resources he will need next or in the near future (Starner, 2004). Wearable computing is on the horizon, and will enable immersive and more intuitive experiences. Examples of the first pioneering devices capable to fulfil addressed possibilities are Google Glass or Microsoft HoloLens (Munro, 2013). These IT firms were sceptical

to the enclosed world of virtual reality and rather focused their research and development in augmented direction (Parkin, 2016). However, Google Glass project was suspended in 2015 after only two years of existence when only a chosen few could buy the gadget for $1,500. Even though the Time magazine honoured Google Glass as one of the best inventions of the year 2012 (McCracken, 2013), the smart glasses however did not find many fans due to its high price, unprepared ecosystem of third party applications and visual creepiness affecting the nature of humanity (Montgomery, 2015).

Yet, such utilization of the AR wearables has been rare in marketing, due to the limited access to aforementioned devices (Javornik, 2016). In addition to the lower accessibility, sociologists question the society's readiness for these products in terms of the challenges that they will bring to public life, personal privacy, and consumers' relationship with the companies and authorities that will have access to more accurate personal data than ever before (Statt, 2014).

2.2 Overview about Augmented Reality in Marketing Research

So far, research in the marketing field focused on the acceptance of the AR technology (Huang & Liao, 2015; Kang, 2014; Olsson & Salo, 2011; Rese, Schreiber, & Baier, 2014), the perception of AR ads (Sung & Cho, 2012; Yaoyuneyong et al., 2016), guidance for the design of the AR experience (Javornik et al., 2017; Scholz & Smith, 2016), the anticipated consumer responses to media characteristics of AR (Javornik, 2016), post-use evaluations of individuals (Kim & Forsythe, 2008), and the influence on purchase intention for apparel shopping (Schwartz, 2011).

Based on the study by Schwartz (2011), AR has the potential to provide online shoppers with a more direct and engaging product experience, and thus can lead to a decrease in returns and increase in conversions. Furthermore, it has the capability to attract the attention of consumers in advertising (Javornik et al., 2017).

2.3 Types of AR in Marketing

2.3.1 AR Advertising

In the past years, eye-catching advertisements that used AR at public places evoked media and consumer attention. An example for this would be a Swedish pharmacy using an interactive billboard screen at a public space in Stockholm that utilized a smoke detector which was directly reacting to smoking people who passed by with an anti-smoke video (Figure 3) (Mallinson, 2017). Furthermore, Pepsi made commuters believe they were looking through the bus shelter's glass wall, while they were actually watching a live video with augmented 3D objects like a walking tiger or attacking robot (Escribano, 2017).

Figure 3. Interactive anti-smoke ad (Mallinson, 2017)

The possibility to retrieve additional information beyond the physical ad was first utilized through QR codes which did not receive the broad acceptance of consumers (Marquis; 2012 Stratten, 2014). In terms of rich hypermedia ads, Yaoyuneyong et al. (2016) compared classic print ads with both QR and AR hypermedia ads (Figure 4). In their study, the AR ad performed better than both traditional print ads and QR ads in almost every dimension such as overall performance, quality, ad appeal, memorability and ad success. Surprisingly, even though a smart device is needed to retrieve the information, participants evaluated the AR option as more time and effort saving as they could explore what was beyond the print ad. The informational value of AR ads is further pointed out by Sung & Cho (2012), who identified that informativeness and interactivity have a significant effect on shaping the attitude of customers towards a product and brand, while for 2D ads the entertainment value seems to be the strongest influencer.

Figure 4. Three types of print ads: traditional, QR and AR (Yaoyuneyong et al., 2016)

The QR images are the older and limited version of AR, but they were vastly used across many marketing activities. When adopting this medium, companies failed to understand the technology from customers' point of view, documented with poor marketing strategy executions (Marquis, 2012). Inevitably, consumers ended up confused, irritated or totally unconcerned. Thus, QR is

leaving the advertising stage without significant impact (Stratten, 2014).

2.3.2 Shopping-oriented AR

Shopping-oriented AR applications usually have the aim to provide an engaging product experience to consumers, as a direct experience and interaction with the product is not possible in a digital environment. Further, Lu and Smith (2007) mention that "traditional electronic commerce (e-commerce) is limited, because it cannot provide enough direct information about products to online consumers" (p. 643), which leads to high product return rates and shopping cart abandonments.

For online retailers, AR tools like virtual try-ons have the capacity to increase the conversion and decrease the returns (Schwartz, 2011). Moreover, also for offline retailers the technology has a potential, as it enables consumers to "try" the product at home before they buy it in the store. In order to be a successful tool in the marketing of products, both the virtual experience must have a significant impact on customer dimensions and the augmentation technology needs to be accepted by consumers (Schwartz, 2011).

2.4 Frame of References

2.4.1 Interactive Image Technology (IIT) and Telepresence

Interactivity can be described as "the extent to which users can participate in modifying the format and content of a mediated environment in real time" (Steuer, 1992, p. 84). Following, AR can be classified as a highly interactive technology. Various studies explored the different aspects of interactive functions on e-commerce sites (Fiore, Kim & Lee, 2005a; Mollen & Wilson, 2010).

In the last decade, the level of interactivity quickly evolved from 360° product presentations to virtual fitting rooms which allow users to experience the products of retailers on themselves or project them in their own living space. Solutions like Fitnect or the IKEA app enable customers to visualize how different clothing matches together or whether a piece of furniture fits at the allocated place (Fitnect, n.d.; Stinson, 2013).

Telepresence can be described as "the experience of presence in an environment by means of a communication medium" (Steuer, 1992, p. 76). According to Fiore et al. (2005a) and Schwartz (2011), the evoked telepresence through interactive image technologies plays an intermediate role in influencing consumers' cognitive responses. In addition, Schwartz (2011) showed an effect of telepresence on the attitude towards the product and on customer's purchase intention through increased product knowledge. Moreover, this in line with previous studies which found out that while interacting with technology, the emotional, behavioural and cognitive engagement is assumed

to have an effect on gaining certain knowledge (Deater-Deckard, Chang, & Evans, 2013; Pekrun & Linnenbrink-Garcia, 2012).

Thus, whether the quality and design of AR experience can create telepresence, and convincingly imitates a direct product experience, seems to be a crucial factor in influencing purchase intention. Several researchers examined how telepresence is achieved. Klein (2003) found that "user control" and "media richness" of the virtual product experience are facilitating telepresence, while Coyle and Thorson (2001) identified the similar constructs "interactivity" and "vividness." Furthermore, Papagiannidis, See-To and Bourlakis (2014) hypothesized control, colour vividness, graphic vividness and 3D authenticity as determinants of telepresence. The ability to have control over the experience and product is also assumed to be one of the main reasons why users are fascinated by computer-based activities (Ghani & Deshpande, 1994; Song & Zinkhan, 2008), and which leads to a stronger attitude towards the product (Klein, 2003).

The possibility to change elements of a virtualized product and the design process of fitting a virtualized product in the customer's own space has also a co-creational value, which can have an effect on customer relationships (Prahalad & Ramaswamy, 2000), and evokes innovation through customer ideas (Prahalad & Ramaswamy, 2004). Moreover, customers have a high level of control in a direct product experience, and thus can decide what to touch and in what order. In a mediated experience, such as through television and interactivity lacking online presentation, the possible range of choices is limited (Klein, 2003).

Nevertheless, Fiore et al. (2005a) assumes that interactivity, for instance through an image manipulation, 3D visual tours and entertaining games, may deny the negative effects of the inability to experience the real products. As the level of interactivity can be considered as high for the augmentation of products in the chosen AR applications, the created authentic experience is expected to be similar to a direct product experience, and therefore creates a high level of engagement and telepresence.

2.4.2 Virtual (Product) Experience

To have a positive effect on customer behaviour such as increasing product knowledge and positively influencing the attitude toward the product, a more direct experience with the product needs to be evoked by the technology (Schwartz, 2011). Product experiences can be categorized as either direct (e.g. trying a product in-store) or indirect (e.g. watching an ad), with the virtual experience (telepresence) being between direct and indirect on the experience spectrum (Schwartz, 2011).

Li, Daugherty and Biocca's (2002) study showed that the product knowledge which a consumer gained through the 3D product presentation (virtual experience) was higher than both in the indirect experience and, surprisingly, even the direct experience. Consequently, this leads to a positive effect on attitude and purchase intention.

Moreover, Fiore et al. (2005a) found out that the use of virtual model technology can affect the attitude toward the retailer, the willingness to patronize and purchase from the online retailer, as the customers feel that they make a better decision and receive a rewarding shopping experience. In terms of authenticity, the virtual products should match what customers can expect in the real world, but the experience can also be slightly different in order to catch the user's attention and persuade him to try the product in reality (Fiore et al., 2005a; Papagiannidis et al., 2014). Papagiannidis et al. (2014) let participants virtually test-drive a MINI car in a computer-simulated game environment, which increased the users' purchase intention towards the real product not through the authenticity of the product but the entertaining simulation experience itself. Hence, whether an AR application can persuade customers is therefore not exclusively depending on creating a direct product experience which is useful with respect to their purchase decision process, but can also be achieved through an engaging and enjoyable experience. Furthermore, the influence of hedonic values on purchase dimensions is also in line with prior research of non-augmented online (Chen, Shang, Shu & Lin, 2015; Childers, Carr, Peck, & Carson, 2001) and offline shopping behaviour (Babin, Darden, & Griffin, 1994; Chiu, Wang, Fang, & Huang, 2014).

2.4.3 Technology Acceptance

Even if the technology can provide favourable outcomes, the actual acceptance and usage intention of users can be considered as key in order to evaluate whether, and how these applications can be a sustainable and beneficial tool for marketers. For this purpose, many researchers investigated AR on the basis of the technology acceptance model (TAM) by Davis (1989). The original model by Davis (1989), who examined job-related computer-use, states that the users' acceptance is mostly affected by extrinsic motivation - perceived ease of use and usefulness of a technology. This motivation has an effect on the intention of consumers to use the system. As the model led to inconsistent findings, the intrinsic (hedonic) motivation to adopt a new technology was later added to the TAM, and therefore allowed the model to be also used for technologies with both utilitarian and hedonic nature (Davis, Bagozzi, & Warshaw, 1992; Huang & Liao, 2015; Kim & Forsythe, 2007; Kim & Forsythe, 2008). The perceived usefulness can be understood as the perceived capability of a technology to improve the performance at tasks. In contrast, the hedonic dimension specifies the extent to which enjoyment can be derived from using the technology system (Davis et al., 1992).

The perceived ease of use implicates that the individual is not exhausting its cognitive resources to use a technology, whereas the effect on the intention to use the technology seems to be indirect through the perceived usefulness and enjoyment (Davis, 1989; Davis et al. 1992; Kim & Forsythe, 2008). Consequently, it can be assumed that in order to influence consumers' cognitive responses and get adopted by the consumers, the AR experience needs to be easy to use and enhance the online shopping-experience by providing utilitarian and/or hedonic value. Moreover, Gopalan, Zulkifli and Aida's (2016) study about the usage of AR in a learning environment indicates that the technology is capable of creating engagement and enjoyment while being easy to use.

Moreover, several authors also considered characteristics of shoppers and their influence on the adaption of AR. According to Kim and Forsythe (2008), the innovativeness and technology anxiety of users have a significant influence on their intention to use a given AR application in the future. In addition, Kang (2014) discovered that if a consumer's ego is connected to a certain product category or a product, the adaption of a technology that is related to the category will be more likely to happen. Also, there seem to be differences between the genders not just in terms of whether or not a technology gets adopted, but also in their underlying motivations. Kim and Forsythe (2008) identified that hedonic values are more important for women than for men in the use of AR, which is consistent with the prior findings about gender differences in technology acceptance by Venkadesh and Morris (2000).

2.4.4 Attitude and Purchase Intention

According to the theory of planned behaviour (TPB) by Ajzen (1985), the attitude toward a behaviour can predict an intention of performing the behaviour. Hence, it can be inferred that the more positive the attitude towards a product is, the higher the intention to purchase is. Furthermore, the theory of attitude-behaviour consistency by Smith and Swinyard (1983) shows that a direct product experience leads to a more favourable attitude and behaviour consistency than an indirect product experience. Hence, as AR is capable of creating telepresence, which is comparable with a direct product experience, the attitude-behaviour-consistency can be expected to be high (Schwartz, 2011).

According to Huang and Liao (2015), the visual appeal and the entertainment value of an AR application are important factors that further foster the sustainable usage of the application. Especially for virtual try-ons, the visual attractiveness has an influence on rational purchase decisions and the utilitarian experience when virtual clothing gets fitted to the consumer's body and several clothing items are worn together (Eckman, Damhorst, & Kadolph, 1990; Geissler & Zinkhan, 1998). Moreover, the usefulness and ease of use are assumed to be the main constructs

that influence attitude towards using AR, and thus in line with research about the interactive website elements and their influence on attitude towards the website (Chen, Gillenson, & Sherrell, 2002; Kim & Forsythe, 2008). Furthermore, websites that are highly informative, entertaining and lack irritation, are assumed to create favourable attitudes towards them (Chen, Clifford, & Wells, 2002). The usefulness of AR thereby highly depends on the task and will be often seen by users in comparison with their existing shopping routine. Bulearca and Tamarjan (2010) investigated the usage of an online AR app to try-on glasses, and found out that the users mostly valued the convenience and time-saving of the online application. However the users also expressed some constraints regarding whether it can substitute their traditional purchase process in local stores, which provides not just an expertise but also recommendations in terms of taste. A similar explanation could be applied to the study of Rese et al. (2014) who found relatively positive attitudes towards the IKEA AR app, but also considerably lower behavioural intention to use it. Furthermore, Schwartz (2011) showed that the virtual product experience of AR can also influence the attitude and purchase intention negatively when a given product is not liked by consumers. It has to be mentioned that besides technology-related factors, other aspects such as social influence, trust and brand confidence are also assumed to influence purchase intentions (Bearden et al., 1989; Mayer et al., 1995; Park & Lessig, 1981).

Consequently, the enhanced experience of interactive image technology - and thus AR - can provide both high utilitarian and hedonic value, and is capable of influencing cognitive responses of consumers (Kim & Forsythe, 2008; Klein, 2003; Li et al., 2002; Schwartz, 2011). However, many users do not trust the accuracy of measurements in an AR setting, for instance whether clothes are fitting (Kim & Forsythe, 2008). Hence, trusting the applications in terms of real size, graphics, colour accuracy and the alignment with the reality can be considered to be crucial for creating a direct (virtual) product experience and influencing the decision-making process of customers.

2.5 Hypotheses Development

The proposed theoretical model (Figure 5) extends Schwartz's (2011) model by hedonic and utilitarian value, as well as ease of use and human characteristics, to explain the use of shopping-oriented AR applications and their influence on the purchase intention. The model by Schwartz (2011) already connected the increased interactivity and thereby evoked telepresence of virtual apparel try-ons with purchase intention, and thus is suitable for adapting it to the purpose of examining the AR effects on furniture buying process. Moreover, the effect of highly interactive product presentations on telepresence, which is antecedent of favourable consumer-related outcomes, was also shown for websites (Fiore et al., 2005a; Mollen & Wilson, 2010; Schwartz, 2011). AR applications can be furthermore seen as improved and more interactive virtual model

technology.

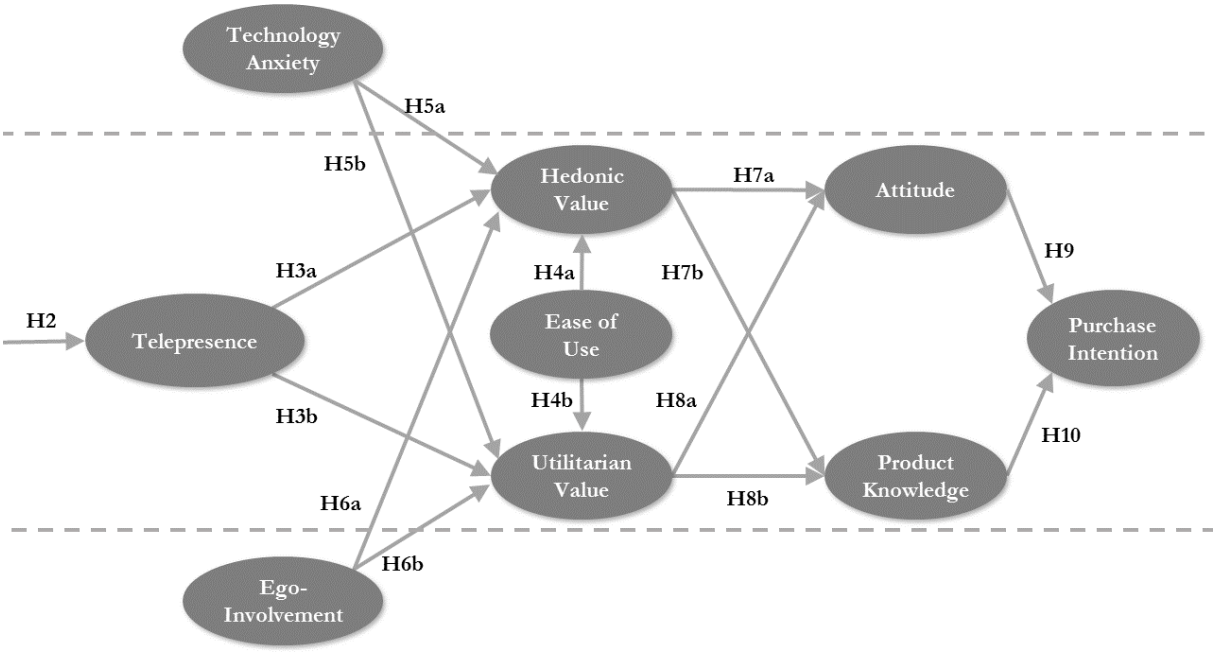


Figure 5. Theoretical model with proposed paths to purchase intention (own model)

The added variables, hedonic and utilitarian value as well as the ease of use, play an important role in the adoption of AR and the motivation to shop online and offline (Arnold & Reynolds, 2003; Babin et al., 1994; Davis et al., 1992). It can be assumed that these values provided by the virtual product experience are facilitating the purchase decision-making and will influence the purchase intention. Moreover, the ease of use of the AR application is assumed to impact the hedonic and utilitarian value perceived by the users (Heijden, 2000).

Furthermore, in Schwartz's (2011) study, the product knowledge about the apparel item, which was considered by her as a low-involvement product, influenced the purchase intention indirectly through the attitude. As buying furniture is a high involvement decision (Ponder, 2013), we assume that product knowledge will influence purchase intention directly. Moreover, the influence of attitude towards a product on purchase intention will be analysed.

In addition, the path to attitude and product knowledge will be tested to see if telepresence is mediated by the utilitarian and hedonic value of the virtual product experience or if there is a direct effect. As technology anxiety and ego involvement are assumed to have an influence on how people perceive, interact with and adopt the AR technology (Kang, 2014; Kim & Forsythe, 2008), we presume an influence of ego involvement and technology anxiety on the hedonic and utilitarian value that they derive from the technology. Moreover, the demographics will be controlled to minimize their effect on the technology-related variables. In Table 1, the constructs of the

theoretical model are described.

Table 1

Constructs of the theoretical model

Construct	**Conceptual Definition**	**Source**
Utilitarian Value	The degree to which an individual perceives a (AR) technology as enhancing his or her performance at tasks.	Davis, 1989
Perceived Ease of Use	The degree to which an individual perceives a (AR) technology as exhausting his or her cognitive resources.	Davis, 1989
Hedonic Value	The extent to which using a (AR) technology is perceived to be enjoyable for its own sake, without considering performance related outcomes.	Davis et al., 1992
Telepresence	The extent to which an individual experience presence in an environment by means of a communication medium (AR).	Steuer, 1992
Attitude towards the Product	The degree of favourable or unfavourable evaluation of a particular entity (augmented product).	Eagly & Chaiken, 1993
Product Knowledge	Perceived knowledge a consumer has for a product.	Bettman & Park, 1980
Purchase Intention	The intention to purchase the (augmented) product	Fiore et al., 2005a
Technology Anxiety	The fear or presentiment individuals feel when they use or consider using (AR) technology-related tools.	Cambre & Cook, 1985; Meuter, Ostrom, Bitner, & Roundtree, 2003; Scott & Rockwell, 1997
Ego Involvement	The extent to which individuals' self-concept is connected to a particular issue (furniture).	Lapinski & Rimal, 2005

In order to address the first research question, it is open to question whether AR is capable of increasing purchase intention stronger than a traditional, less interactive product presentation on websites. Schwartz (2011) already investigated the influence of AR for apparel shopping and could not prove a significantly higher purchase intention. However, virtual model technology in general is assumed to affect favourable outcomes like the willingness to purchase from the online retailer and more purchase intention positively (Fiore et al., 2005a; Li et al., 2002). Consequently, we

assume that AR as an enhanced product virtualization technology will affect the purchase intention more positively than a less interactive 2D website experience.

H1: Using an AR application leads to a higher purchase intention than a 2D website presentation.

The alignment of furniture using AR can be compared to physically moving furniture in one's place. In terms of AR, telepresence can be understood as a favourable outcome, which expresses both the quality of provided information and the system quality (Huang & Liao, 2015). Additional to the manual adjustment of size and position, an AR application is often capable to adjust the product size automatically to the real environment, and therefore provides an embedment close to reality. This high level of interactivity is hypothesized to be an antecedent of telepresence (Coyle & Thorson, 2001). Therefore, we assume that AR evokes a higher level of telepresence than 2D product presentations.

H2: Using an AR application leads to a higher level of telepresence than a 2D website presentation.

The possibility to have control over the stimulus in terms of choosing the augmented product, view it from all sides and in relation with the environment, is presumed to have a high utilitarian value. In addition, the visual attractiveness and authenticity of AR also provide utilitarian value and are crucial for customers in order to make rational purchase decisions (Huang & Liao, 2015). Moreover, the utilitarian value of an image interactive experience is assumed to engage users for high-involvement or less frequently purchased goods (Fiore, Jin, & Kim, 2005b). Hence, we hypothesize:

H3a: Telepresence positively affects utilitarian value.

Moreover, the visual attractiveness, novelty of the technology and the enhancement of pleasurable imagery involving the product can evoke playfulness, and is assumed to lead to increased hedonic value (Fiore et al., 2005a).

H3b: Telepresence positively affects hedonic value.

Previous studies provided empirical support for a positive relationship between perceived ease of use and both hedonic (Davis et al., 1992; Kim & Forsythe, 2008) and utilitarian value (Davis, 1989; Davis et al., 1992; Huang & Liao, 2015; Kim & Forsythe, 2008). Thus, the easier the AR application is to use, the more useful and enjoyable it will be perceived.

H4a: Perceived ease of use positively affects hedonic value.
H4b: Perceived ease of use positively affects utilitarian value.

The absence of technology anxiety has already been shown to facilitate the adoption of a new technology like AR (Kim & Forsythe, 2008; Laguna & Babcock, 1997; Meuter et al., 2003). Moreover, Kim and Forsythe (2010) found a negative effect of technology anxiety on the enjoyment and perceived usefulness of a product virtualization technology.

H5a: Technology anxiety negatively affects hedonic value.
H5b: Technology anxiety negatively affects utilitarian value.

Ego involvement is assumed to affect the way users perceive, interact with and whether they adopt new technology (Kang, 2014). Furthermore, Javornik (2017) examined augmented "magic mirrors" and found out that people derive different purposes and utilization from the same technology. Therefore, we assume that ego involvement is facilitating the hedonic and utilitarian value users assign to an AR application.

H6a: Ego involvement positively affects hedonic value.
H6b: Ego involvement positively affects utilitarian value.

Telepresence is assumed to influence attitude towards the retailer through the hedonic and utilitarian value of the interactive product experience (Fiore et al., 2005a). Moreover, it was found that telepresence has an influence on the attitude towards the product (Klein, 2003; Schwartz, 2011) and on the product knowledge a consumer reports (Fiore et al. 2005a; Li et al., 2002; Schwartz, 2011). Consequently, we assume that the effect of telepresence on attitude and product knowledge is mediated by the hedonic and utilitarian value of the virtual product experience.

H7a: Hedonic value positively affects the attitude towards the product.
H7b: Hedonic value positively affects product knowledge.
H8a: Utilitarian value positively affects the attitude towards the product.
H8b: Utilitarian value positively affects product knowledge.

According to the attitude-behaviour theory of Smith and Swinyard (1983), a direct product experience creates a significantly higher consistency of stated attitude and behaviour than an indirect experience. As we assume that AR is capable of creating telepresence (Schwartz, 2011), which can be considered as a direct product experience (Li et al., 2002; Schwartz, 2011), the stated attitude will be expected to be more consistent with the purchase intention. Thus, we can assume that a favourable attitude towards the product will also lead to a high purchase intention.

H9: Attitude positively affects purchase intention.

Kim and Lennon (2008) reported that the amount of verbal information on a website correlated with the purchase intention of the participants. Therefore, it can be assumed that the product knowledge gained through the interactive AR experience will increase the purchase intention. Thus, Hypothesis 9 is as follows:

H10: Product knowledge positively affects purchase intention.

3. Methodology & Data

The following chapter explains how the research on effects of augmented reality was conducted, and which methods were undertaken. The section starts with the positivistic theory as the philosophical foundation for the research. Then, the chosen methods of data collection and analysis of our experiment are discussed.

3.1 Research Philosophy

The research philosophy is a starting point when designing the research, since it underpins the authors' assumptions and the way the world is viewed (Malhotra & Birks, 2007). According to Saunders, Lewis and Thornhill (2007), the philosophy of research can undertake one of six philosophical approaches: positivism, realism, interpretivism, subjectivism, objectivism, or pragmatism.

The predominant perspective of developing new theory in marketing research has been positivism (Malhotra & Birks, 2007). The belief of a positivists is a view that the study of consumers and marketing phenomena should be in the manner of the natural sciences. Marketing researchers of this conviction adopt a framework for investigation alike to the natural scientist (Malhotra & Birks, 2007). According to Welman, Kruger and Mitchell (2005), research must be limited to what we can observe and measure objectively. This excludes the feelings and opinions of individuals. Hence, other people than the researcher should agree on what is being observed (Welman et al., 2005).

The positivistic approach has been used in our study, since it allows us to use existing theory, and on the top of it, to develop hypotheses. These hypotheses will have to be tested, and then confirmed or rejected (Saunders et al., 2007). The main purpose of a scientific approach to marketing research is to establish causalities that enable the prediction and explanation of the AR marketing phenomena (Malhotra & Birks, 2007).

3.2 Research Design

According to Malhotra and Birks (2007), a research design is a framework or blueprint for conducting a marketing research. Research designs can be classified as exploratory or conclusive. For the needs of our research, conclusive design is applied, and more specifically its causal - sometimes also termed explanatory - version (Malhotra & Birks, 2007; Saunders et al., 2007). As the name implies, the object of causal research is to study cause-and-effect relationships (Robson, 2005). The causal research is appropriate to determine the nature of the relationship between the causal variable (experiencing AR) and the consumer effect to be predicted (purchase intention), as well as to find out about other outcomes such as attitude and product knowledge. Moreover, it is a recommended research design to test hypotheses (Malhotra & Birks, 2007).

Regarding the time horizon, the design can be either cross-sectional or longitudinal (Saunders et al., 2007). Since our purpose does not require a longitudinal design and the research is time-constrained, the cross-sectional is a more suitable form. It involves the collection of data from a given sample of population only once (Saunders et al., 2007).

3.3 Research Approach

There are two main research approaches: deduction and induction. With deductive approach, a theory and hypotheses are developed, and then a research strategy is designed to test the hypotheses. Whereas with inductive approach, primary data are collected, and as a result of analysis the theory is developed (Saunders et al., 2007). Due to the fact that deduction is associated with a positivist perspective, and follows the process from the theoretical framework towards data, this approach is applicable to our study. This master thesis focuses on further developing of the theories found in the literature, and builds on it.

Another attribute of deduction is generalisation of facts (Malhotra & Birks, 2007). The results of this research showing regularities in consumer behaviour can be then statistically generalised for the specified population. In order to do so, it is necessary to select a sample of a sufficient number and identical characteristics (Saunders et al., 2007). The sample chosen for our purpose will be described in the section *3.4.3 Sample*. Finally, an important characteristic of deduction is that concepts need to be operationalised and the methodological process structured. This enables facts to be measured quantitatively (Gil & Johnson, 2002; Saunders et al., 2007).

The quantitative approach to collect primary data differs from the qualitative in a way that it seeks to quantify data and requires some type of statistical analysis. In contrast, the qualitative approach tends to be unstructured and typically adopting an exploratory design based on small samples. The qualitative research should provide deep insights about a researched topic (Malhotra & Birks, 2007). Our study is classified as a multi-method quantitative research, since we used a combination of quantitative techniques to collect data – a questionnaire for the experimental group and the same questionnaire online for the control group. The term multi-method refers to those fusions where more than one data collection technique is used with associated analysis methods (Tashakkori & Teddlie, 2003). Following the purpose of deepening the knowledge within this field of research, a questionnaire is argued to be an appropriate approach (Saunders et al., 2007). Furthermore, according to the study by Curwin and Slater (2007), the quantitative research provides more accurate results than qualitative, because it incorporates answers of a larger sample size.

3.4 Data Collection

The study takes usage of both primary and secondary data. This combined procedure to data collection establishes a foundation for research that is more reliable (Saunders et al., 2007).

The secondary data were used first during the research. These data were developed by previous research for its own purposes, and include raw data, as well as published summaries (Malhotra & Birks, 2007; Saunders et al., 2007). We used the secondary data beforehand to explore the previous relevant research to our topic of study, proceed a literature review and to build knowledge and especially the research model for our use case. The secondary data were mainly collected from the Google Scholar service and Jönköping University library's online database. These tools provided us with various scientific articles, journals and published books. Search keywords such as "augmented reality," "AR," "virtual reality," "interactive technology," "consumer perception," "purchase intention," "advertising," "marketing," and combinations of these terms were used to obtain literature sources.

Nevertheless, primary data had to be collected, since there is a lack of previously conducted research to answer our research questions (Ghauri & Grønhaug, 2005). It represents the original data collected by the researchers to obtain relevant information for the purpose of study (Saunders et al., 2007). The collected primary data gave us the access to information about factors that lead to the consumer's purchase intention. It enabled discoveries that would not be available through secondary data.

3.4.1 Experimental Setup

The main method of causal research is termed as experimentation (Winer, 1999), hence this research strategy has been chosen by the authors. Another reason behind the selection of this technique is to fulfil the purpose of our study, which discusses needs for this methodological approach. The objective of an experiment is to study causal linkages, whether a change in one independent variable produces a change in the dependent variable (Hakim, 2000). To investigate the causality between AR and purchase intention, two groups have to be established and participants assigned to them (Saunders et al., 2007). After the collection of data in both groups, the dependent variable (purchase intention) should be compared (Figure 6) for both groups in the post-test (Creswell, 2009; Kothari, 2004).

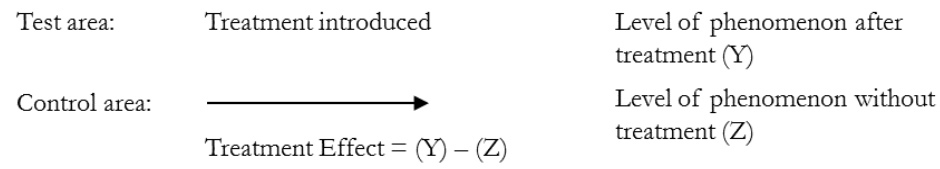


Figure 6. Post-test experimental setup (Kothari, 2004)

In our experimental group, the participants from Jönköping University were exposed to the treatment of the IKEA AR application in our laboratory setting. We have decided to choose the IKEA app because of its popularity, availability and relatively long-standing development. In 2013, IKEA, the Swedish furniture corporation, unveiled a digital extension of their printed catalogue, which is globally produced in more than 60 languages (Accenture, 2014). Using the augmented reality application, users can visualize several pieces of furniture inside their homes. Following, customers are able to see the products in real size and with true colours to aid them with making a purchase decision (Stinson, 2013).

The experimental procedure took place at the university in an arranged room to simulate participants' home (Figure 7). The participants were invited to take part one after another to reduce their reciprocal influencing. The IKEA application offers, besides browsing the current published catalogue and locating a nearby store, a function to place furniture in the customer's room. Using the camera, a smart device measures the room in comparison to the size of the paper catalogue, and then is able to visualize the furniture item in the actual size. Thus, the experimental group was asked to test out the AR experience on a tablet with products of their choice to get insights how the interactive technology works. Finally, they were advised to visualize and experience the preselected piece of furniture - a white armchair (Figure 8). Afterwards, these participants filled out the questionnaire that was asking about their shopping experience with the app.

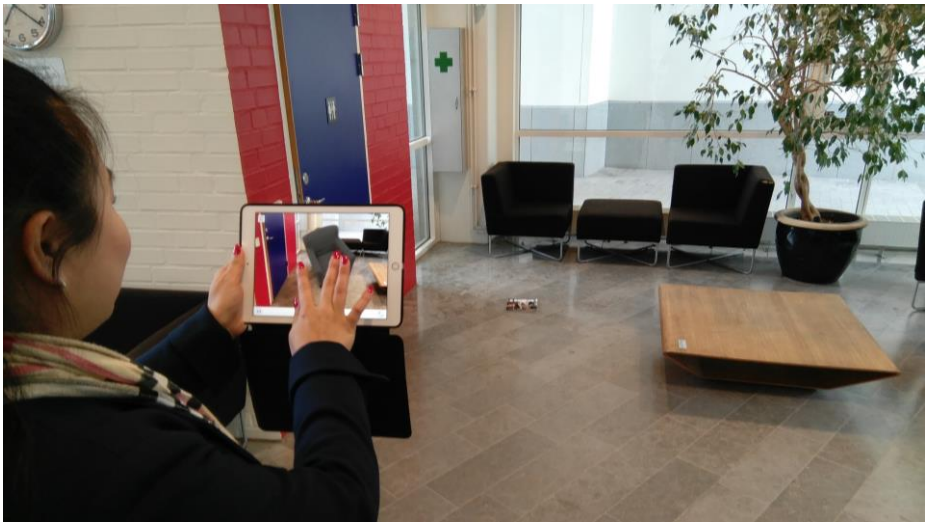


Figure 7. A participant of the AR experiment (own photography)

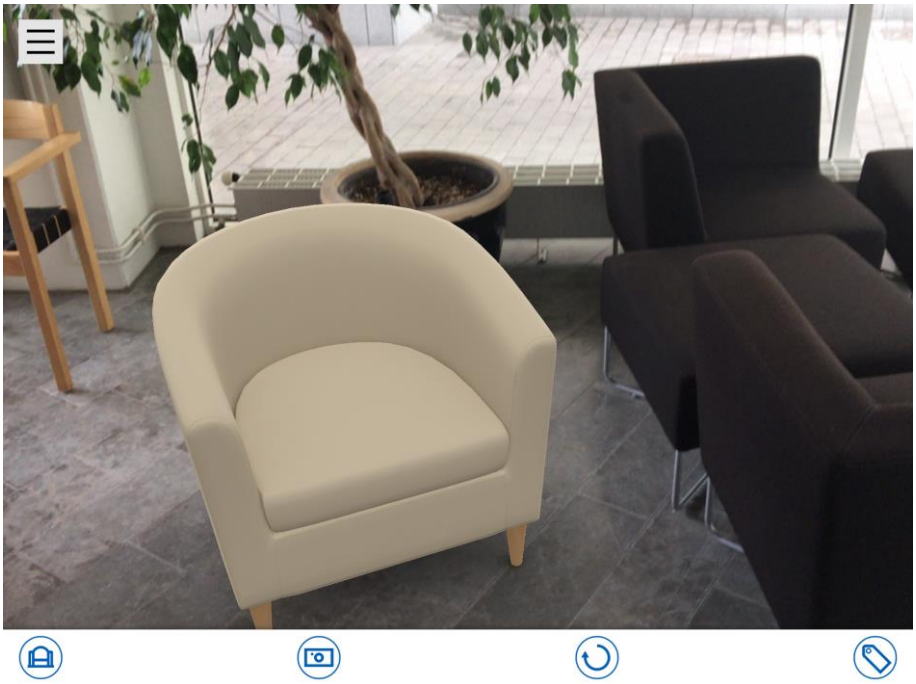


Figure 8. Screenshot of the IKEA app

On the other hand, the control group, which cannot get the intervention (Saunders et al., 2007), received only an online self-administered questionnaire. This questionnaire begins with the screenshot from the IKEA website showing the same white armchair and provides no interactivity. As found out by Bulearca and Tamarjan (2010), the usefulness of AR will be often seen by users in comparison with their existing shopping routine such as the furniture shopping. Since the majority of consumers prefer going online to gather all possible data before heading out to the store to make a significant purchase (Rothstein Tauber, 2013). Therefore, we have decided to investigate whether the AR applications can substitute customers' online purchase process.

Malhotra and Birks (2007) stress out the importance of elimination of other possible factors in experiments. The absence of other potential causal factors means that only investigated variable should cause the effect. Thus, other purchase intention factors such as price, product quality, brand (Li, Zhang, & Zhao, 2016) were controlled by using the same IKEA product in both groups. In addition, to ensure the equal conditions in each group, price of the product was also removed from the screenshot shown to the control group using a graphics software, as there is no visible price during the IKEA AR experience for the experimental group.

To limit the diffusion of treatment, which could be a threat to internal validity (Creswell, 2009), the two groups were kept as separate as possible. The participants from the experimental group were all students from Jönköping University because of convenience reasons, whereas members of the control group were approached by social media, and in most of the cases living outside Sweden. Further, to lower possibility of dropouts of participants that can occur during the experiment (Creswell, 2009), we tried to establish a friendly atmosphere in the laboratory environment by providing drinks and snacks.

3.4.2 Questionnaire Design

With regards to the purpose and quantitative approach, a standardized questionnaire was selected as a suitable way to collect primary data. An online tool called SurveyMonkey was used to administer the questionnaire, because of its simplicity for the respondents and accurate transfer of data into SPSS, a statistical software used for the analysis.

The questionnaire used in both experimental and control group was based on itemised rating scales (Malhotra & Birks, 2007). These types of questions are presumed to be appropriate when investigating preferences and attitudes (Saunders et al., 2007). More specifically, we predominantly used 7-point Likert scale questions ranging from *Strongly disagree* to *Strongly agree* statements. Keeping the same order of response categories is recommended when creating a series of statements to avoid confusing respondents (Dillman, 2000). The only exceptions were the questions asking about perceived product knowledge which adopted the original scale from Schwartz (2011) with the extremes from *None* to *A Ton*; and about purchase intention that used the likability scale from Papagiannidis et al. (2014) ranging from *Not at all likely* to *Very likely*. Nevertheless, for most of the constructs, both positive and negative items were included to ensure that the respondents read and tick each one carefully (Saunders et al., 2007). The wording of questions was in English due to its internationality and adapted for each group to reflect the scenario whether it asks about the AR experience or the online shopping experience with a website. However, the meaning of questions was preserved. Each question had to be carefully designed, the layout of questionnaire form clearly

designed, and the purpose of the questionnaire lucidly explained; in order to maximise response rate, validity and reliability (Saunders et al., 2007).

The measured constructs, accompanied with the explanations and original sources, are presented in the following. In addition, the original questionnaires in the AR version (experimental group) and in the website-related version (control group) can be both found in Appendix A and Appendix B.

The initial question dealt with the attitude towards the IKEA product. In the case of the control group, as already mentioned, a screenshot with the identical chair as the one from the application was placed above the first question (Figure 9). The construct's four items were adapted from Schwartz's (2011) study, and as well as following, were using 7-point Likert scale.

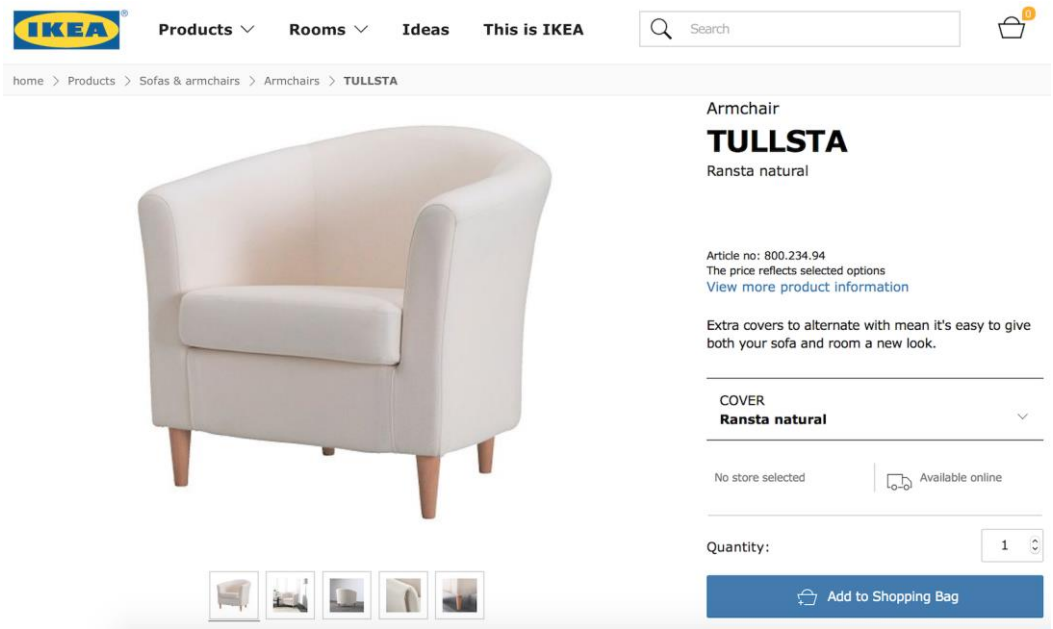


Figure 9. Edited screenshot simulating the IKEA website with the preselected product

The following questions investigated the respondent's utilitarian and hedonic values, as well as perceived ease of use. The constructs were based upon the original TAM model by Davis (1989), but the items were inspired by questions used by Childers et al. (2001) who measured the constructs in the context of online shopping. For ego involvement, the four items were adapted from Park, Jung and Lee (2011) who adapted the ego-related construct from the self-identity scale of Conner, Warren, Close and Sparks (1999). Telepresence was measured with a five-item scale from Fiore et al. (2005a), as they also used it in an online shopping context. Moreover, the items were narrowed down from the original 9-point Likert scale to a 7-point scale to keep the integrity with other questions. The technology anxiety measurement consisted of nine items which were taken over from Meuter et al. (2003). The purchase intention of participants was furthermore measured with

four items adapted from Papagiannidis' et al. (2014) study about virtual test drive in gaming environments. The respondents firstly expressed their opinions on the 5-point likability scale and then rate their agreement with three statements. Finally, product knowledge was the last tested construct. Based on Schwartz's (2011) approach, we proceeded with an online pre-testing questionnaire to find out product attributes besides price and brand that are relevant for customers when buying an armchair. Thirty-one respondents that belonged to neither the experimental group nor the control group, but were part of the same population, had chosen the most important factors that were initially preselected from a survey about furniture purchasing (Furniture World, 2004). Following, the identified product attributes were implemented in the questionnaire for experimental and control group to measure the subjective product knowledge. Hence, the participants were asked to express the amount of information they thought to possess about the chair regarding the overall assessment, comfort, quality, style, functionality and size.

In the end, the questionnaire consisted of a series of demographic questions determining gender, age, nationality and education level. These attributes were added to ensure that the respondents hold the sampling criteria and to control possible effects on the model constructs.

3.4.3 Sample

Before collecting the primary data, it was necessary to select suitable participants. In order to do so, a target population had to be specified. A population consists of all people that share a common set of attributes (Malhotra & Birks, 2007). For our purposes, the homogenous population of young people belonging to Generation Y (around 18-34 years), who are mostly targeted by AR applications (Metafacts, 2016; Owyang, 2010), has been chosen. Generation Y is considered an important group from brands' point of view, because it is sizeable and has a significant purchasing power (Parment, 2013). Members of this generation are often so-called digital natives, and 71% of them own a smart device such as a smartphone or tablet (Rowinski, 2012) Moreover, according to Barkley (2011), the majority of this generation belongs to early adopters, and therefore is more likely to adopt augmented reality.

Since involving the entire population requires a great deal of time, money and energy (Kothari, 2004), the sampling technique was used. A sample is a portion of the population to gather data from and to represent the whole population (Saunders et al., 2007).

There are two kinds of sampling techniques that can be applied to a population: probability and non-probability sampling (Saunders et al., 2007). Our research is of a conclusive nature, thus a probability sampling would have been the most favourable option as it allows the researchers to

make statistical assumptions about the entire target population. However, this option could not be applicable since it requires the possession of a sampling frame over the whole population, which we were not able to obtain (Malhotra & Birks, 2007). Therefore, we chose the second possible method, the non-probability sampling, which is also known as a deliberate sampling. This type of sampling relies on the personal judgment of the researcher rather than on chance (Kothari, 2004; Saunders et al., 2007). To execute non-probability sampling, the convenience method was applied, which is often used at universities, as it is the least expensive and least time consuming (Aczel & Sounderpandian, 2006). The convenience sampling enabled us to obtain a sample of convenient elements (participants) that belong to the desired population (Malhotra & Birks, 2007). Since this technique is not the most optimal one for experiments (Kothari, 2004), we tried to increase the generalizability by the attempt to control the groups for age, gender and nationality of participants.

The sample size should be large enough, as we aim to analyse quantitative data using statistical methods. Malhotra and Birks (2007) mention that the sample size used in similar researches can be considered as a suitable starting point to estimate the number of participants. We found out that the sample size in the similar studies was ranging from 71 to 184 (Iancu, 2016; Papagiannidis et al., 2014; Schwartz, 2011; Yaoyuneyong et al., 2016). Our research consisted of 177 participants - 59 for the experimental group and remaining 118 for the control group.

3.4.4 Pilot Study

To identify and eliminate errors and misleading wordings in the questionnaire when distributed to the research groups (Malhotra & Birks, 2007), the pilot-testing preceded the actual experiment. A smaller test group of 10 respondents, who were drawn from the same target population, received the AR treatment and filled out a preliminary questionnaire. These participants could not be invited to the subsequent experiment because of a possible learning curve (Malhotra & Birks, 2007).

Besides correcting a few misspellings in the questionnaire, the pilot study showed that the participants did not like the originally used product, and that personal taste about furniture might represent an issue when examining the attitudes. The participants were significantly biased by the actual appearance of the product and expressed their negative attitudes based on that. Thus, we have decided to follow the advice of the test group, as well as Schwartz (2011) suggestion about examining the effect of AR for a liked product, and changed the armchair to be more appealing for more people.

3.5 Overview of Methodology and Data

For a better understanding of all our steps regarding methodology and data collection, we have

created a simplified scheme (Figure 10).

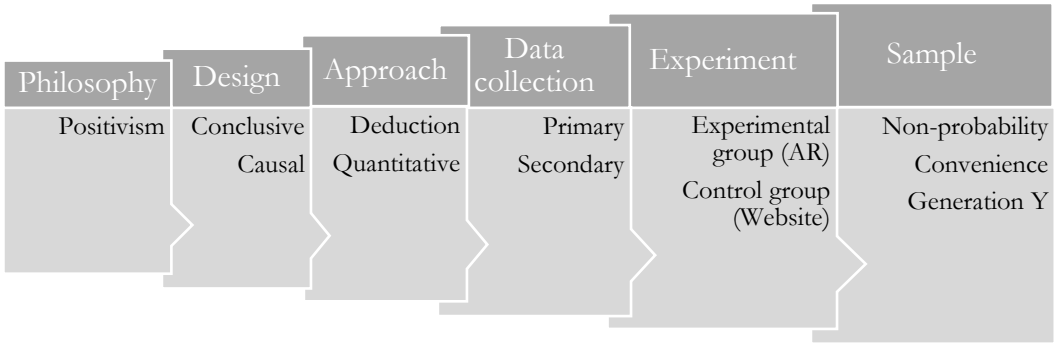


Figure 10. Overview of methodology and data collection techniques

3.6 Data Analysis

To analyse the quantitative data collected from the experiment, we used the statistical software IBM SPSS. Before the actual analysis could have been done, the data was transferred from SurveyMonkey tool into Excel to convert the participants' answers into numerical data and rename each question into the variable it measured. Following, the data was imported to SPSS and checked for outliers and missing values to ensure that it was transferred correctly between each step. Due to a software error at the beginning of the data collection, three participants of the experimental group and 35 of the control group did not see the questions regarding the ease of use. As the data was missing completely at random (MCAR), the cases were excluded pairwise for the following tests, thus only when the missing data required for the specific analysis (Pallant, 2005).

First, the descriptive, frequency and exploratory tools were used to gain insights in the general characteristics of the sample. Since the experimental group was already chosen based on the right age, the age distribution of the control group was examined to ensure that all respondents belong to Generation Y. Moreover, the distribution of both genders was looked at. Even though the used scales were based on previous research, the small changes in wording led us to the examination of the reliability of scales with factor analysis (FA). Followingly, the principal component analysis (PCA) was used, which is not the same as FA, but often leads to the same results (Jolliffe, 2002). The PCA is more frequently applied in research (Velicer & Jackson, 1990), to see whether the items were a good manifestation of the constructs, and thus should be included in the summated scale. First, the Kaiser-Mayer-Olkin (KMO) criterion was determined and the Bartlett's test for sphericity was done to ensure the appropriateness of the test (Appendix C). The KMO measure of sampling adequacy was .833, which is above the minimum value of .6 for a good factor analysis (Tabachnick

& Fidell, 2001). Furthermore, the Bartlett's test of sphericity was statistically significant and indicated that the correlation matrix was not an identity matrix (Pallant, 2005). To ease the interpretation, all factor loadings that explained less than .4 of the variance of the constructs were suppressed (Ahmed & Salas, 2008), resulting in just few cross loadings. For the components, in fact the underlying constructs, all items that had loadings above .45 (Hair, Tatham, Anderson, & Black, 1998), and furthermore had no higher cross loadings on other components, were considered. For all constructs apart from ease of use and telepresence, all initially assumed items loaded on the overall construct and lead to the inclusion in the corresponding summated scales (Appendix C). However, the first item of telepresence and the fourth of ease of use were excluded. Also, the reliability of scales was assessed with Cronbach's alpha. The examined internal consistency of the scale indicates whether all items are measuring the same underlying attribute and refers to the degree items "hang together" (Pallant, 2005). Furthermore, alpha values above .7 indicate a reliable scale (Nunnally, 1978). For all of the used scales, the Cronbach's alpha was between .744 and .923 and therefore sufficient (Table 2). Following, the items that were determined by the PCA and proven to be reliable were bundled into a scaled mean measure and labelled according to their construct.

Table 2

Reliability of scales

	Purchase Intention	Attitude	Utilitarian Value	Hedonic Value	Telepresence	Ease of Use	Technology Anxiety	Ego Involvement
Cronbach's alpha	.756	.885	.875	.923	.852	.826	.877	.744
N	4	4	4	8	4	3	9	4

In order to examine whether both groups differ significantly, the variables of each group were tested on normality distribution and equal variances (homoscedasticity) with the Kolmogorov-Smirnov and Levene's test (Appendix D). As most scale values were not normally distributed and hedonic value and telepresence had unequal variances in both groups, the independent t-test was chosen, as it is robust in terms of the distribution assumption when the sample size is over 30 and furthermore provides an alternative output when the homogeneity of variances is violated (Pallant, 2005). Furthermore, besides finding out whether the group differences are significant, the effect strength, eta squared, was calculated and gives an indication of how big the difference between the experimental and control group is. The calculation is presented in Figure 11.

$$\text{Eta squared} = \frac{t^2}{t^2 + (N1 + N2 - 2)}$$

Figure 11. Eta squared calculation (Pallant, 2005)

According to Cohen (1988), the eta squared can be interpreted as an effect size, whereas .01 is a small, .06 a medium and .14 a large effect between variables.

Also, the correlations between the variables were looked at to gain first insights in the relationships of the variables. As the most variables did not have normally distributed scores, the correlations were assessed with the non-parametric Spearman's rank order correlation instead of the Pearson product-moment test (Pallant, 2005). The correlation between variables indicates both the direction and the strength of the relationship (Pallant, 2005). In addition, the variables were checked for multicollinearity, thus correlations above .9 that are significant ($p<.05$), as multicollinearity between predictors can influence the outcome of a multiple regression (Franke, 2010; Pallant, 2005).

The relationship of variables in the introduced model was tested with several multiple linear regressions using the ordinary least square (OLS) method and a simple linear regression for the path to telepresence. Also, the variables were checked for multicollinearity with the help of the correlation matrix, and the "tolerance" and "VIF" indicator in the regression output. Pallant (2005) further describes tolerance values of less than .10, and VIF values of above 10 as indicator for multicollinearity. Conducting several multiple linear regressions, and working from the left to the right in the model, enabled us to understand the interrelationships of variables, evaluate the importance of each variable in the model and provided insights into the way the purchase intention is shaped. Thus, answering the major share of hypotheses. As the OLS regression is vulnerable to low sample sizes, Stevens (1996) recommends about 15 participants per predictor to reach a reliable equation. Thus, with four variables maximum as predictors in the individual regressions, the samples size of the experimental group can be considered as sufficient. Also, the multiple regression is sensitive to outliers (Pallant, 2005). Besides the initial data screening process, which showed that all scores were lying in the determined scale borders, the standardised residual plot was assessed. Moreover, in order to check normality, linearity and homoscedasticity of the residuals for each regression equation, the residual scatter plot was used. Residuals are the difference between the obtained and the predicted score of the dependent variable (Pallant, 2005). For the linear regressions, the standardized coefficient β is reported in the findings of this thesis. With β, the values for each variables are converted to the same scale and thus allow us to compare the contribution of each independent variable (Pallant, 2005). Furthermore, the standardized coefficient indicates how many standard deviations the dependent variable would change if there

was one standard deviation unit change in the independent variable (Pallant, 2005). As for small sample sizes R square tends to be an overestimation of the true population value (Tabachnick & Fidell, 2001), the Adjusted R square is reported. Furthermore, R square can be interpreted as how many per cent of variance in the dependent variable are explained by the model (Pallant, 2005). For the relationship among hedonic value, product knowledge and purchase intention, a mediation analysis following the four-step approach by Baron and Kenny (1986) was also conducted. The statistical significance of this mediation effect was further examined with the Sobel test (Preacher, n.d.). Moreover, the SPSS macro by Hayes (n.d.) called PROCESS was used to confirm the indirect effect with the bootstrapping method including 5000 resamples, as it is more reliable than the Sobel test for a small sample size (Fritz & MacKinnon, 2007).

3.7 Ethics

In addition to designing the research, authors need to anticipate the ethical issues that may arise (Hesse-Biber & Leavy, 2006). Since the research involved collecting data from people about people; it was necessary to develop trust with participants, protect their personal privacy, and promote the integrity of research (Israel & Hay, 2006). Therefore, each participant of the experimental group was given a consent form to sign, informing about the purpose of study and use of collected data, as well as guaranteeing their anonymity. The same information was also provided to the control group in the online questionnaire. However, if we would have revealed the participants the purpose of the experiment prior the actual procedure, it could have affected the results (Israel & Hay, 2006). Hence, we decided that the participants were given this background information and consent form after they filled out the questionnaire.

3.8 Limitation of Method

The chosen method of research can possess several limitations. One such constraint might be an impossibility to generalize the findings of our research. Generalizability refers to the external validity of the conducted research, which means if results can be transferrable to other settings (Saunders et al., 2007). A threat to external validity might be the interaction within the experimental setting and treatment procedure (Saunders et al., 2007). One can argue whether the outcome would have been same if the participants of the experimental group were asked in their homes where they would more likely use the IKEA application. According to Kothari's (2004) principle of replication, the experiment should be repeated in the future within another setting to increase the accuracy with which the effects and interactions can be estimated. The selection of the only one particular application could be also seen as a limitation of our experimental method.

Furthermore, the selected non-probability sampling technique can be seen as a limitation to

generalizability (Malhotra & Birks, 2007; Saunders et al., 2007). If we were endowed with greater resources, the probability sampling would be a preferable technique. Moreover, due to the convenience character of the study where individuals were not randomly assigned to groups, the procedure cannot meet a true experiment requirements to a full extent (Creswell, 2009). Finally, with regards to the questionnaire design, Cook and Campbell (1979) argue for a randomized presentation of question items to minimize common method bias, which could be seen as a limitation of our data collection.

4. Findings & Analysis

The following chapter presents the demographics of the sample, as well as differences of both experimental (AR) and control (website) group followed by path analyses in order to test the hypotheses. Finally, a revised model is presented which fits the data better.

4.1 Sample Characteristics

Our research consisted in total of 177 participants. Fifty-nine of them took part in the experimental laboratory setting at Jönköping University and the remaining 118 filled out the online questionnaire for control purposes. The age of the respondents in the experimental group ranged from 18 to 30 with a mean of 23.56 years and a standard deviation of 2.54. Further, the range of ages in the control group was from 18 to 33 years, with a mean of 24.72 and standard deviation of 2.55. As Figure 12 from descriptive statistics presents, men and women were almost equally distributed in the AR test, on the other hand, the control group consisted of 59.3% female and 40.7% male participants.

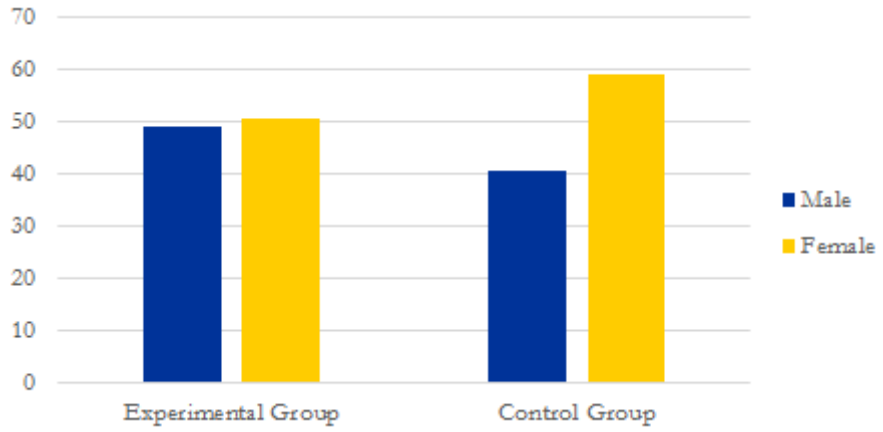


Figure 12. Gender distribution across groups

Furthermore, it has to be noted that the majority of participants in the experimental group came from Germany and Sweden, while the control group was mostly consisting of respondents with Czech and German origin as Figure 13 shows.

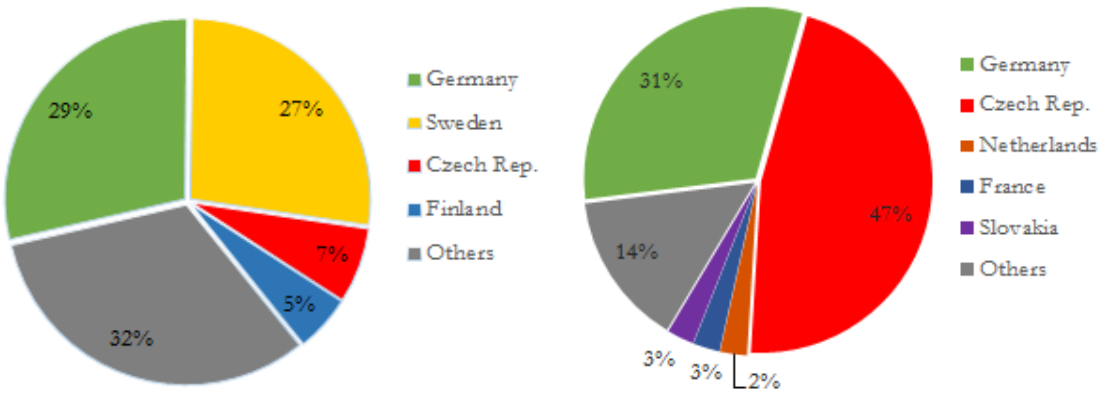


Figure 13. Nationalities represented in the experimental group (left) and the control group (right)

Moreover, in both groups identically 64.4 per cents of the participants, and thus the majority, had a Bachelor's degree at the time of our data collection (Figure 14).

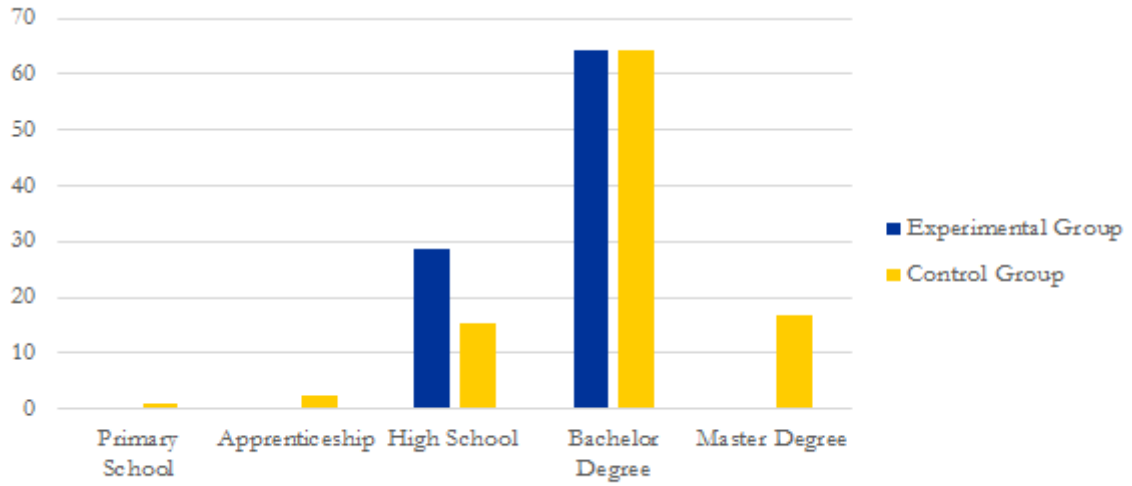


Figure 14. Educational degree of participants of both groups

4.2 Univariate Analysis

An overview of descriptive statistics and results of the independent sample t-test, which determines the statistically significance of differences between both groups, is presented and analysed here. As the summated scales are the means of all items that make up the scale, the values can be interpreted similarly with 1 (strongly disagree), 4 as centre point (neither agree nor disagree), to 7 (strongly agree).

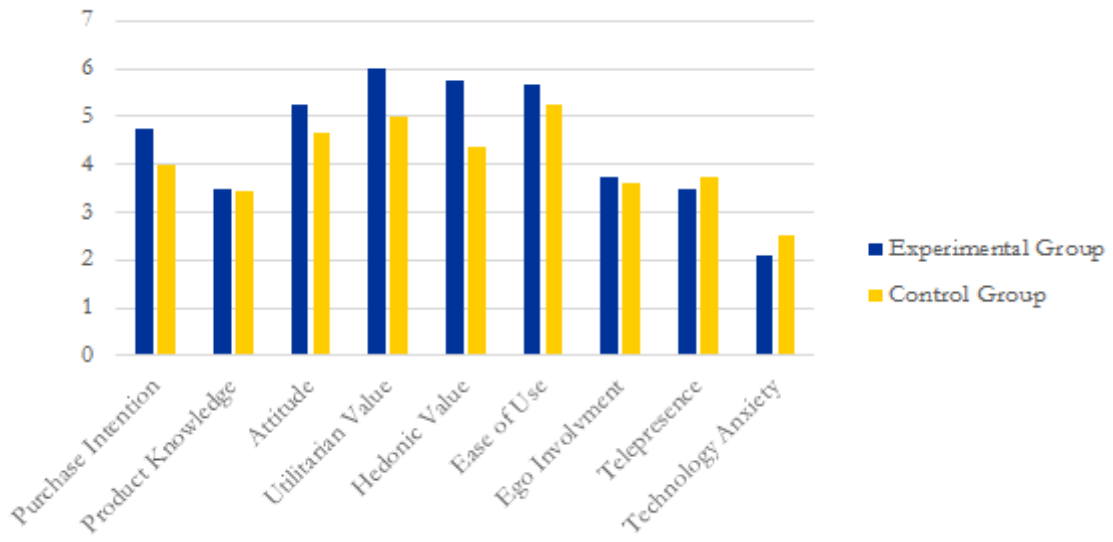


Figure 15. Mean scores of the scales for both groups

It is apparent that the experimental group scored higher on several dimensions, but lower for telepresence and technology anxiety (Figure 15, Table 3). The difference in telepresence was insignificant (Table 3) and unexpected, as Schwartz (2011) and Fiore et al. (2005a) found a positive effect of increased interactivity that AR provides on telepresence. As the alignment of the virtual furniture in the experiment was often incorrect and needed many retries, it could be possible that users felt less control over the experience. Furthermore, the virtual furniture lacked the graphical vividness of the real product. Besides the interactivity the AR experience offers, both user control and the graphic and colour vividness are assumed to have an effect on the telepresence created, and thus could explain why no significantly higher level of telepresence was found (Coyle & Thorson, 2001; Klein, 2003; Papagiannidis et al., 2014). Unlike Schwartz (2011) and Fiore et al. (2005a) who projected the virtual interactive content on TV or via data projector, our research adopted a tablet for the experiment. Thus, the different results could be also explained by Lombard's (2000) theory in which he reported a diverging sense of telepresence when using different screen sizes. Moreover, the participants' trust regarding the accuracy of the size and colour of the product provided by AR can influence telepresence (Kim & Forsythe, 2008).

Table 3

Descriptive statistics and independent t-test

	Experimental Group		Control Group		t-test			Effect Size
	Mean	Std. Dev.	Mean	Std. Dev.	Sig. (2-tailed)	t	df	eta squared
Purchase Intention	4.71	1.01	4.00	.91	.000*	4.68	175	.11
Product Knowledge	3.32	.73	3.44	.73	.301	-1.034	175	
Attitude	4.95	1.14	4.64	1.35	.136	1.50	175	
Utilitarian Value	5.82	1.17	4.99	1.10	.000*	4.60	175	.11
Ease of Use	5.40	1.12	5.25	1.03	.243	.85	137	
Hedonic Value	5.64	.72	4.37	1.09	.000*	9.24	160.94	.33
Telepresence	3.59	1.24	3.75	1.48	.480	-.71	175	
Technology Anxiety	2.25	.78	2.51	.96	.062	-1.77	175	
Ego Involvement	3.77	1.18	3.63	1.31	.265	.70	175	

*significant at the .01 level (2-tailed)

The low technology anxiety of the experimental and control group were expected, as participants belong to Generation Y. Several researchers have already shown that technology anxiety is lower for young users, which is furthermore facilitating the adoption of a new technology like AR (Kim & Forsythe, 2008; Laguna & Babcock, 1997; Meuter et al., 2003). Ego involvement, and thus the participants' self-concept, was generally not strongly connected to furniture shopping in both experimental and control group. Moreover, the means of both groups in terms of technology anxiety and ego involvement did not differ significantly (Table 3). In terms of product knowledge, both groups showed similar levels without significant higher values for the experimental group (Table 3). On the first sight, this might be surprising, because other researchers found a positive effect of interactive technology on product knowledge (Li et al., 2002; Schwartz, 2011). But, the product knowledge scale consisted of several items that covered different product attributes. The experimental group scored higher for assessing the "style" and "size" of the chair, as well as for confidence they had if they would make a purchase decision (Appendix E). Of these attributes, the perceived information about the "size" [M=4.02, SD=.94; f(123.52)=4.10 p=.000] was significantly higher. On the other hand, the control group scored significantly higher for "comfort" [M=2.36, SD=.97; f(175)=-3.86, p=.000], "design features" [M=3.66, SD=.78; f(94.25)=-2.061, p=.042] and "quality" [M=2.61, SD=.94; f(175)=-5.10 p=.000] of the chair (Appendix E), which can be

attributed to the graphical vividness of a high-resolution product picture that allows the participants to draw conclusions regarding the mentioned product characteristics. Consequently, the AR experience did not lead to a higher overall product knowledge, as it is assumed to lack information that a product picture offers. Also, the higher utilitarian value of the experimental group indicates that the interactive technology offers information, for instance in terms of "size" of the product, that is relevant to and can enhance the shopping process of users in a way traditional online shopping cannot.

Both groups had a positive attitude towards the shown product. Although the experimental group had a higher score of attitude than the control group, the difference was not statistically significant (Table 3). Schwartz (2011) found a significant effect of AR on attitude that is not supported by our study. This could have several reasons. On the one hand, the similar telepresence levels are an indicator that participants were not completely immersed in the AR environment, hence did not have a virtual product experience similar to a direct product experience, which is assumed to shape attitude and purchase intention (Li et al., 2002). On the other hand, this could be an indicator that both AR and e-commerce website have similar capabilities of shaping attitudes. Furthermore, the armchair was relatively neutral in terms of colour and design and maybe already familiar to participants who are customers of IKEA, thus not suitable for evoking stronger attitude differences. Also, demonstrating the AR functionalities beforehand with other furniture items could have mitigated the effect on the attitude towards the product of experimental interest.

Furthermore, participants perceived both the website and the AR application as easy to use. Even though the experimental group experienced a fairly new technology, no significant difference in the ease of use scores was found between the groups (Table 3). It can be assumed that Generation Y, which was a target population of our research, is already prepared to adopt the AR technology, and does not perceive it to be more difficult to use than a website. A broad explanation might be that the majority of this particular generation tends to adopt a new technology quicker than others (Rowinski, 2012). Additionally, members of this generation are the most numerous demographic population on the social network Snapchat that already uses AR (Newberry, 2016) or already interacted with a phenomenon called Pokémon GO (Parkin, 2016; Seitz, 2016).

This thesis found statistically significantly higher purchase intention as well as higher hedonic and utilitarian value for the experimental group compared to respondents who saw the product only on the IKEA website (Table 3). These results suggest that the augmented product experience is perceived as more enjoyable (hedonic) and useful (utilitarian) than the traditional website experience. The effect of AR on purchase intention and utilitarian value can be further described

as moderate to large, while the effect on hedonic value was very large (Cohen, 1988). Interestingly, although the levels of telepresence were not significantly different and even higher for the control group, the purchase intention was statistically significant higher in the experimental group (Table 3). Consequently, the evocation of a high level of telepresence, which is assumed by Schwartz (2011) to be the main factor of AR in influencing purchase intention, seems to play a lesser role in shaping purchase intentions. This supports Papagiannidis et al. (2014) study about the virtual product experience in a computer game environment, in which they found out that increased purchase intention towards a real product may occur not through the authenticity of the product (telepresence), but via the hedonic, engaging experience itself. Since AR is still mainly perceived as entertainment (Hirsen, 2015), it has several similarities with 3D computer games. Furthermore, Mollen and Wilson (2010) add that telepresence leads to engagement, which consists of hedonic and utilitarian values, and finally induces purchase intention. It can be derived that the evoked telepresence via the AR application was high enough to evoke engagement and thus higher purchase intention. On the other hand, there could be no direct association between telepresence and purchase intention as suggested by Suh and Chang (2006).

As the control group comprised of 59.3% females and 40.7% males, the differences between both groups might be affected by the gender distribution. Therefore, two independent t-test were conducted to validate the group differences for each gender separately (Appendix F). For both genders, the differences between experimental and control group in purchase intention, hedonic and utilitarian value were statistically significant, and furthermore had a similar effect size (eta squared). Hence, this indicates that the effect of AR on purchase intention, hedonic and utilitarian value is not gender-specific.

Finally, the significantly higher purchase intention in the experimental group leads us to the **acceptance** of **Hypothesis 1**.

H1: Using an AR application leads to a higher purchase intention than a 2D website presentation.

To gain further insights in the differences of the genders for each group, an additional independent t-test was separately conducted for each group to compare the scores for male and females (Appendix G). For the experimental group, a significant difference in the level of telepresence for males (M=3.91, SD=1.25) and females [M=3.28, SD=1.16; f(57)=2.03, p=.047] was found. The magnitude of the differences in the means was small (eta squared=.067). Already conducted research related to telepresence suggests that females may be more likely to adopt and use 2D technology while males prefer 3D telepresence technology (Maurin, Sonnenwald, Cairns, Manning, Freid, & Fuchs, 2006). Furthermore, according to Lee and Chung (2014), females perceive 3D

objects differently than males within a computer game environment, which could be also the case for AR experiences.

For the control group, a significant difference for ease of use [f(41.79)=-2.78, p=.008], hedonic value [f(116)=-2.41, p=.019] and technology anxiety [f(113.67)=-4.97, p=.00] was found. In this group, females (M=4.57, SD=1.05) perceived significantly more enjoyment (hedonic value) than males (M=4.09, SD=1.09). According to research, women are assumed to have more hedonic shopping expectations whereas men put more emphasis on rational purchasing decisions (Dennis, Morgan, Wright, & Jayawardhena, 2010; Dittmar, Long, & Meek, 2004). Also, females (M=5.50, SD=.78) considered the website as more easy to use than males (M=4.80, SD=1.26) even though the technology anxiety of females (M=2.83, SD=.96) was higher than of their male counterparts (M=2.04, SD=.753). The higher anxiety of females towards technology is further in line with previous studies of Reidsma (2013) and Schumacher and Morahan-Martin (2001). Moreover, the difference in ease of use could be attributed to prior experiences with the IKEA website or the more regular online shopping of women (Burke, 2002).

4.3 Multivariate Analysis

4.3.1 Correlations

In order to examine how AR affects the purchase intention of the participants, several multiple regressions were conducted. But before that, the correlations were determined to explore the direction and strength of the relationships between the variables, and to find possible multicollinearity. The correlation matrix for the experimental (Table 4) and control group (Appendix H) does not raise concern that variables are multicollinear (r>.9). Furthermore, for the experimental group, there was a strong, positive and statistically significant monotonic relationship between purchase intention and product knowledge, as well as between purchase intention and hedonic and utilitarian value (Table 4). Consequently, if one of these variables increases, also purchase intention does. Also, the large correlation between product knowledge and telepresence suggests a strong, positive monotonic relationship between both variables (Cohen, 1988). As higher levels of telepresence describe a virtual product experience which is closer to a direct product experience, the effect is in line with Li et al. (2002), who showed that virtual product experiences are capable of conveying product knowledge up to a similar level as direct product experiences.

It has to be mentioned that no statistically significant correlation of ego involvement and technology anxiety with any other variables was found. As both constructs are characteristics of the participants and not depending on the experimental stimulus, the comparably low coefficients are not surprising.

Table 4

Correlation matrix for the experimental group (Spearman's rank order correlation)

Experimental Group	1	2	3	4	5	6	7	8	9
(1) Purchase Intention (PI)	1								
(2) Product Knowledge (PK)	.725**	1							
(3) Attitude (Att)	.378**	.312*	1						
(4) Utilitarian Value (UV)	.706**	.441**	.361**	1					
(5) Ease of Use (EOU)	.379**	.322*	.247	.288*	1				
(6) Hedonic Value (HV)	.630**	.440**	.392**	.552**	.497**	1			
(7) Ego Involvement (Ego)	.029	-.089	.177	.032	.051	.213	1		
(8) Telepresence (TP)	.587**	.622**	.301*	.417**	.384**	.430**	.031	1	
(9) Technology Anxiety (TA)	-.054	-.12	.033	.033	.025	-.16	-.08	.095	1

** Correlation is significant at the .01 level (2-tailed).
* Correlation is significant at the .05 level (2-tailed).

4.3.2 Linear Regressions: Path Testing

The linear regressions were done in six steps to test the paths of the model and the hypotheses (Table 5). All results of the multiple regressions were statistically significant ($p<.05$), but not the simple linear regression that described the path to telepresence. Following, experiencing the AR application or the website is not a statistically significant predictor of telepresence. As mentioned in the univariate analysis, the evocation of telepresence in the experimental group was assumed to be disturbed by technical bugs of the application and the graphical inferiority in comparison to a picture of real product. Moreover, several researchers have shown that interactivity, user control, graphic and colour vividness are able to arouse telepresence (Coyle & Thorson, 2001; Klein, 2003; Papagiannidis et al., 2014). As no statistically significant higher level of telepresence could be observed for the experimental group, and the simple regression did not show AR having a positive effect on telepresence, **H2** has to be **rejected**.

H2: Using an AR application leads to a higher level telepresence than a 2D website presentation.

Table 5

Linear regression results

Hypotheses	Path	Coefficient*	Sig.	Adj. R^2
H2	IIT -> TP**	.053	n.s. (p=.480)	-.003
H3a	TP -> HV	.316	.016	.296
H4a	EOU -> HV	.314	.017	
H5a	TA -> HV	-.231	.049	
H6a	Ego -> HV	.128	n.s. (p=.268)	
H3b	TP -> UV	.443	.001	.242
H4b	EOU -> UV	.18	n.s. (p=.178)	
H5b	TA -> UV	-.076	n.s. (p=.526)	
H6b	Ego -> UV	-.002	n.s. (p=.99)	
H7a	HV-> Att	.183	n.s. (p=.263)	.174
H8a	UV -> Att	.305	n.s. (p=.065)	
H7b	HV-> PK	.379	.013	.306
H8b	UV -> PK	.246	n.s. (p=.104)	
H9	Att -> PI	.147	n.s. (p=.112)	.554
H10	PK -> PI	.701	0	

*standardized coefficient: β

**data of both groups, as experimental group has high IIT and control group low IIT

The first multiple regression with hedonic value as dependent variable included the predictors telepresence, ease of use, technology anxiety and ego involvement. Of these variables, telepresence and ease of use made the largest unique contribution, although technology anxiety also had a statistically significant contribution. Ego involvement was not found to be a significant predictor of hedonic value. This was not surprising, as the correlation matrix already indicated a small and not significant shared variance. With an Adjusted R squared of .296, the predictors explained 29.6% of the total variance in hedonic value. Moreover, if the scores of telepresence (M=3.59, SD=1.24) could be increased by one standard deviation, the hedonic value (M=5.64, SD=.72) would be likely to increase by .316 standard deviation units, thus .23 score points. For technology anxiety, the coefficient was negative, which supported the assumption that people, who are anxious about technology, are also deriving less hedonic value from the AR experience. Besides the negative effect

of technology anxiety on the usage intentions of AR applications (Kim & Forsythe, 2008), the same effect on the enjoyment (hedonic value) was also shown by Kim and Forsythe (2010) in their later study.

Moreover, with telepresence, ease of use and technology anxiety having a significant and direct effect on hedonic value, **H3a, H4a** and **H5a** can be **accepted** while **H6a** has to be **rejected**.

H3a: Telepresence positively affects hedonic value.
H4a: Perceived Ease of Use positively affects hedonic value.
H5a: Technology anxiety negatively affect hedonic value.
H6a: Ego Involvement positively affects hedonic value.

In the second regression, the paths to utilitarian value were examined. Only telepresence was found to be significant predictor of utilitarian value. The predictors furthermore explained 24.2% of the total variance in utilitarian value. Moreover, if telepresence (M=3.59, SD=1.24) would be increased by one standard deviation unit, the utilitarian value score is likely to increase by .52, which can be interpreted as a half step in the answer choices. Even though several researchers have shown the effect of ease of use on hedonic and utilitarian value and its importance in the adoption of new technology (Davis et al., 1992; Heijden, 2000; Kim & Forsythe, 2008), the evoked telepresence, and thus the quality of the virtual product experience, is the main predictor of utilitarian value. In addition, the influence of technology anxiety on utilitarian value assumed by Kim and Forsythe (2010) is not supported. Furthermore, ego involvement, which was presumed to affect how people perceive the technology (Kang, 2014), does not have a significant effect on either hedonic or utilitarian value. Consequently, if a shopping-oriented AR application is sufficiently easy to use, like the mean values of ease of use indicate, the usefulness that users perceive depends on how the app is capable of creating telepresence.

Following, **H4b, H5b** and **H6b** have to be **rejected**, while **H3b** is **accepted**.

H3b: Telepresence positively affects utilitarian value.
H4b: Perceived ease of use positively affects utilitarian value.
H5b: Technology anxiety negatively affects utilitarian value.
H6b: Ego involvement positively affects utilitarian value.

The third regression encompassed the paths from hedonic and utilitarian value to the attitude towards the product. Neither utilitarian nor hedonic value were significant predictors of attitude. The positive effect of perceived usefulness and perceived enjoyment on shaping attitude, which

was assumed by Fiore et al. (2005a) and Huang and Liao (2015), could therefore not be proven. Moreover, the Adj. R^2 square of .174 indicates that there might be other variables influencing the actual attitude of the users towards the product. However, the presumed effect of telepresence on attitude (Klein, 2003; Schwartz, 2011) does not seem to be mediated by hedonic and utilitarian value. As mentioned before, this could be due to, inter alia, the limited degree of telepresence, neutral style of the chair or pre-existing attitude towards the style or the chair in particular. Finally, **H7a** and **H8a** are **rejected**.

H7a: Hedonic value positively affects the attitude towards the product.
H8a: Utilitarian value positively affects the attitude towards the product.

Similarly, the fourth regression covered the effect of utilitarian value and hedonic value on the dependent variable product knowledge. Hedonic value was found to be the only significant contributor, while the contribution of utilitarian value was not significant in predicting product knowledge. With an Adjusted R square of .306, the predictors explained 30.6% of the total variance in product knowledge. Moreover, an increase of one standard deviation in the scores of hedonic value (M=5.64, SD=.72) is likely to increase the product knowledge by .27. These findings are partially in line with research that states that emotional, behavioural and cognitive engagement has an effect on gaining certain knowledge while interacting with technology (Deater-Deckard et al., 2013; Pekrun & Linnenbrink-Garcia, 2012). As engagement can be furthermore separated into experiential (hedonic) and functional (utilitarian) value (Mollen & Wilson, 2010), the effect on product knowledge is only supported for the hedonic nature of engagement. Moreover, adapting a gaming industry analogy, it has been proven that fun of problem-solving games directly leads to user's learning (Connolly, Boyle, MacArthur, Hainey, & Boyle, 2012; Lee & Peng, 2006; Lievrouw, 2010). Oppositely to research about e-commerce, in which Chiu et al. (2014) found a linkage between perceived usefulness and product knowledge, the data could not prove this relationship within the AR environment. As discussed in 4.2 Univariate Analysis, the AR experience just conveyed certain attributes of product knowledge. In the scale, all attributes were however weighted equally, even though the participants might have a different assessment of importance. Consequently, if the AR experience is perceived by a group of participants as valuable but just complementing tool in the decision process, as it lacks certain attribute dimensions, the product knowledge levels are not consistent with the hedonic value that participants assign to the application.

Consequently, **H8b** has to be **rejected** and **H7b** can be **accepted**.

H7b: Hedonic value positively affects product knowledge.
H8b: Utilitarian value positively affects product knowledge.

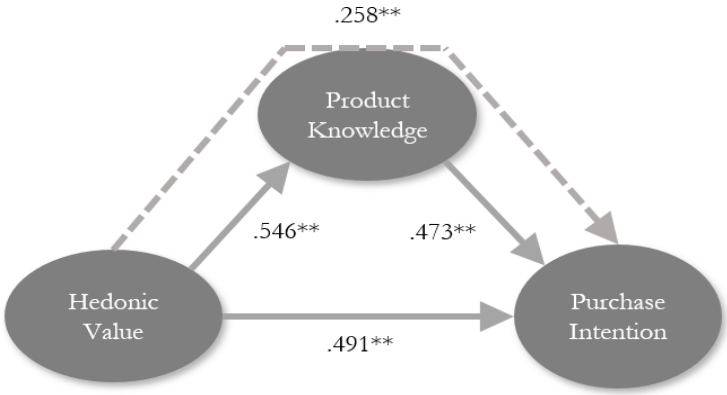
Finally, the fifth regression encompassed the direct effects of attitude and product knowledge on the purchase intention. The suggested predictors explained with 55.4% a relatively high share of the variance in purchase intention. Furthermore, of both independent variables, product knowledge was the largest and only significant unique contributor in the prediction of purchase intention. Therefore, the expected attitude-behaviour-consistency (Schwartz, 2011) is not supported, as attitude was no significant predictor of purchase intention. Thus, **H9** is **rejected** and **H10 accepted**.

H9: Attitude positively affects purchase intention.
H10: Product knowledge positively affects purchase intention.

As the levels of product knowledge and the attitude towards the product were similar for the experimental and control group, the significantly higher purchase intention of the experimental group cannot be sufficiently explained by product knowledge. In the following, two possible explanations are provided. First, it is possible that some product attributes that get conveyed through the AR experience are more relevant for the consumers' intention to purchase, thus leading to a higher consistency between product knowledge and behaviour. In terms of the product attributes which constituted product knowledge, the experimental group had significantly more information about the "size of the chair".

Since the sole information about the size of the chair is very unlikely to be the main predictor of purchase intention, this leads us to the second consideration; other variables that are not initially hypothesized are having an influence on the purchase intention. As Chen et al. (2015) and Papagiannidis et al. (2014) already found a direct effect of hedonic value on the purchase intention of customers when shopping online, a multiple linear regression was conducted with both variables that are assumed to be affected by the AR experience hedonic and utilitarian value, as well as product knowledge as predictors (Figure 17, Appendix J). A significant regression equation was found ($f(3,55)=79.513$, $p<.000$), with an Adjusted R square of .802. Of these three variables, utilitarian value made the largest contribution ($\beta=.427$), with product knowledge ($\beta=.392$) and hedonic value ($\beta=.246$) also contributing to the prediction. All mentioned variables were significant predictors of purchase intention. The higher explanatory power of that regression showed that, even though not assumed in the first place, utilitarian and hedonic value also have a direct influence

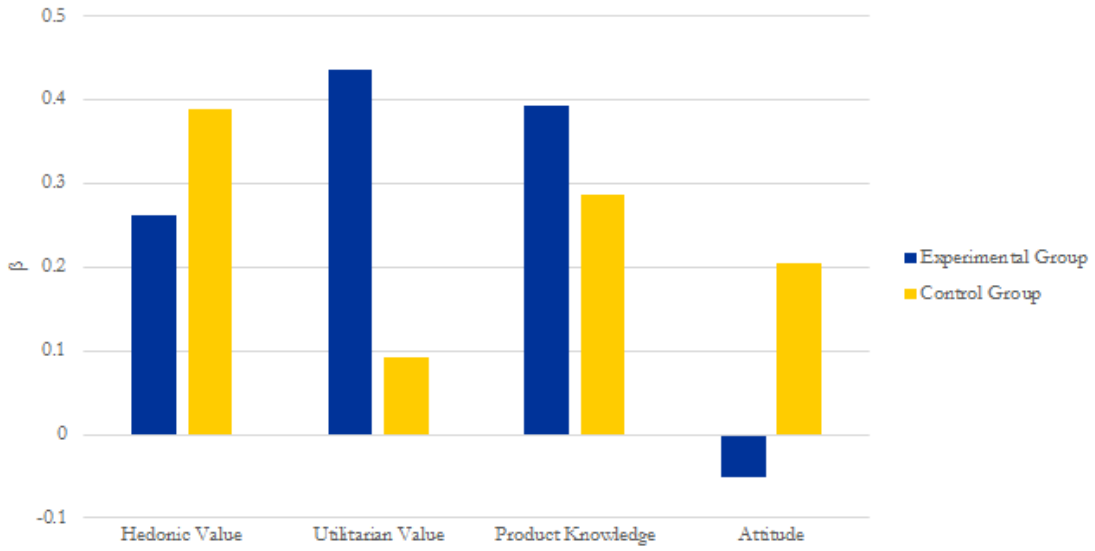
on purchase intention. To determine how much of the effect that hedonic value has on purchase intention is mediated by product knowledge, a mediation analysis was conducted (Appendix I). As Figure 16 illustrates, the path between hedonic value and product knowledge was statistically significant, as was the path between product knowledge and purchase intention. The effect of hedonic value on purchase intention was partially mediated by product knowledge, and furthermore confirmed to be statistically significant with the Sobel test ($z=3.69$, $p<.01$) and the standardized indirect effect was (.546)*(.473) = .258. Furthermore, the bootstrapping confirmed the mediation (Appendix I). Consequently, the direct effect of hedonic value on purchase intention was even higher than the indirect effect through product knowledge. Nevertheless, it can be said that in order to achieve a high purchase intention, an AR experience also needs to convey product knowledge.



**p<.01

Figure 16. Mediation of hedonic value on purchase intention through product knowledge

The effect on purchase intention seems to be mainly determined by utilitarian and hedonic value, as well as the product knowledge the consumers achieve through using the AR application. For the experimental group, the shaping of purchase intention does not seem to operate only through a direct product experience (telepresence), and the mediation through attitude like presumed by Schwartz (2011), but also through the creation of an engaging experience with hedonic value that furthermore enhances the transmission of product knowledge. In the control group, hedonic value was even the main predictor of purchase intention (Figure 17, Appendix J). The effect of hedonic value on purchase intention was already found for non-augmented online (Childers et al., 2001), offline shopping behaviour (Babin et al., 1994; Chiu et al., 2014), and for virtual product experiences in a computer-simulated game environment (Papagiannidis et al., 2014).



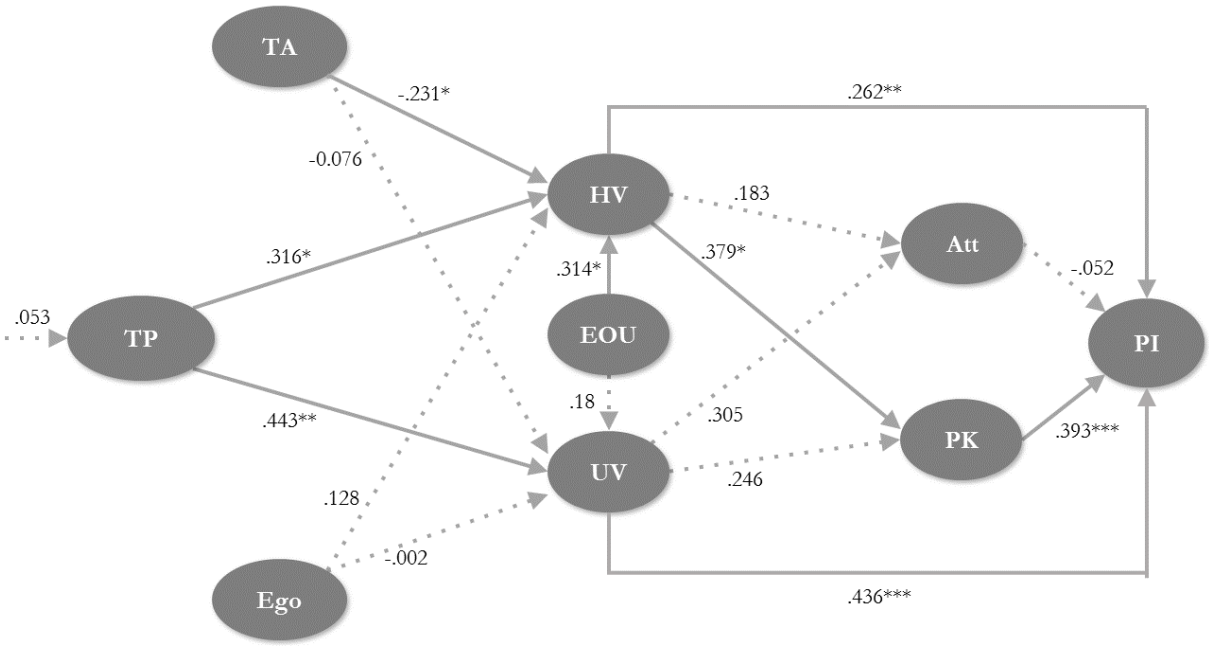
Note. n.s. = not significant

Figure 17. Multiple regression with dependent variable: purchase intention

In comparison to the control group, both product knowledge and utilitarian value of the experimental group had a bigger effect on the resulting purchase intention (Figure 17, Appendix J). It can be inferred that the interaction with the virtual furniture in one's own home (utilitarian and hedonic value) is more engaging and the product knowledge that retrieved from this augmentation is more relevant to the users' purchase process and finally their purchase intention. It has to be noted that the direct effect of hedonic value on purchase intention is lower for the experimental group, but the total effect, thus including the indirect effect through product knowledge (Figure 16, Appendix I), is similar.

Also, the paths differ from Schwartz (2011), who found attitude to be main predictor of purchase intention and furthermore as a mediator of product knowledge for virtual try-on applications. Nevertheless, considering factors such as the augmentation in the IKEA app, which does not directly involve users like personal virtual try-ons do, the apparel item in Schwartz's (2011) study, which is assumed to be a highly ego-involving product (Michaelidou & Dibb, 2006), and that the IKEA AR app was not able to create higher telepresence than the website (Table 3); it might explain the observed importance of rational components of furniture (product knowledge) and attitude towards the app itself (hedonic and utilitarian value).

At last, we present the revised model for the paths leading to purchase intention of the experimental group in Figure 18.



Note: Standardized path estimates are reported.
Dashed lines indicate paths that are not statistically significant.
*p<.05, ** p<.01, ** p<.001

Figure 18. Revised model for the experimental group

5. Conclusion

This chapter gives the conclusions drawn from our research. It reflects the overall purpose based on the previous presentation of findings and analysis.

The purpose of our study was to investigate if and how the experience with the AR shopping application can affect customer's purchase intention. In order to fulfil the stated purpose, a set of the research questions was identified, and now has to be addressed.

- *RQ1: Does an augmented reality application affect customers' purchase intention?*

Contrary to Schwartz (2011) who used a video presentation of the AR technology as her method of research, our experimental approach showed a more positive effect on purchase intention of customers within the experimental group after experiencing the AR application than in the control group that saw a screenshot of traditional e-commerce website. Hence, the results suggest that an engaging AR application does not have to necessarily be just a fun gimmick, but can actually influence the users' purchase intention and possibly convert them into buying customers.

- *RQ2: If so, what can explain the possible increase of purchase intention when experiencing an augmented reality application?*

Based on the findings, we are also eligible to explain possible factors leading to the aforementioned increase of purchase intention. The higher utilitarian and hedonic value of the augmented experience directly influence the purchase intentions of users. Also, the AR experience and its highly hedonic nature is affecting product knowledge. Being consistent with previous research, product knowledge gained through the 3D augmentation of a product positively influences consequent purchase intention, however, the provided product knowledge is unique in comparison to traditional online product experiences but the scope is still limited. Interestingly, the attitude towards the product was neither positively nor negatively affected by the AR experience. Also, it did not contribute to the higher customer's purchase intentions. The assumption that telepresence evoked by AR is a main driver of increased purchase intentions cannot be supported. However, mediated by hedonic and utilitarian value, and product knowledge, the arousal of telepresence in an easy to use application can improve the AR experience and contribute to higher purchase intentions.

6. Discussion

In this chapter, additional findings obtained during the process of creating the thesis are presented and put in context with the research forefront. Following, these comments go beyond the purpose of our research.

This thesis provides the evidence of an effect between AR applications and customer's purchase intention. As already concluded, the most significant factors leading to purchase intention are product knowledge, hedonic and utilitarian value conveyed by the augmented experience. Despite the acknowledged limitations of method, we assume that these factors could be generalized from the IKEA case to other shopping-related AR applications such as virtual try-on "magic mirrors" in the beauty or fashion industry. Furthermore, our research showed that interactive technology has progressed since the studies by van Krevelen and Poelman (2010) and Olsson and Salo (2011), when the researchers concluded that the technology had limited user applicability.

Even though our methodological approach was intended to be purely quantitative in order to investigate causal effects, the participants from the experimental group expressed additional comments during the process of the actual experiment. When first trying out the application, nearly all participants were amazed by the way it simulated the real pieces of furniture in front of their hands, and making similar exclamations like in the AR study by Javornik (2017) such as *"Wow!"* or "*This is so cool.*". Even though the technology is already known for some time, we can assume there is still a lack of hands-on experience among members of Generation Y. Nevertheless, few participants stated at the end of the experiment that they appreciated the fun side of the augmenting experience, but they would not use it as a part of their shopping process in the future. This kind of statement supports the concerns about the practicality of applications that are perceived as "gimmicky" (Owyang, 2010; Scholz & Smith, 2016) and the low intent to use those (Rese et al., 2014). However, our experiment showed that if a shopping-oriented AR application is sufficiently easy to use, the usefulness that users perceive depends on how the app is capable of creating telepresence.

Despite not being a main part of our research model, the research process led us to the examination of the effect for both genders. It can be assumed that the AR effect on the experienced hedonic and utilitarian value, as well as the purchase intentions are similar for both genders. However, females were more anxious towards technology than male counterparts, which is in line with the previous research by Reidsma (2013) and Schumacher and Morahan-Martin (2001). In addition, women in the control group had more fun than men, which is supported by the extensive research about different motives for online shopping. Women tend to do shopping with the expectation of pleasure whereas men put more emphasis on rationalist purchasing decisions (Dennis et al., 2010;

Dittmar et al., 2004).

6.1 Implications

On the contrary to the few verbal comments of the participants about the limited usefulness of the technology in terms of their shopping behaviour, our statistical results showed that the AR experience can positively influence customer's purchase intention. This finding, although it has not been discovered for AR before and should be verified by future research, could change the perception of AR among more sceptical marketing managers. Moreover, it justifies investments into the development of AR solutions.

The implications drawn from our research seem to gain on importance, because during the last stage of thesis process, Mark Zuckerberg, CEO of Facebook, introduced the first open AR platform, which all developers can work on, to push the AR to new dimensions (Constine, 2017). Zuckerberg (2017) argues that everyone already has a camera phone, thus the technology does not necessarily have to wait for a spread of new devices such as smart glasses or lenses. Apart from his argumentation, our experimentally collected data showed that the participants perceived the AR application as easy to use as the traditional online e-commerce website. Therefore, it can be assumed that Generation Y is already prepared to adopt AR technology on their smart devices. Moreover, besides the ease of use, technology anxiety of the potential users and the perceived hedonic and utilitarian value of the application are predictors of the intention to use the technology (Kim & Forsythe, 2008). In our research, the participants' technology anxiety was low, and the hedonic and utilitarian value higher than for a comparable online shopping experience, thus it confirms the intent of users to use it. This could be the impulse to specifically target this particular generation with AR apps. Especially, because the majority of the participants, who inherently belong to Generation Y, remarked as a side note that they had never heard about such a feature the official IKEA application offers.

Another implication we would like to point out is that product knowledge seems to be an important predictor of purchase intention with regards to augmented reality. So far, the AR applications can contribute to the customer assessment of the size and style of a product, confidence when making a purchase decision, and thus improve their shopping process. Consequently, the provided product knowledge through the augmentation has a potential to decrease the goods returns as suggested by Schwartz (2011). However, other product attributes in applications have to be enhanced. Therefore, the shopping with AR cannot fully replace online websites or offline stores yet. Companies could enhance the shopping experience with better integration of website features such as more detailed pictures, product description, customer reviews in the AR application and vice

versa. Nevertheless, participants' verbal feedback stressed that for chairs as a product category the personal evaluation and "hands-on feeling" of comfort is important. Moreover, the fun aspect (hedonic value) of the augmented reality experience also significantly influences customer intention of purchase or indirectly mediated by product knowledge. Therefore, laying stress on the entertaining aspects of the AR applications is justified. Also, the high hedonic and utilitarian value of the AR application compared to traditional online shopping indicate the potential of a future adoption of shopping-oriented AR. Several researchers pointed out the key role of these factors in the adoption of new technologies (Davis et al., 1992; Huang & Liao, 2015; Kim & Forsythe, 2007; Kim & Forsythe, 2008). Therefore, retailers should view AR as a form of persuasive technology that elicits and delivers experiential values rather than as only a functional technology (Huang & Liao, 2015; McCarthy & Wright, 2007).

Another implication we would like to stress, is that companies should aim to improve the user experience of AR applications in order to increase their telepresence. This could mean inter alia enhancing the graphics of 3D models, colour vividness and eliminating software bugs. Moreover, in the case of furniture applications, many participants also expressed a desire to visualize more than one piece of furniture to actually design the whole room. Lack of this functionality prevents them from engaging more with the application. If we apply the resemblance from the website e-commerce to the m-commerce environment, the lower engagement and less time spent in the application may lead to lower customer conversions (Lambrea, 2016; McDowell, Wilson, & Kile, 2016).

6.2 Limitations

The outcome of the study has to be comprehended while considering the limitations. Critique can be drawn to the chosen method with the laboratory experiment and convenience sampling, which was conducted on the expense of further generalizability to real-life settings and to other population groups beyond Generation Y. Moreover, since the technology adoption and smart devices ownership differ among countries, the limitation could be not considering the cultural effects and country of origin of the participants (Didero et al., 2008; Lee, Trimi, & Kim, 2013; Rainie & Poushter; 2014). It could be also questioned if the number of participants was sufficient for the experimental purpose even though we followed the sample size estimate by Malhotra and Birks (2007), using similar sample size as in other studies. Especially 59 participants within the experimental group could be a small size for reliable statistical conclusions. Also, important to note is that the participants were exposed to only one product - the white armchair. Although the product was nearly equally liked and disliked by both groups, Schwartz (2011) in her study suggested using more products to minimize personal bias and taste. Since we only investigated

effects of presenting the single chair, limitation can be also extended to a product category. Results for other furniture categories like beds, tables or decorations might differ from ours. Also, the effect on consumer dimensions might be different for AR applications of other industries, as the utilitarian value of interactive image experiences is assumed to engage users primarily for high-involvement and not frequently purchased goods (Fiore et al., 2005b).

As discussed in the implications, the scores for ease of use were high for the AR experience. It seems to be important to acknowledge at this point that all participants in the experimental group were first given a brief tutorial how to use the application. This short introduction from the researchers might have affected participants' perception of simplicity of the app. Outside our laboratory setting users may not perceive the IKEA application that easy to interact with, even though there is an illustrated tutorial included. Moreover, for delivering a better AR experience to the participants, we decided to use a smart device with a bigger display such as an iPad. This laboratory solution could have an impact on telepresence, hedonic and utilitarian values as well as ease of use (Lombard, 2000). Hence, it is possible that when using a smaller tablet or smartphone, the overall AR experience might diverge.

Since we decided for a more technological approach towards the research and based our model on the interactivity framework by Schwartz (2011) and the TAM model by Davis et al. (1992), a limitation may also be not taking account of other factors leading to purchase intention such as social influence, trust or brand confidence (Bearden et al., 1989; Mayer et al., 1995; Park & Lessig, 1981).

6.3 Future Research

Since the AR technology is still in its infancy and prior research in this particular area is limited, more empirical information needs to be gathered (Bulearca & Tamarjan, 2010; Javornik, 2017). This research attempted to do so and be more relevant for business organisations. However, there is still an unexplored field of study.

As most previous studies about AR did measure responses of participants without them actually experiencing the technology, like Schwartz (2011) or Kang (2013) who used a video to present the capabilities of the AR applications, we make a suggestion to use a more hands-on approach. For factors like telepresence and other factors which are derived from the rich interactivity and the user control of the AR application (Coyle & Thorson, 2001; Klein, 2003; Papagiannidis et al., 2014), a stimulus with limited interactivity might yield results which are not reflecting the actual phenomenon.

We suggest testing the developed theoretical model for other augmented products, as well as other virtual try-on applications that intend to affect customer shopping behaviour. If additional research controls for the aforementioned limitations, results could be more accurate and comparable. The research may verify our and Gopalan, Zulkifli and Aida's (2016) findings in terms of whether AR is truly perceived by users to be easy to use. Additionally, as the usage of AR resulted in a higher hedonic value within the experimental group, the researchers may explore what UX factors present in an application are mainly predicting the enjoyable experience. Moreover, similar research conducted by Schwartz (2011) discovered that AR can also strengthen a negative attitude which leads to lower purchase intentions, and suggested to determine whether this effect flows the other way as well. In our case, nonetheless, the experimental group expressed a positive attitude towards the armchair, but the path did not lead to significantly higher purchase intentions. This could be explained either by the fact that the already liked product by the experimental group as well as the control group is not likely to change regardless of the manipulation, or that the attitude towards a novel and engaging AR app is overshadowing the product experience. However, the future directions of research could test again whether the attitude towards the product is able to predict purchase intention when the product is liked or if the attitude towards the application is a more significant factor of user outcomes.

In view of fact that our AR experiment showed a high utilitarian value for members of Generation Y, and previous research of the AR applications discovered differences with respect to the kind of users (Javornik et al., 2017), we propose to examine the value for other groups of users (age, profession, etc.). Considering possible cultural differences when adapting new technology (Lee et al., 2013), future studies on AR could also explore cultural effects to increase the external validity of existing AR literature. As the utilitarian value of interactive image technology is assumed to be engaging for high-involvement goods (Fiore et al., 2005b), future studies should also explore the effect for less involving and/or more frequently purchase products.

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Appendix A

Questionnaire for the experimental group

Augmented Reality - Master Thesis Experiment

* 1. What are your feelings towards the chair?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I enjoyed viewing the chair.	○	○	○	○	○	○	○
I like the chair.	○	○	○	○	○	○	○
The chair is appealing to me.	○	○	○	○	○	○	○
The chair is stylish.	○	○	○	○	○	○	○

* 2. Please rate how do you agree with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
IKEA augmented reality can improve my shopping productivity.	○	○	○	○	○	○	○
IKEA augmented reality can enhance my effectiveness in shopping.	○	○	○	○	○	○	○
IKEA augmented reality can be useful in buying what I want.	○	○	○	○	○	○	○
IKEA augmented reality can improve my shopping ability.	○	○	○	○	○	○	○

* 3. Please rate how do you agree with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
IKEA augmented reality is clear and understandable.	○	○	○	○	○	○	○
IKEA augmented reality does not require a lot of mental effort.	○	○	○	○	○	○	○
IKEA augmented reality is easy to use.	○	○	○	○	○	○	○
IKEA augmented reality allows me to shop the way I want to shop.	○	○	○	○	○	○	○

* 4. Please rate how do you agree with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
Shopping with IKEA augmented reality would be fun for its own sake.	○	○	○	○	○	○	○
Shopping with IKEA augmented reality would make me feel good.	○	○	○	○	○	○	○
Shopping with IKEA augmented reality would be boring.	○	○	○	○	○	○	○
Shopping with IKEA augmented reality would involve me in the shopping process.	○	○	○	○	○	○	○
Shopping with IKEA augmented reality would be exciting.	○	○	○	○	○	○	○
Shopping with IKEA augmented reality would be enjoyable.	○	○	○	○	○	○	○
Shopping with IKEA augmented reality would be uncomfortable.	○	○	○	○	○	○	○
Shopping with IKEA augmented reality would be interesting.	○	○	○	○	○	○	○

* 5. Please rate how do you agree with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
Furniture shopping is an important part of who I am	○	○	○	○	○	○	○
I would feel a loss if I were forced to give up furniture shopping	○	○	○	○	○	○	○
Furniture shopping is something I rarely even think about	○	○	○	○	○	○	○
Furniture shopping will be a normal part of everyday life	○	○	○	○	○	○	○

* 6. If I were shopping for furniture, this augmented reality application would...

	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
let me visualize what the actual piece of furniture is like.	○	○	○	○	○	○	○
give me as much sensory information (taste, sight, smell, hearing, and touch) about the product as I would experience in a store.	○	○	○	○	○	○	○
create a product experience similar to the one I'd have when shopping in a store.	○	○	○	○	○	○	○
allow me to interact with the product as I would be in a store.	○	○	○	○	○	○	○
provide me accurate information about the products.	○	○	○	○	○	○	○

Augmented Reality - Master Thesis Experiment

* 7. Please rate how do you agree with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
I am confident I can learn technology-related skills.	○	○	○	○	○	○	○
I have difficulty understanding most technological matters.	○	○	○	○	○	○	○
I feel afraid about using technology.	○	○	○	○	○	○	○
When given the opportunity to use technology, I fear I might damage it in some way.	○	○	○	○	○	○	○
I am sure of my ability to interpret technological output.	○	○	○	○	○	○	○
Technological terminology sounds like confusing jargon to me.	○	○	○	○	○	○	○
I have avoided technology because it is unfamiliar to me.	○	○	○	○	○	○	○
I am able to keep up with important technological advances.	○	○	○	○	○	○	○
I hesitate to use technology for fear of making mistakes I cannot correct.	○	○	○	○	○	○	○

* 8. After using the application, how likely is...

	Not at all likely	Slightly likely	Moderately likely	Very likely	Completely likely
that you would consider to buy this chair?	○	○	○	○	○

* 9. Please rate how do you agree with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
The augmented reality experience in the application would be helpful in aiding me to make purchase decision if I am considering buying the chair.	○	○	○	○	○	○	○
The augmented reality experience increased my intention to buy the chair I visualised in the application.	○	○	○	○	○	○	○
I would be willing to recommend to my friends to use the augmented reality in the application as a decision aid when considering what chair to buy.	○	○	○	○	○	○	○

* 10. How much information do you feel you have from augmented reality experience...

	None	Very little	Some	A good amount	A ton
about the chair overall?	○	○	○	○	○
about the comfort of the chair?	○	○	○	○	○
about the quality of the chair?	○	○	○	○	○
about the style of the chair?	○	○	○	○	○
about the design features/functionality of the chair?	○	○	○	○	○
about the size of the chair?	○	○	○	○	○

* 11. Please rate how do you agree with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
I believe that I have enough information to make a purchase decision	◯	◯	◯	◯	◯	◯	◯
If I were to make a purchase decision, I would be confident in that decision	◯	◯	◯	◯	◯	◯	◯

Augmented Reality - Master Thesis Experiment

And now something about you..

The data for the thesis remains anonymous.

* 12. What is your gender?

- ◯ Male
- ◯ Female

* 13. What is your age?

* 14. What is your nationality?

* 15. What is the highest degree or level of school you have completed?

- ◯ No schooling completed
- ◯ Primary school
- ◯ High school (Secondary school)
- ◯ Apprenticeship (Trade/technical/vocational/nursery training)
- ◯ Bachelor degree
- ◯ Master degree
- ◯ Doctorate degree

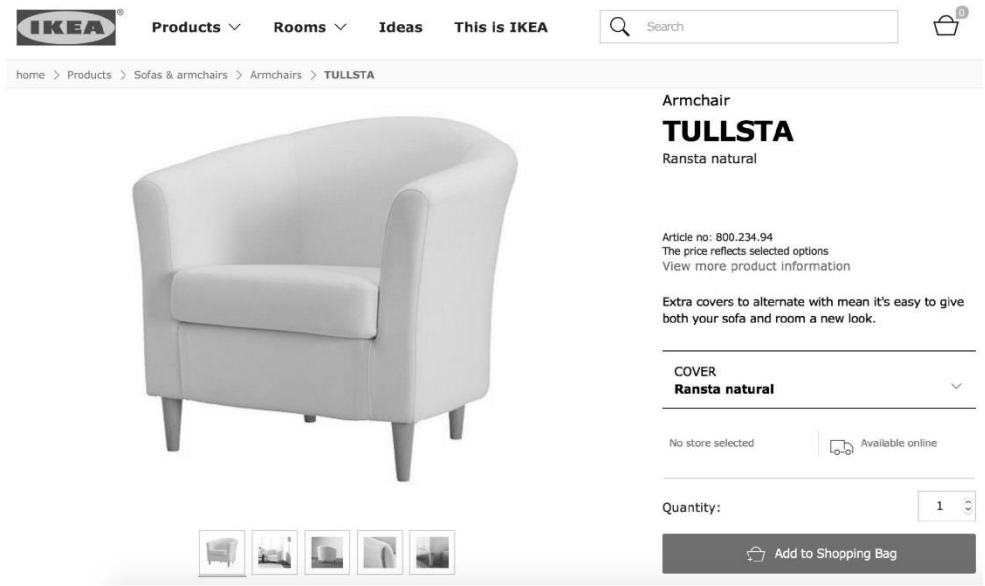
Appendix B

Questionnaire for the control group

IKEA Website - Master Thesis Experiment

Imagine you are about to buy an armchair and you have just visited the IKEA product website. Answer please the following questions based on that.

Screenshot of IKEA website



* 1. What are your feelings towards the chair?

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I enjoyed viewing the chair.	○	○	○	○	○	○	○
I like the chair.	○	○	○	○	○	○	○
The chair is appealing to me.	○	○	○	○	○	○	○
The chair is stylish.	○	○	○	○	○	○	○

* 2. Please rate how do you agree with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
IKEA website can improve my shopping productivity.	○	○	○	○	○	○	○
IKEA website can enhance my effectiveness in shopping.	○	○	○	○	○	○	○
IKEA website can be useful in buying what I want.	○	○	○	○	○	○	○
IKEA website can improve my shopping ability.	○	○	○	○	○	○	○

* 3. Please rate how do you agree with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
IKEA website is clear and understandable.	○	○	○	○	○	○	○
IKEA website does not require a lot of mental effort.	○	○	○	○	○	○	○
IKEA website is easy to use.	○	○	○	○	○	○	○
IKEA website allows me to shop the way I want to shop.	○	○	○	○	○	○	○

* 4. Please rate how do you agree with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
Shopping with IKEA website is fun for its own sake.	○	○	○	○	○	○	○
Shopping with IKEA website makes me feel good.	○	○	○	○	○	○	○
Shopping with IKEA website is boring.	○	○	○	○	○	○	○
Shopping with IKEA website involves me in the shopping process.	○	○	○	○	○	○	○
Shopping with IKEA website is exciting.	○	○	○	○	○	○	○
Shopping with IKEA website is enjoyable.	○	○	○	○	○	○	○
Shopping with IKEA website is uncomfortable.	○	○	○	○	○	○	○
Shopping with IKEA website is interesting.	○	○	○	○	○	○	○

* 5. Please rate how do you agree with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
Furniture shopping is an important part of who I am	○	○	○	○	○	○	○
I would feel a loss if I were forced to give up furniture shopping	○	○	○	○	○	○	○
Furniture shopping is something I rarely even think about	○	○	○	○	○	○	○
Furniture shopping is a normal part of everyday life	○	○	○	○	○	○	○

* 6. If I were shopping for furniture, this website would...

	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
let me visualize what the actual chair is like.	○	○	○	○	○	○	○
give me as much sensory information (taste, sight, smell, hearing, and touch) about the product as I would experience in a store.	○	○	○	○	○	○	○
create a product experience similar to the one I'd have when shopping in a store.	○	○	○	○	○	○	○
allow me to interact with the product as I would be in a store.	○	○	○	○	○	○	○
provide me accurate information about the products.	○	○	○	○	○	○	○

IKEA Website - Master Thesis Experiment

* 7. Please rate how do you agree with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
I am confident I can learn technology-related skills.	○	○	○	○	○	○	○
I have difficulty understanding most technological matters.	○	○	○	○	○	○	○
I feel afraid about using technology.	○	○	○	○	○	○	○
When given the opportunity to use technology, I fear I might damage it in some way.	○	○	○	○	○	○	○
I am sure of my ability to interpret technological output.	○	○	○	○	○	○	○
Technological terminology sounds like confusing jargon to me.	○	○	○	○	○	○	○
I have avoided technology because it is unfamiliar to me.	○	○	○	○	○	○	○
I am able to keep up with important technological advances.	○	○	○	○	○	○	○
I hesitate to use technology for fear of making mistakes I cannot correct.	○	○	○	○	○	○	○

* 8. After seeing the website, how likely is...

	Not at all likely	Slightly likely	Moderately likely	Very likely	Completely likely
that you would consider to buy this real chair?	○	○	○	○	○

* 9. Please rate how do you agree with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
The website would be helpful in aiding me to make purchase decision if I am considering buying the chair.	○	○	○	○	○	○	○
The website increased my intention to buy the chair.	○	○	○	○	○	○	○
I would be willing to recommend to my friends to use the website as a decision aid when considering what chair to buy.	○	○	○	○	○	○	○

* 10. How much information do you feel you have from the website...

	None	Very little	Some	A good amount	A ton
about the chair overall?	○	○	○	○	○
about the comfort of the chair?	○	○	○	○	○
about the quality of the chair?	○	○	○	○	○
about the style of the chair?	○	○	○	○	○
about the design features/functionality of the chair?	○	○	○	○	○
about the size of the chair?	○	○	○	○	○

* 11. Please rate how do you agree with the following statements:

	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
I believe that I have enough information to make a purchase decision	○	○	○	○	○	○	○
If I were to make a purchase decision, I would be confident in that decision	○	○	○	○	○	○	○

IKEA Website - Master Thesis Experiment

And now something about you..

The data for the thesis remains anonymous.

* 12. What is your gender?

- ◯ Male
- ◯ Female

* 13. What is your age?

* 14. What is your nationality?

* 15. What is the highest degree or level of school you have completed?

- ◯ No schooling completed
- ◯ Primary school
- ◯ High school (Secondary school)
- ◯ Apprenticeship (Trade/technical/vocational/nursery training)
- ◯ Bachelor degree
- ◯ Master degree
- ◯ Doctorate degree

Appendix C

Factor analysis

Table C1

Kaiser-Meyer-Olkin Criterion & Bartlett's Test of Sphericity

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.833
Bartlett's Test of Sphericity	Approx. Chi-Square	3155.996
	df	703
	Sig.	.000

Table C2

Rotated component matrix

Rotated Component Matrix[a]								
	Component							
	1	2	3	4	5	6	7	8
Att1			.591					
Att2			.915					
Att3			.899					
Att4			.872					
UV1	.432				.682			
UV2					.795			
UV3					.794			

UV4	.416				.648			
EOU1						.786		
EOU2						.793		
EOU3						.840		
EOU4					.465	.446		
HV1	.802							
HV2	.815							
HV3R	.809							
HV4	.511							
HV5	.871							
HV6	.841							
HV7R	.509							
HV8	.787							
Ego1							.826	
Ego2							.805	
Ego3R							.772	
Ego4							.511	
TP1								.579
TP2				.846				
TP3				.872				
TP4				.858				
TP5				.559				.474
TA1R		.665						
TA2		.719						
TA3		.735						
TA4		.726						
TA5R		.651						
TA6		.738						
TA7		.802						

TA8R		.662						
TA9		.699						

Extraction Method: Principal Component Analysis.

Appendix D

Normality assumption and variance test

Table D1

Normality test

Tests of Normality							
		Kolmogorov-Smirnov			Shapiro-Wilk		
Group		Statistic	df	Sig.	Statistic	df	Sig.
Utilitarian Value	Experimental	.172	59	.000	.851	59	.000
	Control	.109	118	.001	.954	118	.000
Attitude	Experimental	.180	59	.000	.950	59	.018
	Control	.184	118	.000	.908	118	.000
Ease of Use	Experimental	.167	56	.000	.916	56	.001
	Control	.159	83	.000	.916	83	.000
Hedonic Value	Experimental	.151	59	.002	.943	59	.008
	Control	.067	118	.200	.991	118	.658
Ego Involvement	Experimental	.096	59	.20*	.970	59	.159
	Control	.092	118	.016	.973	118	.019
Telepresence	Experimental	.122	59	.029	.971	59	.174
	Control	.151	118	000	.941	118	.000
Technology Anxiety	Experimental	.120	59	.034	.956	59	.032
	Control	.153	118	.000	.944	118	.000
Purchase Intention	Experimental	.131	59	.014	.942	59	.008
	Control	.093	118	.014	.980	118	.069
Product Knowledge	Experimental	.106	59	.097	.965	59	.093
	Control	.096	118	.009	.989	118	.455

Table D2

Levene's test for homoscedasticity

	Levene's Test for Equality of Variances	
	F	Sig.
Utilitarian Value	.002	.968
Attitude	1.730	.190
Ease of Use	1.377	.243
Hedonic Value	14.454	.000
Ego Involvement	1.252	.265
Telepresence	5.179	.024
Technology Anxiety	3.520	.062
Purchase Intention	.202	.654
Product Knowledge	.210	.647

Appendix E

Product knowledge

Table E1

Comparison of product knowledge items for groups

Product Knowledge	Experimental Group		Control Group		t-test			effect size
	Mean	Std. Dev.	Mean	Std. Dev.	Sig. (2-tailed)	t	df	eta squared
PK1	3.458	.7028	3.559	.6608	.346	-.945	175	
PK2	1.797	.783	2.356	.9654	.000	-3.859	175	.078
PK3	1.864	.8602	2.61	.9431	.000	-5.103	175	.13
PK4	4.119	.7447	3.915	.7347	.086	1.728	175	
PK5	3.356	.9959	3.661	.7759	.042	-2.061	94.246	.024
PK6	4.017	.9376	3.39	1.0046	.000	4.095	123.52	.087
PK7	3.881	1.6514	3.983	1.5905	.693	-.396	175	
PK8	4.068	1.6067	4.051	1.5183	.945	.069	175	

Appendix F

Group Differences: Independent t-test

Table F1

Differences between groups for males

Male	Experimental Group		Control Group		t-test			effect size
	Mean	Std. Dev.	Mean	Std. Dev.	Sig. (2-tailed)	t	df	eta squared
Purchase Intention	4.7241	1.08015	3.9427	1.05719	.003	3.117	75	.115
Product Knowledge	3.2931	.73366	3.3932	.70945	.555	-.592	75	
Attitude	4.9741	1.21806	4.4531	1.42700	.106	1.638	75	
Utilitarian Value	5.8621	1.19259	4.9375	1.29596	.003	3.124	75	.115
Ease of Use	5.3457	1.18206	4.8000	1.25518	.098	1.684	55	
Hedonic Value	5.5517	.85076	4.0885	1.09458	.000	6.157	75	.336
Telepresence	3.9138	1.25406	3.3906	1.49867	.498	.681	75	
Technology Anxiety	2.0575	.78152	3.6875	.75346	.930	.088	75	
Ego-Involvement	3.5172	1.03925	2.0417	1.36435	.669	.430	75	

Table F2

Differences between groups for females

Female	Experimental Group		Control Group		t-test			effect size
	Mean	Std. Dev.	Mean	Std. Dev.	Sig. (2-tailed)	t	df	eta squared
Purchase Intention	4.6917	.95971	4.0393	.80829	.001	3.493	98	.111
Product Knowledge	3.3458	.73745	3.4732	.74694	.435	-.784	98	
Attitude	4.9250	1.08705	4.7714	1.28800	.569	.571	98	
Utilitarian Value	5.7750	1.16403	5.0286	.95983	.001	3.339	98	.102
Ease of Use	5.4598	1.07058	5.5031	.77521	.848	-.192	44.403	
Hedonic Value	5.7333	.57866	4.5696	1.04510	.000	7.113	91.555	.34
Telepresence	3.2750	1.16403	3.7893	1.48277	.067	-1.859	69.278	
Technology Anxiety	2.4407	.74990	2.8254	.95573	.053	-1.959	98	
Ego Involvement	4.0167	1.27295	3.7929	1.24962	.416	.816	98	

Appendix G

Gender Differences: Independent t-test

Table G1

Comparison of genders in experimental group

Experimental Group	Male		Female		t-test			effect size
	Mean	Std. Dev.	Mean	Std. Dev.	Sig. (2-tailed)	t	df	eta squared
Purchase Intention	4.7241	1.08015	4.6917	.95971	.903	.122	57	
Product Knowledge	3.2931	.73366	3.3458	.73745	.784	-.275	57	
Attitude	4.9741	1.21806	4.925	1.08705	.871	.164	57	
Utilitarian Value	5.8621	1.19259	5.775	1.16403	.778	.284	57	
Ease of Use	5.3457	1.18206	5.4598	1.07058	.706	-.379	54	
Hedonic Value	5.5517	.85076	5.7333	.57866	.34	-.962	57	
Telepresence	3.9138	1.25406	3.275	1.16403	.047	2.029	57	.067
Technology Anxiety	2.0575	.78152	2.4407	.7499	.06	-1.922	57	
Ego-Involvement	3.5172	1.03925	4.0167	1.27295	.105	-1.648	57	

Table G2

Comparison of genders in control group

Control Group	Male		Female		t-test			effect size
	Mean	Std. Dev.	Mean	Std. Dev.	Sig. (2-tailed)	t	df	eta squared
Purchase Intention	3.9427	1.05719	4.0393	.80829	.575	-.562	116	
Product Knowledge	3.3932	.70945	3.4732	.74694	.561	-.583	116	
Attitude	4.4531	1.427	4.7714	1.288	.21	-1.262	116	

Utilitarian Value	4.9375	1.29596	5.0286	.95983	.662	-.438	116	
Ease of Use	4.8	1.25518	5.5031	.77521	.008	-.783	41.788	.087
Hedonic Value	4.0885	1.09458	4.5696	1.0451	.019	-2.41	116	.048
Telepresence	3.6875	1.49867	3.7893	1.48277	.717	-.365	116	
Technology Anxiety	2.0417	.75346	2.8254	.95573	.000	-4.969	113.671	.175
Ego Involvement	3.3906	1.36435	3.7929	1.24962	.101	-1.654	116	

Appendix H

Correlations

Table H1

Correlation matrix for control group (Spearman's rank order correlation)

Control Group	1	2	3	4	5	6	7	8	9
(1) Purchase Intention	1								
(2) Product Knowledge	.508**	1							
(3) Attitude	.429**	.309**	1						
(4) Utilitarian Value	.442**	.163	.213*	1					
(5) Ease of Use	.311*	.479**	.095	.165	1				
(6) Hedonic Value	.620**	.401**	.366**	.564**	.440**	1			
(7) Ego Involvement	.304**	.068	.118	.239*	.021	.297**	1		
(8) Telepresence	.272**	.457**	.254**	.136	.174	.143	.248**	1	
(9) Technology Anxiety	-.052	-.003	-.071	-.169	-.021	.022	-.07	-.1	1

** Correlation is significant at the .01 level (2-tailed).
* Correlation is significant at the .05 level (2-tailed).

Appendix I

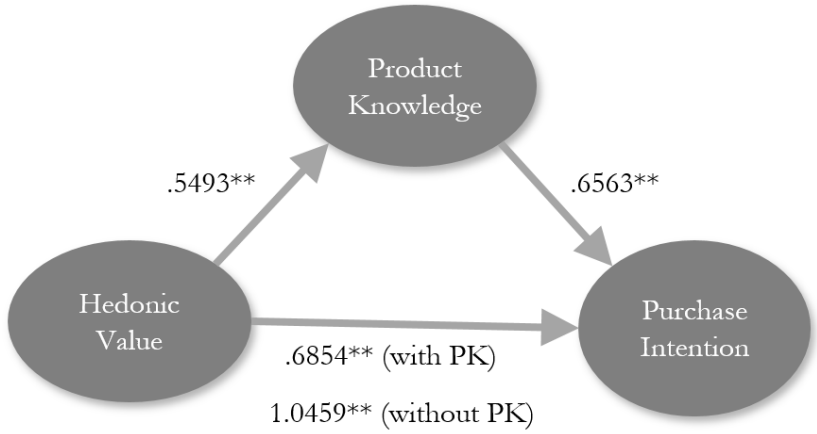
Mediation analysis

Table I1

Mediation of hedonic value through product knowledge on purchase intention

		β	Coefficient*	Std. Error	Sig.	Adj. R^2
total effect	HV -> PI	.749	.536	.63	.000	.553
	HV -> PK	.546	.549	.112	.000	.285
	HV-> PI	.491	.685	.118	.000	.708
	PK -> PI	.473	.656	.117	.000	
indirect (standardized) effect	.546* .473= .258					

*unstandardized coefficient



Note. 5000 resamples.
Indirect effect: .3605**
CI [.2125, .5638]
**p<.01

Figure I1. Mediation analysis with bootstrapping

Appendix J

Multiple regression

Table J1

Predictors of purchase intention

	Experimental Group		Control Group	
	β	Sig.	β	Sig.
Hedonic Value	.262	.004	.389	.000
Utilitarian Value	.436	.000	.092	.253
Product Knowledge	.393	.00	.287	.000
Attitude	-.052	.430	.205	.004

Note. Dependent Variable: Purchase Intention