

# Virtual Reality, Moving from Science Fiction to E-commerce

A Study of the Effects of Virtual Reality within E-commerce

**Abstract:**

Virtual reality (VR) is growing and expected to disrupt the retail e-commerce market within a few years. Despite the bright forecasts, there is still a lack of academic research on what the effects would be of using VR within e-commerce product presentations and what that could imply for both business and consumers. The aim of this thesis is therefore to fill the research gap by investigating if VR product presentations within an e-commerce context will necessarily result in improved cognitive and conative effects on the consumer compared to only 2D pictures. Furthermore, this thesis investigates if different product types and consumer's level of involvement with technology will affect the results. A quantitative study was composed for four fictitious websites, in which either VR or only 2D pictures were used to show two different products within furniture. The study found that VR product presentations resulted in improved positive cognitive and conative effects on the consumer compared to only 2D presentations and that this can be explained by an increased sense of consumer's telepresence. The product type used did not work as a moderator and hence did not affect the product evaluation. However, consumer's level of involvement with technology affected if VR product presentations will have a spill-over effect in terms of favourable branding and website evaluations or not. Therefore, this thesis generates both important managerial - and consumer implications for the next digital era.

**Key words:**

Virtual reality, e-commerce, telepresence, merchandising, product presentation, furniture, product type and involvement with technology

**Authors:**

Caroline Erkhammar, 22938  
Filippa von Schoultz, 50274

**Supervisor:**

John Karsberg

**Examiner:**

Magnus Söderlund

**Word count:**

19952

*Thanks to*  
John Karsberg  
Warpin Media  
Furniturebox  
and all respondents

# TABLE OF CONTENTS

|                                                                          |           |
|--------------------------------------------------------------------------|-----------|
| 1.1 BACKGROUND.....                                                      | 7         |
| 1.2 PROBLEM DISCUSSION.....                                              | 8         |
| 1.3 PURPOSE AND EXPECTED CONTRIBUTION.....                               | 10        |
| 1.3.1 <i>Research Question</i> .....                                     | 10        |
| 1.4 DELIMITATIONS .....                                                  | 10        |
| 1.5 THESIS OUTLINE.....                                                  | 12        |
| <b>2. THEORY.....</b>                                                    | <b>13</b> |
| 2.1 LITERATURE REVIEW .....                                              | 13        |
| 2.1.1 <i>Virtual Reality Definition in Past Literature</i> .....         | 13        |
| 2.1.2 <i>Research on Non-Immersive VR</i> .....                          | 13        |
| 2.1.3 <i>Research on Immersive VR and Theoretical Research Gap</i> ..... | 15        |
| 2.1.4 <i>VR Definition in This Thesis</i> .....                          | 15        |
| 2.2 THEORETICAL FRAMEWORK AND HYPOTHESIS GENERATION.....                 | 15        |
| 2.2.1 <i>Telepresence</i> .....                                          | 16        |
| 2.2.2 <i>Cognitive and Conative Effects</i> .....                        | 17        |
| 2.2.3 <i>Cognitive Effects</i> .....                                     | 17        |
| 2.2.4 <i>Conative Effects</i> .....                                      | 20        |
| 2.2.5 <i>Summary of H2</i> .....                                         | 21        |
| 2.2.6 <i>Telepresence as a Mediator</i> .....                            | 21        |
| 2.2.7 <i>Product Type</i> .....                                          | 22        |
| 2.2.8 <i>Involvement with Technology</i> .....                           | 24        |
| 2.3 SUMMARY OF HYPOTHESIS GENERATION .....                               | 26        |
| <b>3. METHODOLOGY.....</b>                                               | <b>27</b> |
| 3.1 SCIENTIFIC APPROACH TO THE RESEARCH DESIGN.....                      | 27        |
| 3.2 INTERVIEWS WITH INDUSTRY EXPERTS.....                                | 28        |
| 3.2.1 <i>Insight from the VR Industry</i> .....                          | 28        |
| 3.2.2 <i>Insight from E-commerce within Furniture Shopping</i> .....     | 29        |
| 3.2.3 <i>Concluding Remarks from the Interviews</i> .....                | 30        |
| 3.3 PREPARATORY WORK FOR THE MAIN STUDY.....                             | 31        |
| 3.4 PRE-STUDY 1: PRODUCT CATEGORIES WITHIN FURNITURE .....               | 32        |
| 3.4.1 <i>Purpose and Survey</i> .....                                    | 32        |
| 3.4.2 <i>Result and Conclusion</i> .....                                 | 32        |
| 3.4.3 <i>Criticism of Pre-study 1</i> .....                              | 33        |
| 3.5 PRE-STUDY 2: GENERAL ATTITUDE.....                                   | 34        |
| 3.5.1 <i>Purpose and Survey</i> .....                                    | 34        |
| 3.5.2 <i>Result and Conclusion</i> .....                                 | 34        |
| 3.5.3 <i>Criticism of Pre-study 2</i> .....                              | 35        |
| 3.6 PREPARATORY WORK FOR PRE-STUDY 3 AND THE MAIN STUDY .....            | 35        |
| 3.6.1 <i>The E-commerce Site “Furniturestore”</i> .....                  | 36        |
| 3.6.2 <i>The VR Material</i> .....                                       | 37        |

|                                                               |           |
|---------------------------------------------------------------|-----------|
| 3.7 PRE-STUDY 3: TELEPRESENCE.....                            | 37        |
| 3.7.1 Purpose.....                                            | 37        |
| 3.7.2 Pilot Test of Question and Method .....                 | 38        |
| 3.7.3 Results.....                                            | 39        |
| 3.7.4 Criticism of Pre-study 3.....                           | 39        |
| 3.8 MAIN STUDY.....                                           | 40        |
| 3.8.1 Pilot Test of the Questionnaire.....                    | 40        |
| 3.8.2 Sampling Approach.....                                  | 40        |
| 3.8.3 Questionnaire .....                                     | 41        |
| 3.8.4 Questionnaire Measures .....                            | 42        |
| 3.8.5 Quantitative Sampling.....                              | 44        |
| 3.8.6 Analytical Tools .....                                  | 45        |
| 3.9 CRITICAL REVIEW OF DATA QUALITY .....                     | 46        |
| 3.9.1 Reliability .....                                       | 46        |
| 3.9.2 Validity .....                                          | 47        |
| 3.9.3 Replicability.....                                      | 48        |
| <b>4. RESULTS AND ANALYSIS .....</b>                          | <b>49</b> |
| 4.1 HYPOTHESIS TESTING.....                                   | 49        |
| 4.1.1 Telepresence.....                                       | 49        |
| 4.1.2 VR Effects on Dependent Variables .....                 | 50        |
| 4.1.3 Telepresence as a Mediator.....                         | 51        |
| 4.1.4 Product Type as a Moderator .....                       | 53        |
| 4.1.5 Involvement with Technology as a Moderator .....        | 55        |
| 4.1.6 Involvement with Technology ANOVA.....                  | 57        |
| 4.1.7 Previous VR Experience.....                             | 58        |
| 4.2 MODEL SUMMARY .....                                       | 59        |
| <b>5. FINAL DISCUSSION .....</b>                              | <b>61</b> |
| 5.1 DISCUSSION OF RESULTS AND THEORETICAL CONTRIBUTIONS ..... | 61        |
| 5.1.1 Increased Sense of Telepresence .....                   | 61        |
| 5.1.2 Cognitive and Conative Effects.....                     | 62        |
| 5.1.3 Telepresence as a Mediator.....                         | 63        |
| 5.1.4 Product Type as a Moderator .....                       | 64        |
| 5.1.5 Involvement with Technology as a Moderator .....        | 66        |
| 5.2 MANAGERIAL IMPLICATIONS.....                              | 67        |
| 5.2.1 Sales Perspective .....                                 | 67        |
| 5.2.2 Cost Perspective.....                                   | 68        |
| 5.2.3 Branding Perspective .....                              | 68        |
| 5.3 CONSUMER IMPLICATIONS.....                                | 69        |
| 5.3.1 Evaluation Perspective.....                             | 69        |
| 5.3.2 Critical Perspective .....                              | 70        |
| 5.4 CONCLUSION.....                                           | 70        |
| 5.4.1 Product Evaluations .....                               | 70        |
| 5.4.2 Telepresence.....                                       | 71        |

|                                                 |           |
|-------------------------------------------------|-----------|
| 5.4.3 Product Type.....                         | 71        |
| 5.4.4 Branding and Website Evaluation .....     | 71        |
| 5.4.5 Concluding Summary.....                   | 72        |
| 5.5 CRITICISM AND LIMITATIONS OF THE STUDY..... | 72        |
| 5.5.1 Respondent Access and Sample .....        | 72        |
| 5.5.2 Website Design.....                       | 72        |
| 5.5.3 Product Types.....                        | 73        |
| 5.6 SUGGESTIONS FOR FUTURE RESEARCH .....       | 73        |
| <b>6. LIST OF REFERENCES.....</b>               | <b>75</b> |
| 6.1 LITERATURE: ACADEMIC JOURNALS .....         | 75        |
| 6.2 LITERATURE: BOOKS .....                     | 79        |
| 6.3 ELECTRONIC SOURCES.....                     | 79        |
| 6.4 INTERVIEWS WITH INDUSTRY EXPERTS.....       | 80        |
| <b>7. APPENDIX.....</b>                         | <b>81</b> |

## Definitions

**Virtual reality headset (VR headset):** A headset that is putted on a user's head to cover the eyes (see appendix 11). The headset is used for the user to be immersed into a virtual reality (Goldman Sachs investment research, 2016).

**Virtual reality (VR):** A technology that immerses the user with a VR headset into an imagined or replicated world or simulates presence in what resembles the real world (Goldman Sachs investment research, 2016).

**Non-immersive virtual reality:** Non-immersive VR is an interactive 3D picture used to display products on websites (see appendix 1). The user can interact with the 3D image on a computer screen where the user can rotate and alter functions of the product as well as zoom in on the product image. The experience is limited to the computer screen and is not used with a VR headset (Mills and Noyes, 1999). Non-immersive VR used to be referred to as only VR, but could more correctly be referred to as 3D in 2017. This will be further elaborated in section 2.1.2.

**Immersive virtual reality:** This form of VR is what is more correctly referred to as VR in 2017 and will be investigated in this thesis. Immersive VR requires the wearing of a VR headset. When the user put on the head-mounted display they are surrounded by a virtual environment and excluded by the physical surrounded environment (Mills and Noyes, 1999). See section 2.1.3.

**Augmented reality (AR):** Unlike VR that creates a totally artificial environment, AR uses the existing environment and overlays new information (as for example pictures) on top of it (Goldman Sachs investment research, 2016). AR will not be investigated in this thesis.

**Virtual reality picture (VR picture):** A picture that can be seen in a 360 degrees format with a VR headset (Interview Emma af Robson, 20-02-2017).

**Virtual reality movie (VR movie):** A movie that can be seen in a 360 degrees format with a VR headset (Interview Emma af Robson, 20-02-2017).

**2D picture:** A two-dimensional picture on a computer screen in which a consumer can only view. No rotation functions are possible.

**E-commerce:** Commercial transactions conducted online (Levy and Weitz, 2012).

**Online pure player:** A company that only operates on the Internet through e-commerce, as opposed to traditional *brick and mortar* retailer (Levy and Weitz, 2012).

**Brick and mortar retailers:** A retailer that operates with physical stores (Levy and Weitz, 2012).

# 1. INTRODUCTION

*This introductory chapter will cover the background and current problem of marketing research within virtual reality. This is in order to explain the urgent importance of further research in the effects of virtual reality, especially within e-commerce. The sections purpose, expected contribution and research question will explain how the thesis will investigate the effects of using virtual reality in an e-commerce context.*

## 1.1 BACKGROUND

Virtual reality (VR) could in its simplest form be described as a virtual created world (Mills and Noyes, 1999). In order to see the virtual created world, users are required to put on a VR headset that simulates presence in what resembles the real world. It might sound like science fiction but it is a matter of fact a more and more common consumer product in 2017.

Nintendo launched VR headsets already in 1995, but the launch was described as a flop (Goldman Sachs investment research, 2016). Instead, 2016 was the year when VR could be described as having a commercial breakthrough (HUI Research, 2016). One of the reasons was that the smartphone industry has improved quality and cost of VR since most smartphones can be used as displays in VR headsets (see appendix 11) (Goldman Sachs investment research, 2016). Therefore, more consumers have now bought affordable VR headsets to their homes. A VR headset was even awarded *The Christmas present of the year* 2016 in Sweden (HUI Research, 2016). Furthermore, VR has developed within education, healthcare and especially gaming, which has expanded the amounts of households with VR headset even more (Interview Emma af Robson, 20-02-2017). This has resulted in that many different companies have even started using VR for marketing purposes. For example, the real estate agency Sotheby started to show real estate listings in VR (ibid.).

Based on many of these recent events, VR is described to be the biggest technological progression since the development of moving images (HUI Research, 2016). Heather Bellini, Business Unit Leader of Goldman Sachs Research, expects VR and augmented reality (AR) to be roughly equal the size of the desktop PC market in 2025. The evolution of VR is even estimated to eventually replace mobile phones and PCs. Retail e-commerce is estimated as one of the first markets to be disrupted and is expected to have 32 million users of VR by 2025. This since VR reduces the need for in-store-

display of products and makes it possible for consumers to view products with their VR headset at home (Goldman Sachs investment research, 2016).

Meanwhile, e-commerce continues to rise in importance. In Sweden, retail e-commerce increased by 16% in current value terms in 2016 (Euromonitor International, 2017). The e-commerce landscape is faced with fierce competition and is struggling to overcome the obstacle of not being able to physically display their products (Levy and Weitz, 2012). Since more and more consumers now have access to a VR headset, a VR picture for product presentations could be a perfect example of how retail e-commerce could create an advantage towards its competitors. The question still remains: What are the online companies waiting for?

## 1.2 PROBLEM DISCUSSION

The problem, despite these bright VR forecasts and recent commercialisation of VR headsets, is that there is a significant lack of examples and research in the effects of using VR in e-commerce both within the retail industry and also within academic literature.

The VR agency Warpin Media states that e-commerce companies would have an easier time to approach VR product presentations if there were more examples and studies on the effects of using it (Interview Emma af Robson, 20-02-2017) (see the interviews in section 3.2). They further states that the reports on the effects of VR that are available today are rather based on the effects of brand building VR movies and not the effects of VR product presentations within e-commerce (ibid.). For example, the Nielsen report in 2016 (Nielsen research, 2016). The results from those studies are therefore difficult to connect to how consumers would react to product presentations in a purchase situation.

An interview with the online retailer Furniturebox believes that VR will develop within e-commerce but that it would be expensive for the company to invest in without any indications of what the consumer effects would be (Interview Felix Kwick, 21-02-2017). So even though companies within e-commerce would like to implement VR they are left without guidance on how and what the effects would be. Based on the above interviews, the question to be answered and requested in the industry



is still if it would be necessarily better to merchandise products with VR or would the effects be the same as with pictures?

There has been academic research on the effects of VR within other industries than retail e-commerce, as for example engineering (Meyrueis et al., 2013), education (Roussou, 2009), medicine (Hoffman et al., 2009) and psychology (Bouchard et al., 2013). However, this research leaves no guidance on e-commerce related responses, as for example product attitude and purchase intention. There has previously been research that could be considered similar to VR product presentations, as for example research within website atmospherics, 3D product presentations or advertising in e-commerce/websites (Choi and Taylor, 2014; Debbabi et al., 2010; Eroglu et al., 2003; Jiang and Benbasat, 2007; Klein, 2003; Lee et al., 2014; Li et al., 2001, 2002; Song et al., 2007; Suh and Chang, 2011; Suh and Lee, 2005). However, a 3D picture on a computer screen is a fundamentally different medium that differs significantly from being immersed with a VR headset (Mills and Noyes, 1999). It could therefore be a mistake to draw conclusions of VR based on 3D research.

The choice of medium context for the communication message has previously shown to give different effects on the consumer response (Lorenzo et al., 2007; Pelsmacker et al., 2002). The characteristics of the medium could influence the perception. For example, there could be different consumer effects based on if an advertisement is placed in a magazine or run as a TV-commercial (Pelsmacker et al., 2002). Also, in an e-commerce context, product pictures compared to product movies have shown to give different effects on customers (Lorenzo et al., 2007). The medium of presentation has therefore previously shown to matter for the response. Since VR differs fundamentally from other mediums, it is of importance that the effects of VR will be further investigated.

The problem is therefore the lack of research into the effects of VR within e-commerce. Considering the forecasted success of VR within e-commerce makes it of critical importance for e-commerce stakeholders as well as academic literature that the effects of VR are more carefully investigated. This in order to drive more informed investment decisions based on research within e-commerce in the future.

## 1.3 PURPOSE AND EXPECTED CONTRIBUTION

Based on the background and problem discussion, the purpose and aim of this thesis will consequently be to answer if a product shown with a VR picture compared to only 2D pictures could have more positive effects on the consumers. Furthermore, the thesis investigates if there are certain types of products that suit better in VR and if consumers' involvement with technology can have an impact on the effects.

First of all, this thesis is expected to contribute theoretically to the line of research on VR as it is expected to grow significantly in importance over the next coming years. Additionally, the thesis will contribute empirically with guidance to organisations that want to optimise a future investment in VR within e-commerce. Moreover, the thesis will, besides empirically investigating the effects of VR, contribute with a simple example of how to use VR product presentations within e-commerce, as there is currently a lack of examples of usages.

### 1.3.1 RESEARCH QUESTION

Based on the background, problem discussion and purpose the primary research question of the thesis is:

- *Will there be more positive effects on the consumer of displaying products in VR product presentations as compared to only 2D pictures in an e-commerce context?*

Two secondary research questions are also being investigated:

- *Is there any specific product type that suits better in VR than others?*
- *Are the effects on consumers different depending on their level of involvement with technology?*

## 1.4 DELIMITATIONS

The first delimitation is that this study chooses to focus on VR product presentations within retail e-commerce. This since research of the effects of VR product presentations within e-commerce was found to be a major literature gap within current academic research (see section 2.1). Furthermore, furniture is predicted to remain some of the most popular product categories in Swedish e-

commerce (Euromonitor International, 2017). Additionally, furniture is one of the product categories predicted by The Goldman Sachs Group to be disrupted by VR (Goldman Sachs investment research, 2016). Therefore, furniture is the selected product category of investigation in this study.

The second delimitation is that the stimulus used is VR 360 degrees pictures and not VR 360 degrees movies. This since the chosen product category furniture does not necessarily has moving attributes for evaluation. Therefore, VR pictures are expected to be the most reasonable media for evaluation of products in the future. Since this study investigates the effects of VR 360 degrees pictures it was considered a logical choice to compare the results to 2D pictures. 2D pictures are also the most common way to display products for e-commerce. It would therefore be reasonable to compare VR to the current state of art in e-commerce merchandising.

The third delimitation is the VR headset chosen for this study. The study is using a VR headset for 360 degrees pictures in the experiment (see appendix 11) and is not investigating VR headset equipped with controls to navigate or touch into the virtual environment. The reason is that the most common VR headset during 2016 among consumers is the simpler kind with non-navigation functions (Interview Emma af Robson, 20-02-2017). Therefore, it could be argued reasonable that the progression of using VR within e-commerce would be adapted to this simple form of VR, and not the more expensive and advanced VR with navigation controls (see appendix 11 and 12). The definition of VR will therefore in this thesis be regarded to be VR 360 degrees pictures seen from a VR headset with non-navigation functions (see 2.1.4).

The fourth delimitation is the effects selected in this study (see section 3.8.4). The chosen effects are well-established measures within previous e-commerce research and are also being considered the most interesting ones for online retailers based on the interviews with industry experts (see section 3.2). The effects to be measured are product attitude, product knowledge, purchase intention, perceived diagnosticity, brand attitude, website trust, website satisfaction and intention to return to similar websites.

The last delimitation is that the target group is the age of 18-29 since the sampling method was made on the students at Stockholm School of Economics. The reasons were financial- and time constraints of this thesis (section 3.7.2).

## 1.5 THESIS OUTLINE

This thesis consists of five chapters being 1) Introduction, 2) Theory, 3) Methodology, 4) Results and Analysis, and 5) Final discussion. The next chapter, Theory, will present the review of the relevant literature that will be fundamental for the hypothesis generation. The third chapter, Methodology, will give insights from industry experts and present three pre-studies that will guide the design of the main study. The fourth chapter, Results and Analysis, will test the hypotheses presented in the second chapter and analyse the results in order to conclude whether to support the hypotheses or not. The last and fifth chapter, Final Discussion, will discuss the results found from the fourth chapter and present the theoretical contribution followed by managerial implications, consumer implications, criticisms of the study and suggestions for future research on the investigated area.

## 2. THEORY

*This section will further look into the current academic literature within VR in order to define the current research gap on VR. The section will thereafter present the theoretical framework used for hypothesis generation and a conceptual model for this thesis.*

### 2.1 LITERATURE REVIEW

The literature review will begin by investigating the definition of virtual reality in past literature since there are inconsistencies of the definition.

#### 2.1.1 VIRTUAL REALITY DEFINITION IN PAST LITERATURE

The term VR is quite misleading as it could refer to different applications. In order to review the existing VR literature, it is first important to distinguish between the different definitions. VR applications can be divided into two categories: 1) immersive VR and 2) non-immersive VR (Mills and Noyes, 1999). These two categories are described as being two completely different applications.

1) *Immersive VR* is what is referred to as VR in 2017. Immersive VR requires the users to wear a VR headset, which creates a virtual world around them.

2) *Non-immersive VR* could more correctly in 2017 be referred to as 3D and not VR. It is described as a 3D picture on a computer screen where the user can rotate and alter functions of the product as well as zoom in on the product image. The experience is limited to the computer screen and is not used with a VR headset (Mills and Noyes, 1999). See an example of a 3D picture in appendix 1.

#### 2.1.2 RESEARCH ON NON-IMMERSIVE VR

Despite the distinctions between non-immersive VR and immersive VR, earlier researchers have sometimes used the broad term VR when they more correctly are referring to a 3D picture (Jiang and Benbasat, 2007; Suh and Chang, 2011; Suh and Lee, 2005). This could create some confusion about the concept and what kind of VR applications the researchers are referring to.

For instance, the term VR was in research by Suh and Lee (2005) and Suh and Chang (2011) described as interactive 3D pictures on a computer screen where consumers can rotate, alter functions of the product and zoom in on the image. However, this sort of VR would correctly be referred to as non-immersive VR or even 3D pictures on a computer screen. This research has shown that the 3D pictures were able to benefit the shopping by improving, for example, purchase intention and consumer learning (ibid.).

In addition, research on non-immersive VR is often referred to as *virtual product experiences*, *VPE* (Jiang and Benbasat, 2007; Li and Meshkova, 2013; Song et al., 2007). However, this is also more correctly referring to 3D product presentations and not VR. Research on virtual product experience has shown to increase consumers' willingness to purchase and also make it easier for consumers to evaluate the product (ibid.).

Moreover, there has been research on the effects of brands and products displayed in virtual worlds (Hassell et al., 2009). Virtual worlds could here be described as the online game *Second life* where the user has an avatar to navigate itself around in a 3D world. Even though that this line of research refers to virtual worlds, it is still seen in 3D on a computer desktop and should not be confused with a world in immersive VR. This research has found that the user experiences more satisfaction with the learning and that the experience could be equal to face-to face learning (ibid.).

Since immersive VR is a fundamental different medium from non-immersive VR (Mills and Noyes, 1999), one should be critical to draw conclusions that the previous research on 3D pictures or non-immersive VR would give the same consumer effects as in immersive VR. As previously described in *Problem discussion* (section 1.2), the characteristics of the medium could influence the perception (Pelsmacker et al., 2002). For example, there could be different consumer effects based on if an advertisement is placed in a magazine or is run as a TV-commercial (ibid.). Also, in an e-commerce context, product pictures compared to product movies have shown to give a different response from customers (Lorenzo et al., 2007). It could therefore be a mistake to draw conclusions on VR based on 3D research without empirical testing. It is therefore important with further research within the use of immersive VR within e-commerce to be able to draw correct conclusions regarding the consumer response.

### 2.1.3 RESEARCH ON IMMERSIVE VR AND THEORETICAL RESEARCH GAP

When reviewing existing literature within immersive VR, it becomes clear that this research is more limited compared to literature within non-immersive VR. As described above, research within non-immersive VR has investigated the effects of 3D within marketing and especially in product evaluation in e-commerce. However, research on immersive VR has mostly been conducted within engineering, education, medicine and psychology. Within engineering, Meyrueis et al. (2013) proposed that VR provides a more cost effective prototyping process. Within education, Roussou (2009) showed that a VR interface did not seem to enhance conceptual learning but did improve problem-solving skills. Gou et al. (2004) showed encouraging results for the use of VR within memory rehabilitation among elderly. Within medicine, Hoffman et al. (2009) showed that VR could be an effective tool in pain reduction technique during physical therapy. Also within psychology, Bouchard et al. (2013) showed that people could feel empathy for other humans in VR. However, one should be critical to draw conclusions on VR based on this research since it does not give guidance on the e-commerce related effects, as for example product attitude and purchase intention. Thus, a literature gap can be found on the effects of immersive VR product presentations within e-commerce.

### 2.1.4 VR DEFINITION IN THIS THESIS

All sections below will not mention immersive or non-immersive VR. *Immersive VR* will in this thesis be referred to as only *VR*. More specifically this will mean VR 360 degrees pictures seen from a VR headset with non-navigation functions as described in *1.4 Delimitations*. Non-immersive VR will more correctly be referred to *3D* pictures in which users can interact with the image on a computer screen by rotating, altering and zooming (Mills and Noyes, 1999).

## 2.2 THEORETICAL FRAMEWORK AND HYPOTHESIS GENERATION

The conceptual model below is proposed to show a visual overview of the hypotheses (figure 1). The theory that forms the conceptual model will further be elaborated in the following section. Due to the lack of research within VR, this section has instead used extensive research that could be analysed as having similar effects as VR in order to form the hypotheses. Even though it would not be correct to draw conclusions of the effects of VR based on 3D product presentations and other similar research, it could still be reasonable to use it as an inspiration for what variables to test in

VR. The below listed theory is from research on telepresence, 3D product presentations, website atmospherics and advertising.

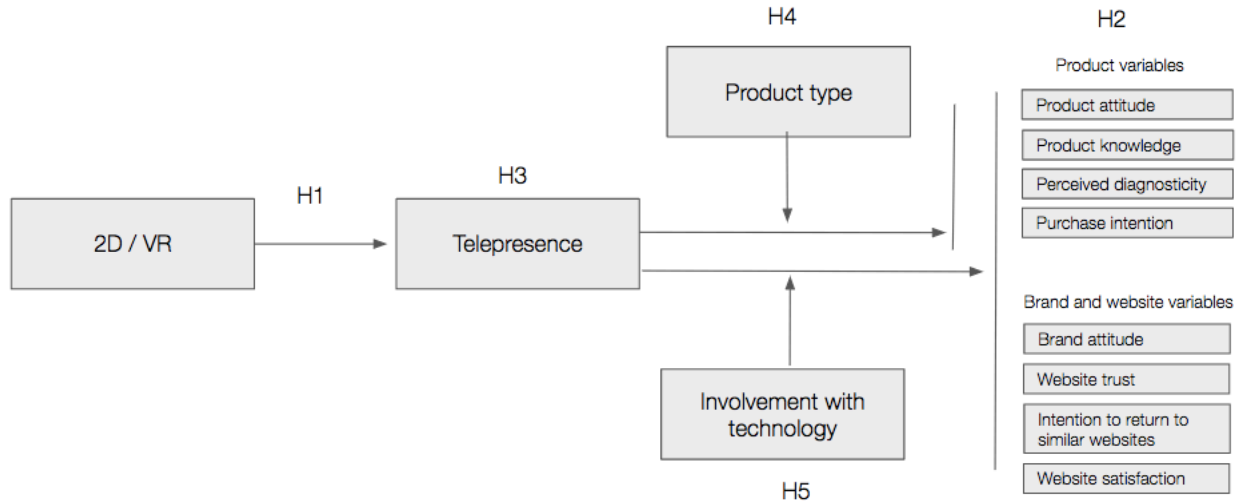


Figure 1: Conceptual model of the thesis

### 2.2.1 TELEPRESENCE

Previous research on 3D pictures has found that 3D affects the respondent's sense of *telepresence*. The concept telepresence has been broadly defined over the years. In a literature review study by Grüter and Myrach (2012), the most appropriate and referred definition is by Steuer (1992): “Telepresence is the experience of presence in an environment by means of a communication medium”. Thus “presence” refers to being in the natural environment, and “telepresence” refers to being in the computer-mediated environment (Steuer, 1992). Telepresence is created by two characteristics: (1) media richness and (2) interactivity (Biocca, 1997; Klein, 2003; Steuer, 1992). (1) Media richness is the intensity level of the mediated environment that provides stimuli to the senses and consists of breadth and depth. Breadth refers to the number of sensory channels simultaneously presented (i.e. sight, hearing, smell, touch and taste) and depth refers to the quality of each sensory channel. (2) The second characteristic, interactivity, represents how much users can change the form and content of a mediated environment in real time (Steuer, 1992).

Research has demonstrated that 3D images increase the level of telepresence compared to 2D images (Biocca and Daugherty, 2001; Debbabi et al., 2010; Klein, 2003; Li et al., 2001, 2002; Suh and Chang, 2011; Suh and Lee, 2005). This because of the high level of media richness and interactivity



through better visual sense and interactivity with the 3D image by zoom-, alter- and rotation functions (Klein, 2003). Therefore, it is reasonable to believe that products displayed in VR compared to 2D pictures can generate more telepresence for users through higher focus of the vision and rotation function of deciding what to look at in the virtual world.

**H1:** Websites that provide VR product presentations will give a higher sense of telepresence as compared to websites that only provide 2D pictures.

Telepresence has also shown to act as a mediator for other positive consumer effects from a 3D product presentation. These other proposed effects will therefore first be presented below before telepresence will be further elaborated as a mediator in section 2.2.4.

## 2.2.2 COGNITIVE AND CONATIVE EFFECTS

Research on telepresence, 3D product presentations, website atmospherics and advertising has previously shown to give *cognitive* and *conative* effects on the consumer. This section of the chapter will therefore further describe how these below listed variables could be affected by the use of VR product presentations. The section will start by describing the cognitive effects and thereafter the conative effects. The hypothesis will be presented in the end of the section.

## 2.2.3 COGNITIVE EFFECTS

*Cognitive* measures are used to investigate the ability of a stimulus to draw attention and generate knowledge and comprehension (Li et al., 2002). This section will further elaborate on what cognitive effects that might result from the use of VR product presentations.

### 2.2.3.1 Product Attitude

An attitude is by Fishbein (1963) described as “the results from the accumulation of values that an individual comes to expect from the attributes of an object”. Previous research on telepresence and the effects of 3D has shown that 3D product presentations as compared to 2D images could result in improved product attitude (Kim et al., 2007; Klein 2003; Li et al., 2001, 2002; Suh and Chang, 2011). This was explained with the concept of direct and indirect product experiences. A direct

product experience refers to when the customer inspects the product in reality and indirect experience refers to the experience of a product from a mediated source (e.g. advertising) (Li et al., 2002). When a customer experiences telepresence, it is more likely that the customer considers its experiences as direct (Kim and Biocca, 1997; Li et al., 2001, 2002; Suh and Lee, 2005). Why a direct product experience is so effective in forming favourable attitudes could be explained since it allows the consumer to better inspect and evaluate the product, which gives the consumer a greater level of confidence (Debbabi et al., 2010). VR does not have the same rotation and interactivity functions as a 3D picture and therefore it is uncertain if the same results will hold for product presentations in VR as in 3D. However, since VR compared to 2D images offers an even better level of visual media richness it is reasonable to believe that VR could help the customer to better understand the product than 2D pictures, which could result in better product attitude.

Moreover, a VR product presentation could be seen as a creative and expensive investment from the company. Greater perceived advertising spending and advertising creativity have shown to indicate more effort from the company (Kirmani and Wright, 1989; Dahlén et al., 2008). More effort in the advertising could in turn signal that the company has a greater level of confidence in their products, which indicates a better product quality (Kirmani and Wright, 1989). The consumers thus feel safer that the company will live up to their promise if the company has put more money and therefore risk into the marketing (Kirmani, 1997). In the same reasoning, it can be argued that VR used by a brand can indicate credibility for its products and therefore increase product attitude. The hypothesis proposition is therefore that VR product presentation will improve positive consumer response in form of product attitude as compared to 2D pictures.

#### 2.2.3.2 Brand Attitude

Brand attitude could be defined as a consumer's evaluation of the brand and is a well-established marketing effectiveness measure (Batra and Ray, 1986; Li et al., 2001). A firm that uses 3D could potentially be seen as more creative or innovative, which would result in better brand attitude. In the same reasoning as with product attitude, the consumer thus feels safer that the company will live up to their promise if the company has put more money and therefore risk into the marketing (Kirmani, 1997). Also, previous research has shown that 3D pictures could increase brand attitude (Lee et al., 2012; Li et al., 2001, 2002). Therefore, besides that VR is facilitating the understanding of the product presentation, VR could potentially also work as a tool that affects the brand attitude.

#### 2.2.3.3 Website Satisfaction

A study by Eroglu et al. (2003) showed that consumers will get higher satisfaction with a website that has a higher level of quality of their atmospheric cues (colours, graphics, layout, design and information). To get higher website satisfaction means that the consumer enjoyed visiting it, was satisfied with the shopping experience and would recommend the website to other people (ibid.). A website that provides VR can be seen as giving higher atmospheric cues, which could therefore increase the website satisfaction among consumers.

#### 2.2.3.4 Website Trust

Website trust is a relevant measure in e-commerce since online shopping is perceived to be risky and if a website is unknown or new to a consumer, uncertainty increases (Liu et al., 2005). A product that has been more real due to higher immersion from the website has reduced the ambiguity of the product information and increased website trust (Song and Zinkhan, 2008). Website interactivity has also proven to increase consumer's confidence about a website, and hence trust (Fiore et al., 2005). Lee and Park (2014) showed that a greater number of cues on an online website led to a greater sense of telepresence, which in turn led to more website trust. It can therefore be assumed that websites that provide VR compared to only 2D will increase website trust.

#### 2.2.3.5 Perceived Diagnosticity

Jiang and Benbasat (2005) described the measure *perceived diagnosticity* as to represent consumers' perceptions of a website's ability to give relevant product information that can help them understand and evaluate products online. They showed (2007) that 3D product presentations enhanced the perceived diagnosticity when comparing to 2D product presentations. Jiang and Benbasat (2005) explained that if a product presentation provided richer language and more cues that could engage more senses with interactivity function to alter the product design and distance, people would understand and evaluate the quality and performance of the product better. Therefore, it is reasonable to believe that VR (i.e. has a better product presentation provided by the website) compared to 2D is expected to have more media richness and interactivity that will increase perceived diagnosticity.

#### 2.2.3.6 Product Knowledge

Product knowledge is the amount of knowledge a consumer has of a product (Li et al., 2002). Greater product salience through colour, 3D and sound (Hutchinson and Alba, 1991) as well as interactive and rich media content online, have been linked to increased learning (Hoffman and Novak, 1996, 1997). 3D advertising and product presentations compared to 2D have also proven to increase product knowledge (Li et al., 2002; Suh and Chang, 2011; Suh and Lee, 2005). Therefore, it is believed that VR will increase consumers' product knowledge compared to 2D.

#### 2.2.4 CONATIVE EFFECTS

*Conative* measures are used to anticipate the behaviour of a consumer after exposure to a stimulus. For example, purchase intention is one of the most widely used conative measures within advertising research and is defined as a thing intended; an aim or a plan (Andrews et al., 1999; Li et al., 2001).

##### 2.2.4.1 Purchase Intention

Research on 3D advertising has previously shown that 3D pictures tend to increase purchase intention of the product (Li et al., 2001, 2002; Suh and Lee, 2005). This could be explained by the direct experience that the virtual 3D picture succeeds to communicate (Li et al., 2002). Since 3D pictures could be more effective in communicating a direct experience and therefore can more effectively present product information, it should provide the customer with the ability to make a more informed and confident decisions regarding the product (Debbabi et al., 2010). Previous research on telepresence has also shown that an increased sense of telepresence increases shopping enjoyment, which has in turn led to increased willingness to purchase (Song et al., 2007). Shopping enjoyment is defined as the pure joy that people feel in their shopping experience for its own sake besides from any product selection and evaluation (Hirschman and Holbrook, 1982) and is increased by mental engagement in a shopping activity (Song et al., 2007). A VR product presentation could because of its immersive headset be seen as a way to increase mental engagement in a shopping activity and therefore also create more telepresence, shopping enjoyment and willingness to purchase. It is therefore reasonable to believe that a VR product presentation should increase customers' purchase intention compared to 2D.

#### 2.2.4.2 Intention to Return to Similar Websites

Previous research on 3D product presentations has also shown that consumers would like to return to websites more with 3D advertising than websites with 2D advertising (Choi and Taylor, 2014). Intention to return to similar websites is a behavioural intention where consumers would like to return to similar websites the next time they need a product and would like to use websites with similar characteristics (Coyle and Thorson, 2001). In the same vein, websites with VR and not only 2D pictures could increase the revisit rate among consumers.

#### 2.2.5 SUMMARY OF H2

Here follows a summary of all the cognitive and conative effects presented above in Hypothesis 2.

**H2:** Websites that provide VR product presentations will result in more positive effects on the dependent variables (a-h) as compared to websites that provide only 2D pictures.

- a - Product attitude
- b - Product knowledge
- c - Purchase intention
- d - Perceived diagnosticity
- e - Brand attitude
- f - Website trust
- g - Website satisfaction
- h - Intention to return to similar websites

#### 2.2.6 TELEPRESENCE AS A MEDIATOR

Telepresence has not only been seen as an effect in isolation. Instead, previous research has shown that telepresence has worked as an explanatory variable for other cognitive and conative effects (Debbabi et al., 2010; Li et al., 2002; Suh and Chang, 2011). A higher sense of telepresence is what gives the consumer a higher sense of a direct experience with the product. Telepresence has therefore been analysed as the factor that affects consumer behaviour and attitudes (Debbabi et al., 2010; Li et al., 2002). For example, Debbabi et al. (2010) found that telepresence mediates the

relationship from the format (2D, 3D) to product attitude, purchase intention and also the level of confidence the consumer feels about the product. Li et al. (2002) found that telepresence is what mediates the effects on brand attitude and product knowledge. Since Debbabi et al. (2010) and Li et al. (2002) showed that telepresence is an explanatory variable that function as a mediator, one could therefore argue that it is reasonable that telepresence will work as a mediator to the other above mentioned cognitive and conative effects.

**H3:** Telepresence will function as a mediator from the manipulation (VR/2D) to the dependent variables (a-h):

- a - Product attitude
- b - Product knowledge
- c - Purchase intention
- d - Perceived diagnosticity
- e - Brand attitude
- f - Website trust
- g - Website satisfaction
- h - Intention to return to similar websites

## 2.2.7 PRODUCT TYPE

Li et al. (2003) analysed three types of products that are commonly used in 3D; categorised as geometric, material and mechanical products. They define geometric products as those whose attributes can be fully understood by the visual dimension (i.e. candy bar), material products that require touch to be evaluated (e.g. towel) and mechanical products that are those objects that the consumers also want to interact with before making a purchase decision (e.g. camera).

These product types have been used in different product evaluation experiments (Choi and Taylor, 2014; Debbabi et al., 2010; Li et al., 2003; Suh and Lee, 2005). However, Suh and Lee (2005) criticised the product definitions in their study for being not exhaustive. They explained that other sensory dimensions such as taste, smell or hearing are not included in the typical classification system. For example, a bag of potato chips or a candy bar also require consumers' smell and taste for satisfactory information, not only vision. Moreover, the authors complained that it was an

absence of a proper product type fitting in the medium of 3D that included both vision and hearing. Therefore, they created their own product definitions called *virtually high experiential* (VHE) products suited perfectly in 3D and *virtually low experiential* (VLE) products that were not as suitable. VHE products could effectively be evaluated by only vision and hearing such as a computer table (see appendix 1). VLE products also required other sensory dimensions that 3D could not offer (ibid.).

In the same way as Suh and Lee (2005) defined new product types which they considered important for 3D pictures, the same thinking has been used in this thesis due to lacking product definitions suited for VR within the cognitive fit theory. Two product types have therefore been created and defined in this thesis based on the special characteristics of VR. See the new created product types defined and explained below:

| Product types                                            | Definition and explanation                                                                                                                                                                         |
|----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Vision Product (VP)<br>Vision Products (VPs)             | Products that consumers require only the visual inspection as important before making a purchase. Since VR provides only strong visual inspection, VP types are therefore fully appropriate in VR. |
| Vision Product Plus (VP+)<br>Vision Products Plus (VPs+) | Products that consumers require more sensory inspections as important before making a purchase. Since VR lacks the interaction capabilities, VP+ types are less appropriate in VR.                 |

Figure 2: Product type definitions

Since this thesis is limited to study only furniture, smell and taste inspections are excluded from this study. Moreover, the three most common inspection variables when evaluating products used by Li et al. (2003) are vision, touch and behavioural. Therefore, those three inspection variables have been chosen to be suitable for the study. This means that for VP+, both vision as well as the touch- and/or the behavioural inspection are important.

Previous research has found that product type works a moderator when comparing 2D and 3D (Choi and Taylor, 2014; Debbabi et al., 2010; Li et al., 2003; Suh and Lee, 2005). VHE products showed significant higher effects than VLE products, and geometric products showed significant higher effects than material- and mechanical products. However, all studies still show that products

displayed in 3D regardless of what type of product (geometric, material, mechanical, VHE products or VLE products) have resulted in improved effects compared to 2D.

Therefore, it is reasonable to believe that product type in this study also can be used as a moderator since the similar characteristics of 3D and VR. However, unlike previous studies on 3D product presentations, both product types are not expected to gain improved effects when they are displayed in VR. Since VR pictures are mainly providing visual attributes and lack the interactivity functions (rotation, audio, zoom and alter functions of the product) that 3D pictures could provide, it could be believed that only VP, and not VP+, could gain higher effects from using VR than only showing those products in 2D. The hypothesis will only affect the product related variables (a-d) since the product type-moderator is only affecting variables regarding the product.

**H4:** Product type (VP and VP+) will moderate the relationship between the manipulation VR/2D, telepresence as a mediator and the dependent product variables (a-d).

a - Product attitude

b - Product knowledge

c - Purchase intention

d - Perceived diagnosticity

## 2.2.8 INVOLVEMENT WITH TECHNOLOGY

Personal characteristic such as involvement with a product category has in previous research shown to influence the outcome of the study and functioned as a moderating variable (Bloch, 1981). Day (1970) defines product involvement as “the general level of interest with an object or the centrality of an object with the person's ego-structure”. A consumer's ability to process information is largely due to the consumer's ability, motivation and opportunity to do so (Batra and Ray, 1986). The level of consumer involvement has been used as an explanation of a person's motivation to process the information from a product, situation or action. Consumer with a high level of involvement will allocate more effort and attention into the cognitive processing of information as compared to consumers with low involvement (Celsi and Olson, 1988). Thus, why involvement is seen as an



explanatory variable is because product categories differ in the level of interest among customers, and highly involved customers engage in more complex purchase decision-making (Bloch, 1981).

In this study, a VR headset could be seen as a technical equipment that respondents with high technology involvement might have a more positive attitude towards using. Consumers with high involvement with technology might see the use of a VR headset as something exciting and entertaining while consumers without technology involvement might see it as something difficult and therefore annoying. Therefore, consumers involved and interested in technology might evaluate the VR product presentation better than consumers without a technology involvement, both in terms of product, branding and website variables.

**H5:** Involvement with technology will moderate the relationship between the manipulation VR/2D, telepresence as a mediator and the dependent variables (a-h).

- a - Product attitude
- b - Product knowledge
- c - Purchase intention
- d - Perceived diagnosticity
- e - Brand attitude
- f - Website trust
- g - Website satisfaction
- h - Intention to return to similar websites

## 2.3 SUMMARY OF HYPOTHESIS GENERATION

For this study, five hypotheses are generated to lead the empirical investigation and analysis. Every hypothesis is related and developed from previous literature. See the summary below.

| Summary of Hypotheses       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Main effects of VR          | <p>H1: Websites that provide VR product presentations will give a higher sense of telepresence as compared to websites that only provide 2D pictures.</p> <p>H2: Websites that provide VR product presentations will result in more positive effects on the dependent variables (a-h) as compared to websites that provide only 2D pictures.</p> <p>H3: Telepresence will function as a mediator from the manipulation (VR/2D) to the dependent variables (a-h).</p> |
| Product type                | <p>H4: Product type (VP and VP+) will moderate the relationship between the manipulation VR/2D, telepresence as a mediator and the dependent product variables (a-d).</p>                                                                                                                                                                                                                                                                                            |
| Involvement with technology | <p>H5: Involvement with technology will moderate the relationship between the manipulation VR/2D, telepresence as a mediator and the dependent variables (a-h).</p>                                                                                                                                                                                                                                                                                                  |

Figure 3: Summary of hypotheses

### 3. METHODOLOGY

*In this chapter the method of the empirical studies will be elaborated. Initially, the scientific approach to test the hypotheses is described, followed by insights from industry experts who inspired the studies. After that, the preparatory work of three pre-studies is presented for the main study. Thereafter, the main study is presented with the sampling methods and variables in the questionnaire. The chapter will end with a discussion of the study's reliability, validity and replicability.*

#### 3.1 SCIENTIFIC APPROACH TO THE RESEARCH DESIGN

This thesis uses a deductive research methodology, grounded in existing theory but with hypotheses tested through empirical analysis (Bryman and Bell, 2011). Due to the lack of research within VR, similar academic research has been used to form the hypotheses. This study aims to investigate the causal relationships between presentation format (2D, VR), product type (VP, VP+) and several dependent variables. A quantitative survey based approach (Bryman and Bell, 2011) seemed therefore appropriate due to similar research approaches in this area (Li et al., 2002; Suh and Lee, 2005). Moreover, the study has support of qualitative interviews for the selection of important effects to measure. The lack of academic research within VR in e-commerce could further motivate the qualitative interviews within relevant industries for useful insights to the study. The quantitative main study had the chosen format of middle group design (Söderlund, 2010) with a 2x2 format consisting of four different groups. This research design was chosen since both effects from the used presentation format (VR compared to only 2D pictures) as well as effects from product type were of interest for the study. No group did see the product with only VR. The main study was an experiment with a self-reported questionnaire. The manipulation created for these groups will further be described in section 3.6.1. In summary, the four different groups included in the study were:

|                        | Visual product (VP) | Visual product plus (VP+) |
|------------------------|---------------------|---------------------------|
| 2D picture             | Group 1             | Group 2                   |
| 2D picture +VR Picture | Group 3             | Group 4                   |

Table 1: Experiment groups

## 3.2 INTERVIEWS WITH INDUSTRY EXPERTS

A preliminary step of this study was to get valuable insights from what could be considered industry experts. This was an important first step towards inspiring the main study since there is currently a lack of research within VR in e-commerce. Two exploratory interviews with similar questions were therefore conducted in order to see how different industries anticipated the future of VR and the effects from using it (see questions in appendix 2). The first interview of interest was with Emma af Robson, Co-founder of the VR agency *Warpin Media*, to get important insights of the VR industry. The second interview of interest was with Felix Kvik, Board Member and Former CEO of the online furniture company *Furniturebox*, to get insights from an e-commerce perspective and especially within furniture that was the chosen product category for this study.

### 3.2.1 INSIGHT FROM THE VR INDUSTRY

The first interview was conducted with Emma af Robson, Co-founder of Warpin Media. Warpin Media is one of the world's first VR agencies specialising in consulting and producing VR related content for various industries with customers such as H&M (Interview Emma af Robson, 20-02-2017).

The kind of VR requests that Warpin Media receives today are for VR movies that companies use for brand building purposes rather than the purpose of displaying products in e-commerce. Af Robson says that this is similar to when Internet still was a new concept and companies used websites mostly for brand building campaigns. However, af Robson refers to many VR forecasts and claims that VR in the future will rather function as the main page for e-commerce in the same way as a website functions as the main page for e-commerce today. Af Robson thinks that the next step for e-commerce will be product presentations in VR and not only for brand building. VR will, according to af Robson, offer many advantages for e-commerce since the new VR store does not need to be built within the physical boundaries of a traditional store. She says that “the opportunities are endless within a VR store. For example, products could be flying instead of being placed on a shelf”. Therefore, af Robson is convinced that VR will change the e-commerce industry completely.

When af Robson was asked about the effects suggested for this study, she was determined saying: “everything will be more positive evaluated”. She believes that seeing a product in VR will help the

consumer to evaluate the product attributes better and that VR can work as a branding tool for the company's website. Af Robson also thinks that bigger products that are difficult to move around will have an advantage of being exposed in VR. However, despite these advantages, af Robson claims that there is currently a lack of great examples of VR product presentations within e-commerce. She mentions that IKEA offered VR for a limited time in 2016 in their physical stores for customers to inspect their kitchen remodelling projects and was not available in their e-commerce stores. According to af Robson, there are many consumers in possession of a VR headset but there is rather a lack of VR content to experience today. Af Robson believes that all it would take for VR to take over in e-commerce is that one company has to start and be the first, then the rest will follow.

Warpin Media knows that many companies would be very interested in reports that would look into the actual effects on consumer behaviour from using VR in e-commerce. The reports available today are rather based on the effects of brand building VR movies and not the effects of VR product presentations (Nielsen research, 2016). The results from those studies are therefore difficult to connect to how consumers would react to product presentations in e-commerce.

When af Robson was asked about if there is a difference between targets of people and in how well they can take in the VR experience, she answered: "it is rather about how well you can respond and react to technology". She thinks that this would be interesting to look more into when researching the effects of VR. For example, she has noticed that younger people have an easier time in understanding and using VR, and therefore might get more out of the experience with it.

### 3.2.2 INSIGHT FROM E-COMMERCE WITHIN FURNITURE SHOPPING

The second interview was with Felix Kvik, Board Member and Former CEO of Furniturebox. Furniturebox is a Swedish e-commerce furniture company with online stores in several European countries (Interview Felix Kvik, 21-02-2017).

Kvik believes that VR will develop more within e-commerce but that it will probably take a few years before the consumers will understand the new technology. Kvik thinks VR could offer great advantages in terms of showing the product in a better way. This since the product could be placed in an actual environment for inspiration compared to what is possible with 2D pictures. One of the reasons why Furniturebox has not yet offered VR techniques to their website is that the effects are

unknown, why it is expensive to implement when not knowing the real consumer benefits from it. Additionally, he points out that he is unaware of any great example of an e-commerce company that has implemented it for product presentations, which makes it difficult to see how they would do it. Instead, he means that other simpler functions, like search functions for orders, are prioritised since these are known for increasing the customer benefit.

When Kvik was asked about the dependent variables suggested for this study, he strongly believed that particularly website trust and brand attitude would be increased for a company since the investment of VR. Kvik is primarily interested in to see if the conversion rate would increase if using VR for the products or if the cost of returned products could be lowered since that is one of the biggest costs for e-commerce companies today. He thinks that consumers would probably like the product better if a website offered more ways to interact with it and therefore it would be interesting to see if it would result in more purchases. However, he is still uncertain of what the exact effects would be since there is a lack of studies today within VR product evaluations.

Moreover, when asking about if the effects of VR can vary for different types of people Kvik answered that “a consumer that try VR for the first time would probably think it’s amazing, but a consumer that is used to it would probably require higher quality on the VR content produced”. Also, he believes that all type of products would benefit from it since VR could build up a whole new room with furniture for inspiration.

### 3.2.3 CONCLUDING REMARKS FROM THE INTERVIEWS

In conclusion, it was clear from both interviews that there are no great examples of e-commerce stores within the furniture industry that have used VR and no studies proving any positive effects from using VR for product presentations. This strengthens the interest of the research gap in this thesis as well from the business industry, and not only within theoretical academia.

Considering what type of products that would suit in VR, different answers were found from the interviews. Af Robson thought only big products meanwhile Kvik thought all products. These different opinions confirmed that it is interesting to test the cognitive fit theory based on previous academia to provide them with clear answers.

Additionally, an interesting point was that af Robson believed that it is a difference between targets of people in how well they can take in VR experience. Furthermore, Kwick rather thought that first time experience consumers would react more positive and therefore a question about *first time VR experience* was considered important to have in the survey.

Lastly, regarding the dependent variables, it was clear from the interviews that af Robson was confident in believing that all variables would be more positively evaluated in VR but that Warpin Media lacks proof of this. Kwick was more uncertain about the effects since the lack of studies but thought that primarily website trust would be enhanced due to a company's increased investment of VR. Overall, there seems to be many companies interested in these types of results that this study will provide and that it is expensive to implement VR when not knowing the real consumer benefits from it.

### 3.3 PREPARATORY WORK FOR THE MAIN STUDY

Three pre-studies were conducted in preparatory work for the construction of the main study. The purpose of all the three pre-studies was to select appropriate products for the manipulation of the study. The purpose of the first pre-study was to examine what product categories within furniture that would fit into the new defined product types: VP and VP+. In the second pre-study, the purpose was to determine specific product designs within the chosen product categories that did not differ in general product attitude. Lastly, the purpose of pre-study 3 was to test the level of telepresence for one of the chosen products with the fictitious website and VR material used since this was a fundamental part of the conceptual model in this thesis.

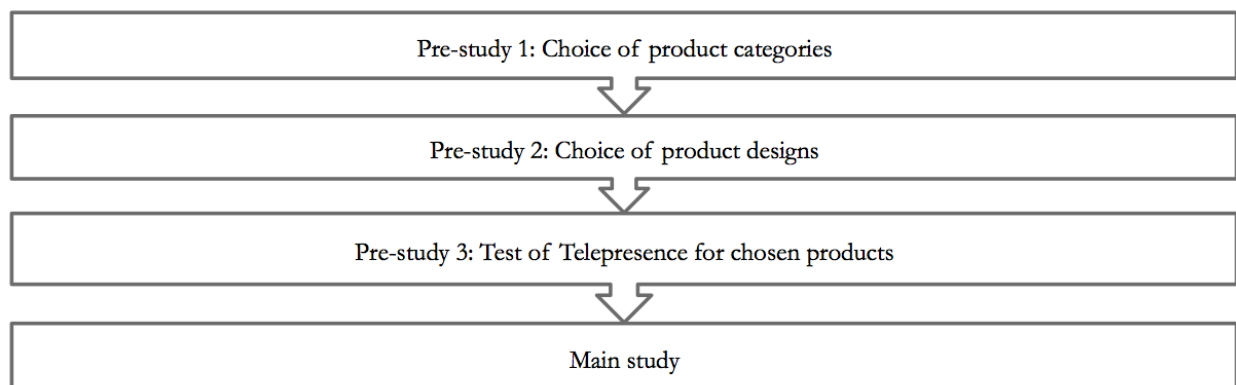


Figure 4: Overview of the pre-studies

## 3.4 PRE-STUDY 1: PRODUCT CATEGORIES WITHIN FURNITURE

### 3.4.1 PURPOSE AND SURVEY

The purpose of pre-study 1 was, as previously mentioned, to determine what product categories within furniture that could be classified into being a VP and VP+ type. The test was inspired by a study (Li et al., 2003) that defined geometric, material and mechanical products. The study defined the products by investigating what kind of inspections the respondents considered important when evaluating different products. A single-item eleven-point Likert scales (ranging from *not important at all* to *extremely important*) were taken from Li et al. (ibid.) to collect the responses on how important the *visual inspection* (to see the product), *touch inspection* (to touch the product) and *behavioural inspection* (to interact with the product) were before purchasing the product (see appendix 3). For a product to be defined as VP, the visual inspection needed to be the only important inspection. Therefore, the visual inspection mean should be significantly higher than the midpoint of 6 on the scale and the mean of the other inspections being significantly lower than the mean of 6. For VP+, other inspections besides visual inspections are important as well. Therefore, both the mean of the visual inspection and the other inspections are significantly higher than point 6 on the scale.

Six product categories in total were selected for the test: sofa tables, TV tables, lamps, carpets, sofas and armchairs. The study did not include 2D pictures since the purpose was to test products categories in general and not specific designs, which was pointed out as important by Li et al. (ibid.). The order of the six product categories was randomised, in order to not affect the outcome of the results. The survey was made in the common online survey tool *Qualtrics* and sent out to the authors' social network online, which could be referred as a convenience sample (Jacobsen, 2002).

### 3.4.2 RESULT AND CONCLUSION

The data was analysed in *SPSS 24* (see section 3.8.6 for more information). The survey received 33 respondents in the chosen target of 18-29 years old. Before analysing the results, the two variables *touch inspection* and *behavioural inspection* were put together into a mean called *interaction inspection mean*. The mean of the interaction inspection was then compared to the variable *visual inspection*. This was made in order to evaluate the relative importance of the visual inspection mean compared to the interaction mean of each product.



A *one sample t-test* with the test value 6 was conducted to compare the means of the different products and two of them were selected (see table 2). The sofa table had a high visual inspection mean (M=9.42) significantly higher ( $p=0.00$ ) from the midpoint 6 and a low interaction inspection mean (M=5.02) significantly lower ( $p=0.039$ ) from the midpoint 6. This means that a sofa table can be defined as being a VP. For the sofa, both the visual inspection (M=9.82) and the interaction inspection mean (M=8.83) were significantly higher from the midpoint 6 ( $p=0.00$ ). A sofa could therefore be put into the VP+ type.

| Product category | Test value= 6               |    |      |                |         |         |
|------------------|-----------------------------|----|------|----------------|---------|---------|
|                  | Manipulation                | N  | Mean | Std. deviation | t       | p       |
| Sofa table       | Visual inspection mean      | 33 | 9.42 | 2.61           | - 4.206 | .000*** |
|                  | Interaction inspection mean | 33 | 5.02 | 2.63           | -2.149  | .039*   |
| Sofa             | Visual inspection mean      | 33 | 9.82 | 1.76           | 12.731  | .000*** |
|                  | Interaction inspection mean | 33 | 8.83 | 1.224          | 6.809   | .000*** |

Significance levels: \*\*\*  $\leq .001$ , \*\*  $\leq .01$ , \*  $\leq .05$

Table 2: Result of Pre-study 1

### 3.4.3 CRITICISM OF PRE-STUDY 1

One could criticise that the first pre-study was sent out to the author's social network online that could be referred as a convenience sample (Jacobsen, 2002). Hence, it was not possible to ensure that the respondents had full attention of the survey (Jacobsen, 2002). In order to avoid any situations like this, the respondents were encouraged to answer when they had enough of time.

Another critique could be that two new product types were created in the study, VP and VP+. However, since there is limited research within VR in product evaluations it was considered appropriate to create two new product types like Suh and Lee (2005) did than using previous ones such as geometric, material and mechanical products (Li et al., 2003) (see section 2.2.5 for a review).

## 3.5 PRE-STUDY 2: GENERAL ATTITUDE

### 3.5.1 PURPOSE AND SURVEY

The second pre-study was conducted in order to select the two actual product designs for the main study. The aim was to find one product design for each of the two product types, which not significantly differ in general attitude. This in order to make sure that those subjective attitudes regarding the different product categories would not affect the outcome of the main study. The chosen product categories from pre-study 1 were sofas and sofa tables. Therefore, three 2D pictures of different sofa designs and three 2D pictures of different sofa table designs were tested in pre-study 2. The product designs were neutral in colours with a white background and no visual brand in order to make sure that the results were not affected by any other stimuli (see appendix 4). The pre-study was sent out online to the authors' social network in the chosen target age of 18-29 years old that is called a convenience sample (Jacobsen, 2002). The respondents saw the six product designs one by one and could after each picture answer the questions regarding their attitude towards the product design. The scale of Berger and Mitchell's (1989) that measure general product attitude was chosen and adapted, which also has been used by Klein (2003) and Debbabi et al. (2010) in a similar research context. Respondents were given the statement "*My general appreciation of this product is:*" and answered on three semantic seven-point differential scales being *Negative-Positive*, *Dislike-Like* and *Unfavourable-Favourable*. The order of the product designs was randomised, in order to not affect the outcome of the results.

### 3.5.2 RESULT AND CONCLUSION

The data was once again analysed in SPSS 24 (see section 3.8.6). The survey received 31 respondents, which made it possible to conduct parametric tests (Saunders et al., 2009). A reliability test was conducted for the questions for each product design in order to create a *general attitude index*. The Cronbach's alpha measured over 0.7 on each product design, which made it possible to create indexes (Bryman and Bell, 2011).

A paired sample t-test was conducted and based on the means of the indexes; two suitable product designs were chosen that did not differ significantly in general attitude ( $p=0.638$ ) (see table 3). The selected product designs were one grey sofa ( $M=5.06$ ) and one marble sofa table ( $M=5.17$ ), and were therefore chosen as suitable for the main study.

| Product design | N  | Mean | Std. deviation | t     | p     |
|----------------|----|------|----------------|-------|-------|
| Grey sofa      | 31 | 5.06 | 1.152          | - 476 | 0.638 |
| Marble table   | 31 | 5.17 | 1.255          |       |       |

Significance levels: \*\*\*  $\leq .001$ , \*\*  $\leq .01$ , \*  $\leq .05$

Table 3: Result of pre-study 2

### 3.5.3 CRITICISM OF PRE-STUDY 2

One could once again criticise that the pre-study was a convenience sample from the author's social network online (Jacobsen, 2002). The respondents were also encouraged in this pre-study to answer when they had time.

One could also criticise that pre-study 1 and pre-study 2 were not conducted as the same pre-study. However, it was important for pre-study 1 to not include pictures (Li et al., 2003), and the second pre-study had to include pictures in order to measure general attitude. Therefore, they had to be separated.

## 3.6 PREPARATORY WORK FOR PRE-STUDY 3 AND THE MAIN STUDY

The purpose of pre-study 3 was to test the assumption that showing a product in VR could increase the level of telepresence compared to showing only 2D pictures. Moreover, pre-study 3 would work as a suitable pilot study of the method for the main study since it would have the same approach of sampling respondents and also require the same manipulation material. Therefore, this section will further describe the material produced both for pre-study 3 and the main study before further describing pre-study 3 in section 3.7.

### 3.6.1 THE E-COMMERCE SITE “FURNITURESTORE”

The main study required four versions of an e-commerce site for the experiment (see appendix 6, 7, 8, 9) since there are four different test groups with two different product types (VP and VP+) and two different product presentations (VR/2D).

| Website   | Stimuli                                                                     |
|-----------|-----------------------------------------------------------------------------|
| Website 1 | Four 2D pictures of the sofa + product description                          |
| Website 2 | Four 2D pictures of the sofa table + product description                    |
| Website 3 | Three 2D pictures of the sofa + VR sign picture + product description       |
| Website 4 | Three 2D pictures of the sofa table + VR sign picture + product description |

Table 4: Manipulation overview

The fictitious brand name *Furniturestore* was chosen for the website in order to be neutral and avoid any prejudices from the respondents. Based on pre-study 1 and pre-study 2, two products were selected for the websites. Four identical websites were then created, besides the product (sofa or sofa table), the corresponding product description and also the type of media format (VR or only 2D). This approach was made to ensure that no other variables affected the outcome of the result. The layout and the choice of four pictures were taken from a research made by looking at the biggest furniture companies online. A minor focus group gave feedback on the website to see if it had a realistic design. No amendments were needed.

For the 2D picture format, four 2D pictures were displayed for the respective product (see appendix 6 and 7). The pictures showed two pictures with the product from different angles, one close-up picture of the material and the last picture showed the product in a styled apartment. The picture of the styled apartment was the same picture for both products showing the sofa table placed in front of the sofa. This was to make sure that the apartment styling did not affect the outcome of the study.

For the VR group, three 2D pictures were the same but the fourth 2D picture (showing the product in a styled apartment for the 2D groups) was replaced with VR sign picture to see the product in VR (appendix 8 and 9). This meant that the customer could have the option of seeing the product in a styled apartment as well when putting on the VR headset. The same VR picture was used for both products, which showed the same styled apartment as for the 2D groups. Also, this was in order to control the outcome of the study.

### 3.6.2 THE VR MATERIAL

The authors of this thesis produced the VR picture used for group 3 and 4 with the VR camera *RICOH THETA S*, which was borrowed from Warpin Media. The VR picture of the sofa and the sofa table was taken in a pre-furnished living room. The VR picture displayed the living room in a 360 degrees angle, which gives the user the experience of being in the living room when the user put on a VR headset. As previously mentioned, the same VR picture was used for both VR groups where the sofa table was placed in front of the sofa. This was in order to ensure validity of the results and also for the simplicity when randomly collecting the respondents. Respondents were given the VR glasses made by SPECTRA Optics Industries when looking at the VR picture (see appendix 11). The glasses are universal, which means that the VR headset is suited for every smartphone. To review, this was used due to the most common VR headset today among consumers (Interview Emma af Robson, 20-02-2017).

## 3.7 PRE-STUDY 3: TELEPRESENCE

### 3.7.1 PURPOSE

To review, the purpose of pre-study 3 was to test the assumption that showing a product in VR could increase consumer's level of telepresence compared to showing only 2D pictures. The test would therefore compare the sense of telepresence among respondents who only saw 2D pictures at an e-commerce site and respondents that saw the product in VR as well. This had to be tested in a pre-study since it was an important first assumption in the conceptual model.

Compared to the main study only one product would be needed in pre-study 3 in order to test the different levels of telepresence. The grey sofa and the corresponding e-commerce site and VR

material were therefore chosen. Half of the respondents would see the e-commerce site with 2D pictures, and the other half would see the e-commerce site with pictures and also the grey sofa in a VR headset. The measurement used to test respondents' sense of telepresence was the seven-questions scale used by Klein (2003) (see appendix 5). Initially, the planned method in order to conduct the test was to take the respondents one by one into a quiet room at Stockholm School of Economics (SSE).

### 3.7.2 PILOT TEST OF QUESTION AND METHOD

Two problems occurred during the initial phase of the pre-study. Firstly, it was noticed that many of the respondents from both groups interpreted the questions in the wrong way or could not understand them properly. Therefore, after discussions with a few of the first respondents the questions were adjusted to be more clear and better suited in the chosen research context. The scale has previously been modified in a similar way to better fit the research context (Lee and Park, 2014).

Furthermore, the method used to collect respondents one by one to a quiet room was discovered wrong in nature for this study. When measuring telepresence, the questions are formulated to see how much *presence* the respondents feel in their experiment (see appendix 5). Therefore, the responses could be affected by putting respondents into a quiet room; for example question 7: *"When the exercise ended, I felt like I came back to the real world after a journey"*. This could mislead the respondent in thinking that the journey included both looking at the e-commerce site but also being taken into a quiet room from the loudly atrium in the school, which may have affected that the respondents, regardless of group, felt a high sense of telepresence.

An alternative of taking respondents one by one into a quiet room would instead be to send out the survey online. However, this was not possible since the VR group needed to be given instructions and provided with a VR headset, which required personal contact. If the two VR groups were given personal contact and the two 2D groups were not, it could affect the outcome of the results. Therefore, it was decided that all groups would be personally approached and instructed to the survey.

The method of collecting respondents was therefore changed to the atrium of SSE where students sitting at tables were randomly approached. This was considered an appropriate way of approaching the respondents with instructions and at the same time avoiding being in a quiet room or being taken away, which could affect the answers. After the questions were modified and the sampling approach changed, pre-study 3 could be conducted.

### 3.7.3 RESULTS

After the pilot testing and finding the correct method of investigating, 60 respondents were collected. It was 30 respondents for the VR manipulation and 30 respondents for the 2D picture manipulation, in order to be able to make parametric tests in SPSS (Saunders et al., 2009). Firstly, a reliability test was conducted for the telepresence questions. The Cronbach's Alpha test measured 0.874 for the VR manipulation and 0.909 for the picture manipulation. Since both measured over 0.7 it was possible to create indexes for telepresence (Bryman and Bell, 2011). An independent sample T-test was then conducted in order to compare the means of telepresence between the two manipulations. The test showed a significant difference ( $p=0.000$ ) between the means of the VR manipulation ( $M=4.59$ ) and the 2D picture manipulation ( $M=2.67$ ) (table 5), indicating that respondents who saw the products in VR could feel a higher sense of telepresence. To conclude, respondents who could see the product in VR felt a significantly higher sense of telepresence compared to the group that only saw the 2D pictures.

| Manipulation | N  | Mean | Std. deviation | t     | p       |
|--------------|----|------|----------------|-------|---------|
| 2D           | 30 | 2.67 | 1.140          | 6.224 | .000*** |
| VR           | 30 | 4.59 | 1.251          |       |         |

Significance levels: \*\*\*  $\leq .001$ , \*\*  $\leq .01$ , \*  $\leq .05$

Table 5: Results of pre-study 3

### 3.7.4 CRITICISM OF PRE-STUDY 3

In addition to the issues of the sampling method, one could criticise that since the respondents answered relative few questions (7) it might have been difficult to really feel the scenario of shopping. One could also criticise that one of the main components in the main study was tested in advance.

## 3.8 MAIN STUDY

After the three pre-studies and pilot testing, the main study could be conducted. For the main study, a grey sofa and a marble sofa table were chosen as a result from pre-study 1 and pre-study 2. This section describes components of the main study including pilot testing, approached sampling method, content of the survey and quantitative sampling.

### 3.8.1 PILOT TEST OF THE QUESTIONNAIRE

Before conducting the main study, a pilot test of the questionnaire was needed to test for potential mistakes that could occur with the questions. A total of 14 randomised respondents were asked to give feedback on the survey of the main study. Eight people in the VR group and six people in the 2D group to make sure that both manipulation groups (VR/2D), regardless of product, would understand the questions properly. The pilot test group was the same target group as in the main study. The questionnaire was edited during the meantime while every respondent took the survey. This method of making each respondent speak their mind while answering the questions in the survey has proven to be suitable (Malhotra, 2010). For example, the order of the questions was changed, the questions were rephrased to be comprehensible and display logic was corrected. No changes were made on the telepresence questions due to the full examination of the concept in pre-study 3. After editing the survey by the feedback given, the main study was again tested on six people but no amendments were then required.

### 3.8.2 SAMPLING APPROACH

In the main study, the sampling of respondents was made between the 13<sup>th</sup> and 20<sup>th</sup> of March, 2017. Four different groups were needed in order to get results to the outlined research design (see section 3.1). The approached respondents were students at SSE in the age of 18-29 due to time and resource constraints. The experiment was conducted in the atrium of SSE that had been tested being the most suitable approach for this study according to pre-study 3. To review, since two groups needed to be instructed how to use a VR headset to answer the questions, all four groups were decided to get physical contact before answering the survey in order to get the method as correct as possible. The students could be primed to figure out what the experiment was about if they saw that some students received a VR headset and some did not. In order to avoid this, the respondents who only saw 2D pictures on the website were instead collected during the first days, before the collection of



VR respondents started. However, within the 2D manipulation and within the VR manipulation the product type of the website was randomised.

For the 2D groups, the students were approached with a computer and personal instructions on how to conduct the survey. When the two 2D groups were completed, the two VR groups were collected. The same method was used there but the respondents were also given VR headsets in which they could inspect the product.

As the survey took approximately 10 minutes and most of the students were in an examination period, it was considered important to give an incentive. All respondents were informed in the beginning that they could get free coffee if they could participate in the study. This was a proven efficient method for convincing people easier to participate. A total number of 200 respondents were physically collected, 50 in every group to ensure that each group contained at least 30 respondents (in case of excluding respondents) as this will result in sampling distribution for the mean that is very close to generate a normal distribution curve desired for parametric analysis (Saunders et al., 2009). This total amount of respondents was considered an appropriate number due to the amount of time and effort required to physically collect each respondent.

### 3.8.3 QUESTIONNAIRE

The main survey was made in the common online survey tool Qualtrics. The survey started with a short scenario in which the respondent was going to move to a new home and therefore looked for new furniture with the link given to the e-commerce website of the sofa or the sofa table. In the first block of questions, telepresence was examined since that is directly affected by the manipulation of 2D and VR. After that, attitude variables and purchase intentions were examined, which were followed by questions about the website. The second block of questions was regarding the level of involvement with technology. The final block consisted of control and demographic questions (see the main study in appendix 10). The chosen structure of the questions asked, by beginning with the most important questions and end with the least important, is recommended by Malhotra (2010).

The quantitative study has only used structured questions with almost no open answers, as that enables easier comparisons in the analysis (Bryman and Bell, 2011). All structured questions were presented with a seven-point Likert scale or semantic differential scale, with numerical equal distance

between every scale point that would give the respondent the possibility to be neutral and extreme. This gives easy comparison of the results.

### 3.8.4 QUESTIONNAIRE MEASURES

#### 3.8.4.1 Telepresence

Telepresence was measured using a seven multi-scale question, which was taken and adapted from Klein (2003) as it is a well established and replicated scale for measuring telepresence (Suh and Lee, 2005). The measure consisted of seven-point Likert scales regarding how digitally present the respondent felt in the environment. For example, respondents were asked to agree or disagree to the following statements: *"While looking at the product, I felt I was in a new world"* and *"While looking at the product, I felt I was there next to the product"*, (see all questions in appendix 10). The seven questions computed a telepresence index with a Cronbach's alpha of 0.907.

#### 3.8.4.2 Product and Brand Attitude

Previous research (Klein, 2003; Kim et al., 2007) has shown that strong telepresence can influence attitude towards products and brands. Product attitude and brand attitude were measured using a well-established three-item measure (Li et al., 2001; Bruner, 1998) where respondents were questioned: *"How do you feel about the product/brand?"*. The respondents indicated their answer on a bipolar Likert scale including 1. *Bad - Good*, 2. *Not appealing - Appealing*, 3. *Unattractive - Attractive*. The product attitude index indicated a Cronbach's alpha of 0.915 and the brand attitude indicated a Cronbach's alpha of 0.913; both could thus be computed into separate indexes.

#### 3.8.4.3 Purchase Intention

Purchase intention was measured with a well-established semantic differential scale that has been used in similar research contexts before (Suh and Lee, 2005). Respondents were asked to answer: *"How likely is it that you will purchase the evaluated product?"* and then indicate 1. *Unlikely - Likely*, 2. *Improbable - Probable*, 3. *Impossible - Possible* on a seven-point scale. The three questions indicated a Cronbach's alpha of 0.913 and could thus be computed into an index.

#### 3.8.4.4 Intention to Return to Similar Websites

Intention to return to similar websites-measurement was taken from a web marketing research (Coyle and Thorson, 2001). It was measured with the statement: *"I would like to use websites with similar characteristics to those of this website in the future"*. Respondents indicated their agreement or disagreement on a seven-point Likert scale.

#### 3.4.4.5 Website Satisfaction

Satisfaction with website was measured with a three-item statement: *"How much do you agree with the following:"* and the respondents indicated their agreement or disagreement on a seven-point Likert scale of 1. *I enjoyed visiting the website*, 2. *I was satisfied with my shopping experience at the website*, 3. *I would recommend the website to other people*. The measurement was taken from research on online store atmospherics (Eroglu et al., 2003). The three statements indicated a high internal reliability with a Cronbach's alpha of 0.898 and could thus be computed into an index.

#### 3.8.4.6 Website Trust

Website trust is an important characteristic when shopping online (Lee and Park, 2014). Website trust was taken and adapted from Lee and Park (2014) and measured with three-item questions using a seven-point Likert scale. The respondent indicated their agreement or disagreement to the statements: 1. *The website seems genuinely committed to my satisfaction*, 2. *The website seems very reliable*, 3. *The product presentation is helpful in familiarising me with the product*. The three statements indicated a Cronbach's alpha of 0.868 and could therefore be computed into an index.

#### 3.8.4.7 Perceived Diagnosticity

VR could have the potential to make it easier for consumers to evaluate the product and a measure indicating this was therefore of importance to include in the questionnaire. The measure was called *perceived diagnosticity* (i.e. the extent to which consumers believe a website is helpful for them to understand products) and taken from Jiang and Benbasat (2007). The measure was a seven-point Likert scale with disagreement to agreement regarding: 1. *The product presentation is helpful for me to evaluate the product*, 2. *The product presentation is helpful in familiarising me with the product*, 3. *The product presentation is helpful for me to understand the performance of the product*. The three statements had a Cronbach's alpha of 0.863 and could therefore be computed into an index.

#### 3.8.4.8 Product Knowledge

Since easier evaluation could improve *product knowledge* (Li et al., 2002), that variable was decided to be included. The measure was a seven-point Likert scale (disagree-agree) where respondents answered: “*I feel very knowledgeable about the product I just examined*”.

#### 3.8.4.9 Involvement with Technology

In this study, VR could be seen as a technical equipment and respondents with technical interest might have a more positive attitude towards a product compared to respondents without. Personal user characteristics, such as involvement with technology, could influence the responses and was therefore considered important to include. The measurement *involvement* was adapted from Bloch (1981). Respondents indicated on a seven-point Likert scale how much they agree or disagree to the following: 1. *I am curious and I like to try technological innovations*, 2. *I like to talk about technological innovations to friends and others*, 3. *I am very interested in new technology*. The three statements measured 0.921 when testing the Cronbach’s alpha and could therefore be computed into an index.

#### 3.8.4.10 Final Control Measures

The final part of the survey included first of all demographic questions (gender and age). Furthermore, two question were included where respondents could disagree or agree on a seven-point Likert scale asking: “*The website had a realistic design*” and answer openly on “*what they think was the purpose of the experiment*”. If respondents indicated low answers of the design or correct answers about the purpose of the test, these would be excluded from the experiment. Finally, a question asking if the respondent had tried a VR headset before was included in the questionnaire to see if this could affect the outcome of the answers.

### 3.8.5 QUANTITATIVE SAMPLING

Since every respondent was collected physically in the SSE atrium, it could be controlled that all respondents were students at SSE. However, since the survey required some effort from the respondents, especially in the examination period, it was crucial to check for eventual consumer fatigue although they received incentives (Bryman and Bell, 2011). Respondents were sorted out based on 1) consumer fatigue, 2) if they answered low on the question: “*Did the website have a realistic design?*” and 3) if they had figured out the purpose of the study in the open-answer question. The

criteria for taking away respondents was important since the answers could have been affected if the respondent was unfocused, did not have a realistic experience or knew the purpose of the experiment. This led to that five respondents were excluded from the main study before analysing the results. In total, 195 responses were collected for the analysis in this study after excluding invalid responses. The data set represents a gender distribution of 53 percent male and 47 percent female (table 6). The number of respondents was very equal in the different test groups (table 7).

| Gender | Percent |
|--------|---------|
| Male   | 97 %    |
| Female | 98 %    |

Table 6: Gender distribution

| Manipulation   | N  |
|----------------|----|
| 2D, Sofa       | 50 |
| 2D, Sofa table | 47 |
| VR, Sofa       | 49 |
| VR, Sofa table | 49 |

Table 7: Distribution of manipulation groups

### 3.8.6 ANALYTICAL TOOLS

As the survey tool Qualtrics was used to collect the responses, the data was exported to *IBM SPSS 24*, in which statistical analyses were made. Hence, the data was not transferred manually to the analytical program and could therefore be argued to not suffer from any errors relating to that. Preliminary analyses tested multi-scale measures for internal reliability with Cronbach's alpha and the general rule of 0.7 was used in order to create an index (Bryman and Bell, 2011). Mean comparison was conducted with two way ANOVAs and Independent Sample T-tests in order to test the hypotheses. The add-on program *Hayes's PROCESS* tool for SPSS was installed and used in order to test mediating and moderating effects (see the fourth chapter for further descriptions). The confidence interval of 95% was used for all tests. In the case of a confidence interval of 90%, the result was described as a tendency.

## 3.9 CRITICAL REVIEW OF DATA QUALITY

The common issue of quantitative studies is the quality of the collected data, which is evaluated by looking at reliability, validity and replicability. The three factors are analysed below.

### 3.9.1 RELIABILITY

A high reliability means that the study has been conducted correctly and that the study can ensure reliable and accurate results. According to Bryman and Bell (2011) there are two important dimensions of reliability that are applicable for this study: stability and internal reliability.

#### 3.9.1.1 Stability

The stability dimension of reliability is to evaluate if a measure is stable over time and does not vary within the time frame and contextual condition. This means that if a measure is tested twice to the same sample with the same contextual conditions, there would be similar results and little variation in the data collected (Bryman and Bell (2011)). First of all, 3 pre-studies were conducted in order to test the intended components of the manipulation to ensure reliability of the results in the main study. The questionnaire was also tested through a pilot study before used in the main study. Results from pre-study 3 (level of telepresence tested) were compared with results from the main study in order to ensure that the results were stable over time and indicated same results.

#### 3.9.1.2 Internal Reliability

Internal reliability determines whether a multi-item measure is coherent and measures the same intended variable, e.g. product attitude (Bryman and Bell, 2011). All multi-scale measures were using the reliability test Cronbach's alpha and had higher than the general rule of 0.7 (ibid.), indicating high internal reliability (table 8). All the measures used in the questionnaire were also taken from previous academic literature with similar research field. The literature was checked for the number of times the article had been cited before in order to ensure credible sources.

| Measure                        | No of items | CA   |
|--------------------------------|-------------|------|
| 1. Telepresence                | 7           | .907 |
| 2. Product attitude            | 3           | .915 |
| 3. Perceived diagnosticity     | 3           | .863 |
| 4. Purchase intention          | 3           | .909 |
| 5. Brand attitude              | 3           | .913 |
| 6. Website trust               | 3           | .868 |
| 7. Website satisfaction        | 3           | .898 |
| 8. Involvement with technology | 3           | .921 |

Table 8: Cronbachs' Alpha dependent variables

### 3.9.2 VALIDITY

Validity is considered being the most important criterion of research to make sure that the study is measuring what it aims to measure and that the conclusions are accurately drawn. Four main constructs have been evaluated, which are internal validity, measurement validity, external validity and ecological validity (Bryman and Bell, 2011).

#### 3.9.2.1 Constructs Giving High Validity

Internal validity evaluates the content in the questionnaire given to the respondent and whether the independent variable can truly be the causation for the observed effects of the different dependent variables (Bryman and Bell, 2011). In this study, the internal validity is considered high due to that the tested causal relationships have been used in previous research in the hypothesis generation. For example, product type has been a proven used moderator that affects the dependent variables such as product attitude, knowledge and purchase intention (Choi and Taylor, 2014; Debbabi et al., 2010; Li et al., 2003; Suh and Lee, 2005). To further make sure that any extraneous errors could be avoided the main study was pilot tested as explained in section 3.8.4 in order to ensure that the respondents would understand all questions properly. According to Bryman and Bell (2011), internal validity is also improved by using high Cronbach's alpha, which has been proven in this thesis for all indexes (over +0.7). Finally, the study used a fictitious brand name in order to make sure that no prejudices

could affect the results. This was also controlled by asking in the end of the survey if the respondents thought that the website had a realistic design.

The questions asked to the respondents of testing the causal relationships were also all taken from reliable sources, which ensures that the measurements capture the idea intended to be captured and denote the supposed concept. This is called measurement validity (ibid.) and is evaluated to be high.

### 3.9.2.2 Constructs Lowering the Validity

However, the total validity is lowered when looking at the external and ecological validity. The external validity addresses whether the conclusions drawn in this study can be generalised to the larger population and hence beyond the specific research context (Bryman and Bell, 2011). The sample taken of students at SSE is representative in terms of age (18-29) but all are students and live in Stockholm, which cannot be considered generable for the larger population in Sweden. The sample taken is, however, a great first step to future research when testing the effects of VR. Ecological validity can also be criticised in this thesis and lower the total validity. It is about if the conclusions drawn can be applied to people's everyday natural social settings (ibid.). The respondents looking at the fictitious website and answering the questionnaire are being observed by other people. The natural way might have been respondents that could evaluate furniture in their homes and take the time needed before judgement without people observing them in their mind process. This could not been fulfilled in this study since the groups testing VR needed to be collected physically, which implied that the 2D groups had to be collected in school as well to avoid any method mistakes as explained in section 3.7.2.

### 3.9.3 REPLICABILITY

Replicability refers to the extent the study is possible to reproduce, which is regarded of importance for the quality of the research (Bryman and Bell, 2011). The measures included in the survey are well-established multi-scale measures, which have previously been successfully replicated by other authors. Also, this study can be argued to ensure replicability since theory, method and analysis are well described in detail. This in order to easy replicate the experiment in which steps can be followed clearly as theoretically, methodically and empirically. Therefore, the study can be argued to ensure replicability.



## 4. RESULTS AND ANALYSIS

*In this chapter the analytical tool IBM SPSS 24 was used to analyse the collected empirical data and test the hypotheses. The results are presented in the same order as the hypotheses were presented in chapter 2, starting from left in the conceptual model (figure 5). The proposed conceptual model is presented below as a visual reminder before testing the hypotheses.*

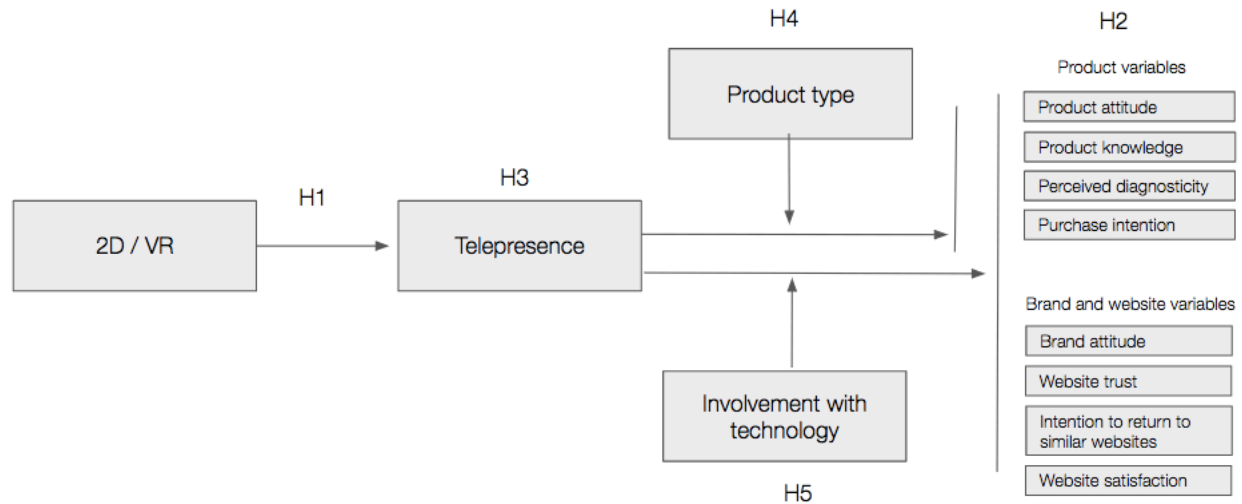


Figure 5: Conceptual model reminder

### 4. 1 HYPOTHESIS TESTING

#### 4.1.1 TELEPRESENCE

The first hypothesis states that websites that provide VR product presentations will result in higher consumers' sense of telepresence as compared to websites that only provide 2D pictures. To test the first hypothesis, an independent sample t-test was conducted that compared the VR and the 2D manipulation groups with the variable telepresence. The results showed that the VR group ( $M=5.05$ ) scored significantly higher ( $p=.000$ ) on the telepresence variable than the 2D group ( $M=2.91$ ) with a mean difference of 2.14 (table 9). This suggests that websites with VR contribute to a higher sense of telepresence. Hence, empirical support was found to accept H1.

| Manipulation | N  | Mean | Std. deviation | t        | p       |
|--------------|----|------|----------------|----------|---------|
| 2D           | 97 | 2.91 | 1.041          | - 14.748 | .000*** |
| VR           | 98 | 5.05 | .983           |          |         |

Significance levels: \*\*\*  $\leq .001$ , \*\*  $\leq .01$ , \*  $\leq .05$

Table 9: Results of H1 (T-test of Telepresence)

**H1:** Websites that provide VR product presentations will give a higher sense of telepresence as compared to websites that only provide 2D pictures.

**H1 SUPPORTED**

#### 4.1.2 VR EFFECTS ON DEPENDENT VARIABLES

Hypothesis 2 states that websites with VR product presentations will give more positive effects on the dependent variables as compared to websites that provide only 2D pictures. To test hypothesis 2, independent sample t-tests were conducted that compare the 2D and the VR manipulation groups for each of the dependent variables (a-h). The results indicate that the VR group had a significant higher mean and therefore more positive effect compared to the 2D group in each test (table 10 and 11) Hence, empirical support was found to accept H2.

| Dependent variable      | Manipulation | N  | Mean | Std. deviation | t       | p       |
|-------------------------|--------------|----|------|----------------|---------|---------|
| Product attitude        | 2D           | 97 | 5.09 | 1.306          | - 4.206 | .000*** |
|                         | VR           | 98 | 5.77 | 0.914          |         |         |
| Product knowledge       | 2D           | 97 | 3.45 | 1.323          | -8.023  | .000*** |
|                         | VR           | 98 | 4.92 | 1.224          |         |         |
| Purchase intention      | 2D           | 97 | 3.91 | 1.392          | -3.403  | .001**  |
|                         | VR           | 98 | 4.62 | 1.486          |         |         |
| Perceived diagnosticity | 2D           | 97 | 4.46 | 1.247          | - 6.374 | .000*** |
|                         | VR           | 98 | 5.54 | 1.099          |         |         |

Significance levels: \*\*\*  $\leq .001$ , \*\*  $\leq .01$ , \*  $\leq .05$

Table 10: Result of H2 (Product variables)

| Dependent variable                      | Manipulation | N  | Mean | Std. deviation | t      | p       |
|-----------------------------------------|--------------|----|------|----------------|--------|---------|
| Brand attitude                          | 2D           | 97 | 4.17 | 1.2667         | -5.739 | .000*** |
|                                         | VR           | 98 | 5.22 | 1.278          |        |         |
| Website trust                           | 2D           | 97 | 4.44 | 1.316          | -5.675 | .000*** |
|                                         | VR           | 98 | 5.41 | 1.050          |        |         |
| Website satisfaction                    | 2D           | 97 | 4.02 | 1.216          | -5.254 | .000*** |
|                                         | VR           | 98 | 4.95 | 1.242          |        |         |
| Intention to return to similar websites | 2D           | 97 | 4.45 | 1.436          | -5.802 | .000*** |
|                                         | VR           | 98 | 5.59 | 1.299          |        |         |

Significance levels: \*\*\*  $\leq .001$ , \*\*  $\leq .01$ , \*  $\leq .05$

Table11: Result from H2 (Brand and website variables)

**H2:** *Websites that provide VR product presentations will result in more positive effects on the dependent variables (a-h) as compared to websites that provide only 2D pictures.*

- a - Product attitude
- b - Product knowledge
- c - Purchase intention
- d - Perceived diagnosticity
- e - Brand attitude
- f - Website trust
- g - Website satisfaction
- h - Intention to return to similar websites

**H2 SUPPORTED**

### 4.1.3 TELEPRESENCE AS A MEDIATOR

The third hypothesis proposed that the variable *telepresence* would function as a mediator to the dependent variables (a-h). A mediation analysis was therefore performed using Hayes's bootstrapping macro PROCESS for SPSS and tested the mediating variable telepresence on each dependent variable (figure 6). The tests produced significant mean indirect effects at a 95% confidence interval for telepresence on each of the dependent variables (table 12 and 13). This since

no confidence intervals (BootLLCI to BootULCI) crossed zero. For example, product attitude had a significant indirect effect of 0.992 (BootLLCI=0.669 to BootULCI=1.357). This suggests that the influences of the 2D/VR condition on the dependent variables are affected by the sense of telepresence. Hence, empirical support was found to accept H3.

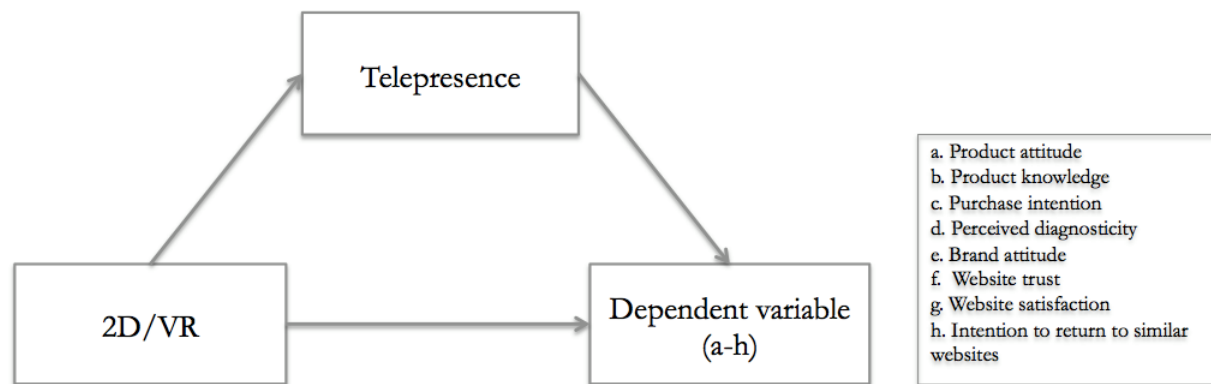


Figure 6: Telepresence as a mediator

| Dependent variable      | Direct effect | Indirect effect | BootLLCI | BootULCI |
|-------------------------|---------------|-----------------|----------|----------|
| Product attitude        | .679          | .992            | .669     | 1.357    |
| Product knowledge       | 1.465         | .937            | .576     | 1.336    |
| Purchase intention      | .702          | 1.080           | .696     | 1.490    |
| Perceived diagnosticity | 1.074         | .977            | .614     | 1.337    |

Table 12: Results of H3 (telepresence mediates product variables)

| Dependent variable                      | Direct effect | Indirect effect | BootLLCI | BootULCI |
|-----------------------------------------|---------------|-----------------|----------|----------|
| Brand attitude                          | 1.046         | 1.191           | .805     | 1.621    |
| Website trust                           | .968          | 1.041           | .708     | 1.433    |
| Website satisfaction                    | .925          | 1.131           | .780     | 1.519    |
| Intention to return to similar websites | 1.138         | .929            | .527     | 1.405    |

Table 13: Results of H3 (telepresence mediates branding and website variables)

**H3:** Telepresence will function as a mediator from the manipulation (VR/2D) to the dependent variables (a-h):

- a - Product attitude
- b - Product knowledge
- c - Purchase intention
- d - Perceived diagnosticity
- e - Brand attitude
- f - Website trust
- g - Website satisfaction
- h - Intention to return to similar websites

**H3 SUPPORTED**

#### 4.1.4 PRODUCT TYPE AS A MODERATOR

The following hypothesis (H4) was to see if product type could have a moderating effect on the mediation hypothesized in H3 considering the product related variables (a-d). To review, in H4 it was hypothesized that product type (VP and VP+) would moderate the relationship between the manipulation VR/2D, telepresence as a mediator and the product related variables (a-d).

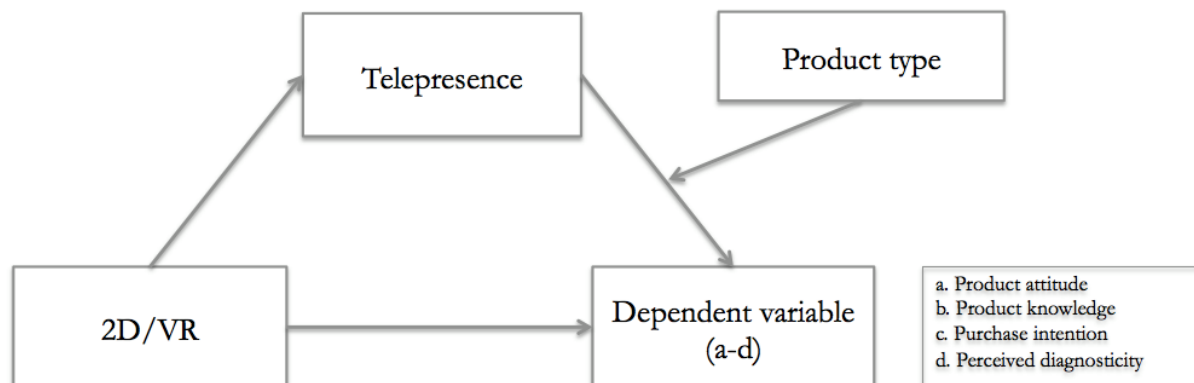


Figure 7: Model of product type as a moderator

This was tested using Hayes's PROCESS tool for SPSS, which allows estimation of moderated mediation models in which Model 14 was used (figure 7). The sample was bootstrapped for indirect effects (n=5000 bootstrap samples) to prevent any non-normality and to receive a better data representation (Preacher and Hayes, 2008). Unexpectedly, the test showed no significant interaction effects at both 95% and 90% confidence intervals for all the product related variables. This means that product type cannot be used as a moderator and can therefore not explain the relation between telepresence and the dependent variables. See the interaction coefficients and significance levels in (table 14) below. Hence, Hypothesis 4 is not supported. This means that it does not matter which particular product that is displayed in VR according to the VP and VP+ types.

| Dependent variable      | Interaction coefficient | p    |
|-------------------------|-------------------------|------|
| Product attitude        | .099                    | .321 |
| Product knowledge       | .111                    | .344 |
| Purchase intention      | .049                    | .712 |
| Perceived diagnosticity | .031                    | .768 |

Significance levels: \*\*\*  $\leq .001$ , \*\*  $\leq .01$ , \*  $\leq .05$

Table 14: Result of H4 (product type as a moderator)

**H4:** Product type (VP and VP+) will moderate the relationship between the manipulation VR/2D, telepresence as a mediator and the dependent product variables (a-d).

a - Product attitude

b - Product knowledge

c - Purchase intention

d - Perceived diagnosticity

**H4 NOT SUPPORTED**

#### 4.1.5 INVOLVEMENT WITH TECHNOLOGY AS A MODERATOR

Hypothesis H5 states that involvement with technology will moderate the mediation model hypothesized in H3. To clarify, it was hypothesized in H5 that the involvement with technology would moderate the relationship between the manipulation VR/2D, telepresence as a mediator and the dependent variables (a-h) (figure 8).

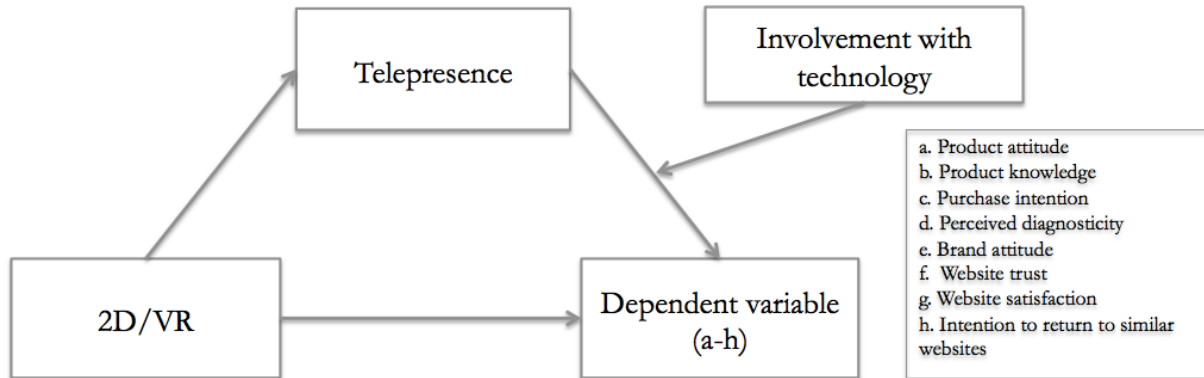


Figure 8: Model of involvement with technology as a moderator

This was again tested using Hayes's PROCESS tool for SPSS in which model 14 was applied. The sample was also bootstrapped for indirect effects (n=5000 bootstrap samples) as in test for H4. For the product variables (a-d) (table 15), the test revealed no significant interaction effect on 95% confidence interval. Unlike product variables, significant interaction effects could be found for website variables (f-h) (table 16). Significant interaction effects were found for website trust (int=0,126) and website satisfaction (int=0,115) at 1% significance level. Intention to return to similar websites (int=0,087) had significant interaction effects at a 5% significance level. A tendency could also be found for brand attitude at a 10% significance level. Since branding and website are closely associated within e-commerce the authors think that this is still an interesting result to include in the discussion. Therefore, H5 could be partially supported.

| Dependent variable      | Interaction coefficient | p    |
|-------------------------|-------------------------|------|
| Product attitude        | .030                    | .374 |
| Product knowledge       | .044                    | .266 |
| Purchase intention      | .023                    | .596 |
| Perceived diagnosticity | .051                    | .149 |

Significance levels: \*\*\*  $\leq .001$ , \*\*  $\leq .01$ , \*  $\leq .05$

Table 15: Results from H5 (product variables)

| Dependent variable                      | Interaction coefficient | p       |
|-----------------------------------------|-------------------------|---------|
| Brand attitude                          | .064                    | .087    |
| Website trust                           | .126                    | .000*** |
| Website satisfaction                    | .115                    | .001**  |
| Intention to return to similar websites | .087                    | .040*   |

Significance levels: \*\*\*  $\leq .001$ , \*\*  $\leq .01$ , \*  $\leq .05$

Table 16: Results from H5 (brand and website variables)

**H5:** Involvement with technology will moderate the relationship between the manipulation VR/2D, telepresence as a mediator and the dependent variables (a-h).

|                                             |                          |
|---------------------------------------------|--------------------------|
| a - Product attitude                        | Not supported            |
| b - Product knowledge                       | Not supported            |
| c - Purchase intention                      | Not Supported            |
| d - Perceived diagnosticity                 | Not Supported            |
| e - Brand attitude                          | Tendency to be supported |
| f - Website trust                           | Supported                |
| g - Website satisfaction                    | Supported                |
| h - Intention to return to similar websites | Supported                |

**H5 PARTIALLY SUPPORTED**



#### 4.1.6 INVOLVEMENT WITH TECHNOLOGY ANOVA

To further understand how the brand and website related variables (e-h) were affected by the moderator involvement tech, a One way ANOVA was conducted. The results indicate that when comparing the groups of high involvement with low involvement, it is apparent that the VR manipulation is only significant higher evaluated within the high involvement group and not within the low involvement group (table 17). In the case of brand attitude, there is a significant difference between 2D and VR also within the low involvement group. However, for brand attitude there is clearly a higher mean difference within the high involvement group compared to the low involvement group. The result therefore indicates that VR could benefit website variables (f-h) more if the respondent is interested in technology and tendency is found that the same would hold for brand attitude.

| Dependent variable                      | Involvement with technology | Manipulation | N  | Mean | Std. deviation | p       |
|-----------------------------------------|-----------------------------|--------------|----|------|----------------|---------|
| Brand attitude                          | Low                         | 2D           | 62 | 4.26 | 1.255          | .015*   |
|                                         |                             | VR           | 35 | 4.95 | 1.410          |         |
|                                         | High                        | 2D           | 35 | 4.01 | 1.290          | .000*** |
|                                         |                             | VR           | 63 | 5.37 | 1.185          |         |
| Website trust                           | Low                         | 2D           | 62 | 4.66 | 1.206          | .117    |
|                                         |                             | VR           | 35 | 5.06 | 1.142          |         |
|                                         | High                        | 2D           | 35 | 4.06 | 1.429          | .000*** |
|                                         |                             | VR           | 63 | 5.61 | .948           |         |
| Website satisfaction                    | Low                         | 2D           | 62 | 4.09 | 1.133          | .150    |
|                                         |                             | VR           | 35 | 4.47 | 1.370          |         |
|                                         | High                        | 2D           | 35 | 3.90 | 1.361          | .000*** |
|                                         |                             | VR           | 63 | 5.22 | 1.086          |         |
| Intention to return to similar websites | Low                         | 2D           | 62 | 4.53 | 1.339          | .175    |
|                                         |                             | VR           | 35 | 4.91 | 1.292          |         |
|                                         | High                        | 2D           | 35 | 4.31 | 1.605          | .000*** |
|                                         |                             | VR           | 63 | 5.97 | 1.150          |         |

Significance levels: \*\*\*  $\leq .001$ , \*\*  $\leq .01$ , \*  $\leq .05$

Table 17: One way ANOVA for involvement with technology

#### 4.1.7 PREVIOUS VR EXPERIENCE

The question: “Have you tried a VR headset before this experience?” was included in the experiment in order to see if previous experience with VR could affect the result of the study. Independent sample t-tests were conducted for each dependent variable where the group of previous experience of VR was compared with the group of no previous VR experience (table 18 and 19). The test was only conducted among the respondents who tried the VR manipulation. The test indicated no significant difference among the two groups that have tried VR before and the group that had not. Therefore, the result indicates that this study is not affected with regards to if the respondent tried VR for the first time during the experiment.

| Dependent variable      | Have you tried VR before? | N  | Mean | Std. deviation | t      | p    |
|-------------------------|---------------------------|----|------|----------------|--------|------|
| Product attitude        | YES                       | 60 | 5.85 | 0.770          | 1.025  | .310 |
|                         | NO                        | 38 | 5.64 | 1.103          |        |      |
| Product knowledge       | YES                       | 60 | 4.87 | 1.186          | - .513 | .609 |
|                         | NO                        | 38 | 5.00 | 1.294          |        |      |
| Purchase intention      | YES                       | 60 | 4.69 | 1.459          | .604   | .548 |
|                         | NO                        | 38 | 4.50 | 1.540          |        |      |
| Perceived diagnosticity | YES                       | 60 | 5.61 | 1.020          | .739   | .462 |
|                         | NO                        | 38 | 5.43 | 1.220          |        |      |

Significance levels: \*\*\*  $\leq .001$ , \*\*  $\leq .01$ , \*  $\leq .05$

Table18: Previous VR experience (product variables)

| Dependent variable                      | Have you tried VR before? | N  | Mean | Std. deviation | t     | p    |
|-----------------------------------------|---------------------------|----|------|----------------|-------|------|
| Brand attitude                          | YES                       | 60 | 5.26 | 1.295          | .423  | .673 |
|                                         | NO                        | 38 | 5.15 | 1.266          |       |      |
| Website trust                           | YES                       | 60 | 5.55 | 1.061          | 1.675 | .101 |
|                                         | NO                        | 38 | 5.19 | 1.006          |       |      |
| Website satisfaction                    | YES                       | 60 | 4.97 | 1.218          | .174  | .862 |
|                                         | NO                        | 38 | 4.92 | 1.295          |       |      |
| Intention to return to similar websites | YES                       | 60 | 5.70 | 1.293          | 1.034 | .305 |
|                                         | NO                        | 38 | 5.42 | 1.308          |       |      |

Significance levels: \*\*\*  $\leq .001$ , \*\*  $\leq .01$ , \*  $\leq .05$

Table 19: Previous VR experience (brand and website variables)

## 4.2 MODEL SUMMARY

| Summary of Hypotheses       |                                                                                                                                                                                 | RESULT              |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Main effects of VR          | H1: Websites that provide VR product presentations will give a higher sense of telepresence as compared to websites that only provide 2D pictures.                              | SUPPORTED           |
|                             | H2: Websites that provide VR product presentations will result in more positive effects on the dependent variables (a-h) as compared to websites that provide only 2D pictures. | SUPPORTED           |
|                             | H3: Telepresence will function as a mediator from the manipulation (VR/2D) to the dependent variables (a-h).                                                                    | SUPPORTED           |
| Product type                | H4: Product type (VP and VP+) will moderate the relationship between the manipulation VR/2D, telepresence as a mediator and the dependent product variables (a-d).              | NOT SUPPORTED       |
| Involvement with technology | H5: Involvement with technology will moderate the relationship between the manipulation VR/2D, telepresence as a mediator and the dependent variables (a-h).                    | PARTIALLY SUPPORTED |

Figure 9: Summary of hypotheses and results

To summarise the table above, the result of the study shows that VR creates a significant increased sense of telepresence compared to 2D (H1 supported) and acts as an important mediator between the manipulation 2D/VR and all dependent variables (H3 supported). All dependent variables are more positively evaluated in VR compared to 2D (H2 supported). However, product type does not work as a moderator to the mediation model of the manipulation 2D/VR, telepresence and the product related variables (H4 not supported). Involvement with technology on the other hand, works partially as a moderator to the mediation model for the branding and website related variables (H5 partially supported). The respondents who were highly involved with technology evaluated the website better with VR, the group with low involvement did not.

The model below illustrates a revised conceptual model based on the summary of the supported hypotheses in order to provide a visual overview of the results that will be discussed during the final chapter. There is a clear difference in the result for the product related variables and the branding

and website related variables, which is illustrated in the model. This model shows that the product presentation (VR/2D) affects the product related variables through telepresence without a moderator. However, for branding and website related variables the positive effect is dependent on consumers involvement with technology.

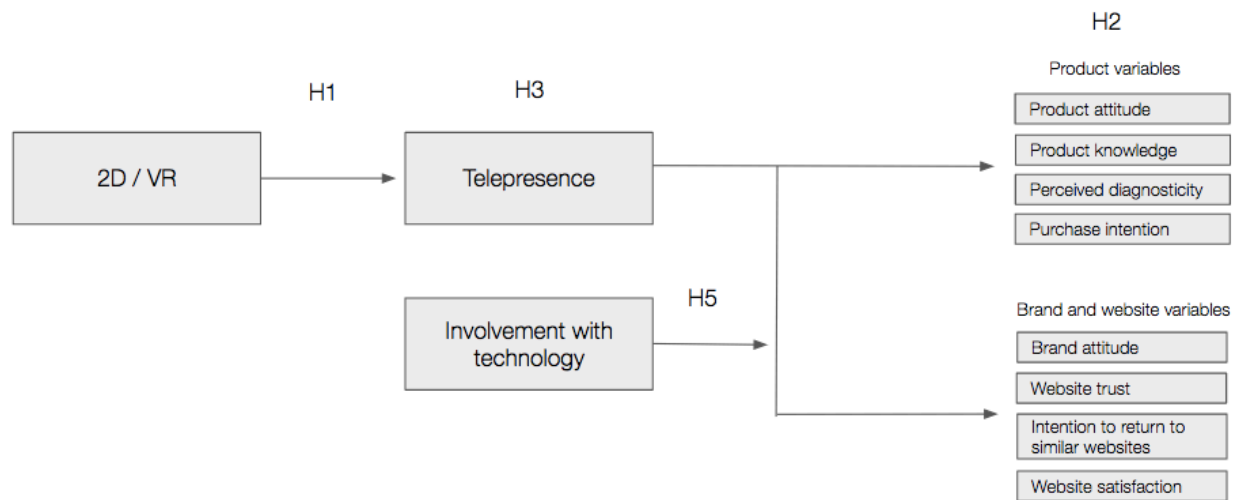


Figure 10: Revised conceptual model of the thesis

## 5. FINAL DISCUSSION

*This section will discuss the results of the hypothesis testing that will result in discussion, theoretical contributions, managerial - and consumer implications. Thereafter, conclusion of the thesis and criticism will be given, followed by suggestions for future research in the end of the chapter.*

### 5.1 DISCUSSION OF RESULTS AND THEORETICAL CONTRIBUTIONS

The section 5.1.1 to 5.1.3 will start by discussing the primary research question:

- *Will there be more positive effects on the consumer of displaying products in VR product presentations as compared to only 2D pictures in an e-commerce context?*

In some parts of the discussion the cognitive and conative effects will be divided into product variables (a-d) and branding and website variables (e-h). This is due to that different results can be detected for the two groups (see table 20).

| Product variables (a-d)     | Branding and website variables (e-h)        |
|-----------------------------|---------------------------------------------|
| a - Product attitude        | e - Brand attitude                          |
| b - Product knowledge       | f - Website trust                           |
| c - Purchase intention      | g - Website satisfaction                    |
| d - Perceived diagnosticity | h - Intention to return to similar websites |

Table 20: Product variable groups and branding and website variable groups

#### 5.1.1 INCREASED SENSE OF TELEPRESENCE

The finding from hypothesis 1 implies similar result as previous research on 3D presentations and telepresence. Telepresence has previously shown to increase when consumers were exposed to more realistic product displays such as 3D pictures as compared to 2D pictures (Biocca and Daugherty, 2001; Debbabi et al., 2010; Klein, 2003; Li et al., 2001, 2002; Suh and Chang, 2011; Suh and Lee, 2005), which is consistent to the results of hypothesis 1. To review, telepresence is a measure of the amount of digital presence the consumer feels and the use of a VR headset immerses the user into a new spatial environment. Therefore, the use of VR gives the expected result of an increased sense of consumer's telepresence. Unlike previous studies and therefore one of the theoretical contributions

of this study, is that the effects on telepresence are evident from using VR headsets, which have not been tested within product presentations in an e-commerce context before.

### 5.1.2 COGNITIVE AND CONATIVE EFFECTS

The findings from hypothesis 2 indicate that the use of VR product presentations as compared to 2D pictures results in improved cognitive and conative effects on the consumer (table 10). A detailed description is that VR product presentations improved the evaluation of product attitude, product knowledge, purchase intention, perceived diagnosticity, brand attitude, website trust, website satisfaction and intention to return to similar websites. This is similar to previous research on increased website cues or the use of 3D pictures that resulted in similar improved consumer effects (Choi and Taylor, 2014; Coyle and Thorson, 2001; Eroglu et al., 2003; Jiang and Benbasat, 2007; Kim et al., 2007; Klein, 2003; Lee et al., 2012; Lee and Park, 2014; Li et al., 2001, 2002; Suh and Chang, 2011; Suh and Lee, 2005). However, this thesis is the first to show that the use of VR product presentations in e-commerce resulted in the above-mentioned positive effects on the consumer, and is therefore a theoretical contribution. This was a major question from the interview with Furniturebox that there are no studies or examples that have shown clearly that VR has provided better effects on consumers within product and website evaluations (Interview Felix Kvik, 21-02-2017).

In order to analyse the positive results it is important to consider that VR is currently experiencing a hype. People responding to this survey might be fascinated and give positive evaluations since they are first time users of VR. It could be reasonable to believe that the first experience would be more exciting and therefore result in a more positive evaluation. From the interview with Furniturebox this was an important aspect to look into (Interview Felix Kvik, 21-02-2017). However, when comparing the two groups who previously had tried VR and the ones who had not, the results did not differ significantly (table 18 and 19). Therefore, this result points to a possible insight that positive effects from using VR was not only a result from first time users. Instead, in order to further analyse the results of hypothesis 2 it could be useful to look into the results of hypothesis 3 and the theory of direct and indirect experiences, which will follow below.

### 5.1.3 TELEPRESENCE AS A MEDIATOR

Hypothesis 3 contributes to new theoretical findings that the positive effects from using VR could be explained with the fact that telepresence mediates the cognitive and conative effects (table 12 and 13). Telepresence has in earlier research on 3D advertising been shown to mediate product attitude, purchase intention, brand attitude and product knowledge (Debbabi et al., 2010; Li et al., 2002, Suh and Chang, 2006). Unlike previous studies, telepresence has in this study been shown to function as a mediator also for website trust, website satisfaction, intention to return to similar websites and perceived diagnosticity. The theoretical contribution is therefore not only that VR product presentations result in positive effects, but also that these effects can be explained by an increased sense of telepresence.

These results of hypotheses 2 and 3 could be further analysed with theory on direct and indirect experiences. To review, a direct product experience refers to when the customer inspects the product in reality and indirect experience refers to the experience of a product from a mediated source (e.g. advertising) (Li et al., 2002; Suh and Lee, 2005). Previous research has shown that direct experiences are more effective in forming favourable attitudes since it allows the consumer to inspect and evaluate the product better, which gives the consumer a greater level of confidence (Debbabi et al., 2010). Since VR offers a better level of visual media richness and has shown to increase telepresence, it is reasonable to believe that VR offers customers what resembles a more realistic direct experience with the product as compared to 2D images. Therefore, this could help the customer to better understand the product, which therefore could explain why the use of VR and increased telepresence result in improved product attitude and purchase intention. Following this line of reasoning of easier evaluation from a direct product experience, this can also explain why product knowledge and perceived diagnosticity result in more positive effects in VR. One could therefore argue that since VR is a way to get a closer direct mediated experience with the product through telepresence, it could be reasonable to further suggest that the positive effects from viewing a product in VR could stay. This even though the hype around VR headsets might eventually stop.

There are also other theories regarding company effort that could be used to analyse these results. To review, greater perceived advertising spending (Kirmani and Wright, 1989) and creativity (Dahlén et al., 2008) have shown to indicate more effort from the company. More company advertising effort could in turn signal that the company has a greater level of confidence in their products and

therefore quality (Kirmani and Wright, 1989). The consumers thus feel safer that the company will live up to their promise if the company has put more money and therefore risk into the marketing (Kirmani, 1997). Whereas it could be argued that VR product presentation is more technically advanced and could be considered a creative tool, that could further suggest that use of VR could work as a cue of company effort. In the same line of reasoning, this can signal to consumers that the company has put a lot of effort into presenting their products and therefore has a great level of confidence in their products. Hence, this could contribute to that consumers perceive the quality as higher and thus better product attitude and purchase intention.

Furthermore, a last analysis could be that previous telepresence research has found that telepresence increased the sense of shopping enjoyment, which led to more willingness to purchase among consumers (Song et al., 2007). To review, shopping enjoyment is defined as the pure joy that people feel in their shopping experience besides from any product selection and evaluation (Hirschman and Holbrook, 1982). Shopping enjoyment could be increased by mental engagement in the shopping activity (Song et al., 2007). In the same vein of rationale, VR could because of its immersive capabilities be seen as a way to create more mental engagement and therefore a more fun shopping experience for its own sake. In line with previous research (ibid.), it could therefore work as an explanation to why consumer's purchase intention improved when the consumers were provided with a VR product presentation.

Due to the moderating effects of involvement with technology (H5) on the branding and website related variables, these variables will be discussed further in section 5.1.4.

#### 5.1.4 PRODUCT TYPE AS A MODERATOR

This section will discuss the secondary research question:

- *Is there any specific product type that suits better in VR than others?*

The results from hypothesis 4 indicated that there were no significant results that product type would act as a moderator to the mediation model of the manipulation 2D/VR, telepresence and the product related variables (table 14). This is unlike previous research within 3D product presentations



and cognitive fit theory that showed that product type could moderate the relation (Choi and Taylor, 2014; Debbabi et al., 2010; Li et al., 2003; Suh and Lee, 2005).

To further analyse why product type did work as a moderator for 3D pictures but not for VR, one could further look into the differences of 3D as compared to VR. It is of importance to address that 3D pictures offers an interactivity function and often an audio function, which allow consumers to interact more with the product on the computer screen (Choi and Taylor, 2014; Debbabi et al., 2010; Suh and Lee, 2005). It could further be suggested that products that allow interaction (for example opening table drawers) could therefore benefit more from 3D presentations compared to product without interaction attributes. This could be analysed as the reason to why the effects from 3D pictures are dependent to what product type that is used (geometric vs material; VHE vs VLE). VR product presentations on the other hand, lack the interactivity function with an object and rather provide stronger visual immersion that can due to increased telepresence be resembled a more direct experience with the product. In this line of reasoning, consumers could get greater level of confidence and thus have easier to form favourable opinions (Debbabi et al., 2010), why VR favours both products, no matter of product type (VP or VP+).

Since the moderating effect of product type differed between VR and 3D compared to previous studies, 3D product presentations might differ even more from VR than previously expected in the hypothesis generation of this thesis. Research on 3D product presentation might therefore not work as a good benchmark for guidance on how to use VR for merchandising. One could therefore argue even more for the need of research within the attributes of VR.

Interestingly, this result could be further analysed together with the statement from af Robson that mainly large products would benefit from being displayed in VR (Interview Emma af Robson, 20-02-2017). The study only tested large products, which can perhaps explain why the effects for both products were positive. This could further suggest for future research that product size could be an interesting area of investigation as a moderator.

### 5.1.5 INVOLVEMENT WITH TECHNOLOGY AS A MODERATOR

This section will further discuss the result from the other secondary research question:

- *Are the effects on consumers different depending on their level of involvement with technology?*

The fifth hypothesis was partially supported since the results were different for the product related variables compared to the branding and website related variables (table 15 and 16).

For the product variables, involvement with technology did not function as a significant moderator (table 15). The result further implies that VR could be used to improve product evaluation no matter of consumers' level of involvement with technology. This further strengthens the results from hypothesis 2 that using VR had positive effects on the evaluation of the product.

However, for website related variables involvement with technology functioned as a significant moderator, and tendencies could also be found for brand attitude (table 16). The group of high involvement indicated a significant higher website satisfaction, website trust and intention to return to similar websites when the website provided VR compared to only 2D pictures (table 17). Interestingly, the group of low involvement indicated no such significant improvements when comparing VR with only 2D. There was also a clear tendency that brand attitude had a greater mean difference for VR in the high involvement group compared to the low involvement group. It is therefore important to address that even though the results from hypothesis 2 imply that website and branding variables are better evaluated when providing VR, this is not the case when further investigating the results more in detail. These results indicate that there is only an improved evaluation of the website variables and also a tendency of a better effect on the branding attitude from using VR, if the consumer is interested in technology. This is an important theoretical implication into the effects of using VR.

Theory on consumer involvement could be used to further analyse these results. To review, a consumer's ability to process information is largely due to the consumers' ability, motivation and opportunity to do so (Batra and Ray, 1986). Consumers with a high level of involvement will allocate more effort and attention into the cognitive processing of information as compared to consumers with low involvement (Celsi and Olson, 1988). Following this line of reasoning, consumers with a

high level of involvement will use more cognitive effort into processing the information from technological tools such as VR and thus have an easier time to form attitudes. Since involvement with technology did not moderate the product related variables, it could further suggest that all consumers regardless of the involvement with technology could benefit from a more direct VR experience with the product. Therefore, they could evaluate the product variables as better with VR. However, in order for VR product presentations to have a spillover effect on the brand and website, the consumer need to have an interest in technology. Consumers with high technology involvement might see the use of a VR headset as something exciting and entertaining while consumers without technology involvement might see it as nothing special. In the same vein of rationale, the people that are interested in technology considers a brand or a website that uses VR as better, which improves the brand attitude, website satisfaction, website trust and their intention to return to similar websites. However, consumers who do not share the same interest for technology do not evaluate the website and brand related variables as significant better just because they use VR.

Previous research has often found involvement to work as a moderating variable (Bloch, 1981). In line with previous research, the theoretical contribution of this study is that involvement with technology has a moderating effect on the relation between telepresence and branding and website variables. This means that VR product presentations could improve the brand and website evaluations depending on if the respondent can be described as involved with technology. Therefore, involvement with technology could now be used as a moderator for future studies of the effects of VR relating to the brand and website.

## 5.2 MANAGERIAL IMPLICATIONS

These results indicate remarkable managerial implications that will be presented below from a sales perspective, a cost perspective and a branding perspective for the e-commerce industry.

### 5.2.1 SALES PERSPECTIVE

From a sales perspective, this study indicates that e-commerce would gain from investing in VR product presentations. This since the product related variables, such as product attitude and purchase intention, improved when the product was displayed in VR (table 10). Furthermore, the results of the study indicate that there is no difference between what product categories within

furniture that are displayed in VR. A VR product presentation would therefore be beneficial in order for companies to enhance their products. It is important to point out that VR would require a big investment, but VR could be seen as an alternative for companies that today are putting that budget into branding to enhance their products. In this line of reasoning, VR could for example be useful for a luxury company who needs to provide more experience and therefore is struggling to justify their premium price online. In the same vein of rationale, VR could also be useful for more unknown e-commerce companies that are trying to create credibility for its products online without a well-established brand.

### 5.2.2 COST PERSPECTIVE

From a cost perspective, VR could further offer great solutions for e-commerce companies. This since one big challenge for e-commerce is the cost of returned products (Interview Felix Kvik, 21-02-2017). VR improved consumers' product knowledge and perceived diagnosticity (table 10). Even though VR as for now might be a big investment it is important to put forward that VR might help consumers to get the right expectations before making an online purchase. Following this line of reasoning, VR could result in fewer products that fail to live up to consumer expectations and therefore lower the return rate costs for the company. Thus, a company struggling with high return rates might find VR as a good solution. In the long term cost perspective, VR could also be seen as a good replacement of having products in a physical store, which would further decrease costs and improve the current disadvantage towards competitors with physical stores.

### 5.2.3 BRANDING PERSPECTIVE

From a branding perspective, this thesis is further suggesting that using a VR product presentation could be both effective and ineffective. The improved website evaluations from using VR was a result of the group of high involvement technology and not significantly different within the group of low involvement (table 17). Therefore, a target group with high interest in technology compared to low interest would evaluate the brand and website with VR product presentations as better compared to a brand and website without VR. Following this line of reasoning, the spillover effect of favourable brand and website evaluations from VR product presentation might be dependent on the target group's interest in technology. These results indicate that e-commerce companies need a more careful investigation of the technology interest among their target groups. Good target insights

are important for any company and it could be expected that companies are well aware of the interest of their target group. For example, online pure players should likely have a target that is more open minded to technology since they purchase products online as compared to the consumers of a brick and mortar store. Age could also work as an indication of the target group whether it would be more or less responsive to technology since younger people use technology to a greater extent today, which was also discussed in the interview with af Robson (Interview Emma af Robson, 20-02-2017).

It is also of importance to address that if companies consider their targets as interested in technology and would consider VR product presentations as an investment for the purpose of brand building, the managerial implication could be to act as soon as possible. According to forecasts (Goldman Sachs investment research, 2016) and the VR industry expert af Robson (Interview Emma af Robson, 20-02-2017), VR is likely to soon disrupt the e-commerce landscape. It would be recommended to act soon before VR is no longer considered something innovative, but rather a fundamental criterion of an e-commerce site.

## 5.3 CONSUMER IMPLICATIONS

The results from the thesis do also indicate important implications for consumers. This will be presented from an evaluation perspective but also from a perspective that warns potential customers.

### 5.3.1 EVALUATION PERSPECTIVE

This thesis has shown that VR could provide valuable help for consumers to evaluate products online. This since both product diagnosticity and product knowledge improved when products were displayed in VR compared to only 2D pictures. The product presentations of today's e-commerce landscape with mostly 2D pictures are filled with ambiguity and it can be uncertain if a product will live up to the customer's expectations before the purchase. VR can therefore provide more information about the product and have positive advantages for the customers.

### 5.3.2 CRITICAL PERSPECTIVE

Despite these positive advantages of VR in terms of product evaluation, it is of importance in this thesis to also state the disadvantages for consumers. According to the interview with af Robson, e-commerce is likely to move into the VR platform, which leaves no physical limits for the way to display and experience products (Interview Emma af Robson, 20-02-2017). VR, as an immersive tool, could give e-commerce a whole new level of shopping experience and this thesis has shown that VR improved product attitude and purchase intention as compared to only 2D pictures. It is therefore important to inform that this could be used to not only help customers but also to persuade customers into purchases. Consumers should be aware of that the same product was evaluated better just because it was presented with a VR experience as well and one could therefore consider how this can impact their decision-making. Therefore, consumers should critically consider if they really like the product or rather if this could have been affected by the VR experience itself. Furthermore, it is important to point out that it is possible to edit colours, lightning and retouch VR pictures in a similar way as with 2D pictures. So even though VR might resemble more of a real experience as compared to 2D pictures, consumers should keep a critical perspective and remember that VR pictures could have been edited in order to appeal more to consumers.

## 5.4 CONCLUSION

The primary research question of this study was:

- *Will there be more positive effects on the consumer of displaying products in VR product presentations as compared to only 2D pictures in an e-commerce context?*

The conclusion based on the above results and discussion the answer would be: *YES*. VR product presentations improved product evaluations, however it is of importance to address that consumers' level of involvement affect the improved evaluation of the brand and website. These conclusions are further elaborated below.

### 5.4.1 PRODUCT EVALUATIONS

The results of this study show that VR product presentations gave positive cognitive and conative effects on the consumer. For example, VR product presentations gave the consumers a more

favourable product attitude and they also indicated stronger purchase intentions. In addition, consumers had an easier time to evaluate the product in VR and felt more knowledgeable about the product. The study shows no indications that these positive effects of using VR are only because of consumers' first time experience with VR.

#### 5.4.2 TELEPRESENCE

This study can also conclude that telepresence mediates the effects of VR. Consumers feel a strong digital presence, which result in more direct experiences with the products. Therefore, the study does not only show positive effects from the use of VR, but can also demonstrate that this can be explained by an increased sense of telepresence.

#### 5.4.3 PRODUCT TYPE

The first secondary research questions was:

- *Is there any specific product type that suits better in VR than others?*

Based on the above results and discussion the answer to this would be: *NO*. The type of furniture used in the VR presentation did not affect the product evaluation. These results differ from previous research on 3D product presentations where product type affected the outcome of the study. As previously mentioned, this can indicate that 3D product presentations might not work as a good benchmark for effects on VR product presentations and that more research within VR is needed.

#### 5.4.4 BRANDING AND WEBSITE EVALUATION

The other secondary research questions was:

- *Are the effects on consumers different depending on their level of involvement with technology?*

The answer to this question would be: *YES*. The positive branding and website evaluations were more apparent if the consumers were interested in technology. These results indicate that consumers' level of involvement with technology will affect if the VR product presentations give benefits in terms of favourable branding and website evaluations.

#### 5.4.5 CONCLUDING SUMMARY

Concluding remarks are therefore that presenting a product in VR will give positive product evaluations for both product types (VP and VP+) in this study, however it only gives positive spillover effects on branding and website if the target is interested in technology. In line with the forecasted success of VR and the positive results in this study, it is very likely that VR could be moving from science fiction to e-commerce in the very near future.

### 5.5 CRITICISM AND LIMITATIONS OF THE STUDY

This study has broadened the research scope of product evaluations in VR within an e-commerce context. However, criticism and limitations should be considered when interpreting the results of the study.

#### 5.5.1 RESPONDENT ACCESS AND SAMPLE

The first limitation is the access and sample of respondents in this study. In order to collect all four test groups in the same way, physical collection of all respondents were required. This physical collection of 200 respondents required more time than sending out the survey online. It is possible that an even larger dataset could have given more significant conclusions. The optimal solution would be to have all the respondents at home answering the survey. This could be tested in the future when all people are expected to have a VR headset at home like they have computers. Additional time and resources would therefore allow opportunities to collect even larger sample and to have an optimal method solution.

Moreover, another issue is the sample of respondents. Since the specific sample for the survey was students at SSE, it could be questioned whether this group can be generalizable for the Swedish population in the age of 18-29. Hence, the observed behaviour by students could be criticised as not reflecting other consumer groups as well.

#### 5.5.2 WEBSITE DESIGN

The second criticism is the design of the website provided to the respondents. Although, the website design had been pilot tested being similar to a real website, respondents' judgements could have



been affected since the functions of clicking around at the website were missing. Also, the respondents were put into a scenario but not a real shopping situation. This could generate some criticism regarding the validation of the results.

### 5.5.3 PRODUCT TYPES

A third criticism could be that only two products were tested in this thesis, which may not be generalizable to the two product types created in this thesis within furniture. Only one product was tested as representative for the VP and the VP+ type. Replications in this field with other products are needed to verify and validate the results in order to understand properly the impact of VP and VP+ type within VR. Furthermore, this result might not be generalizable for other product categories besides furniture.

## 5.6 SUGGESTIONS FOR FUTURE RESEARCH

First of all, it would be interesting to replicate the study with another target group not consisting of students to further validate the results. Also, it would be of interest to examine the sample using a VR headset at home to get a more realistic e-shopping scenario. Moreover, it would be interesting for replications of this study in a few years to see if the positive effects from VR compared to 2D pictures will be even more apparent. This as VR within the retail e-commerce is expected to become a fundamental attribute and not something regarded as only innovative (Goldman Sachs investment research, 2016).

Secondly, since no result was found for any differences between VP and VP+, new research would be of interest to see if other aspects could play an importance instead. To review, af Robson believed that large products would have greater advantage in VR than smaller products (Interview Emma af Robson, 20-02-2017), why product size could be tested as a moderator in future research in order to investigate more if certain types of products could gain larger benefits from consumers by using VR.

Thirdly, involvement with technology was in this thesis seen to work as a moderator, which should be reused in future studies when testing the effects of VR. Also, further types of user characteristics,

should be of interest to test in order for e-commerce stores to know what works best for their target group.

Lastly, this study only tested the product category furniture. Therefore, more product categories, such as real estates and cars, should be tested in order to also get a more generalizable result of the effects from VR product presentations in different industries.

## 6. LIST OF REFERENCES

### 6.1 LITERATURE: ACADEMIC JOURNALS

Andrews, J.C., Akhete, S., Durvasula, S. and Muehling, D. (1992). The effects of advertising and message content involvement on cognitive and affective responses to advertising. *Journal of current issues and research in advertising*, 14(1), pp. 45-58.

Batra, R. and Ray, M. (1986). Situational effects of advertising repetition: The moderating influence of motivation, ability, and opportunity to respond. *Journal of Consumer Research*, pp. 432-445.

Berger, I. and Mitchell, A.A. (1989). The effect of advertising on attitude accessibility, attitude confidence, and the attitude-behavior relationship. *Journal of Consumer Research*, pp. 269-279.

Biocca, F. (1997). Cyborg's dilemma: Progressive embodiment in virtual environments. *Journal of Computer Mediated-Communication*. (3:2).

Biocca, F., Li, H. and Daugherty, T.M. (2001). Experiential ecommerce: Relationship of physical and social presence to consumer learning, attitudes, and decision-making. *Proceedings of Presence Conference*, Mai, Philadelphia, PA.

Bloch, P. (1981). An exploration into the scaling of consumers' involvement with a product class. In NA - Advances in consumer research volume 08, eds. Kent B. Monroe, Ann Arbor, MI : *Association for Consumer Research*, pp. 61-65.

Bouchard S., Bernier F. and Renaud P. (2013). Empathy toward virtual humans depicting a known or unknown person expressing pain. *Cyberpsychology, Behavior & Social Networking*. 16(1), pp. 61-71.

Celsi, R. and Olson, J. (1988). The role of involvement in attention and comprehension processes. *Journal of Consumer Research*, pp. 210- 24.

Choi, Y.K. and Taylor, C.R. (2014). How do 3-dimensional images promote products on the Internet? *Journal of Business Research*. 67, pp. 2164-2170.

- Coyle, J. R. and Thorson, E. (2001). The effects of progressive levels of interactivity and vividness in web marketing sites. *Journal of Advertising*. 30(3), pp. 65–77.
- Dahlén, M., Rosengren, S. and Törn, F. (2008). Advertising creativity matters. *Journal of advertising*. 48(3), pp. 392-403.
- Debbabi, S., Daassi, M. and Bail, S. (2010). Effect of online 3D advertising on consumer responses: The mediating role of telepresence. *Journal of Marketing Management*. 26(9–10), pp. 967–992.
- Eroglu, S. A., Machleit, K. A. and Davis, L. M. (2003). Empirical testing of a model of online store atmospherics and shopper responses. *Psychology & Marketing, Special Issue: Behavioral Dimensions of E-Commerce*. Volume 20, nr 2, pp. 139–150.
- Fiore, A.M., Kim, J. and Lee, H.H. (2005). Effect of image interactivity technology on consumer responses toward the Web-based retailer. *Journal of Interactive Marketing*. 19, 3, pp. 38–53.
- Fishbein, M. (1963). An investigation of the relationships between beliefs about an object and the attitude toward that object. *Human Relations*, 16, pp. 233–240.
- Grüter, M. and Myrach, T. (2012). Understanding virtual experience and telepresence - A review and synthesis of literature. *ECIS 2012 Proceedings*. 104.
- Guo, W., Lim, S., Fok, S. and Chan, G. (2004). Virtual reality for memory rehabilitation. *International Journal Of Computer Applications In Technology*. 21(1/2):1.
- Hassell, M.D., Goyal, S., Limayem, M. and Boughzala, I. (2009). Effects of presence, copresence, and flow on learning outcomes in 3D learning spaces. *Administrative Issues Journal*. Vol 2, pp. 62-73.
- Hoffman, D. L. and Novak, T. P. (1996). Marketing in hypermedia computer-mediated environments: Conceptual foundations. *Journal of Marketing*. 60(3), pp. 50–68.
- Hoffman, D. L. and Novak, T. P. (1997). A new marketing paradigm for electronic commerce. *Information Society*. 13(1), pp. 43–54.
- Hoffman, H., Patterson, D., Soltani, M., Teeley, A., Miller, W. and Sharar, S. (2009). Virtual reality pain control during physical therapy range of motion exercises for a patient with multiple blunt force trauma injuries. *Cyberpsychology & Behavior*, 12(1), pp. 47-49.

- Hutchinson, J. W. and Alba, J. W. (1991). Ignoring irrelevant information: Situational determinants of consumer learning. *Journal of Consumer Research*, 18, pp. 325–345.
- Jiang, Z. and Benbasat, I. (2005). Virtual product experience: Effects of visual and functional control of products on perceived diagnosticity and flow in electronic shopping. *Management Inform. Systems*, 21(3), pp. 111-148.
- Jiang, Z. and Benbasat, I. (2007). The effects of presentation format and task complexity on online consumers' product understanding. *MIS Quarterly*. Vol. 31 No. 3, pp. 475-500.
- Kim, T. and Biocca, F. (1997). Telepresence via television: Two dimensions of telepresence may have different connections to memory and persuasion. *Journal of Computer Mediated-Communication*, 3(2).
- Kim, J., Fiore, A. and Lee, H-H. (2007). Influence of online store perception, shopping enjoyment, and shopping involvement on consumer patronage behaviour towards an online retailer. *Journal of Retailing and Consumer Services*, Vol. 14, pp. 95-107.
- Kirmani, A. (1997). Advertising repetition as a signal of quality: If it's advertised so much, something must be wrong. *Journal of Advertising*. 26, 3, pp. 77–86.
- Kirmani, A. and Wright, P. (1989). Money Talks: Perceived Advertising Expense and Expected Product Quality. *Journal of Consumer Research* .16 (3), pp. 344-53.
- Klein, L. (2003). Creating virtual product experiences: The role of telepresence. *Journal of Interactive Marketing*, 17(1), pp. 41–55.
- Lee, E-J. and Park, J. (2014). Enhancing virtual presence in e-tail: Dynamics of cue multiplicity. *International Journal of Electronic Commerce*. Vol. 18, No. 4, pp. 117–146.
- Li, H., Daugherty, T. and Biocca, F. (2001). Characteristics of virtual experience in electronic commerce: A protocol analysis. *Journal of Interactive Marketing*. 15(3), pp. 13–30.
- Li, H., Daugherty, T. and Biocca, F. (2002). Impact of 3-D advertising on product knowledge, brand attitude, and purchase intention: The mediating role of presence. *Journal of Advertising*. 31(3), pp. 43–57.

- Li, H., Daugherty, T. and Biocca, F. (2003). The Role of Virtual Experience in Consumer Learning. *Journal of Consumer Psychology*. (13:4), pp. 395-408.
- Liu, C., Marchewka, J., Lu, J., and Yu, C. (2005). Beyond concern: A privacy-trust-behavioral intention model of electronic commerce. *Information and Management*, 42, 2 , pp. 289–304.
- Lorenzo, C., Gómez, M. and Mollá, A. (2007). Website design and e-consumer: effects and responses. *International Journal Internet Marketing and Advertising*. Vol. 4, No 1, pp. 114-141.
- Meyrueis, V., Paljic, A., Leroy, L. and Fuchs, P.A. (2013). Template approach for coupling virtual reality and CAD in an immersive car interior design scenario. *International Journal Of Product Development*. 18(5), pp. 395-410.
- Mills, S. and Noyes, J. (1999). Virtual reality: an overview of user-related design issues revised paper for special issue on “Virtual reality: User issues” in interacting with computers, May 1998. *Interacting with Computers* 11, pp. 375-386.
- Pelsmacker, P.D., Geuens, M. and Anckaert, P. (2002). Media context and advertising effectiveness, the role of context appreciation and context/ad similarity. *Journal of advertising*. Vol. 31, No. 2, pp. 49-61.
- Preacher, K. J. and Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, 40(3), pp. 879- 891.
- Roussou, M. A. (2009). VR playground for learning abstract mathematics concepts. *IEEE Computer Graphics & Applications*. 29(1), pp. 82-85.
- Song, J.H. and Zinkhan, G.M. (2008). Determinants of perceived website interactivity. *Journal of Marketing*. 72, 2, pp. 99–113.
- Song, K., Fiore, A.M. and Park, J. (2007). Telepresence and fantasy in online apparel shopping experience. *Journal of Fashion Marketing and Management: An International Journal*. Vol. 11 Iss 4, pp. 553-570.
- Steuer, J. (1992). Defining virtual reality: dimensions determining telepresence. *Journal of Communication*. 42, pp. 73 – 93.

Suh, K.S. and Chang, S. (2011). User interfaces and consumer perceptions of online stores: The role of telepresence. *Behaviour & Information Technology*. 25:2, pp. 99-113.

Suh, K.S. and Lee, Y.E. (2005). The effects of virtual reality on consumer learning: An empirical investigation. *MIS Quarterly*. 29(4), pp. 673–697.

Jiang, Z. and Benbasat, I. (2007). Investigating the Influence of the Functional Mechanisms of Online Product Presentations. *Information Systems Research*. Vol. 18, No. 4, pp. 454-470.

## 6.2 LITERATURE: BOOKS

Bryman, A., and Bell, E. (2011). Business research methods (Third ed.). New York: Oxford University Press.

Day, George S. (1970). Buyer attitudes and brand choice (First edition) New York free press.

Jacobsen, D.I. (2002). Vad, hur och varför? Om metodval i företagsekonomi och andra samhällsvetenskapliga ämnen. First edition. Lund: Studentlitteratur.

Levy, M. and Weitz, B. A. (2012) Retailing Management. New York, NY: McGraw-Hill Irwin.

Malhotra, N. (2010). Review of marketing research. Armonk, N.Y.: M.E.

Saunders, M., Lewis, P. and Thornhill, A. (2009). Research Methods for Business Students (Vol.5). Harlow: Pearson Education.

Söderlund, M. (2010). Experiment med människor, First edition. Malmö: Liber.

## 6.3 ELECTRONIC SOURCES

Virtual & augmented report (2016), by The Goldman Sachs Group. Available at: <http://www.goldmansachs.com/our-thinking/pages/technology-driving-innovation-folder/virtual-and-augmented-reality/report.pdf>. Accessed latest 07-03-2017.

VR-glasögon är Året Julklapp 2016 (2016), by HUI Research. Available at: <http://www.hui.se/nyheter/arets-julklapp-2016>. Accessed latest 09-03-2017.

Euromonitor /Passport (2017). Internet Retailing in Sweden, Available at: <http://www.euromonitor.com/internet-retailing-in-sweden/report>. Accessed latest 07-03-2017.

Virtual reality advertising effectiveness study (2016). By Nielsen research. Available at: <http://virtualsky.com/wp-content/uploads/2016/12/Virtual-Reality-Advertising-Effectiveness-Study.pdf>. Accessed latest 27-02-2017.

## 6.4 INTERVIEWS WITH INDUSTRY EXPERTS

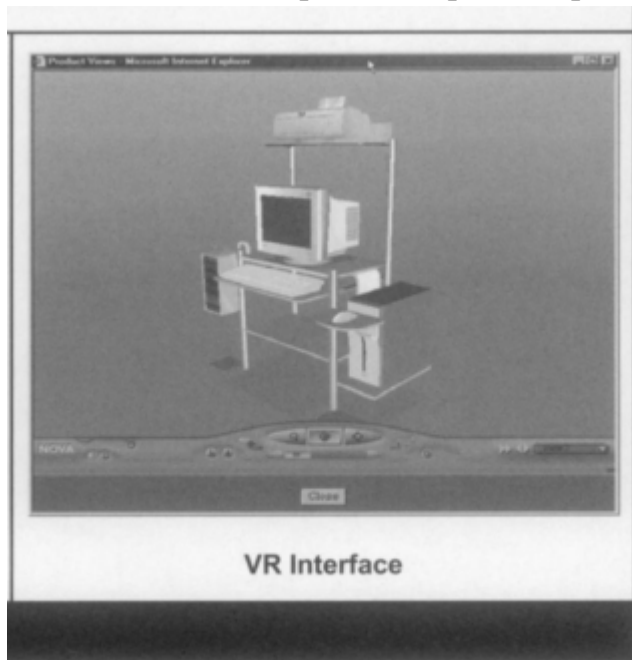
Emma af Robson, Co-Founder of Warpin Media, Interview, 20-02-2017.

Felix Kvik, Former CEO and Board Member of Furniturebox, Interview, 21-02-2017.



## 7. APPENDIX

### Appendix 1: Example of 3D product presentation (Suh and Lee, 2005)



This is a computer table that the user can see on a computer screen and interact with by rotating, zooming in on it and examining alterations such as pull out the keyboard and adjust the height of the table. Suh and Lee (2005) described this as a VHE product that could be evaluated by only vision and hearing dimensions and therefore suited perfectly in 3D format compared to VLE. They had a desktop computer as their VLE product that did not suit perfectly in 3D.

### Appendix 2: Interview Questions with Industry Experts

#### Interview Warpin

1. Warpin specific question: What is the type of VR requests that companies are asking you today?
2. Warpin specific question: What kind of requests you do not get today, but you think will increase in the future? Retail for example?
3. Warpin specific question: Do you notice if companies are hesitant to use VR? If so, what is uncertain?
4. Warpin specific question: Do you know if companies do not dare to implement VR because there are no studies about the effects of it?

5. Warpin specific question: Do companies you work with request any reports or studies on what the effects of VR will be?
6. Warpin specific question: Is there anything that companies want to know that you don't have the answer to at the moment?
7. Warpin specific question: What are the types of effects you lack studies of?
8. What do you think about the development of VR within e-commerce?
9. What do you think are the benefits / opportunities of using VR within e-commerce?
10. What do you think are the disadvantages of using VR within e-commerce?
11. What do you think is the biggest obstacle for e-commerce to implement VR?
12. What do you think would be interesting to test if you would test VR for product presentations in furniture?
13. Do you know any good example of retail within e-commerce that uses VR today?
14. Do you know an example within e-commerce that uses VR for product presentations today?
15. Do you think the effects of using VR will be stronger for certain types of people than others, for example those who are more tech interested?
16. Do you think the effects of using VR will be stronger for certain types of products?
17. Do you think VR should be used mostly as a branding tool or that it can also enhance product attitudes? Enhance product quality?
18. Do you think customers will have more confidence in their attitudes of a product if the consumers see the product in VR?
19. Do you think that the use of VR could make consumers feel better about the website? Brand?
20. Do you think customers will be more willing to buy a product if they have seen it in VR?
21. Do you think VR could create more brand loyalty? For example, if you like a website because it offers VR, do you think you would like to visit the website again for the next product purchase?

22. Do you think customers could trust the website more if you offer VR?
23. Do you think the customer will think they know more about the product because you have seen it in VR?
24. Do you think the customer will be more curious when shopping if the website provides VR?
25. Do you think the customer will perceive the risk with the product as lower if the website provides VR?
26. Do you think the customer will have more fun when shopping if seeing the product in VR?

### **Interview Furniturebox**

1. What do you think about the development of VR within e-commerce?
2. What do you think are the benefits/ opportunities of using VR within e-commerce?
3. What do you think are the disadvantages of using VR within e-commerce?
4. What do you think is the biggest obstacle to e-commerce of implementing VR?
5. Why is Furniturebox not using VR today?
6. What do you think is interesting to test if you would like to test VR for product presentations within e-commerce?
7. Do you know a good example of retail within e-commerce that uses VR today?
8. Do you know an example of e-commerce that uses VR for product presentations today?
9. Do you think the effects of using VR will be stronger for certain types of people than others, such as those who are more tech interested?
10. Do you think the effects of using VR will be stronger for certain types of products?
11. Do you think VR should be used mostly as a branding tool or that it can also enhance product attitudes? Enhance product quality?

12. Do you think customers will have more confidence in their attitudes of a product if the consumers see the product in VR?
13. Do you think that the use of VR could make consumers feel better about the website? Brand?
14. Do you think customers will be more willing to buy a product if they have seen it in VR?
15. Do you think VR could create more brand loyalty? For example, if you like a website because it offers VR, do you think you would like to visit the website again for the next product purchase?
16. Do you think customers could trust the website more if you offer VR?
17. Do you think the customer will think they know more about the product because you have seen it in VR?
18. Do you think the customer will be more curious when shopping if the website provides VR?
19. Do you think the customer will perceive the risk with the product as lower if the website provides VR?
20. Do you think the customer will have more fun when shopping if seeing the product in VR?

### Appendix 3: Pre-study 1: Product Categories Within Furniture

Hi!

This is a small pre-study about furniture shopping. Imagine that you have just moved to your new home and are therefore looking for furnitures. You will be asked questions about what is important for you when you buy certain furniture categories.

Rate how important the following inspections are before purchasing a sofa table?  
1=Not important at all, 11= Extremely important

|                                                      | Not important at all  |                       |                       |                       |                       |                       |                       |                       |                       |                       | Extremely important   |  |
|------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|--|
|                                                      | 1                     | 2                     | 3                     | 4                     | 5                     | 6                     | 7                     | 8                     | 9                     | 10                    | 11                    |  |
| Visual inspection - To see the product               | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |  |
| Touch inspection - To touch the product              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |  |
| Behavioral inspection - To interact with the product | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |  |

The same question was repeated six times but with different categories within furniture (i.e. sofa table, armchair, carpet, TV table, lamp, sofa). No pictures in this study.

## Appendix 4: Pre-study 2: General Attitude

Hi!

This is a small pre-study about furniture shopping. Imagine that you have just moved to your new home and are therefore looking for furnitures. You will be asked questions to each furniture picture.

My general appreciation of this product is:

|              | 1                     | 2                     | 3                     | 4                     | 5                     | 6                     | 7                     |            |
|--------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------|
| Negative     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Positive   |
| Dislike      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Like       |
| Unfavourable | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Favourable |

The same question was repeated six times but with different product designs of furniture. See the selected product designs below.



## Appendix 5: Pre-study 3: Telepresence

### Telepresence

1. How much do you agree with the following:

|                                                                                                   | Disagree              |                       |                       |                       |                       |                       | Agree                 |
|---------------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|                                                                                                   | 1                     | 2                     | 3                     | 4                     | 5                     | 6                     | 7                     |
| 1. While looking at the product, I felt I was in a new world.                                     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. While looking at the product, I forgot I was in the middle of an experiment.                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. While looking at the product, I felt I was there next to the product.                          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 4. While looking at the product, I felt that I visited the product, rather than only seeing it.   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 5. While looking at the product, I felt I was more in a "new world" rather than the "real world". | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 6. I forgot my immediate surroundings when I was looking at the product.                          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 7. After looking at the product, I felt like I came back to the "real world".                     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

## Appendix 6: 1 Website 1, Sofa (VP+), 2D pictures

# Furniturestore

Search

VIEW CART

TOTAL: € 0.00

FURNITURE

GARDEN FURNITURE

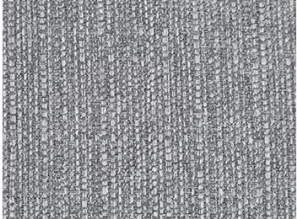
YARD

DECORATING PRODUCTS

FIXTURES

SWIMMING & HOT TUBS

BATHROOM



### HOWARD-DELUXE 3-SEATER SOFA LIGHT GRAY

3-seater sofa Howard-light gray fabric. Dimensions: L206 S94 K83 cm.

The Howard sofa has become a timeless classic, which is the heart of the interior in many apartments. The soft round shapes, combined with the elegantly turned legs with practical wheels, complement each other to a piece of furniture that flirts with the classic English style and the popular New England style.

**Check stock at your local store**

Choose

Store selection may vary and prices may differ from those online.

**Assembly instructions & manuals**

Downloads

[Share](#) [Pin it](#) [G+1](#) [0](#) [f Like](#) [Share](#) [7](#)

## Appendix 7: 2 Website 2, Sofa table (VP), 2D pictures

# Furniturestore

Search

VIEW CART

TOTAL: € 0.00

FURNITURE

GARDEN FURNITURE

YARD

DECORATING PRODUCTS

FIXTURES

SWIMMING & HOT TUBS

BATHROOM



### CARRIE COFFEE TABLE IN WHITE MARBLE / STEEL

120X60X45 CM

**Description**

Carrie is an elegant and minimalist coffee table, a work top is made of marble and steel frame. Material is a combination of trendy and timeless. Design a clear table suitable for many interiors.

**Check stock at your local store**

Choose

Store selection may vary and prices may differ from those online.

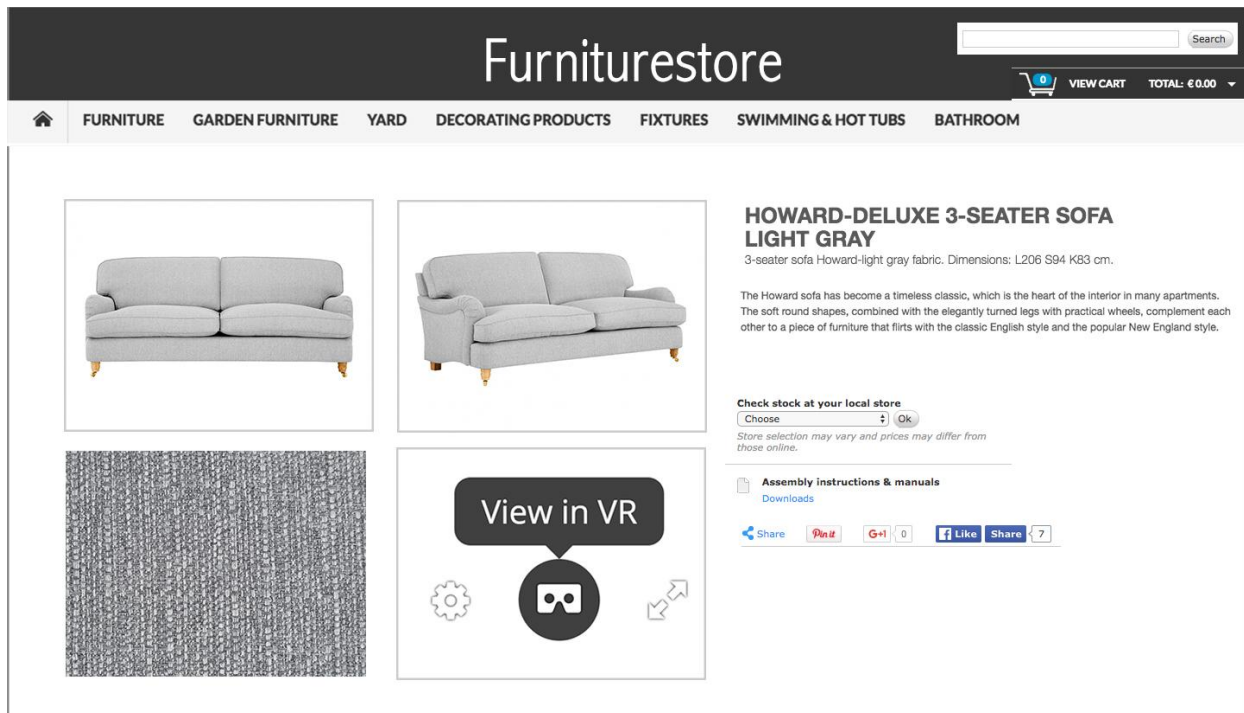
**Assembly instructions & manuals**

Downloads

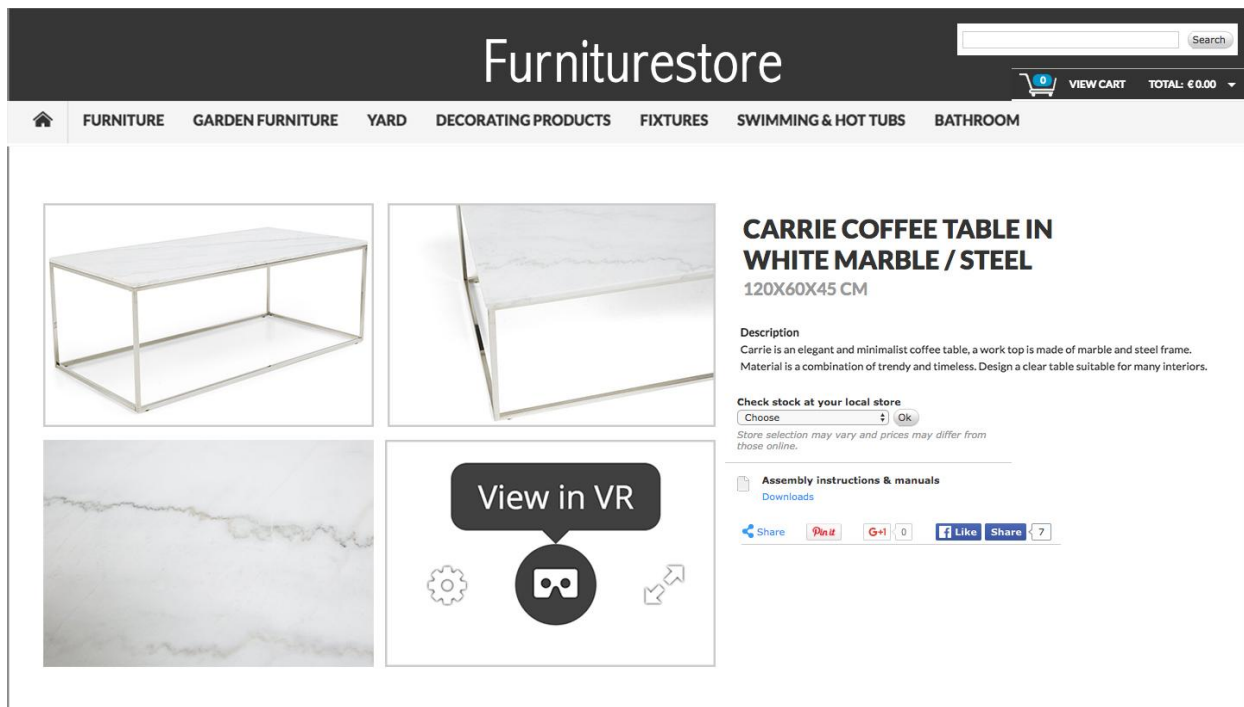
[Share](#) [Pin it](#) [G+1](#) [0](#) [f Like](#) [Share](#) [7](#)



## Appendix 8: Website 3, Sofa (VP+), 2D pictures and VR sign



## Appendix 9: Website 4, Sofa table (VP), 2D pictures and VR sign



## Appendix 10: Survey used for main study in Qualtrics.

Hi!

Imagine that you have just moved to a new home and are therefore looking for new furniture. Look around at the product on the e-commerce website *Furniturestore* for a minute in this link

<http://www.biiddump.se/bilder/20170320111612-193.10.50.254.jpg>

before coming back and answering some questions.

All answers are anonymous.

### Telepresence

1. How much do you agree with the following:

|                                                                                                   | Disagree              |                       |                       |                       |                       |                       |                       | Agree |
|---------------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-------|
|                                                                                                   | 1                     | 2                     | 3                     | 4                     | 5                     | 6                     | 7                     |       |
| 1. While looking at the product, I felt I was in a new world.                                     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |       |
| 2. While looking at the product, I forgot I was in the middle of an experiment.                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |       |
| 3. While looking at the product, I felt I was there next to the product.                          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |       |
| 4. While looking at the product, I felt that I visited the product, rather than only seeing it.   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |       |
| 5. While looking at the product, I felt I was more in a "new world" rather than the "real world". | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |       |
| 6. I forgot my immediate surroundings when I was looking at the product.                          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |       |
| 7. After looking at the product, I felt like I came back to the "real world".                     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |       |

### Product attitude

2. How do you feel about the product?

|                  | 1                     | 2                     | 3                     | 4                     | 5                     | 6                     | 7                     |            |
|------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------|
| 1. Bad           | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Good       |
| 2. Not Appealing | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Appealing  |
| 3. Unattractive  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Attractive |

### Brand attitude

3. How do you feel about the brand *Furniturestore*?

|                  | 1                     | 2                     | 3                     | 4                     | 5                     | 6                     | 7                     |            |
|------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------|
| 1. Bad           | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Good       |
| 2. Not Appealing | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Appealing  |
| 3. Unattractive  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Attractive |

### Purchase intention

4. How likely is it that you will purchase the evaluated product?

|            | 1                     | 2                     | 3                     | 4                     | 5                     | 6                     | 7                     |          |
|------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------|
| Unlikely   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Likely   |
| Improbable | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Probable |
| Impossible | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Possible |

### Intention to return to similar websites

5. I would like to use websites with similar characteristics to those of this website in the future.

| Disagree              |                       |                       |                       | Agree                 |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1                     | 2                     | 3                     | 4                     | 5                     | 6                     | 7                     |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

### Website satisfaction

6. How much do you agree with the following:

|                                                                | Disagree              |                       |                       |                       |                       |                       | Agree                 |
|----------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|                                                                | 1                     | 2                     | 3                     | 4                     | 5                     | 6                     | 7                     |
| 1. I enjoyed visiting the website.                             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. I was satisfied with my shopping experience at the website. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. I would recommend the website to other people.              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

### Website trust

7. If I were shopping in this website in reality, I would say that:

|                                                                              | Disagree              |                       |                       |                       |                       |                       | Agree                 |
|------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|                                                                              | 1                     | 2                     | 3                     | 4                     | 5                     | 6                     | 7                     |
| 1. The website seems genuinely committed to my satisfaction.                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. The website seems very reliable.                                          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. The product presentation is helpful in familiarizing me with the product. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

### Perceived diagnosticity

8. How much do you agree with the following:

|                                                                                             | Disagree              |                       |                       |                       |                       |                       | Agree                 |
|---------------------------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|                                                                                             | 1                     | 2                     | 3                     | 4                     | 5                     | 6                     | 7                     |
| 1. The product presentation is helpful for me to evaluate the product.                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. The product presentation is helpful in familiarizing me with the product.                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. The product presentation is helpful for me to understand the performance of the product. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

### Product knowledge

9. How much do you agree with the following:

|                                                                 | Disagree              |                       |                       |                       |                       |                       | Agree                 |
|-----------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|                                                                 | 1                     | 2                     | 3                     | 4                     | 5                     | 6                     | 7                     |
| 1. I feel very knowledgeable about the product I just examined. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

### Involvement with technology

10. How much do you agree with the following:

|                                                                          | Disagree              |                       |                       |                       |                       | Agree                 |                       |
|--------------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|                                                                          | 1                     | 2                     | 3                     | 4                     | 5                     | 6                     | 7                     |
| 1. I am curious and I like to try technological innovations.             | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. I like to talk about technological innovations to friends and others. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. I am very interested in new technology.                               | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

### Control questions

11. The website had a realistic design.

| Disagree              |                       |                       |                       |                       | Agree                 |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 1                     | 2                     | 3                     | 4                     | 5                     | 6                     | 7                     |
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

12. What do you think is the purpose of this experiment?

13. Have you tried a virtual reality headset before this experiment?

- ☐ Yes
- ☐ No
- ☐ I don't know what virtual reality is

### Demographic questions

14. Sex:

- ☐ Male
- ☐ Female

15. Age:

### **Appendix 11: VR headset used in this study**

The VR headset used for pre-study 3 and the main study was a universal VR headset made by SPECTRA Optics Industries.



### **Appendix 12: VR headset with navigation controls**

The picture below shows a more advanced and expensive VR headset with navigation controls, which is not used in this thesis.

