Master's thesis

NTNU
Norwegian University of Science and Technology
Faculty of Information Technology and Electrical Engineering
Department of Computer Science

Charlotte Söderström

Augmented Reality and Artificial Intelligence: The Influence on Behavioral Consumer Responses in E-Commerce

Master's thesis in Computer Science
Supervisor: Patrick Mikalef
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Preface

This thesis is the final part of the five-year master's degree in Computer Science at the Norwegian University of Technology (NTNU) in Trondheim. The thesis was written in Oslo during the period of September to December 2021.

I would like to give great thanks to my supervisor, Patrick Mikalef for his excellent job in guiding me in both the specialization project and this thesis. Working remotely could have been a challenge, but his direct and helpful feedback at both physical and distributed meetings and always being available on e-mail made it function well. Additionally, I would like to thank my partner, family, friends, and colleagues for their support.

Abstract

In the marketing sector, augmented reality (AR) is growing in popularity, and the market size of AR is predicted to grow remarkably in the coming years. The technology enables consumers in electronic commerce (e-commerce) to view products in a more vivid and entertaining manner when shopping online. One of IKEA's goals for implementing the technology into their platforms is to reduce product returns. The opportunities with AR are many, but the technology is still at an early stage. There is limited knowledge on how this technology's effect on behavioral consumer responses may differ over time and the possible wear-out effects. This study aims to examine how the AR mobile application (app), IKEA Place, influences affective, cognitive, and behavioral responses, and to compare first-time users of the app with experienced users. More specifically, this research examines ten constructs: vividness, augmentation, product informativeness, personalized recommendations, enjoyment, immersion, usefulness, choice confidence, purchase intention, and product return intention.

By applying the stimulus-organism-response (SOR) model, the cue-utilization theory, and the habituation-tedium theory, twelve hypotheses on behavioral consumer response have been developed. To evaluate the hypotheses, a survey questionnaire with 401 participants with various age groups was conducted. The quantitative data from the survey were analyzed using partial least squares structural equation modeling (PLS-SEM).

Finally, some key findings of the study are (1) first-time users seem to have a utilitarian motivation for using the app, while (2) experienced users seem to have hedonic motivations for continuing to use the app. (3) Perceived usefulness is the most important factor for first-time users' purchase intention, whereas (4) perceived enjoyment is found to be the most dominant factor for influencing experienced users' purchase intention. (5) Choice confidence has more effect on reducing the product return intentions for first-time users than for experienced users. Further, (6) vividness has a greater effect on first-time users' affective responses than experienced users, and augmentation has a higher influence on experienced users' cognitive and affective responses than first-time users. Lastly, (7) Personalized recommendations are shown to have a great effect on experienced users' perceived usefulness.

Keywords: *Augmented reality, purchase intention, artificial intelligence, e-commerce, product return intention, IKEA Place app*

Sammendrag

I markedsføringssektoren vokser utvidet virkelighet (AR) i popularitet, og markedsstørrelsen til AR er forutsatt til å vokse bemerkelsesverdig i de kommende årene. Teknologien gjør at forbrukere innen elektronisk handel (e-handel) kan se produkter på en mer virkelighetsnær og underholdende måte når de handler på nett. Et av IKEAs mål for å implementere teknologien på deres plattformer er å redusere produktreturer. Mulighetene med AR er mange, men teknologien er fortsatt i en relativt tidlig fase. Det er lite kunnskap om hvordan teknologiens effekt på forbrukeradferd kan variere over tid, og mulig reduserte effekter. Denne studien har som mål om å undersøke hvordan AR-mobilapplikasjonen, *IKEA Place*, påvirker forbrukernes respons og deres atferdsrespons, og å sammenligne førstegangsbrukere av appen med erfarne brukere. Mer spesifikt undersøker denne forskningen ti konsepter: livlighet, produktutvidelse, produktinformasjon, personlige anbefalinger, glede, opplevd fordypning, nytte, valgsikkerhet, kjøpsintensjon og intensjoner om produktretur.

Ved å bruke *stimulus-organism-respons* (SOR)-modellen, *cue-utilization*-teorien og *habituation-tedium*-teorien, er det utviklet tolv hypoteser om forbrukeratferd. For å evaluere hypotesene ble det gjennomført et spørreskjema med 401 deltakere med ulike aldersgrupper. De kvantitative dataene fra undersøkelsen ble analysert ved bruk av *partial least squares structural equation modeling* (PLS-SEM).

Noen nøkkelfunn i studien, (1) førstegangsbrukere ser ut til å ha en utilitaristisk motivasjon for å bruke appen, mens (2) erfarne brukere ser ut til å ha hedoniske motivasjoner for å fortsette å bruke appen. (3) Opplevd nytte er den viktigste faktoren for førstegangsbrukers kjøpsintensjon, mens (4) glede er funnet å være den mest dominerende faktoren for å påvirke erfarne brukeres kjøpsintensjon. (5) Valgsikkerhet har mer effekt på å redusere produktreturintensjonene for førstegangsbrukere enn for erfarne brukere. Videre har (6) livlighet en større effekt på førstegangsbrukeres affektive responser enn erfarne brukere, og utvidelse av produkter har større innflytelse på erfarne brukeres kognitive og affektive responser enn førstegangsbrukere. Til slutt, (7) Personlige anbefalinger har vist seg å ha stor effekt på erfarne brukeres oppfattede nytteverdi.

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Abbreviations

AR	=	Augmented reality
E-commerce	=	Electronic commerce
AI	=	Artificial intelligence
SOR	=	Stimulus-organism-response
TAM	=	Technology acceptance model
TPB	=	Theory of planned behavior
PLS-SEM	=	Partial least squares-based structural equation modeling
PLS-MGA	=	Partial least squares multi-group analysis
AVE	=	Average variance extracted
HTMT	=	Heterotrait-monotrait

Construct variables

AUGM	=	Augmentation
CC	=	Choice confidence
ENJ	=	Perceived enjoyment
IMM	=	Perceived immersion
PI	=	Purchase intention
PR	=	Personalized recommendations
PRIN	=	Product informativeness
Rev RETURN	=	Reversed Product return intention
USF	=	Perceived usefulness
VIV	=	Vividness

Chapter 1

Introduction

This chapter gives an introduction to the thesis and a report outline. First, the problem description of the research is presented, followed by the motivation for conducting the study. Furthermore this chapter includes an initial task description of the thesis, and overview of the goal and research question that the study strives to reach, followed by an overview of the research methodology. The final section gives an overview of the thesis structure.

1.1 Problem statement

Augmented reality (AR) is an emerging technology that combines the real world with virtual objects. The popularity of the technology is increasing with the usage of AR, allowing companies to present items in a new and appealing way (Yim et al., 2017). Therefore, it is critical for the marketing sector to constantly adapt and evolve according to consumers' needs, where AR has become an essential factor in marketing today (Ooi and Yazdanifard, 2015). The global market size for AR was calculated to be $4.16 billion for 2020 and is anticipated to grow to $97.76 billion by 2028 (Insights, 2021).

There have been conducted multiple studies to understand how consumers' behavior is influenced by AR applications (apps) in electronic commerce (e-commerce). Previous AR literature suggest shopping online using AR leads to positive impact on consumer engagement and their perceived enjoyment (Kowalczuk et al., 2021; Raska and Richter, 2017). Moreover, it is indicated that consumers' choice confidence is increased when viewing products through AR (Kowalczuk et al., 2021). Additionally, previous research has found that consumers experience novelty after shopping with AR (Yim et al., 2017). Prior AR literature contains many important findings on the field of study. However, there is limited research regarding the possible wear-out effects and how this novel technology influences behavioral consumer responses when experiencing it for the first time versus after multiple times.

IKEA is one of the companies that have embedded this technology in their platform and launched IKEA Place app in 2017 to let their customers place virtual IKEA furniture in the home. One of IKEA's goals in launching this AR mobile app was to reduce product returns (Alves and Reis, 2020). If this goal is reached is not yet answered. This research will try to contribute to the study on how AR technology influences consumers' product return intention to aid companies in achieving their goal of reducing the number of returns.

1.2 Motivation

Rauschnabel et al. (2019) expressed in their research study, "Try to spell the word marketing without AR – it won't work. Try to develop an inspiring marketing strategy without AR – it won't work either" (Rauschnabel et al., 2019, para. 1). The AR market size is anticipated to continue to grow in the coming years. Consequently, it is crucial for retailers, marketers, and developers to understand how this novel technology affects behavioral consumer responses - how does the consumer respond to the characteristics in an AR mobile app and what are their behavioral responses. Customer loyalty or continued purchasing is crucial for the success of any store (Chiu et al., 2014). Moreover, AR mobile applications in e-commerce are not designed for one-time use. Thus, it is essential to comprehend better how the technology influences consumers over time and the possible wear-out effects. The motivation for doing this research is to fill the gap in previous research and to benefit future retailers to determine the next steps for AR. Like AR, artificial intelligence (AI) has also increased in popularity within the marketing sector (Huang and Rust, 2021). Therefore it is interesting to research how the consumer, when purchasing online, is influenced when AI characteristics are included in the research.

1.3 Context

The initial task description of this thesis is the following:

Augmented reality (AR) has increasing popularity among companies today and in the marketing industry. IKEA is one of the companies that has utilized AR in one of their mobile applications to view their products for consumers when shopping online. However, in the marketing industry in e-commerce, this technology is not designed for one-time use. There is little research on how this novel technology influences the consumers' purchase behavior after multiple times of use. And, how will the use of personalized recommendations in these AR apps affect the consumers' purchase behavior? The study will use quantitative research methods, such as a survey, to collect and analyze data.

1.4 Goal and Research Questions

Goal: The goal of the research is to examine further how AR and AI technology influence the behavioral consumer responses for both first-time use of the technologies in

e-commerce and after multiple times of usage.

- **RQ1:** *How do augmented reality and artificial intelligence influence behavioral consumer responses?*
  - **RQ1.1:** *What aspects of augmented reality and artificial intelligence have an impact on affective and cognitive responses?*
  - **RQ1.2:** *How do affective and cognitive responses affect the behavioral responses, purchase intention, and product return intention?*

1.5 Overview of Research Methodology

Figure 1.1 shows the methodical approach of this research. After conducting a literature review of previous research to identify gaps, the research questions were constructed. The literature review was the basis for the theoretical framework and conceptual framework. To answer the research questions, a survey was chosen as the research strategy. Quantitative data was generated by distributing a questionnaire, and it was analyzed using partial least squares structural equation modeling (PLS-SEM). Chapter 4 gives a more detailed description of the methodology of the research.

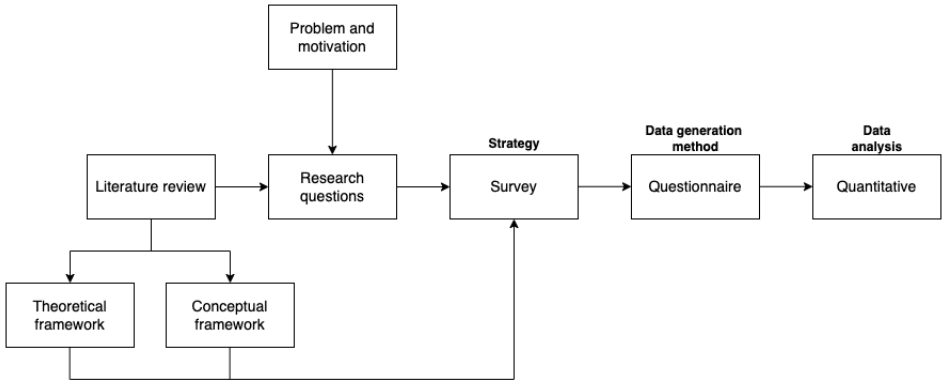

Figure 1.1: Research methodology

1.6 Report Outline

This thesis consists of seven chapters, where chapter 1 is an introductory chapter that presents the problem description for the study, the motivation for doing the research, and the initial task description of the thesis. The first chapter also includes an overview of the goal and research questions for the study, an overview of the methodological research approach, and a summary of the thesis structure. Chapter 2 presents the literature review and a synthesis of the literature as a basis for the theoretical and conceptual framework.

Moreover, chapter 3 includes the theoretical framework, the conceptual framework and the hypotheses for this study. Chapter 4 contains a recapitulation of the goals and the research questions, an overview of the survey design process, and details about the questionnaire used to gather the quantitative data to be further analyzed. Chapter 5 presents the PLS-SEM analysis of the data, measurement models, structural models, and results of a multi-group analysis. Chapter 6 summarizes the practical implications and the theoretical implications from the findings of the research. Outlined limitations of the study along with suggestions for future work are also included. Chapter 7 gives a summary of the work and findings of the study.

Chapter 2

Literature Review

This chapter is based on the work from the literature review and synthesis of the literature from the specialization project, which this thesis is built further upon. Elucidation of the term *augmented reality* was necessary at the beginning of the literature review. Thus, this chapter starts by addressing the technology. Moreover, the usage of AR technology in the marketing sector is examined. As AI can be used to enhance AR technology, a section concerning AI for marketing purposes is therefore included. Subsequently, a set of selected theories is introduced. The keywords *augmented reality*, and *artificial intelligence* were used along with the keywords *purchase intention*, *marketing*, and *e-commerce* in distinct searches to Google Scholar's database. Supplemental papers were found through the bibliography list in the initially located papers from the search with the mentioned keywords. This chapter ends with a synthesis of the previous AR literature to outline what previous researchers have found concerning the *stimulus-organism-response* (SOR) model.

2.1 Development of AR

AR is an innovative technology that blends the real world and the virtual world (Rauschnabel et al., 2019). To achieve this blend of the two worlds, software is used to present the real environment with computer-generated objects, which are perceived in the environment as physical objects. It is possible to create next-generation interfaces by using AR. (Abed, 2018). AR can be viewed in two ways: magic mirror and a magic lens. Magic mirror is used when viewing augmented objects in videos that are in real-time. It is established by utilizing a projecting screen. For the magic lens, users can view an image of the physical environment along with computer-generated objects (van Arnhem et al., 2018). The Pokémon GO mobile application is a well-known example of immersive technology with a magic lens. In the application users can catch computer-generated Pokémons in their own physical environment such as in their home, at a store or in the street (Rauschnabel

et al., 2019; van Arnhem et al., 2018).

The term *augmented reality* was coined at the beginning of the 1990s. Nevertheless, AR systems have been used since the 1950s. A cinematographer, Morton Heiling, applied for a patent on a simulator prototype and developed the prototype in 1962. The prototype was called Sesnorama, enabling people to interact with image perceptions, smell, sound and vibration (van Arnhem et al.,2018; Raska and Richter, 2017; Carmigniani et al., 2011). In 1968, Ivan Sutherland and his colleagues invented head-piece and 3D displays with view-through. Users could see a mix of virtual information and real object through the display. The real objects were in this case laboratory signs on the walls (Abed, 2018; (van Arnhem et al.,2018; Carmigniani et al., 2011). An important chapter in the history of AR was in the early 1990s when Tom Caudell and David Mizell from Boeing coined the term *augmented reality*. This is also when the discussions about the benefits of the use of this technology started (Raska and Richter, 2017; Carmigniani et al., 2011; Aukstakalnis, 2016) In newer times, AR became mainstream when Pokémon GO mobile application was released in 2016 and caused a major eagerness among people (van Arnhem et al., 2018). Giant corporations are using AR in their platforms today, such as Facebook, Microsoft, Google and Snap (Rauschnabel et al., 2019; Raska and Richter, 2017).

In comparison to AR, where virtual objects are combined with the real world, virtual reality immerses the user entirely into the virtual world, where the user cannot perceive their physical environment (Rauschnabel et al., 2019; van Arnhem et al., 2018). By adding headsets or controllers to enhance simulations such as sound, optical sense, or touch, the immersive experience may be strengthened (van Arnhem et al., 2018).

2.2 Marketing Purposes

This section contains a definition of the term *purchase intention* and clarifies the link between attitude towards a product and purchase intention. After that, AR and AI for marketing purposes are explored.

2.2.1 Attitude and Purchase Intention

The concept *purchase intention* is associated with whether a consumer plans to buy something from a business at some point in the future. The purchase intention is influenced by many aspects when examined simultaneously. For instance, strong brand identities in a company may improve the perceived impression of a product, reduce the perceived risk, and reduce the consumer's inclination to judge a product merely on its price (Dontigney, 2016). Moreover, the attitude towards a product is believed to influence the consumer's purchase intention. The more positive attitude an individual has towards a product, the more likely it is that the individual will plan to purchase it (Schwartz, 2011).

2.2.2 Augmented Reality in Marketing Research

The marketing industry has grown and reshaped continuously to attract consumers and meet their demands (Ooi and Yazdanifard, 2015). According to Alves and Reis (2020),

it has been remarkably beneficial to use AR in retail. The purposes of including AR were to allow people to engage with the brand, and let them recall associations to the brand. As a result, AR has become a marketing tool for engaging with customers (Ooi and Yazdanifard, 2015). The benefits of utilizing AR technology are numerous. From the marketers' perspective, the newness of the technology can boost brand visibility and engagement. AR is enjoyable and can give a wow factor that captures their attention (Feng and Mueller, 2019).

Augmented reality experiential marketing is a notion created in the marketing sector and refers to the usage of AR in marketing for consumer encounters with a brand or a product. Companies employ AR for a variety of reasons, for instance to engage, interact and astonish (Rauschnabel et al., 2019; Ooi and Yazdanifard, 2015). Other key reasons for employing AR in the marketing business include facilitating repeat sales, positive word-of-mouth, and gaining a higher market share (Ooi and Yazdanifard, 2015). AR technology applied in marketing campaigns is an example of experiential marketing strategy, since in addition to targeting a product or services, it lets consumers get an impressionable experience that is memorable (Yuan and Wu, 2008). One advantage of employing AR in an advertisement, is its originality, with entertaining and interactive elements. This may be incorporated to approach the audience along with a new audience that is unfamiliar with the product (Ooi and Yazdanifard, 2015). A case of an AR advertisement is a Swedish pharmacy that launched an anti-smoking campaign. They employed a digital billboard with a smoke detector that displayed a person coughing whenever someone walked by with a cigarette (McCarthy, 2017). Another example that went viral is Pepsi's advertisements in London in 2014. Pepsi installed a fake glass wall that displayed unlikely objects such as an assaulting robot and a flying tiger to make bus waiting more entertaining (Kastrenakes, 2014).

Commerce has been a significant field for AR, where the technology enables consumers to get a virtual presentation of the products before making a purchase decision (Abed, 2018). For instance, customers at Timberland can try on clothes without entering a dressing room. With AR mirrors, customers can get a full-size avatar of themselves by standing in front of a wall. Here they can virtually try on clothes from Timerland's collection (Feng and Mueller, 2019). Also, cosmetic companies have utilized AR technology. Sephora and L'Oréal employed AR to let their customers get a more realistic experience with their products to aid them in purchasing decisions (McLean and Wilson, 2019).

Despite the many benefits of utilizing AR for product visualizations, not all customers may be convinced of favoring shopping digitally with AR. Consumers that prefer physical shopping, where they can feel the fabric and evaluate the quality of the product, may not be as persuaded as the companies hope (Feng and Mueller, 2019).

2.2.3 Artificial Intelligence in Marketing Purposes

The marketing sector utilizes AI to analyze and predict future purchase decisions of potential customers and improve the customer's "journey" (Dimitrieska et al., 2018). The problem related to information overload on the internet is getting more significant over time. Personalized recommendations can ease the information overload by assessing a

person's activity history, such as past preferences and interests, to offer future suggestions that may better complement the user's preferences (Dzulfikar et al., 2018). In e-commerce, Patil and Rao (2019) argue that personalized recommendations help the consumers in their decision-making process. In a recommendation system, one of the key factors is predicting users' preferences by comparing and calculating the commonalities between user groups. By utilizing a technology such as personalized recommendations in e-commerce, this can result in minimizing the human effort when shopping online, while simultaneously increase their efficiency and enhance their user experience. In general the technology can lead to a higher consumer satisfaction (Patil and Rao, 2019).

AI has also been applied to enhance AR technology. With AR, the data is filtered and only relevant data is displayed in an immersive way to avoid information overload. When the data is displayed through AR, it seems "alive" when being placed in the correct spatial and temporal environment (Lampropoulos et al., 2020). Some of the essential technologies to enhance AR interactions and implementation are deep learning and semantic web. Deep learning describes a subset of neural networks, similar to the human brain (Karunakaran, 2018). The method can be used to inject intelligence into AR systems to enhance computer vision (Lampropoulos et al., 2020). Semantic web is a knowledge graph that connects intelligent data with content for computers to understand and facilitate the information (Saunders, 2018). The entire process of information retrieval will be improved by including semantic web into AR systems (Lampropoulos et al., 2020). An example of an AR app using AI to improve the visualization is the IKEA Place app (Hensel, 2020).

2.3 Frame of References - Theories

Solomon et al. (2006) defines consumer behavior as "...the study of the processes involved when individuals or groups select, purchase, use or dispose of products, services, ideas or experiences to satisfy needs and desires." (Solomon et al., 2006, page 6). An individual can be regarded as an information processor from a cognitive-behavioral perspective. Today's information processing widely acknowledges that prior experience will influence the information processing in addition to what information is sought and gathered by the individual. This has resulted in the depiction of consumer decision-making to be more of a circular process (Bray, 2008). Table 2.1 shows an overview of the selected theories in e-commerce.

A few theories that are applied to describe consumer behavior are the theory of planned behavior (TPB), technology acceptance model (TAM), consumer behavior theory, habituation-tedium theory, and cue-utilization theory. TPB extends the theory of reasoned action and acknowledges individuals' intent to do a particular behavior. Based on the assumptions of these intentions to do a behavior, the theory strives to define what inspires the influence of the individual's behavior (Pappas, 2016). TAM describes three elements that drive users to utilize a technology: (1) Attitudes regarding the technology, (2) perceived ease of use, and (3) perceived usefulness (McLean and Wilson, 2019). The consumer behavior theory examines the behavior of consumers in commerce, and more specifically, what motivations are behind their behavior, and what affects the consumer's decision-making process (Jisana, 2014). The habituation-tedium theory (Sawyer, 1981) describes that a consumer's

sense of stress and uncertainty by experiencing a new stimulus, is minimized over time when they have been exposed to the stimulus multiple times. When the feeling of stress is minimized over time, the theory suggests that the consumer will experience habituation instead. The cue-utilization theory (Easterbrook, 1959) proposes that when consumers experience a new and unforeseen stimulus, their cognitive flow can get shivered, leading them to feel a large amount of arousal.

The five-stage consumer decision-making process and the SOR model are theories related to a consumer's information processing. The five-stage consumer decision-making process looks into the different stages when the consumer is making a decision related to purchasing a product. The theory is used to comprehend behavioral consumer responses. The five stages are (1) need recognition, (2) search, (3) evaluation, (4) purchase, and (5) post-purchase (Zhang and Benyoucef, 2016). The SOR model proposes that when an individual is exposed to a stimulus from the environment, the individual will develop internal states (organism), which will further lead to a response or an action (Watson et al., 2018).

Table 2.1: Selected theories in e-commerce

Theory	**Applied by**
Behavioral consumer responses	
Technology acceptance model (TAM)	(McLean and Wilson, 2019)
Theory of planned behavior (TPB)	(Pappas, 2016)
Consumer behavior theory	(Jisana, 2014)
Habituation-tedium theory	(Yim et al., 2017)
Cue-utilization theory	(Yim et al., 2017)
Information processing	
SOR model	(Watson et al., 2018)
Five stage consumer decision-making process	(Zhang and Benyoucef, 2016)

2.4 Synthesis of Past Literature

This section provides a description of general application of the SOR model. Further, previous studies on AR characteristics in e-commerce that are categorized as a stimulus in the SOR model are presented, followed by the internal responses by a technology in online shopping purposes (organism). Lastly, behavioral responses in e-commerce are looked into, which are also recognized as the response step in the SOR model.

2.4.1 Stimulus-Organism-Response Model

The initial stimulus-response model was criticized for being too simple (Zhang and Benyoucef, 2016). This leads to an extension of the model, resulting in supplying the organism

factor to the model by Mehrabian and Russell (1974). The new and improved model, namely the SOR model, suggests that stimuli from the environment affect an individual's internal responses, which will further impact the individual's response and behavior (Sheng and Joginapelly, 2012). Retailers can utilize the SOR model to comprehend how new technology in the retail sector impacts cognitive and affective responses, in addition to their behavioral responses (Watson et al., 2018). An overview of how the SOR model is built can be viewed in Figure 2.1.

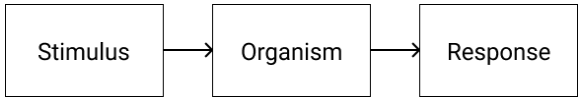

Figure 2.1: SOR model

Stimulus

For humans, a stimulus can be recognized as an external environmental factor that affects an individual in some manner (Sheng and Joginapelly, 2012). Previous research has studied how AR affects behavioral consumer responses, both their internal responses and their behavioral response. AR characteristics can be divided into entertainment content and information content and can be recognized as the stimuli in the SOR model. Augmentation and vividness can be classified as entertainment content, whereas product informativeness can be categorized as information content.

Augmentation is a characteristic that is unique to AR. A key factor for augmentation is complementing virtual objects to physical environments (Javornik, 2016b). Through the study of Javornik (2016b), it is suggested that augmentation is a key factor for influencing affective responses such as engagement, playfulness and immersion. Steuer (1992) defines vividness as "the ability of a technology to produce a sensorially rich mediated environment" (Steuer, 1992, p. 80). In e-commerce, vividness often relates to the "quality of product presentations" (Yim et al., 2017, p. 3). Both Yim et al. (2017) and McLean and Wilson (2019) have studied the consumer response of vividness. Both studies conclude that vividness help consumers in generating mental images of future usage of the displayed product. Also McLean and Wilson (2019) propose that consumers are able to produce precise and original mental images after viewing a product through AR. This helps the consumers in their decision-making process by boosting their choice confidence (McLean and Wilson, 2019). Regarding the third outline stimuli, product informativeness, Kowalczuk et al. (2021) found in their research that product informativeness had a positive impact on the user's perceived media usefulness. Lastly, when considering personalized recommendations, prior research has found that a recommender system in a website positively influences users' perceived usefulness of the system (Armentano et al., 2015).

Organism

For humans, organism is considered as the internal responses generated by the exposure of a stimulus. The internal responses will further influence consumers' behavioral responses.

Prior literature has examined how stimuli from a technology influence the individual's internal responses. Internal responses can be divided into cognitive and affective responses. Cognitive responses are associated with the information processing of an individual. Relevant responses in this category are choice confidence, perceived usefulness, and utilitarian values. Affective responses on the other hand relate to an individual's emotional states, such as enjoyment, immersion, habituation, boredom, novelty, and hedonic values (Kowalczuk et al., 2021).

In e-commerce, utilitarian values include functional aspects such as ease of use, convenience, and advantages of buying a product (To et al., 2007). Further, in a study conducted by Kowalczuk et al. (2021), where IKEA's AR mobile app, IKEA Place, was compared with IKEA's website. It was disclosed that participants of the study generally had higher affective responses in the AR app, while the cognitive responses were found to be lower for the AR app than the website. For online retail purposes, it has been revealed by Chiu et al. (2014) that "93% of consumers demand freshness, innovation, and discovery to satisfy their intrinsic needs" (Chiu et al., 2014, para. 2). Further, Chiu et al. (2014) disclosed that both hedonic and utilitarian values are important factors that affect the purchase intention of the consumers.

Hedonic values in online shopping purposes relate to emotional and experiential values in addition to non-functional motivation (To et al., 2007). The study conducted by Sohn and Kwon (2020) disclosed that enjoyment highly influences the consumer's purchase intention. Further, Kowalczuk et al. (2021) argue in their study that enjoyment has a positive influence on behavioral consumer responses. Peng and Kim (2014) suggest in their study that both hedonic values influence both emotional purchase and the consumer's attitude towards buying online. Moreover, Yim et al. (2017) conclude in their study that the previous media experience influences the user's perceived media novelty. Yim et al. (2017) further suggest that the perceived media novelty affects the user's value of AR. In regards to long-term usage of an AR app, the researchers discuss in their study that habituation or boredom are affective responses the consumers may develop.

Response

Response, also referred to as behavioral response is the last step in the SOR model. The consumer's behavioral response is affected by the internal responses of the consumer. The *five-stage consumer decision-making process* can be applied in the response step of the SOR model, which includes the following stages (Zhang and Benyoucef, 2016):

1. Need recognition
2. Search
3. Evaluate
4. Purchase
5. Post-purchase

The first step examines the attention-seeking of the consumer. The second step looks into how the consumer seeks information. The third step is evaluation and is related to their

attitude towards a technology, product or an application in general. The fourth step is related to the consumer purchase behavior. Finally, the fifth step examines the behavioral response after a purchase, such as a repurchase intention, reuse intention, or product returns (Zhang and Benyoucef, 2016). As a means to describe behavioral consumer responses, all the above-mentioned steps are important, but steps 4 and 5, namely purchase and post-purchase will be in focus, as these steps are more heavily covered in prior research.

Kowalczuk et al. (2021) found in their study that product informativeness influences perceived media enjoyment, which further has a positive impact on reuse intentions and choice confidence. The authors found that the purchase intention was influenced by choice confidence. Moreover, Watson et al. (2018) found in their study that perceived augmentation in an AR app in e-commerce seems to have a positive influence on the consumer purchase intention. The study also revealed that the consumer's hedonic motivations had an impact on the perceived augmentation. Watson et al. (2018) also disclosed that consumers with higher hedonic motivations experienced more positive emotions than consumers with lower hedonic motivations. The additional authors found that positive emotions could lead to a higher purchase intention. Findings from research conducted by Raska and Richter (2017) indicate that consumer engagement and increased product knowledge in e-commerce seemed to positively influence the consumer's purchase intention, whilst the consumers' attitude toward an AR app in e-commerce appeared not to influence the purchase intention. Yim et al. (2017) found in their study that AR characteristics positively influenced perceived enjoyment, usefulness, immersion, and novelty, which led to positive purchase intention in addition to attitude towards the AR system.

In regards to traditional website shopping, Peng and Kim (2014) revealed in their study that there is a link between consumers' attitudes toward online shopping and their repurchase intention. Nonetheless, the findings of the study could not indicate any links between emotional buying and the utilitarian value of the consumers, nor between emotional buying and the repurchase intention of the consumers. Findings from a research by Chiu et al. (2014) suggest that there is a positive relationship between both hedonic and utilitarian values and consumers' continued purchase intention.

Chapter 3

Research Model and Hypotheses

This chapter presents the selected theoretical framework, consisting of the SOR model and the two theories, cue-utilization theory and the habituation-tedium theory. The conceptual framework along with the hypotheses for the research is subsequently included in this chapter.

3.1 Theoretical Framework

The theoretical framework is composed of an application of the SOR model, the cue-utilization theory, and the habituation-tedium theory. The SOR model was chosen because it has been proven in previous research to be a feasible to use for the study of behavioral consumer responses in online shopping purposes (Zhang and Benyoucef, 2016; Oh et al., 2008b). The two theories are chosen because they explain how individuals respond to stimuli differently over time, which is found relevant for the current research due to the comparison of the two user groups, first-time users and experienced users.

3.1.1 Stimulus-Organism-Response Model

The author will apply the SOR model in the conceptual framework to comprehend how stimuli from the IKEA Place app affect the affective and cognitive responses. The outlined stimuli that will be examined are divided into entertainment and information content, and the organism section is divided into cognitive and affective responses. The final behavioral responses are divided into purchase and post-purchase, which are two steps of the five-stage consumer decision-making process. An overview of SOR model with categorizations is shown in Figure 3.1.

Figure 3.1: SOR model with categorizations

3.1.2 Cue-Utilization Theory

The cue-utilization theory (Easterbrook, 1959) explains how individuals respond to new or unforeseen stimuli versus the response after the individuals are familiar with the stimuli. Previous literature have applied the theory to understand behavioral consumer responses and the consumer decision-making (Johnson and Wells, 2011). Moreover, the theory suggests that when an individual experience an unexpected and new stimuli such as sound or scene, their cognitive flow is shaken, which cause a high level of arousal. Simultaneously, the individual will focus on the foremost stimuli, while neglecting the other stimuli. Thus over time, when the individual has gotten used to the stimuli, they are expected to experience low level of arousal, low selectivity or low attention (Yim et al., 2017; Song et al., 2019; Easterbrook, 1959). The theory is relevant to apply in the conceptual framework to better understand how consumers might respond differently to stimuli the first time versus after multiple times of exposure. For experienced users that have encountered a stimulus multiple times before, the theory suggests that the stimulus will not be perceived as functional enough for it to have an effect on the user's cognitive flow (Yim et al., 2017). That is, a familiar stimulus may not make a significant enough impact on the experienced user to serve its purpose.

3.1.3 Habituation-Tedium Theory

The habituation-tedium theory (Sawyer, 1981) explains how individuals respond to a new stimuli over time, which is why this theory will be applied in the conceptual model to examine how characteristics from an AR mobile app influences consumers after multiple times of usage. The selected theory proposes that the possible negative effects of perceiving a new stimulus, such as feeling of uncertainty or stress will be reduced over time after multiple times of exposure to the stimulus (Sawyer, 1981; Song et al., 2019). Nonetheless, concurrently as the individual gets familiar with the stimulus and the possible feeling of tension is reduced, the individual may experience tedium by the stimulus. In accordance with the theory, the pace of feeling tedium is more rapid than the feeling of habituation (Yim et al., 2017; Sawyer, 1981). This theory provides a different view than the cue-utilization theory on how individuals respond to stimuli over time, and therefore it is interesting to apply.

3.2 Conceptual Framework: Research model

The theoretical framework from Section 3.1 is the basis for the conceptual framework. This section contains an overview of the research model (Figure 3.2), which includes links between the concepts, which are hypotheses that are further addressed in Section 3.2.1. Lastly, this section is followed by a summary of how the author assumes that the different effects will vary for first-time users versus experienced (Section 3.2.2).

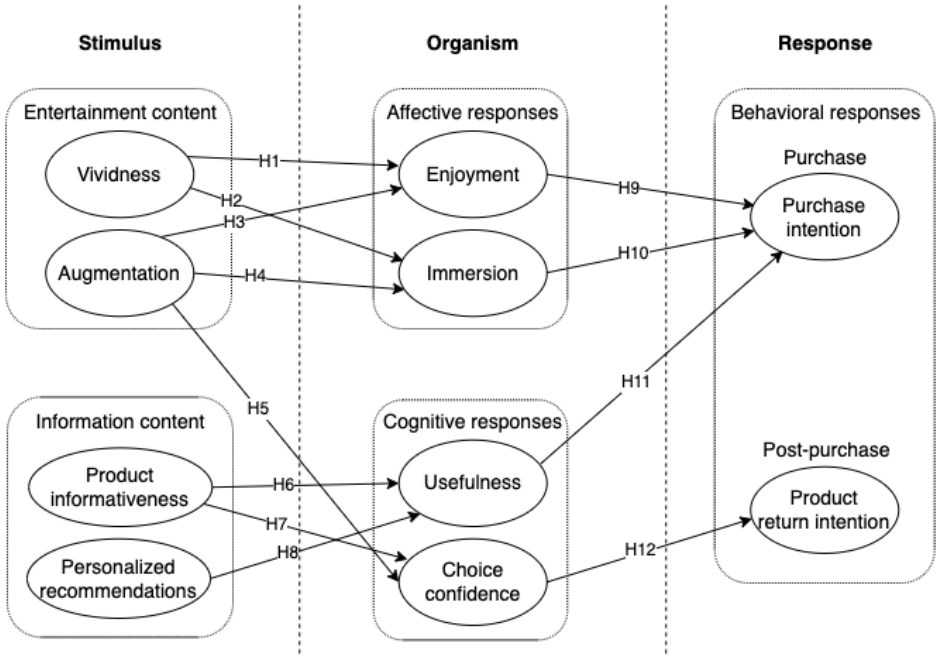

Figure 3.2: Research model

The research model shown in Figure 3.2 is structured similar to the SOR model, where the constructs are divided within the categories stimulus, organism and response. The overall relationship of the model is that the stimulus has an effect on organism, which further has an effect on the response. The stimulus constructs to be measured in this study are divided into entertainment content and information content. Vividness and augmentation have been placed into entertainment content, whereas product informativeness and the AI characteristic, personalized recommendations have been categorized as information content. In regards to the organism step of the research model, perceived enjoyment and immersion have been classified as affective responses, whilst perceived usefulness and choice confidence are the cognitive responses to be measured. Lastly, the response step of the SOR model includes two of the steps from the five-stage consumer decision-making process, where purchase intention from the purchase step and product return intention, found in the post-purchase step will be measured.

3.2.1 Hypotheses

Vividness can be defined as being clear in your mind and attracting attention. Further, in e-commerce, vividness is often correlated to how well a product is presented (Yim et al., 2017). Consumers have been shown to get a more positive customer experience when being presented with a more vivid presentation of the products (Pantano et al., 2017). Moreover, media features can enhance the consumers' ability to imagine the products in different ways, enabling consumers to experience exciting and realistic products. This will then result in affective responses such as enjoyment (Childers et al., 2001). McLean and Wilson (2019) found out in their research that vividness positively impacted consumers' perceived enjoyment by an AR application. (Witmer and Singer, 1998, p. 227) defines immersion as "a psychological state of being enveloped by, included in, and interacting with and an environment that provides a continuous stream of stimuli and experiences". Slater et al. (1996) suggest that the level of immersion can rise by the vividness of the displays. Although the authors argue that it is needed to take into account how the displayed information enables the individuals to generate mental images of the reality on their own. Therefore, it is hypothesized that vividness has a positive impact on the affective responses, enjoyment, and immersion:

H1: Vividness positively affects enjoyment

H2: Vividness positively affects immersion

Augmentation can be recognized for adding virtual objects to physical surroundings (Javornik, 2016b). Studies on AR in shopping purposes have outlined enjoyment and playfulness as one of the outcomes when AR is present (Huang and Liao, 2017; Javornik, 2016b; Olsson et al., 2013). Further, shopping in a virtual mall can be more enjoyable than in a traditional physical one (Lee and Chung, 2008). On the same note, Nah et al. (2011) found that 3D environments lead to more enjoyment than 2D environments. In the research of Javornik (2016a) it seemed that AR gave more hedonic experiences than utilitarian ones. Immersion is related to a specific moment. In the research of Shin (2019), it is implied that the perceived immersion is associated with the subjective and objective part of technology. A study conducted by Kowalczuk et al. (2021) reveal that an AR application results in higher immersion and enjoyment compared to a web version. Further, to feel totally immersed, the AR functions in an app such as quality and interactivity is crucial. AR in shopping purposes has the ability to give the consumers more information about the products, resulting in more confidence in their decision-making (Oh et al.,oh2008can; Dacko, 2017). Seeing as AR can provide 3D product visualisations in the consumer's environment, the evaluation of the product is simplified. On the opposite manner where product specifications are insufficient, the consumer are forced to make unpredictable purchase decisions (Kim and Forsythe, 2008). With the AR feature, a consumer can see the real dimensions of a product in their physical environment (Alves and Reis, 2020). Therefore, the author suggests the following hypotheses:

H3: Augmentation positively affects enjoyment

H4: Augmentation positively affects immersion

H5: Augmentation positively affects choice confidence

Chen and Tan (2004) outlines that applicable and convenient product information lets customers get more clarity about a product, and lets them be able to make a sufficient choice regarding the product (Wixom and Todd, 2005). Previous research support that perceived informativeness has a positive effect on perceived usefulness (Rese et al., 2014; Rese et al., 2017). Further, mobile AR apps have been proven to be found useful based on the information the apps provide (Olsson et al., 2013). Based on this, the following hypotheses are suggested:

H6: Product informativeness positively affects perceived usefulness

H7: Product informativeness positively affects choice confidence

Personalized recommendations are used to give suggestions to consumers, such as product suggestions based on their previous preferences (Dzulfikar et al., 2018). Swearingen and Sinha (2001) early argued that one of the most important factors in rating a recommender system as successful, is the perceived usefulness. Armentano et al. (2015) found in their research that a recommender system in a website results in perceived usefulness of the system. Further, previous research has established that customers experience higher perceived usefulness with personalized services such as product recommendations to individuals than from non-personalized services, such as discount coupons to all customers (Liang et al., 2009).

H8: Personalized recommendations positively affects perceived usefulness

The research of Bonera (2011) concludes that online purchase intention is affected by factors such as playfulness and perceived usefulness. Shang et al. (2005) argue that intrinsic motivations for consumers to shop online are more important than extrinsic motivations. Intrinsic motivations are cognitive absorption, for instance entertainment or perceived enjoyment, while extrinsic motivations are perceived usefulness. They furthered argued that consumers that experience perceived playfulness are more likely to shop online and have a positive attitude towards it.

H9: Enjoyment positively affects purchase intention

In regards to 3D virtual worlds, previous research has found that perceived telepresence leads to trust in the virtual 3D prototype, and also increased purchase intention (Peng and Ke, 2015). Furthermore, studies have shown that online flow, categorized as complete immersion has resulted in increased purchase intentions (Wu and Chang, 2005; Korzaan, 2003). Based on existing flow theory and consumer behavior theories, Korzaan (2003) ar-

gue that individuals experiencing flow are more likely to form positive attitudes regarding purchasing online. This will further lead the individuals to more likely purchase online by the influence on their attitude. Consequently, the following hypothesis is drawn:

H10: Immersion positively affects purchase intention

Perceived usefulness in this context is how useful the consumer finds the IKEA Place app in general. This involves the shopping experience, with a focus on the AR functionality. When shopping online, perceived usefulness includes that the consumer can search through products, compare them, get product information and receive more from the purchase (Alba et al., 1997). Bonera (2011) argue that when an individual feel the shopping experience to be useful, there is a higher likelihood that they will shop online.

H11: Perceived usefulness positively affects purchase intention

After a purchase, the consumer will either keep the product or return it to the seller. Seeing as AR enables consumers to get a higher product knowledge by viewing the desired product in their own environment with real dimensions, AR has the possibility to reduce the amount of product returns (Raska and Richter, 2017; Kowalczuk et al., 2021; Schwartz, 2011). Therefore, a hypothesis are drawn upon that the more confident one is on a purchase decision, the less likely one is to return the product.

H12: Choice confidence negatively affects product return intention

3.2.2 First-time users versus experienced users

Based on previous AR literature, the author assumes that consumers that have only used the IKEA Place app once will have a sense of novelty to some degree, either by experiencing an AR feature for the first time or by shopping online using an AR feature for the first time. Building upon that individual's attention tends to be drawn by novelty, which further leads to feeling engrossed (Lang, 2000), it is expected that first-time users will experience a higher sense of immersion by the novelty of the technology (Yim et al., 2017). By this means, drawing upon the cue-utilization theory (Easterbrook, 1959), the theory is also in line with this assumption, that first-time users will experience a high level of arousal by the augmentation characteristic if they find it unexpected, and focus on this stimulus. When keeping the habituation-tedium theory (Sawyer, 1981) in mind, new consumers could also experience tension and stress by the new stimulus such as augmentation, leading them to not be immersed or feel enjoyment.

In addition to the hypotheses presented insubsection 3.2.1, the author believes that for consumers that have used the application multiple times, the utilitarian value will be the most important factor on the purchase behavior for long-term users. More specifically, it is believed that the cognitive response, perceived usefulness of the app with a focus on the AR functionalities will affect the consumer's purchase intention more than the affective responses, perceived enjoyment, and immersion (Chiu et al., 2014).

Concerning personalized recommendations, it is assumed that it will have a significantly higher effect on the consumer's perceived usefulness for experienced users than first-time users given that the app will have more data related to the experienced users' preferences since they have used the app before. While some stimuli might be either shaking the users' cognitive flow or not affecting them, personalized recommendations through AI technology might give the users a sense of usefulness when using the application (Swearingen and Sinha, 2001). This might be the case for long-term users where personalized data about the users would perhaps be greater.

Chapter 4

Research Methodology

Beyond the overview of the research methodology presented in Section 1.5, this chapter provides a recapitulation of the research questions and the goal of this study (Section 4.1, along with a description of the survey design process applied in this research (Section 4.2). Lastly, this chapter gives an overview of the data generation method Section (4.3).

4.1 Goal and Research Questions

Goal: The goal of the research is to further examine how AR and AI technology influence the behavioral consumer responses for both first-time use of the technologies in e-commerce, and after multiple times of usage.

- **RQ1:** *How do augmented reality and artificial intelligence influence behavioral consumer responses?*
  - **RQ1.1:** *What aspects of augmented reality and artificial intelligence have an impact on affective and cognitive responses?*
  - **RQ1.2:** *How do affective and cognitive responses affect the behavioral responses, purchase intention, and product return intention?*

4.2 Survey Design

The research strategy chosen for this study is a survey. This type of research strategy is commonly associated with the positivism research paradigm, as it builds upon existing theories from previous research and develops hypotheses (Oates, 2005). One benefit of using a survey is that it aims to look for patterns and generalizations, because of this, the researcher must assume beforehand that such a pattern exists. A downside however with the chosen strategy is that it cannot find cause and effect, which is possible with experiments

(Oates, 2005, p. 299). Using a survey and a suitable sample of participants, a researcher can have the data as a sample to make it represent a larger population in a standardized and systematic way (Oates, 2005, p. 93). The steps of planning and conducting a survey are listed below, and are inspired by chapter 7 of (Oates, 2005). These steps will be further elaborated in the current chapter, and in Chapter 5.

1. Data generation method
2. Data requirements
3. Development of measures
4. Pre-test
5. Sampling
6. Analysis method

4.3 Questionnaire

For the quantitative data generation method, a questionnaire was used. The questionnaire was published at Amazon Mechanical Turk (Amazon MTurk) Turk (2021) in September 2021, and the data was used for the current research the same month. Amazon MTurk is a marketplace where researchers and individuals can outsource their jobs and processes to other people for a reward. The marketplace is a good place to gather insights from individuals from around the world (Turk, 2021). The questionnaire made it possible for the participants to complete it on their own, without the need for observations. There are some disadvantages however of using a questionnaire. For instance, it is not possible for the participants to get clarification by asking the creators of the questionnaire. Because of this, it is important that each question is well-formulated to exclude any misunderstandings or differences in understanding and to have the questions in a logical order with a similar formulation.

From the participants' point of view in the questionnaire, they were first introduced with some background questions regarding their nationality, age group, yearly income, education level, previous usage of the mobile AR app, and their annual money spent at IKEA. After that, a set of statements were introduced which all were related to their past experience using the IKEA Place app. See Appendix B for screenshots of user interfaces and usage of the IKEA Place app.

4.3.1 Data Requirements and Measures

Prior to the data collection, the author had some requirements for the participants to get meaningful data. The first requirement was that the participants needed to have a smartphone to use the AR mobile app. Secondly, the participants must have used the IKEA Place app at least one time for their responses to be relevant in the research. Further, the author wanted a variety in age groups, gender, and nationality, but these factors were more

preferences rather than requirements for the survey. Table 4.1 shows an overview of the relevant constructs for the research model, and the sources for the statements. A seven-point Likert scale was used for the questions, since five different options may not be detailed enough. In total, 66 Likert scale statements were included in the survey to measure the constructs, with 1 = Strongly disagree and 7 = Strongly agree. A full view of the questionnaire with all questions and statements can be seen in Appendix A. There are statements to measure constructs in the questionnaire that were excluded from the research model after the distribution of the questionnaire. Some of the constructs (interactivity, product liking, habituation, boredom, novelty, and repurchase intention) were removed from the research model to simplify it to be able to get more specific in the remaining constructs.

Table 4.1: Constructs and sources for survey statements

Construct	**Sources for survey statements**	**Explores**
Vividness	(Yim et al., 2017), (McLean and Wilson, 2019)	Consumer's perceived vividness by the IKEA Place app
Augmentation	(Javornik, 2016b)	Consumer's perceived augmentation by the IKEA Place app
Product informativeness	(Rese et al., 2017), (Kowalczuk et al., 2021), (Raska and Richter, 2017)	Consumer's perceived product informativeness by the IKEA Place app
Personalized recommendations		The usefulness by personalized recommendations
Enjoyment	(McLean and Wilson, 2019), (Kowalczuk et al., 2021), (Raska and Richter, 2017), (Yim et al., 2017)	Consumer's perceived enjoyment by the IKEA Place app"
Immersion	(Yim et al., 2017), (Kowalczuk et al., 2021)	Consumer's sense of immersion while using the IKEA Place app
Usefulness	(McLean and Wilson, 2019), (Kowalczuk et al., 2021), (Raska and Richter, 2017), (Rese et al., 2017), (Yim et al., 2017)	Consumer's perceived usefulness by the IKEA Place app
Choice confidence	(Kowalczuk et al., 2021)	Consumer's sense of choice confidence by viewing products in the IKEA Place app
Purchase intention	(Yim et al., 2017), (Watson et al., 2018)	The consumer's intention to purchase a product after viewing it in the app
Product return intention		The consumers intention to return a product that they have purchased after viewing it int he app

4.3.2 Data Collection and Ethics

Before gathering the quantiative data, a pre-test was done by the researcher and supervisor. A small test was conducted to check that the questionnaire was understandable, had the correct content and was free from errors. As mentioned above in this Section, the data was collected from Amazon MTurk. The author did not need to submit an application to the Norwegian Centre for Research Data (NSD), since no sensitive information about the participants were gathered from the questionnaire and it was impossible for the researcher

to link a response to a specific participant. The researcher was only given an ID for each participant's responses. Further, the participants had the right to withdraw from the questionnaire at any point without giving an explanation. At the beginning of the questionnaire, the participants were given information about the gathering and collection of data. They were informed that their responses will be treated anonymously, and no sensitive information will be linked to their responses. They were further informed that no third parties will receive the responses, and that the purpose of the questionnaire is for research only.

4.3.3 Analysis method

The author used PLS-SEM to analyze the data such as finding patterns, relationships between constructs and validity of the analysis in the quantitative data from the questionnaire. In regards to the statements to measure the product return intention, the author had to revert one of the questions for the analysis to make sense, since it had an opposite of negation than intended to. Further, the last and third statement to measure the construct was removed from the analysis since it had a zero loading factor. More on the analysis and results of the data can be read in chapter 5

4.3.4 Participants

There were a total of 480 responses from the questionnaire at Amazon MTurk. Of all the records, 48 of them were partially completed, whilst 432 participants have completed the questionnaire. This results in a response rate at 90%. Further, 31 participants had never used the IKEA Place app before. Seeing as that was one of the requirements for the responses to be meaningful, these responses were not included in the analysis. Consequently, a total of 401 responses were collected and analyzed.

As can be seen in Table 4.2, the gender distribution was fairly balanced, with 59.85% females, 39.65% males and remaining 0.5% of others. In regards to the age groups, young Generation Y (25-34 years) was dominating, with 52.12% of the participants within this age group, followed by 22.69% in the age group of 35-44 years. The smallest age group was the ones that are 55 years or older, with 5.49% of the total amount of participants. The education level of the participants shows a strong majority of Bachelor degrees (43.39%) and Master degree (35.66%), followed by High school as the highest achieved degree (11.72%). Moreover, almost all participants were from the United States (98.25%). Other than that, five other nationalities were represented in the study. Concerning the annual gross income, the participants are quite distributed in the six groups, with the highest group with 33.67% with an income on more than $57,000, followed by 27.43% that have an annual gross income between $47,000-$57,000. The descriptive statistics of the sample further show that 52.87% of the participants usually make purchases at IKEA a few times every year, and only 1.50% never make purchases at IKEA. Further, most of the participants spend between $100-$5,000 (88.28%), and 0.5% of the participants do not spend any money at IKEA. In respect to the approximate encounters using the IKEA Place app before, 52.12% of the sample have used the app a few times, 22.19% have used it multiple times, whilst 25.69% have used the app one time before.

Table 4.2: Descriptive statistics of the sample

Factor	Sample (N=401)	Proportion (%)
Gender		
Female	240	59.85%
Male	159	39.65%
Other	2	0.50%
Age		
18-24	36	8.98%
25-34	209	52.12%
35-44	91	22.69%
45-54	43	10.72%
55 or older	22	5.49%
Education level		
Primary school	1	0.25%
High school (Secondary school)	47	11.72%
Apprenticeship (Trade/technical/vocational/ nursery/training)	25	6.23%
Bachelor degree	182	45.39%
Master degree	143	35.66%
Doctorate degree	3	0.75%
Nationality		
Armenia	2	0.50%
Australia	1	0.25%
Azerbaijan	1	0.25%
India	2	0.50%
United Arab Emirates	1	0.25%
United States	394	98.25%
Annual gross income in USD		
Less than $14,000	20	4.99%
$\$14,000-\$24,000$	30	7.48%
$\$25,000-\$35,000$	56	13.97%
$\$36,000-\$46,000$	50	12.47%
$\$47,000-\$57,000$	110	27.43%
more than $57,000	135	33.67%
Annual purchases at IKEA		
Never	6	1.50%
Once	110	27.43%
A few times	212	52.87%
Many times	73	18.20%

Average annual shopping expenses at IKEA in USD		
$0	2	0.50%
$1−$100	25	6.23%
$100−$500	111	27.68%
$500−$1,000	112	27.93%
$1,000−$2,000	87	21.70%
$2,000−$5,000	44	10.97%
More than $5,000	20	4.99%
Approximate encounters using the IKEA Place app before		
Once	103	25.69%
A few times	209	52.12%
Many times	89	22.19%

Chapter 5

Analysis and Results

This chapter presents the analysis and results from the conducted survey. Section 5.1 introduces the PLS-SEM that was used to analyze the quantitative data in the study. Section 5.2 presents how reliability and validity were assessed. Section 5.3 presents the structural models in the research. Section 5.4 contains the results of the multi-group analysis conducted for the two groups, first-time users and experienced users.

5.1 Analysis Method

To assess the research model's validity and reliability, PLS-SEM was used. More precisely, the software SmartPLS 3 was utilized to perform all the necessary analyses (Ringle et al., 2015). The software can disclose if there are patterns in the dataset or not.

PLS-SEM is extensively utilized to analyze data and to estimate complex relationships between various constructs, especially within research in management and business areas (Ahammad et al., 2017; West et al., 2016). In regards to requirements of the sample size, the number of participants of 401 in this research exceeds the requirement of having "ten times the largest number of structural paths directed at a particular latent construct in the structural model" (Hair et al., 2011, p. 7). PLS-SEM can analyze relationships with a complex research model for rather small samples (Wong, 2019). Furthermore, PLS-SEM is suitable to use as a predictive tool for theory building, whereas covariance-based SEM is more suitable for theory testing (Lowry and Gaskin, 2014). Seeing as the suggested research model builds on existing theories, PLS-SEM is considered as an appropriate methodology to use for this research.

5.2 Measurement Models

The model is solely constructed by reflective constructs, and to evaluate the reliability and validity of the reflective latent constructs. A set of tests have been applied on both construct and item levels. The author has used conducted reliability, convergent validity, and discriminant validity tests. For the construct level, Cronbach Alpha (CA) and Composite Reliability (CR) values were examined to ensure that these values were above the threshold of 0.70 (Nunnally, 1978). The reliability of the indicator was evaluated by examining if the loadings between constructs and items were above the threshold of 0.70 (Appendix C). To assess the convergent validity, the author checked that the Average Variance Extracted (AVE) was higher than the lower limit of 0.5. The lowest observed value was 0.628, hence all values were remarkably within the threshold which can be seen in Table 5.1. Discriminant validity was assessed by checking that the indicators' cross-loadings were greater than the cross-loadings to other constructs (see Appendix C) (Farrell, 2010).

For further assessment of discriminant validity, the criterion Heterotrait–Monotrait ratio (HTMT) is used as an indicator. Values below 0.85 indicate discriminant validity (Henseler et al., 2015). The subsequent values transcend the threshold of 0.85; HTMT(Choice Confidence, Purchase Intention) = 0.895, HTMT(Usefulness, Purchase Intention) = 0.856, HTMT(Choice Confidence, Augmentation) = 0.862, HTMT(Personalized recommendations, Augmentation) = 0.874, HTMT(Enjoyment, Choice Confidence) = 0.858, HTMT (Product Informativeness, Choice Confidence) = 0.874, HTMT(Usefulness, Choice Confidence) = 0.964, HTMT(Vividness, Product Informativeness) = 0.892. Even though some values did not meet the criteria of not exceeding the threshold of 0,85, the validity had been assesed with the cross-loadings. Furthermore, Henseler et al. (2015) argue that the threshold of the HTMT could also be set to 0.9, that being so, only one value would transcend the threshold. For an overview of all values, see Table 5.1.

Table 5.1: Reliability, convergent, and discriminant validity of reflective constructs.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Purchase Intention										
(2) Augmentation	0.828									
(3) Choice Confidence	0.895	0.862								
(4) Enjoyment	0.843	0.809	0.858							
(5) Immersion	0.741	0.728	0.813	0.72						
(6) Personalized Recommendations	0.807	0.874	0.845	0.75	0.712					
(7) Product Informativeness	0.793	0.85	0.874	0.794	0.684	0.805				
(8) Product Return Intentions	0.282	0.276	0.238	0.246	0.293	0.289	0.101			
(9) Usefulness	0.856	0.791	0.964	0.823	0.816	0.819	0.788	0.211		
(10) Vividness	0.73	0.813	0.789	0.783	0.627	0.737	0.892	0.158	0.722	
Mean	5.508	5.541	5.461	5.549	5.446	5.500	5.680	3.243	5.553	5.666
Standard Deviation	1.131	1.165	1.135	1.104	1.215	1.123	1.046	1.607	1.123	1.029
AVE	0.69	0.638	0.771	0.735	0.819	0.754	0.628	0.878	0.701	0.666
Cronbach's Alpha	0.85	0.81	0.852	0.82	0.889	0.837	0.803	0.862	0.858	0.833
Composite Reliability	0.899	0.876	0.91	0.893	0.931	0.902	0.871	0.935	0.903	0.889

5.3 Structural Models

Figure 5.1 outlines the structural model from PLS analysis, with the variance of the endogenous variables (R^2) and the standardized path coefficients (β). To verify the structural model, coefficient of determination (R^2) values were examined. The significance of estimates (t-statistics) was calculated through a bootstrap analysis in SmartPLS3 with 5000 subsamples. A two-tailored test was applied with a confidence level of 95%. If $p < 0.05$, the statistical significance is ensured. In the structural model, the significance levels of the path coefficients are shown in asterisks. As shown in Figure 5.1, all twelve hypotheses are empirically supported. Vividness is shown to have a positive and significant impact on the consumers' perceived enjoyment (β = 0.375, t = 5.659, $p < 0.001$) and perceived immersion (β = 0.233, t = 2.530, $p < 0.5$). Augmentation is found to have positive and significant effects on perceived enjoyment (β = 0.409, t = 6.311, $p < 0.001$), perceived immersion (β = 0.461, t = 4.637, $p < 0.001$) and choice confidence (β = 0.417, t = 6.798, $p <$ 0.001). Furthermore, product informativeness is shown to have a positive and significant impact on perceived usefulness (β = 0.347, t = 4.932, $p < 0.001$) and choice confidence (β = 0.438, t = 6.740, $p < 0.001$). Personalized recommendations has a positive and significant effect on perceived usefulness (β = 0.466, t = 6.483, $p < 0.001$). Moreover, the consumer's purchase intention is shown to be positively and significantly impacted by perceived enjoyment (β = 0.342, t = 5.290, $p < 0.001$) , perceived immersion (β =0.161, t = 2.710, $p < 0.01$) and perceived usefulness (β = 0.382, t = 4.333, $p < 0.001$). Lastly, choice confidence is found to have a negative and significant effect on product return intention (β = -0.206, t = 3.649, $p < 0.001$). The structural model explains 51.3% of variance for perceived enjoyment (R^2=0.513), 41.1% for perceived immersion (R^2=0.411), 55.0% for perceived usefulness (R^2=0.550), 61.5% for choice confidence (R^2=0.615), 62.4% for purchase intention (R^2=0.624) and 4.2% for product return intention (R^2=0.042).

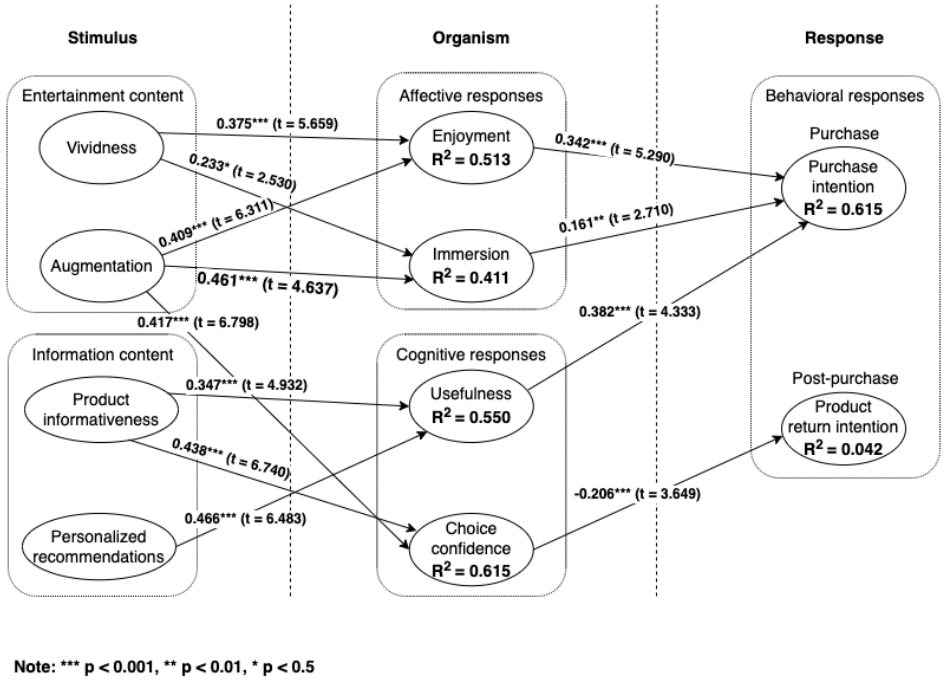

Figure 5.1: Complete structural model

5.3.1 Structural Model for First-Time Users

As can be seen in Figure 5.2, nine of twelve hypotheses are empirically supported. Vividness is shown to have a positive and significant impact on first-time users' perceived enjoyment (β = 0.473, t = 4.121, $p < 0.001$) and perceived immersion (β = 0.429, t = 2.124, $p < 0.5$). Furthermore, augmentation is found to have a positive and significant impact on new user's perceived enjoyment (β = 0.366, t = 2.872, $p < 0.01$) and choice confidence (β = 0.327, t = 3.292, $p < 0.01$). Augmentation is not found to have a significant effect on perceived immersion for first-time users (β = 0.346, t = 1.669, $p < 0.5$). Moreover, product informativeness is shown to have a positive and significant impact on perceived usefulness (β = 0.626, t = 6.553, $p < 0.001$) and choice confidence (β = 0.589, t = 6.132, $p < 0.001$). Personalized recommendations was not found to have a significant impact on perceived usefulness (β = 0.197, t = 1.855, $p < 0.5$). Further, the first-time user's purchase intention is shown to be positively and significantly impacted by perceived enjoyment (β = 0.298, t = 2.006, $p < 0.5$) , but not for perceived immersion (β = 0.067, t = 0.392, $p > 0.5$). Perceived usefulness was to have a positive and significant impact on the new consumer's purchase intention (β = 0.513, t = 5.023, $p < 0.001$). Lastly, choice confidence is found to have a negative and significant effect on product return intention (β = -0.312, t = 2.543, $p < 0.5$). The structural model explains 58.5% of variance for perceived enjoyment (R^2=0.585), 49.9% for perceived immersion (R^2=0.499), 60.2% for perceived usefulness (R^2=0.602), 73.2% for choice confidence (R^2=0.732), 69.7% for purchase in-

tention (R^2=0.697) and 9.8% for product return intention (R^2=0.098). To conclude, hypotheses H4, H8 and H10 were not empirically supported for first-time users. Table 5.2 shows an overview of the evaluation of the hypotheses based on the analysis.

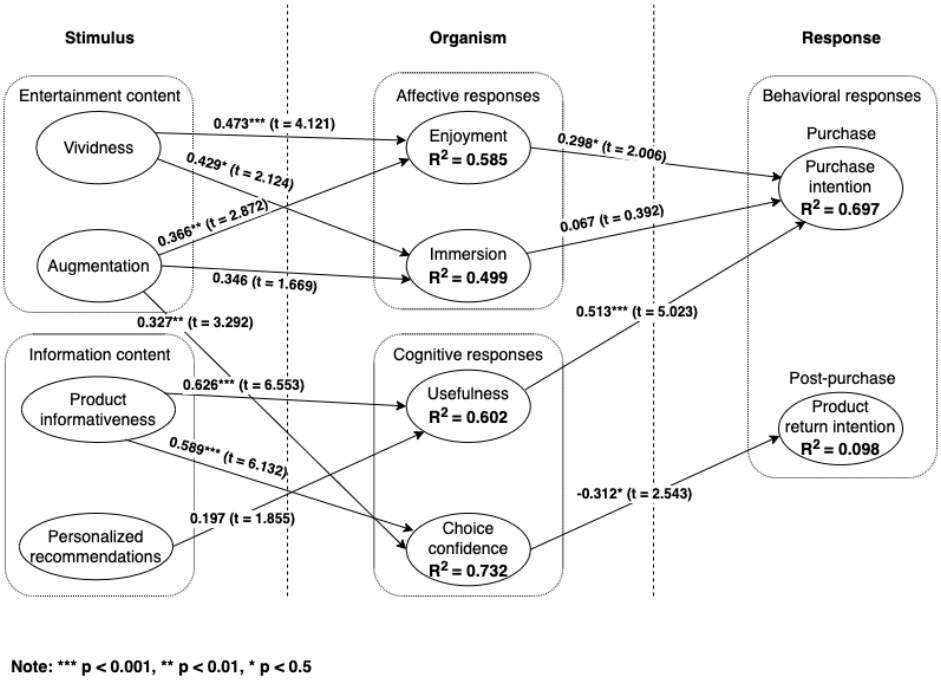

Figure 5.2: Structural model for first-time users

Table 5.2: Summary of the hypotheses for first-time users

Hypothesis	**Relationship between constructs**	**Hypothesis effect**	**Significance effect**	**Findings**
H1	Vividness positively affects enjoyment	+	$***$	Supported
H2	Vividness positively affects immersion	+	$*$	Supported
H3	Augmentation positively affects enjoyment	+	$**$	Supported
H4	Augmentation positively affects immersion	+		Not Supported
H5	Augmentation positively affects choice confidence	+	$**$	Supported
H6	Product informativeness positively affects perceived usefulness	+	$***$	Supported
H7	Product informativeness positively affects choice confidence	+	$***$	Supported
H8	Personalized recommendations positively affects perceived usefulness	+		Not Supported
H9	Enjoyment positively affects purchase intention	+	$*$	Supported
H10	Immersion positively affects purchase intention	+		Not Supported
H11	Perceived usefulness positively affects purchase intention	+	$***$	Supported
H12	Choice confidence negatively affects product return intention	-	$*$	Supported
$***p < 0.001, **p < 0.01, *p < 0.5$				

5.3.2 Structural Model for Experienced Users

As can be viewed in Figure 5.3, only one hypothesis is not empirically supported for experienced users of the IKEA Place app, which is hypothesis H2. Vividness is found to positively and significantly impact the experienced users' perceived enjoyment (β = 0.330, t = 4.103, $p < 0.001$) but not perceived immersion (β = 0.159, t = 1.621, $p < 0.5$). Augmentation is shown to have a positive and significant impact on perceived enjoyment (β = 0.428, t = 5.772, $p < 0.001$), perceived immersion (β = 0.502, t = 4.610, $p < 0.001$) and choice confidence (β = 0.445, t = 6.227, $p < 0.001$). Moreover, product informativeness is found to have a positive and significant effect on perceived usefulness (β = 0.267, t = 3.445, $p < 0.5$) and choice confidence (β = 0.378, t = 5.005, $p < 0.001$). Personalized recommendations has a positive and significant effect on perceived usefulness (β = 0.543, t = 7.445, $p < 0.001$). Furthermore, the experienced consumers' purchase intention is shown to be positively and significantly affected by perceived enjoyment (β = 0.342, t = 4.510, $p < 0.001$) , perceived immersion (β = 0.179, t = 2.706, $p < 0.01$) and perceived usefulness (β = 0.364, t = 3.997, $p < 0.5$). Finally, choice confidence is found to have a negative and significant effect on product return intention (β = -0.179, t = 2.798, $p < 0.5$). The structural model explains 48.0% of variance for perceived enjoyment (R^2=0.480), 38.2% for perceived immersion (R^2=0.382), 55.5% for perceived usefulness (R^2=0.555), 56.4% for choice confidence (R^2=0.564), 59.6% for purchase intention (R^2=0.596) and 4.2% for product return intention (R^2=0.042). Table 5.3 shows a summary of the evaluation of the hypotheses based on the findings.

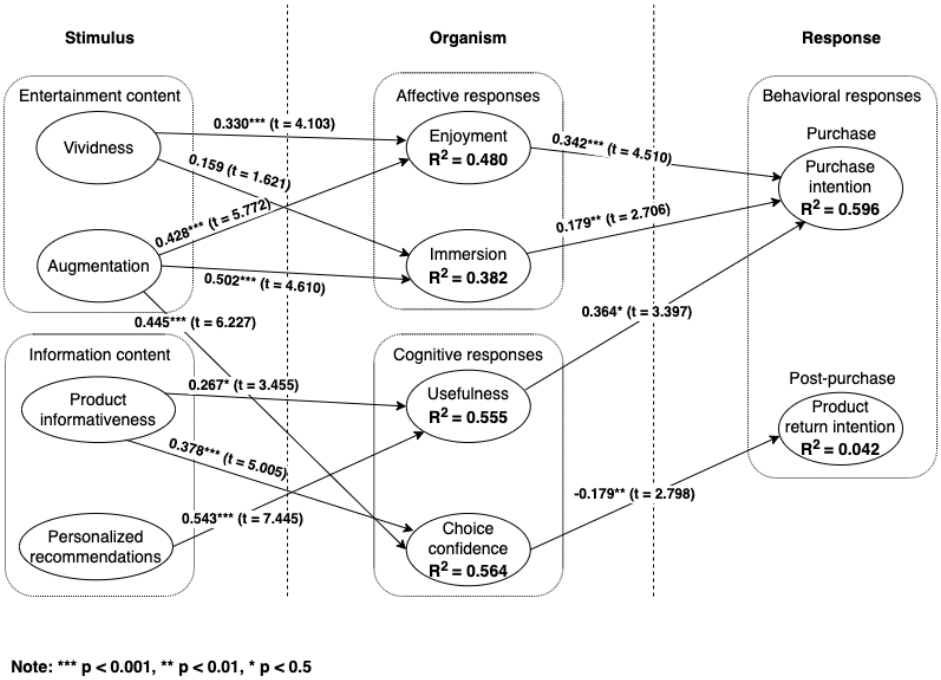

Figure 5.3: Structural model for experienced users

Table 5.3: Summary of the hypotheses for experienced users

Hypothesis	**Relationship between constructs**	**Hypothesis effect**	**Significance effect**	**Findings**
H1	Vividness positively affects enjoyment	+	$***$	Supported
H2	Vividness positively affects immersion	+		Not Supported
H3	Augmentation positively affects enjoyment	+	$***$	Supported
H4	Augmentation positively affects immersion	+	$***$	Supported
H5	Augmentation positively affects choice confidence	+	$***$	Supported
H6	Product informativeness positively affects perceived usefulness	+	$*$	Supported
H7	Product informativeness positively affects choice confidence	+	$***$	Supported
H8	Personalized recommendations positively affects perceived usefulness	+	$***$	Supported
H9	Enjoyment positively affects purchase intention	+	$***$	Supported
H10	Immersion positively affects purchase intention	+	$**$	Supported
H11	Perceived usefulness positively affects purchase intention	+	$*$	Supported
H12	Choice confidence negatively affects product return intention	-	$**$	Supported
$***p < 0.001, **p < 0.01, *p < 0.5$				

5.4 Multi-Group Analysis

To explore the differences between first-time users of the IKEA Place app and experienced users, the dataset was split up in two groups in SmartPLS 3. The first group was the ones that only had used the app once, and the second group included those who had used the app a few times or multiple times before. The same set of hypotheses (Section 3.2.1) applies for both groups. To examine if the observed differences between both groups are significant, Partial Least Squares Multi-Group Analysis (PLS-MGA) was used (Ringle et al., 2015). Table 5.4 summarizes the results of the MGA analysis, where the differences of each group's path coefficient were calculated, and the differences of the p-values. A p-value for a path coefficient's difference that is lower than 0.05 ($p < 0.05$) indicates that the observed differences between the groups are significant (Hair et al., 2011; Ringle et al., 2015). The results from the MGA analysis show that there is a significance in difference regarding what consumers in the two user groups find useful, namely the path between personalized recommendations and perceived usefulness ($p = 0.013$), and the path between product informativeness and perceived usefulness ($p = 0.008$). On the contrary, the path between perceived enjoyment and purchase intention had the highest p-value ($p = 0.797$) which indicates that both user groups find enjoyment to be important for their purchase intention. The table includes explanations for the constructs that have abbreviations.

Table 5.4: Multi-group analysis

Path	**Path coefficient difference (once vs. frequently)**	**P-value (once vs. frequently)**	**Significance in difference (once vs. frequently)**
augmentation → choice_confidence	-0.118	0.332	✗
augmentation → enjoyment	-0.062	0.699	✗
augmentation → immersion	-0.156	0.513	✗
choice_confidence → prod_returns	-0.133	0.333	✗
enjoyment → PI	-0.043	0.797	✗
immersion → PI	-0.112	0.559	✗
pers_recom → usefulness	-0.346	0.013	✓
prod_inform → choice_confidence	0.21	0.094	✗
prod_inform → usefulness	0.36	0.008	✓
usefulness → PI	0.148	0.317	✗
vividness → enjoyment	0.143	0.31	✗
vividness → immersion	0.27	0.245	✗

once = Used the app one time,
frequently = Used the app a few times or multiple times
prod_returns = Product return intention,
PI = Purchase intention,
pers_recom =Personalized recommendations,
prod_inform = Product informativesness

Chapter 6

Discussion

This chapter provides the theoretical implications (Section 6.1) of the conducted research, in addition to the practical implications (Section 6.2). Lastly, limitations of the study and suggestions for future research that would be interesting to study are presented in Section 6.3

6.1 Theoretical Implications

This research contributes to further investigating the effects that AR characteristics and personalized recommendations have on cognitive and affective responses and on behavioral responses. Furthermore, this research compares first-time users with consumers that have used the IKEA Place app a few times or multiple times to explore if there are any differences in how the stimuli affect the consumers' affective and cognitive responses, and their purchase behavior (purchase intention and product return intention). The results reveal that all hypotheses are accepted for the complete analysis containing both groups. For first-time users, H3, H8, and H10 were rejected, while the other hypotheses were accepted. For the experienced user group, all hypotheses except H2 were accepted.

In line with the research of McLean and Wilson (2019), it is found in this study that the entertainment content vividness has a positive impact on consumer's perceived enjoyment. For first-time users, the effect are a bit higher than for the experienced user group. The results of this research show that first-time users'ss perceived enjoyment are higher than for experienced users when looking at the effect that vividness has. Previous research argue that in addition to vividness, other factors such as interactivity, reality congruence and system quality are important factors on the consumer's perceived immersion (Yim et al., 2017; Kowalczuk et al., 2021). The current research found that vividness has a greater impact on the consumer's sense of immersion for first-time users than for experienced users. This hypothesis was only accepted for the user group that had only used the IKEA Place app once. This is consistent with the findings of Yim et al. (2017), where the AR app

can benefit from the novelty effect of the AR technology. The overall results of both user groups showed evidence that consumers experience enjoyment by the augmentation functionality, which previous AR literature also have indicated (Javornik, 2016a). However, the results of the study reveal that experienced users of the IKEA Place app experience more enjoyment by the augmentation characteristic than first-time users do. Similarly, this study shows that experienced users feel more immersed than first-time users by augmented product visualizations, which are not quite inline with the research findings by Yim et al. (2017), that argue that media novelty positively influence the immersion. These findings may be due to the need of habituation of the technology. Other reasons for explaining the findings could also be that new users of the IKEA Place app have previous AR experience. This is a factor that is not disclosed in the research model of this study, and is solely an assumption that new users of the app have less previous AR experience than frequent users have. New users that might have experienced frustration by the augmentation technology might experience stress rather than enjoyment, whilst users that are more familiar with augmenting objects can appreciate the value and get immersed.

Moreover, it is found in this study that augmentation enhances the consumer's choice confidence, which is consistent with previous AR literature (McLean and Wilson, 2019). In regards to the difference between the two users groups, experienced users are found to get higher choice confidence by viewing the products with augmentation. Also for this hypothesis, the findings suggest that first-time users do not experience the benefits of AR as experienced users do. This may be explained by the cue-utilization theory (Easterbrook, 1959), where new or unforeseen stimuli can shiver the consumers' cognitive flow, leading them to focus on the most important stimuli. The first-time users may be overwhelmed by the new way of visualizing products, with the result of them not getting enough information about the product to be confident enough in their decision-making. From the results, it seems that the consumers need some habituation of the augmentation characteristics to get the most positive affective and cognitive responses.

The results of the study indicate that consumers that have used the application only one-time experience greatly stronger cognitive responses from product informativeness than experienced users do. This may be explained by the fact that it seems that new users have a utilitarian motivation for using the app. Therefore, they focus on stimuli that boost their decision-making instead of the experience of enjoyment while using the app. Furthermore, experienced users find it more useful with being presented with personalized recommendations than first-time users, which was suspected prior to the analysis of the survey results. For first-time users, the hypothesis was not accepted, whilst the usefulness of personalized recommendations was the strongest effect in the study of all hypotheses in the experienced user group.

Regarding the impact on consumers' purchase intention, the results indicate great differences in which affective and cognitive responses have an impact on their intentions to buy. Previous AR literature have shown evidence of purchase intention being positively affected by a user's perceived enjoyment (Kowalczuk et al.,2021; Sohn and Kwon, 2020; Watson et al.,2018) The outlined link is also found in the current research results, with significant effect. Surprisingly, the findings show that enjoyment has a more important impact on the experienced users' purchase intention than for the first-time users. This is

not in line with the initial assumption of the differences between the user groups, as can be seen in Section 3.2.3. Experienced users might find enjoyment as the most important factor to influence their purchase intention, as it seems that they continue to use the app due to hedonic reasons because they use the app because it is fun.

Furthermore, a significant difference between the user groups is found when investigating the effect that perceived immersion has on purchase intention. The results suggest that when experienced users feel immersed, it will positively impact their purchase intention. For the first-time users on the other hand, their sense of immersion does not have almost any impact on their purchase intention, and the hypothesis for this link is not accepted for this user group. In general, the results suggest that new users only perceive immersion by the vividness of the app, and not by the augmentation characteristic. Despite new users that feel immersed by the vividness, it does not seem to affect their purchase intention. These findings are in line with the above-mentioned findings of this study, that first-time users appear to need habituation of the augmentation characteristics to appreciate the benefits of the technology.

In line with mediating effects in previous research (Kowalczuk et al., 2021; Yim et al., 2017), the results show a positive and significant relationship between the consumer's perceived usefulness of the app, and their purchase intention. Also for this link, it is observed a remarkable difference between the user groups in the study. The perceived usefulness of first-time users has a greater impact on their purchase intentions than for experienced users' perceived usefulness. In general, the results indicate that first-time users seek the utilitarian values of the applications, whilst experienced users seek hedonic values.

For both users groups, choice confidence negatively affects their product return intentions. Unexpectedly, the effect is stronger for first-time users than for experienced users. This might be explained by the fact that first-time users seem to have a utilitarian motivation for utilizing the app, whilst experienced users appear to continue to use the app due to hedonic reasons, such as the enjoyment of using the app.

6.2 Practical Implications

In addition to the theoretical implications, the findings in this study provide valuable insights to retailers and marketers as well to better understand how consumers respond to AR characteristics over time. This study has revealed that first-time users find the IKEA Place app to be very enjoyable, through its vividness. When the wow-effect and newness of AR wear out, however, the vividness seems to decrease its effect on affective responses. Retailers should therefore focus on enhancing the augmentation characteristic as it gives experienced users high cognitive and affective responses such as enjoyment, immersion, and choice confidence, which are consumer responses that have been indicated in this study to positively influence the experienced users' purchase intention and reduced product return intentions. Additionally, first-time users do not seem to get the same high values from augmentation as experienced users. The author sees a need of ensuring a more user-friendly augmentation experience to lower the user's need for habituation to best exploit

the functionality. For instance, augmented furniture in the IKEA Place app can sometimes not follow a realistic gravity, and be floating in the air instead of laying on the floor, which may be received negatively as non-realistic behavior.

Furthermore, the results of the study show that first-time users find product informativeness to be greatly useful and to boost their choice confidence in their decision-making. This relation is found to be higher for first-time users than for experienced users. Consequently, companies should concentrate on enhancing the information about the products, seeing as the resulting cognitive responses, usefulness, and choice confidence are indicated to positively influence purchase intention and to reduce product returns for both first-time users and experienced users.

Continuing, personalized recommendations are indicated to be very useful for experienced users. The users might save time on the shopping experience, or get inspired by being surprised by new suggestions. Companies should therefore continue to use AI to aid the consumers in their decision-making process, and hopefully, help them save some time on their product search.

Another point the author would like to stress is that first-time users do not seem to feel immersed by augmentation, but solely by vividness. On the opposite side, experienced users feel less immersed by the vividness of the app, but more immersed by the augmentation of the products. In both cases, the consumers feel immersed by one of the characteristics, but one finding regarding immersion that retailers should note is that immersion does not significantly affect first-time users' purchase intention. Previous literature has recommended to enhance the quality of the app, such as system quality to enhance the immersion (Kowalczuk et al., 2021). Otherwise, this could be explained by the basic motivation that this user group has, with seeking internal responses that give the utilitarian values, and not as many hedonic ones, even though the latter one also is important.

In general, the results indicate that first-time users utilize the IKEA Place app due to utilitarian motivations where they seem to actively want to use the app to purchase something. On the other hand, the other user group seems to continue to use the app for hedonic reasons, because they find it enjoyable. This conclusion is drawn since experienced users do not seem to focus on product informativeness as much as the first-time users, and the biggest impact on experienced users' purchase intention, is how much they enjoy the shopping experience. Nevertheless, for first-time users, it is their sense of usefulness that is the most important driver to their purchase intention. Because of these findings, companies that utilize AR in their strategies should highlight the usefulness of their AR app to get more new users to try out their application. Getting users to return to the applications, and to continue to purchase is crucial for any successful e-commerce business (Chiu et al., 2014), therefore it is important for companies to understand what influences experienced users to intend to purchase products. Seeing as users seem to return to the IKEA Place app since it is fun, it is important to continue to focus on the playfulness of the experience. Experienced users also find usefulness to be important for their purchase intentions, so the utilitarian aspects should also be in focus for app developers and marketers (Chiu et al., 2014).

To get more new users to get engaged with AR, app developers could try out gamification

(Mohamed Noor et al., 2015). An example of use of gamification that greatly increased a company's revenue is McDonald's Japan that cooperated with Pokémon Go (Calvo, 2019). This could get new users familiar with AR, get a tighter bond with new customers through higher engagement, and maybe lead new users using AR in shopping purposes to experience more affective and cognitive responses from the augmentation functionality, and not just experienced users.

Regarding product returns, the author sees a trend that first-time users' choice confidence has a higher influence on returning the product return intentions than experienced users do. Product returns are costly for a business (Ofek et al., 2011). Retailers should therefore work on boosting the consumer's choice confidence, by giving sufficient product information and accurate augmentation to give the consumers as much information about the product as possible before they make a purchase. Highlighting the usefulness and focus on the cognitive responses of an AR app, might lead experienced consumers to use the app with higher utilitarian motivations. The results in this study show this has a higher effect on product return intentions when the utilitarian motivations are higher.

6.3 Limitations and Future Work

This study contains some limitations that should be taken into consideration. First, the author mainly used Google Scholar as the search engine for the literature review. To evaluate which papers to use, the author evaluated the title, abstract, and the publication year of the studies. Given that the evaluation was subjective, biases could occur in the search for previous research papers. Concerning the survey at Amazon mTurk, 98.25% of the participants were from the United States. Such a dominant amount of participants from the same country could affect the results as it is the same culture and might be too homogeneous. The ruling majority of the American participants might be related to the fact that the survey was written in English, which might rule out possible participants that do not sufficiently master the language. Moreover, 52.12% of the participants were Generation Y, which may be above average at being open and curious with new technologies, which Raska and Richter (2017) also pointed out in their study. Further, the author did not have any communication with the participants. They did not have the opportunity to ask follow-up questions about the survey question to make sure everything was understood correctly. Consequently, there could be some bias with the responses here, with possible confusion or misunderstandings.

Beyond this study, there are still unexplored fields that should be examined in future research. The author suggests to study an app with different products than furniture to get a wider AR literature on how the technology influences behavioral consumer responses over time. In regards to the participants, it would be interesting to get a wider spread of the nationalities. By this means, one could compare if and how different cultures affect the product returns of consumers to find out if there are any factors that lead to reduced product returns. The current structural model had a fairly low variance for the product return intention construct, which indicates that there are effects on product return intentions that the research model did not cover in this study. The author sees a need to further investigate the effects on product return intentions in future studies. Different constructs

could be included such as trust and product knowledge.

Chapter 7

Conclusion

The purpose of this study was to get a deeper understanding of how novel technology such as AR and AI influence behavioral consumer responses over time. To do this, the author compared two user groups, namely first-time users of the IKEA Place app, and the ones that have used the app a few times or multiple times before. A literature review was conducted along with a synthesis of the literature to investigate what has been done in previous studies. To answer the research questions of the study, the SOR model and two theories, cue-utilization theory and habituation-tedium theory were included in the theoretical framework and applied in the conceptual framework. Further, a survey with 401 participants with a 7 point Likert scale was conducted. The raw quantitative data from the questionnaire were analyzed using PLS-SEM.

First-time users seem to have a utilitarian motivation for using the app. They responded higher to the vividness stimulus of the app by generating higher cognitive responses. Further, first-time users find product informativeness to be extremely useful when shopping, and the most important factor to influence their purchase intention is their perceived usefulness of the app. First-time users' sense of enjoyment is additionally an important factor for their intentions to buy, while immersion however barely has any effect. Further, their choice confidence has a higher effect on reducing their intentions to return products than for experienced users. Experienced users do not seem to be affected by the vividness of the app to the same degree as first-time users. They appear to generate much more positive cognitive and affective responses when viewing products with augmentation. Also, this user group finds product informativeness to be useful, although not as much as first-time users. Nonetheless, experienced users appear to find personalized recommendations to be greatly useful. Concerning what the effects are on their purchase intention, enjoyment, immersion, and usefulness all have a significant impact, but enjoyment is the most important factor. The results show that choice confidence appears to negatively influence the product return intention, but not as much as for new users.

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Appendices

A Survey questions

IKEA AR App

Background Questions

Purpose: The goal of this study is to explore how Augmented Reality (AR) applications are influencing consumer behavior. This study is done solely for scientific purposes.

Confidentiality: The data from this survey will be treated anonymously and no personal information will be linked to your answers. All gathered data is for research purposes only and will not be distributed to third parties.

Researcher: Master Student Charlotte Maigull Søderstrøm

Thank you for participating in my study, it is very helpful to me!

1. What is your gender? *

- ◯ Male
- ◯ Female
- ◯ Other

2. What is your age? *

- ◯ Younger than 18
- ◯ 18 - 24
- ◯ 25 - 34
- ◯ 35 - 44
- ◯ 45 - 54
- ◯ 55 or older

3. What country are you from?

-- Please Select --

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

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

Figure A1: Survey questions (part one)

5. What is your yearly income before taxes? *

- ◯ less than $14,000
- ◯ $14,000-$24,000
- ◯ $25,000- $35,000
- ◯ $36,000-$46,000
- ◯ $47,000-$57,000
- ◯ more than $57,000

6. Have you used the IKEA Place app before? *

- ◯ Never
- ◯ Once
- ◯ A few times
- ◯ Many times

7. How often do you purchase from IKEA every year? *

- ◯ Never
- ◯ Once
- ◯ A few times
- ◯ Many times

8. How much do you spend on average every year in IKEA? *

- ◯ I don't purchase at IKEA
- ◯ $1-$100
- ◯ $100-$500
- ◯ $500-$1,000
- ◯ $1,000-$2,000
- ◯ $2,000-$5,000
- ◯ more than $5,000

Figure A2: Survey questions (part two)

AR experience and beliefs

9. Please answer the following statements with the answer that best fits. *

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
I am familiar with AR	○	○	○	○	○	○	○
I have experiences with AR	○	○	○	○	○	○	○
I am cofident I can learn technology-related skills	○	○	○	○	○	○	○
I have avoided technology because it is unfamiliar to me	○	○	○	○	○	○	○
I am able to keep up with important technological advances	○	○	○	○	○	○	○

10. Please answer the following statements with the answer that best fits. *

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
The visual display through the AR feature was clear	○	○	○	○	○	○	○
The visual display through the AR feature was vivid	○	○	○	○	○	○	○
The visual display through the AR feature was well-defined	○	○	○	○	○	○	○
The visual display through the AR feature was sharp	○	○	○	○	○	○	○

11. Please answer the following statements with the answer that best fits. *

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
I was in control of my navigation through the AR feature	○	○	○	○	○	○	○
I had some control of the AR feature that I wanted to see	○	○	○	○	○	○	○
The AR feature had the ability to respond to my specific needs quickly and efficiently	○	○	○	○	○	○	○

12. Please answer the following statements with the answer that best fits. *

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
The IKEA product seemed real	○	○	○	○	○	○	○
The IKEA product seemed to be a part of the real environment	○	○	○	○	○	○	○
The AR feature provides me a product experience similar to in the store	○	○	○	○	○	○	○
The IKEA products seem to have real dimensions	○	○	○	○	○	○	○

Figure A3: Survey questions (part three)

AR experience and beliefs

13. Please answer the following statements with the answer that best fits. *

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
The IKEA Place app showed the information I expected	○	○	○	○	○	○	○
The IKEA Place app provided detailed information about the product	○	○	○	○	○	○	○
The IKEA Place app provided complete information about the product	○	○	○	○	○	○	○
The IKEA Place app provided information that helped me in my decision	○	○	○	○	○	○	○

14. Please answer the following statements with the answer that best fits. *

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
The IKEA Place app performed its functions quickly and efficiently	○	○	○	○	○	○	○
The IKEA Place app was reliable (it is always up and running, runs without errors, and does what it is supposed to do)	○	○	○	○	○	○	○
The IKEA Place app fully met my needs	○	○	○	○	○	○	○
I assume no limitations or problems in using the IKEA Place app	○	○	○	○	○	○	○

15. Please answer the following statements with the answer that best fits. *

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
The personalized recommendations were good recommendations	○	○	○	○	○	○	○
The personalized recommendations made the experience more efficient	○	○	○	○	○	○	○
The personalized recommendations increased the usefulness of the app	○	○	○	○	○	○	○

16. Please answer the following statements with the answer that best fits. *

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
I have gotten used to the AR feature	○	○	○	○	○	○	○
I have gotten used to the IKEA Place app	○	○	○	○	○	○	○
I have made a habit of using the IKEA Place app	○	○	○	○	○	○	○

Figure A4: Survey questions (part four)

Feelings using AR

17. Please answer the following statements with the answer that best fits. *

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
I experience stress or frustration when using the AR feature	○	○	○	○	○	○	○
I experience stress or frustration when trying to learn/understand the AR feature	○	○	○	○	○	○	○
I experience frustration when the AR feature does not fulfill my needs	○	○	○	○	○	○	○

18. Please answer the following statements with the answer that best fits. *

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
I find using the AR feature in the app to be enjoyable	○	○	○	○	○	○	○
The actual process of using the AR feature in the app is pleasant	○	○	○	○	○	○	○
I have fun using the AR feature in the app	○	○	○	○	○	○	○

19. Please answer the following statements with the answer that best fits. *

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
I experience boredom when viewing the products with AR	○	○	○	○	○	○	○
I experience boredom when using the IKEA Place app	○	○	○	○	○	○	○
Using the Ikea Place app is monotonous/dull	○	○	○	○	○	○	○

20. Please answer the following statements with the answer that best fits. *

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
My attention is absorbed when using the IKEA Place app	○	○	○	○	○	○	○
My attention is deeply engrossed when using the IKEA Place app	○	○	○	○	○	○	○
My attention is focused when using the IKEA Place app	○	○	○	○	○	○	○

Figure A5: Survey questions (part five)

Experience using AR

21. Please answer the following statements with the answer that best fits. *

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
Using the AR feature offers something new each time	○	○	○	○	○	○	○
Using the AR feature offers unique information	○	○	○	○	○	○	○
Using the AR feature offers specific content	○	○	○	○	○	○	○
Using the AR feature is something different each time	○	○	○	○	○	○	○

22. Please answer the following statements with the answer that best fits. *

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
I usually like the products viewed in the IKEA Place app	○	○	○	○	○	○	○
I usually like the products viewed in the IKEA Place app better than viewing them in the website	○	○	○	○	○	○	○
I usually like the products viewed in the IKEA Place app better than viewing them in the physical store	○	○	○	○	○	○	○

23. Please answer the following statements with the answer that best fits. *

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
Using the AR feature in the app enables me to accomplish shopping tasks more quickly	○	○	○	○	○	○	○
Using the AR feature in the app would make it easier to shop	○	○	○	○	○	○	○
Overall, I find the AR feature in the app to be useful in my shopping experience	○	○	○	○	○	○	○
Using the AR feature gives me inspiration and knowledge about how the product fits my home	○	○	○	○	○	○	○

Figure A6: Survey questions (part six)

Purchase Intention

24. Please answer the following statements with the answer that best fits. *

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
I feel sure about my choice of products when I view them through AR	○	○	○	○	○	○	○
I feel confident that I have enough information about the product to make a purchase decision	○	○	○	○	○	○	○
I feel more confident that I will make the right choice about the product after viewing the product with AR	○	○	○	○	○	○	○

25. Please answer the following statements with the answer that best fits. *

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
I am certain that I will purchase the product at some point in the future	○	○	○	○	○	○	○
It is likely that I will purchase the product at some point in the future	○	○	○	○	○	○	○
It is possible that I will purchase the product at some point in the future	○	○	○	○	○	○	○
There is a strong likelihood that I will buy the product I have interacted with	○	○	○	○	○	○	○

26. Please answer the following statements with the answer that best fits. *

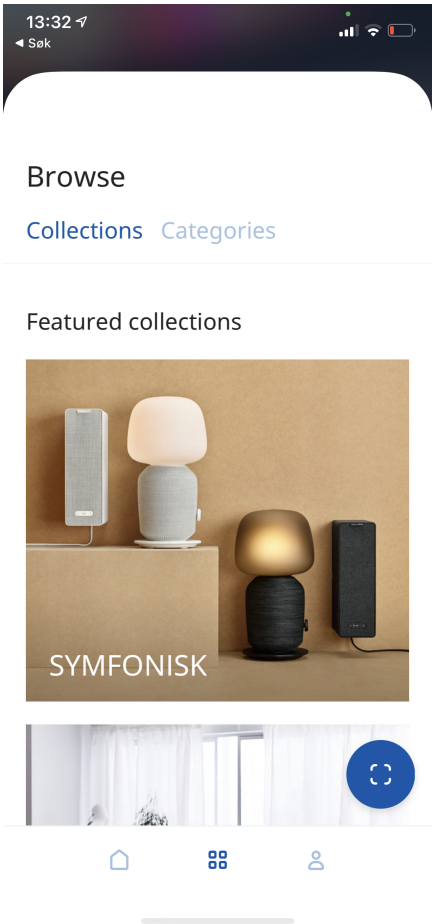
	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
I predict I'll buy products from the IKEA Place app several times in the future	○	○	○	○	○	○	○
When I need new furniture in the future, I intend to use the IKEA Place app to view and purchase products	○	○	○	○	○	○	○
I plan to buy products from the IKEA Place app several times in the future	○	○	○	○	○	○	○

27. Please answer the following statements with the answer that best fits. *

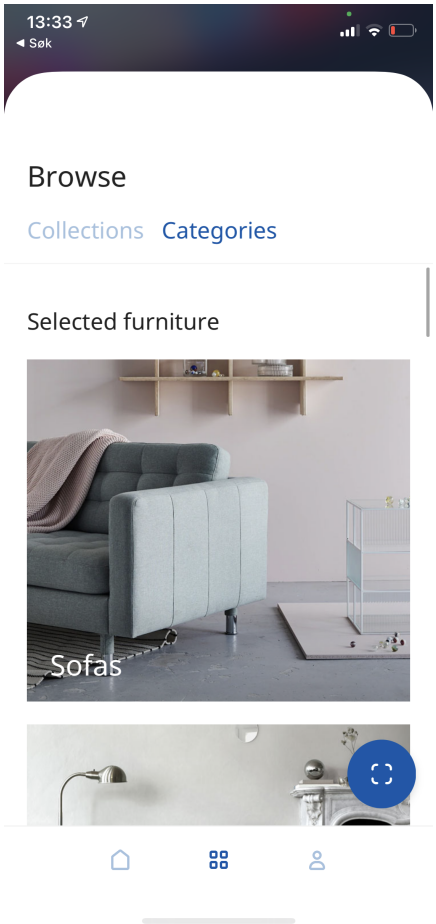
	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
I think it's likely that I'll return a purchased product I've viewed in AR in the IKEA Place app	○	○	○	○	○	○	○
I think it's more likely that I'll return a product I've viewed in the IKEA Place app than in a physical store	○	○	○	○	○	○	○
I think it's more likely that I'll return a purchased product from IKEA's website than from IKEA Place app	○	○	○	○	○	○	○

Figure A7: Survey questions (part seven)

B Screenshots of IKEA Place application

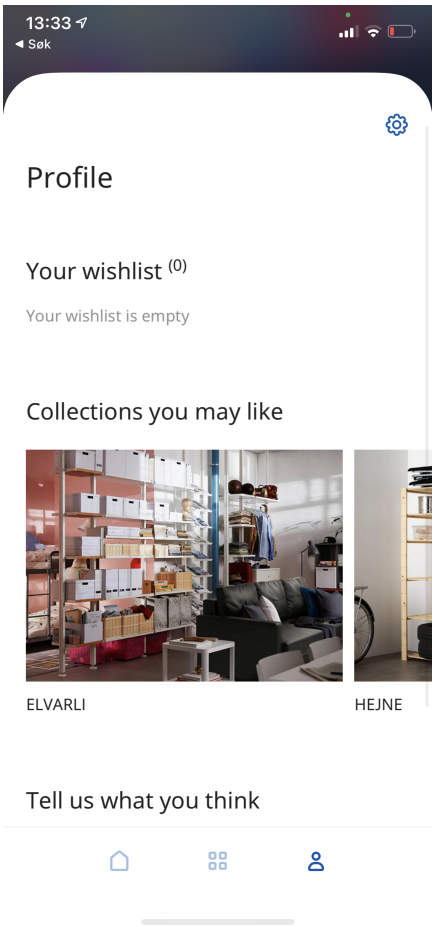


(a) User interface of collections

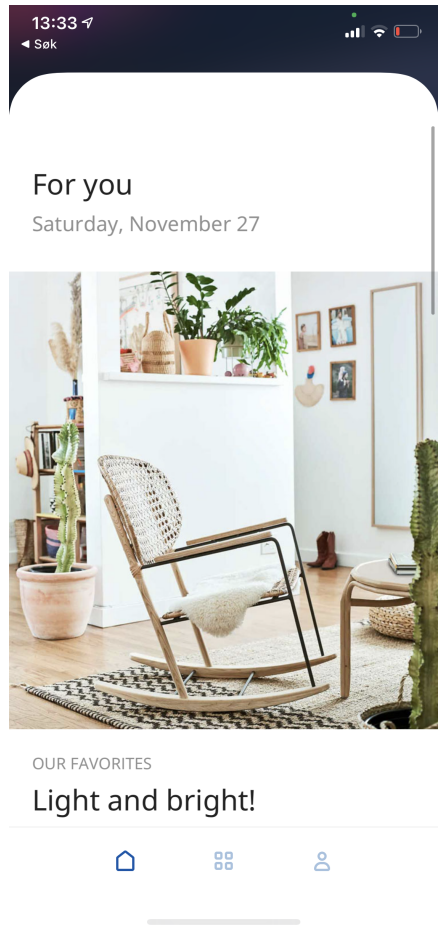


(b) User interface of categories

Figure B1: Screenshots of the IKEA Place app (part one)



(a) User interface of profile page



(b) User interface of personalized recommendations

Figure B2: Screenshots of the IKEA Place app (part two)

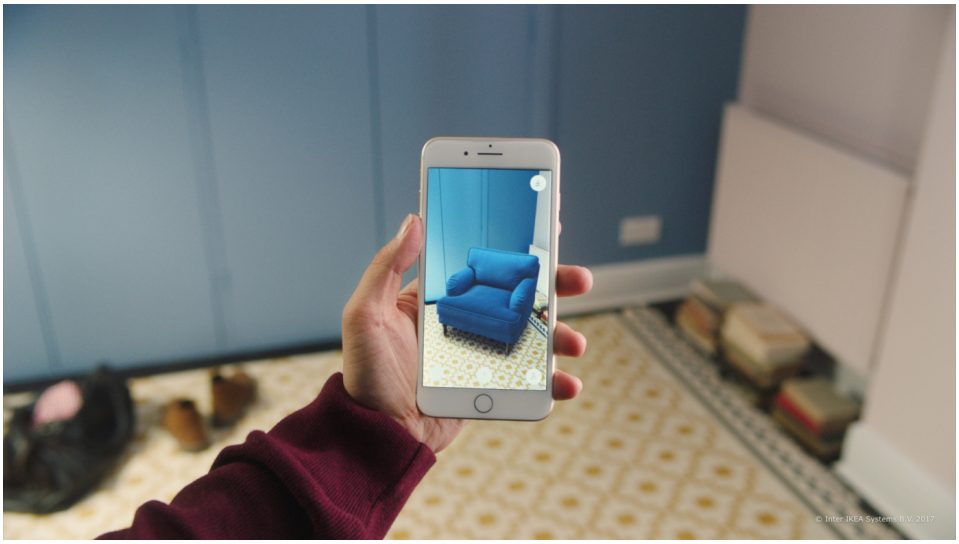


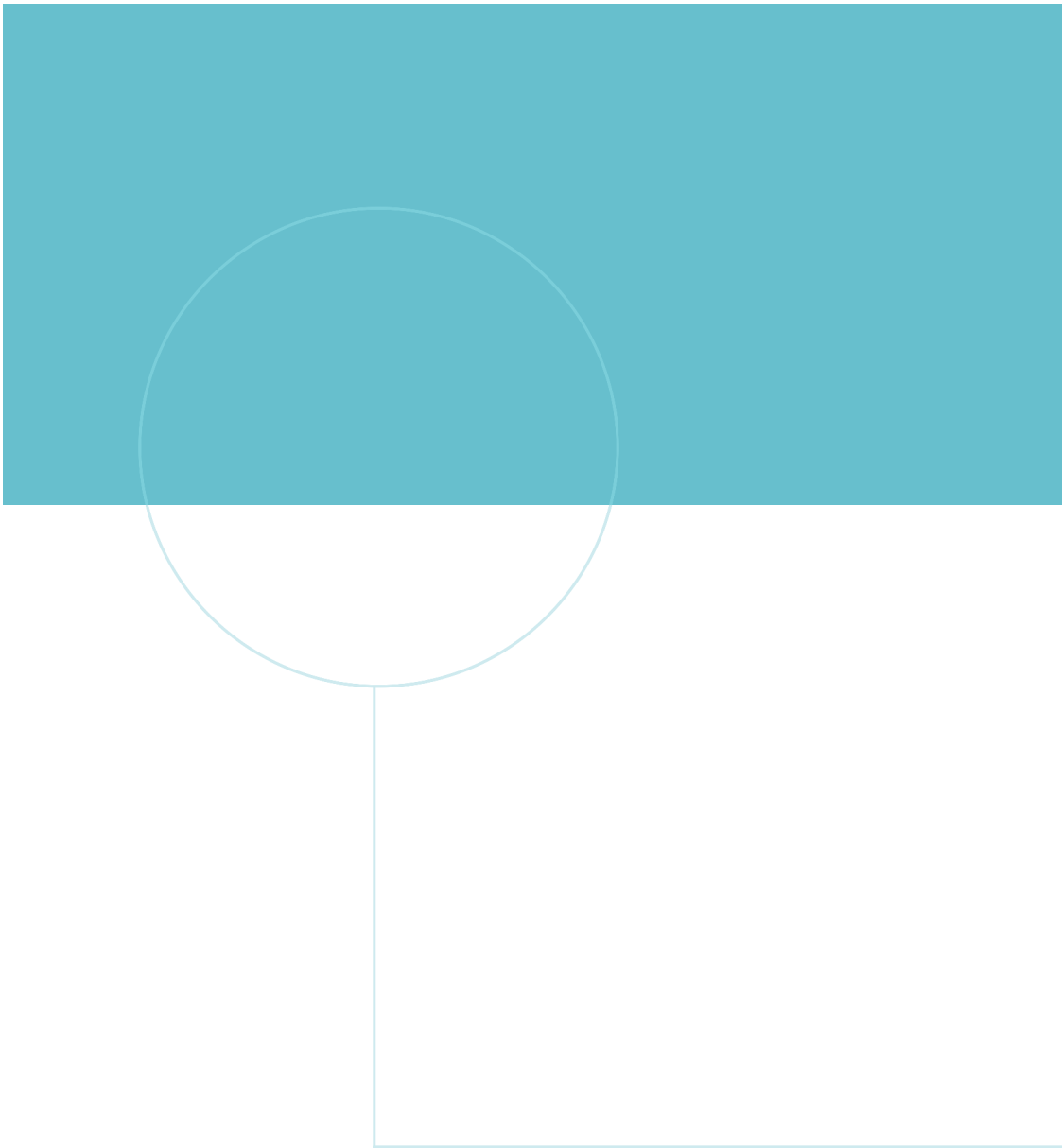
Figure B3: Usage of the IKEA Place app (Lunden, 2017)

C Cross Loadings

Table C1: Cross-Loadings

	augmentation	choice_confidence	enjoyment	immersion	PI	pers_recom	prod_inform	prod_returns	usefulness	vividness	
AUGM1	**0.818**	0.583	0.553	0.466	0.547	0.532	0.607	-0.135	0.489		0.608
AUGM2	**0.843**	0.617	0.552	0.501	0.598	0.607	0.59	-0.208	0.553		0.574
AUGM3	**0.759**	0.564	0.494	0.518	0.514	0.584	0.453	-0.261	0.556		0.43
AUGM4	**0.773**	0.523	0.508	0.489	0.536	0.579	0.538	-0.138	0.51		0.522
CC1	0.634	**0.884**	0.646	0.589	0.674	0.638	0.643	-0.167	0.741		0.574
CC2	0.644	**0.877**	0.628	0.651	0.678	0.646	0.651	-0.195	0.716		0.633
CC3	0.61	**0.873**	0.618	0.625	0.655	0.597	0.611	-0.18	0.715		0.547
ENJ1	0.592	0.654	**0.863**	0.58	0.608	0.56	0.566	-0.201	0.617		0.589
ENJ2	0.559	0.586	**0.854**	0.487	0.595	0.529	0.554	-0.163	0.584		0.533
ENJ3	0.545	0.605	**0.855**	0.515	0.61	0.511	0.538	-0.168	0.575		0.545
IMM1	0.532	0.631	0.574	**0.904**	0.591	0.54	0.536	-0.222	0.647		0.507
IMM2	0.56	0.636	0.535	**0.895**	0.556	0.566	0.508	-0.249	0.608		0.458
IMM3	0.583	0.655	0.562	**0.915**	0.601	0.56	0.524	-0.226	0.68		0.504
PI1	0.557	0.632	0.589	0.505	**0.84**	0.59	0.5	-0.272	0.606		0.491
PI2	0.577	0.635	0.624	0.504	**0.852**	0.605	0.55	-0.193	0.656		0.531
PI3	0.567	0.628	0.592	0.586	**0.807**	0.524	0.611	-0.089	0.586		0.556
PI4	0.586	0.639	0.534	0.548	**0.824**	0.546	0.516	-0.245	0.584		0.467
PR1	0.661	0.644	0.588	0.51	0.617	**0.866**	0.611	-0.18	0.624		0.526
PR2	0.621	0.626	0.532	0.57	0.593	**0.874**	0.586	-0.256	0.597		0.555
PR3	0.592	0.59	0.499	0.519	0.565	**0.865**	0.521	-0.206	0.588		0.521
PRIN1	0.502	0.57	0.507	0.409	0.493	0.521	**0.789**	-0.033	0.549		0.595
PRIN2	0.561	0.555	0.515	0.445	0.538	0.553	**0.805**	-0.073	0.491		0.609
PRIN3	0.564	0.596	0.515	0.48	0.532	0.533	**0.795**	-0.092	0.515		0.599
PRIN4	0.546	0.57	0.506	0.497	0.517	0.489	**0.781**	-0.074	0.516		0.508
Rev RETRUN2	-0.231	-0.21	-0.197	-0.244	-0.214	-0.235	-0.095	**0.949**	-0.192		-0.158
Rev RETURN1	-0.202	-0.173	-0.192	-0.237	-0.237	-0.225	-0.062	**0.924**	-0.152		-0.094
UF2	0.538	0.693	0.574	0.607	0.608	0.572	0.54	-0.153	**0.837**		0.503
US3	0.551	0.686	0.555	0.576	0.595	0.548	0.548	-0.087	**0.848**		0.52
US4	0.507	0.656	0.584	0.577	0.594	0.592	0.552	-0.135	**0.823**		0.512
USF1	0.61	0.724	0.598	0.628	0.653	0.611	0.55	-0.24	**0.84**		0.511
VIV1	0.543	0.545	0.566	0.368	0.509	0.543	0.651	-0.088	0.486		**0.83**
VIV2	0.535	0.507	0.48	0.44	0.474	0.479	0.563	-0.09	0.462		**0.792**
VIV3	0.541	0.539	0.544	0.454	0.497	0.469	0.582	-0.132	0.503		**0.823**
VIV4	0.564	0.581	0.525	0.501	0.528	0.517	0.587	-0.138	0.541		**0.819**

AUG = Augmentation, CC = Choice confidence, ENJ = Enjoyment, IMM = Immersion, PI = Purchase intention, PR = Personalized recommendations, PRIN = Product informativeness, REV RETURN = Reversed product return intention, UF = Perceived usefulness, VIV = Vividness



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