Technology Acceptance of Mobile Augmented Reality Applications in E-Commerce in Germany and the United States

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1 Introduction

It is undeniable that online shopping has become increasingly popular in recent years. In 2020, e-commerce accounted for 18% of total global retail sales, which is approximately 4.28 trillion U.S. dollars (eMarketer, 2021a). In 2015, the global share was only 7.4%, and it is expected to reach 21.8% in 2024 (eMarketer, 2021a; eMarketer, cited according to Statista, 2021).

However, there are not only advantages associated with online shopping, such as convenience, lower prices, easier price comparison, or a wider selection of products, but also disadvantages (y Monsuwé et al., 2004). Not all product information can be visualized online, and descriptions are often inadequate for customers to evaluate the product. This leads to higher product risk, which discourages consumers from buying online (Kim & Forsythe, 2008). For example, it is difficult for customers to imagine the fit of clothes seen online without trying them on or to imagine how the sofa seen online will look in their own living room (Kim & Forsythe, 2008; Park & Yoo, 2020). When the online purchased product is returned due to lack of information, the process can be tedious, especially for large items. AR technologies offer a solution to the disadvantages of online shopping by reducing product risk, simplifying the customer's decision-making process, and decreasing the number of product returns (Hilken et al., 2017; Huang & Liao, 2015; Poushneh & Vasquez-Parraga, 2017).

Mobile AR applications are already being used successfully in social media and entertainment, such as with *Instagram* and *Snapchat* filters or the game *Pokémon Go*. In addition, there are already a few mobile AR applications in e-commerce, such as *IKEA Place*. While in 2019 the number of active mobile AR users was 440 million worldwide, by 2024 there will be estimated 1.7 billion mobile AR users (AR Insider, 2021). A large proportion among the active users of mobile AR applications relate to the field of social media. *Snapchat*, for example, had an average of 306 million daily active users worldwide in the third quarter of 2021 (Snap Inc., 2021). However, studies have illustrated that also the use of AR in e-commerce has positive impacts on purchase intention, sales, patronage intention, word-of-mouth, customer satisfaction, brand attitude, brand loyalty, and the intention to use brands in the future (Baek et al., 2018; Beck & Crié, 2018; Hilken et al., 2017; Huang & Liao, 2017; McLean & Wilson, 2019; Poushneh, 2018; Poushneh & Vasquez-Parraga, 2017; Rauschnabel et al., 2019; Tan et al., 2021; Verhagen et al., 2016; Watson et al., 2018; Yim et al., 2017). When stores were closed during the COVID-19 pandemic lockdowns, companies using AR technologies provided customers a digital fitting experience. Nevertheless, AR offers not only utilitarian benefits to users but also hedonic benefits (Rauschnabel et al., 2019). Through its interactive features, AR creates visual and haptic simulations which enrich customer experience (Huang & Liao, 2015; Park & Yoo, 2020). Customer experience in turn influences customers' satisfaction and their buying intention (Poushneh & Vasquez-Parraga, 2017). But before these positive impacts can occur, AR must first be accepted and used in e-commerce. However, only a few studies have investigated the

acceptance of mobile AR applications in e-commerce based on technology acceptance models even though the acceptance of a technology is crucial for its successful implementation (Chau & Hu, 2001).

Studies examining AR acceptance in e-commerce almost exclusively use or extend the TAM (e.g. Huang & Liao, 2015; Rese et al., 2017), although the UTAUT and its extension are also established models to assess technology acceptance (Williams et al., 2015). Additionally, several studies have not focused on mobile AR applications, but on AR applications that are used with a computer and a webcam (e.g. Huang & Liao, 2015; Kang, 2014; Pantano et al., 2017). Therefore, the aim of this thesis is to identify factors that influence the intention to use mobile AR applications in e-commerce while adapting and extending the UTAUT2. Since it has already been found in the literature that cultural aspects influence technology acceptance, two countries, Germany and the U.S., are considered in this thesis (Srite & Karahanna, 2006). The following research question is answered:

Which factors influence the behavioral intention to use mobile augmented reality applications in e-commerce in Germany and the United States?

To answer this research question, a survey is conducted, and the data is analyzed using partial least squares analysis. The mobile AR application *IKEA Place* is used as the object of study. The disadvantages of online shopping are particularly evident in the furniture market. Mobile AR applications in e-commerce can counteract the possible inability of buyers to imagine furniture in their homes and avoid the complicated return process (Park & Yoo, 2020).

This thesis is structured as follows: Chapter 2 describes the UTAUT and its extension as well as Hofstede's cultural dimensions and their influence on technology acceptance. The terms AR and e-commerce are defined, mobile AR applications in e-commerce are introduced, and an overview of previous research on the acceptance of AR applications in e-commerce is given. Chapter 3 presents the object of study, the research countries, the research model, and the hypotheses. Chapter 4 presents the research methodology by explaining the measures used in this study, the process of data collection, and the method of data analysis. Chapter 4 also provides descriptive analyses of the German and U.S. samples. Chapter 5 displays the results of partial least squares analysis. Chapter 6 reviews the results and outlines the theoretical and practical implications as well as limitations and implications for further research. Chapter 7 presents the conclusion of this thesis.

7 Conclusion

Currently, mobile AR applications are mainly used in the field of social media. However, studies have repeatedly shown that the use of AR in e-commerce positively influences purchase intention, sales, patronage intention, word-of-mouth, customer satisfaction, brand attitude, brand loyalty, and the intention to use the brand in the future (Baek et al., 2018; Beck & Crié, 2018; Hilken et al., 2017; Huang & Liao, 2017; McLean & Wilson, 2019; Poushneh, 2018; Poushneh & Vasquez-Parraga, 2017; Rauschnabel et al., 2019; Tan et al., 2021; Verhagen et al., 2016; Watson et al., 2018; Yim et al., 2017). But before these positive impacts can occur, AR must first be accepted and used in e-commerce. The acceptance factors of technologies can vary in different cultures (Srite & Karahanna, 2006). It is, therefore, important to not only identify factors that influence the adoption of mobile AR applications in e-commerce but also to evaluate countries individually.

The aim of this thesis was to identify factors that influence the intention to use mobile AR applications in e-commerce in Germany and the U.S. For this purpose, the UTAUT2 by Venkatesh et al. (2012) was adapted and extended with the constructs PC and BF. The literature on the acceptance of mobile AR applications in e-commerce has not focused on PC and BF so far. The adapted UTAUT2 model with the extensions of PC and BF was appropriate to explain the BI to use mobile AR applications in e-commerce in the U.S. and Germany. The research question can now be answered. The results of this study revealed that in Germany the intention to use mobile AR applications in e-commerce is significantly influenced by PE, SI, HB, PC, and BF. In the U.S., the intention to use mobile AR applications in e-commerce is only significantly influenced by PE, SI, HB, and BF. The results of this study were based on a survey with 181 participants from Germany and 175 participants from the U.S.

Online retailers in both countries should focus on developing and communicating features that add functional values to users because PE is the strongest predictor of BI. They should also integrate features into their mobile AR applications that enable social interaction with potential users because SI has a significant positive influence on BI in Germany and the U.S. Since HB has a significant positive impact on BI, retailers in both countries could cooperate with companies that already offer established mobile AR applications, for example, in social media. Furthermore, especially companies that are already well-known, should offer mobile AR applications in Germany and the U.S because BF has a significant positive effect on BI. In Germany, additional attention should be placed on marketing activities that focus on mitigating the PC of users, since PC influence BI negatively. For example, when developing a mobile AR application, it is important to ensure that users are only asked for necessary permissions and that the purpose of the permission as well as the privacy policies are clearly communicated (Gu et al., 2017).

This study has some limitations which should be further investigated in future research. A large proportion of the study participants belong to Generation Y and Generation Z. Thus, the findings of this study are limited to a rather younger age group in both countries. Although the survey results indicated that many of the participants already have experience with AR applications, only a small proportion in either country had experience with *IKEA Place*. To get a more generalized insight into the acceptance of mobile AR applications in e-commerce, future research should include older age groups and individuals who already have experience with *IKEA Place*. By including people who already have experience with the specific AR application, application-related constructs like vividness, application aesthetics, or constructs of the flow theory could be included in the model. In addition, only one subject of study was used in this study, namely *IKEA Place*. Accordingly, the questionnaire focused only on this application. The results regarding the acceptance of mobile AR applications in e-commerce focused on the product area of furniture and home furnishings. It is reasonable for further research to take other product categories into account and investigate whether there are any differences regarding the acceptance factors. Also, the data collection for this study took place during the COVID-19 pandemic when people avoided non-essential tasks that brought them into contact with other individuals. Accordingly, online shopping, in combination with AR applications, could have been a useful alternative for looking at furniture. This could explain why, in contrast to other studies, enjoyment-related factors, namely HM, do not have a significant influence on BI in this study and PE is of enormous importance. For further research, it would be meaningful to conduct the data after the COVID-19 pandemic and examine how the results differ.

Finally, this thesis provides an important insight into the factors that influence the acceptance of mobile AR applications in e-commerce in Germany and the U.S. It also offers practical implications to online retailers and mobile AR application developers, especially from the furniture and interior product area. Although these two countries differ in some of Hofstede's cultural dimensions, they can still be categorized as Western countries where individuals are familiar with e-commerce and the use of innovative technologies (Hofstede et al., 2010; Smith et al., 2013). Future research could consider countries where online shopping is not as widely used, and which tend to adopt new technology more hesitantly. Here, the e-commerce process in combination with AR technologies could combine the advantages of online shopping with the advantages of stationary shopping and strengthen the acceptance of e-commerce.