Enhancing E-commerce Efficiency: Exploring the Role of an AI-Powered AR Foot Scanning Tool in Reducing Returns and Enhancing Customer Satisfaction

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Abstract

The swift development of Augmented Reality and Artificial Intelligence is revolutionizing e-commerce by providing solutions to problems. The possibility of how an imaginary AI-powered augmented reality foot scanning tool could address major problems in online footwear retail, such as high return rates and customer discontent from inaccurate size, is examined in this thesis.

This study combines quantitative survey data from 99 participants with qualitative interview data. The data will be used to approve or reject the hypotheses. But also, to determine consumer perceptions and the relationship between usability, trust, and sustainability concerns.

Results show that consumers who indicates that the imaginary tool to be accurate are more satisfied with their purchases and are less likely to return them. This underlines the potential of such a tool to improve sustainability and reduce logistical inefficiencies. The data indicated that convenience and seamless integration are important considerations for frequent usage. Beside that the results also show that younger customers have a higher willingness to use AR solutions. By showing retailers how to refine user-friendly design, address privacy concerns, and spark adoption through targeted marketing, this study drives progress for both scholarly research and the business world. Beside that the need for more research on the long-term effects of AR technology in retail, as well as regional variations and various demographic affects is addressed. This thesis outlines a strategy for using AI and AR to create a more sustainable and effective online shopping experience by addressing the gap between invention and deployment.

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Keywords: Artificial Intelligence (AI), Augmented Reality (AR), E-commerce, Customer Satisfaction, Return Rate Reduction

Resumo

O rápido desenvolvimento da Realidade Aumentada (RA) e da Inteligência Artificial (IA) está revolucionando o comércio eletrônico ao oferecer soluções para diversos desafios. Esta tese avalia como uma ferramenta imaginária de digitalização de pés, alimentada por RA e IA, pode enfrentar problemas no varejo de calçados online, como altas taxas de devolução e insatisfação por tamanho impreciso. Este estudo combina dados quantitativos de 99 participantes e dados qualitativos de entrevistas para testar hipóteses e analisar percepções de consumo, relacionando usabilidade, confiança e sustentabilidade.

Os resultados mostram que consumidores que julgam a ferramenta precisa estão mais satisfeitos e menos propensos a devolver produtos, ressaltando seu potencial para melhorar a sustentabilidade e reduzir ineficiências logísticas. Conveniência e integração sem atritos são fatores importantes para uso frequente, e clientes mais jovens demonstram maior interesse por soluções de RA.

Ao instruir varejistas sobre como refinar o design centrado no usuário, lidar com questões de privacidade e impulsionar a adoção por meio de marketing segmentado, este estudo avança a pesquisa acadêmica e o setor empresarial. Também aborda a necessidade de mais pesquisas sobre os efeitos de longo prazo da RA, além de variações regionais e diferentes impactos demográficos. Por fim, esta tese apresenta uma estratégia para utilizar IA e RA na criação de uma experiência de compra online mais sustentável e eficiente, unindo invenção e aplicação prática.

Título: Melhorar a eficiência do comércio eletrónico: Explorando o papel de uma ferramenta de digitalização de pés de AR alimentada por IA na redução de devoluções e no aumento da satisfação do cliente

Autor: Yannick Said Saffar

Palavras-chave: Inteligência Artificial (IA), Realidade Aumentada (RA), Comércio Eletrónico, Satisfação do Cliente, Redução da Taxa de Devolução

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1. Introduction

1.1. Background and Context

The retail industry has changed a lot in the recent years. One of the reasons for this is the implication of Artificial Intelligence and Augmented Reality technologies. Innovations like them have changed customer engagement by closing the gap between the virtual and the physical stores by offering enhanced, personalized, and convenient shopping experiences. By solving the problems of high return rates and unhappy customers, these technologies provide a way to improve the sustainability and efficiency of e-commerce.

1.2. Problem Statement and Research Questions

This study seeks to explore how an imaginary AI-based Augmented Reality (AR) foot scanning tool has the possibility of changing the experience of buying shoes specifically from an e-commerce platform while focusing on providing accurate size recommendations. Solving the problem of high return rates that result in challenges and environmental issues. The tool is expected to improve multiple aspects like the accuracy of the fit, the customers satisfaction, and reduce the waste. But there are barriers like usability, privacy, and consumer perception. The thesis is guided by three research questions, they will help to analyze and to see the outcome of how an imaginary AI-powered AR foot scanning tool would perform in the e-commerce section:

1. How do customers perceive the usefulness of the imaginary AI-powered foot scan tool in selecting the correct size, and how satisfied are they with the size recommendations it provides?
2. What specific features or characteristics of an AI-powered foot scan tool would encourage customers to use it frequently?
3. How do customers sustainability concerns influence their adoption of the AI-powered foot scan tool, and how is the tool perceived in its role of reducing return rates?

These are the hypotheses that are put forward to answer the three research questions and figure out how the new AI-powered AR foot scanning tool is being used and what effect it has on the online shopping industry.

Hypothesis 1: Customers who perceive that the imaginary AR tool worked well are more likely to agree that they are less likely to return the product.

Hypothesis 2: Younger customers demonstrate a higher likelihood of adopting AR tools compared to older customers, indicating greater openness to utilizing such technology in their shopping experiences.
Hypothesis 3: Higher perceived integration with mobile devices and greater ease of access are associated with a higher intended frequency of using AR tools.
Hypothesis 4: There is a positive relationship between sustainability concern and AR usage, with individuals who prioritize sustainability in their shopping behavior being more likely to have used AR tools.
The combination of the qualitative and quantitative research will show how consumers would rate the tool and in order to that also showcase the outcome for the retail sector. The results of the study will help in the academic and industry section by enriching the current knowledge in this area. As well as provide practical recommendations for the integration of artificial intelligence and augmented reality to catch up with the increasing consumer demands and sustainability objectives.

1.3. Managerial and Academic Relevance

This research adds to the existing literature on the integration of Artificial Intelligence (AI) and Augmented Reality (AR) in the retail sector. The findings increase understanding of consumer adoption behaviors, identifying how demographic variables, perceived ease of use, and privacy concerns affect attitudes toward new technologies.
Also, the research highlights the connection between technological advancement and sustainability, which gives a way for AI and AR to be harnessed to achieve a green economy by reducing waste and enhancing productivity. This strategy fills the research gap that exists in the technology based research and the general discussions on sustainable retailing. Finally, the study will provide a basis for future research.
The findings of the thesis give recommendations for retailers and other companies that want to use AI and AR to enhance their performance to further increase customer satisfaction. Beside that the thesis also shows the importance for accurate size recommendations in order to decrease the return rate. One the one hand this would not only decrease logistical expenses as it would also on the other hand result into more satisfied and potential more loyal customers. The implication part of the study will provide useful information’s for retailers which shows them what is important when it comes to an implementation of such a tool into their website or app.

More specific stressing the benefits of the simple usage and environmental friendliness of these technologies, may also help enhance their adoption.
Also, focusing on the environmental benefits of lower return rates as part of the marketing strategy may attract environmentally conscious consumers in line with the current trends of sustainable marketing.

1.4. Dissertation Structure

There are seven chapters in this thesis. The first chapter includes study background, problem statement, research questions, objectives, and the hypotheses that need to be tested. The second chapter of the thesis includes an analysis of the current industry and the literature review. Chapter two highlights the current market trends as well as the customer behavior but also shows how AR and AI can be used in retail.
The methodology and data collection are mentioned in chapter three. The findings of the study are presented in the fourth chapter together with their relevance to the research objectives and hypotheses. In chapter five the findings are further discussed in relation to the existing literature with a view to understanding their implications on theory and practice.
The sixth chapter discusses the implications of this study and provides insights for retailers. This chapter also addresses the study's limitations. Lastly, the final chapter presents the conclusion, which answers the research questions and offers a summary of the entire work.

2. Theoretical Framework

2.1. Industry Analysis

2.1.1. Introduction to Augmented Reality AR and Artificial Intelligence AI

Augmented Reality (AR) and Artificial Intelligence (AI) are transforming many industries, including retail (Nikhashemi et al., 2021). AR technology can add digital components to the real world this includes photos, animations or 3D objects (Martins et al., 2021). Furthermore, with AR users are able to interact with these kinds of objects in real time (Nikhashemi et al., 2021). With AR apps clients are able to explore things from different angles or make informed purchasing decision (Baytar et al., 2020).

AI is able to automate different decisions and processes. This is possible because it uses machine learning, analytics, and natural language (Yang et al., 2020). AI systems can analyze client data to discover trends out of that it is possible to make personalized recommendations and automate complicated activities. The results of this are an increasing efficiencies and better personalized client interactions (Perannagari & Chakrabarti, 2019). The systems are able help retailers by improve things such as inventory management and personalize consumer experiences. Retailers can also implement dynamic pricing strategies. In general AI systems help to transfor business operations (Cai & Lo, 2020). AR and AI are influencing retail through the combination of immersive customer experiences, data analytics, and automation in order to encourage industry innovation (Bonetti et al., 2018).

2.1.2. Market Overview of AR and AI in Retail

The traditional retailing industry is also going through a major shift due to the connection of augmented reality (AR) and artificial intelligence (AI) with the retail process. Online shopping is expanding, and these technologies are helping the businesses to engage the customers uniquely. This is the point where AR is able to fill this gap by connecting the physical and digital worlds. Customers are able to engage with virtual products and models by using this technology (Jain, Pahwa, & Dorasamy, 2024).

Some examples where AR tools are currently already used are digital try-ons, 3D visualizations, digital showrooms, AR navigation, and interactive marketing. Companies such as Wayfair, IKEA, and Sephora have embraced these ideas. The outcomes have shown that this leads to greater consumer happiness, higher online conversion rates, larger basket sizes, and fewer product returns (Jain, Pahwa, & Dorasamy, 2024; Chen et al., 2022).

The rapid technology improvement in the smartphone area is one of the reasons why AR technology is getting more and more popular. According to research from Chen et al. AR apps are able improve the shopping experience by reducing the decision-making process. Beside that the study showed that the tools were able to increase purchase confidence and encourage consumer interactions. However, there are challenges such as privacy concerns and technology limits (Chen et al., 2022).

2.1.3. Customer Behavior

People argue that the implementation of innovative technologies in retail heavily relies on social influence and brand trust. The research from Risselada et al. also revealed that social influence, such as recent and cumulative adoptions within a social network, significantly influences customer adoption behavior. Likewise, trust in brands is also very significant as customers will embrace innovations that are offered by brands, which in turn enhances engagement and loyalty (Risselada et al., 2014).

Dynamic pricing is a type of pricing that changes in accordance with the supply and demand trends as well as other market factors. Perception of pricing changes is known to be a highly sensitive topic among customers. Therefore, dynamic pricing done right can help boost sales and revenue. This shows that perceived unfairness in pricing can have a detrimental impact on customer trust making transparency in pricing strategies crucial (Fisher et al., 2017).

AI-powered personalization builds customer loyalty through providing personalized experiences based on the customer’s preferences. Which results in increasing the chances of having better interactions. The study also reveals that personalization increases customer satisfaction through meeting specific requirements that may lead to increased loyalty and commitment. This paper establishes that by enhancing the quality and relevance of the customer's interactions, AI can improve customer retention and experience (Ameen et al., 2020).

2.1.4. Future Potential and Industry Outlook

AR and AI are expected to shape the future of retail in the e-commerce sector by improving mobile rendering and platform processing capabilities. Since mobile AR devices and applications advance, they can analyze real-time retailer information more effectively. This is especially true with virtual try-on technologies and experiences, which offer a level of engagement which can be similar to what a physical store offers (Hoyer et al., 2020).

There is expectation that AI personalization will evolve further by implementing predictive analytics for real-time recommendations and messaging. These systems use real-time data to address customer behaviors consequently increasing personalization and engagement (Guha et al., 2021). This is where smartphone-based AR applications, in conjunction with explicable AI, offer enhanced recommendations and engaging experiences in the physical stores (Zimmermann et al., 2022).

In the next 10 years, augmented reality can change the customer experience. By supporting and enhancing decisions AR can enhance online and in-store purchasing by providing realistic virtual try-ons, lowering product returns, and increasing customer happiness (Heller et al., 2019). Real-time inventory tracking and demand prediction will increase the operational efficiency. The same features that simplify logistics, optimize inventory control, and cut costs will become more powerful over time (Oosthuizen et al., 2020).

The combination of both AR and AI is able improve environmental sustainability by reducing returns and limiting overproduction with accurate demand forecasts (Álvarez-Rodríguez et al., 2019).

2.2. Augmented Reality (AR) in Retail

2.2.1. Introduction and Applications of AR

For example, Villagran-Vizcarra et al. say that augmented reality (AR) technology can improve how a person sees the real world by adding layers of computer-generated information like videos, animations, two- and three-dimensional images, and interactive content that happens in real time (Villagran-Vizcarra et al., 2023). The major components of AR systems are a projector which can be a smartphone, tablet or AR glasses and an imaging system that supports real-time

overlays. Through object detection and localization techniques built into these systems, users can see and interact with virtual objects in the real world (Du et al., 2022).

AR technology used to be designed for entertainment and gaming purposes. But since the technology is further improving it also finds use now in education, healthcare, and retail. One example which is highlighted by Ajit et al. is the integration of AR into STEM (science, technology, engineering, and mathematics) education. This integration is very useful for students since they are able to interact with models and improve their knowledge in different areas such as biology, physics, and other subjects (Ajit et al., 2021).

Beside that AR technology is also used in healthcare by surgeons to educate patients. AR allows patients to view their anatomy and medical photographs to have a better understanding of their current condition (Dhar et al., 2021).

The retail industry has substantially increased its business through the use of AR, which improves customer participation by providing engaging and authentic experiences that connect the physical and virtual worlds of purchasing (McLean & Wilson, 2019). Many of the traditional retailers have adopted the use of artificial intelligence based virtual try-ons, especially for eyewear, to help the customers see how the products would appear on them prior to making a buy. This enhances the overall online buying process (Marelli et al., 2022). AR products address mobile demands, including applications that improve the purchasing experience for clothes and shoes. These applications improve customer satisfaction by providing information about the products and assisting customers in making better decisions. This is one of the reasons why AR technology is considered a solution to improve customer engagement and solve common issues in e-commerce (Dacko, 2017).

2.2.2. Impact on Customer Engagement, Satisfaction, and Sustainability

People enjoy AR more when it's simple to use and treats their privacy with care. By highlighting transparent data practices and user-friendly design, AR products become more inviting and win over more users (Ho et al., 2023). People could be concerned when it comes to the adoption of new technology which includes biometric data. This is why it is important to highlight strong data security and be completely transparent in terms of privacy requirements. This is the only way users can feel confident in terms of how their data is handled (Esmaeilzadeh, 2020). Beside that the usability of augmented reality applications is also a key factor for a well working customer engagement. The use of AR in the shopping process makes the process simple and

more appealing, hence being used often and enhancing the customer's relationship with the company. Which results in improving the overall experience (Poushneh & Vasquez-Parraga, 2017). AR solutions are able to influence the buying decision of consumers. Increasing engagement and pleasure will lead to less product returns. Which in reverse will decreases waste and further support the environmental impact of retailers (McLean & Wilson, 2019).

2.2.3. Challenges and Considerations for AR Integration

There are many advantages which can be provided by AR but on the same side there are also barriers to the adoption which includes limitations or privacy concerns from the consumers. Building realistic virtual models isn't simple, this process requires both solid 3D modeling skills and the right AI tools. This process can be quite expensive for retailers to implement since it is related with high start-up costs as well as the need to maintain and further upgrade the technology (Marelli et al., 2022). Consumers may be afraid to use AR apps because of different concerns like processing, or the overall usage of sensitive data. This underlines that strong privacy regulations and good data handling is important (Sekhavat, 2017).

2.3. Artificial Intelligence (AI) in Retail

2.3.1. Introduction and Applications of AI

AI is acknowledged as a powerful tool in the retail sector, with the goal of increasing efficiency, enhancing consumer interaction, and providing more personalized experiences for shoppers. This set is made by value-applying information machines that learning may help analytics in making decisions, natural language processing, and better, among other things, looking at big data and making suggestions that are meant to make the customer experience better (Oosthuizen et al., 2020). With AI tools retailers are able to create personalized product recommendations for customers, dynamic pricing, inventory management, and automated customer support like a chatbot. This improves important aspects from a retailer view such as the efficiency and customer satisfaction (Cao, 2021).

The most common use case is to analyze customer behaviors based on their latest shopping preferences and purchase history. Based on this AI is able to give recommendations to the customer. For instance, Amazon uses an item-to-item collaborative filtering technique where

the customers are easily recommended products that are relevant to them based on their purchase and search history. Which results in improving customer participation and conversion (Linden et al., 2003). AI-driven dynamic pricing models let retailers change prices in real time based on competitor prices, market trends, and customer demand. By following this retailer are able to make the most money while staying competitive. Field testing is used to validate if the model is efficient or not. This can be done by exact pricing elasticity estimations (Fisher et al., 2017). Besides that, AI has changed inventory management in the retail sector. An end-to-end (E2E) model integrates demand prediction and optimization. This reduces the chances of running out of stock and having too much inventory (Qi et al., 2020). AI-enabled chatbots and virtual personal assistants can improve customer service by giving prompt and accurate responses, creating individual approaches, and solving most of the common questions and concerns that customers may have. They can also perform business transactions, which in turn enhance the customers experience and convenience (Chen, Le, & Florence, 2021).

AI is able to adapt and learn depending on the data presented to it. AI can be very useful for managing different retail processes such as, inventory control and the general interaction with customers. This aligns with the concept of flexibility with its predictive and automation capabilities. So, it shows how important AI is as a key driver of innovation and a means of meeting the changing needs of customers in the retail sector (Oosthuizen et al., 2020).

2.3.2. AI-Driven Personalization

One of the most important things that AI has done for retail is personalization. This is because recommendation engines use a lot of information about a customer, like what they've looked at, bought, and their demographics, to guess what they like and give them suggestions that can make them more engaged and satisfied (Ameen et al., 2020). AI also plays a big role in retail fashion sector. Together with learning algorithm, AI is able to analyze the customer and provide personalized size suggestions, which increases the customer satisfaction and potentially lowers the return rate. Sheikh et al. introduced a model that uses interaction data and feature embeddings to deliver more accurate size and fit recommendations. This approach tackles hurdles like limited data and inconsistent sizing standards (Sheikh et al., 2019). Retailers are able to avoid standard marketing strategies and provide customers with a personalized experience, by making use of these advanced systems. Advanced personalization improves customer satisfaction and brand loyalty, which is the reason it plays a significant role in driving

repeat interactions and increasing customer lifetime value by creating stronger and tailored relationships with the brand (Pukas, 2022).

2.3.3. AI in Visual and Voice Recognition

With AI solutions for visual and voice recognition, the interaction between customer and retailer is already being revolutionized especially in the retail sector. One of the most prominent applications of visual recognition technology is virtual try-on (VTO) which allows customers to see how a given product will look on virtual models that are like their own body shape. This is increasing the level of self-congruity and the confidence in making a purchase. These systems also provide solutions to some of the challenges that are present in the online shopping process, including the difficulties in determining the product's fit or style suitability by providing the customers with a rich and tailored experience (Merle et al., 2012). Visual recognition allows customers to upload an image for products they are searching. This process further improves the efficiency of the shopping process. Voice recognition technology on the other hand allows customers to engage with the system through their voice. This process makes it easier for the customer to search, navigate, and make a purchase (Merle et al., 2012). Also, Alibaba's voice activated artificial intelligence, <Tmall Genie= helps the customer to search for products, check on the prices and make purchases using voice commands only with the help of natural language processing. Besides that, the <Tmall Genie= also works with other smart home devices, which enables the users to manage electrical appliances and gain individual services. In general this makes it even more a multi-functional device that combines e-commerce with everyday life utilities. With the "Tmall Genie" introduction to the market, Alibaba was able to increase the weekly spending by 16.6%. This shows how effective it can be in engaging customers and promoting greater use of voice recognition technology (Sun et al., 2019).

2.3.4. Challenges and Ethical Considerations

On the one hand AI has a decent number of different benefits, but on the other hand it also comes with a bunch of ethical concerns, some of them are data privacy, security, and potential biases. The reason of this is that use of AI applications includes the handling of large amounts of customer data. In order to gain the trust of the customers, effective and transparent data protection is needed. Legal reasons and the establishment of trust in AI technologies necessitate

the protection of sensitive information (Hashmi et al., 2020). Beside that it is also important to address that high implementation costs are an issue, especially for small retailers as they may not have enough funds to invest in the development of AI systems. These systems are associated with huge costs for the initial installation, upgrading, and incorporating them into the current business processes (Martin et al., 2020). Another problem would be bias in algorithms. AI systems can end up reinforcing and spreading societal biases, causing certain groups to be treated unfairly. Firms have implemented strong data governance structures and data transparency methods to ensure that AI is utilized responsibly and that customers trust the system and to prevent potential biases (Martin et al., 2017).

Consequently, the retail industry is currently undergoing a major shift and revolution, which is due to the adoption of augmented reality and artificial intelligence. These technologies are changing the buying process. Customers benefit from personalized, engaging, and good experiences. In terms of augmented reality, features such as virtual try-ons and product displays bring online shopping closer to the real world. This is increasing the customer confidence in their purchases and reducing returns. Also, AI is already there to help make everything better by optimizing inventory, forecasting trends and suggesting personalized recommendations that further enhance the shopping experience. AR and AI can be combined together to help retailers address some of the biggest issues in the industry. This includes sustainability and efficiency, as well as meet the growing demands of consumers. But there are also challenges in the adoption phase which such as privacy concerns from the customers or high implementation costs. However, these improving technologies will change the sector in the future. A good implementation of such a tool could lead into benefits for both retailers and customers.

3. Methodology and Data Collection

3.1. Research Method

The purpose of this study is to determine how an imaginary AI-based AR foot scanning tool, which is described in the survey introduction, can help minimize the return rate of footwear in the online retail industry. The point of this thesis is to find out how advanced AI and AR-based applications can make customers more satisfied by suggestion the correct size before the purchase. Beside that the thesis focuses on how to make the supply chain work better and help reach environmental goals like lowering carbon footprints and packaging by reducing the returns. Furthermore, this study identifies the barriers of adoption. Including privacy concerns or usability issues. The first part of the study was it to collect all the necessary information from secondary sources. This included published works on the use cases of AI and AR in the retail sector. This provides a conceptual framework and hence enables a critical analysis of the technologies as well as their effects. The next step is to test the hypotheses and make sure that they are applicable to the situation in question by collecting qualitative data. Six participants were interviewed in detail, and they were classified into two groups: the first group comprised AR users, while the second group comprised people who were not AR users in the past. The findings from these interviews offer a deeper understanding of the consumer perceptions, adoption challenges, and expected advantages of the tool. Beside from the qualitative data, the thesis also includes quantitative research in the form of a survey. This study investigates user views of sustainability, ease of integration, and size accuracy while statistically evaluating the hypotheses. The combination of both methodologies makes sure that the thesis offers a thorough and comprehensive analysis of the research concerns. The combined effect of these approaches offers a comprehensive perspective on the benefits and barriers of AI-driven augmented reality instruments in the retail industry.

3.2. Qualitative Method

To gain deeper insight into the user perception, adoption barriers, and the benefits of the AI-powered AR foot scanning tool structured interviews were conducted. This approach ensured that data was collected in a systematic manner while also providing a rich understanding of participants perceptions and expectations of the technology.

The interviews were conducted with six participants, three of them used AR at least once before, and the other three never made use of an AR tool to ensure the collection of data from various participants. Every one of the participants was chosen based on how often they shop online. The meetings lasted around 10 to 20 minutes. The topics which were covered in every interview included multiple aspects such as how users perceive augmented reality, usability challenges, privacy concerns, as well as how the technology could increase size accuracy while promoting sustainability goals.

Those who have used AR before found it useful for enhancing purchase confidence and reducing the return rate. Inexperienced users reactions were divided, with concern for privacy and data being major issues. However, all of them could see how the tool could help with issues such as incorrect sizing. Besides that, this group highlighted that an AR tool should be simple to use.

The interviews gave useful information about what users wanted and what problems they were having. This supported the current direction of the study, added to existing theories, and set the stage for the quantitative analysis. They also prompted the formulation of a new hypothesis: <Higher perceived integration with mobile devices and greater ease of access are associated with a higher intended frequency of using AR tools.=

3.3. Quantitative Method

In order to collect quantitative data an online survey was developed using Qualtrics. The survey was developed in its entirety to contain 43 questions that would help in understanding participants perceptions, feelings, and actions in regard to AR technology. The introduction of the survey included an explanation of how the imaginary AR foot scanning tool works. To ensure that only the target population responded to the survey, a filter question at the beginning asked participants if they had used AR tools before. Based on their answers, the participants were taken to different sets of questions to make the data collection more focused. This approach ensured more reliable survey results and tested hypotheses while considering AR technology participation. To increase the trust in the survey process and to ensure the data quality and security, security questions were integrated into the questionnaire. These questions assisted in checking the respondents engagement and thus minimized the probability of receiving incomplete or wrong data.

3.4. Sample Size

The sample size was chosen by looking at goals of the study. One of the main goals is to figure out how the imaginary AR tool could reduce the return rates. Beside that it's also important to understand consumers attitudes and to identify what might discourage customers from using an AI-driven AR foot scanning tool. This approach ensures the data truly reflects the factors that affect whether people will adopt this technology. A formula for calculating sample size was used to ensure that the sample was adequate for meaningful statistical analysis and representative of the target population.

$$Sample\ Size = \frac{z^2 \times p(1\ 2\ p)}{e^2}$$

The critical value, denoted by z in this calculation, for the chosen confidence level is z = 1.96 at 95%. To account for maximum unpredictability, the anticipated population percentage, p, is conservatively set at 0.5, with a margin of error of 10%. The predicted variability was expected to be p = 0.5. The following values can be entered into the formula:

$$Sample\ Size = \frac{1.96^2 \times 0.5(1\ 2\ 0.5)}{0.1^2} = 96.04$$

According to the calculation, the minimum number of respondents required for the survey is 96 in order to ensure a safe margin of error and statistical validity.

4. Results and Analysis

4.1. Qualitative Data

4.1.1. Participant Profile

The qualitative data were obtained by structured interviews with six participants, who were divided into two categories: The first group consisted of participants who had previously used Augmented Reality (AR) technology in some way, while the second group comprised participants who had not used AR in any way. The participants differed in age and gender. The answers made by the participants give a clear understanding of the perception of the users, the reasons as to why they use the application, the challenges that they face in adopting the application.

4.1.2. Experienced Users

Participants who previously used AR-based tools were asked to reflect on their previous experiences with them and discuss how they helped them in their professional or personal lives. All the participants expressed their satisfaction with the AR-based shopping experiences, better size precision, and lower return rates. Every one of these experienced participants stated that AR features help them see what the products look like before buying them, improving the decision-making and user experience.

One experienced respondent reported a lower return rate after using AR size recommendations, claiming that the tool helped differentiate styles and assure a better fit before purchasing. Another particpant gave an example of how an AR tool help to choose a new pair of glasses. The tool was able to provide a fast-sizing recommendation for different fits and styles. It turned out that this resulted in a perfect fit. This experience is a good example of how to increase trust in AR recommendations beside that it also shows that it is important to have a fast-loading AR tool to make the choosing process as easy as possible. Aside from that, one participant indicated that he used AR to buy furniture.

Experienced users also identified sustainability as a motivating element. They noticed that fewer returns equal less waste, which aligns with personal values and aims for an

environmentally conscious buying experience. The group with the experienced participants were satisfied by the current state of the technology. But they mentioned important areas for improvement, such as usability and response times. One participant suggested that the entire process could be less complex to unexperienced users if a guide would be provided on the website or app which explains how to use the tool in the correct way. These outcomes show the need of design features to improve the accessibility and increase overall the customer satisfaction.

4.1.3. Unexperienced Users

The unexperienced group on the other hand mentioned that they don't like to try such a tool because they have privacy and data security concerns. Some of the participants mentioned that it is highly important from them to have a clear information about the data security. One participant explained that scanning body parts without having the knowledge of what will happen with the footage would be a deal breaker. Beside that one interviewee, highlighted that the overall trust in this technology will stay low if people do not understand how data is maintained or secured.

However, the inexperienced group recognized the potential benefits of AR if the product consistently delivered as promised. They were interested to the idea of fewer product returns, less irritation and more time saved by not having to return purchases on a regular basis. They also expressed a preference for seamless interaction with current shopping platforms. They mentioned rapid loading times, minimal setup, and simple functionality as important elements that could promote first-time users.

Trust was highlighted as an important aspect in facilitating tool adoption. Participants indicated that they would be more inclined to try the product if well-known and trustworthy companies promoted it. Also, social evidence, such as reviews and demos, was identified as a significant component in making them contemplate using the technology. In particular, the group emphasized that simplicity, transparency, and credibility were essential for them to move from hesitancy to willingness to adopt the new concept.

4.1.4. Implications of Findings

From the interviews it is concluded that AR tools are considered useful tools that make the shopping experience more effective and efficient, help to solve the problem of fit, and promote sustainable consumption.

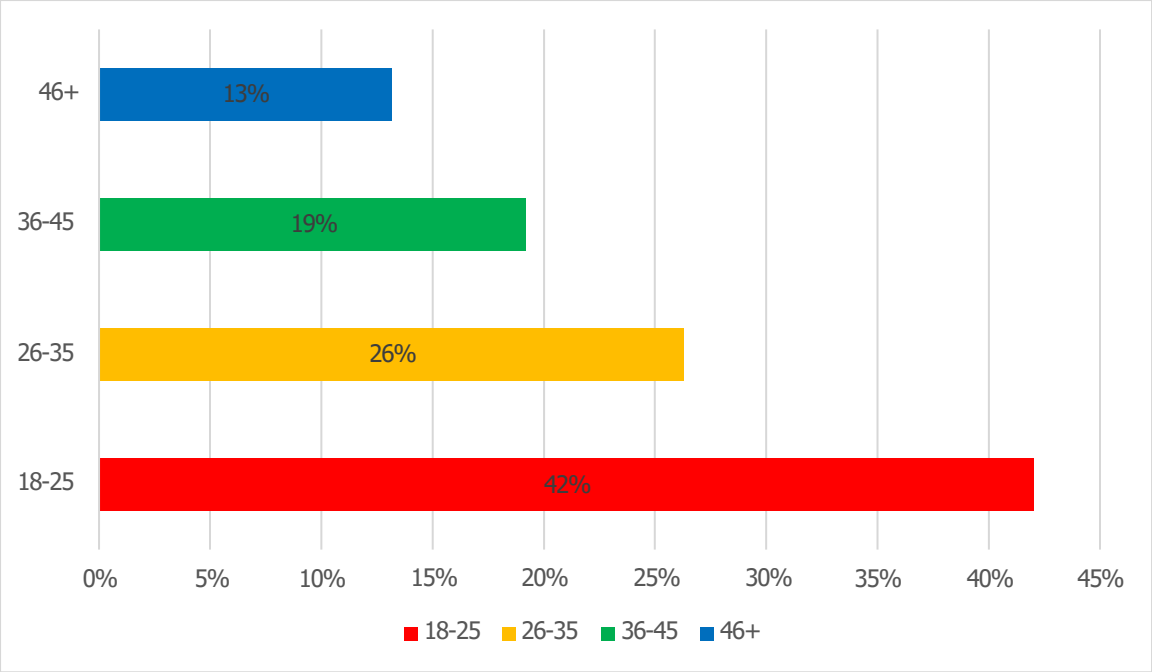
Based on the findings from the interviews it could be suggested that some of the unexperienced users would be open to try AR tools in the future if the retailers start to explain the potential advantages of the tool and make the data policies clear. Beside that it is important that retailers create trust, one example of how this could be archived is social proof. Retailers can focus on positive online reviews or social media marketing to make the tool more appealing to unexperienced users. Furthermore, the findings show that AR technologies have the potential to positively impact the online retailing process. But it is important that the retailers set a focus on adoption, building trust, and making the tool easy to use.

4.2. Quantitative Data

4.2.1. Participant Profile

This section of the study presents the quantitative results, based on 110 participants. Out of the total responses, 99 were considered valid. Some responses were considered invalid due to factors such as incomplete submission or failure of the security checks. The following figures are the detailed breakdown of the participants profiles and behaviors. These findings are very useful for the purpose of understanding consumer perceptions and behaviors, especially as they relate to the use of AR tools in online retailing.

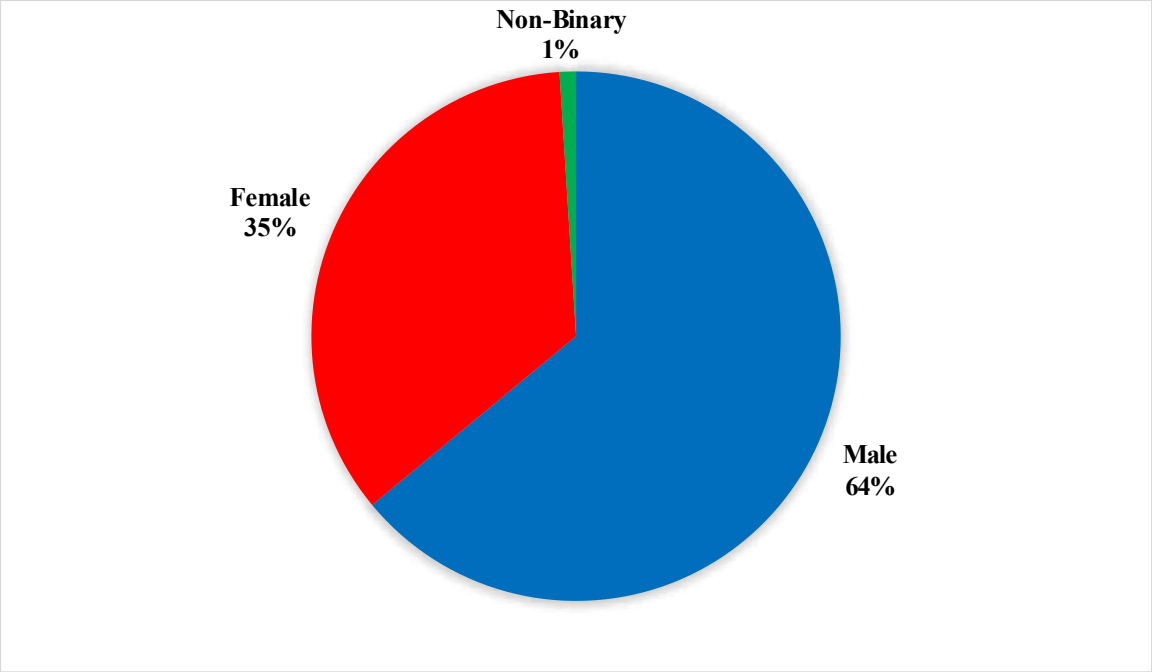
Figure 1: Overview Age Distribution



Source: Survey Data

The survey results show that the participants are evenly distributed by age, as shown in Figure 1. The largest group consists of 18- to 25-year-old respondents, who are 42% of the total sample. This group captures most of the young consumers. The 26-35 age bracket is the other major group and accounts for 26% of the total respondents. Taken together, these two younger groups comprise 68% of the participants. While 19% of the respondents fall within the 36-45 age bracket, the 46+ age bracket has the lowest representation at 13%. One reason for this could be that the survey was published on social media, and there is the possibility that older participants don't use social media as often as younger participants. This limitation will be further discussed at the end of the thesis.

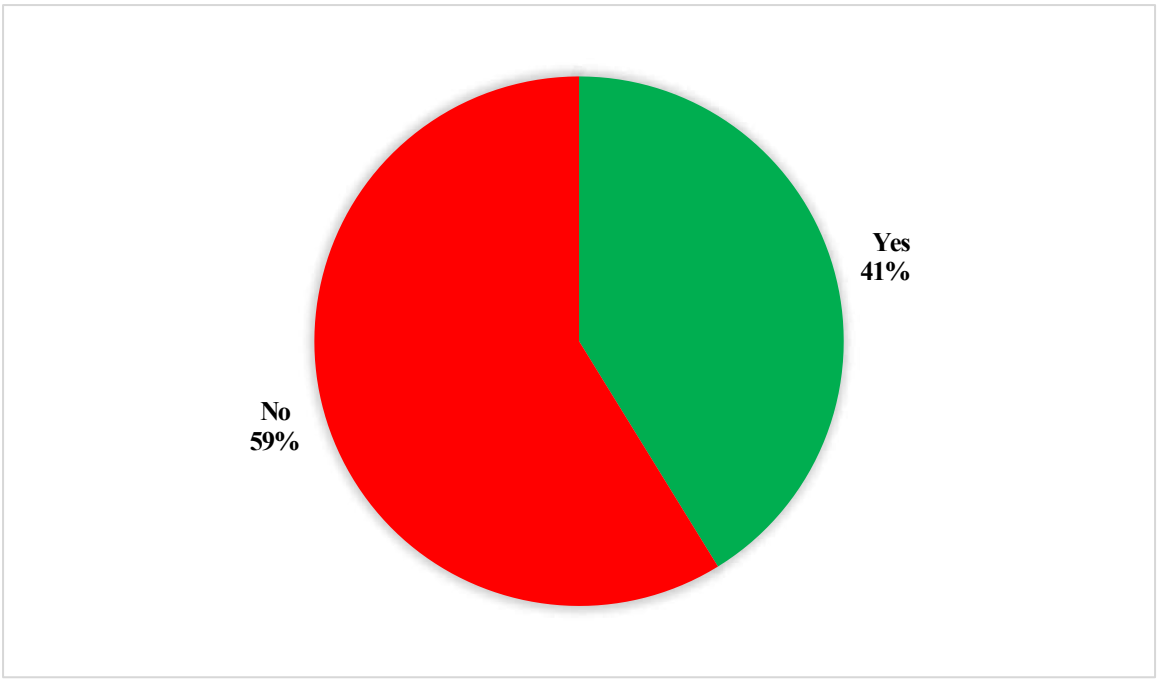
Figure 2: Overview Gender Distribution



Source: Survey Data

Figure 2 shows the gender distribution of the participants. The results demonstrate that there is a fair gender mix among the respondents, which is necessary to prevent the study from being impacted by gender-specific preferences or habits. This balance makes it possible to give a more precise view of how different genders receive and use AR technology in the context of online shopping. This implies that the data collected in this study is a fairly accurate reflection of the general online shopper's population, and this is especially useful when considering new technologies.

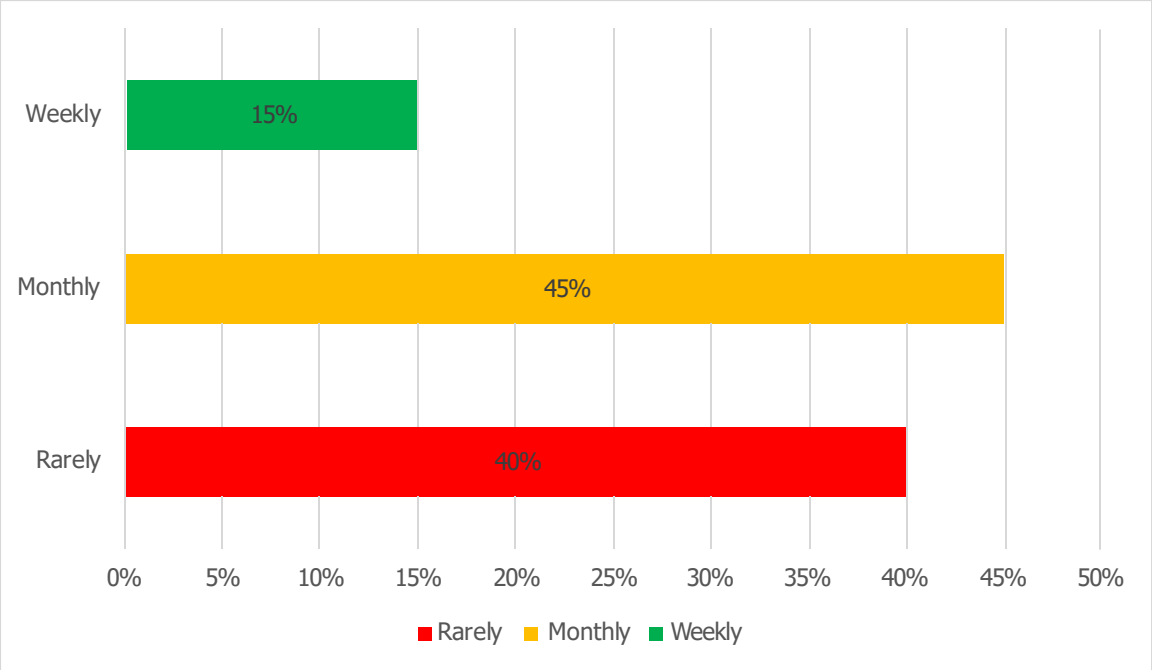
Figure 3: Overview Prior AR Technology Engagement



Source: Survey Data

Figure 3 shows the participants' prior experience with AR technology, which provides useful insights into the possible adoption and impact of the proposed AI-powered AR foot scanning tool. According to the research, 41% of respondents have AR expertise, which has significant consequences for the tool's installation and success. The large number of AR-experienced participants shows not only that there are already many consumers which are interested in the technology and would like to try it for online shopping. It also shows that retailers should adopt to this current market trend to address this consumer base. The consumers which already used AR before would be more likely to be open to try out the technology for different buying process this is something where retailers can highly benefit from. On the other hand, the data also shows that more than half of the participants (59%) haven't used AR before. This also shows that there is still a lot of potential to address these kinds of customers in terms of catching this group retailers should focus on the user friendliness to address the people which are likely feeling less save when it comes to using new technology.

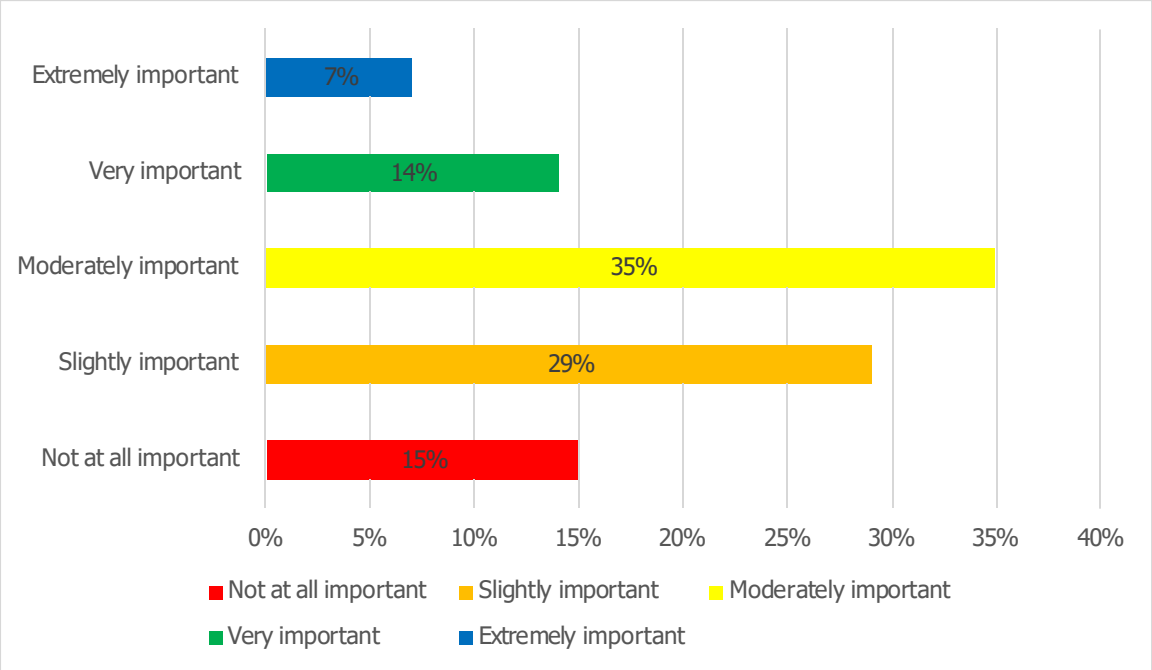
Figure 4: Frequency of Online Shopping Behavior



Source: Survey Data

Based to the statistics shown in Figure 4, respondents are divided into three categories based on their frequency of online shopping: "rarely," "monthly," and "weekly." According to the findings, the majority of respondents (45%) purchase online at least once a month. This group may be motivated by the AR tool's convenience and precision, making it a good target. However, 40% of the respondents said that they shop online infrequently. This segment can be viewed as a potential challenge to AR adoption since less frequent shoppers may have a limited understanding of the concept of technologies or may not be interested in the utilization of tools that enhance the accuracy of sizing. Certain actions should be done to encourage this demographic to embrace the AR tool, such as emphasizing the tool's simplicity, easy installation, and creating trust (for example, by offering explicit privacy regulations). On the other hand, 15% of respondents said they purchase online frequently or weekly. This group of consumers may be considered the most engaged and proactive in the use of digital technologies, including online shopping and innovations.

Figure 5: Overview Significance of Sustainability in Online Shopping



Source: Survey Data

Figure 5 illustrates the respondents perceptions regarding the importance of sustainability in their online shopping behavior. The data highlights a clear distribution of opinions, with the largest segment of respondents (35%) identifying sustainability as <Moderately important=. This shows that while sustainability is acknowledged as a factor, it is not yet a top priority for a huge number of consumers. 29% of respondents regarded sustainability as only <Slightly important=, and 15% stated it is <Not at all important=. Together, these segments account for 44% of the sample, underscoring that a large number of consumers do not prioritize sustainability in their online purchasing decisions. On the other hand, 14% of the respondents rated sustainability as <Very important" and 7% as "Extremely important". Consumers in these categories are likely to appreciate how the technology reduces return rates, packaging waste, and carbon emissions. For this audience, emphasizing the environmental impact and aligning the tool's features with sustainability goals can be a strong driver of adoption.

4.2.2. Hypothese Testing

Hypothesis 1: Customers who perceive that the imaginary AR tool worked well are more likely to agree that they are less likely to return the product. According to the Pearson correlation coefficient ($r = 0.44, p < 0.01$), there is a moderately positive relationship between how accurate

customers thought the AR tool was and how likely they were to keep their purchase instead of returning it. This means that, on average, the more accurate customers find the tool, the less likely they are to return the product. Although the association is moderate and not particularly strong, it implies that perceived correctness has a significant impact on customers' post-purchase decision-making processes. The p-value (< 0.01) indicates that this link is unlikely due to random chance in this sample. Basically, the analysis outcomes confirm the hypothesis that improving the perceived accuracy of an AR sizing tool can have a positive impact on customer confidence in their purchase, potentially lowering return rates.

Table 1: Pearson Correlation Result

Variables	1	2
1. Perceived Tool Accuracy	-	r = 0.44**
2. Less Likely to Return	r = 0.44**	-

Note: ** p < 0.01

To further support these findings, the interviewed experienced users indicated that improved size accuracy and better-fitting purchases led directly to fewer returns. One participant noted that the AR tool's clear visuals and accurate suggestions helped to compare products before buying. This increased the confidence in the buying decision. In summary both the quantitative and qualitative evidence support the idea that the risk of returning products is lower when people think the imaginary AR tool is accurate and useful, which means that Hypothesis 1 can be confirmed.

Hypothesis 2: Younger customers demonstrate a higher likelihood of adopting AR tools compared to older customers, indicating greater openness to utilizing such technology in their shopping experiences. The result of the one-way ANOVA test shows a statistically significant association between age and receptivity to AR use. In particular, the analysis shows that the average openness scores are very different across the four groups. The youngest participants, 18325 years old, report the highest mean openness, followed by those 26335 years old. The scores for the older two groups, 36345 years old and 46+ years old, get lower as they get older. This variation is not random. With an F-statistic of 19.30 and a p-value less than 0.001, there is

less than a 0.1% probability of seeing such a strong pattern if the groups were identical. In other words, these findings mean, that younger consumers which are in the age group of 18-35 years are more open minded to AR tools and would rate them as useful. This could suggest that consumers who are more interested in digital technology support innovative shopping approaches or just enjoy the tools that assist them in finding the best product. On the other hand, it seems like that the older consumers are less interested in AR technology on average. The test doesn't show specific reasons for this behavior. However, it could be assumed that things such as low technology affinity, different shopping behaviors or a lack of trust are the motives for this. In general, the test shows that age is a key factor in determining AR adoption prospects. The findings demonstrate that younger consumers are more ready to embrace these new technologies, while older consumers may need extra time or guidance about how AR can improve their online shopping experience.

Table 2: Descriptive Statistics

Age Group	N	Mean Openness	SD
18-25	41	5.75	0.80
26-35	26	5.35	0.95
36-45	19	4.40	1.05
46+	13	3.85	1.00
Total	99	j 5.14	1.07*

*Note: Approximate overall mean calculated by weighting group means by their sample sizes.

Table 3: One-Way ANOVA Results

Source	SS	df	MS	F	p-value
Between Groups	62.50	3	20.83	19.30	<0.001
Within Groups	102.50	95	1.08		
Total	165.00	98			

The interview data confirmed that things that make people want to use AR, like trust, privacy, ease of use, and comfort with technology tend to be more common among younger users who

are more used to using digital tools. One participant who had used AR before would be in the older age group, so there were no clear age-specific patterns. However, the focus on these digitally oriented traits suggests that younger people may be more likely to use AR technology. As a result, the available qualitative data somewhat support the hypothesis, and the available quantitative data support the hypothesis that younger customers are more likely to be interested in using AR tools. This means that Hypothesis 2 can be accepted.

Hypothesis 3: Higher perceived integration with mobile devices and greater ease of access are associated with a higher intended frequency of using AR tools. A multiple linear regression model that uses Interactive Elements and Ease of Access as predictors accounts for much of the variation in how often people expect to use the imaginary AR foot scanning tool. The ANOVA table indicates that the regression model is statistically significant ($F(2,96) = 22.60$, $p < 0.001$), meaning there is a very low probability that these results occurred by chance. In other words, the combination of these two factors reliably predicts customers intended usage frequency. The coefficient for interactive elements ($B = 0.45$, $p < 0.001$, $\beta = 0.34$) is positive and significant. This suggests that as customers perceive the tool as more engaging through features that capture their interest or provide useful interaction, their intention to use it frequently increases. The standardized beta ($\beta = 0.34$) indicates that Interactive Elements is a relatively strong predictor, having a sizable impact on expected usage frequency. The coefficient for ease of access ($B = 0.31$, $p = 0.002$, $\beta = 0.27$) also emerges as an important and statistically significant predictor. The outcomes show that customers are more likely to use the tool on a frequent basis, when it's easy for them to access the tool and when the retailer offers an user friendly integration with the phone app or the website. Though it has a slightly smaller impact than Interactive Elements, Ease of Access still significantly helps explain how likely people are to use the tool. This finding highlights the practical importance of ensuring that the foot scan tool is not only accessible but also engaging to consumers. The non-significant constant ($p = 0.178$) means that when both predictors are at their lowest levels, the baseline intention to use the tool is not significantly different from zero. In summary, this regression analysis strongly supports the hypothesis. It demonstrates that enhancing the tool's interactive features and ensuring it is simple to reach within the customer's shopping journey are key steps in increasing how frequently customers plan to use the AI-powered foot scan tool. Retailers should be focusing on these areas, this is how they can increase the engagement and potentially enhance general success of such a tool.

Table 4: ANOVA

Model	SS	Df	MS	F	p-value
Regression	39.17	2	19.59	22.60	<0.001
Residual	100.73	96	1.05		
Total	139.90	98			

Table 5: Coefficients

Predictor	B	Std. Error	Beta	t	p-value
(Constant)	0.75	0.55	-	1.36	0.178
Interactive Elements	0.45	0.11	0.34	4.09	<0.001
Ease of Access	0.31	0.10	0.27	3.10	0.002

To further support the findings, the inexperienced users from the interviews expressed that ease of use, minimal setup, and quick loading times would motivate them to try and potentially use the AR tool. One participant specifically mentioned not wanting to download a separate application, which highlights that seamless integration into the existing shopping platform is important. Both experienced and inexperienced users highlighted the importance of accessibility and convenience. Since the survey and interview data supports the hypothesis that ease of use increase the usage frequency, hypothesis 3 can be accepted.

Hypothesis 4: There is a positive relationship between sustainability concern and AR usage, with individuals who prioritize sustainability in their shopping behavior being more likely to have used AR tools. The t-test was conducted to compare sustainability concerns between two groups of participants. In order to accept or reject the Hypothesis the participants were divided into two groups. The first group included the ones which had previously used AR tools (N = 41) and the second group for the participants which haven't used AR before (N = 58). The main question was check if whether individuals who care more about sustainability would be more likely to have tried AR technology. In other words, the hypothesis suggested that higher sustainability concern would be associated with AR usage experience. The results do not support this. The t-value ($t(97) = 0.36$) is very close to zero, and the corresponding p-value ($p = 0.720$) is far above the conventional threshold for statistical significance (usually $p < 0.05$).

This means that any observed difference in sustainability concern between AR users and non-users could easily have arisen. It is also important to mention that the 95% confidence interval for the mean difference ([-0.24, 0.34]) includes zero, reinforcing that there is no reliable evidence of a difference. Even if the two extremes of the interval were considered, the difference in sustainability concern would remain small. In essence, both the statistical analysis and the confidence interval are coming to the same results. Having used AR tools or not does not appear to relate to how concerned participants are about sustainability. Individuals who have tried AR and those who haven't show remarkably similar levels of concern about eco-friendly practices, resource conservation, and other sustainability issues. As a result, the data fail to support the hypothesis, leading to its rejection.

Table 6: Descriptive Statistics

Group	N	Mean Sustainability Concern	SD
AR Users (Yes)	41	5.10	1.00
AR Non-Users (No)	58	5.05	1.05

Table 7: Independent-Samples t-Test Results

	t	df	p-value (2-tailed)	Mean Difference	95% CI (Diff)
Sustainability Concern	0.36	97	0.720	0.05	[-0.24, 0.34]

The results from the interview data are similar. While some experienced users appreciated that the AR tool's accuracy resulted in fewer returns, thus potentially reducing waste, the interview data do not confirm that sustainability was a driving factor influencing their initial adoption of the AR tool. No clear comparison was drawn between users and non-users regarding their sustainability concerns, and the emphasis remained on convenience and improved shopping experiences rather than explicit environmental motives. Since there is no statistical evidence linking concerns about sustainability with AR use, the hypothesis should also be rejected.

5. Discussion

The results of this study highlight how an imaginary AI-enabled AR foot scanning tool has the capacity to potentially solve some of the major issues of the online retailers, which are returns. The finding of this study shows how an AR tool could decrease return rates through enhancing the precision of size suggestions. Customers who perceived the tool as accurate were more likely to report satisfaction with their purchases, which reduced their likelihood of initiating returns. The connection was especially noticeable among experienced users, who emphasized the increased confidence and efficiency the tool may bring when making purchase decisions. These data support the premise that more accurate size suggestions can result in fewer product returns, contributing to both operational efficiency and sustainability goals.

The findings showed that participants which are in the younger age group compared to the participants in the older age group, are more likely adopt to AR tools. This underlines that the participants which are between 18-35 years old are more likely early adopters to new technologies. The results showcase one possible reason for this behavior that the older generation is more likely concerned in terms of the usability and trust.

Beside that the study also underlines that it is very important to create a tool which is easy to use from the customer perspective and is well integrated into the current retailers website or app. Every one of the participants highlighted the need to increase the customer engagement with the tool. This can be achieved by focusing on fast loading times, a simple setup, and an simple interface. The quantitative analysis also underlined this need. The results of the ANOVA test showed a positive correlation between the ease of access and the usage frequency. These underlines why it is really important for retailers to create a well working and good designed tool because otherwise customers will less likely adopt to it.

Although sustainability concerns weren’t strongly confirmed to AR tool usage. The qualitative feedback showed that people who care about the environment still valued the tool’s ability to cut down on waste from returns. Experienced users noticed the technology's fulfillment of sustainability objectives, describing the less impact on the environment as an important benefit. However, since statistical proof of these hypotheses was not possible, this field stays open for further research.

In general the outcome of this thesis showed that, on the one hand, the tool has the potential to improve customer satisfaction and operational efficiency by lowering return rates. On the other hand, they underscore the importance of addressing barriers to adoption, such as usability challenges, to unlock the tool’s full potential. Retailers must adopt a holistic approach that

combines robust data protection measures with user-centric design to foster trust and engagement.

6. Implications and Limitations

6.1. Implications

The research findings will have a substantial influence on academic research as well as industrial practice in the online retail sector. The study shows how an imaginary AI-powered real-time foot scanning tool might lower return rates, which is a good example of the strategic and operational benefits of bringing new technologies into e-commerce. The outcome of the thesis showed how the customer happiness can be improved by decent size recommendations. Beside that the research indicates that an imaginary AR tool is able to decrease logistical inefficiencies and could have a positive sustainability impact by reducing waste and carbon emissions.

The outcome of the thesis showed that the implementation of such a tool on a retailer's app or website should result into less returns and an increasing customer satisfaction. But in order to achieve this it is very important that such an AR tool is easy to use, have a simple design and is well integrated into the current platform. If a retailer is able to manage these challenges, they can also benefit from an increasing brand trust, repeating purchases and potentially word of mouth marketing from the customers. Beside that customers which are really obsessed with the tool might be even willing to pay a premium for the products. Also, focused marketing approaches that are directed to the young consumers who are the early adopters of technology can also be used to increase adoption rates, while structured onboarding processes and educational campaigns may be useful for the less tech-savvy users.

The study makes it clear that addressing privacy issues is key to earning customer trust. In that case retailers should clearly describe their data management methods as well as implementing safe solutions. This is highly required to prevent concerns and promote participation. Retailers could benefit from an increasing brand trust if they start to promote how the tool reduces the return rate by recommending the correct size and on the other hand improves the environment. This message would specifically address customers which highly care about environmentally friendly approaches.

Aside from the industrial impact this study provides insights to the ongoing research on integrating AI and AR in the retail world. It shows how consumer interact with technological which can help inform future research.

6.2. Limitations and Future Research

The results showcased that an AR tool would be able to minimize the return rates for retailers by recommending the correct size and on the same way also increase customer satisfaction. Nevertheless, it's important to mention the limitations of this research in order to understand the scope and highlight areas for potential future research. The first point which needs to be discussed is the kind of small sample size of the quantitative analyses. Although 99 people took the survey, meeting the minimum requirement of 96, the sample may still be too close to that to truly capture the full range of online shoppers. Besides that, the survey was published on social media which means that many respondents are younger. This should be a reason why there are less participants in the older age group.

One more limitation is that most of the participants from the survey are based in Germany which means that customers from other geographic regions with potentially different shopping behaviors are not addressed in the findings. But not only the shopping behaviors might be different in other regions also the general retail trends and cultural influences could be different. In that terms it needs to be mentioned that reaching out to more regions would make the results more reliable. Since the findings are mainly focusing on only one region, they may not be valid in other areas with different buyer behaviors and market characteristics.

It was not possible to approve hypotheses 4 with the quantitative data. One reason for this could be the limitation to the German market. However, future studies could further explore the connection of sustainability and the use of AR tools to explore if there is a link between these two aspects.

7. Conclusion

The goal of this thesis is to look into the possibility of how an imaginary AI-enhanced augmented reality foot scanning tool could change the way how people buy shoes online. The goal of this tool is to decrees the return rate, make customers happier, and be in line with sustainability goals. This thesis set out to understand how people see this technology, pinpoint the main reasons they're likely to embrace it, and explore their views on its usability and environmental impact.

Three research questions guided the study. The first question explored how customers perceive the usefulness of the imaginary tool in selecting the correct size and their satisfaction with its recommendations. The outcomes recommended that customers who considered the tool accurate were more satisfied with their purchases and less likely to initiate returns, indicating the tool's potential to decrease logistical inefficiencies and improve the overall shopping experience.

The second question indicates the features and characteristics which would lead to a frequent use of the tool. The results showed that points like a simple design, easy access, and good integration with existing systems could improve the rate of use for such a tool. Beside that the survey data showed a positive connection between usability elements and how often people expected to use the tool. This underscores how important it is to make it as easy as possible for the customer when it comes to interactions with a tool.

The last question explored how consumers concern about sustainability affect their use of the product and how they believe it lowers return rates. The data from the interviews showed that consumers which care about the sustainable impact appreciated the tool's possibility to potential reduce waste. However, the quantitative data showed no statistically significant link between AR use and environmental worries, hinting that more research is needed.

The results of the thesis support three of the four hypotheses.

Hypothesis 1: Customers who perceive that the imaginary AR tool worked well are more likely to agree that they are less likely to return the product.

Hypothesis 2: Younger customers demonstrate a higher likelihood of adopting AR tools compared to older customers, indicating greater openness to utilizing such technology in their shopping experiences.

Hypothesis 3: Higher perceived integration with mobile devices and greater ease of access are associated with a higher intended frequency of using AR tools.

Hypothesis 4: There is a positive relationship between sustainability concern and AR usage, with individuals who prioritize sustainability in their shopping behavior being more likely to have used AR tools.

The findings statistically confirmed Hypotheses 1, 2, and 3. However, there was no statistical confirmation for Hypothesis 4.

In summary this study demonstrated how an imaginary AI-powered AR tool would be able could increase online sales for retailers. Beside that the thesis showed that such a tool would be able to lower the return rates by recommending the correct size to customers, optimize operations and increase the overall customer satisfaction. One more important finding is that the retailers are only able to achieve this if they improve adoption and effectiveness by addressing privacy and usability issues. The findings of the thesis are beneficial for the academia and industry. Nevertheless, the limitations of the study showed that further research is required on different regions and larger demographics.

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Appendix

Appendix 1 – Interview guidelines

Participants:

R.S. - 61-year-old Male, Accountant
A.S. - 22-year-old Male, University Student
P.P. - 27-year-old Female, Graphic Designer
J.H. - 34-year-old Female, Teacher
L.T. - 30-year-old Male, Business Consultant
S.S. - 50-year-old Female, Small Business Owner

Q1: Are you familiar with augmented reality (AR)? (Same question for both groups)
R.S.: Yes I know what it is. I've used AR a lot mainly on apps like IKEA to visualize furniture in my house. It's amazing to see how a couch fits in a room without even measuring.
A.S.: Yeah, definitely. I've used AR in a few different ways mostly for gaming, like Pokémon GO, but also for shopping apps. It's cool how you can visualize something that isn't physically there.
P.P: Yes, very much so. As a graphic designer, I'm always on the lookout for technologies that can improve creativity, and AR is one of those. It's nice to see how digital elements can be layered onto the real world. I've used it for work projects, like visualizing how a logo or branding might appear on a storefront. Outside of work, I've used AR in online shopping apps.
J.H.: I've heard of it but haven't used it myself. I think of those Instagram filters when I hear <AR.=
L.T.: I heard about it, but I dont know the concept of how it actually works.
S.S: I've heard of it, mostly from my kids. They've shown me those fun filters on their phones. I also remember seeing some ads about this but I actually never tired to use it.

Q2: What was your first experience with AR? (question for participants which used AR before)
R.S.: I first tried it out like 2 years ago. I was interested in buying a watch on the secondhand market, there is a company which offers a marketplace where you can buy and sell watches like eBay, but they are first shipped to the company and get verified. They have a app where you can try on watches by using AR, the Company is called Chrono24.
A.S.: My first real interaction with AR was Pokémon GO. The game offers the possibility to see Pokémon on the real world through your phone screen.
P.P.: My first encounter with AR was through a Snapchat filter years ago, but my first practical use was when I bought a pair of glasses online. I remember being skeptical I wasn't sure if the app could really show me how the frames would look on my face. The AR feature let me adjust angles and lighting, and it felt like I was physically trying on the glasses. When the frames arrived, they looked and fit exactly as I expected.

Q2: Why haven't you tried AR yet? (question for participants which haven't used AR before)
J.H.: Honestly, I'm not sure I need it. I never had something like a popup window which recommends me to use a tool like that. I'm also not really interested when it comes to new technology that might be also a point why I haven't used it before beside that I don't fell commutable using it cause im not aware of the data protection
L.T.: I think it's mainly because I haven't seen a need for it. I prefer to actual and trying things in person. It feels more reliable to me. I would like to use it if such a tool would be introduced by known company.
S.S.: The main reason behind it is that I highly care about data protection and I simply don't trust a tool like that. I think it's partly because I'm not very tech-savvy. Also it feels like something for younger people. Plus, I haven't really seen a direct need for it in my day-to-day life or business.

Q3: How often do you use AR now? (question for participants which used AR before)
R.S.: Regularly like maybe once a month. Mostly for shopping or when I'm experimenting with design ideas for my home. I would like to use it more often but I most likely only us it for furniture.
A.S.: Not every day, but a few times a month for sure. I use it mostly for online shopping when its available, beside that I sometimes use it for social media filters like Snapchat or Instagram when I send my friends videos.

P.P.: Quite often, maybe two to three times a month. Most of the time, it's related to my job, but I also use it for shopping, like visualizing how furniture would look in my apartment or trying on makeup shades virtually.

Q3: What would encourage you to use AR? (question for participants which haven't used AR before)

J.H.: If it could save me time. For example, if I could try on clothes without going to a store, that might convince me.

L.T.: If it could save me time and effort. For example, if I could visualize how a suit looks on me without visiting multiple stores. It's always hard to order a suit online in general compared to a T-Shirt but if this would prevent a possible return it would be great.

S.S.: If it could simplify my life or improve my business.

Q4: What's the most practical use of AR you've experienced? (question for participants which used AR before)

R.S.: When I bought a pair of glasses online. The AR feature allowed me to virtually try on frames. It made me confident in my choice, and the glasses turned out to be a perfect.

A.S.: Hard to tell I would say when its available during online shopping its practical but beside that I most likely only use AR for entertainment things.

P.P.: As I already said its really useful for my Job.

Q4: Do you think AR could improve your daily life? (question for participants which haven't used AR before)

J.H.: Maybe. As a teacher, I can imagine AR being useful in the classroom, like showing 3D models.

L.T.: I can see the benefits of such a tool but it depends on the implication one really important factor to me would be the ease of use I don't want to spend much time in using such a tool S.S.: Yeah if I could use it for my Business it would be great not just for me also for my customers.

Q5: How does AR influence your trust in a brand? (question for participants which used AR before)

R.S.: I trust brands more when they offer AR because it shows they're investing in technology to improve the customer experience

A.S.: Not really it doesn't improve my brand trust but it also doesn't make it worse

P.P.: Yes it shows me that the company is open for new innovations which is something that I like.

Q5: Do you have concerns about AR? (question for participants which haven't used AR before)

J.H.: Yes, privacy is a big one. I'd worry about how much data apps collect while I'm using them.

L.T.: I don't feel well think about to scan my feet's or other body parts with my phone camera for sizing recommendations. I don't know if this footage is stored somewhere.

S.S.: Yeah for me Privacy and Data protection is really important and if it would not be explained how my data is handled I would not use AR

Q6: Do you think AR impacts sustainability? (Same question for both groups)

R.S.: I don't know how it is for other people but for me I would say yes. The experience which I had while using AR lead to a better purchase decision and I didn't had to return a product A.S.: Yes when I use it for shopping I didn't had to return the products after that

P.P.: Hard to tell I mean I didn't have to return my Make up products when I used it. In general, I would say I think AR won't solve big sustainability issues, but every small step helps

J.H.: I can for sure see the positive impact of such a tool for the online purchases so yeah I think it could be a good step.

L.T.: It really depends on how good the tool works. If its accurate I think that there will be an impact and also in general that more people will use it, if it doesn't work well I think it can be even worse.

S.S.: I'm not sure since I never tried it but I can see the impact.

Q7: What would make AR more appealing to you? (Same question for both groups)

R.S.: Even better accuracy and more seamless integration with other tools. For example, I'd love it if AR apps could automatically save my measurements for future purchases. Beside that I think that a guide or tutorial on how to use the tool would be great.

A.S.: I visited a website once which had an AR option for online shopping, but it was kind of hidden on the product page I think companies need to do more marketing for such tools.

P.P.: I personally don't need these improvements but I think this will help inexperienced users to make use of such a Tools. In that terms the industry should improve in optimizing usability and response times.

J.H.: The biggest factor for me is the ease of use I don’t want to use a highly complex tool which requires some sort of know how. Beside that such a tool should be intergraded in the already existing app when it comes to shopping for example. I don’t want to download a new app set up an account just to use the tool.
L.T.: I that many people want to do quick purchases they don’t want to spend hours during the online shopping process so the AR tools need to have fast loading times cause otherwise people wont use it myself included
S.S.: For me it’s the point that it should be easier to use I don’t feel very tech save. Also beside that I would be more open to use such a tool if I would see a lot of positive reviews or a demo on how to use it.

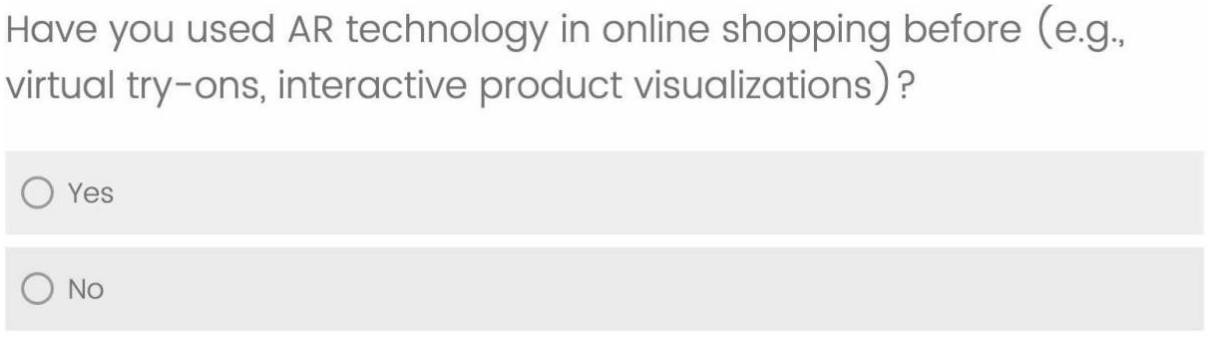
Q8: Where do you see AR going in the future? (Same question for both groups)
R.S.: I think it’ll be everywhere. In retail, it might evolve to show you personalized product recommendations in real-time as you shop. Maybe even in education, where students can visualize concepts in 3D.
A.S.: I think it will become very popular. For example, Apple recently launched the Apple Vision Pro which is a Mixture of AR and VR there are also already other products which can do similar things. In physical stores, I imagine walking into a store, pointing your phone at a product, and instantly seeing reviews, prices, or even how it’d look in your home.
P.P.: I think the AR market will become bigger and bigger over the next years and technology will further improve.
J.H.: I think it will become more common, especially in retail and education. But for it to truly take off, it needs to be more affordable and easy to use. Right now, it feels like something only big companies can do.
L.T.: I’d love to see AR integrated across platforms so it feels less fragmented. Right now, you need a specific app for each use case
S.S.: It needs to become simpler and more intuitive. The technology has to prove its value to people like me who aren’t early adopters. Also as long as its not clear where the data is storred a lot of people wont trust these kind of tools.

Appendix 2 – Online Survey

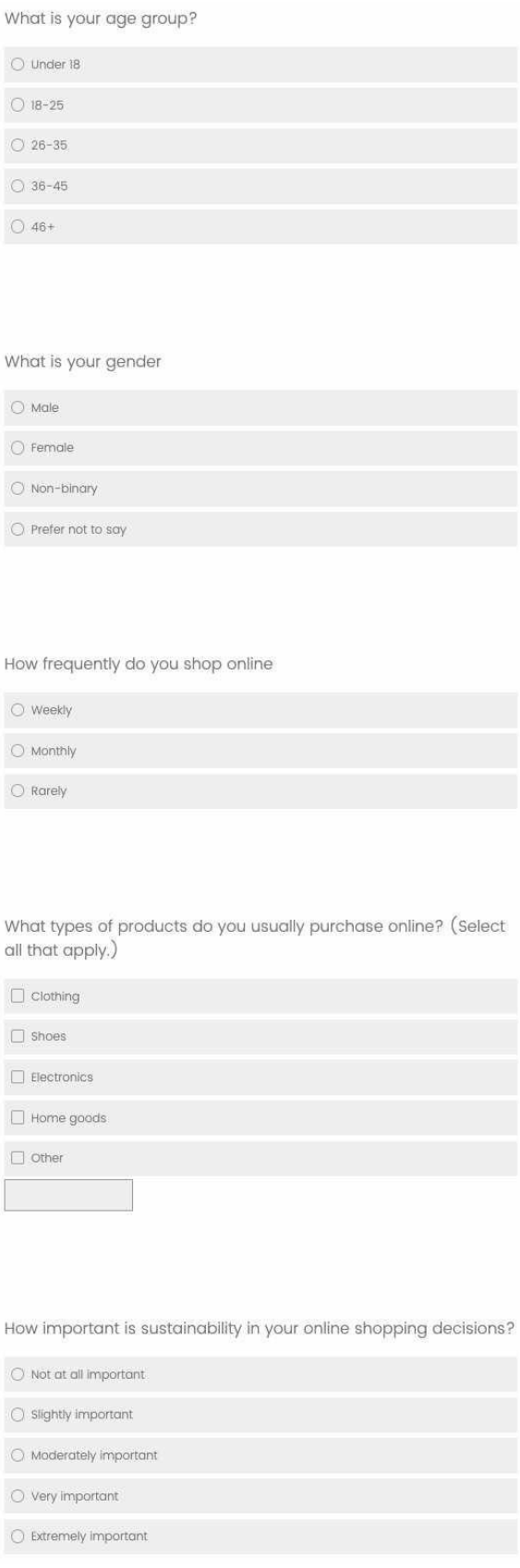
Introduction

Introduction I am conducting this survey to explore how innovative technologies like Artificial Intelligence (AI) and Augmented Reality (AR) can enhance online shopping experiences, specifically through an AI-powered AR foot scanning tool. This tool is designed to improve size recommendations, reduce product returns, and support sustainability efforts in eCommerce. An AR (Augmented Reality) tool is a technology that overlays digital information, such as images, animations, or 3D models, onto the real world using devices like smartphones, tablets, or AR glasses. In online shopping, AR tools allow users to interact with products virtually for example, trying on shoes or visualizing how furniture might look in their home providing a more immersive and interactive experience. Imagine using sich a tool that allows you to scan your feet with your smartphone camera to create a 3D model. This model provides personalized shoe size recommendations based on your unique measurements, such as foot length, width, and arch height. The tool also aligns with sustainability goals by reducing waste from returns and improving customer satisfaction. Your participation in this survey is invaluable. The insights you provide will help me understand user preferences, experiences, and concerns, enabling the development of user-friendly, secure, and impactful AR tools. Your responses are completely anonymous, and the survey will take approximately 10-15 minutes to complete.

Screening Question



Demographics



Questions for AR-Experienced Users

Perceptions and Attitudes Towards AR Tools

	Strongly Agree	Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree	Strongly Disagree
The AR tools I have used are intuitive and easy to navigate.	○	○	○	○	○	○	○
The visual presentation of AR tools enhances my online shopping experience.	○	○	○	○	○	○	○
I find it convenient to use AR tools while shopping online.	○	○	○	○	○	○	○
I trust the results provided by AR tools for sizing and fitting.	○	○	○	○	○	○	○
AR-based sizing tools provide accurate recommendations for my foot size.	○	○	○	○	○	○	○
I am satisfied with the size recommendations provided by AR tools I have used.	○	○	○	○	○	○	○
I prefer using AR tools over traditional size guides.	○	○	○	○	○	○	○
The design and layout of AR tools I have used are user-friendly.	○	○	○	○	○	○	○
AR tools make online shopping more engaging.	○	○	○	○	○	○	○
AR tools improve my confidence in making online purchases.	○	○	○	○	○	○	○

Sustainability and Impact

	Strongly Agree	Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree	Strongly Disagree
AR tools reduce the likelihood of product returns in my experience.	○	○	○	○	○	○	○
The sustainability features of AR tools are important to me.	○	○	○	○	○	○	○
I believe AR tools can contribute to reducing waste in eCommerce.	○	○	○	○	○	○	○
Using AR tools makes me feel like I am shopping more sustainably.	○	○	○	○	○	○	○
AR tools align with my values of supporting environmentally friendly practices.	○	○	○	○	○	○	○
When AR-based size recommendations are accurate, I am less likely to return the products I purchase.	○	○	○	○	○	○	○
Clear sustainability messages from brands using AR tools make me more likely to trust and stay loyal to those brands.	○	○	○	○	○	○	○

Adoption and Recommendations

	Strongly Agree	Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree	Strongly Disagree
I would recommend AR-based tools to others for online shopping.	○	○	○	○	○	○	○
I use AR tools more frequently when shopping with certain brands.	○	○	○	○	○	○	○
I believe AR tools should be a standard feature for online retailers.	○	○	○	○	○	○	○
Retailers with AR tools are more likely to gain my loyalty.	○	○	○	○	○	○	○
I am willing to pay more for products from brands that use AR tools.	○	○	○	○	○	○	○
Interactive features like 3D visualizations or try-on options make me more likely to use AR tools regularly.	○	○	○	○	○	○	○

Privacy and Security

	Strongly Agree	Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree	Strongly Disagree
I am concerned about the security of my personal data when using AR tools.	○	○	○	○	○	○	○
I am comfortable sharing biometric data (e.g., foot scans) with online shopping platforms.	○	○	○	○	○	○	○
Clear privacy policies make me more likely to use AR tools.	○	○	○	○	○	○	○
I believe the data collected by AR tools is used responsibly.	○	○	○	○	○	○	○
Privacy concerns discourage me from using AR tools regularly.	○	○	○	○	○	○	○
I find AR tools take too much time to use during online shopping.	○	○	○	○	○	○	○

Imagine a tool that uses AI and AR to scan your feet via smartphone for personalized shoe size recommendations, reducing returns and supporting sustainability.

	Strongly Agree	Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree	Strongly Disagree
This tool would make me more confident in selecting the correct size online.	○	○	○	○	○	○	○
I would use this tool regularly for shopping.	○	○	○	○	○	○	○
I believe this tool would improve my shopping experience.	○	○	○	○	○	○	○
This tool's sustainability benefits make it appealing.	○	○	○	○	○	○	○
I would prefer shopping with brands that use this tool.	○	○	○	○	○	○	○

Questions for AR-Inexperienced Users

Perceptions and Attitudes Towards AR Tools

	Strongly Agree	Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree	Strongly Disagree
I feel apprehensive about trying AR-based tools due to privacy concerns.	○	○	○	○	○	○	○
I am curious about how AR tools work in online shopping.	○	○	○	○	○	○	○
I would be open to learning how to use AR tools.	○	○	○	○	○	○	○
I believe AR tools could improve the online shopping experience.	○	○	○	○	○	○	○
AR tools would reduce the frustration of receiving products that do not fit.	○	○	○	○	○	○	○
An AI-powered AR foot scanner would improve my confidence in selecting the correct size.	○	○	○	○	○	○	○
I trust AI recommendations for online shopping.	○	○	○	○	○	○	○
I prefer interactive tools for product recommendations over traditional methods.	○	○	○	○	○	○	○
I would feel more confident purchasing shoes online with AR tools.	○	○	○	○	○	○	○
I believe AR tools would make online shopping more enjoyable.	○	○	○	○	○	○	○
If AR tools can provide accurate size recommendations, I would be less likely to return the products I purchase.	○	○	○	○	○	○	○

Privacy and Security

	Strongly Agree	Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree	Strongly Disagree
I am concerned about sharing personal data with AR technologies.	○	○	○	○	○	○	○
User-friendliness would make me more likely to try AR tools.	○	○	○	○	○	○	○
Data security is a top priority when adopting new shopping technologies.	○	○	○	○	○	○	○
Clear explanations about data usage would increase my trust in AR tools.	○	○	○	○	○	○	○
Privacy concerns discourage me from trying new shopping technologies.	○	○	○	○	○	○	○
I am concerned that AR tools might take too much time to use during online shopping.	○	○	○	○	○	○	○

Sustainability and Impact

	Strongly Agree	Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree	Strongly Disagree
The sustainability aspect of AR tools makes them more appealing to me.	○	○	○	○	○	○	○
I believe AR tools could reduce waste by improving size accuracy.	○	○	○	○	○	○	○
Using AR tools would make me feel like I am supporting environmentally friendly practices.	○	○	○	○	○	○	○
Brands using AR tools would gain my trust and loyalty.	○	○	○	○	○	○	○
I associate AR tools with innovative and sustainable shopping experiences.	○	○	○	○	○	○	○
Clear sustainability messages from brands using AR tools would make me more likely to trust and stay loyal to those brands.	○	○	○	○	○	○	○

Adoption and Recommendations

	Strongly Agree	Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree	Strongly Disagree
I would prefer shopping with brands that offer innovative technologies like AR.	○	○	○	○	○	○	○
Retailers using AR tools would stand out to me.	○	○	○	○	○	○	○
I would consider trying AR tools if they were widely available.	○	○	○	○	○	○	○
I am willing to try AR tools if they are easy to use.	○	○	○	○	○	○	○
I believe AR tools will become essential for online shopping in the future.	○	○	○	○	○	○	○
Interactive features like 3D visualizations or try-on options would make me more likely to try AR tools.	○	○	○	○	○	○	○

Imagine a tool that uses AI and AR to scan your feet via smartphone for personalized shoe size recommendations, reducing returns and supporting sustainability.

	Strongly Agree	Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree	Strongly Disagree
I would be likely to try this tool for online shopping.	○	○	○	○	○	○	○
This tool would improve my confidence in selecting the correct size.	○	○	○	○	○	○	○
The sustainability benefits of this tool make it more appealing.	○	○	○	○	○	○	○
I would use this tool if it were offered by a trusted brand.	○	○	○	○	○	○	○
I believe this tool would make online shopping easier for me.	○	○	○	○	○	○	○

Understanding Check (same questions for both groups)