ERASMUS UNIVERSITY ROTTERDAM
Erasmus School of Economics
Master Thesis Marketing

Master Thesis Economics and Business specialization in Marketing

Beyond the screen: the role of AR on consumers' intention to purchase smart wearables in an online environment.

Name student: Janice Wever
Student ID number: 427221

Supervisor: DS Kolesnyk
Second assessor:

Date final version: 12-08-2024

Abstract

The use of Augmented Reality (AR) allows online shoppers to perceive virtual products as existing in the real world, creating a unique online shopping experience. This research investigated how AR affects consumers' purchase intentions in context of smart wearables, and how this effect is moderated by brand familiarity and prior AR experience. A two-by-two survey-based experimental design with 224 participants was conducted. Participants were introduced to one of the four conditions: a shopping experience with or without AR, and with either an existing high-familiarity brand (Xiaomi) or a fictious new low-familiarity brand (Mozo). The results showed that using AR as implemented in this study did not significantly increase purchase intentions compared to a non-AR online shopping experience. Furthermore, there was no significant moderating effect of brand familiarity or prior AR experience on the relationship between AR and consumer purchase intentions, however, the means were in the hypothesized direction. These results suggest that the way AR was implemented in this study may not be sufficient to influence consumers purchase intention. This research emphasizes the importance of smoothly integrating AR into online shopping experiences and how important it is to provide high-quality, engaging AR experiences that add value. To further understand the potential of AR in online shopping environments, future studies should take into account wider demographic samples, different product categories and long-term effects.

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1. Introduction

This chapter shows a general overview and insights of this research. The background of this research and its relevance will be explained including the purpose of the research. Lastly the main research question will be introduced.

1.1. Augmented Reality at first sight and Smart Wearables

With technology constant changing how consumers engage with products and make judgements during their buying process, the online shopping scene has changed over the last years. Augmented Reality (AR) technology gained more publicity (Alkhamisi & Monowar, 2013; Kotler et al., 2021). An AR environment is created when a computer-generated, virtual contents are added to the real-world environment to augment the real world. In other words, adding a layer of digital data over the actual world making the distinction between real and virtual world blurry. It changes the way users interact with their surroundings, creating an interactive experience for users. Users may be able to see virtual items in their own environment, interacting with digital content in that moment and obtaining information easily through smart wearables and applications (Carmigniani & Furht, 2011). The phenomenon of virtual components incorporation in the real world has been widely used in different industries although there is still much to learn about how they affect consumer behaviour in the context of online retail especially for smart wearables (Wedel et al., 2020).

In this study I focused on smart wearables which is a growing segment of consumer's electronics market. Smart wearables include many forms of wearable technology such as fitness trackers, hearables, smartwatches, and augmented reality glasses. The wrist-wear product segment dominated the market globally by accounting for 49.5% of the overall revenue (Grandview Research, 2023). These gadgets are changing how people interact with technology in their daily lives by providing wide range of functionalities. While future advancements in technologies such as smart glasses and other screen technologies progress, society will endure more digital interactions. Which therefore is crucial to understand the impact AR technology has on consumer behaviour (Qiao et al., 2019).

Consumers can perceive and interact with virtual representations of smart wearables due to the implementation of AR. This gives consumers a chance to investigate features, evaluate the fit and facilitate try-ons (Liu et al., 2020). This could close the gap between online

and offline shopping experiences, by lowering purchase uncertainties. With the help of AR technology retailers will be able to understand their own customers better by investigating their purchase desires leading to potential better sales and customer overall satisfaction. It could additionally lower return of items because being able to visualise or wear an item in the comfort of your home could help making a better analysis prior to purchasing. Viewing an item in 3D instead of 2D gives the consumer a more tailor-made experience and feel of the product. This could lead to a potentially better decision-making when purchasing, which in turn leads to less returns and lowers the costs associated with having high return rates (Cveticanin, 2024). Research indicates that by utilizing AR technology to create unique and unforgettable experiences, customer engagement can be encouraged (Sung, 2021). Applications of AR technology in marketing is anticipated to increase as it keeps developing further with the rapid technology evolvements and innovations. Therefore, this phenomenon creates new opportunities for companies to engage with their customers in creative ways (Rauschnabel et al., 2019). AR contributes to a potential transformation of the consumer experience to potentially impact purchase intentions.

Despite its widespread appeal AR has not been widely adopted yet in the customers' shopping experience. In 2020, only 1% of the retailers used AR or VR (Virtual Reality) to provide a better shopping experience to their customers. Market insights indicate that consumer interaction with AR or VR remained limited. Interestingly, it has been reported that the enthusiasm for AR/VR is particularly low especially among younger people, with less than 10% of the population currently engaging with it (Prakash, 2023). While the rate of adoption is gradually increasing, many retailers still struggle to incorporate these technologies completely into their daily operations. By 2023, circa 16% of retailers had adopted AR or VR in some way, reflecting a notable but still moderate rise (Cureton, 2023). However, it is clear that both AR and VR are on the rise, with their applications expected to grow significantly in the coming years. The AR market is growing on a fast pace and estimates to reach USD 597.54 billion by 2030 (Statista, 2023) (Grandview Research, 2023).

The impact of AR technology on purchase intentions differs among consumers. Brand familiarity and prior AR experience are two important factors that could be of crucial impacting this relationship. It is known that consumers are seeking more active, personal and precise interaction with brands (Yılmaz & Enginkaya, 2015). Which therefore the level of familiarity a consumer has with a specific brand, explaining the created identity the consumer has with

this brand, could impact the way AR's ability influences purchase intentions. Being highly familiar with a brand could possibly lead to increased level of trust and favourable associations with this specific brand. Therefore, it is of importance to maintain relevance and engagement. While in contrast being less familiar with a brand could require implementation of different strategy to gain trust while introducing a new brand (Campbell & Keller, 2003). Therefore, this research contributes to understanding how brands can tailor their AR experiences to suit varying levels of consumer familiarity, thereby enhancing purchase intentions. By examining these dynamics this research contributes to the field by clarifying the complex ways that AR might be optimized to improve connections between consumers and brands, a subject that has not fully been explored (Scholz & Duffy, 2018).

Likewise having prior AR experience might influence the effect of AR on consumers' purchase. Previous studies have focused on various theories and models to understand AR technology and its feasibility and usefulness. Such as technology giants Samsung and Google focusing on making sure the software technology works well rather than the consumers impression of AR implementation and understanding how this makes the product more appealing to consumers (Grandview Research, 2023). Consumers might be more accepting of AR features finding these to be useful and straightforward when previously used AR technology, which could have an effect their online shopping experience. While being introduced to AR technology for the first time in a shopping experience might require additional support and instructions to understand the benefits in their online shopping experience. For marketing managers, it is crucial to find out how AR in marketing can make the consumer feel and experience the product rather on focusing on the technology itself. Customer focused approach is key to marketing strategies (Rust et al., 2004).

This information is valuable to businesses when deciding on investments in AR as companies might spend too much on AR without knowing how to implement it to attract their consumers. Meanwhile also understanding the purpose of brand familiarity and prior AR experience to be able to customize their AR strategies accordingly to attract customers and influence their purchase intentions. Understanding how these relationships affect each other and how it can affect both existing and new customers. Having a tailor-made approach for customers could impact the conversion rates and customer satisfaction effecting the overall online shopping experience. Similarly, this information is of scientific relevance as it helps to gain knowledge how different consumers perceive digitalization in shopping experiences and

how businesses can benefit from technologies as AR to influence consumers purchase decisions (Scholz & Smith, 2016).

This research aims to investigate how consumers intentions to buy smart wearables in an online setting are influenced by augmented reality while clarifying the mechanisms behind the consumers perceptions of this presentation such as brand familiarity and prior experience with AR. Contributing to the complexity of consumer behaviour in response to evolving technological innovations. The following main research question is introduced.

How does the presence of Augmented Reality (AR) influence consumer' intention to purchase smart wearables in an online environment compared to an online shopping experience without AR, and how does brand familiarity and prior AR experience moderate this relationship?

2. Theoretical Framework

In this chapter the relevant literature for this research is presented. Based on the literature the research question and hypotheses have been developed. First Augmented reality (AR) will be explained in detail along with introduction of the hypotheses with support of literature. Lastly the conceptual model of this research is presented.

2.1. Augmented Reality (AR) definition

The integration of digital data with the user's surroundings in real time is known as augmented reality, also AR. In contrast to Virtual Reality (VR), users of AR see the real world with added virtual content on top of it meanwhile VR generates an entirely fabricated environment. The advantage of AR is its ability to integrate digital and three dimensional (3D) elements with an individual's reality experience. Its usage can be applied to different dimensions such as entertainment all the way to decision support. Through a device such as a smartphone or smart glasses AR can provide the user with visual elements, sounds and other sensory information. In 1998 the first commercial use of augmented reality technology used in advertisement was the yellow first down marker that started appearing in football games (Stern, 2024). Note that sometimes AR is used not add to the world but also to hide unnecessary information from viewing. Meaning that AR also functions as an augmentation of simplicity. With help of AR technology, users can be assisted to see through clutter and view key features of their environment more clearly. Moreover, AR can also be combined with different technologies, while the definition staying the same regardless of the methods used to incorporate it (Craig, 2013).

2.2. Literature review

Table A (Appendix A) provides an overview of the literature reviewed for this study. Previous research stated that direct product experiences such as trying on the products and physical interaction with products were superior to indirect product experiences. However, findings showed that manipulating mental construal changes the way the consumer evaluated products based on different types of experiences (Hamilton & Thompson, 2007). This research utilized this knowledge while delving into the AR aspect on how this type of content customization could influence the consumers purchase intentions. In contexts where physical product

interaction was not possible, AR could be used as a bridge to mitigate the physical distance and stimuli direct product experiences. Potentially this effect could influence purchase intentions more strongly than traditional online shopping experiences.

The study of Jiang & Benbasat (2007) highlighted that vividness and interactivity positively contributed to the consumer's ability to understand the products better due to the perceived capability of the website. Vividness, however, had a stronger effect than interactivity in contributing to the consumers' shopping enjoyment. Insights on vividness and interactivity provided a basis for investigating how AR features could influence consumers purchase intentions, mirroring the positive effects found in studies of interactive and vivid online product presentations. Nawres et al. (2024) suggested that AR can enhance the consumers shopping experience by enabling a better understanding and connection with the product. As their study focused on more product categories such as watches, sneakers, cosmetics the comparison of the effect of AR experiences was challenging. It was difficult to understand how variations in application design within the same product category could influence the consumers' feeling and perceptions of the product. With these insights the first hypothesis is introduced:

> *Hypothesis 1: The usage of AR in online environments compared to an online shopping experience without AR, positively influences consumers' intentions to purchase smart wearables.*

2.3. Brand Familiarity and consumer perceptions

When it comes to influencing consumer purchase intentions and behaviour, brand familiarity plays an important role. According to Campbell and Keller (2003) brand familiarity is the extent to which the consumers as result to prior exposure and interactions are both aware and at ease with this brand. The more consumers are positively influenced and familiar with a brand the more exposure the brand would receive. Familiar brands tend to have greater credibility and trust than less well-known brands. This due to recurring exposure and favourable prior experiences which therefore lowers the risk perception and uncertainty which are important factors in the purchasing process. Moreover, Campbell and Keller (2003) investigated the impact of brand familiarity on consumer engagement and response to advertising. Showing that ads for unfamiliar brands tend to wear out more quickly than ads for familiar brands. Investigating better processing of repetition among ads for unfamiliar brands is required.

Retailers could use AR to provide experiences to the consumer varied by brand familiarity or exposure to minimize wear out effects.

Previous research indicated that consumers are more inclined to make purchases when they are familiar or have heard from the brand beforehand, consumers recall the brand from their memory and therefore affect preference and selection (Ha, 2006). Highly familiar brands can implement more nuanced or sophisticated advertising techniques as their messages are processed with more attention to details to these types of consumers. When these brands decide to launch a new product, these are more welcomed by consumers who have already connected with the brand's previous accomplishments and more willing to consider or accept innovative shopping (Campbell & Keller, 2003). This lays the base for the second hypothesis suggesting that indeed high brand familiarity will result in a higher purchase intention:

Hypothesis 2: Consumers with high brand familiarity will report higher purchase intentions compared to consumers with low brand familiarity.

Similarly, customers who are familiar with a brand might have higher trust level and feel more connected towards this brand (Erdem et al., 2006). Therefore, customers might be more likely to interact and allow usage of additional features, such as AR offered by a familiar brand, which increases the likelihood of purchase intentions. Additionally recalling a brand and having positive associations with a brand while using AR to visualize and connect with their product could help to reinforce their initial feelings such as excitement and innovativeness, with the brand further. Making the product presented even more attractive which could lead to potential increase in purchases. Additionally, AR provides an engaging experience that can deepen the emotional bond with a brand. According to previous research AR can improve brand experiences by making interactions more memorable and engaging (Hilken et al., 2021). This effect is stronger for brands that are well-known since consumers are already more likely to form favorable connections. Through AR engagement these associations could be strengthened improving the product's attractiveness and alignment with expectations of the consumers (Scholz & Smith, 2016). Therefore, the third hypothesis is introduced. Examining how strong the effect of brand familiarity is on AR usage and consumers' purchase intentions.

Hypothesis 3: The effect of AR usage on consumers' purchase intentions is stronger for consumers with high brand familiarity than for those with low brand familiarity.

2.4. Prior AR experience and Consumer behaviour

According to the Technology Acceptance Model (TAM) developed by Davis (1989) familiarity with technology significantly influenced its perceived usefulness and ease of use (Venkatesh & Davis, 2000). This method showed that consumers who had previously made use of AR technology were more likely to accept the technology as practical and simple. Consumers' perception of AR features when making an online purchase could be influenced by this familiarity. It could lower their technological knowledge effort and give a boost of confidence when AR is implemented in their shopping experience. Moreover, the study of Kang et al. (2022) showed that consumers who have prior AR experience tend to perceive the AR features as beneficial. Consumers accustomed to AR could make them more receptive to AR features when it comes to online purchasing environments. Research showed that prior experience with technology influenced the consumers acceptance towards technology and willingness to actually use it. Therefore, consumers would be more likely to navigate through AR interfaces and understand how AR effects their shopping experience, may having a beneficial effect on their purchase intentions (Devagiri et al., 2022). Therefore, the fourth hypothesis is introduced:

> *Hypothesis 4: The effect of AR usage on consumer purchase intentions is stronger for consumers with prior AR experience than for those with no AR prior experience.*

2.5. Conceptual framework

Find below (figure 1) the conceptual framework illustrated for this research. The model consisted of one independent variable: AR usage, two moderators: brand familiarity and AR prior experience and one dependent variable: consumer purchase intentions.

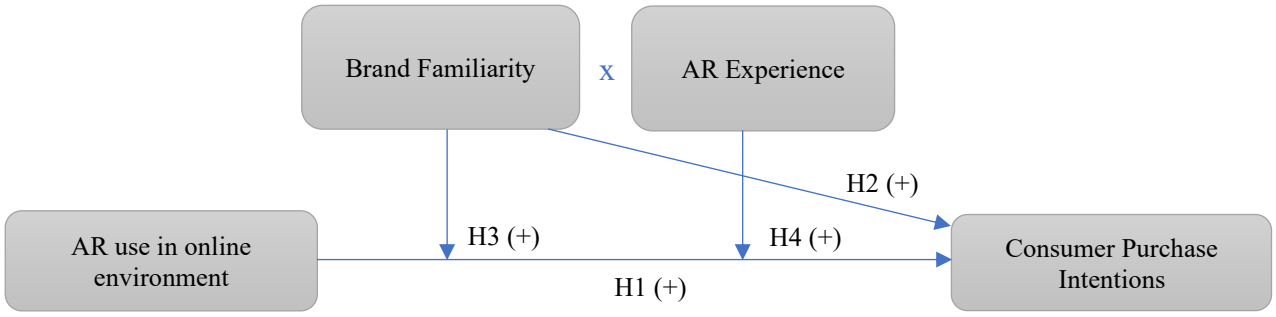


Figure 1: Conceptual Model

3. Method

In this chapter the research design, data collection procedure, sample and data analysis method are explained to investigate the usage of AR on consumers' purchase intentions of smart wearables.

3.1. Research design and procedure

A survey-experiment with a 2 (AR: present versus absent) x 2 (brand familiarity: known brand versus unknown brand) between-subjects design was conducted. A between-subjects design is an experimental design where the participants are allocated randomly to each of the experimental conditions. This research manipulated two independent variables: Brand familiarity (known brand versus unknown brand) and AR (presence versus absence) which resulted in four experimental conditions. Indicating that each participant was randomly exposed to one of the four conditions (Appendix A, Table B). The first condition involved an AR shopping experience with a known brand Xiaomi. The second condition involved an AR shopping experience with an unknown brand Mozo. The third condition involved a non-AR shopping experience with a known brand Xiaomi. The fourth condition involved a non-AR shopping experience with an unknown brand Mozo. The experiments are illustrated in appendix B.

Primary data was utilized for this research to ensure the respondents were asked questions designed to gather data that provide insightful details on the different constructs that could influence purchase intentions. Primary data was gathered by conducting a survey. A survey is a research method that is used to collect information regarding experiences, emotions and opinions of the participants (Draugalis et al., 2008). Data was collected using a survey through a software called Qualtrics. An invitation with an URL link to this survey was sent out through WhatsApp and social media channels such as Facebook and Instagram. Participants were expected to complete the AR or non-AR shopping experience on a smartphone or other compatible device as specified in the instructions.

An overview of the questionnaire can be found in the Appendix A, Table C. The questions presented were closed questions, except for age, that consisted of multiple-choice responses that the participant selected to be able to continue. Closed questions allowed the

survey to take less time and effort to respond to as it did not require writing as well as it made comparison easier (Schaeffer & Presser, 2003). Moreover, rating questions were presented where the respondent could rate their response from a negative to positive scale. Researchers, Weng (2004) and Gehlbach & Artino (2018), explained that creating survey with a response scale of five to seven are most used. Using a five-point scale made it easier for the respondent to understand and choose from the options given without feeling cognitive overwhelmed or hesitation which can result from using bigger scales. While providing enough detail to capture the important variations in responses. In this research, a five-Likert scale response ranging from 5. Strongly agree to 1. Strongly disagree was used to determine the degree that the respondents agreed or disagreed with the statements that were introduced in the survey. Whereas a five-Likert scale response ranging from 5. Extremely likely to 1. Extremely unlikely was used to determine the likelihood of purchase filled in by the respondents.

At the beginning of the survey participants were screened to help eliminate and filter those who were not qualified to this study. Participants were requested to agree with the informed consent to begin the research. If the participants agreed with the terms and therefore were qualified to participate, the survey would begin, if not they would automatically be directed to the end of the survey. At first the respondents received some warmup questions as refreshment towards the subject of and familiarity with AR technology. Whereas afterwards the participants were introduced to one of the four conditions. The participants were randomly allocated to either the treatment group (AR usage, 3D visualization) or the control group (non-AR usage, 2D visualization) for AR experience. The respondents in both treatment and control group were presented with a smart wearable product, in this case a smartwatch, with the difference being the smartwatch presented influenced with AR or not. Also, this smartwatch introduced was either from a high familiar brand (Xiaomi) or a low familiar brand (Mozo). Participants were randomly allocated to either the treatment (high familiar brand) or control group (low familiar brand) for brand familiarity. After a short introduction of the brand including the smart wearable product, the shopping experience began. The participant was being guided through the shopping experience. After the shopping experience the participants were asked questions regarding their purchase intentions, brand familiarity and experience. As there were two manipulated variables Brand familiarity (known brand versus unknown brand) and AR (presence versus absence) the respondents were asked how familiar they were with the brand presented. This to investigate whether the manipulation worked. To revise whether the AR manipulation had worked the respondents were asked to choose whether they viewed an

AR presentation or non-AR presentation. Furthermore, demographic questions were presented at the end such as age, gender, residency, education level, employment and individual annual income (Appendix A, Table C).

3.2. Sample

A population of interest referred to the research's target population that was intended to be researched or treated. However, it was not feasible to recruit the entire population targeted. Instead, a sample from the population was recruited to include in the research and form a group representing the whole population (Majid, 2018). For this research a combination of convenience sampling and self-selection sampling has been used. Shortly overall a non-probability sampling method has been used to gather data more efficiently and quicker due to limited time availability. Through asking acquaintances and family to fill out and share the survey to further acquaintances the number of responses increased rapidly. This effect is also known as snowball sampling which is part of non-probability sampling (Taherdoost, 2016). Furthermore, ensuring qualitative data gathering all participants based on their current academic state have been selected through a mutual university group who share similarity in education subject. Which contributed to reducing bias that might occur through snowball sampling (Marcus et al., 2016). Moreover, also sharing the survey through channels such as survey swap, Facebook groups and Instagram. The participants volunteered themselves to participate in the survey. The advantages of using this type of method were that it was doable in a short amount of time, and it was less costly. However, due to the relatively small sample size generalization to the population was more limited. The final sample for this research consisted of 224 respondents, with 56 respondents in group 1 (AR, Xiaomi), 56 respondents in group 2 (AR, Mozo), 57 respondents in group 3 (non-AR, Xiaomi) and lastly 55 respondents in group 4 (non-AR, Mozo).

3.3. Data analysis method

The software Statistical Product and Service Solutions (IBM SPSS) was used to analyse the collected data. A quantitative approach was used to analyse the data that was gathered through the survey. Descriptive statistics were analysed to allow to simplify and summarize the data. This to make it easier to understand the data and provide an overview of the sample distribution, measures of central tendency (mean, median, mode) and dispersion (frequency distribution,

maximum and minimum, standard deviation) were presented (Marshall & Jonker, 2010). The control variables: age, gender, residence, education, employee status and individual income were analysed using descriptive statistics to delineate the demographic profile of the participants.

Additionally, to investigate the effects between variables and test the hypothesis the following statistical techniques were used. For manipulation checks, an independent t-test was performed to compare the mean brand familiarity ratings between the groups to check if the manipulation caused a significant variation in perceived brand familiarity. Before conducting the independent t-test a Levene's test for equality of variances has been conducted to show whether the variances between two groups are equal and therefore, to check for robustness. A chi-square test has been performed to check whether the AR manipulation caused a significant association between participants on whether they believed they had experienced an AR or non-AR shopping experience and the condition they were actually exposed to (Bakker & Wicherts, 2014).

To be able to answer the hypotheses and main research question a multiple linear regression analysis was performed. A multiple linear regression is performed to capture the relationship between a dependent variable and one or more independent variables (James et al., 2013). Prior to performing the regression normal distribution of the data were tested by performing plots (Schmidt & Finan, 2018). The R-squared was used to determine the overall fit of the regression model. Together the descriptive and statistical analysis allow for a through analysis of the data.

3.4. Mathematical models

Below for each hypothesis the mathematical models are explained. The variables used had the following descriptions. Y represented the dependent variable (DV) – consumer purchase intentions. AR described the independent variable (IV) AR experience in online environments. BF represented the moderating variable brand familiarity while PRE represented the moderating variable Prior AR experience. $_{CV}$i represented the control variables in this research: age, gender, residence, education, employment and income)

This baseline model represented the main effect of AR experience on consumers' purchase intentions.

H1 $Y=\beta 0+\beta 1AR+\sum i\ \beta_{CV}i*_{CV}i+\epsilon$

Where $\beta 0$ was the intercept and $\beta 1$ was the coefficient of the effect of AR on Y. ϵ was the error term. $\beta_{CV}i$ represented the coefficients for each control variable ($_{CV}i$) indicating their individual effects on purchase intentions.

The second main effect introduced focused on brand familiarity. This model tests if the influence of being familiar or not with a brand affected the consumer's willingness to purchase, independent of the AR effect.

H2 $Y=\beta 0+\beta 1AR+\beta 2BF+\sum i\ \beta_{CV}i*_{CV}i+\epsilon$

Where $\beta 2$ was the coefficient of the effect of BF on Y.

Third an interaction term was introduced to explore how AR experience and brand familiarity together influenced purchase intentions. This was crucial to understand if the influence of AR was stronger depending on the brand's familiarity.

H3 $Y=\beta 0+\beta 1AR+\beta 2BF+\beta 3(AR\times BF)+\sum i\ \beta_{CV}i*_{CV}i+\epsilon$

$(AR\times BF)$ was the interaction term between AR experience and Brand familiarity. Where $\beta 3$ represented the coefficient for the interaction effect on Y.

Furthermore, it was examined how prior AR experience interacted with AR experience to affect purchase intentions. Specifically whether previous experience with AR modified the effectiveness of AR usage in online shopping.

H4 $Y=\beta 0+\beta 1AR+\beta 2BF+\beta 3(AR\times BF)+\beta 4PRE+\beta 5(AR\times PRE)+\sum i\ \beta_{CV}i*_{CV}i+\epsilon$

$\beta 4$ was the coefficient of the effect of PRE on Y. $(AR\times PRE)$ was the interaction term between AR experience and Prior AR Experience. Where $\beta 5$ represented the coefficient for the interaction effect on Y.

3.5. Measures

3.5.1. Consumer purchase intentions

Consumer purchase intention was the dependent variable in this research. This variable was crucial as it measured the consequence of interest directly, the probability that the consumer would purchase a product. The participants were asked based on the information showcased how likely they were to purchase the smart watch. In previous research, purchase intentions have been widely used as reliable indicator coming as close to the actual consumer purchases (Grimmer & Bingham, 2013). In this study purchase intentions were measured using a five-point Likert scale from "very unlikely" to "very likely". The survey implied that based on the information showcased by the scenario how likely the respondents were to purchase the smart watch after engaging with the product through the presentations provided (Spears & Singh, 2004). Purchase intentions was treated as a continuous variable measured on a five-point Likert scale, as shown in Appendix A, Table D.

3.5.2. Manipulation of AR and AR manipulation check

To completely understand the value AR brings to the consumers shopping experience it was essential to investigate how AR has an impact on consumer purchase intentions. It was crucial to measure the impact of AR on consumer engagement and purchase intentions as it is a phenom that is becoming more used nowadays. The independent variable for this study was AR experience, a binary variable indicating whether participants had an AR experience or a non-AR experience (Appendix A, Table D). Through the experiment this variable was manipulated. One group received the AR experience, whereas another group received the non-AR experience.

The group that was exposed to the AR experience in the experiment first received an introduction explaining what they could expect through this survey. The participant was informed that he or she will be visualizing a latest smart wearable, in this case a smartwatch of the brand in question. They were asked to imagine using an AR app on their smartphone that allowed to project a 3D model of the smartwatch on their wrist. Including explanation how they would be able to view the smart watch its design, models and features. Recreating their shopping experience. First step involved the participant viewing the AR watch app, browsing through various models, selecting a model, viewed an example how the smartwatch will appear

on the wrist including different colours, and lastly the respondent viewing three features – fitness activity, stress level monitoring and heart rate monitoring – of the smartwatch on the wrist.

For the non-AR experience the participants also received a brief introduction of what they could expect from the upcoming experience. It allowed the respondent to imagine exploring options for purchasing a new smart watch online and navigating through the website while viewing different models in 2D, selecting a model and viewing the features through a product information page (Appendix B). The independent variable AR experience was a binary categorical variable that took the value 0 for non-AR scenario and 1 for an AR scenario.

To revise whether the AR manipulation had worked the respondents were asked to choose which of the following scenarios best described their recent interaction with the product presentation, with two possible answer options based on their experience in the survey "I viewed the product in a three-dimensional space, where the product was virtually tried on including the smart watch features (AR scenario)" and " I viewed the product through standard images and descriptions without interaction in a three-dimensional space" (Non-AR scenario).

3.5.3. Manipulation of brand and brand familiarity manipulation check

Brand familiarity was a manipulated variable in this study. Participants were introduced to either a familiar brand Xiaomi or an unfamiliar brand named Mozo. A categorical variable. To check if the manipulation worked a five-point Likert scale was presented to measure manipulation. In the high brand familiarity conditions respondents were exposed to a smart watch from Xiaomi brand. A brand that is popular in China and relatively well-known in the global market for its smartphones and smart hardware. Xiaomi is laying the focus on the European market and attracting customers (Chen et al., 2023). Xiaomi reported second rank for Xiaomi's smartphones shipments in Europe in quarter three with a market share of 23.3% in 2022. (Xiaomi Global Home, 2022). Despite facing a decline of 3% in Year-over-Year in quarter three of 2023 Xiaomi remained a top player in Eastern Europe with 35% market share (Counterpoint, 2023).

For the low brand familiarity condition respondents were exposed to a smart watch of a fictious, unknown brand called Mozo, respondents were informed that this is a "new" brand.

There was one question asked for both brands to measure this variable. To investigate whether the manipulation worked the respondents were asked how familiar they were with the brand presented. The respondents exposed to the Xiaomi brand were asked how familiar they were with the brand Xiaomi while the respondents who were exposed to the unfamiliar brand Mozo were also asked to rate their familiarity with the unknown brand (Campbell & Keller, 2003). For the manipulation check between low brand familiarity and high brand familiarity, the brand familiarity was measured by a five-point Likert scale where the participants rated their overall familiarity with the brand presented with options "strongly disagree" to "strongly agree" (Martí-Parreño et al., 2017).

3.5.4. Prior AR Experience

The moderator prior AR experience was a categorical variable. The respondents were asked questions (Appendix A, Table C) regarding their AR experience as explained below. First a picture was shown of someone using AR technology to visualize sneakers available in store on their feet through their smartphone. Recreating the physical shopping experience in their own environment. The respondent was informed that this was an example of AR technology used to virtually try-on sneakers in their own environment. Next, there were three statements presented about the respondents their possible prior AR experience.

The statements were as follows: I have used AR technology before with the possible answers "yes", "no" or "I am not sure". Then secondly the statement "I am familiar with AR technology" was introduced, and third the statement "if available, I make use of AR technology while shopping online" was presented. With the last two statements their possible options were measured on a five-point Likert scale from "strongly disagree" to "strongly agree" (Andaç et al., 2016).

For data analysis the first statement represented the variable prior AR experience. This was a binary variable with the value 1 prior AR experience and 0 if the respondents were not sure or had no prior AR experience. The first statement represented this variable because a reliability test was conducted for the second and third prior AR experience questions, resulting in an alpha of $0.461 < 0.7$ which represented poor reliability. Therefore, the first statement was chosen to represent this variable as it was the most straightforward question matching the variable prior AR experience (Tavakol & Dennick, 2011).

3.5.5. Gender, age, education level, residence, employment status and income.

The control variables were included in this research as the impact of outside factors could influence consumer purchase intentions independently of AR presence, brand familiarity or prior AR experience. Age might have influenced how consumers might have evaluated AR experiences while income levels could give insights of the impact on purchase power. Implementing demographic variables was intended to increase validity and generalizability of the results in this research. Previous research showed that purchase intentions could be influenced by demographic characteristics (Bhat et al., 2021). Therefore, the control variables were included in the multiple regression.

Gender was treated as a binary variable taking the value 1 for male and 0 for female with reference category being female. The variable age was a continuous variable with a minimum age of 18 and a maximum age of 52 in this sample. Younger adults (18-25 years old) might be more influenced by tech and social media trends whereas, adults and middle-aged adults (26-44 years old and 46+ years older) might differ broadly in interests due to diverse life stages occurring in this life cycle such as being parents, career changes, experiences, seniorities and having different priorities (Sugarman, 2004).

Education level was a categorical variable coded as an ordinal scale ranging from 1 (high school) to 3 (master's degree or higher) (Mostafa, 2006). Dummy variables were created with the reference category being high school. Education has influence on an individual's ability to understand and interact with new technologies which could affect purchase intentions (van der Heijden et al.). Residence was coded as a categorical nominal variable with options as Asia, Europe, South America, Africa, Australia and other. Africa and North America were not included in the analysis as there were no respondents from this area collected through this survey. Geographical location could influence an individuals' consumer behaviour due to cultural, economic and market influences (Pookulangara & Koesler, 2011).

Income was measured in the survey using categorical ranges. In this research the categorical income data was treated as continuous variable using midpoints for each category (Denzin, 2020). This transformation enhances analytical power maintaining the ordinal nature of the data (Donaires et al., 2023). For the first income group less than €10.000 the midpoint

was set at €5.000. For the second income group between €10.000 - €24.999, the midpoint was set at €17.500. This method was equally performed for each income range and for the last income range representing the income group with incomes more than €100.000, the mid-point was set at €100.000 due to its open-ended nature. The assigned midpoints were equally spaced for each income range, and this variable was considered an interval variable (Liddell & Kruschke, 2018). As income influences an individual's purchase power it was important to be included as it could influence an individual's purchase intentions.

The employment status variable was a categorical nominal variable with the options of having a job, not having a job and others. For this research based on the data collected this variable was transformed into a binary variable with the options 1 for having a job and 0 for not being employed, as there were no respondents that were retired. Employment could impact an individual's purchase intentions as it effects purchasing power, disposable income and available free time (Bhat et al., 2021).

4. Results

In this chapter the descriptives, statistical analyses and their findings are provided. An independent t-test and multiple linear regression using ANOVA were the statistical analysis performed. The significant level used in the analysis was an alpha ($\alpha = 0.05$) of 5%.

4.1. Descriptive Statistics

The total data collected represented a sample of total of 236 respondents. A total of 12 respondents did not fill out the survey completely and therefore were excluded from the analysis. The remaining 224 respondents filled out the survey completely. There were between 55-57 respondents collected per condition. The average age of the respondents was 33 years old, with the total sample respondents age ranging from 18 to 52 years old. The gender distribution was quite balanced and equally represented. The male respondents accounted for 51.3% whereas 48.7% identified as female.

For the group who viewed the AR conditions consisting of 112 respondents the age category of respondents ranged between 18 to 52 years old. The average respondent in this group was 34 years old (mean) and the gender distribution consisted of 45.5% female and 54.5% male. The group who viewed the non-AR conditions consisted of the remaining 112 respondents ranging between the age of 21 to 46 years old. The average age (mean) of the respondent of this group was 32 years old. 51.8% of the respondents in this group were females and the remaining 48.2% were male individuals. Shortly, there were on average more females in the non-AR group compared to the AR group (figure 2).

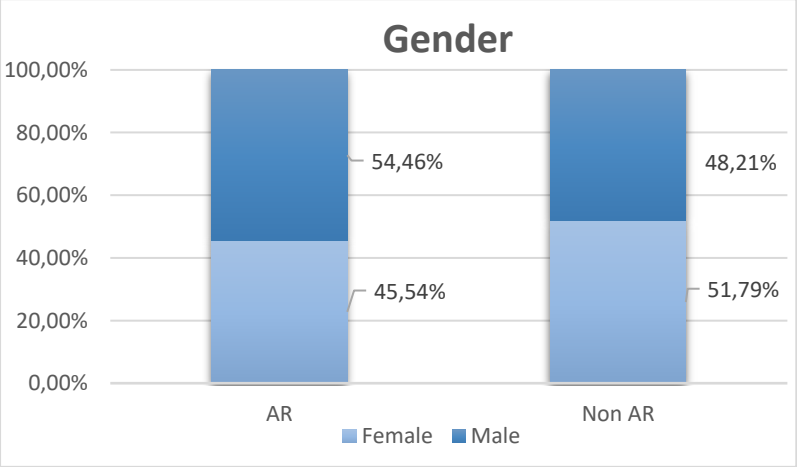


Figure 2 Gender distribution AR compared to non-AR in percentages.

Respondents from Europe made up 84.8% of the total sample, representing the majority. Other locations represented in the data collected were South America accounting for 13.39%, Asia representing 0.45%, Australia representing 0.89% and other regions of 0.45% not defined. Due to an uneven distribution, location was excluded from further analysis. Although the respondents educational background differed, most of the respondents did have a master's degree representing 55.80% of all the respondents. Which consisted of 61,6% of the respondents having a master's degree in the AR experiment group and 50,0% in the non-AR group. Shortly most of the respondents had a high level of education suggested that they might be more sceptical towards and more knowledgeable about emerging technologies such as Augmented reality.

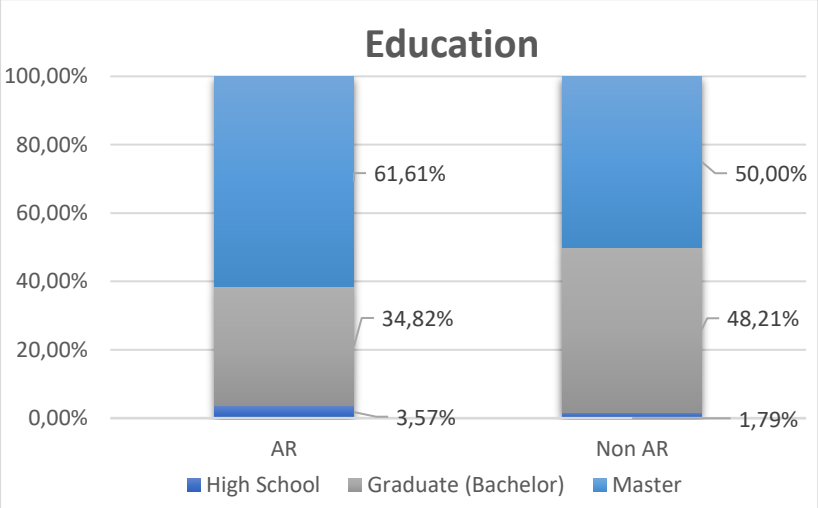


Figure 3 Education level AR compared to non-AR in percentages.

Majority of the respondents had a job, accounting for 95.98% of total respondents. Given the high employment rate in this sample it likely that this group had disposable income which was crucial for this research when examining purchase intentions. This group, being the largest, represented the middle-income class with an income between €44,000 - €75,000 annually, compromising 69.20% of the respondents. The total average (mean) annual personal income of the respondents in the sample was €57,979.91. The average (mean) income of the respondents in the AR group was €57,165.18 annually whereas for the participants in the non-AR group an average of €58,794.65 annually was reported. Three respondents preferred not to disclose their salary. Although the mean of income within group was quite similar the variability within groups presented by the standard deviations (Table 2) could still imply a variety in income through the conditions. The different ranges of income levels in this sample indicated a potential difference in purchasing power. The distribution of income for the AR and non-AR groups can be visualised in figure 4.

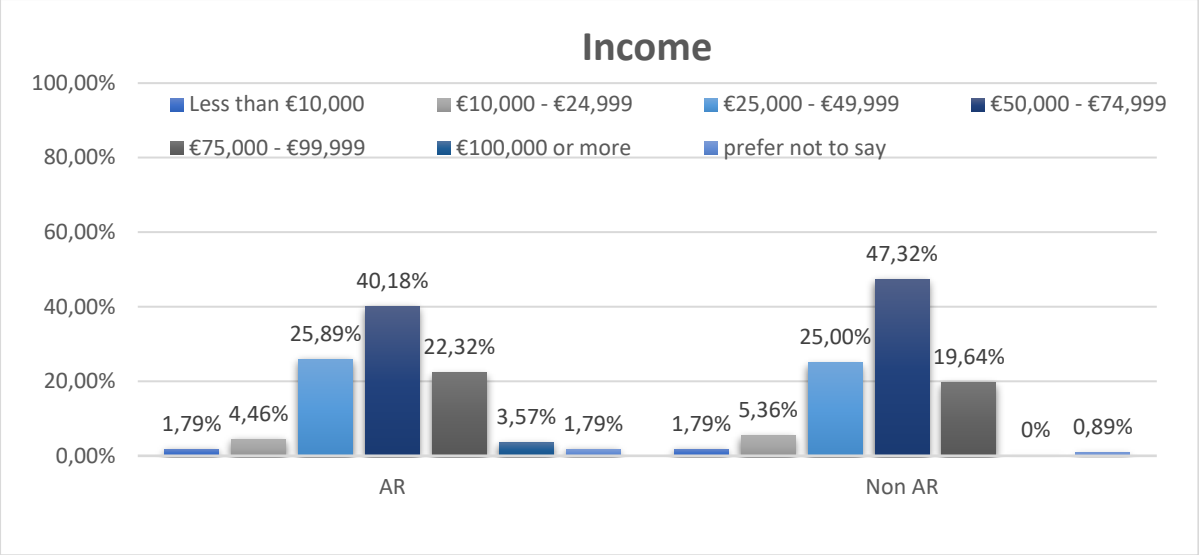


Figure 4 Income distribution in categories AR group versus non-AR group 2024

Table 1 Descriptive statistics Most frequent value per condition (percentage)

	Condition AR		**Total AR**	**Condition non-AR**		**Total non-AR**	**Total all conditions**
	High brand familiarity Xiaomi	Low brand familarity Mozo		High brand familiarity Xiaomi	Low brand familarity Mozo		
Age	37 (14.3%)	36 (16.1%)	35 (13.4%)	32 (12.3%)	35 (16.4%)	32 (11.6%)	35 (43.8%)
Gender	Male (55.4%)	Male (53.6)	Male (54.5%)	Female (54.4%)	Male (50.9%)	Female (51.8%)	Male (51.3%)
Residence	Europe (89.3%)	Europe (96.4%)	Europe (86.6%)	Europe (78.9%)	Europe (87.3%)	Europe (83.0%)	Europe (84.8%)
Education	Master (62.5%)	Master (60.7%)	Master (61.6%)	Bachelor (49.1%)	Master (50.9%)	Master (50%)	Master (55.8%)
Employee status	Have a job (96.4%)	Employed (96.4%)	Employed (96.4%)	Employed (93%)	Employed (98.2%)	Have a job (95.5%)	Employed (96.0%)
Income Individual	€50,000-€74,999 (35.7%)	€50,000-€74,999 (44.6%)	€50,000-€74,999 (40.2%)	€50,000-€74,999 (42.1%)	€50,000-€74,999 (52.7%)	€50,000-€74,999 (47.3%)	€50,000-€74,999 (43.8%)

Table 2 Descriptive statistics for Age and Income by AR usage (AR) and brand familiarity (High=Xiaomi and Low=Mozo)

Condition	N (age & Income)	Mean (age)	Minimum-Maximum (age)	Standard Deviation (age)	Mean (income)	Minimum-Maximum (income)	Standard Deviation (income)
AR, High brand familiarity	56	33	21 – 45	5.85	€58,839.29	€0 - €100,000	€23,898.29
AR, Low brand familiarity	56	34	18 - 52	6.22	€58,750.00	€0 - €100,000	€23,731.45
Non-AR, High brand familiarity	57	32	21 - 43	5.34	€55,043.86	€0 - €87,500	€22,763.79
Non-AR, Low brand familiarity	55	33	22 - 46	5.31	€59,363.64	€5,000 - €87,500	€19,809.38

4.2. Manipulation check and validity of brand familiarity and AR

An independent t-test was performed to assess whether the manipulation for Brand familiarity worked. The Levene's test for equality of variances showed whether the variances between both groups were equal. The p-value of 0.015<0.05 was significant at a significant level of 5%, ceteris paribus. Therefore, the variances were assumed not the be equal. The positive difference in means between the two groups was 0.367. The Xiaomi group reported a higher familiarity rating than the Mozo group. The mean familiarity of the Xiaomi group was 4.14. whereas the mean familiarity of the Mozo group was 3.77. Moreover, the t-test showed a significant effect with a positive T value of 3.193 and a p-value of 0.002, which is less than 0.05 at a 5% significant level (Table 3). This result indicated that there was a significant difference in how the participants perceived the brands which was the intended outcome.

Table 3 Independent t-test results for brand familiarity

Brand familiarity	Value F	Df	Sig.	T	Mean difference
Equal variances assumed	5.972	222	0.015	3.202 (0.002)***	

Equal variances not assumed	3.193 (0.002)***	0.367

*** p < 0.01, ** p < 0.05, * p < 0.10

Furthermore, to ensure that the respondents correctly identified the type of product visualization presented in the survey a manipulation check question was asked. About 52.2% of the participants correctly identified their experience as visualizing the smartwatch through an AR perception. Whereas 53.5% of the participants correctly identified their experience as visualizing the smartwatch through a 2D non-AR perception (appendix A, Table F). More than half of the participants did correctly perceive their experience as intended. To determine the effectiveness of the experimental condition and the participants' answers to the manipulation check question, a chi-square test was used, as shown in Table 4. The chi-square results showed that there was no significant result, with a p-value of 0.410 > 0.05 at a significant level of 5%. Suggesting that the manipulation of AR usage was unsuccessful.

Table 4 Chi-square test results for AR experience

Test	Value	Df	Sig.
Pearson Chi-square	0.679	1	0.410
N of valid cases	224		

*** p < 0.01, ** p < 0.05, * p < 0.10

4.3. Model fit

A multiple linear regression analysis was used to test the hypotheses for this research. This method is broadly used in consumer behaviour studies to be able to determine the effect between dependent variable and multiple independent variables. This method helps to analyse both main effects and interaction effects (Cohen et al., 2013). As in this study not only main effects were investigated but also the interactions between multiple factors, this method allowed for an examination of how the impact of AR on purchase intentions could possibly be different due to both brand familiarity and prior AR experience. The control variables were included as continuous variables (age and income) and dummy variables (gender, employment

and education) in the regression. For this research a significant level of 5% was used to strike the right balance in hypothesis testing avoiding being too liberally (10%) or too rigorously (1%) (Amrhein et al., 2017). Therefore, an alpha of 5% (α=0.05) was maintained. The ANOVA test was performed to investigate if the model fit the data well, using the F-test. An R-squared of 0.32 indicated that 32% of the variance in purchase intentions was explained by the independent variables in the model (Table 5). This amount of explanatory strength supported a moderate fit. The overall model had a p-value of $p < 0.001 < 0.05$ at a significant level of 5%, indicating that the overall regression model was significant.

Table 5 Model summary fit ANOVA

Purchase intentions	**F**	**R square**	**df**
Model 1	8.98*** (0.64)	0.32	11

*** p < 0.01, ** p < 0.05, * p < 0.10

4.4. Reporting results multiple linear regression analysis

The first hypothesis investigated whether the usage of AR in online environments positively influenced consumers' purchase intentions. This hypothesis was tested by performing a linear regression. The results of the regression performed are shown in Table 6. From Table 6 it was concluded that respondents who viewed a product presentation through AR, rated their purchase intentions on average 0.253 points lower than respondents who viewed the product presentation through non-AR, ceteris paribus. But this effect was not statistically significant with a p-value of 0.557>0.05, which is greater than 0.05 at a significant level of 5%. Consequently, the first hypothesis was rejected, concluding that the current AR implementation might not have been effective in influencing consumer's purchase intentions. The results of the first hypothesis showed that AR shopping experience solely did not positively impact purchase intentions, which is contrary to previous research suggesting AR increases consumer engagement and purchase intentions (Hilken et al., 2021).

When looking at the control variables it was noticeable that only employee status had a significant effect on purchase intentions with a p-value of $< 0.001 < 0.05$ at a significant level of 5%, ceteris paribus. The control variables reflected that most of the demographic and socio-

economic factors did not significantly play a role affecting purchase intention, although factors such as having more disposable income or age differences were expected to play a role.

The second hypothesis which stated that consumers with high brand familiarity would show higher purchase intentions compared to consumers with low brand familiarity, was also tested. Respondents with high brand familiarity reported their purchase intentions, on average 0.218 points higher than those with low brand familiarity. Although the positive coefficient supported this direction, the effect was not statistically significant, with a p-value of 0.075 > 0.05 at a significant level of 5%, ceteris paribus (Table 6). The effect is significant at 10% significance level, and the positive effect of brand familiarity on purchase intention is well-established in marketing (Campbell & Keller, 2003), therefore it is likely that the study lacks statistical power to identify the effect. Despite the positive coefficient, the second hypothesis formally was not supported, indicating that consumers with high brand familiarity did not report significantly higher purchase intentions in comparison to consumers with low brand familiarity.

The third hypothesis which stated that the effect of using AR on purchase intentions would be stronger for consumers with high brand familiarity than for those with low brand familiarity, was tested. As shown in Table 6, the interaction term had a p-value of 0.143 > 0.05 at a significant level of 5%, ceteris paribus indicating an insignificant effect. It was noticeable that the coefficient for the interaction term was negative -0.254 showing that the effect of AR might have had a weaker effect on a consumer's willingness to purchase for consumers with high brand familiarity compared to low brand familiarity. However, given the insignificance of the result, the effect of using AR on purchase intentions was the same for consumers with high brand familiarity compared to low brand familiarity, rather than stronger. Therefore, the third hypothesis was not supported.

The fourth hypothesis investigated whether the effect of AR on consumer purchase intentions was stronger for consumers with prior AR experience than for those with no AR prior experience. The results showed an insignificant interaction term with a P-value of 0.389>0.05, which is greater than 0.05 at a significant level of 5%, ceteris paribus. The positive coefficient of 0.368 showed that the effect of AR on consumer purchase intentions might have been stronger for consumers with prior AR experience compared to those without AR prior experience, however this result was not significant and therefore, there was no difference for

consumers with prior AR experience compared to without prior AR experience. The fourth hypothesis was not supported. Shortly having experience with AR did not significantly enhance the effectiveness of AR on purchase intentions.

With support of the multiple linear regression, the effect of AR on purchase intentions was explored through the hypotheses (Table 7). The first hypothesis which implied that the usage of AR in online environments positively influences consumers' purchase intentions was not supported, as using AR resulted into a lower purchase intention, although this result was not significant and therefore, no significant differences concluded. Additionally, high brand familiarity was associated with an increase in purchase intentions. However, this result was not significant. Therefore, the second hypothesis which stated that consumers who report high brand familiarity would show higher purchase intentions compared to consumers with low brand familiarity, was not supported. The third hypothesis which investigated the effect of AR on purchase intentions being stronger for consumers with high brand familiarity than for those with low brand familiarity was rejected. Finally, prior AR experience did not significantly influence the relationship between AR on purchase intentions, thus not supporting the fourth hypothesis, which investigated whether the effect of AR on consumer purchase intentions was stronger for consumers with prior AR experience than for those with no AR prior experience.

Table 6 Multiple linear regression of factors influencing purchase intentions.

	Purchase intentions
Variable	Dy/dx
AR used	-0.25 (0.43)
High brand familiarity	0.22* (0.12)
Prior AR experience	0.87** (0.34)
Age	0.01 (0.01)
Income	-0.00 (0.00)
Male	0.08 (0.09)
Bachelor[1]	-0.24 (0.30)
Master[1]	-0.02 (0.31)
Have a job	1.46*** (0.28)
Fam x AR	-0.25* (0.17)
Exp x AR	0.37 (0.43)
Observations	224
R^2	0.32

Note: Standard errors are in parentheses.

[1]Reference category for education is high school.

*** p < 0.01, ** p < 0.05, * p < 0.10

Table 7 Hypothesis support Table

Hypothesis		**Result**
H1	The usage of AR in online environments compared to an online shopping experience without AR, positively influences consumers' intentions to purchase smart wearables.	Rejected
H2	Consumers with high brand familiarity will report higher purchase intentions compared to consumers with low brand familiarity.	Rejected
H3	The effect of AR usage on consumers' purchase intentions is stronger for consumers with high brand familiarity than for those with low brand familiarity.	Rejected
H4	The effect of AR usage on consumer purchase intentions is stronger for consumers with prior AR experience than for those with no AR prior experience.	Rejected

5. Discussion and Limitations

In this section the research findings and theoretical findings from previous research are discussed. Academic and managerial implications are presented as well as shortcomings of this research. Lastly suggestions for further research are provided.

5.1. General discussion

This research explored how consumers' intentions to purchase smart wearables in an online setting are influenced by the presence of AR. The statistical results showed that, contrary to the predicted benefits of AR technology, it did not significantly increase purchase intentions in the way it was presented. The expected effects of brand familiarity and prior AR experience were not supported, showing the complexity of consumer behaviour in terms of new technology. Suggesting that the effectiveness of AR in an online retail environment may not have been completely captured in this research.

There could have been multiple reasons for the lack of significant effect of AR on purchase intentions. Customer engagement and enjoyment might have been impacted by the way the AR experience was designed. If the AR experience did not provide an exciting, unique, smooth and high qualitative experience, it could have impacted how the consumer perceived the experience and their level of engagement. Additionally, the effect may have been tempered by individual variances in their acceptance towards technology and the level of comfort with digital tools. While this study focused on smart wearables, specifically a smart watch, interest in this product could be different within the same product category but also across other product categories, where capturing the product in a person's own surroundings may have a greater impact.

The association between AR presence and purchase intentions was also investigated in respect to brand familiarity and prior AR experiences. The findings showed that this effect was not substantially strengthened by either one, an unexpected conclusion based on previous literature (Campbell & Keller, 2003) (Ha, 2006), which indicated that having high brand familiarity often increases a feeling of trust and acceptance towards new methods of digital marketing. Similarly, it was anticipated that participants with prior AR experiences would possibility be more responsive to AR features due to increased level of comfort and thus more

likely to enhance their shopping experience and purchase intentions (Venkatesh & Davis, 2000) (Kang et al., 2022). However, the insignificant moderation effects showed that other variables not included in this study might have played a crucial role in affecting how users both engaged with and perceive AR in terms of online shopping. Additionally, the negative coefficient found in the interaction between AR and brand familiarity, though not statistically significant, raises an interesting topic for further investigation. As it implies that customers who are more familiar with a brand may see a lesser impact from AR possibly because their purchase intentions are already shaped by their past exposure and trust in the brand. Although, this result is not clear it does emphasize the need for more research on this relationship between brand familiarity and emerging technologies as AR.

It is possible that the quality and realism of the AR experience offered in this research were not as convincing to recreate the actual experience. Jiang and Benbasat (2007) remarked the significance of interaction and vividness in online product displays and pointed out that these components greatly enhance consumers understanding and satisfaction. In this research, the AR experience might not have been as engaging and qualitative for consumers, underscoring the importance of investing in high-quality, specific AR systems that provide an interesting, understanding, smooth, high-quality, and enjoyable user experience.

Another element contributing to these results could have been consumers' comfort and familiarity with AR technology. Although AR is becoming more common, many consumers are still unfamiliar with the technology. Research has indicated that perceived utility and ease of use impact consumers' acceptance of technology (Davis, 1989) (Venkatesh & Davis, 2000). Purchase intentions may be neutral or negatively impacted by consumers who are less accustomed to or comfortable with AR, as they may not see its advantages. This emphasizes how important it is to provide example videos and create user friendly AR designs to assist consumers realize benefits of AR in their shopping experiences.

Depending on the environment and the type of goods, AR its impact on the purchasing experience can change. While AR for example can improve furniture and sneakers purchases, its impact on other product categories may not be as significant (Nawres et al., 2024). Certain products might need additional explanation or advanced technology to achieve benefits. It is crucial to ensure that AR is integrated through the whole shopping experience, offering tangible benefits and employing a customer-focused strategy to increase purchases. This means that the

interface should be designed to be not only entertaining but also useful, helping users make more informed purchases. These aspects might have been less emphasized in this research due to limited resources and budget.

5.2. Academic implications

The findings of this research made multiple contributions to the academic investigation of AR and consumer behaviour. The assumption that AR increases purchase intentions has been combatted showing that its effects are more complex and situation specific than previously thought. This emphasizes the necessity of conducting more detailed research into AR to determine the precise circumstances under which AR can be beneficial. Additionally, it highlights the importance of considering consumers attributes in research on digital marketing technologies, such as brand familiarity and prior AR experience.

In this research, these factors did not show significant results in moderating the relationship between AR and purchase intentions, but they remain of theoretical importance and warrant further investigation, especially given the contrary results observed. The findings showed that conventional models might need to account for the special characteristics, features and user interfaces of AR when extending these technologies to shopping experiences in an online environment. This contributes to the ongoing expansion of technology acceptance models in the context of online shopping.

5.3. Managerial implications

The findings of this research showed interesting and valuable insights for managers. It showed that the implementation of new technologies methods such as AR might require more careful consideration, as it may not be the only driver to increased consumer purchases. Retailers could concentrate on improving both the quality and user interface of AR shopping experiences to be certain that it is indeed entertaining and interesting enough to the consumers, for them to derive value and interact with the product, potentially leading to a purchase. Enhancing AR's visual and interactive components should be a top priority for businesses to make sure it significantly improves the purchase experience when shopping online and it adds tangible value to the overall customer journey.

This research also revealed that brand familiarity on its own might not have been a sufficient factor to greatly increase AR's effectiveness. For this reason, this finding suggests that businesses should not solely rely on brand familiarity but should be focussing on combining AR with more comprehensive marketing plans that gradually establish and strengthen brand awareness and trust. The findings contrasted previous research which had found that using AR in shopping experiences enhanced purchase intentions for highly familiar brands (Javornik, 2016). As shown in this research, high brand familiarity did not necessarily increase purchase intentions, even in presence of AR. Therefore, while high brand familiarity offers advantages in terms of customer loyalty, trust and recognition, the strategy used for online product presentation remains crucial. Businesses with high familiar brands should concentrate on showcasing distinctive product attributes and reinforcing their brand image with help of AR. This method can ensure that their online product displays are both engaging and effective in translating familiarity into actual purchases. Meanwhile AR provides the chance for new, less-known or younger businesses to establish credibility and brand awareness from the ground up. By embracing innovation through AR and showcasing a clear product excellence these businesses can make a noteworthy progress in their market positioning. By leveling the playing field it makes it possible for them to compete more against well-known rivals.

As consumers may still be uncomfortable with AR technology, businesses should focus on consumer education and assistance to be able to encourage the acceptance and effectiveness of AR technologies. Features for AR should be easily included into the whole online purchasing process. The perception of AR as untrustworthy or not representable, as opposed to a practical tool, is not likely to increase purchases. Therefore, it is important to make sure it is integrated seamless and user-friendly. By giving demonstrations, clear instructions and information of AR consumers can recognize its advantages, which enhances consumer acceptance and overall satisfaction. Providing consumers with a thorough and interesting purchasing experience, including AR. along with product descriptions, reviews and personalised recommendations, is essential.

Business should stay ahead of both consumers trends and technology improvements to stay competitive in the fast-evolving AR sector. Maintaining user interest and engagement with AR features requires constant innovation and refinement. Managers should investigate fresh

approaches to incorporate AR effectively into the online shopping experience and keep exploring new ways to enhance and interact with both their loyal and new customers.

5.4 Limitations and future research directions

This research showed some noteworthy limitations that could affect how broadly the results may be applied. One significant limitation pertains to the sample size and the demographic characteristics of the participants. This research lacked participant diversity, with 85% of the respondents being European. As a result, the information acquired might not have accurately reflected the broader population, particularly individuals from other regions with variety in cultural and economic contexts. Additionally, the sample was relatively homogenous, with the average age of the respondents being 33 years old, a group more prone to using technology, which could indicate that majority of the individuals might had less technological fear when it comes to AR. To improve the robustness of findings, future research should strive to include a larger and more varied sample.

Another limitation is that this research utilized a non-probability sampling method. This method, in which human-judgement could have impacted the sample selection, increased the likelihood that some people would be selected over others. Additionally, this method did not provide every individual in the population an equal chance of being selected (Taherdoost, 2016).

Moreover, this research focused on smart wearables as a product category, specifically testing a smartwatch, which means these findings might not apply to other smart wearable products. Future research should also examine the differences in other products within this category to determine which AR effects could be beneficial, as the impact of AR might be different for products where fit, and visualisation is crucial.

A potential research limitation also lies in the choice of brands used in this research, namely Xiaomi and a fictious brand Mozo. The global brand Xiaomi, which focuses on the European market with a market share of 35% (Counterpoint, 2023). Due to time and resource constraints this research only examined one product from Xiaomi – the smartwatch - among the numerous types of products offered including different designs by this brand. This narrows the focus where the difference in consumers' purchase intentions across different smart wearables is not captured.

Furthermore, there are many moderating factors to consider that could possibly affect the relationship between AR and purchase intentions, such as customer personality traits, cultural variations and technology literacy. To give a more thorough knowledge of the dynamics in this relationship future research should also take these elements into account. Similarly, in this research, it was only possible to test one AR product experience. This experience was a recreated AR experience, and the respondents were not able to actually try it out themselves, as would typically be the case with implementation of such technology. However, due to limited resources, the AR experience had to be recreated. Which therefore could have impacted the outcomes based on the quality of the experience and realism perceived by the respondents. The manipulation check for AR showed statistically insignificant results, which could indicate that the survey design was not as clear and distinctive. Future research could investigate the different effects of varying AR quality and realism on consumer behaviour.

Lastly to investigate the long-term impact of AR on consumer behaviour longitudinal research is required as this study only offered a glimpse into how consumers are responding to AR. It is important to investigate how these responses might change over to create successful AR strategies for online retailers. AR offers a lot of potential to improve online shopping experiences but the designed experience in this study might have not influenced purchase intentions enough. Therefore, to fully realize AR's potential in the online retail experience further investigation and experiences are required.

6. Conclusion

This research set out to investigate the impact of AR on purchase intentions within the smart wearable industry particularly in an online shopping context. Additionally, this research explored how brand familiarity and prior AR experience moderated this relationship. This research aimed to address a gap in the literature by investigating AR's role in smart wearables, with a particular concentration in a European population. The conceptual model was constructed based on earlier theories of AR, as well as brand familiarity and prior AR experience, as factors influencing customers' intentions to purchase.

This research conducted a variety of statistical methods, including t-test, chi-square test, Cronbach's alpha, normality test, and multiple linear regression analyses to achieve the purpose of this study. The results of the t-test validated the experimental manipulation by showing a significant difference between the group exposed to Xiaomi (high brand familiarity) and the group exposed to Mozo (low brand familiarity). However, the results of the chi-square test showed that there was not a clear distinction between the AR visual presentation and the non-AR visual presentation, questioning the validity of the AR manipulation. Reliability and normality tests further ensured the robustness of the data analysis.

The findings showed that, despite the theoretical potential of AR to improve online shopping experiences through dynamic and lifelike product presentations, the presence of AR as it was implemented in this online shopping experience, did not significantly increase consumers' purchase intentions. Moreover, neither brand familiarity nor prior AR experience significantly enhanced the effect of AR usage on purchase intentions. Surprisingly, purchase intentions were not substantially greater for brands with a high familiarity compared to those with low brand familiarity. This finding contradicted earlier studies that suggested brand familiarity usually lowers perceived risk, raises trust and thereby increases purchase intentions (Campbell & Keller, 2003). Similar to having prior AR experience showed an enhanced yet insignificant effect of AR on purchase intentions. This finding did not support the initial theory that having prior knowledge of AR technology would boost receptiveness and purchase intentions (Devagiri et al., 2022).

These overall findings imply that existing AR implementations may not be as interesting enough to influence a customer behaviour in a favourable way. Factors including

the design and quality of the AR experience, variations in individual technology adoption, and the specific focus on smartwatches likely played a role in these outcomes. Shortly, how well the AR technology is integrated in the whole shopping process could be essential in determining the effectiveness of AR shopping experiences.

For managers, the findings show that merely putting AR into practice is insufficient. In order to improve customer experience and drive purchase intentions, it must be carefully and strategically be integrated into the online shopping journey. This involves not only ensuring a high-quality and engaging product presentation but also aligning these experiences with broader marketing strategies.

Future studies should investigate these aspects in greater detail, looking at larger and more varied samples, various products, and various characteristics of AR. Understanding the nuances of how AR interacts with consumer behaviour across different contexts will be essential to realise AR its full potential in online shopping experiences.

7. Appendix

7.1. Appendix A

Table A Comparison table literature review

Research	Methodology	Manipulation	Mediator	Moderator	Key findings
Hamilton & Thompson, (2007)	Mixed design approach: between-subject design and within-subjects design.	Product experience (direct versus indirect) Product type (desirability and feasibility) Mental thinking (abstract and concrete) social distance (self and others)	Mental construal	Mental construal and Social Distance	Direct experiences lead to concrete thinking and presence for feasibility. Indirect experience with product led to abstract thinking and preference for desirability. Construal manipulation showed that making direct experiences more abstract did not significantly change preferences.
Jiang & Benbasat, (2007)	Survey method within laboratory environment. Randomly assigned to one of the four conditions. ANOVA and Partial Least Squares (PLS)	Vividness and interactivity	Shopping enjoyment		Vividness and interactivity on online product demonstrations has positive effect on diagnosticity, compatibility and shopping enjoyment. Moreover, encourages consumers attitude towards online shopping at a website increasing returns to the website. Vividness had a stronger effect than interactivity on shopping enjoyment.
Nawres et al. (2024)	Confirmatory factor analysis (CFA) and structural equation modeling (SEM)	Tactical input requirement. Luxury versus non-luxury	Satisfaction	Product type Luxury versus non luxury	AR positively influences response and trust, influencing satisfaction and influence purchase intent and Word of

					mouth. AR applications have a stronger impact on low tactical and luxury products.
Campbell and Keller (2003)	Controlled experimental design with a between-subject factor (familiar brand) and within-subject factor (ad repetition)	Familiar and unfamiliar brand names mentioned in the ads. Repetition of the ads at different levels.	Cognitive processing effects: negative tactic-related thoughts and perceived tactic inappropriateness	Brand familiarity	Ads for unfamiliar brands tend to wear out more quickly than ads for familiar brands. Better processing of repetition among ads for unfamiliar brands due to increase in negative tactic-related thoughts and perceived tactic inappropriateness
Ha (2006)	Survey method with different scenario evaluation focusing on the aspects of performance, financial, psychological and time risk	Perceived risk levels; performance, financial, psychological and time	Brand information	Perceived risk levels	Brand information reduces performance and search cost risk but does not significantly influence privacy and security concerns. Consumers perceptions of riskiness of online purchases can be managed through providing pre-purchase information. Such as brand information and customized information.
Venkatesh & Davis (2000)	Longitudinal study conducted in four organizations.	Voluntary and mandatory systems	System characteristics and social context	voluntariness	Both social influences and cognitive instrumental processes influence acceptance of technology. Explaining user adoption behavior.
Kang et al., (2022)	Surveyed 630 mobile users in the USA. Online panel	Showed different videos of AR apps	Trust	Self-determination	Importance of trust , expectancy-value and self-determination shaping consumer engagement with AR apps and influencing shopping behavior.

Table B Number of conditions

	High brand familiarity **Xiaomi**	**Low brand familiarity** **Mozo**
AR Experience	AR experience, Xiaomi (1)	AR experience, Mozo (2)
Non – AR Experience	Non-AR experience, Xiaomi (3)	Non-AR experience, Mozo (4)

Table C Questionnaire

Questions		**Response scale**
Introduction consent	Dear participant, Thank you for taking this 5-10 minutes survey. Your input is an important part of this research about Augmented Reality (AR) in shopping experiences. You are participating on a voluntary basis and can stop and withdraw whenever you want to. Confidential information or personal data relating to you is used for research purposes only and will not be publicised in any way. We appreciate your dedication to fill in this survey and look forward to receiving your feedback. The quality of our survey data is important to us, therefore, to get the most accurate measures of your opinions, it is important that you provide thoughtful answers in this survey. By agreeing you commit to stating honest opinions and providing thoughtful answers to each question, and declare that you are older than 18 years old . If you **agree** with the terms of this survey, please check the box below.	o I agree o I do not agree
AR definition	The purpose of AR technology in shopping experiences is to present customers with similar product experiences and information as in physical shopping stores. The picture below is an example of AR* technology used to virtually try-on sneakers in your own environment.  *Augmented reality (AR) is the integration of digital information with the user's environment in real time.	
1. AR Experience	Have you previously used AR technology for any purpose? *Augmented reality (AR) is the integration of digital information with the user's environment in real time.	o Yes o Not sure o No

2. AR Experience	To what extent do you agree or disagree with the following statements *Augmented reality (AR) is the integration of digital information with the user's environment in real time. 1. I am familiar with AR technology 2. If available, I make use of AR technology while shopping online	o Strongly disagree o Somewhat disagree o Neither agree nor disagree o Somewhat agree o Strongly agree
Introduction scenarios	In the next section, you will be presented with descriptions of **online shopping experiences for smartwatches**. These scenarios are designed to simulate the process of exploring and interacting with smartwatches from a selected brand. Your task is to read through the scenario presented to you carefully and imagine yourself in the described shopping experience as vividly as possible. After reading the scenario, you will be asked a series of questions about your perceptions and potential intentions based on the described experience. Please remember, **there are no right or wrong answers**. We are interested in your honest opinions and how you would feel in these shopping scenarios. Your responses will remain confidential and will be used solely for the purpose of this research. Proceed to the next page when you are ready to begin.	
Experiment	AR Xiaomi, AR Mozo, non-AR Xiaomi, non-AR Mozo (refer to appendix B)	
3. Purchase intentions	Based on the information showcased how likely are you to purchase this smart watch?	o Extremely unlikely o Somewhat unlikely o Neither likely nor unlikely o Somewhat likely o Extremely likely
4. Brand Familiarity	To what extent do you agree or disagree with the following statement. "XIAOMI/MOZO is a brand I am familiar with"	o Strongly disagree o Somewhat disagree o Neither agree nor disagree o Somewhat agree o Strongly agree
5. AR	"Which of the following best describes your recent interaction with the product presentation?	o I viewed the product in a three-dimensional space, where the product was virtually tried on including the smart watch features. (AR) o I viewed the product through standard images

		and descriptions without interaction in a three-dimensional space. (Non-AR)
6. Age	How old are you? (example: 22)	Open question
7. Gender	What gender you identify with?	o Male o Female o Non-binary/third gender
8. Residence	Where do you live?	o Asia o Europe o South America o Africa o Australia o North America o Other
9. Education	What is the highest degree of level of education that you have completed?	o High school o Graduate (Bachelor) o Master's degree or higher o Others
10. Employment	Are you currently employed?	o I am not employed o I have a job o I am retired o Prefer not to answer
11. Income	Which of the following best describes your personal income last year? *Please use all examples below when thinking about your overall income. If you do not know your exact income, please estimate. Wages, salary, commissions, bonuses, or tips for all jobs (Report amount before deductions for taxes, bonds, dues, or other items)	o Less than €10,000 o €10,000 - €24,999 o €25,000 - €49,999 o €50,000 - €74,999 o €75,000 - €99,999 o €100,000 or more o prefer not to say

Table D Description of all the variables and their coding: AR, brand familiarity, purchase intentions, prior AR experience, age, gender, residence, education, employee status and income status

Variable label	Value		Reference
AR	0.	Non-AR (reference)	(Olsson & Salo, 2011)
	1.	AR	
Brand Familiarity	0.	Mozo (reference)	(Martí-Parreño et al., 2017)
	1.	Xiaomi	
Purchase intentions	1.	Extremely likely	(Spears & Singh, 2004)
	2.	Somewhat likely	
	3.	Neither likely nor unlikely	
	4.	Somewhat unlikely	
	5.	Extremely unlikely	
Prior AR Experience	1.	Strongly disagree	(Andaç et al., 2016).
	2.	Somewhat disagree	
	3.	Neither agree nor disagree	
	4.	Somewhat agree	
	5.	Strongly agree	
Age		18 - 99	(Busija et al., 2007)
Gender	0.	Female (reference)	(Busija et al., 2007)
	1.	Male	
Education	1.	High school (reference)	(Mostafa, 2006).
	2.	Graduate (Bachelor)	
	3.	Master's degree or higher	
Employee status	0.	I am not employed (reference)	(Busija et al., 2007)
	1.	I have a job	
Income Individual	1.	Less than €10,000 (mid €5,000)	(Hughes et al.,2022).
	2.	€10,000 - €24,999 (mid €17,500)	
	3.	€25,000 - €49,999 (mid €37,500)	
	4.	€50,000 - €74,999 (mid €62,500)	
	5.	€75,000 - €99,999 (mid €87,500)	
	6.	€100,000 or more (mid €100,000)	
	7.	Prefer not to say (mid €0)	

Table E Descriptive statistics and independent sample t-test Brand familiarity

Rating	N	Mean	Min	Max	Std. Deviation	Standard Error Mean
Brand familiarity Xiaomi	113	4.14	3	5	0.705	0.066
Brand familiarity Mozo	111	3.77	1	5	0.988	0.094

*** p < 0.01, ** p < 0.05, * p < 0.10

Rating	T
Equal variances not assumed	3.19*** (0.12)

*** p < 0.01, ** p < 0.05, * p < 0.10

Table F Descriptive statistics cross Table manipulation check AR versus Non-AR manipulation check

Actual condition	Reported AR	Reported non-AR	Total
AR (1)	72 (52.2%)	40 (46.5%)	112 (50%)
Non-AR (0)	66 (47.8%)	46 (53.5%)	112 (50%)
Total	138 (100%)	86 (100%)	224 (100%)
	N	N	N

7.2. Appendix B.

7.2.1. Experiment AR, Xiaomi

Imagine you are exploring the latest smart wearable from **Xiaomi**, a global name in technology. You're using an advanced AR app on your smartphone, which allows you to project a 3D model of the smartwatch right onto your wrist. As you move your arm, the virtual watch stays perfectly in place, showcasing its sleek design and advanced features in real-time.

You zoom in to admire the craftsmanship, noticing the clarity of the display and the smooth finish. With a swipe, you toggle through various features all displayed in an immersive, interactive experience that feels almost tangible.

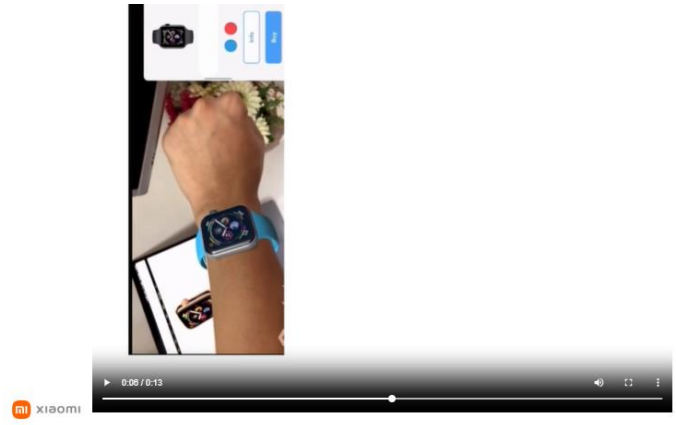
Click on "Next page" to begin the shopping experience!

"Opening the augmented reality app on your smartphone to explore the smartwatch collection"

"Browsing through various models. You tap on the smartwatch that caught your eye for a closer look."

You tap **'View in AR'** and point your phone's camera at your wrist. The smartwatch appears on your screen, as if it's on your wrist."

Click on " Next page" to visualize this experience through a video. Don't forget to click play.



Click on "Next page" to test some **features** on your wrist"

7.2.2. Experiment AR, Mozo

Imagine you are exploring the latest smart wearable from **Mozo**, a new brand in the smart wearables industry. You're using an advanced AR app on your smartphone, which allows you to project a 3D model of the smartwatch right onto your wrist. As you move your arm, the virtual watch stays perfectly in place, showcasing its sleek design and advanced features in real-time.

You zoom in to admire the craftsmanship, noticing the clarity of the display and the smooth finish. With a swipe, you toggle through various features all displayed in an immersive, interactive experience that feels almost tangible.

Click on "Next page" to begin the shopping experience!

"Opening the augmented reality app on your smartphone to explore the smartwatch collection"

"Browsing through various models. You tap on the smartwatch that caught your eye for a closer look."

You tap '**View in AR**' and point your phone's camera at your wrist. The smartwatch appears on your screen, as if it's on your wrist."

Click on " NEXT" to visualize this experience. Don't forget to click play.

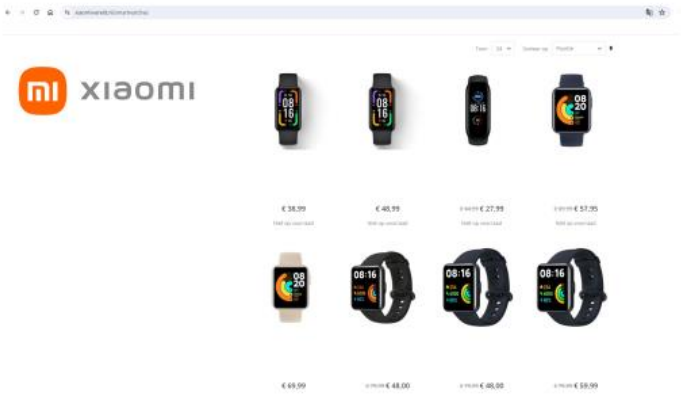
Click on "Next page" to test some **features** on your wrist"

7.2.3. Experiment non-AR, Xiaomi

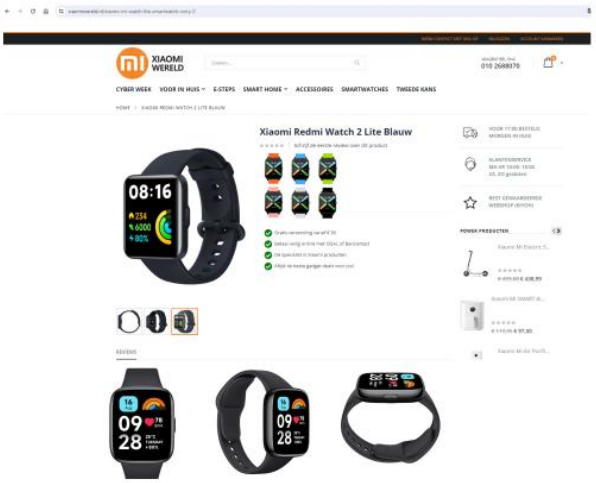
"Imagine you're exploring options for purchasing a new smartwatch, and while browsing online, you stumble upon **Xiaomi**—a global brand in the smart wearables industry, claiming to offer cutting-edge technology and stylish design at competitive prices. Navigate through **Xiaomi's** website to explore the smartwatch of your interest. Engage with crystal-clear images showcasing the smartwatch and from different angle, offering you a detailed view of its sleek design and innovative features. Read through the product descriptions to understand its capabilities. The comprehensive presentation of the smartwatch, through vivid images and informative descriptions will be displayed.

Click on "Next page" to view the smartwatch models.

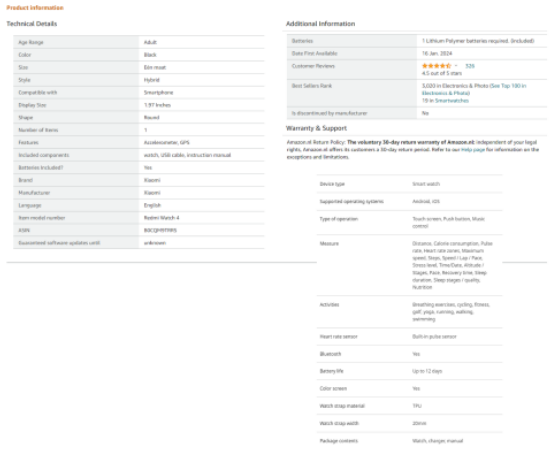
"View the smartwatch models of **XIAOMI** brand below. Click on "Next page" to select a model"



After viewing the possible **XIAOMI** smartwatch and the available colors in combination with the product visuals. Please select "Next page" to view the **features**.



Find below the specifications of the **XIAOMI** smartwatch. Click on "Next page" to continue your journey.

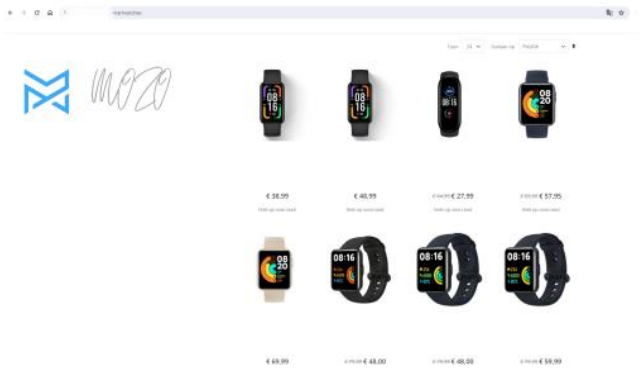


7.2.4. Experiment non-AR, Mozo

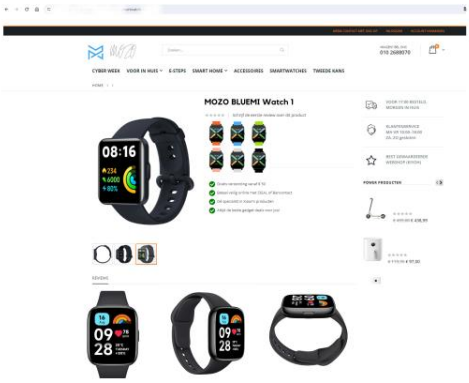
"Imagine you're exploring options for purchasing a new smartwatch, and while browsing online, you stumble upon Mozo—a new brand in the smart wearables industry, claiming to offer cutting-edge technology and stylish design at competitive prices. Navigate through **Mozo's** website to explore the smartwatch of your interest. Engage with crystal-clear images showcasing the smartwatch and from different angle, offering you a detailed view of its sleek design and innovative features. Read through the product descriptions to understand its capabilities. The comprehensive presentation of the smartwatch, through vivid images and informative descriptions will be displayed.

Click on "Next page" to view the smartwatch models.

"View the smartwatch models of **MOZO** brand below. Click on "Next page" to select a model"



After viewing the possible **MOZO** smartwatch and the available colors in combination with the product visuals. Please select "Next page" to view the **features**.



Find below the specifications of the **MOZO** smartwatch. Click on "Next page" to continue your journey.

Product information

Technical Details

Age Range	Adult
Color	Black
Size	Een maat
Style	Hybrid
Compatible with	Smartphone
Display Size	1.97 Inches
Shape	Round
Number of Items	1
Features	Accelerometer, GPS
Included components	watch, USB cable, instruction manual
Batteries Included?	Yes
Brand	Mozo
Manufacturer	Mozo
Language	English
Item model number	1
ASIN	B0CQHHTWR5
Guaranteed software updates until	unknown

Additional Information

Batteries	1 Lithium Polymer batteries required. (included)
Date First Available	16 Jan. 2024
Customer Reviews	4.5 out of 5 stars 326
Best Sellers Rank	3,020 in Electronics & Photo (See Top 100 in Electronics & Photo) 19 in Smartwatches
Is discontinued by manufacturer	No

Warranty & Support

Amazon.nl Return Policy: **The voluntary 30-day return warranty of Amazon.nl:** independent of your legal rights, Amazon.nl offers its customers a 30-day return period. Refer to our Help page for information on the exceptions and limitations.

Device type	Smart watch
Supported operating systems	Android, iOS
Type of operation	Touch screen, Push button, Music control
Measure	Distance, Calorie consumption, Pulse rate, Heart rate zones, Maximum speed, Steps, Speed / Lap / Pace, Stress level, Time/Date, Altitude / Stages, Pace, Recovery time, Sleep duration, Sleep stages / quality, Nutrition
Activities	Breathing exercises, cycling, fitness, golf, yoga, running, walking, swimming
Heart rate sensor	Built-in pulse sensor
Bluetooth	Yes
Battery life	Up to 12 days
Color screen	Yes
Watch strap material	TPU
Watch strap width	20mm
Package contents	Watch, charger, manual

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