

Who embraces augmented reality in fashion retail? Generational and gendered adoption pathways

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Abstract: This study examines how Spanish consumers perceive and adopt augmented reality (AR) in fashion retail, focusing on awareness, adoption, trust and perceived usefulness across generational cohorts and gender. To address this objective, the research combines a systematic literature review covering the period 2015–2024 with a cross-sectional online survey of 203 Spanish consumers aged 18–65. Descriptive statistics, chi-square tests, two-proportion Z-tests and Spearman correlations were used to analyse differences across segments. The findings show high overall awareness of AR, but substantial differences in adoption, trust and perceived usefulness. Generation Z and Millennials report higher levels of AR adoption, trust and usefulness than Generation X and Baby Boomers, while women show greater intention to use AR in fashion and beauty contexts and higher trust in AR-based experiences. The main barriers identified are limited access to compatible devices, doubts about technological accuracy in terms of fit, colour and realism, and privacy concerns regarding camera and biometric data. The study concludes that AR adoption in fashion follows segmented pathways rather than a uniform diffusion pattern. Fashion retailers should therefore tailor AR strategies to generational and gender segments, improve realism, simplify access and communicate data practices transparently to support more inclusive, trustworthy and sustainable retail experiences.

Keywords: *Augmented reality, Consumer adoption, Experiential shopping, Fashion retail, Generational and gender differences, Sustainable consumption, Technology acceptance.*

1. Introduction

Augmented Reality (AR) has rapidly transitioned from experimental pilots to mainstream technology in fashion retail, enabling real-time overlay of digital information on physical environments and allowing consumers to virtually visualize garments, accessories, and cosmetics before purchase (Azuma, 1997; Javornik, 2016; Rauschnabel, Felix, & Hinsch, 2019). Unlike Virtual Reality, which replaces the physical environment, AR enhances it, transforming traditional points of sale into hybrid spaces where digital content augments sensory and informational dimensions of the shopping experience (Caboni & Hagberg, 2019). Leading fashion and beauty brands such as Zara, Gucci, H&M, Sephora, and L'Oréal have integrated AR into mobile apps, websites, and in-store displays to reduce uncertainty, facilitate decision-making, and create memorable, shareable experiences that differentiate their value propositions in increasingly saturated markets (Bonetti, Warnaby, & Quinn, 2018; McLean & Wilson, 2019).

From a theoretical standpoint, AR in fashion is closely aligned with experiential marketing and the broader paradigm of Marketing 5.0. Experiential marketing posits that consumption decisions are shaped not only by functional attributes but also by sensory, emotional, and cognitive experiences generated during brand interactions (Lemon & Verhoef, 2016; Schmitt, 2010). In parallel, Marketing 5.0 emphasizes that technology should be deployed to humanize and enrich consumer–brand relationships, rather than merely optimize efficiency (Kotler, Kartajaya, & Setiawan, 2021). AR embodies this convergence: it enables physical experiences that combine the convenience of online retail with the sensory richness of

physical stores, fostering immersion, interactivity, and co-created value (Pantano, Pizzi, Scarpi, & Dennis, 2020). As such, AR has been positioned as a strategic enabler of experiential retail, supporting more personalized, engaging, and data-rich interactions across the customer journey (Rauschnabel, 2021).

At the same time, AR is increasingly discussed as a tool with potential sustainability benefits in retail. By improving size and fit assessment and providing richer product information before purchase, AR can help reduce product returns, unnecessary shipments, and associated packaging and transport emissions, which are critical issues in the fashion sector's environmental footprint. AR may also decrease reliance on physical samples and fitting-room trials, thereby contributing to more resource-efficient store operations and mitigating textile waste linked to over-ordering and mis-purchasing.

Despite the growing adoption of AR tools in fashion, important questions remain regarding how consumers perceive, trust, and effectively use these technologies. Previous studies suggest that AR can increase perceived usefulness and trust by reducing uncertainty about fit, colour, and style, thereby enhancing confidence in online purchases and reducing product returns (Hilken, De Ruyter, Chylinski, Mahr, & Keeling, 2017; Poushneh & Vasquez-Parraga, 2017). At the same time, the literature identifies substantial barriers related to implementation costs, unequal access to compatible devices, usability limitations, and privacy concerns arising from the use of cameras and biometric data (Javornik, 2016; Rauschnabel, 2021). These tensions are particularly salient in fashion, where the value of AR depends on both technological performance and the extent to which consumers feel comfortable, represented, and protected when engaging with virtual try-on experiences. Against this backdrop, a critical but underexplored issue concerns who embraces AR in fashion and under what conditions. Research in technology acceptance has consistently shown that perceived usefulness, perceived ease of use, and social influence shape adoption intentions (Davis, 1989; Venkatesh, Morris, Davis, & Davis, 2003). However, empirical evidence focused on AR in fashion remains fragmented, particularly with respect to age- and gender-based differences. Digital natives such as Generation Z and Millennials are often portrayed as enthusiastic adopters of immersive, mobile-centric experiences, whereas older cohorts like Generation X and Baby Boomers may display higher perceived risk and lower technological self-efficacy (Bonetti et al., 2018; Pantano et al., 2020). Similarly, gendered patterns emerge in fashion and beauty: women tend to show greater interest in virtual try-on tools and playful, social uses of AR, while men may concentrate usage on selected categories such as footwear or accessories (McLean & Wilson, 2019). Nevertheless, robust comparative evidence on how age and gender jointly shape awareness, adoption, trust, and perceived usefulness of AR in fashion is still limited.

Understanding these segmented adoption pathways is essential for both theory and practice. From a theoretical perspective, age and gender can be conceptualized as moderators that influence how AR's experiential and functional attributes translate into perceived value and behavioral intention within established acceptance frameworks (Javornik, 2016; Pantano et al., 2020). From a managerial perspective, ignoring generational and gendered differences risks designing AR experiences that are optimally tailored to early adopters but inadvertently marginalize older or less digitally confident consumers, thereby widening existing digital divides in access to advanced retail experiences. In a sector as segmented as fashion, where identity, aesthetics, and self-expression are central, AR strategies that do not account for heterogeneous adoption patterns may fall short of their potential or even backfire.

From a sustainability perspective, understanding who adopts AR, under what conditions, and with what level of trust and perceived usefulness is important because AR-enabled benefits, such as fewer returns and more informed, less impulsive purchasing, will only materialize if consumers actually use the technology. If adoption remains concentrated among younger, more digitally equipped consumers, the environmental and social gains associated with AR could be unevenly distributed, raising questions about digital inclusion in sustainable retail transitions.

Addressing these gaps, this article analyzes the impact of AR on consumer behavior in the fashion industry by combining a systematic review of academic literature (2015–2024) with an empirical study based on a survey of 203 Spanish consumers aged 13–65. The study focuses on four core constructs identified in prior research: awareness, adoption, trust, and perceived usefulness, and examines how they

vary across generational cohorts (Generation Z, Millennials, Generation X, and Baby Boomers) and gender. Specifically, the research pursues three questions: (1) What are the levels of awareness, adoption, trust, and perceived usefulness of AR in fashion among Spanish consumers? (2) How do these variables differ across generational cohorts and between women and men? and (3) How can AR be configured as a strategic and inclusive enabler in the transition toward experiential fashion retail?

By integrating insights from experiential marketing and technology acceptance with segmented empirical evidence, this study makes three contributions. First, it conceptualizes generational and gender differences as distinct AR adoption pathways in fashion, rather than treating age and gender as mere control variables. Second, it provides statistically grounded evidence on how awareness, trust, and perceived usefulness evolve across cohorts and between genders, highlighting key levers and barriers for AR-based strategies. Third, it derives managerial implications for tailoring AR implementations to specific consumer segments and for advancing more inclusive and responsible digital transformation in fashion retail.

2. Literature Review

2.1. *Conceptualization of Augmented Reality*

Augmented Reality (AR) was initially defined by Azuma (1997) as the real-time integration of digital information with the physical environment, enabling users to perceive computer-generated content superimposed onto their surroundings. Subsequent work has expanded this definition by emphasizing AR's capacity to generate immersive experiences that seamlessly blend tangible and virtual elements, thereby enhancing users' perception of reality rather than replacing it (Javornik, 2016; Rauschnabel et al., 2019). Unlike Virtual Reality (VR), which transports users into fully virtual environments, AR operates as a complementary layer that enriches physical contexts with interactive, often personalized information, making it particularly suitable for domains where physical product interaction remains central, such as fashion retail (Caboni & Hagberg, 2019).

Within the broader landscape of Industry 4.0 and Marketing 5.0, AR is increasingly conceptualized as a pivotal technology that connects technological innovation, consumer experience, and value creation (Kotler et al., 2021; Pantano et al., 2020). In fashion, AR applications enable consumers to visualize garments, accessories, and cosmetics on their own bodies or in their immediate environment, reducing uncertainty and enhancing confidence in purchase decisions (Hilken et al., 2017). These capabilities position AR not merely as a novelty but as a strategic resource that supports more informed, engaging, and experiential consumer journeys.

2.2. *Applications of AR in Retail and Fashion*

AR applications in retail have diversified rapidly, encompassing virtual fitting rooms, interactive catalogues, in-store navigation, product visualization in context, and campaign-driven filters and lenses on social media platforms (Bonetti et al., 2018; Rauschnabel, 2021). In fashion, virtual try-on experiences allow consumers to assess how garments or accessories might look without physically trying them on, which can streamline decision-making, reduce returns, and encourage experimentation with styles and combinations that might otherwise be overlooked (Poushneh & Vasquez-Parraga, 2017). Similar dynamics are observed in cosmetics, where AR tools allow users to simulate makeup looks in real time, often leading to higher engagement and conversion rates (McLean & Wilson, 2019).

Major brands such as Gucci, Zara, H&M, Sephora, and L'Oréal have integrated AR into mobile apps, e-commerce platforms, and in-store experiences, illustrating how AR can support omnichannel strategies by connecting online and offline touchpoints (Bonetti et al., 2018; Caboni & Hagberg, 2019). These initiatives have contributed to the emergence of "physical" retail environments, where physical and digital dimensions are intentionally blended to create coherent, experience-oriented value propositions (Pantano et al., 2020). In this context, AR is not only a functional tool for product evaluation but also a driver of entertainment, social sharing, and brand storytelling.

2.3. AR and Experiential Marketing

Experiential marketing emphasizes emotions, sensory stimulation, and interactive engagement as central to value creation, suggesting consumers prefer memorable experiences over merely functional benefits (Lemon & Verhoef, 2016; Schmitt, 2010). AR aligns with this approach by enabling multisensory, interactive, and playful experiences, which can enhance immersion, perceived control, and enjoyment during shopping (Hilken et al., 2017). In fashion, where identity, aesthetics, and self-presentation are vital, AR enriches the symbolic and emotional aspects of consumption by allowing consumers to experiment with styles in low-risk, creative ways.

Recent research indicates that AR can enhance perceived diagnosticity, the sense that information is useful and reliable for evaluating products, while simultaneously fostering hedonic value through novelty, entertainment, and social sharing (Hilken et al., 2017; Javornik, 2016). Moreover, AR supports value co-creation: consumers actively participate in constructing their experience by manipulating virtual content, selecting scenarios, and sharing outcomes with peers. This aligns with broader trends toward personalization and co-designed experiences, particularly among younger cohorts such as Generation Z and Millennials, who tend to demand interactive and customizable interactions with brands (Pantano et al., 2020).

2.4. Consumer Trust, Perceived Usefulness, and Adoption

Consumer adoption of innovative technologies has traditionally been analyzed through models such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), which highlight perceived usefulness, perceived ease of use, and social influence as core determinants of behavioral intention (Davis, 1989; Venkatesh et al., 2003). In the context of AR in fashion, perceived usefulness often stems from the technology's ability to reduce uncertainty about product attributes such as size, fit, color, and style, thereby increasing confidence in purchase decisions (Hilken et al., 2017; Poushneh & Vasquez-Parraga, 2017).

Trust plays a multifaceted role in AR adoption. On the one hand, trust in the technology, its accuracy, reliability, and performance, affects whether consumers believe AR-based recommendations and visualizations (Rauschnabel, 2021). On the other hand, trust in the brand and in the handling of personal and biometric data influences perceptions of privacy, security, and fairness (Javornik, 2016; Rauschnabel, 2021). If consumers perceive that AR applications misuse data, exaggerate product benefits, or provide unrealistic visualizations, their trust can decline, undermining adoption even when the technology is functionally capable. Consequently, perceived usefulness and trust are interdependent constructs that jointly shape attitudes and intentions toward AR in fashion.

Despite these insights, empirical research on AR adoption in fashion remains relatively fragmented, with many studies focusing on single cohorts, specific use cases, or limited sets of variables (Bonetti et al., 2018; Pantano et al., 2020). There is a need for more comprehensive analyses that examine awareness, adoption, trust, and perceived usefulness across diverse consumer segments simultaneously.

2.5. Limitations and Challenges in AR Implementation

Alongside its potential benefits, AR faces several challenges that can hinder its effective implementation in fashion retail. First, the development, integration, and maintenance of AR solutions can entail substantial financial and technical costs, particularly for small and medium-sized enterprises with limited resources (Pantano et al., 2020). Second, AR experiences typically require relatively recent mobile devices and stable connectivity, which can exacerbate digital divides and exclude consumers without access to the necessary hardware or data plans (Javornik, 2016).

A third challenge relates to accuracy and realism. Discrepancies between virtual visualizations and actual product appearance, such as differences in colour, texture, or fit, can generate frustration, disappointment, and perceptions of deception, especially when expectations are not properly managed (Hilken et al., 2017). Finally, AR applications often rely on cameras, facial recognition, and biometric data, raising concerns about privacy, surveillance, and potential misuse of sensitive information (Rauschnabel,

2021). If these issues are not addressed transparently and responsibly, they can erode trust and limit the long-term viability of AR-based strategies in fashion.

Together, these limitations underscore that AR adoption is not solely a question of technological capability but also of accessibility, user-centered design, and ethical data governance. For fashion brands, this implies the need to balance innovation and experiential richness with inclusivity, realism, and privacy protection.

2.6. Conceptual Framework of the Study

Building on the reviewed literature, this study proposes a conceptual framework in which AR in fashion influences consumer behavior primarily through three interrelated dimensions: perceived usefulness, trust, and adoption, with age (generational cohort) and gender shaping these relationships.

Perceived usefulness refers to the extent to which consumers believe that AR helps them evaluate fashion products more accurately and make better purchase decisions, particularly by reducing uncertainty about fit, colour, and style (Davis, 1989; Hilken et al., 2017). Trust encompasses both confidence in the technology's performance and realism, and trust in the brand's handling of personal and biometric data (Rauschnabel, 2021). Adoption is conceptualized as actual or intended use of AR applications in fashion contexts, ranging from occasional experimentation to regular reliance on AR during the purchase journey (Venkatesh et al., 2003).

Age and gender are expected to influence these relationships. Younger consumers (Generation Z and Millennials) tend to be more familiar with mobile technologies and immersive experiences, which may lead to higher perceived usefulness, greater trust, and increased adoption of AR compared to older cohorts (Generation X and Baby Boomers) (Bonetti et al., 2018; Pantano et al., 2020). Gender differences are also anticipated, especially in categories such as clothing and cosmetics, where women may attribute greater experiential and symbolic value to AR-based virtual try-on tools and thus display higher levels of trust and adoption (McLean & Wilson, 2019).

Accordingly, the empirical analysis examines four core constructs, awareness, perceived usefulness, trust, and adoption, across generational cohorts and gender. The framework guides the comparative analyses and supports the interpretation of segmented adoption pathways identified in the data. Figure 1 illustrates the proposed conceptual framework.

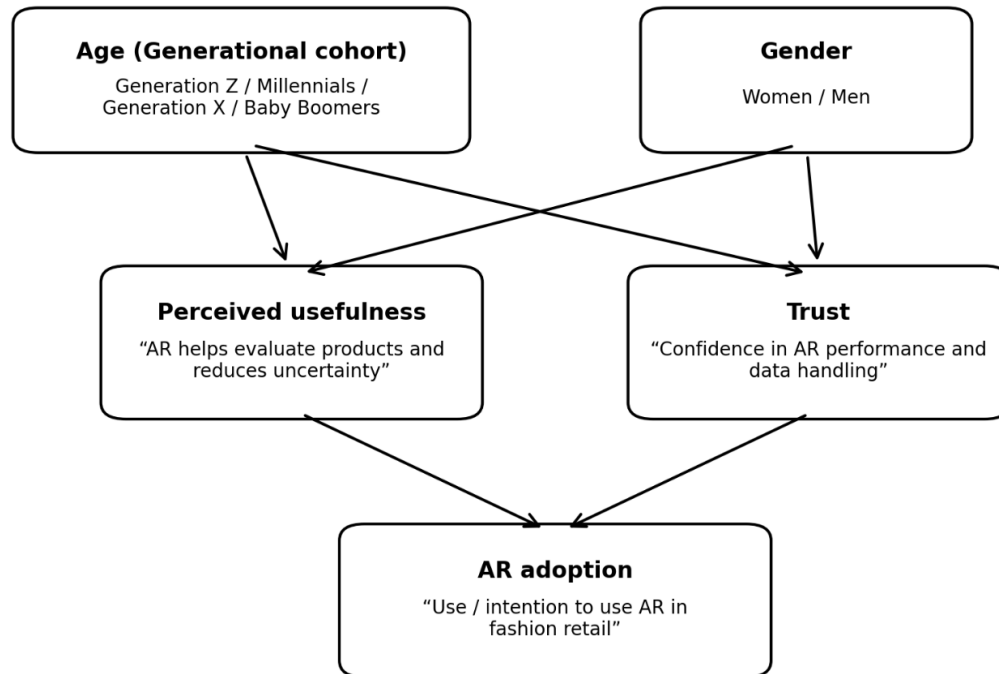


Figure 1.

Conceptual framework of generational and gendered AR adoption pathways in fashion retail. Age (generational cohort) and gender shape perceived usefulness and trust in AR, which in turn influence AR adoption in fashion contexts.

3. Methodology

3.1. Research Design

This study adopts a mixed-methods research design combining a systematic review of academic literature (2015–2024) with a cross-sectional survey of Spanish consumers. The dual approach serves two complementary purposes. First, the systematic review synthesizes the state of knowledge on AR in fashion and retail, clarifying how prior studies have conceptualized perceived usefulness, trust, and adoption, and where gaps remain regarding age- and gender-based differences. Second, the empirical survey provides quantitative evidence on levels of awareness, adoption, trust, and perceived usefulness of AR in fashion, as well as their variation across generational cohorts and gender in a specific national context.

The systematic review followed PRISMA guidelines to ensure transparency and replicability in study identification, screening, and inclusion. Searches were conducted in Web of Science, Scopus, and Google Scholar using combinations of keywords such as “augmented reality,” “fashion retail,” “virtual try-on,” “consumer behavior,” and “experiential marketing.” Inclusion criteria required that studies (a) were published between 2015 and 2024, (b) were written in English or Spanish, (c) addressed AR applications in retail or fashion-related contexts, and (d) reported empirical findings on consumer perceptions, trust, or adoption. Editorials, opinion pieces, and purely technical computer science papers without a consumer focus were excluded. The final corpus was analyzed to identify recurrent constructs, methodological approaches, and unresolved questions related to segment-based adoption.

The empirical study involved an online survey aimed at measuring consumers’ awareness, adoption, trust, and perceived usefulness of AR in fashion retail, along with key sociodemographic variables. The questionnaire was based on constructs from literature on technology acceptance and AR in retail (Davis, 1989; Hilken et al., 2017; Javornik, 2016; Venkatesh et al., 2003) and included items for perceived usefulness (e.g., “Using AR helps me make better fashion purchase decisions”), trust (e.g., “I trust AR applications to represent products realistically”), and adoption (self-reported usage and intention to use

AR in fashion contexts). The overall design is descriptive and comparative, with inferential analyses used to examine differences by generational cohort and gender.

3.2. Sample and Procedure

The survey targeted Spanish consumers aged between 13 and 65 years. A non-probabilistic convenience sampling strategy was employed, using online distribution channels such as university mailing lists, social media, and personal networks. While not representative of the entire Spanish population, this approach enabled access to a diverse set of respondents across age groups and genders, which is consistent with the study's comparative objectives.

The final sample comprised 203 respondents ($M = 31.7$ years; $SD = 11.4$). In generational terms, 32% belonged to Generation Z (18–25 years), 38% to Millennials (26–40 years), 20% to Generation X (41–55 years), and 10% to Baby Boomers (56–65 years). Regarding gender, 54% of the participants identified as female and 46% as male. This structure allows meaningful comparisons across cohorts that differ in digital socialization and across genders in a sector where product categories and communication often follow gendered patterns.

Participation was voluntary and anonymous. Respondents were informed about the study's purpose, the approximate completion time, and data confidentiality. Only individuals who reported having at least some exposure to fashion-related shopping (online or offline) in the previous twelve months were included, ensuring relevance of the context. Given the exploratory and comparative aims, the sample size is considered sufficient to detect medium-sized differences across groups in proportions and mean scores, as supported by standard power considerations for chi-square and correlation tests.

3.3. Measures and Analysis

The questionnaire comprised several blocks. The first covered sociodemographic variables (age, gender, education, frequency of fashion purchases). Age was later recoded into generational cohorts following widely used classifications (Generation Z, Millennials, Generation X, Baby Boomers). The second block assessed awareness and adoption of AR in fashion through dichotomous and ordinal items (e.g., awareness of AR tools, prior use of virtual try-on applications, frequency of use). The third block measured perceived usefulness and trust using Likert-type items (1 = strongly disagree; 5 = strongly agree) adapted from established technology acceptance and AR scales (Davis, 1989; Hilken et al., 2017; Rauschnabel, 2021). The final block included open-ended questions about perceived barriers and concerns, which provided qualitative context for interpreting quantitative findings.

Data analysis proceeded in several steps. First, descriptive statistics summarized awareness, adoption, perceived usefulness, and trust for the overall sample and by segment. Second, inferential tests were conducted to examine group differences: chi-square tests and two-proportion Z-tests for categorical variables (e.g., adoption rates by cohort and gender), and non-parametric correlations (Spearman's rho) for the association between age (ordinal) and perceived usefulness or trust. Third, where appropriate, additional regression analyses can be estimated to explore how age, gender, perceived usefulness, and trust jointly predict AR adoption, although the core results reported focus on the comparative and correlational patterns.

All analyses were performed using standard statistical software. Significance levels were set at $p < .05$, with effect sizes interpreted following conventional benchmarks (Cohen, 1988; Field, 2018). The combination of descriptive, inferential, and qualitative evidence supports a nuanced understanding of how generational and gendered pathways shape AR adoption in fashion retail.

4. Results

4.1. Awareness, Adoption, Trust, and Perceived Usefulness

Overall, awareness of AR in fashion retail was high among Spanish consumers. A large majority of respondents reported having heard about or seen AR applications in at least one retail context, and a substantial proportion had encountered AR specifically in fashion or cosmetics. However, awareness did

not always translate into active use. While younger consumers reported frequent experimentation with virtual try-on tools in mobile apps and social media platforms, many older respondents indicated that they had not yet tried AR or had done so only once.

Perceived usefulness and trust showed moderate to high mean scores, suggesting that, when used, AR is generally seen as helpful for evaluating products and reducing uncertainty, particularly regarding fit and appearance. At the same time, open-ended responses indicated that some consumers remain skeptical about the realism of AR visualizations and express concerns about how images and biometric data are processed. This combination of high awareness, uneven adoption, and mixed attitudes toward accuracy and data practices sets the stage for examining how AR adoption pathways differ across generational cohorts and gender.

4.2. Differences by Generation

To provide an overview of generational patterns, Table 1 summarizes AR adoption, trust, and perceived usefulness for each age group. The figures reveal a clear gradient, with Generation Z and Millennials reporting substantially higher levels on all three dimensions than Generation X and Baby Boomers.

Table 1.
AR adoption, trust, and perceived usefulness by generational cohort (%).

Age Group	Adoption	Trust	Perceived Usefulness
Generation Z (18-25)	78.4	80.2	84.6
Millennials (26-40)	64.7	65.3	69.8
Generation X (41-55)	34.6	40.5	44.7
Baby Boomers (56-65)	15.2	19.7	25.4

Note: Values indicate the percentage of respondents in each age group who report using AR in fashion-related contexts at least once, expressing high trust in AR, and perceiving AR as useful for evaluating fashion products.

Generational differences emerged clearly across all core constructs. Younger cohorts, particularly Generation Z and Millennials, reported higher levels of AR adoption, trust, and perceived usefulness than Generation X and Baby Boomers. The association between age and AR adoption was statistically significant, with younger respondents more likely to have used AR for virtual try-on of garments, accessories, and cosmetics. Additionally, age correlated negatively with perceived usefulness, indicating a progressive decline in perceived value as consumers move from younger to older cohorts.

Generational differences in AR adoption are significant. Generation Z and Millennials exhibit the highest usage levels, with approximately three-quarters and two-thirds of respondents, respectively, having used AR in fashion-related contexts at least once. In contrast, about one-third of Generation X and only one in ten Baby Boomers have done so. As shown in Figure 1, AR adoption declines sharply from younger to older cohorts, confirming that digital natives are the primary drivers of AR diffusion in fashion retail.

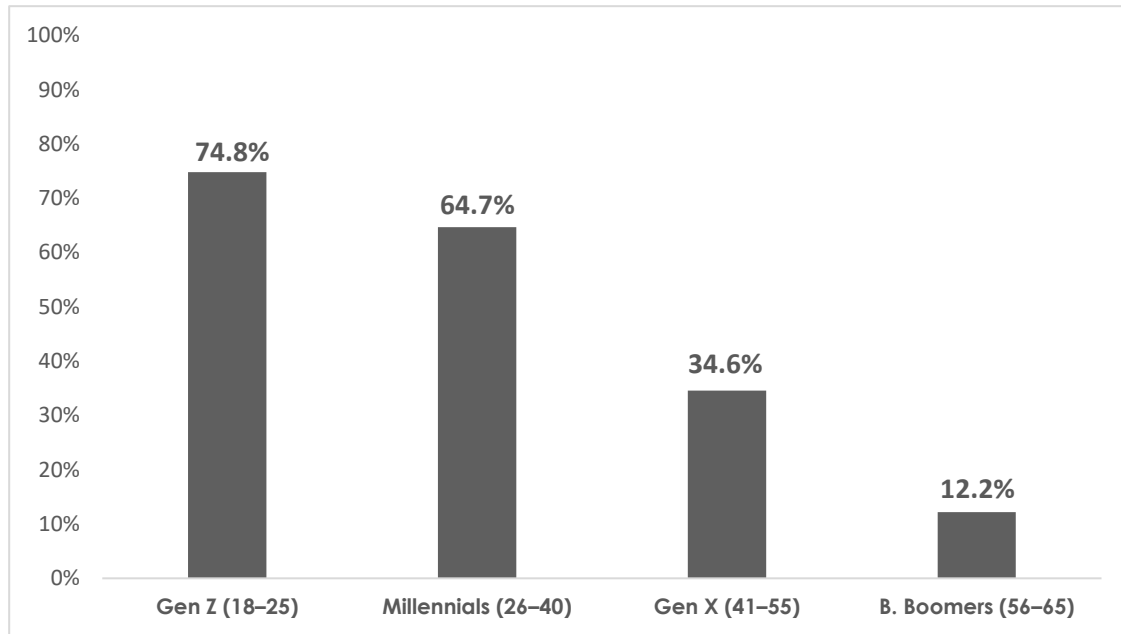


Figure 2.

AR adoption by generational cohort (%).

Note: The figure displays the percentage of respondents in each age group who report having used AR in fashion-related contexts at least once.

These patterns are consistent with prior research that identifies digital natives as key drivers of retail digitalization and early adopters of immersive technologies (Bonetti et al., 2018; Pantano et al., 2020). In the present study, many Generation Z and Millennial respondents described AR-based experiences as “fun,” “practical,” and “time-saving,” while older participants were more likely to characterize AR as “unnecessary,” “complicated,” or “not for me.”

Trust in AR follows a similar pattern. Approximately 80% of Generation Z and 65% of Millennials report high levels of trust in AR applications, compared with 40% of Generation X and only 20% of Baby Boomers. Figure 2 illustrates this progressive decline in trust across cohorts, suggesting that older consumers are not only less likely to adopt AR but also less inclined to perceive AR-based representations as reliable.

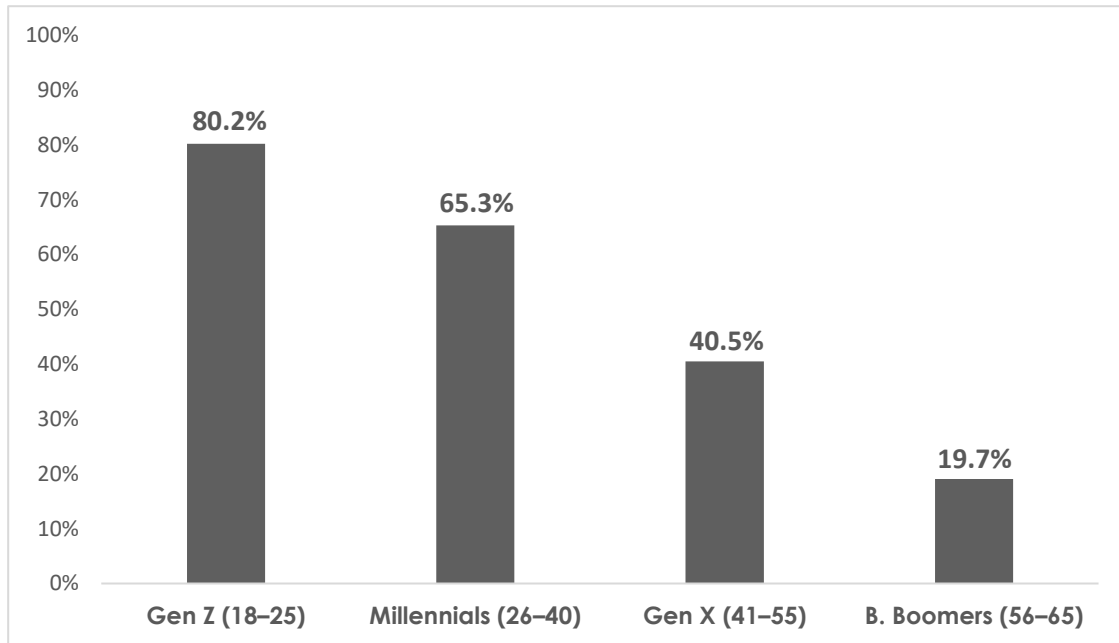


Figure 3.

Trust in AR by generational cohort (%).

Note: The figure shows the percentage of respondents in each age group who indicate high trust in AR applications used in fashion retail.

Perceived usefulness also decreases with age. Around 85% of Generation Z and 70% of Millennials view AR as useful for evaluating fashion products, compared to 45% of Generation X and 25% of Baby Boomers. As shown in Figure 3, perceived usefulness mirrors adoption and trust patterns, reinforcing that older cohorts derive less functional and experiential value from AR in fashion retail.

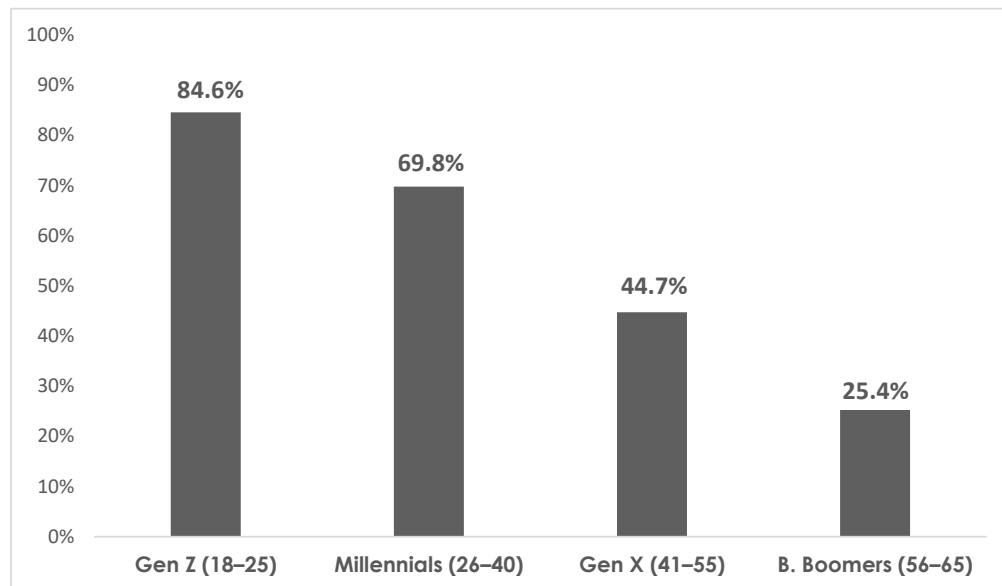


Figure 4.

Perceived usefulness of AR by generational cohort (%).

Note: The figure depicts the percentage of respondents in each age group who consider AR useful for evaluating fashion products and making purchase decisions.

The negative association between age and perceived usefulness is further confirmed by the ordinal correlation analysis. A Spearman coefficient of $\rho = -0.26$ ($p < .001$) indicates a moderate, statistically significant decline in perceived usefulness as age groups increase. Figure 4 summarizes this pattern, showing a clear downward slope in perceived usefulness from Generation Z to Baby Boomers.

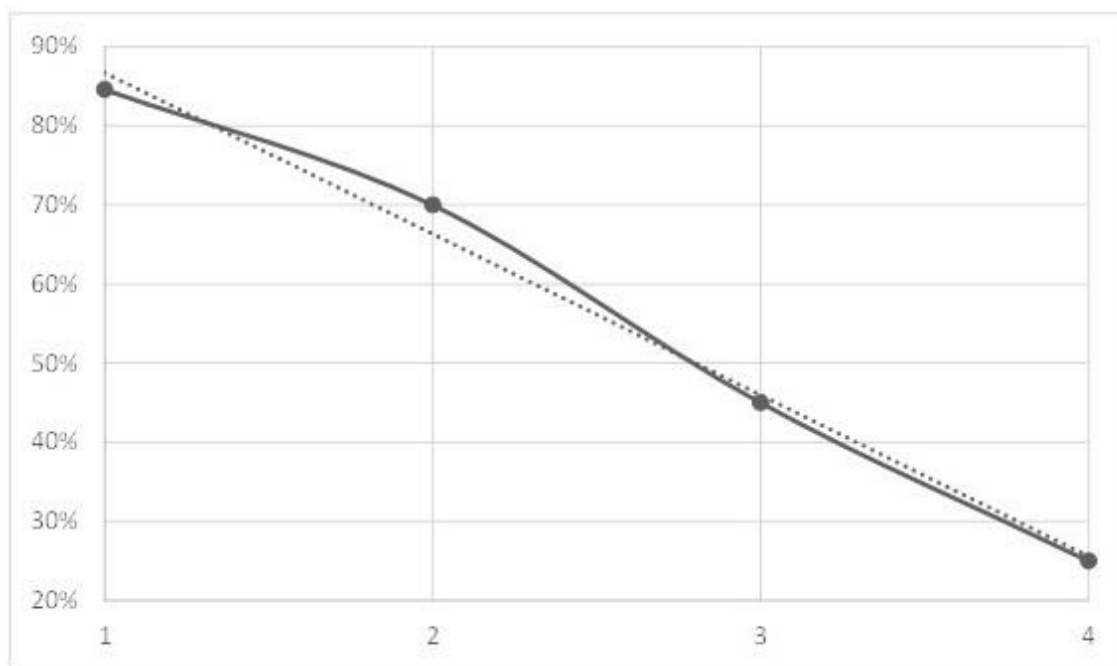


Figure 5.

Age (ordinal) versus perceived usefulness of AR.

Note: The scatterplot represents the average perceived usefulness of AR for each age-group code (1 = Generation Z, 4 = Baby Boomers), highlighting the negative trend across cohorts.

These descriptive patterns are supported by inferential analyses. Chi-square tests confirm significant associations between age and AR adoption, as well as between gender and the intention to use AR; correlation analyses show that age is negatively related to intention and perceived usefulness; and a two-proportion Z-test indicates that women report significantly higher trust in AR than men. Table 2 summarizes the main test statistics, effect sizes, and p-values for these relationships.

Table 2.

Summary of statistical tests for AR adoption, intention, trust, and perceived usefulness.

Test	Test Statistic	Effect Size	p-value
χ^2 (Age x Adoption)	$\chi^2 (3) = 8.62$	$V = 0.206$	$p = 0.035$
χ^2 (Gender x Intention)	$\chi^2 (4) = 14.68$	-	$p = 0.005$
Spearman (Age x Intention)	$\rho = -0.259$	-	$p < 0.001$
Spearman (Age x Usefulness)	$\rho = -0.260$	-	$p < 0.001$
Z-test (Gender x Trust)	$Z = 2.14$	-	$p < 0.05$

The table reports chi-square tests for associations between age and adoption, gender and intention, Spearman correlations between age and intention/usefulness, and a Z-test comparing trust in AR by gender. Effect sizes and p-values are shown for each test.

4.3. Differences by Gender

Gender-based analyses revealed that women generally reported a higher willingness to use AR applications in fashion and cosmetics than men. Women were more likely to describe AR as an engaging and useful tool for exploring outfits, experimenting with looks, and making more confident purchase decisions, particularly in categories closely tied to self-presentation and aesthetics. Men, by contrast, exhibited lower adoption rates and tended to restrict AR use to selected product types such as footwear, sportswear, or accessories.

Gender differences are also evident. Women report higher AR adoption (55% vs. 45% among men), greater trust in AR applications (62% vs. 50%), and higher perceived usefulness (68% vs. 55%). Figure 5 shows that women consistently score above men on all three dimensions, reinforcing the view that AR currently resonates more strongly with female consumers in fashion and beauty categories.

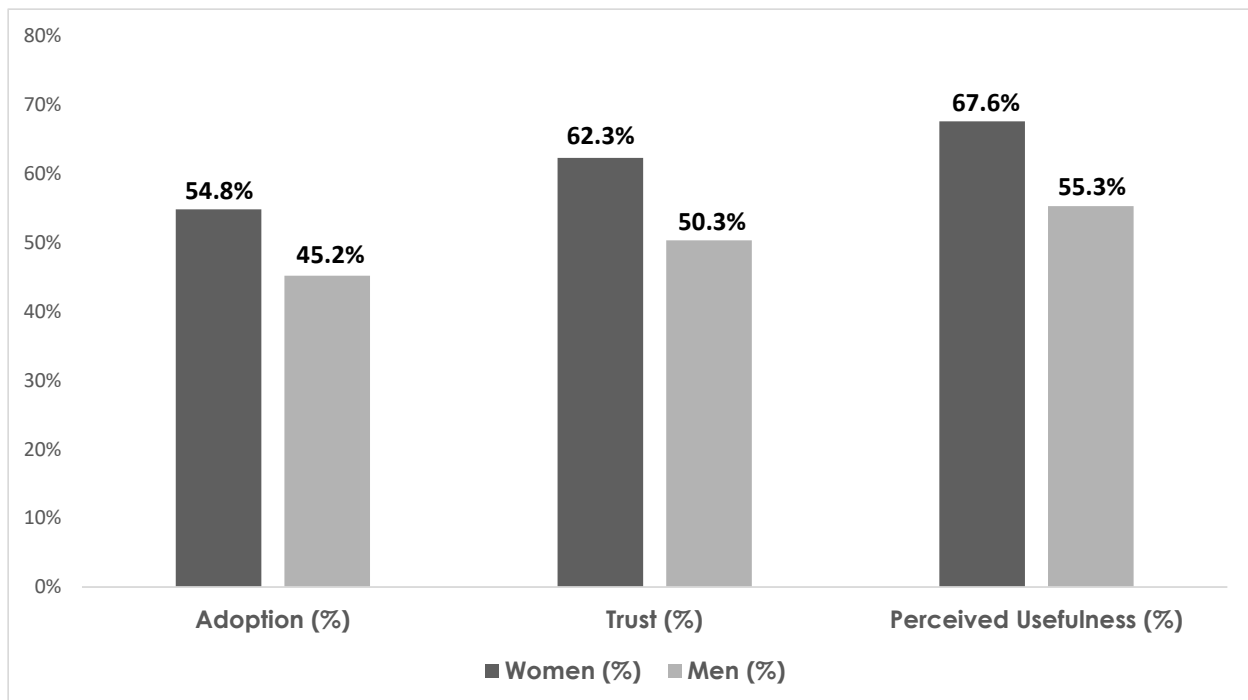


Figure 6. AR adoption, trust, and perceived usefulness by gender (%).

The grouped bars compare the percentage of women and men who report using AR, trusting AR applications, and perceiving AR as useful in fashion-related contexts.

A two-proportion Z-test confirmed that women reported significantly higher trust in AR than men, suggesting that gender not only affects adoption but also shapes perceptions of AR-based experiences' credibility and reliability. This pattern aligns with earlier findings in the cosmetics sector, where AR applications increased engagement and purchase intentions among women by combining utility with playful and social elements (McLean & Wilson, 2019). In the fashion context, these results indicate that AR can be particularly effective for female-oriented segments, while male consumers may require different forms of value articulation and interface design to perceive AR as worthwhile.

4.4. Reported Obstacles

Open-ended responses shed light on why many consumers, particularly in older cohorts, remain hesitant to embrace AR in fashion retail. Three types of obstacles emerged consistently: limited access to compatible technology, doubts about the accuracy and realism of AR visualizations, and concerns

regarding privacy and data security. These barriers help explain why high levels of awareness do not automatically translate into widespread adoption, especially among Generation X and Baby Boomers.

Limited access to suitable devices and connectivity was frequently mentioned by older respondents, who indicated that their smartphones or tablets were either too old to run AR applications smoothly or not used intensively enough to justify installing them. Some participants also reported a lack of guidance or support in learning how to use AR tools, reinforcing perceptions that such technologies are “for younger people” or “too complicated.” These access constraints contribute to a digital divide in experiential retail, whereby the most immersive and informative tools are disproportionately available to younger, more tech-savvy consumers.

Accuracy doubts represented a second major barrier. Respondents across age groups expressed frustration when virtual try-on experiences did not faithfully reproduce product characteristics such as colour, size, or fit. Instances where the garment looked different in reality than in AR reduced confidence in the technology and, in some cases, led consumers to abandon AR altogether. These experiences suggest that perceived realism is not a secondary attribute but a core condition for sustained AR adoption in fashion.

Privacy and data security concerns form the third obstacle. Many respondents felt uneasy about granting AR applications access to their camera, facial images, or body measurements, and were unsure how this data might be stored, processed, or shared. Such concerns were especially salient among older consumers and those less familiar with digital platforms, who sometimes associated AR with broader anxieties about surveillance and misuse of personal information. As shown in Figure 6, these three types of obstacles vary in prevalence across generational cohorts, with older groups more likely to cite limited access and younger groups more likely to emphasize privacy risks.

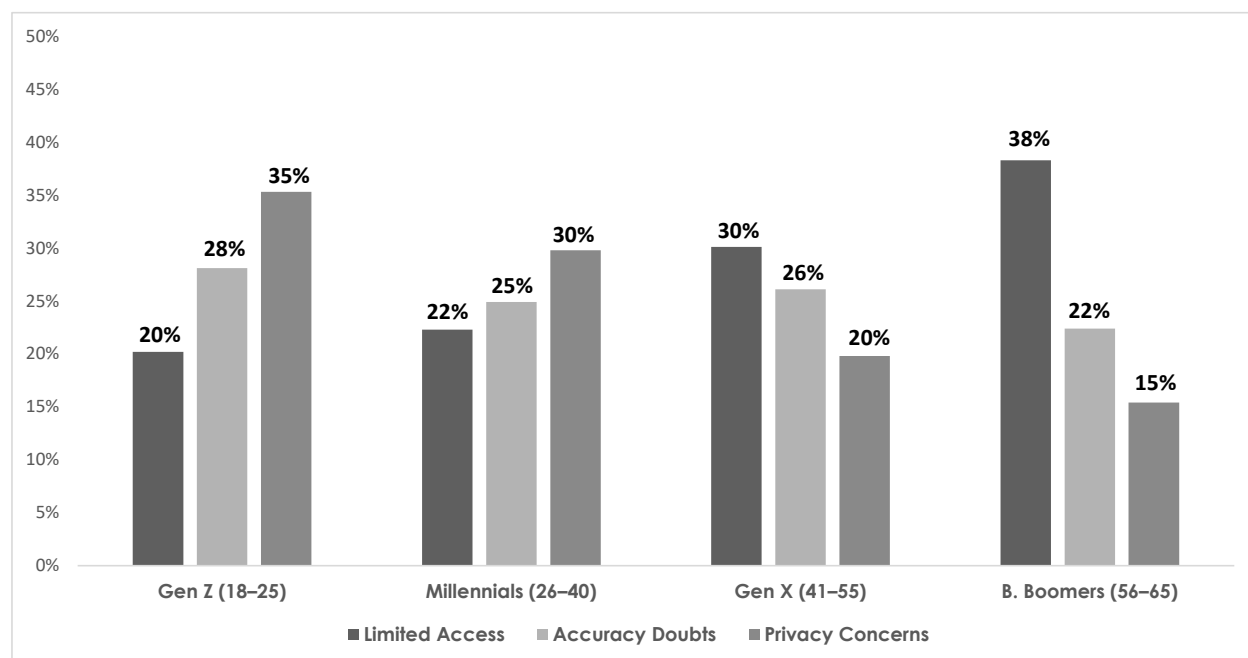


Figure 7. Perceived obstacles to AR adoption by generational cohort (%).

The figure presents the percentage of respondents in each age group who mention limited access, doubts about accuracy, and privacy concerns as barriers to using AR in fashion retail.

5. Discussion

The findings confirm the strategic role of AR as an experiential technology in fashion retail, while revealing that its benefits are unevenly distributed across generational cohorts and genders. Consistent with prior work on AR in retail (Hilken et al., 2017; Poushneh & Vasquez-Parraga, 2017), the results show that AR can reduce uncertainty about product fit and appearance, enhance perceived usefulness, and foster trust in online purchases. However, the present study extends this literature by demonstrating that these effects are strongly conditioned by age- and gender-based adoption pathways, rather than being uniform across consumers.

5.1. Generational Adoption Pathways

The significant decline in AR adoption, trust, and perceived usefulness from Generation Z and Millennials to Generation X and Baby Boomers indicates that age is a critical segmentation variable in AR-based fashion strategies. Younger consumers, who grew up with smartphones, social media, and immersive digital content, are more likely to view AR as both useful and enjoyable, aligning with prior evidence that digital natives are early adopters of emerging retail technologies (Bonetti et al., 2018; Pantano et al., 2020). By contrast, older cohorts tend to perceive AR as less relevant, more complex, or not worth the effort, and report lower levels of trust in AR representations.

These results nuance traditional technology acceptance perspectives (Davis, 1989; Venkatesh et al., 2003) by highlighting age not simply as a background control variable but as a determinant of the strength and direction of key relationships. In the context of AR in fashion, the link between perceived usefulness and adoption appears much stronger among younger cohorts, whereas for older consumers, even moderate usefulness may not translate into actual use if perceived complexity and risk remain high. The negative correlation between age and perceived usefulness suggests that, for older consumers, AR's value proposition is not yet clearly articulated or tailored to their needs.

5.2. Gender Engagement with AR

Gender differences add another layer to these segmented adoption pathways. Women report higher adoption, trust, and perceived usefulness of AR than men, particularly in fashion and beauty categories where self-presentation and aesthetics play a central role. This pattern is consistent with research showing that women engage more deeply with AR-based cosmetics apps that blend functional and playful components (McLean & Wilson, 2019) and extends these insights to the broader fashion context.

From a theoretical standpoint, these findings suggest that gender influences how consumers incorporate AR into their experiential and self-expressive practices. For many women in the sample, AR functions as a creative tool that facilitates exploration and experimentation, enhancing confidence and enjoyment during shopping. For men, AR may still be perceived as peripheral or limited to specific product types, indicating that current AR designs and communications are more aligned with female-oriented usage scenarios. This gendered engagement highlights the need for more differentiated AR experiences that address diverse motivations and categories.

5.3. Barriers, Digital Divides, and Responsible Implementation

The obstacles identified, limited access, accuracy doubts, and privacy concerns, underscore that AR adoption is not solely a question of technological capability or individual willingness. Limited access to compatible devices and connectivity, more prevalent among older cohorts, highlights a digital divide that can restrict who benefits from advanced experiential tools in fashion retail. Accuracy doubts reveal that consumers are sensitive to discrepancies between virtual and real product attributes, and that repeated mismatches can undermine both trust in AR and trust in the brand. Privacy concerns, particularly regarding cameras and biometric data, reflect broader anxieties about surveillance and data misuse that can deter adoption even among otherwise interested users.

These barriers carry implications for responsible and inclusive digital transformation. If AR implementations primarily serve younger, well-equipped, and privacy-tolerant consumers, they risk

reinforcing existing inequalities in access to information and experiential value. Addressing this tension requires brands to invest in clearer communication about data practices, more realistic and transparent visualizations, and user support strategies that lower entry barriers for less digitally confident consumers. In this sense, AR in fashion should be designed not only for maximal engagement but also for fairness, accessibility, and informational integrity.

From a sustainability standpoint, the identified adoption pathways and barriers have direct implications for the environmental performance of fashion retail. AR's potential to reduce returns, transport emissions, and resource use in fitting processes depends on sustained, widespread use across customer segments. If AR adoption remains concentrated among younger consumers and women, then the environmental benefits of reduced mis-purchasing and improved product–consumer matching will accrue primarily to these groups, while others continue to rely on more resource-intensive shopping patterns. Conversely, if AR experiences are designed and governed in ways that enhance realism, accessibility, and privacy protection for older and less digitally confident consumers, AR can support a more inclusive transition toward sustainable fashion consumption.

5.4. Theoretical Contributions

The study makes three main contributions to the literature on AR and fashion marketing. First, it conceptualizes age and gender as drivers of distinct AR adoption pathways, rather than treating them as static controls. By integrating generational and gendered analyses within a unified framework of perceived usefulness, trust, and adoption, the study clarifies how sociodemographic factors shape technology acceptance in experiential retail contexts. Second, it provides empirical evidence on the combined role of usefulness, trust, and sociodemographic factors in AR adoption, thereby extending classic TAM and UTAUT formulations to a high-involvement, identity-relevant category such as fashion. Third, it highlights the importance of considering digital divides and ethical concerns when evaluating AR's impact, suggesting that responsible AR implementation must address not only effectiveness and engagement but also accessibility, realism, and data governance.

5.5. Managerial Implications

For fashion managers, the findings suggest that AR strategies should be explicitly segmented by generational cohort and gender. For younger consumers, particularly Generation Z and Millennials, AR can be positioned as a central component of experiential retail, emphasizing novelty, personalization, and social sharing. For older cohorts, communication should focus more on practical benefits, such as reducing returns, clarifying fit, and saving time, while simplifying interfaces and providing guidance to reduce perceived complexity. Given women's higher adoption, trust, and perceived usefulness, AR investments in fashion and beauty categories targeting female audiences are likely to yield strong returns, but opportunities also exist to redesign AR experiences that resonate more with male consumers.

Beyond purely commercial considerations, managers should treat AR as part of a broader responsibility agenda in digital transformation. Ensuring realistic visualizations, clearly communicating how data are used and protected, and designing experiences that do not exclude consumers with older devices or lower digital skills can help align AR initiatives with principles of inclusivity and ethical technology use.

6. Limitations and Future Research

This study has several limitations that open avenues for future research. First, the empirical analysis is based on a non-probabilistic convenience sample of Spanish consumers, which limits the generalizability of the findings to other cultural and market contexts. Cross-cultural studies comparing AR adoption pathways across countries with different levels of digitalization, fashion cultures, and privacy norms would help validate and refine the segmented patterns identified here.

Second, the cross-sectional design prevents drawing conclusions about causal relationships or changes in perceptions over time. Longitudinal research could examine how repeated exposure to AR,

evolving interface quality, and learning effects shape perceived usefulness, trust, and adoption across the life course, especially as AR becomes more pervasive in retail and social media environments. Experimental designs manipulating factors such as realism, data transparency, or device type would also provide stronger causal evidence regarding key antecedents of AR acceptance.

Third, the study focuses on a limited set of constructs: awareness, adoption, perceived usefulness, and trust, guided by technology acceptance theory and experiential marketing. Future research could incorporate additional psychological and social variables, such as perceived enjoyment, perceived risk, self-efficacy, or social norms, to capture more complex motivational patterns, especially in identity-relevant categories like fashion. It would also be valuable to explore how personality traits, values, and body image concerns interact with age and gender in shaping AR adoption pathways.

Fourth, the measurement of adoption relies primarily on self-reported use and intention, which may be subject to recall bias and social desirability. Integrating behavioral data from AR applications, such as usage logs, session length, and conversion rates, would allow for more precise assessments of adoption and engagement. Finally, while this study highlights issues of digital divides and data governance, it does not directly analyze regulatory frameworks or organizational practices. Future work could examine how policy interventions, industry standards, and firm-level governance mechanisms influence the responsible deployment of AR in fashion retail.

7. Conclusions

Augmented Reality is reshaping fashion retail by enabling immersive, interactive experiences that bridge online and offline environments. This study shows that the benefits and challenges of AR are not evenly distributed: younger cohorts and women are more likely to adopt, trust, and perceive AR as useful, while older consumers report lower engagement and greater access and privacy concerns. These segmented adoption pathways highlight the importance of treating age and gender as central variables in both theory and practice.

By integrating a systematic literature review with empirical evidence from Spanish consumers, the article extends technology acceptance and experiential marketing perspectives to a highly symbolic domain where identity and aesthetics are central. The findings suggest that AR's strategic potential in fashion depends on careful segmentation, inclusive design, and responsible implementation that addresses digital divides, accuracy expectations, and data protection. For researchers and practitioners alike, the challenge is not only to design more engaging AR experiences but also to ensure that these experiences are accessible, trustworthy, and aligned with broader goals of fair and sustainable digital transformation.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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References

- Azuma, R. T. (1997). A survey of augmented reality. *Presence: Teleoperators & Virtual Environments*, 6(4), 355-385. <https://doi.org/10.1162/pres.1997.6.4.355>
- Bonetti, F., Warnaby, G., & Quinn, L. (2018). *Augmented reality and virtual reality in physical and online retailing: A review, synthesis and research agenda*. In *Augmented reality and virtual reality*. Cham, Switzerland: Springer.
- Caboni, F., & Hagberg, J. (2019). Augmented reality in retailing: A review of features, applications and value. *International Journal of Retail & Distribution Management*, 47(11), 1125-1140. <https://doi.org/10.1108/IJRDM-12-2018-0263>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.); Lawrence Erlbaum.

- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319-340. <https://doi.org/10.2307/249008>
- Field, A. (2018). *Discovering statistics using IBM SPSS statistics* (5th ed.). London, United Kingdom: SAGE.
- Hilken, T., De Ruyter, K., Chylinski, M., Mahr, D., & Keeling, D. I. (2017). Augmenting the eye of the beholder: Exploring the strategic potential of augmented reality to enhance online service experiences. *Journal of the Academy of Marketing Science*, 45(6), 884-905. <https://doi.org/10.1007/s11747-017-0541-x>
- Javornik, A. (2016). Augmented reality: Research agenda for studying the impact of its media characteristics on consumer behaviour. *Journal of Retailing and Consumer Services*, 30, 252-261. <https://doi.org/10.1016/j.jretconser.2016.02.004>
- Kotler, P., Kartajaya, H., & Setiawan, I. (2021). *Marketing 5.0: Technology for humanity*. Hoboken, NJ: Wiley.
- Lemon, K. N., & Verhoef, P. C. (2016). Understanding customer experience throughout the customer journey. *Journal of Marketing*, 80(6), 69-96. <https://doi.org/10.1509/jm.15.0420>
- McLean, G., & Wilson, A. (2019). Shopping in the digital world: Examining customer engagement through augmented reality mobile applications. *Computers in Human Behavior*, 101, 210-224. <https://doi.org/10.1016/j.chb.2019.07.002>
- Pantano, E., Pizzi, G., Scarpi, D., & Dennis, C. (2020). Competing during a pandemic? Retailers' ups and downs during the COVID-19 outbreak. *Journal of Business Research*, 116, 209-213. <https://doi.org/10.1016/j.jbusres.2020.05.036>
- Poushneh, A., & Vasquez-Parraga, A. Z. (2017). Discernible impact of augmented reality on retail customer's experience, satisfaction and willingness to buy. *Journal of Retailing and Consumer Services*, 34, 229-234. <https://doi.org/10.1016/j.jretconser.2016.10.005>
- Rauschnabel, P. A. (2021). Augmented reality is eating the real-world! The substitution of physical products by holograms. *International Journal of Information Management*, 57, 102279. <https://doi.org/10.1016/j.ijinfomgt.2020.102279>
- Rauschnabel, P. A., Felix, R., & Hinsch, C. (2019). Augmented reality marketing: How mobile AR-apps can improve brands through inspiration. *Journal of Retailing and Consumer Services*, 49, 43-53. <https://doi.org/10.1016/j.jretconser.2019.03.004>
- Schmitt, B. (2010). *Experiential marketing: How to get customers to sense, feel, think, act, relate*. New York: Free Press.
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view1. *MIS Quarterly*, 27(3), 425-478. <https://doi.org/10.2307/30036540>