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The Billion-Dollar Que$tion

Virtual Try-On Technologies in Fashion E-Commerce:
An Answer to Today's Return Issues?

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— ABSTRACT —

The fashion e-commerce industry faces significant challenges due to high return rates, primarily driven by sizing and fit issues. These returns have substantial economic and environmental consequences, prompting retailers to explore solutions. Virtual Try-On (VTO) technology has been proposed as a potential solution to improve the online shopping experience and potentially lower return rates. This study investigates the factors influencing consumer intentions to adopt VTO technology, emphasizing its role in mitigating product returns. The key constructs examined include perceived usefulness, ease of use, accuracy, enjoyment, and privacy concerns. Particular emphasis is placed on bracketing behavior—the consumer practice of purchasing multiple product variations (e.g., sizes, colors) with the intention of returning those that do not fit.

A mixed-methods approach was employed, integrating insights from three studies: [1] a systematic literature review, [2] expert and company interviews, and [3] a consumer survey analyzed through statistical modeling. The findings indicate that perceived usefulness and ease of use strongly predict positive consumer attitudes and adoption intentions, while accuracy and enjoyment also play significant roles. Privacy concerns, however, exhibit a limited direct effect, suggesting that while privacy is important, other factors—particularly behavioral ones—might better explain consumer engagement with VTO technology. Bracketing behavior emerged as a key moderating factor, influencing how VTO technology exposure interacts with perceptual factors and consumer attitudes. Where bracketers (planned returners) prioritize accuracy and functionality, while non-bracketers (unplanned returners) value ease of use and enjoyment—highlighting the contrast between a functional, pragmatic approach (bracketers) and an emotional, experiential approach (non-bracketers).

This research extends the Technology Acceptance Model (TAM) by incorporating the behavioral dimension of bracketing behavior, providing a more nuanced understanding of consumer adoption. The findings offer actionable insights for retailers aiming to tailor VTO solutions to diverse consumer needs, emphasizing that VTO can influence return behaviors by addressing both functional and emotional drivers. While the study identifies factors that could contribute to reduced apparel returns, it also acknowledges its focus on intended rather than actual adoption. Thus, it cannot conclusively determine whether VTO will fully resolve the return issue, highlighting the persistence of the intention-behavior gap. Additionally, the results may not be fully generalizable due to potential sample biases and the limited scope of the consumer survey. Overall, this study contributes to the academic discourse on consumer technology adoption and provides practical strategies for leveraging VTO to bridge the gap between online and offline shopping experiences.

Key Terminology: *Virtual Try-On (VTO) Technology; Technology Acceptance Model (TAM); Consumer Adoption Intention; Bracketing Behavior; Fashion E-Commerce; Apparel Returns; Return Reduction*

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KEY CONCEPTS, TERMINOLOGY, AND ABBREVIATIONS

The following section provides a list of terms commonly used throughout this research paper and subsequent definitions, which have been modified or limited according to the study's objective.

VIRTUAL TRY-ON [VTO]

= Virtual Try-On technologies enable consumers to visualize apparel on their bodies in real-time, mimicking aspects of the in-store experience. These systems provide an interactive shopping journey, allowing consumers to virtually try on items, mix and match outfits, and assess product fit, thereby reducing hesitation in online shopping.

ARTIFICIAL INTELLIGENCE [AI]

= Artificial Intelligence (AI) refers to computational systems designed to perform tasks that typically require human intelligence, such as personalization, recommendation, and fit prediction in online retail settings. AI-enabled VTOs leverage machine learning algorithms to analyze users' photos or videos, creating a personalized digital try-on experience. By understanding the user's physical features, AI technology predicts how various products would look on them, enhancing the online shopping experience.

AUGMENTED REALITY [AR]

＝Augmented Reality (AR) enhances the real-world environment by overlaying digital elements, such as virtual clothing or accessories, onto live images of users, enabling interactive VTOs. In the context of VTO technology, AR uses a customer's device camera to superimpose a virtual product image onto their live image, simulating the experience of trying on a product.

VIRTUAL REALITY [VR]

＝Virtual Reality (VR) creates immersive, computer-generated environments where consumers can experience virtual dressing rooms, explore stores, and visualize products in an entirely virtual space. VR allows for the real-time rendering of 3D models, providing customers with a detailed and interactive view of products in a fully digital environment.

DIGITAL TWIN TECHNOLOGY

＝Digital Twin Technology creates virtual replicas of garments, accessories, and consumers to enhance online shopping by enabling accurate fit visualizations, personalized recommendations, and real-time data exchange for improved design, product management, and decision-making in the fashion industry.

3D BODY SCANNING

＝3D Body Scanning generates precise digital replicas of consumers' bodies, enabling accurate VTOs and forming the foundation of Digital Twin Technology in fashion.

BRACKETING BEHAVIOR [BB]

＝Bracketing behavior is when consumers order multiple sizes or versions of the same product, intending to return what does not fit. This practice is often due to uncertainty about fit and can lead to logistical challenges for retailers. VTO tools aim to reduce this behavior by increasing confidence in size selection.

PERCEIVED USEFULNESS [PU]

＝The degree to which a consumer believes that using a specific technology, such as VTO, enhances their shopping experience by improving decision-making and overall satisfaction.

PERCEIVED EASE OF USE [PEOU]

＝The extent consumers perceive technology as intuitive, user-friendly, and requiring minimal effort.

PERCEIVED ACCURACY [PA]

＝Consumers' perception of how closely the virtual representation of their figure and the displayed product matches reality regarding fit and appearance.

PERCEIVED PRIVACY RISK [PPR]

＝Perceived privacy risk refers to consumers' concerns about collecting and using sensitive personal data, such as body measurements and facial images, necessary for generating accurate virtual representations.

PERCEIVED ENJOYMENT [PE]

＝The extent to which consumers experience pleasure or enjoyment while using a specific technology, such as VTO systems, during their shopping experience.

ATTITUDE TOWARD WEBPAGE USAGE [ATW]

＝A consumer's overall evaluation of a webpage is based on its design, functionality, and the quality of the VTO content presented. Positive attitudes reflect satisfaction and engagement, while negative attitudes suggest poor usability or lack of interest in the VTO features.

ADOPTION INTENTION [AI]

＝Adoption Intention (AI) refers to the likelihood or willingness of consumers to embrace and incorporate a new technology or system, such as VTO, into their online shopping experience. It reflects their intention to use, integrate, or regularly engage with the technology in future shopping decisions.

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1.0 INTRODUCTION

Imagine a shopping experience where clothing, accessories, and makeup can be tried virtually, all from the comfort of one's home, without ever stepping into a store. This capability is no longer a distant concept but a reality made possible by Virtual Try-On (VTO) technologies. These innovations, leveraging technological advancements such as Augmented Reality (AR) and Artificial Intelligence (AI) to revolutionize online fashion retail, offer consumers a more interactive and personalized shopping experience. As VTO technology continues to evolve in 2024 and onwards, it is not merely a trend but a significant shift in how digital fashion experiences are designed and delivered, reshaping consumer interactions with online fashion (Kurinna, 2023; Bambuser, n.d.).

In the iconic movie *Clueless* (Heckerling, 1995), Cher Horowitz navigates her digital wardrobe effortlessly, selecting and coordinating outfits with just a few clicks. While the technology was a fantasy back then, it foreshadows today's advanced digital fashion landscape. In a recent interview, the former Global CTO of a major fashion retail company (Interview #4) shared his vision of fashion shopping's future:

> ***"I can envision a future where you walk into a store and undergo a complete scan, which then can be used to create a lifelike image of you using light rays. Essentially, it is a 3D model of yourself that can be projected onto something, allowing you to virtually try on clothing right in front of you. It does not have to be that, but I believe we are moving in that direction."***

This vision highlights the capacity of VTO technology to not only enrich the shopping experience but also to integrate the physical and digital realms, thus amplifying consumer engagement. The allure of this technology is evident, with 14% of shoppers in Germany and 12% in the United States having already engaged with VTO experiences, highlighting its increasing popularity and potential impact on the fashion landscape (Kurinna, 2023). The PYMNTS Intelligence report "*How Connected Devices Enable Multitasking Among Digital-First Consumers*" presents findings from a survey of over 4,600 U.S. consumers, revealing that many are eager for experiences incorporating Mixed-Reality (MR) technology. Notably, 38% expressed interest in using virtual technology to preview items in their living space, and 32% are enthusiastic about using Virtual Reality (VR) to shop from physical stores while at home or work (Pymnts, 2024).

In today's fast-paced digital era, the fashion industry faces a pervasive challenge: the high rate of returns (Roberts et al., 2023). E-commerce has fueled an alarming trend, with return rates exceeding 24% for online apparel orders in the U.S., costing retailers an estimated $38 billion annually (McDowell, 2024). This phenomenon is further exacerbated by consumer habits like "*bracketing*," where shoppers purchase multiple sizes intending to return what does not fit (Morris, 2023). The environmental implications are staggering as the fashion industry grapples with its carbon footprint, with returns contributing significantly to carbon emissions through transportation and waste (Dalhammar & Hjort, 2023). In this context, VTO technology emerges as a promising solution to enhance the online shopping experience by allowing customers to visualize how clothing will fit and look before purchasing (Harrop, 2024a).

As one explore the potential of VTO technologies, it is crucial to consider consumers' willingness to embrace the shift. While VTO can potentially reduce material waste and overproduction, privacy and accuracy concerns must be addressed (Harrop, 2024b). The urgency to investigate VTO technology is heightened by its potential environmental benefits and ability to enhance personalization, resulting in more satisfying consumer shopping experiences (Harrop, 2024a; The Squad Nation, 2023).

1.1 Background and Problematization

The global fashion e-commerce market has experienced remarkable growth over the past decade, revolutionizing consumer shopping behaviors and establishing itself as a dominant force in retail. By 2024, the global fashion e-commerce market is projected to reach $781.5 billion, accounting for 19.73% of the overall e-commerce sector, with forecasts suggesting it will exceed $1.6 trillion by 2030 (Statista, 2023; Lindlahr et al., 2024). Similarly, Sweden's fashion e-commerce market is expected

to grow from $2.71 billion in 2024 to $3.95 billion by 2030 (Statista, 2024). This growth is driven by the convenience and accessibility of online shopping, enabling time- and location-independent purchasing and providing access to a vast array of products (Hilpert & Zumstein, 2023).

Despite this expansion, the sector faces significant challenges, particularly regarding high return rates in online fashion retail. Fit-related problems account for approximately 70% of product returns (Beck & Crié, 2018), and the rise of "*bracketing behavior*"—ordering multiple sizes or styles with the intent to return those that do not fit—has further exacerbated the issue (Xu et al., 2023a). This behavior, prevalent among younger consumers, has risen from 48% in 2019 to 63% in 2022 (Navar, 2022), creating logistical inefficiencies, financial burdens, and environmental concerns due to waste and emissions associated with reverse logistics (Wojciechowski et al., 2023). In Sweden, 48% of online shoppers returned at least one item in the past year (Statista, 2024). Globally, the reverse logistics market, valued at $700 billion in 2023, is expected to grow to $954.5 billion by 2029 (Chevalier, 2024).

The implications of these return patterns are significant. High return rates undermine profitability, increase operational costs, and escalate the environmental impact of e-commerce, especially in industries like clothing, footwear, and accessories, where returns are most prevalent (Chevalier, 2024). Addressing these challenges requires innovative solutions that reduce return rates while maintaining consumer convenience and promoting sustainability. VTO technologies have emerged as a promising tool in this regard.

1.1.1 Virtual Try-On Technologies as a Potential Solution

The fashion industry has increasingly turned to VTO technologies to address high return rates and fit-related uncertainties. By leveraging advancements in Artificial Intelligence (AI), Augmented Reality (AR), Virtual Reality (VR), and Digital Twin technology systems, VTO enables consumers to virtually visualize how garments fit and appear on digital representations of themselves. This interactive experience mimics the in-store shopping process, helping consumers make more informed decisions about fit, style, and appearance before purchasing (Hwangbo et al., 2020; Batool & Mou, 2024).

Major brands like Nike and Gap have begun integrating VTO technologies to enhance the online shopping experience, aligning with a broader trend toward immersive and personalized digital retail (Kim et al., 2024). Research indicates that VTO has the potential to improve customer satisfaction and reduce return rates by addressing uncertainties in size and fit, thereby increasing confidence in purchase decisions (Gonçalves et al., 2023; Ghodhbani et al., 2022).

Despite its promise, the adoption of VTO technologies remains limited. Retailers face barriers such as high implementation costs, technical challenges in achieving accurate garment simulation, and consumer concerns over privacy and data security (Heller et al., 2019; Batool & Mou, 2024). Furthermore, the quality of the user experience continues to be a critical issue, with poor representations of body and facial features contributing to unrealistic expectations (Gao et al., 2014).

1.1.2 Research Gap(s) & Significance

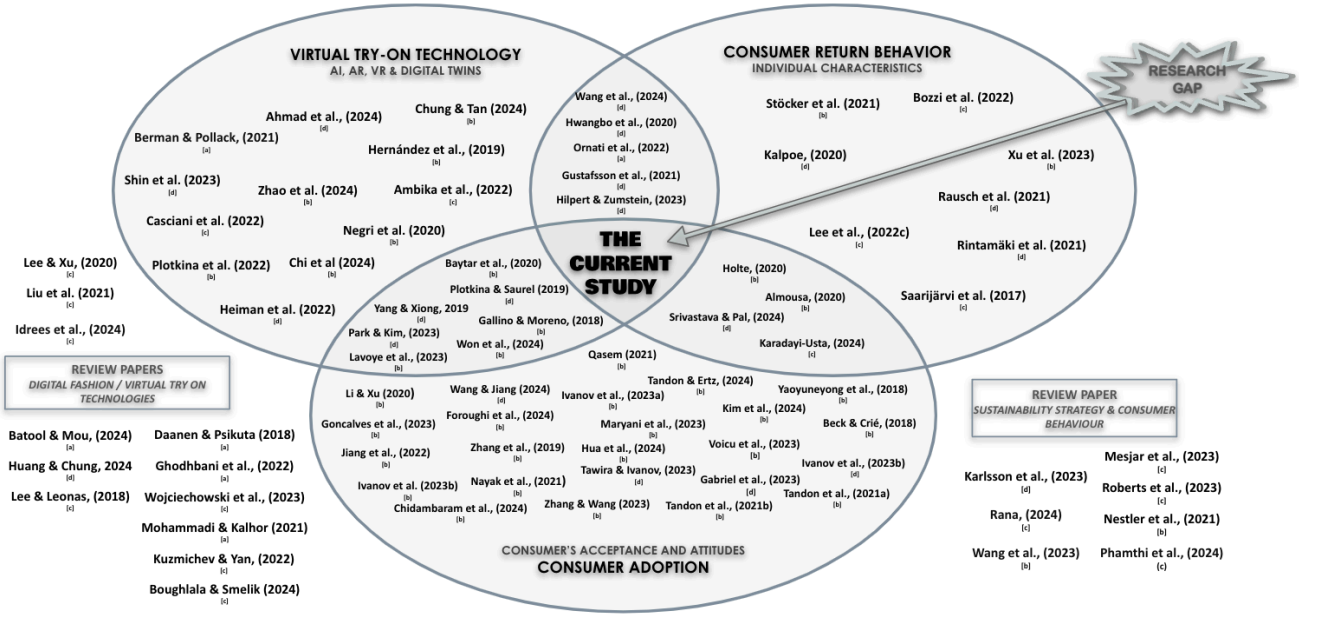
Despite the advancements in VTO technologies, significant gaps remain in understanding the consumer-centric dimensions of their adoption. While many studies have focused on technical enhancements, such as improving garment simulation accuracy (Kaewrat & Boonbrahm, 2017), less attention has been given to how psychological, emotional, and behavioral factors—such as trust, enjoyment, and satisfaction—shape consumer attitudes and usage intentions (Lee et al., 2022c; Chung & Tan, 2024). Additionally, consumer habits like bracketing, which exacerbate high return rates, have yet to be fully explored concerning VTO adoption (Xu et al., 2023a). Another critical research gap is the limited exploration of personalization and interactivity features in VTO systems. These elements, increasingly central to modern e-commerce experiences, remain under examination regarding their influence on consumer engagement and adoption behaviors (Kim et al., 2024; Gonçalves et al., 2023).

Furthermore, most VTO-related studies focus on Western markets, neglecting insights into non-Western contexts and emerging economies, where cultural and technological factors may uniquely shape adoption patterns (Chidambaram et al., 2024; Ivanov et al., 2023). Notably, there is a scarcity of research investigating the impact of VTO on return behaviors,

specifically in mitigating practices like bracketing, and how these behaviors interplay with emotional responses to returns, trust in the technology, and overall satisfaction (Rintamäki et al., 2021; Blazquez, 2014). Examining these interactions could reveal critical insights into how VTO technologies address logistical challenges and the broader psychological barriers to adoption.

Addressing these gaps is vital for understanding the full potential of VTO technologies in transforming online fashion retail. As illustrated in Figure 1, prior research on VTO technologies has primarily focused on technical aspects or narrow theoretical constructs, leaving significant gaps in understanding consumer-centric factors, particularly those influencing adoption and return behaviors. By exploring how technological, behavioral, and emotional factors interact to shape consumer attitudes and behaviors, this study aims to provide actionable insights for fashion retailers. These insights can inform strategies to optimize VTO systems, reduce return rates, and enhance consumer satisfaction, contributing to the broader goals of sustainability and innovation in the fashion e-commerce sector.

FIGURE 1. *Overview of Prior Research on Try-On Technologies, Highlighting the Identified Research Gap Addressed in the Present Study.*



Note: *[a] Conceptual; [b] Quantitative / Theory testing; [c] Interpretive / Theory Building; [d] Mixed Method*

1.2 Purpose and Research Question

Despite the evident advantages of VTO technologies, their adoption in fashion e-commerce remains inconsistent. This inconsistency is primarily attributed to technological challenges, such as inaccurate visualizations, suboptimal user experiences, and the lack of seamless integration into existing retail ecosystems (Heller et al., 2019; Tawira & Ivanov, 2023). Additionally, existing research has primarily emphasized the technical aspects of VTO systems while neglecting the consumer-centric dimensions that shape adoption. Factors such as consumer trust, perceived enjoyment, and behavioral tendencies, including counterproductive behaviors like bracketing, remain insufficiently explored (Batool & Mou, 2024).

In light of these challenges, the primary objective of this thesis is to adopt a holistic approach to understanding the factors influencing the adoption of VTO technologies in fashion e-commerce. Specifically, this research investigates how technological and behavioral factors influence consumer attitudes, perceptions, and behavioral tendencies. To achieve this, the current study is guided by the following central research question:

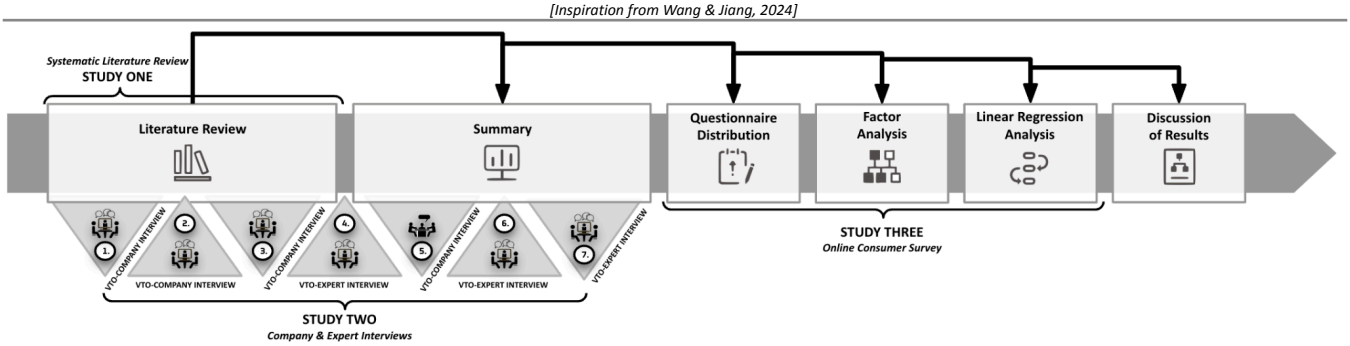
What factors shape consumers' attitudes toward and intentions to use Virtual Try-On (VTO) technologies for future online fashion shopping, and how do these factors relate to return behaviors, specifically bracketing, in apparel e-commerce?

By addressing this research question, the overall aim is to contribute to the existing body of literature by comprehensively analyzing consumer perceptions and characteristics that impact VTO adoption. In particular, by integrating bracketing behavior into the analysis, this research seeks to provide valuable insights for fashion retailers looking to reduce return rates and improve consumer satisfaction through VTO technologies.

1.3 Scientific Approach: Research Design & Methodology

This research adopts a mixed-method approach, combining qualitative and quantitative methodologies to investigate the relationship between VTO technologies and consumer behavior in fashion e-commerce (see Figure 2a). The study follows a deductive approach, where existing theories are tested through empirical observations. Qualitative interviews with industry experts and VTO company representatives provide foundational insights, informing the subsequent design of quantitative surveys aimed at capturing broader consumer perspectives (Creswell & Plano Clark, 2017). This aligns with the concept of methodological fit, which emphasizes the coherence and alignment of research questions, previous work, research design, and theoretical contributions (Edmondson, 1999). Ensuring methodological fit enhances the reliability and validity of the study findings (Edmondson & McManus, 2007; Johnson & Onwuegbuzie, 2004).

FIGURE 2(a). *Research Path Diagram*
[Inspiration from Wang & Jiang, 2024]



Note: *This diagram visually represents the flow and relationship between the three studies, illustrating how each component contributes to answering the central research question.*

1.3.1 Research Design: Three Complementary Studies

To develop a comprehensive understanding of the factors shaping consumer attitudes and intentions regarding VTO technologies in online fashion shopping, this research follows a structured, three-phase approach, where each phase builds upon the previous one, contributing essential insights that collectively address the central research question. Rather than directly measuring actual adoption behavior, the study examines key consumer perceptions, including perceived accuracy, privacy concerns, enjoyment, and behavioral tendencies such as bracketing. This multi-method approach allows for a holistic investigation of the psychological and contextual factors influencing consumer engagement with VTO technology. Accordingly, the research is structured into the following three complementary phases:

- ***Study One: Literature Review (Phase 1)*** – This initial phase involves a systematic literature review to synthesize existing research on VTO technologies, consumer behavior in online apparel shopping, and relevant adoption models. The objective is to identify theoretical frameworks and gaps, particularly regarding consumer attitudes, psychological factors, and decision-making processes related to VTO. These insights lay the groundwork for the expert interviews in the next phase.
- ***Study Two: Expert and Company Interviews (Phase 2)*** – Building on the literature review, this phase involves semi-structured interviews with industry experts and VTO technology providers. The goal is to explore real-world perspectives on the challenges and opportunities surrounding VTO implementation, including privacy concerns, technological limitations, and retailer strategies. Findings from these interviews will inform the design of the consumer survey in Phase three by highlighting critical factors that shape consumer perceptions.
- ***Study Three: Consumer Survey (Phase 3)*** – Informed by the previous two phases, this phase employs a quantitative consumer survey using an extended Technology Acceptance Model (TAM). The survey examines consumer perceptions of VTO technology, focusing on perceived usefulness, accuracy, privacy concerns, enjoyment, and the moderating role of bracketing behavior. By analyzing these perceptions, this phase provides empirical insights into consumer attitudes and potential behavioral tendencies in the context of online fashion shopping.

This phased approach (see Table 1 below for further details) ensures that each stage builds upon prior findings, progressively refining the research focus. The literature review identifies theoretical gaps, expert interviews provide industry perspectives on consumer expectations and implementation challenges, and the consumer survey empirically tests key constructs. This integration of qualitative and quantitative insights enhances the study's ability to contribute both to academic discussions and practical strategies for fashion retailers seeking to optimize VTO technologies.

TABLE 1. *Overview of the Three Studies in the Research Design*

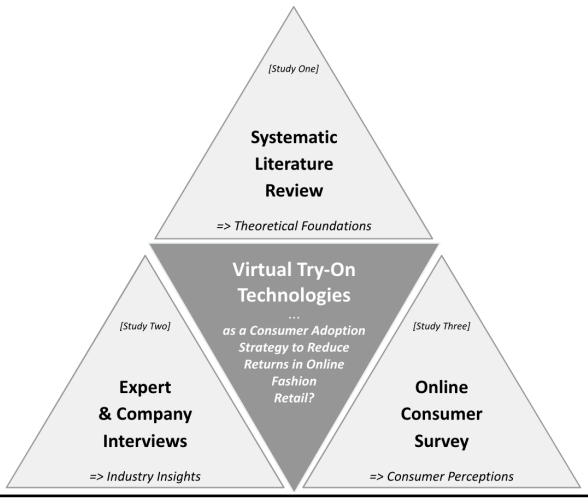
	STUDY ONE: *Literature Review*	**STUDY TWO:** *Expert and Company Interviews*	**STUDY THREE:** *Consumer Survey*
OBJECTIVE	- Systematically review existing research on VTO technologies, consumer adoption models, and return behaviors.	- Obtain expert insights on VTO adoption and implementation.	- Empirically examine consumer attitudes, adoption intent, and behavioral factors in VTO technology.
METHODOLOGY	- Review and synthesis of relevant theories and prior findings.	- Semi-structured interviews with experts and technology providers, thematically coded for insights.	- Online survey utilizing an extended TAM framework to test hypotheses.
KEY FOCUS	- Identifying theoretical frameworks (e.g., TAM) and research gaps, particularly in consumer characteristics influencing VTO adoption.	- Exploring challenges and opportunities in implementing VTO technologies, including privacy concerns, technological limitations, and retailer strategies.	- Examining constructs such as perceived accuracy, enjoyment, privacy concerns, and the moderating role of bracketing behavior.

1.3.2 Data Analysis Strategy and Methodological Integration

Data analysis include thematic analysis for the qualitative component, identifying key themes in consumer experiences with VTO technologies. Statistical methods such as regression analysis will test hypotheses and examine relationships between key variables in the quantitative component. This phased approach allows for iterative refinement based on initial findings, supporting a flexible methodology that can adapt to emerging insights (Edmondson & McManus, 2007). Integrating qualitative and quantitative methods enables a richer understanding of complex phenomena, enhancing research validity and theoretical contributions (Edmondson & McManus, 2007).

By triangulating data sources—combining the literature review, expert interviews, and consumer surveys—this study aims to capture a holistic and multidimensional perspective on VTO adoption (see Figure 2b). Moreover, the iterative learning process emphasized in Edmondson's framework (2007) promotes continuous feedback and adaptation throughout the research journey, further refining the methodology and enhancing the quality of the research. In conjunction with the principles of flexibility and simplicity outlined by Daft (1983), this adaptable approach facilitates the integration of emerging insights, focusing on explicit, targeted modeling. Hence, through this approach, the study aims to contribute to academic knowledge and offer actionable insights for fashion retailers seeking to optimize VTO technologies.

FIGURE 2(b). *Triangulation Method Used to Investigate Consumer Adoption of VTO Technologies in Online Fashion Retail*



1.4 Focus & Delimitations

As with any study, delimitations have been established to fulfill the purpose of this research. Firstly, this study focuses solely on the adoption of VTO technologies within *online fashion shopping*. It examines constructs such as perceived accuracy, privacy risk, enjoyment, and bracketing behavior, offering a targeted analysis of consumer attitudes and adoption intentions.

The scope is deliberately limited to VTO technologies in online fashion retail, particularly apparel shopping, and does not extend to other industries or broader technological innovations outside this context. While this study aims to understand consumer attitudes and intentions toward adopting VTO technologies, it is important to acknowledge the *intention-behavior gap*—the well-documented phenomenon in which stated intentions do not always translate into actual behaviors. This research does not measure *actual* adoption or return behaviors but focuses on early psychological and contextual factors shaping consumer interest in VTO adoption. These insights can inform strategies to encourage real-world adoption and help bridge the gap between intention and behavior. Moreover, this study provides a foundation for future research incorporating longitudinal or experimental designs to observe actual consumer behavior over time.

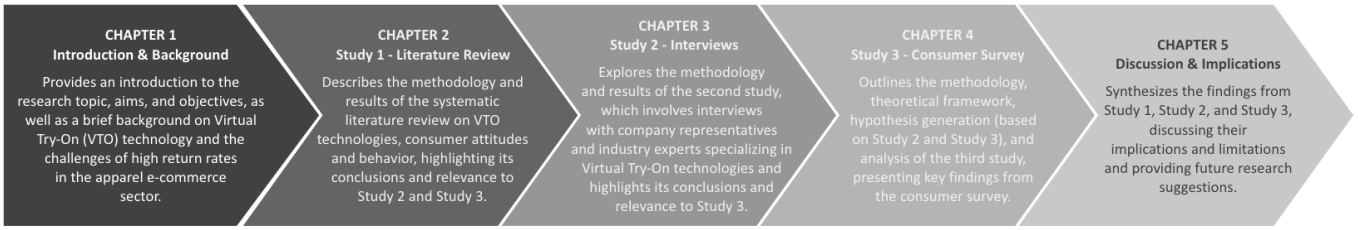
Secondly, the research is structured around three complementary studies, each addressing different aspects of the overall investigation. ***Study One*** consists of a comprehensive literature review exploring the theoretical background of VTO technologies and consumer adoption models within online apparel shopping and fashion e-commerce. ***Study Two*** involves expert and company interviews, offering qualitative insights into industry perspectives on VTO technology, consumer adoption challenges, and opportunities within online fashion retail. ***Study Three*** includes a consumer survey assessing attitudes and perceptions toward hypothetical VTO scenarios, focusing on perceived accuracy, privacy risk, enjoyment, and bracketing behavior. This phased approach provides an in-depth examination of factors influencing adoption intentions while recognizing that actual adoption behavior may differ.

Lastly, while the sustainability implications of VTO technologies will be briefly acknowledged, the primary focus of this study remains on consumer behavior. Thus, an extensive assessment of the environmental impact of VTO technologies, including their potential to reduce return rates, is beyond the scope of this research. Additionally, this study investigates consumer perceptions and responses to hypothetical VTO scenarios rather than conducting real-world testing of VTO's actual impact on return rates. By narrowing the focus to these specific dimensions, the research aims to provide a detailed understanding of the key factors influencing consumer adoption intentions in online fashion retail while critically addressing the intention-behavior gap in the context of VTO technology adoption.

1.5 Disposition

This section outlines the organization and flow of the paper, detailing how each chapter contributes to the overall research objectives. Hence, the subsequent chapters are structured as follows: firstly, the introduction provides an overview of the research topic, aims, and objectives, along with a background on VTO technology and the issue of high return rates in the apparel e-commerce sector. Next, the literature review (Study 1) presents a systematic analysis of existing studies on VTO technologies, consumer attitudes, and behavior, concluding with its relevance for the following studies. The interview study (Study 2) explores insights from VTO industry experts and company representatives, followed by the consumer survey (Study 3), which investigates consumer attitudes and behavior through a detailed theoretical framework and hypothesis-driven analysis. Finally, the discussion synthesizes findings from all three studies, exploring their implications, limitations, and potential avenues for future research. For an overview of the thesis structure, see Figure 3 below.

FIGURE 3. *Illustration of the Thesis Disposition*



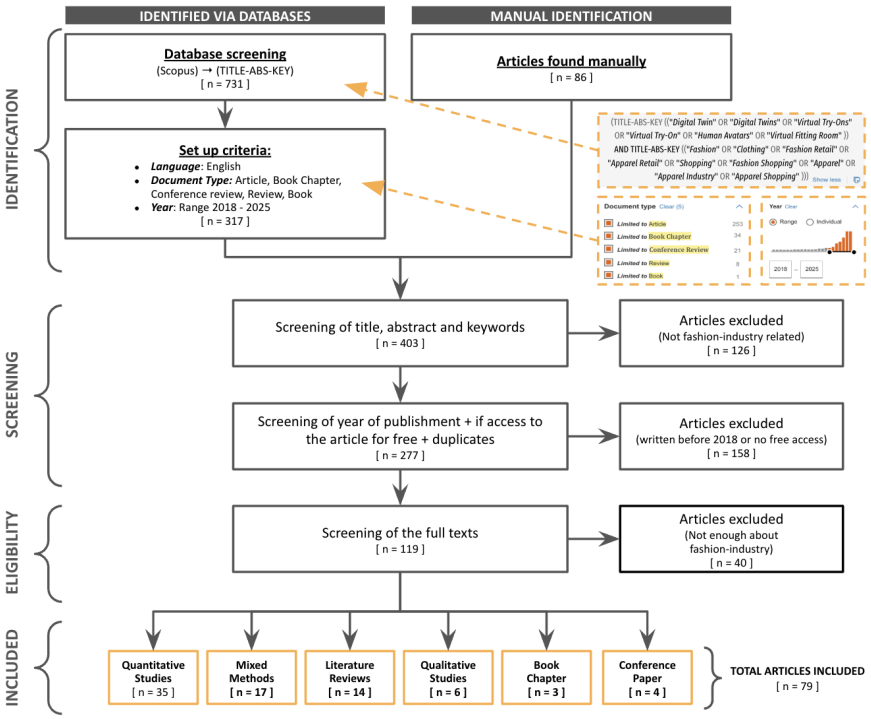
2.0 STUDY ONE - LITERATURE REVIEW

The following chapter presents *Study One*, a systematic literature review that comprehensively overviews existing research on Virtual Try-On (VTO) technology, consumer behavior, and its implications for the fashion industry. This study serves as the foundation for the research process by identifying relevant theoretical frameworks, research gaps, and key themes. By synthesizing previous studies, Study One establishes a theoretical basis for understanding how VTO technology influences consumer attitudes, adoption intentions, and return behaviors in fashion e-commerce. The findings guide subsequent studies' research focus, methodology, and hypothesis development. Details on the systematic literature review process, including selection criteria and methods, are outlined in the following sections.

2.1 Methodology

A systematic approach was applied to analyze existing research on VTO technology and consumer behavior in fashion e-commerce. As outlined in the following section, a structured search strategy was employed to ensure rigor and relevance. A bibliometric analysis was also conducted to identify key research themes and clusters.

FIGURE 4. *The PRISMA Flow Diagram for Virtual Try-On Technology Literature*
[Adapted from (Moher et al., 2010)]



2.1.1 Search Strategy and Inclusion Criteria

To ensure the credibility and relevance of the reviewed literature, searches were conducted using reputable academic databases, specifically Scopus (Elsevier) and Google Scholar. The search strategy was designed to include a broad range of document types, such as journal articles, book chapters, conference proceedings, and books, encompassing both foundational theories and the latest advancements in VTO technologies within the fashion industry.

The initial search on Scopus was structured around core keywords aligned with the primary research topics: *"digital twin technologies," "virtual try-on solutions,"* and *"the fashion industry."* A structured search strategy utilizing the *TITLE-ABS-KEY* field was applied to retrieve articles containing these terms in the title, abstract, or keywords. Boolean operators (e.g., AND, OR) were employed to refine search results and exclude irrelevant publications. Inclusion and exclusion criteria were further established to ensure that only studies relevant to consumer adoption, return behavior, and strategic applications of VTO were considered (as seen in Figure 4). Specifically, inclusion criteria were defined to select studies

directly discussing VTO technology in fashion, its impact on consumer behavior, and relevant theoretical frameworks. Research examining return reduction, sustainability, and consumer attitudes toward digital fashion tools was also included. To ensure a contemporary perspective, peer-reviewed English publications published between 2018 and 2024 were also included. On the contrary, articles were excluded if they solely focused on technical aspects of the technology without a consumer or business perspective, and non-English and non-peer-reviewed articles were excluded to maintain academic rigor.

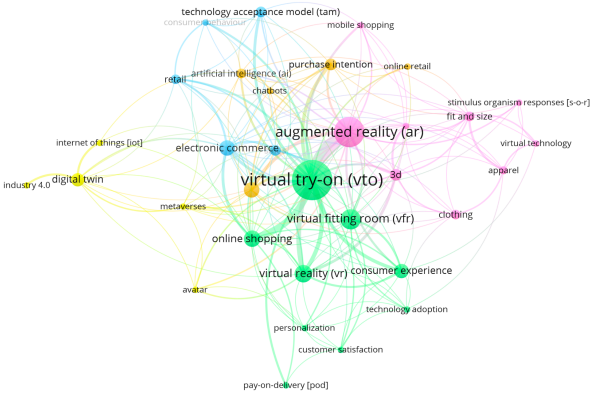
As the research progressed, feedback from expert and company interviews (Study Two) informed further refinements to the keyword selection, adding terms related to consumer behavior, product returns, and sustainable consumption. These supplementary keywords included *"bracketing behavior," "online returns," "consumer returns," "fit uncertainty," "ordering strategy,"* and *"product return costs*." The inclusion of these terms enabled a deeper examination of behavioral factors influencing VTO adoption, the motivations behind product returns, and potential strategies for mitigating return rates in fashion e-commerce. By iteratively refining the search strategy and incorporating insights from expert and company interviews, this review ensured a comprehensive and targeted approach to assessing the academic landscape of VTO technology. This process facilitated a thorough examination of key themes, covering a broad spectrum of topics related to consumer adoption, return behaviors, and strategic applications of VTO in fashion e-commerce. Additionally, by systematically identifying and addressing research gaps, this literature review contributes to the foundation of the present study. The articulation of these gaps aligns with the overarching research focus outlined in Figure 1 (see page 10), which provides an overview of prior research on try-on technologies and highlights the specific gap addressed in this study.

2.1.2 Data Extraction, Analysis, and Visualization

A structured data extraction process was employed to analyze the literature systematically. Key data points extracted from each study included the study's objectives and research questions, the methodological approach (qualitative, quantitative, or mixed methods), key findings, theoretical frameworks used, and identified themes related to consumer behavior, return reduction, and adoption barriers. To organize and synthesize these findings, a thematic coding process was applied to categorize studies into key research areas, including consumer attitudes and behavioral drivers of VTO adoption, barriers to VTO adoption, and technological affordances (e.g., AR, AI), and the impact of VTO on return reduction and sustainability in fashion e-commerce.

VOSviewer software[1] was employed to complement the qualitative synthesis for bibliometric analysis, mapping keyword relationships, and clustering relevant themes within the literature (see Figure 5). A keyword co-occurrence analysis was performed with a minimum occurrence threshold of three, refining keywords through a thesaurus file to consolidate variations (e.g., singular/plural forms, hyphenated terms). As a result, the visual analysis identified key research nodes—VTO and AR—demonstrating high link strengths (91 and 59, respectively), which indicated prominent research areas. Insights from this clustering process informed the development of the study's theoretical framework.

FIGURE 5. *Co-Occurrence Map of Keywords*
[https://app.vosviewer.com/?json=https%3A%2F%2Fdrive.google.com%2Fuc%3Fid%3D1qy_lMDrAXLDrtxOw_nKlMYFHiD9y_yw5]



Items: 33 | Clusters: 5 | Links: 188 | Total Link Strength: 320

Note: *This co-occurrence keyword mapping is solely based on the literature identified through Scopus, i.e., excluding the manually found literature.*

2.2 Analysis & Results

The rapid growth of online shopping has significantly transformed the retail landscape, particularly within the fashion industry, where product fit and style representation challenges remain prevalent. As briefly touched upon in prior sections, a major obstacle for fashion e-commerce is consumers' inability to physically try on products before purchasing. This not only diminishes purchase confidence but also contributes to higher return rates, a persistent issue for online retailers (Gallino &

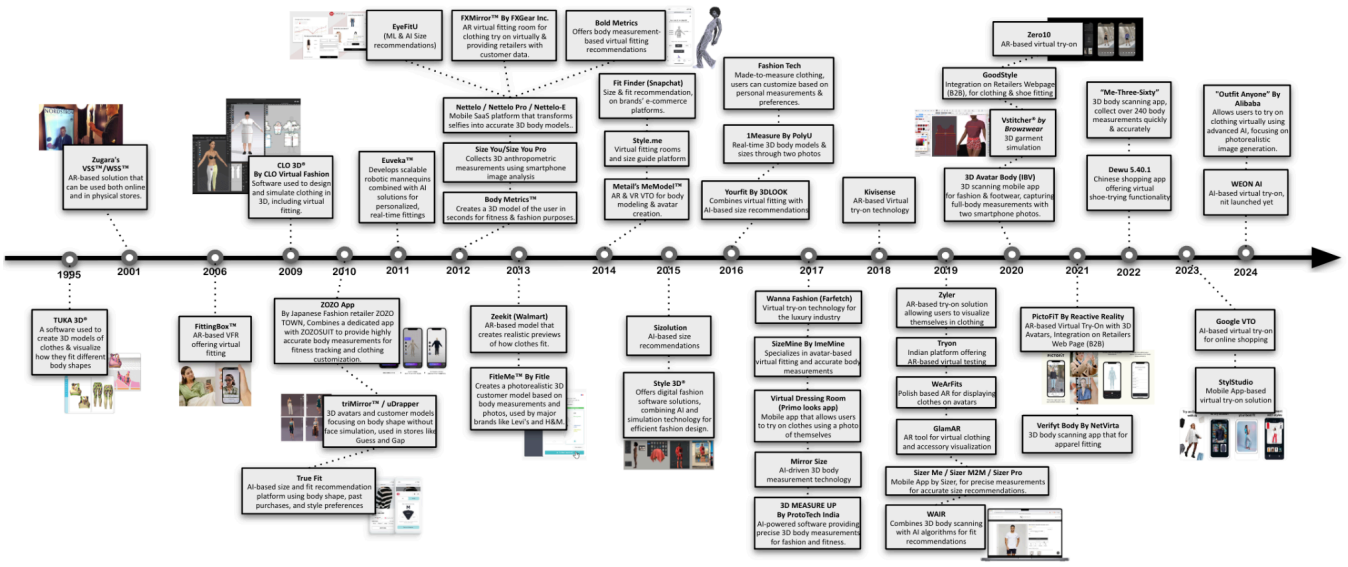
[1] *VOSviewer is a software tool for constructing and visualizing bibliometric networks, link to VOSviewer webpage can be found here: https://www.vosviewer.com/*

Moreno, 2018). In response to these challenges, VTO technologies have emerged as innovative solutions to enhance the online shopping experience.

VTO technologies enable consumers to visualize apparel and accessories on their bodies in real time from the comfort of their homes, mimicking aspects of the in-store experience (Hilken et al., 2017). According to Beck and Crié (2018), VTOs simulate the tactile and immersive aspects of physical shopping, which traditional online retail lacks, helping to reduce consumer hesitation to purchase apparel online. These systems allow consumers to experience a more interactive shopping journey, where they can virtually try on items, mix and match outfits, and assess how products fit. By enhancing the realism of the shopping experience, VTO technologies can significantly influence purchasing decisions and reduce return rates (Gallino & Moreno, 2018). Zhao et al. (2024) further highlight that VTO technologies mitigate the friction associated with buying apparel online, where customers are hesitant to purchase items without physically trying them on first. Brands like Nike, Gap, and Ray-Ban have capitalized on VTO technologies to showcase their products better (Kim et al., 2024). While these innovations show promise, Heller et al. (2019) and Tawira & Ivanov (2023) note that poor augmentation quality has led to slow adoption of VTO systems, as consumers struggle with the realistic visualization of products. Despite these challenges, the potential for VTO technologies to transform the online shopping experience is vast. Studies indicate that VTO technologies can potentially diminish returns significantly (Hernández et al., 2019). This illustrates the operational efficiency gains retailers can achieve alongside enhanced consumer satisfaction, especially during times of increased reliance on online sales, as seen during the COVID-19 pandemic (Heiman et al., 2022).

These technologies—comprising Artificial Intelligence (AI), Augmented Reality (AR), Virtual Reality (VR), and Digital Twins—aim to replicate the in-store experience, allowing consumers to assess product fit and style virtually. Integrating VTO technologies in online retail addresses the core consumer need for fit assurance and elevates the digital shopping experience through personalization and interaction. As these technologies evolve, ongoing research is essential to fully understand their long-term impacts on consumer behavior and retail strategy. (See Figure 6 for a timeline of the development of VTO technologies.)

FIGURE 6. *Timeline of Virtual Try-On Technology Companies, Platforms, Applications, or Similar*[2]



Note: *Created by Authors during the research exploration stage, further revised based on the literature review. However, some of the above-mentioned might not be very relevant, and several new similar competitors/players are constantly entering the market due to the significant potential for the VTO apparel market. In Appendix A, one can find the sources and more information about them.*

The following section will explore the role of VTO technologies in addressing the issue of product uncertainty, with a focus on the technological foundations of AI, AR, VR, and Digital Twins. The analysis will examine how these technologies impact consumer decision-making, particularly regarding fit and style perception, and how they contribute to reducing return rates in the fashion e-commerce sector. Additionally, consumer return behaviors and individual characteristics influencing return rates

[2] *See Appendix A for a larger version of the Figure showcasing the Timeline with VTO Technology companies, platforms, applications, or similar.*

will be discussed, followed by an exploration of consumer adoption models and the factors affecting the acceptance and utilization of VTO technologies. Through this examination, a comprehensive understanding of the interaction between VTO technologies and consumer behavior will be presented, with particular emphasis on the potential of these technologies to address key challenges in online fashion retail.

2.2.1 Virtual Try-On Technology: AI, VR, AR & Digital Twins

The existing body of literature on VTO technologies lacks a fully standardized classification system, with scholars focusing on customer experience, accuracy, and realism. However, the diversity in categorization approaches, scopes, and terminology leads to fragmentation, making it difficult to establish a comprehensive framework (Srivastava & Pal, 2024; Batool & Mou, 2024; Lee & Xu, 2020; Idrees et al., 2024; Mohammadi & Kalhor, 2021; Wang & Jiang, 2024). For instance, Batool and Mou (2024) and Lee and Xu (2020) emphasize customer experience as a primary factor in their classifications, focusing on accuracy, visual appeal, and interactivity. Batool and Mou (2024) discuss how different VTO technologies measure body dimensions and simulate garments, while Lee and Xu (2020) identify critical dimensions of accuracy, attractiveness, and interactivity. On the other hand, Mohammadi and Kalhor (2021) adopt a technical perspective, classifying VTO technologies based on their algorithms and AI models, which is particularly useful for technical research. The scope of these studies also varies: while Idrees et al. (2024) limit their analysis to mobile applications, Batool and Mou (2024) and Lee and Xu (2020) offer broader overviews of various VTO technologies.

Additionally, discrepancies in terminology, such as the distinction between "3D avatar" and "3D customer model," further complicate the classification process. Despite these variations, VTO technologies aim to enhance online shopping experiences by simulating physical try-ons. Research highlights significant differences across technologies such as AI, VR, AR, and Digital Twin Technology—each offers distinct functionalities, capabilities, benefits, and challenges, shaping its role within the retail industry. Hence, the following section presents the four identified technologies, highlighting the key aspects of each underlying technology (see Tables 2a-d).

➔ *Artificial Intelligence (AI)*

AI has emerged as a transformative force in the retail industry, and Silva et al. (2021) identified it as the most transformative technology in the sector. The integration of VTO technology with AI tools, such as chatbots and recommendation agents, has significantly improved the online shopping experience by enhancing customer satisfaction and decision-making through increased personalization and engagement while reducing inefficiencies (Leung et al., 2018; Luo et al., 2019; Yang et al., 2022; Xu et al., 2023b; Pupillo, 2019). AI also plays a pivotal role in developing mobile body scanning technologies and enhancing personalization in fashion retail. These technologies empower consumers with accurate sizing information and provide retailers with insights that have the potential to improve inventory management and reduce return rates (Hwangbo et al., 2020). The effectiveness of mobile body scanning compared to traditional measurement methods is well documented, demonstrating significant accuracy and efficiency (Smith et al., 2022; Almalki et al., 2020). The shift toward mobile applications for body scanning is particularly relevant in online retail, where providing accurate size information can mitigate consumer uncertainties (Idrees et al., 2020).

AI-powered VTO systems are recognized for their ability to deliver highly personalized user experiences by leveraging advanced algorithms. These systems excel in providing tailored size recommendations, product suggestions, and predictive analytics based on user behavior (Srivastava & Pal, 2024). Research highlights their capacity to reduce decision fatigue and improve consumer confidence in online purchases (Gonçalves et al., 2023). However, privacy concerns and issues related to algorithmic transparency remain significant barriers to broader adoption (Przegalinska et al., 2019). While AI enhances utilitarian value by minimizing returns, its dependence on extensive personal data often raises ethical concerns, particularly in regions with stringent data protection regulations.

TABLE 2(a). *Classification of Virtual Try-On Technologies - Artificial Intelligence [AI]*

CAPABILITIES	KEY BENEFITS	CHALLENGES
• **Avatar Creation & Recommendations**: Realistic avatars with tailored clothing recommendations (Lee & Xu, 2020). • **Fit Prediction**: Machine learning simulates garment fit on various body types, improving over time (Nestler et al., 2021). • **Size Recommendation Algorithms**: Predicts best-fit garments using demographic data and past purchases (Wang et al., 2024). • **AI-Powered Chatbots**: Offers real-time fit and style guidance (Lee & Xu, 2020). • **Mobile Body Scanning for Accurate Sizing:** Deep learning and computer vision to create accurate 3D avatars for personalized fit recommendations. (Lee & Xu, 2020).	• **Improved Consumer Confidence:** AI tools help consumers make informed decisions, reducing uncertainty about fit and style (Zhang et al., 2023; Hoyer et al., 2020; Nestler et al., 2021). • **Personalization at Scale:** Enables personalized shopping experiences, increasing customer engagement and satisfaction (Beck & Crié, 2018; Kim & Forsythe, 2008). • **Efficiency in Retail Operations:** Automating recommendations and customer service through AI tools (chatbots, recommendation engines) reduces operational costs (Leung et al., 2018). • **Enhanced Customer Loyalty:** Integrating AI creates more enjoyable and memorable shopping experiences, increasing customer retention (Srivastava & Pal, 2024). • **Reduced Fitting Issues and Return Rates:** AI-driven sizing recommendations lessen the likelihood of receiving incorrect or unsatisfactory products, improving overall customer satisfaction (Smith et al., 2022; Zhang et al., 2023; Won et al., 2024).	• **Dependence on Data Quality:** Relies heavily on accurate input data, such as body measurements provided by the user/customer (Lee & Leonas, 2018). • **Limited Visualization:** Issues related to visually depicting how garments will look to the users/customers (Ghodhbani et al., 2022) • **Ethical Concerns:** Privacy and security risks arise from collecting personal data (Liu et al., 2010; Zhang et al., 2019). • **Algorithm Bias:** This can exhibit bias in recommendations, potentially affecting product diversity and suggestion fairness (Przegalinska et al., 2019). • **Integration Complexities:** Aligning AI-powered tools with traditional retail systems across different platforms (Tsolakis et al., 2023). • **Cultural and Generational Resistance:** Different demographics may show varied levels of trust or acceptance of AI-based solutions in retail, especially among older consumers (Yen et al., 2017).

➔ *Virtual Reality (VR)*

VR has quickly become a transformative force in the fashion industry, particularly in online retail, by significantly enhancing the consumer experience and streamlining operations. As ecommerce evolves, retailers increasingly adopt VR technologies, such as smart mirrors and virtual fitting rooms. These innovations allow consumers to evaluate styles and fit from the comfort of their homes, addressing the growing demand for flexible and engaging shopping experiences (Kuzmichev & Yan, 2022). In addition to virtual fitting rooms, VR has revolutionized how fashion presentations are conducted. Brands can now host immersive virtual fashion shows, offering interactive experiences beyond traditional runways' limitations. This shift has created new avenues for consumer engagement, allowing participants to interact with garments in a three-dimensional environment. Such innovations encourage active participation, fostering emotional connections between consumers and the brands they engage with (Ahmad et al., 2024; Steuer, 1992; Ijsselsteijn et al., 2000; Khurana et al., 2023).

Qasem (2021) further categorizes VR-based VTO technologies into two types: (1) 2D Shape Displays, which present a flat representation of garments, and (2) 3D Forms (or 3D Avatars), which offer dynamic and realistic visualizations. This classification underscores VR technology's diverse capabilities in enhancing the online shopping experience. Integrating VR into the e-commerce landscape enables the creation of virtual shopping environments that closely replicate the in-store experience. This leads to positive outcomes in visitor intention, purchase intention, and overall satisfaction with the shopping process. These virtual spaces offer users a heightened sense of presence and encourage deeper emotional engagement as they explore products (Ahmad et al., 2024).

VR-based VTO systems are widely recognized for their ability to offer highly immersive and engaging shopping experiences. By recreating physical store environments in virtual spaces, VR increases the emotional engagement of consumers, which is shown to drive purchase intent and reduce hesitation (Ahmad et al., 2024; Voicu et al., 2023). However, challenges such as high development costs, reliance on specific hardware, and technical complexities associated with VR environments hinder its widespread adoption (Wang & Jiang, 2024). These obstacles are particularly pronounced in the context of virtual fashion shows, where significant resources are required to create and maintain these interactive experiences (Batool & Mou, 2024).

TABLE 2(b). *Classification of Virtual Try-On Technologies - Virtual Reality [VR]*

CAPABILITIES	KEY BENEFITS	CHALLENGES
• **Immersive VTOs:** Virtual stores with interactive, walk-through experiences (Ahmad et al., 2024). • **Virtual Runways & Shows:** Customers can attend virtual fashion events (Ahmad et al., 2024). • **3D Product Visualization:** View garments from multiple angles (Park & Kim, 2023). • **VR-Enhanced Fit:** Real-time dynamic garment fitting (Sjarov et al., 2020). • **Real-Time Interaction:** Consumers interact with garments virtually (Kuzmichev & Yan, 2022).	• **Immersive Shopping Experience**: Engages users with 360-degree garment views, increasing purchase confidence (Lee & Xu, 2020). • **Realistic Visualization**: Offers lifelike garment simulations to aid decision-making (Park & Kim, 2023). • **Enhanced Emotional Engagement:** VR fosters a more profound connection through immersive experiences (Steuer, 1992; Khurana et al., 2023). • **Increased Sales**: Engaging VR experiences reduce bounce rates and increase conversions (Won et al., 2024).	• **Equipment Requirements**: VR headsets are required, limiting accessibility and adoption. • **High Costs:** Developing and maintaining VR environments can be expensive (França & Soares, 2017). • **Complex Digital Twin Creation:** Challenges in accurately simulating garments and human models (Kuzmichev & Yan, 2022). • **User Experience Variability:** The accuracy and quality of VR experiences vary depending on hardware and software (Park & Kim, 2023).

➔ *Augmented Reality (AR)*

AR enhances consumer experiences by blending virtual elements with the real world, making it a powerful tool in the retail sector. Research indicates that AR technologies significantly improve interactions, making them more enjoyable and memorable, positively influencing consumer attitudes toward brands (Plotkina et al., 2022). By allowing consumers to visualize products within real-world environments, AR reduces uncertainties often associated with online shopping, boosting user engagement and satisfaction (Hsu et al., 2021; Kowalczuk et al., 2020; Tandon & Ertz, 2023; Berman & Pollack, 2021). This reduction in uncertainty leads to enhanced decision-making, as consumers can assess how products will fit and look in their personal context before purchasing.

In addition to improving decision-making, AR elevates service experiences by making them more interactive and intuitive (Rauschnabel et al., 2022; Kumar, 2022). Expert interviews suggest that AR can help reduce product returns by improving the accuracy of product assessments before purchase. However, challenges such as limited consumer awareness, technical constraints, and the need for seamless integration into company strategies remain significant barriers (Hilpert & Zumstein, 2023).

AR-based VTO systems are particularly valued for their accessibility and real-time interactivity, allowing consumers to easily try clothes virtually using smartphones or other devices. Studies show that AR helps reduce purchase uncertainties, particularly related to garment fit, by allowing users to visualize products in real-world contexts (Foroughi et al., 2024). However, one of the key challenges for AR is the difficulty in accurately simulating complex garment textures and materials, which may impact the realism of virtual fitting (Batool & Mou, 2024). Additionally, AR technologies can provide both hedonic (pleasure-driven) and utilitarian (function-driven) benefits, although their effectiveness varies depending on the product category and user interface (Gabriel et al., 2023). Despite its limitations, AR remains a promising tool in enhancing the shopping experience, increasing user engagement, and potentially reducing returns in fashion e-commerce.

TABLE 2(c). *Classification of Virtual Try-On Technologies - Augmented Reality [AR]*

CAPABILITIES	KEY BENEFITS	CHALLENGES
• **AR Virtual Mirrors:** Overlays clothing on live camera feeds for both in-store and online try-ons (Lavoye et al., 2023). • **AR Smartphone Apps:** Provides virtual fitting experiences using camera overlays (Mesjar et al., 2023). • **Social Media Filters:** Interactive VTOs via AR filters on social platforms (Lavoye et al., 2023). • **User Customization:** Allows real-time alteration of color, size, and style (Massa & Ladhari, 2023). • **Enhanced Immersion**: Integrates digital clothing into real-world environments, improving product fit (Rauschnabel et al., 2022).	• **Convenience**: Accessible on smartphones, enabling anytime use and eliminating the need for physical fitting rooms (Wang & Jiang, 2024). • **Enhanced Engagement**: Promotes interactive shopping experiences, positively impacting brand perception (Baytar et al., 2020). • **Real-time Interaction:** Users can interact and adjust the virtual product in real time (Nikhashemi et al., 2021). • **User Satisfaction:** Personalized AR experiences improve satisfaction and engagement (Wang & Jiang, 2024). • **Social Sharing**: Encourages sharing of AR experiences on social media, boosting brand visibility and engagement (Wang & Jiang, 2024).	• **Accuracy Limitations**: Challenges in accurately simulating fit and texture, particularly with complex garments (Batool & Mou, 2024). • **Technical Challenges**: Lighting, camera quality, and device limitations can affect the accuracy of AR experiences (Batool & Mou, 2024). • **Limited Product Range**: Some AR applications offer a narrow selection of garments, limiting the variety of VTO experiences (Batool & Mou, 2024). • **User Frustration:** Limited options or a complex interface can frustrate users (Baytar et al., 2020).

➔ *Digital Twin Technology*

Digital Twin technology enables virtual representations of physical objects and consumers, revolutionizing the online shopping experience through personalized and precise fit simulations (Liu et al., 2021). At the heart of Digital Twin technology is body scanning, which creates accurate virtual replicas of customers' bodies for use in virtual dressing rooms and try-ons (Rodriguez, 2016). While traditional body scanning solutions, such as fixed booth scanners, have been available for several years, their widespread adoption has been limited (Daanen & Ter Haar, 2013). However, mobile scanning apps are emerging as a more accessible and portable alternative, potentially transforming how consumers engage in VTO experiences by providing real-time body measurements, such as dimensions, girths, and surface areas (Idrees et al., 2024).

The primary value of digital twins in fashion is their ability to address fit-related concerns, which are a major driver of returns in e-commerce. By offering highly accurate simulations of body fit, digital twins reduce the perceived risks associated with sizing discrepancies and improve overall customer satisfaction (Paul et al., 2017). Research suggests that the closer the digital twin matches a consumer's actual body, the greater the utilitarian value of the VTO experience, which, in turn, increases convenience and likelihood of purchase (Maryani et al., 2023). Despite its potential, barriers such as high costs, technical

complexity, and privacy concerns related to collecting and storing body data are significant obstacles to broader adoption (Casciani et al., 2022).

Digital Twin technology offers outstanding precision in simulating body dimensions and fabric behavior, making it especially valuable for ensuring accurate fit and enhancing sustainability in the fashion industry (Chung & Tan, 2024). By generating virtual replicas of consumers and garments, Digital Twins significantly reduces the uncertainty around fit and style, directly contributing to decreased return rates (Maryani et al., 2023). However, despite its significant promise, the adoption of Digital Twin technology faces challenges related to high technical complexity, the cost of development and integration, and limited availability outside high-end retail environments (Casciani et al., 2022). Moreover, while existing research has focused on technical aspects, more consumer-facing applications need further exploration to bridge the gap in understanding how these technologies impact consumer behavior and the broader retail experience.

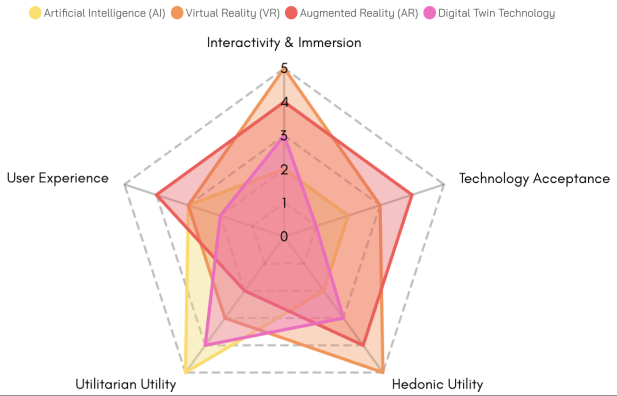
TABLE 2(d). *Classification of Virtual Try-On Technologies - Digital Twin Technology*

CAPABILITIES	KEY BENEFITS	CHALLENGES
• **Avatar-Based VTO:** Personalized avatars generated using advanced body scanning technologies (Kalpoe, 2020). • **3D Body Scanners:** Generate detailed 3D models of users to enhance virtual try-ons (D'Apuzzo, 2009). • **Garment Digital Twins:** Simulate fabric behavior (e.g., draping, stretching) on a user's avatar (Kalpoe, 2020). • **Real-Time Customization:** Continuous updates to avatars based on consumer preferences (Gao et al., 2014). • **Integration with AI & AR/VR:** Combines AI and AR/VR for predictive analytics and immersive experiences (Huang & Qin, 2011).	• **Enhanced Accuracy**: Provides precise fit simulations by replicating body details, surpassing 2D or AR alternatives (Idrees et al., 2024). • **Customization**: Personalized style recommendations based on consumer preferences (Kalpoe, 2020). • **Privacy Assurance**: Secure measurement-based recommendations ensure data protection (Liu et al., 2021). • **Sustainability Impact:** Reduces waste by testing garments digitally before production (Kuzmichev & Yan, 2022). • **Reduced Return Rates:** Ensures better-fit accuracy, lowering return likelihood (Paul et al., 2017).	• **Technical Complexity**: High technical complexity makes it difficult for retailers to implement (Kuzmichev & Yan, 2022). • **High Costs**: Significant investment is required for system development and integration (Boughlala & Smelik, 2024). • **Privacy Concerns**: Storing sensitive body data raises security and ethical issues (Idrees et al., 2024). • **Interoperability:** Compatibility issues across various platforms and software (Kuzmichev & Yan, 2022). • **User Experience Complexity:** Interfaces must be user-friendly to avoid overwhelming consumers (Baek et al., 2018).

To conclude, several key observations can be made regarding VTO technologies, highlighting each technology's strengths and challenges (see Figure 7 for a comparative analysis). VR offers the highest level of immersion, providing users with a pronounced sense of presence, whereas AR is characterized by greater accessibility and user-friendliness. AI excels in personalizing user experiences across platforms, while digital twins are distinguished by their precision in fit simulation. Users' acceptance of these technologies is influenced by perceived usability, privacy concerns, and digital maturity, with AR benefiting from broader acceptance due to its intuitive design. In contrast, AI and digital twins face more substantial barriers to adoption. Regarding utility, AR and VR prioritize hedonic benefits, promoting consumer engagement and enjoyment, whereas AI and digital twins address utilitarian needs, such as efficiency and accuracy. The user experience varies significantly across these technologies: AR is perceived as practical and user-centric, while VR's complexity and high resource requirements limit its scalability. AI and digital twins, while capable of offering advanced personalization, necessitate robust infrastructure and extensive data inputs for optimal functionality. These findings highlight the varied applications and challenges associated with VTO technologies within the apparel and fashion sectors. To maximize the effective integration of these technologies, retailers must tailor their adoption strategies to align with specific business objectives and available resources. Future research should focus on exploring hybrid approaches that combine the strengths of these technologies, aiming to enhance the consumer experience while mitigating their respective limitations.

FIGURE 7. *Comparative Analysis of VTO Technologies in the Apparel & Fashion Industry*

*| **Interactivity & Immersion**: How engaging and immersive each technology is. | **Technology Acceptance**: Reflecting ease of adoption and perceived barriers. | **Hedonic Utility**: Focus on enjoyment, novelty, and user engagement. | **Utilitarian Utility**: Focus on efficiency, accuracy, fit, and sustainability. | **User Experience:** Ease of use, personalization, and interaction complexity. |*



Note: *The radar chart above visually compares the four VTO technologies (AI, VR, AR, and Digital Twin) across the most relevant dimensions. Each axis represents a dimension ranging from 1 (low) to 5 (high). The shaded areas show how each technology performs across these criteria, making it easy to identify strengths and weaknesses visually.*

2.2.2 Consumer Return Behavior: Individual Characteristics

Recent research into VTO technology has predominantly centered on perceptual dimensions such as immersive user experiences, perceived value, and intentions regarding usage in online apparel shopping (Hua et al., 2024). Nonetheless, a notable gap remains in examining individual differences—particularly return behaviors—that can profoundly affect consumer shopping patterns and attitudes toward VTO innovations (Watson et al., 2020).

Bracketing Behavior and Return Culture

Bracketing, defined as purchasing multiple versions of the same product (e.g., different sizes or colors) with the intention of returning the ones that do not meet expectations, has become a prevalent behavior in online fashion shopping (Xu et al., 2023a). Over 60% of consumers engaged in bracketing in 2020, a significant increase from the previous year. This behavior is motivated by the desire to reduce product fit and suitability uncertainty, contributing to higher return rates.

Saarijärvi et al. (2017) contend that customers often pre-plan returns during the decision-making phase, engaging in bracketing behaviors, which involve ordering multiple sizes, colors, or variations to meet the same need. Pricing structures and return policies can also shape this behavior (Saarijärvi et al., 2017; Stöcker et al., 2021; Gustafsson et al., 2021; Balaram et al., 2022). Although recommended mitigative strategies—such as enhanced size charts and personalized recommendations based on historical purchases—have been proposed (Saarijärvi et al., 2017), investigations are scarce concerning the potential role of VTO technologies in addressing bracketing behavior and minimizing return rates (Xu et al., 2023a).

Bracketing is closely tied to a broader "*return culture*," where consumers expect flexible and hassle-free returns, leading to logistical challenges for retailers (Roberts et al., 2023). The lack of physical interaction with products in online shopping—particularly in the context of size and fit—further reinforces this behavior (Stöcker et al., 2021). Zhao et al. (2024) introduce the concept of "*return avoidance*," where consumers actively engage in strategies to minimize returns, including purchasing multiple sizes or colors upfront. While bracketing can enhance the likelihood of finding a properly fitting product, it also increases reverse logistics costs, unsellable returns, and environmental concerns (Saarijärvi et al., 2017; Rintamäki et al., 2021).

The Role of VTO Technology in Reducing Returns

Roberts et al. (2023) delineate an emerging "return culture" within e-commerce, where heightened consumer expectations for product variety and the ease of comparing sizes or styles significantly drive elevated return rates. This phenomenon intensifies the environmental and economic challenges for retailers. VTO technology offers a viable countermeasure by delivering enhanced visual representations of fit and style, thereby aiding consumers in making more assured purchasing decisions and reducing superfluous returns. Furthermore, retailers could enhance their return strategies by segmenting customers according to their return behaviors (Hjort et al., 2019; Rintamäki et al., 2021).

VTO technology can potentially lower return rates by offering more accurate visual and fit-related information, thus reducing uncertainty and minimizing size-related returns (Batool & Mou, 2024; Hwangbo et al., 2020). Furthermore, VTO can help address concerns related to style and suitability, potentially mitigating impulse purchases, which are another driver of high return rates (Stöcker et al., 2021). However, the role of VTO in reducing bracketing is not entirely straightforward. While VTO can decrease fit-related uncertainty, it does not necessarily address other motivations behind bracketing, such as the desire for variety or comparison shopping. Consumers who engage in bracketing for reasons beyond fit may still continue this practice despite the availability of VTO technology.

Although VTO can reduce uncertainty around fit, there is a concern that it might inadvertently lead to over ordering behavior, particularly when combined with generous return policies. The confidence consumers gain from VTO may encourage them to order multiple items, believing they can quickly return those that do not meet expectations. This overconfidence and flexible return policies may exacerbate return volumes, placing additional strain on retail operations (Rintamäki et al., 2021; Roberts et al., 2023). Consequently, it is important to distinguish between intentional (planned) returns, such as bracketing, and unintentional returns that result from product defects or dissatisfaction (Xu et al., 2023a). While VTO

technology may help reduce planned returns, it may also inadvertently promote overordering, contributing to increased return rates and associated challenges.

The Influence of Return Policies on Consumer Behavior

Return policies also play a pivotal role in shaping return behavior. Permissive policies can mitigate perceived shopping risks and foster consumer trust; however, they also contribute to increased return rates (Mollenkopf et al., 2007; Petersen & Kumar, 2015; Hjort et al., 2013; Tandon et al., 2021a, 2021b; Karlsson et al., 2023). Roberts et al. (2023) assert that liberal return policies can escalate logistical and environmental pressures, especially when returned items are rendered unsellable, thus compounding waste and sustainability challenges in fashion e-commerce.

Fit uncertainty, a critical factor driving returns, arises from apprehensions regarding the physical fit of products (Nelson, 1970). Pre-sale solutions like VTO technologies and 3D body scanning can significantly alleviate fit uncertainty, curbing post-sale return costs and enhancing consumer satisfaction (Miell et al., 2018; Liu et al., 2022). By addressing concerns related to fit and style, these technologies represent a promising pathway for reducing return rates while bolstering consumer confidence in the online shopping experience.

To conclude, VTO technology holds promise in reducing returns related to fit uncertainty, yet its potential to contribute to overordering requires careful consideration. Retailers must balance the benefits of VTO with the operational challenges posed by high return volumes. Future research should explore how VTO can be integrated with complementary strategies, such as enhanced size charts, AI-driven recommendations, and adaptive return policies, to address bracketing behavior and over ordering concerns effectively.

2.2.3 Consumer Adoption: Consumer Acceptance & Attitudes

The growing body of literature on try-on technology has utilized several theoretical frameworks to understand consumer adoption of VTO systems. Since 2017, there has been a notable increase in publications, especially between 2019 and 2023, which reflects heightened interest in this field. Quantitative research methodologies dominate the landscape, with cross-sectional surveys preferred; these surveys frequently explore consumer interactions with VTO technologies over a short period, while longitudinal studies assessing the long-term impact are less common.

Theoretical Frameworks for Adoption

Among the theoretical frameworks used in prior studies, the most commonly utilized are the *Technology Acceptance Model* (TAM), the *Stimuli-Organisms-Responses model* (S-O-R), and the *Unified Theory of Acceptance and Use of Technology 2* (UTAUT2). (Batool & Mou, 2024) Research using the S-O-R model evaluates how consumers' perceived ease of use and utility of VTO tools influence their behavioral responses, while UTAUT2 delves into how performance expectations and social influence shape consumer technology adoption. Additionally, studies have identified the critical role of Image Interactivity Technology (IIT) in affecting consumers' emotions and perceived value, which are crucial for accepting VTO technology (Batool & Mou, 2024). [See Appendix B for more details]

Initially proposed by Davis (1985), TAM builds upon Rational Action Theory to elucidate how users accept and utilize technology. Central to this model are two primary constructs: perceived usefulness and ease of use, which significantly influence users' attitudes toward new technology and, subsequently, their behavioral intentions to use it (Ajzen & Fishbein, 1977). TAM has been effectively applied across various contexts, including mobile commerce (Hubert et al., 2017), banking technology (Al-Saedi et al., 2020), and educational applications (Baby & Kannammal, 2019). Research consistently demonstrates that perceived usefulness and ease of use are critical in predicting technology adoption (Jiang et al., 2023; Li & Xu, 2020). However, TAM's predictive validity has been criticized for relying solely on perceived usefulness and ease of use (Legris et al., 2003; Chuttur, 2009). Scholars have suggested enhancing the model's explanatory power by integrating additional factors, such as perceived enjoyment (Li & Xu, 2020; Zhang et al., 2019), perceived privacy risk (Ivanov et al., 2023; Zhang et al., 2019), and perceived accuracy (Tandon et al., 2021a; Tandon et al., 2021b). These extensions are

particularly relevant in VTO technology, where user engagement and enjoyment significantly influence the shopping experience (Kim & Forsythe, 2007).

Key Constructs Influencing VTO Adoption

Perceived usefulness (PU) refers to the extent to which a consumer believes utilizing the technology would enhance their experience by improving decision-making efficiency and satisfaction (Davis, 1989; Venkatesh et al., 2003). In fashion e-commerce, VTO technology reduces uncertainty, enhances satisfaction, and supports better decision-making by enabling consumers to visualize products accurately (Kalpoe, 2020; Jiang et al., 2023). Research consistently identifies perceived usefulness as a critical determinant of consumer attitudes and adoption of VTO technologies (Kowalczuk et al., 2020). For instance, Jiang et al. (2023) found that accurate fit and style visualization positively influence attitudes, while studies on AR applications confirm that perceived usefulness improves satisfaction and behavioral intentions (Hsu et al., 2021; Almousa, 2020). Furthermore, technologies that address consumers' utilitarian needs, such as offering convenience and correct fit, significantly boost adoption intentions (Chidambaram et al., 2023). This aligns with the TAM, which postulates that perceived usefulness and ease of use predict technology adoption (Davis, 1989; Venkatesh & Davis, 2000).

Perceived ease of use (PEOU) refers to the degree to which consumers perceive technology as user-friendly and requiring minimal effort (Davis, 1985). In the VTO context, simplified navigation, responsive interfaces, and intuitive design are critical for encouraging adoption (Venkatesh et al., 2003; Jiang et al., 2023). Studies have shown that perceived ease of use influences consumer attitudes and enhances perceived usefulness, increasing the likelihood of technology adoption (Kalpoe, 2020; Foroughi et al., 2024). For instance, Zhang and Wang (2023) demonstrated that simplified interfaces improve perceived usefulness, while Baby and Kannammal (2019) confirm that reducing technological complexity positively impacts consumer perceptions. However, variability exists in perceived ease of use's effects, as cultural and privacy-related factors may mediate its influence (Gonçalves et al., 2023; Almousa, 2020). Despite this, the correlation between perceived ease of use, perceived usefulness, and consumer attitudes remains well-supported in the literature

Perceived accuracy (PA) relates to consumers' perceptions of how closely a visualized figure matches their actual body and how accurately the product is represented on a model (Gao et al., 2014; Kim & LaBat, 2013). Online shoppers prioritize accurate product information, reducing uncertainty and enhancing decision-making (Vasic et al., 2019; Zhang et al., 2019; Limbu et al., 2011). Thus, essential accuracy-related concerns within fashion e-commerce encompass avatar-body representation, garment fit simulation, and the ability to view garments in motion (Lee et al., 2022). Karadayi-Usta (2024) also concluded that accuracy—regarding reliable measurements and recommendations—significantly influences consumer decision-making in AI and AR applications. Gonçalves et al. (2023) underscores the importance of perceived accuracy in shaping consumer attitudes and intentions. Studies indicate that precise size recommendations through VTO can diminish returns and boost customer satisfaction (Hernández et al., 2019). However, differing levels of accuracy among VTO technologies, such as AR, VR, and 3D body scanners, affect their potential for widespread adoption (Lee & Xu, 2020). Recent findings by Gonçalves et al. (2023) affirm that perceived accuracy is one of the strongest predictors of consumer attitudes toward VTO. A lack of accuracy is a barrier to adoption, highlighting its crucial role in promoting positive consumer attitudes and intentions regarding these technologies.

Perceived privacy risk (PPR) in e-commerce pertains to consumers' concerns regarding sharing personal information, such as body measurements or facial images, necessary for VTO technologies (Merle et al., 2012; Ivanov et al., 2023b). This perceived risk reflects consumers' anxiety about potential adverse outcomes from online purchases, significantly influencing their purchase intentions (Dowling & Staelin, 1994; Featherman & Pavlou, 2003). Advanced VTO solutions that require more sensitive data may exacerbate privacy concerns, potentially serving as a barrier to adoption (Du & Xie, 2021; Chang, 2014; Gonçalves et al., 2023). Nevertheless, the *privacy paradox*—where consumers are willing to compromise on privacy for convenience or enjoyment—often alleviates these concerns (Bélanger & Crossler, 2011; Zhang et al., 2019). Notably, enjoyment has been shown to mitigate the adverse effects of privacy worries, helping to maintain positive attitudes toward

VTO (Chidambaram et al., 2023). Adequate privacy protections and user control over personal data are crucial for fostering trust and bolstering intentions to adopt VTO technologies (Ivanov et al., 2023b; Ornati et al., 2022). Therefore, strong privacy safeguards and ethical data management practices further enhance trust and promote adoption intentions (Rana, 2024; Zhang & Wang, 2023).

Perceived enjoyment (PE) refers to how consumers find using a system intrinsically enjoyable (Venkatesh, 2000). Intrinsic motivations, such as enjoyment, play a significant role in shaping consumers' adoption intentions for new technologies, especially in interactive and immersive contexts like VTO (Davis et al., 1992; Lee et al., 2019; Suki & Suki, 2011; Van der Heijden, 2004). The immersive nature of VTO technologies enhances the shopping experience through features like real-time clothing visualization, manipulation of images, and customization of virtual models, fostering playful interactions and user engagement (Lavoye et al., 2021; Lee et al., 2021; Rauschnabel et al., 2019). This enjoyment leads to greater consumer satisfaction and positive attitudes, which increase purchase likelihood (Pachoulakis & Kapetanakis, 2012; Merle et al., 2012; Kim, 2016; Pantano et al., 2017). Moreover, enjoyment encompasses both hedonic and utilitarian values: hedonic users value novelty and immersion (Ha & Stoel, 2004; Yang & Xiong, 2019), while utilitarian users appreciate practical benefits like accurate size recommendations and reduced returns (Kim & Shim, 2002). Striking a balance between these values is critical, as perceived augmentation enhances perceived usefulness and enjoyment, contributing to a more effective and enjoyable shopping experience (Baytar et al., 2016; Beck & Crié, 2018). However, the degree of perceived enjoyment can vary depending on the quality of the technology and the product category. For instance, while AR applications in beauty often deliver satisfying results, AR for fashion has faced criticism for unrealistic fit simulations, which can negatively impact user satisfaction (Riar et al., 2021; Lavoye et al., 2021). Despite these challenges, enjoyment has been shown to mitigate perceived risks and foster positive attitudes and adoption intentions, highlighting its critical role in VTO adoption (Chidambaram et al., 2023; Heller et al., 2019; Liu et al., 2019).

TABLE 3. *Summary of Key Constructs and Their Role in VTO Adoption*

CONSTRUCT	DEFINITION	IMPACT ON VTO ADOPTION
Perceived Usefulness	= The degree to which a consumer believes using VTO will enhance their decision-making and satisfaction.	- A key determinant of adoption. Accurate fit and style visualization in VTO improve decision-making efficiency and reduce uncertainty, leading to higher adoption rates.
Perceived Ease of Use	= The degree to which a consumer perceives VTO as user-friendly and requiring minimal effort	- Improves perceived usefulness and adoption likelihood. Simplified interfaces and intuitive navigation enhance consumer engagement.
Perceived Accuracy	= The extent to which the visualized fit and product representation match reality.	- Crucial for decision-making in fashion e-commerce. Higher accuracy in fit and styling recommendations reduces return rates and increases consumer satisfaction.
Perceived Privacy Risk	= The level of concern over sharing personal information for VTO technology.	- A significant barrier to adoption. Higher privacy concerns can reduce consumer willingness to share data, but the privacy paradox can mitigate these concerns.
Perceived Enjoyment	= The degree of intrinsic enjoyment derived from using the VTO system.	- Directly influences consumer engagement and repeat usage. Enjoyable interactions increase the likelihood of purchase and foster long-term loyalty.

In summary, the adoption of VTO technology is shaped by several key factors (as detailed in Table 3), including perceived usefulness, ease of use, accuracy, privacy concerns, and enjoyment. While each factor plays a distinct role in influencing consumer attitudes, their interplay ultimately determines whether VTO reduces or reinforces return behavior. Addressing adoption barriers—particularly accuracy and privacy concerns—can enhance consumer trust and lead to lower return rates, making VTO a more effective tool for sustainable fashion e-commerce.

2.3 Conclusion & Relevance

Study One highlights the dynamic and multifaceted nature of VTO technologies and their impact on consumers' attitudes, adoption intentions, and return behaviors in the fashion e-commerce sector. The findings underscore the transformative potential of VTO technologies to enhance consumer experiences, boost fit confidence, and reduce return rates—factors critical to addressing challenges in fashion e-commerce. However, the evolution of these technologies calls for further exploration of their adoption and usage, particularly from the consumer's perspective.

A key takeaway from the literature is the prominence of the Technology Acceptance Model (TAM) as a theoretical framework for studying consumers' attitudes and adoption intentions. However, to capture the full complexity of consumer decision-making, integrating additional constructs—such as perceived *accuracy*, *privacy risk*, and *enjoyment*—is essential.

These factors offer a more comprehensive understanding of consumer perceptions and behaviors, particularly concerning the trade-offs between convenience, trust, and overall user experience. While prior research has provided valuable insights into the benefits of VTO technologies, a notable gap remains in studies that account for individual differences in consumer characteristics and behaviors. In particular, the growing "*return culture*" in fashion e-commerce underscores the importance of examining the interplay between return behaviors and adoption intentions. Factors such as demographic influences (e.g., age and gender), risk aversion, and shopping habits warrant deeper investigation to refine adoption models and align VTO technologies more closely with consumer needs.

Consequently, the present study lays a critical foundation for Studies Two and Three by informing both the interview design and the theoretical framework. Study Two addresses the identified gaps by delving into consumer behaviors and attitudes through qualitative insights, focusing on nuanced aspects such as privacy concerns, personalization, and technology adoption across various demographics. Additionally, it will explore whether VTO technologies mitigate bracketing behaviors or inadvertently promote over ordering due to perceived fit accuracy, thereby enhancing our understanding of return behaviors. Study Three will quantitatively evaluate an extended Technology Acceptance Model (TAM) framework, incorporating new constructs such as perceived accuracy, privacy risk, and perceived enjoyment. Insights from Study One, especially regarding the perceived benefits and drawbacks of VTO technology, will guide the operationalization of these variables within the extended framework. This exploration will better understand how individual characteristics, including age, gender, and risk aversion, influence adoption intentions and usage patterns. Furthermore, outlining the current VTO technologies available in the field has been essential for designing realistic and relevant stimuli for the survey in Study Three. This approach ensures that the survey design reflects a comprehensive representation of VTO technologies, facilitating a robust quantitative assessment of consumer perceptions and behaviors.

Together, these studies will yield a richer understanding of how VTO technologies impact consumer adoption and their potential to address the pressing challenges associated with returns in fashion e-commerce while also considering the dynamic interactions among technology adoption, consumer trust, and retail practices.

3.0 STUDY TWO - EXPERT & COMPANY INTERVIEWS

The following chapter presents *Study Two*, which builds on the insights from the systematic literature review through expert and company interviews. While Study One identified key theoretical perspectives and research gaps, Study Two focuses on gathering practical insights from industry professionals on the challenges and opportunities of Virtual Try-On (VTO) implementation. These interviews provide a real-world perspective on critical factors such as consumer adoption barriers, privacy concerns, and technical limitations. By validating and refining the theoretical conclusions from Study One, Study Two bridges the gap between academic research and industry practice, laying the groundwork for the quantitative investigation in Study Three.

3.1 Methodology

A semi-structured approach was used to balance thematic consistency with flexibility, allowing for exploring emerging topics. Participants were selected through purposive sampling, ensuring diverse perspectives from executives, researchers, and practitioners with expertise in VTO technologies. Each interview lasted approximately 40 minutes, as summarized in Table 4, together with additional interviewee profile information. Overall, the collected data contributes to the study's theoretical framework and strengthens the study's alignment with industry realities, enhancing the reliability and validity of subsequent research stages.

TABLE 4. *Company & Expert Interviews*

NR.	PROFILE	REGION	FORMAT & DURATION	PARTICIPANT PROFILES	EXPERTISE	MAIN INTERVIEW TOPICS
#1	Male in his 40's	North America	Online, Zoom-Meeting 40 Minutes	Head of Product Strategy specializing in AI-driven body data technologies.	Expertise in data-driven apparel fitting and AI for sizing optimization to reduce returns in online retail.	• Reducing return rates and their impact on profitability and sustainability. • Realism and effectiveness of VTO solutions. • Cultural differences in fit preferences. • Data privacy and personal information challenges.
#2	Woman in her 50's	Europe	Online, Zoom-Meeting 40 Minutes	Founder & CTO of a VTO technology company with a background in finance and marketing.	Specialized in innovative VTO solutions to improve customer satisfaction and reduce return rates in e-commerce.	• Influence of VTO on return rates and average order values. • Challenges in consumer adoption and mobile accessibility. • Data privacy compliance. • Openness to innovation and testing in retail technology.
#3	Male in his 40's	North America	Online, Zoom-Meeting 40 Minutes	Digital Media Specialist with expertise in interactive product displays and mobile optimization.	Pioneer of 360-degree product views and interactive retail technologies for the fashion industry.	• Mobile optimization and user experience for VTO. • Post-COVID shopping behaviors. • Personalization and data use in fashion. • Challenges in accurate clothing modeling. • Future applications of 3D scanning in retail.
#4	Male in his 60's	North America	Online, Zoom-Meeting 40 Minutes	Technology Expert with decades of experience in AR/VR and digital innovation for fashion.	Specialist in leveraging emerging technologies for lifestyle and fashion transformation in global markets.	• COVID-19's impact on returns and sizing discrepancies. • Challenges with traditional sizing standards. • Advances in AI and material science. • Personalized retail experiences with scanning technologies.
#5	Male in his 20's	Europe	In Person (IRL), Stockholm, Sweden 65 Minutes	Co-founder of a start-up focusing on AI-driven VTO solutions for consumer engagement.	Experience in developing consumer-centered tools to enhance satisfaction and minimize returns through advanced VTO systems.	• Addressing challenges in size-scanning adoption. • Generative AI's impact on fit and return rates. • Engaging consumers with new technologies. • Adapting to an evolving retail landscape with proactive AI solutions.
#6	Women in her 50's	Europe	Online, Zoom-Meeting 40 Minutes	Professor with 20 years of expertise in simulations, biomaterials, and AI for VTO systems.	Deep involvement in early projects like eTailor and the development of consumer-centric AI in fashion technologies.	• Complexities of VTO implementation and data-driven forecasting. • Fit standardization issues in consumer satisfaction. • Privacy concerns with body scans. • Business model comparisons between traditional and fast fashion.
#7	Male in his 60's	Europe	Online, Zoom-Meeting 40 Minutes	Fashion Technology Advisor with extensive experience in product data management and AI/ML.	Industry veteran focusing on lifecycle data, e-commerce evolution, and advancing digital fashion innovation.	• Evolution of e-commerce from Web1 to Web3. • Barriers to VTO adoption, including accuracy and realism. • Algorithmic improvements for retail AI. • Critical analysis of current VTO solutions and their size offerings.

3.1.1 Interview Design and Protocols

Following Arsel (2017) and Gioia et al. (2013), the interview design was structured yet flexible, guided by a semi-structured format to explore specific themes. This format allowed for conversational flow and enabled participants to share their experiences openly (Adams, 2015; Lune & Berg, 2017; Alvesson, 2003). A basic theoretical framework was used to guide the questions (see Appendix C), influenced by existing literature on consumer attitudes, behavioral intentions, and privacy concerns in VTO. This approach facilitated questions and interpretations while remaining open to insights that could challenge or extend existing theories. As Gluckman (1940) and Burawoy (1998) highlighted, this structure allowed for probing specific insights while remaining receptive to new, emergent themes. Additionally, insights from early interviews informed adjustments

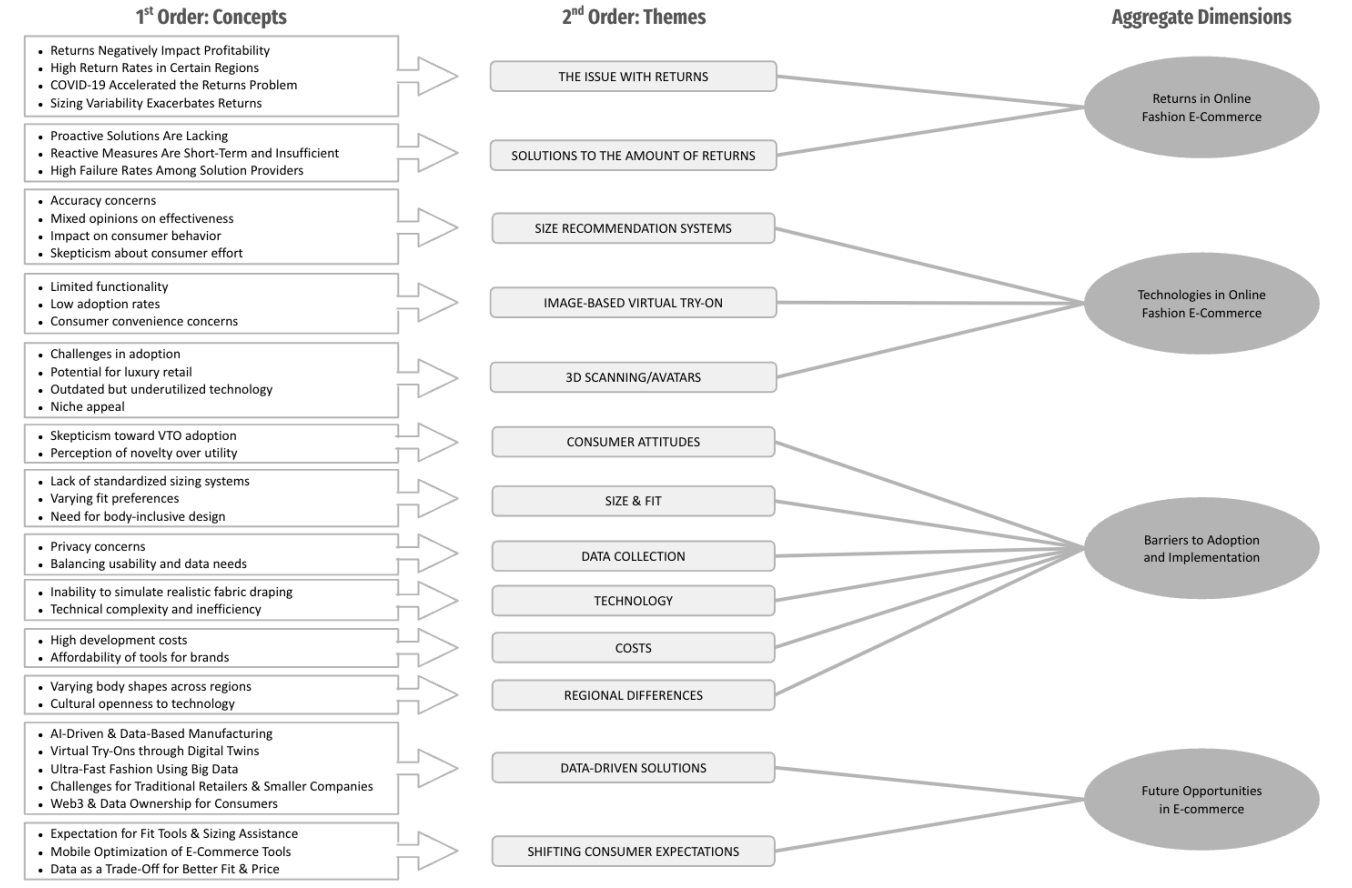
in the questions for subsequent interviews, employing an iterative approach that encouraged reflexive adaptation (Wilk, 2001; Kvale, 2006). This iterative cycle also contributed further to the third study's survey design. Nevertheless, maintaining a reflexive stance in line with Zilber & Meyer (2022), continuous evaluation of the methodological choices to ensure ethical integrity and alignment with the research objectives while considering participants' comfort and autonomy in sharing experiences.

3.1.2 Analytical Approach

The two-stage coding approach analyzes qualitative data following Gioia et al. (2013). In the first-order coding stage, participant-derived terms and descriptions are generated, prioritizing participant language to ensure authenticity and to capture diverse perspectives. In the second-order (Axial) coding stage, these codes are synthesized into broader themes representing theoretical interpretations and identifying relationships between concepts. These themes align with the research questions on VTO technologies.

Using the Gioia Method, a comprehensive data structure is developed to visually map the transformation from raw data to high-level themes. Figure 8 serves as an overarching summary, showcasing how participant input transitions into aggregate dimensions, providing a clear overview of the findings. In the results section, additional figures (Figures 9a, 9b, 9c, and 9d) expand on the first-order themes within each aggregate dimension, offering a more detailed exploration of key insights. These visual mappings collectively function as structured summaries of the findings and frameworks for presenting the analysis—ensuring transparency and coherence in linking participant data to broader theoretical contributions. As data collection progresses, theoretical saturation indicates that additional data no longer introduces novel insights. This process ensures the robustness of perceived security, privacy, and usability concepts in the VTO context. Consistent with Arsel (2017) and Harley & Cornelissen (2022), a reflexive approach is integrated throughout the analysis. It examines methodological choices and their influence on findings, supporting informed adjustments to interview protocols and thematic categorization aligned with the study's evolving focus.

FIGURE 8. *Visual Map for Company & Expert Interviews - Inspired by the Giora Method (Giora et al., 2013)*



3.2 Analysis & Results

3.2.1 Returns in Fashion E-commerce

The first significant theme that emerged during the interviews was the high volume of returns in fashion e-commerce. Participants discussed the potential cost savings for major brands if they could reduce returns, even by as little as 1% (Interview #1). For instance, one participant highlighted:

> *"Profitability is king, and returns go straight to the bottom line. If one can even reduce that 1% for a billion-dollar brand, that is a ton of money saved."*

However, despite the financial implications, there appears to be a lack of proactive solutions among large brands to address the issue. According to a participant from a VTO company (Interview #5):

> *"Brands tend to resort to short-term strategies, such as blocking consumers who frequently return items, instead of tackling the root causes of the problem."*

Further, the discussion also turned to factors contributing to the uptick in returns, particularly the influence of COVID-19 on consumer shopping behavior. The pandemic accelerated the shift to online shopping, creating a culture of ordering multiple items to see which fits best, a practice often referred to as *bracketing behavior.* As noted in Interview #4:

> *"During COVID, people did not know their size, so they would buy three of everything: the size they thought they were, the size they might be, and the size they hoped not to be. It became part of the culture of buying multiple things and seeing which fits best."*

This behavior emerged partly due to the inability to try on clothes in physical stores, which had previously allowed consumers to assess fit directly. Additionally, sizing inconsistencies between manufacturers—and even within brands—exacerbated the uncertainty:

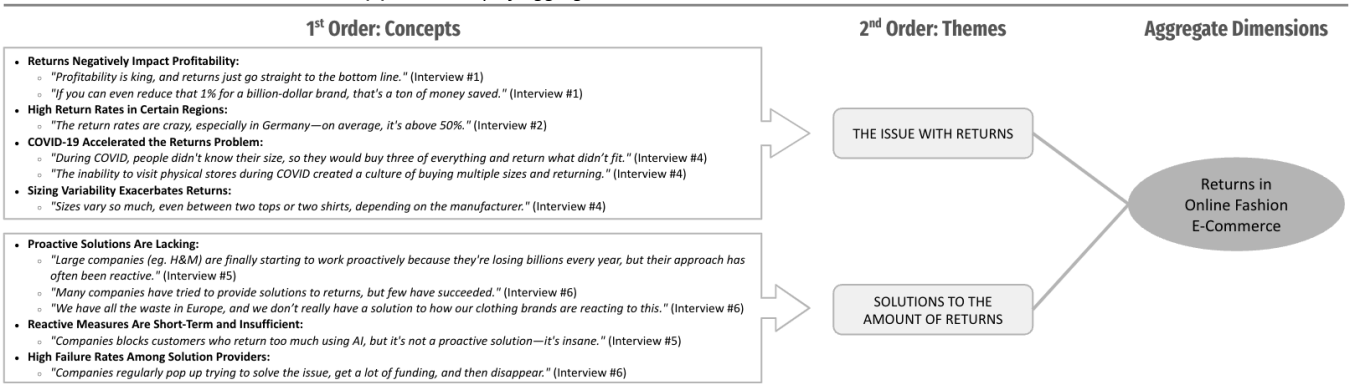
> *"Sizes vary so much, even between two tops or two shirts, depending on the manufacturer."*

The lack of standardized sizing forces consumers to rely on trial-and-error methods, leading to elevated return rates. As the interviewee further explained:

> *"Until you can somehow get standardized sizing across the industry, it will be hard for the consumer not to want to buy different things because they just do not know what will fit."*

Moreover, the rise of bracketing behavior, born out of necessity during the pandemic, has become a persistent challenge for fashion e-commerce. These insights emphasize the need for innovative solutions that mitigate sizing uncertainty and improve the online shopping experience. Technologies such as VTO tools and accurate systems hold promise in addressing these challenges by offering consumers greater confidence in their purchase decisions and reducing reliance on bracketing behavior. The key themes and findings surrounding returns in online fashion e-commerce, including their financial implications, bracketing behavior, and sizing variability, are visually summarized in Figure 9(a) below.

FIGURE 9(a). *Visual Map of Aggregate Dimension 1: Returns in Online Fashion E-Commerce*



3.2.2 Technologies in Fashion E-commerce

Integrating emerging technologies in fashion e-commerce, such as size recommendation systems, image-based VTO, and 3D scanning, has sparked mixed opinions among participants. While some participants recognized the effectiveness of ***size recommendation systems*** in reducing returns and boosting average order value (AOV), as Interview #1 stated:

> *"Once I saw how accurate it was and it worked, the light bulbs started going off."*

While others were skeptical about their accuracy, mainly when relying on limited data, as Interview #4 stated:

> *"They do not have enough information to be able to really determine what will fit properly and what will not; they are just guessing."*

One participant emphasized the potential for size systems to enhance consumer confidence, noting that AOV increased by up to 45% and returns decreased by 35% (Interview #2). However, concerns about consumer effort persist, with one participant questioning whether users would be willing to engage with the technology (Interview #5).

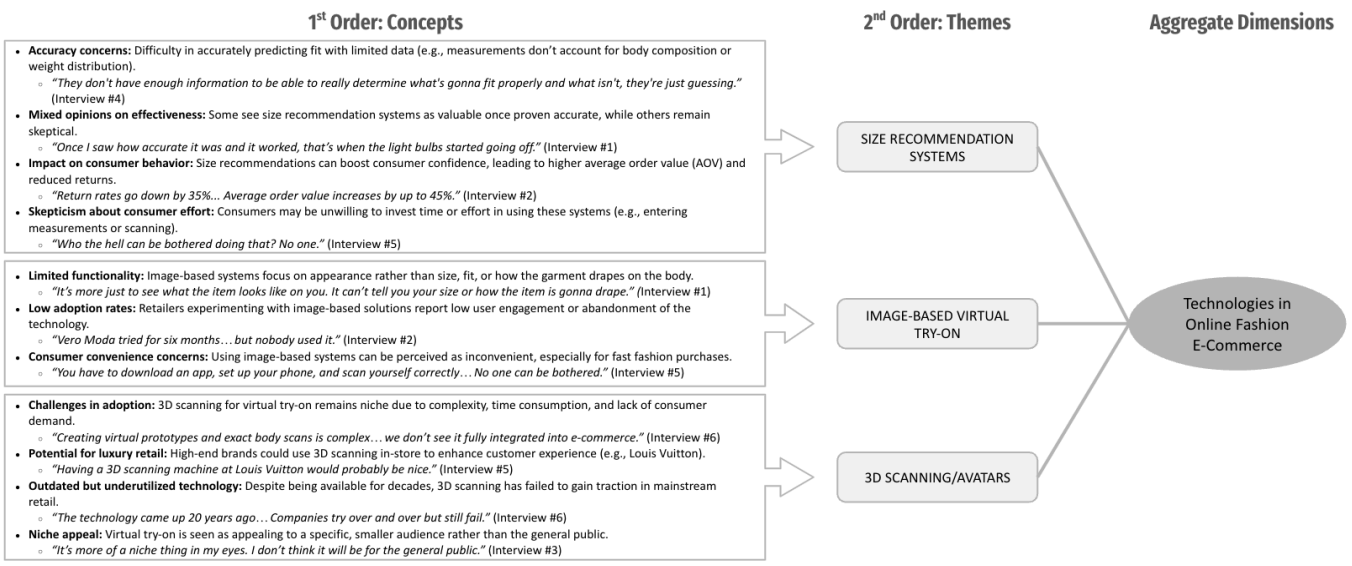
Furthermore, participants also critiqued ***image-based VTO*** for its limited functionality, with some pointing out that it could not accurately predict fit or garment draping (Interview #1). Additionally, consumer convenience was questioned, as engaging with VTO systems can be inconvenient, especially for fast fashion purchases (Interview #5). Low adoption rates were also highlighted, with one participant citing Vero Moda's failed trial (Interview #2).

3D scanning technology for VTO was considered complex and time-consuming, limiting its appeal to luxury brands and niche markets (Interview #5, #6). Despite being available for over two decades, 3D scanning remains underutilized in mainstream fashion e-commerce due to high development costs and limited consumer demand, as per Interview #6:

> *"The technology came up 20 years ago… Companies try over and over but still fail."*

Overall, while the potential benefits of these technologies are recognized, significant reservations remain regarding their effectiveness, consumer engagement, and mass-market applicability. See Figure 9(b) for an overview of the key findings within the second aggregated dimension.

FIGURE 9(b). *Visual Map of Aggregate Dimension 2: Technologies in Online Fashion E-Commerce*



3.2.3 Barriers to Implementation/Adoption

The interviews pinpointed six key barriers to implementing and adopting VTO technologies. These barriers, summarized in Figure 9(c), highlight organizations' challenges when integrating innovative technologies into their operational processes. Understanding these obstacles is crucial for developing effective strategies to promote the adoption of these technologies across relevant industries.

The first significant barrier identified is ***consumer motivation***. Numerous participants expressed a general reluctance among online shoppers to engage with VTO and 3D scanning technologies, primarily rooted in a perceived lack of accuracy and the inconvenience associated with navigating multiple steps to obtain size recommendations (Interview #2, #6, #7). As noted by Interview #6:

> *"We have talked to clothing companies...but will people actually use it...or would they rather just order two sizes and send one back because it is so easy?"*

This quote underscores the skepticism surrounding consumer adoption of VTO technologies, particularly when the simplicity of ordering multiple sizes and returning the excess remains a preferable option for many. Additionally, ***size discrepancies*** emerged as a considerable challenge, with variability in sizing across different brands and manufacturers and diverse fit preferences among consumers (Interview #4, #6). As Interview #6 highlighted:

> *"Each company has its own sizing system...S, M, and L do not mean anything."*

The reliance on standardized mannequin sizing often results in a poor fit for the average consumer, who may not conform to these idealized dimensions (Interview #4, #7). Participants also noted that limited size options exacerbate these challenges, advocating for a more extensive range of sizes to better accommodate diverse body types and fit preferences (Interview #4, #7). Further barriers to adoption pertain to privacy concerns and ***data collection***. Multiple participants emphasized the increasing importance of safeguarding personal information (Interview #1, #2) and the potential risks of sharing personal images online (Interview #6). Interestingly, one participant offered a contrasting perspective, indicating a willingness to share personal data in exchange for improved fitting options (Interview #7). This finding suggests a dichotomy in consumer attitudes, where some individuals may be open to data sharing while others exhibit reservations.

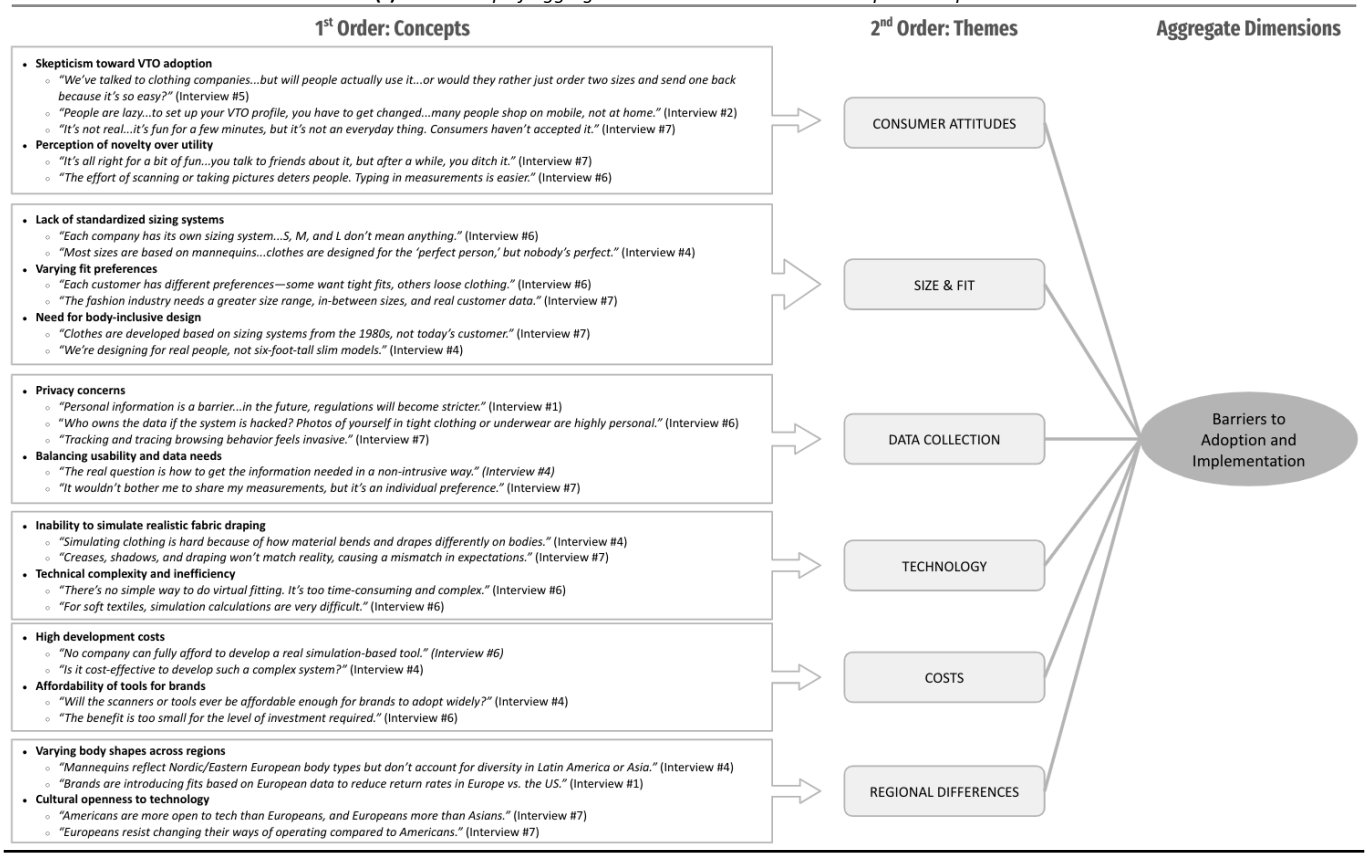
Yet, ***technological limitations*** further complicate the adoption of VTO technologies, particularly in achieving realistic simulations of how various fabrics interact and drape on the body (Interview #4, #6). This challenge highlights the complexities of VTO technologies, which extend beyond simple visual representation. Such barriers hinder the broader acceptance and utilization of innovative try-on technologies in the retail clothing sector, identifying critical areas for further exploration and development.

Financial implications associated with adopting VTO technologies also emerged as a barrier. Several participants noted the ***prohibitive costs*** linked to implementation. One participant shared insights from a previous project involving in-store 3D scanning, noting that high costs and low conversion rates rendered the initiative unsustainable (Interview #5). Furthermore, it was observed that only a limited portion of a brand's collection is typically available for VTO applications, as digitizing each garment is labor-intensive. This limited digital offering can diminish the perceived value of VTO solutions for consumers and brands (Interview #6). Lastly, as Interview #4 highlighted,

> *"Mannequins reflect Nordic or potentially Eastern European body types, but they do not account for the diversity in Latin America or Asia."*

Hence, ***regional differences*** concerning body types and varying degrees of openness to technological solutions were highlighted, emphasizing the necessity for technology adaptation based on diverse contexts (Interview #1, #7). Underlining the complex interplay of factors influencing the adoption of VTO and 3D scanning technologies in the retail landscape.

FIGURE 9(c). *Visual Map of Aggregate Dimension 3: Barriers to Adopt and Implementation*



3.2.4 The Future of E-commerce

The rise of ultra-fast fashion brands like Shein underscores the growing importance of AI-driven, ***data-based manufacturing*** in staying competitive. One participant emphasized the need for traditional fast fashion retailers to accelerate their processes (Interview #4):

> *"The biggest opportunity is in data because fast fashion takes nine months; that is not fast enough."*

Shein's strategy, which leverages data to predict consumer preferences and reduce return rates, highlights a pathway traditional retailers could adopt (Interview #6). Supporting this, another participant predicted that tools assisting consumers with size selection would become a standard expectation in e-commerce (Interview #1), stating that:

> *"In the future, it will just be something customers expect to be available."*

Tools like VTO and digital twins are pivotal for reducing returns and improving fit accuracy, reshaping consumer expectations, and driving adoption (Interview #4, #7). However, implementing these technologies remains challenging for traditional retailers, particularly smaller companies, which face high costs and resource limitations (Interview #6).

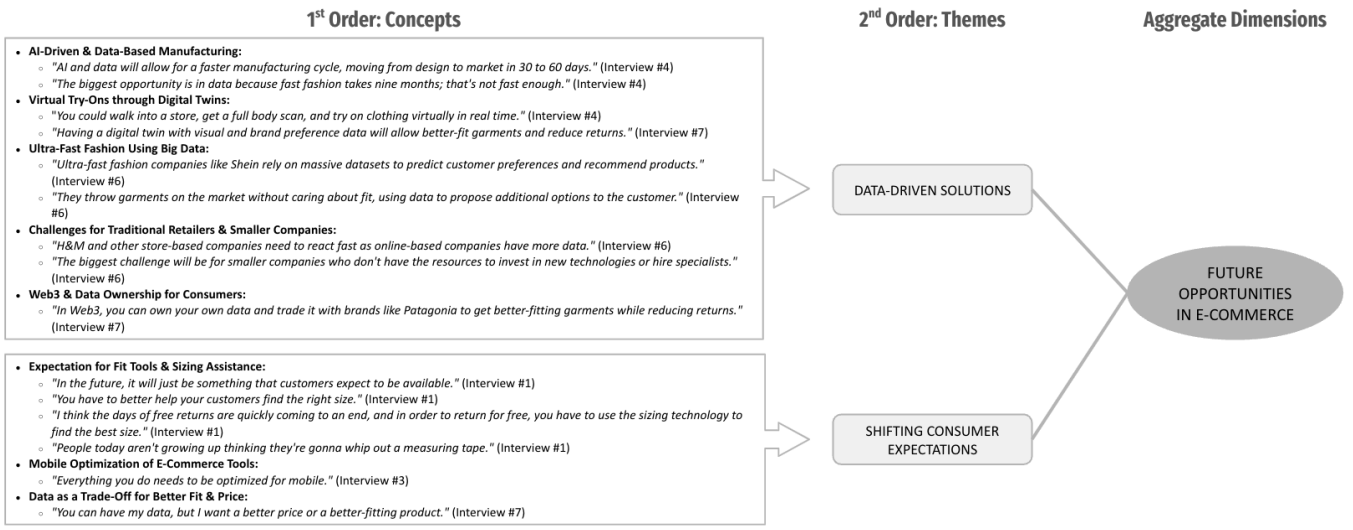
Furthermore, emerging Web3 technologies offer consumers enhanced control over their data, paving the way for ***personalized product recommendations*** and reduced returns. As Interview #7 noted:

> *"In Web3, you can own your own data and trade it with brands like Patagonia to get better-fitting garments while reducing returns."*

These insights highlight the critical role of AI, big data, and Web3 technologies in the future of e-commerce, where balancing technological innovation with consumer demands for convenience, personalization, and accuracy will be essential for success.

To provide a structured overview, Figure 9(d) visually maps the key themes and opportunities within the Future of the E-Commerce dimension, summarizing the pathways for innovation and challenges that retailers must address.

FIGURE 9(d). *Visual Map of Aggregate Dimension 4: Future Opportunities in E-Commerce*



3.3 Conclusion & Relevance

Study Two highlights multiple challenges and considerations for adopting VTO technologies in the online fashion industry. VTO technologies could potentially reduce returns, but substantial barriers such as technological limitations, high costs, privacy concerns, size and fit discrepancies, and limited size options inhibit widespread adoption. While some participants acknowledge VTO technologies' potential to guide consumers in selecting the proper size, skepticism remains high, and several participants pointed to the technologies' limited usefulness in addressing the complexities of sizing and fabric draping.

Furthermore, some participants highlighted that the time and effort required to use these technologies could lead to consumer reluctance. The participants repeatedly cited issues in terms of accuracy, especially regarding solutions based on a few measurements or images, which constitutes a critical challenge for consumer adoption.

Additionally, the participants expressed varying levels of comfort in sharing their data, with the majority expressing privacy concerns. For VTO technology to gain broader acceptance, developers and retailers must prioritize user-friendliness, accuracy in simulations and recommendations, and data protection. Building on these findings, the following research phase (Study 3) will focus on assessing consumer attitudes toward VTO technologies through an online consumer survey to further explore the factors influencing adoption and provide actionable insights for retailers and technology developers.

4.0 STUDY THREE - CONSUMER SURVEY

The following chapter presents *Study Three*, a consumer survey designed to test the insights derived from the previous studies empirically. Study One identified theoretical frameworks, such as the Technology Acceptance Model (TAM), and highlighted research gaps related to consumer adoption of Virtual Try-On (VTO) technology. Study Two expanded this understanding by incorporating industry perspectives on implementation challenges and consumer concerns. Based on these insights, Study Three applies an extended TAM framework by testing specific hypotheses and provides empirical evidence to address the key questions raised in the earlier studies.

4.1 Theoretical Framework & Hypothesis Generation

Building on previous research on attitudes and adoption intentions toward VTO technologies, the TAM will underpin the third study of this thesis. The constructs of perceived *accuracy*, *privacy risk*, and *enjoyment* will enhance the model's explanatory power. Based on insights from Study One and Study Two, hypotheses related to these primary constructs have been developed. Additionally, incorporating *bracketing behavior* into the TAM framework offers a novel perspective on consumer adoption of VTO. While perceived *usefulness* and *ease of us*e address the utility and user-friendliness of VTO technology, recognizing bracketing behavior underscores the practical implications of consumer decision-making patterns in fashion e-commerce.

4.1.1 Consumers' Perceived Usefulness & Ease of Use

Perceived Usefulness (PU)

Study One highlights that prior research has affirmed the functional advantages of VTO technologies. By enabling consumers to visualize products before purchasing, these technologies help alleviate uncertainties regarding size, fit, and style, enhancing PU (Kalpoe, 2020; Jiang et al., 2023). Consistent with prior research, consumers using VTO technologies in online fashion shopping are expected to perceive these tools as more useful for reducing uncertainties and enhancing the overall efficiency and effectiveness of the shopping process. PU is a well-established predictor of attitudes toward technologies, with research suggesting that heightened PU is associated with more favorable consumer attitudes (Venkatesh & Davis, 2000). Consequently, it is reasonable to anticipate that PU will positively influence consumers' attitudes toward the webpage. Building on these insights, this study proposes the following hypotheses:

- → **Hypothesis 1(a).** Consumers exposed to VTO technology (as opposed to no VTO technology on a webpage) will experience greater Perceived Usefulness [PU].
- → **Hypothesis 1(b).** Perceived Usefulness [PU] will positively affect consumers' attitudes toward page usage [ATW].

Perceived Ease of Use (PEOU)

During Study Two, it was noted that consumers might hesitate to engage with VTO technologies due to the inconvenience of navigating multiple steps for size recommendations (Interviews #2, #6, #7). Conversely, research indicates that user-friendly technologies like VTO systems enhance PEOU by reducing cognitive effort (Venkatesh et al., 2003; Kalpoe, 2020). Unlike traditional webpages, these technologies can minimize user effort by incorporating features such as automated size recommendations. Thus, consumers exposed to VTO technologies are expected to report higher PEOU than those interacting with webpages without VTO. As a key construct of the TAM, PEOU is a critical determinant of attitudes toward technologies, significantly impacting user satisfaction and engagement (Venkatesh & Davis, 2000), hence, anticipated to influence ATW positively. TAM posits that PEOU directly affects PU (Venkatesh & Davis, 2000). Various studies have validated this relationship (Jiang et al., 2023; Kalpoe, 2020) across contexts, including e-commerce (Hsu et al., 2021; Venkatesh et al., 2003). Regardless of the presence of VTO technology, PEOU is likely to affect PU by helping consumers achieve shopping objectives more efficiently. In line with these insights, this study formulates the following hypotheses:

- ➔ **Hypothesis 2(a).** Consumers exposed to VTO technology (as opposed to no VTO technology on a webpage) will experience greater Perceived Ease of Use [PEOU].
- ➔ **Hypothesis 2(b).** Perceived Ease of Use [PEOU] will positively affect consumers' attitudes toward page usage [ATW].
- ➔ **Hypothesis 2(c).** The perceived ease of use [PEOU] of the webpage will positively affect consumers' Perceived Usefulness [PU], regardless of whether VTO technology is present or not.

4.1.2 Extended Technology Acceptance Model Factors

Perceived Accuracy (PA)

VTO technologies address sizing and fit concerns that hinder consumer satisfaction (Hernández et al., 2019) and contribute to online returns (Saarijärvi et al., 2017). In Study Two, it was noted that perceived inaccuracy was a barrier to VTO adoption, citing limitations in realistically simulating fabric drapes (Interviews #4, #6). However, research indicates that VTO can enhance PA by providing detailed visualizations and size recommendations based on individual measurements, reducing uncertainties linked to traditional size charts (Kalpoe, 2020; Jiang et al., 2023). Thus, consumers using VTO may perceive greater accuracy than those on standard webpages. Additional studies highlight PA's role in shaping consumer attitudes, suggesting that increased accuracy boosts satisfaction, trust, and engagement with the technology (Lee & Xu, 2020; Karadayi-Usta, 2024). Consequently, PA is expected to influence consumers' attitudes toward the webpage positively; hence, the following hypotheses are proposed:

- ➔ **Hypothesis 3(a).** Consumers exposed to VTO technology (as opposed to no VTO technology on a web page) will experience greater Perceived Accuracy [PA].
- ➔ **Hypothesis 3(b).** Perceived Accuracy [PA] will positively affect consumers' attitudes toward page usage [ATW].

Perceived Privacy Risk (PPR)

During Study Two, participants highlighted the increasing importance of protecting personal information (Interview #1, #2) and the privacy risks linked to VTO technologies (Interview #6), which may impede widespread adoption. This concern is supported by literature showing that while users value the personalization and convenience of VTO technologies, the need to share data can create hesitancy and anxiety about privacy risks (Bélanger & Crossler, 2011; Zhang et al., 2019). Thus, consumers exposed to VTO technology are likely to perceive higher privacy risks than those who are not.

Furthermore, research indicates that PPR affects ATW, with greater PPR associated with negative consumer attitudes toward technology adoption (Featherman & Pavlou, 2003; Ivanov et al., 2023b). Therefore, PPR is expected to impact consumers' ATW negatively. To explore this relationship further, the following hypotheses are proposed:

- ➔ **Hypothesis 4a:** Consumers exposed to VTO technology (as opposed to those who do not have VTO technology on a web page) will experience greater Perceived Privacy Risk (PPR).
- ➔ **Hypothesis 4b:** Perceived Privacy Risk (PPR) will negatively affect consumers' Attitude Toward Webpage Usage [ATW].

Perceived Enjoyment (PE)

Researchers have found that the interactive nature of VTO technologies boosts consumer engagement compared to standard webpages lacking VTO features (Rauschnabel et al., 2019). Studies indicate that VTO attributes increase engagement and enjoyment, leading to the expectation that VTO users will experience higher enjoyment levels than non-users. Additionally, research shows that PE significantly affects consumer attitudes toward technology, as enjoyable experiences enhance satisfaction and positive emotional responses (Van der Heijden, 2004; Pachoulakis & Kapetanakis, 2012). However, as noted in Study Two (Interview #7), the novelty of VTO technologies may limit their long-term appeal. While they can initially generate excitement—encouraging engagement and sharing—current realism limitations (e.g., texture mapping, creases, fit accuracy) may create disconnection, causing consumers to see VTO as a one-time activity rather than a daily utility. Thus, while PE is expected to influence ATW positively, the novelty and realism challenges identified in Study Two suggest that VTO's potential for long-term engagement relies on technological advancements. Therefore, this study proposes the following hypotheses:

- ➔ **Hypothesis 5(a).** Consumers exposed to VTO technology (as opposed to no VTO technology on a web page) will experience greater Perceived Enjoyment [PE].
- ➔ **Hypothesis 5(b)**.Perceived Enjoyment [PE] will positively affect consumers' attitudes toward page usage [ATW].

4.1.3 The Mediating Influence of Consumer Perceptions on Attitudes Toward Webpage Usage

Integrating VTO technologies in online shopping platforms signifies a shift in consumer behavior rooted in the TAM framework. This study highlights the mediating roles of PU [M_1], PEOU [M_2], PA [M_3], PPR [M_4], and PE [M_5] in shaping ATW [Y]. VTO technologies improve the shopping experience by offering personalized fit recommendations and helping consumers make informed decisions. Literature underscores the importance of PU in influencing consumer attitudes online (Kim & Shim, 2002; Lee et al., 2021). Advanced VTO features like 3D avatars enhance PU by allowing consumers to visualize products according to their preferences, creating an engaging shopping environment (Baytar et al., 2016).

Additionally, user-centric designs of VTO technologies boost PEOU by reducing cognitive load and streamlining interactions, positively affecting attitudes toward the webpage (Venkatesh, 2000; Pachoulakis & Kapetanakis, 2012; Liu et al., 2019). PA is vital for establishing trust in online shopping; VTO technologies enhance it by offering accurate size recommendations essential for consumer confidence (Kim & Shim, 2002; Riar et al., 2021). However, the personal data collection required by advanced VTO systems may raise PPR concerns, undermining their positive impact on attitudes (Lavoye et al., 2021; Chidambaram et al., 2023). Moreover, the engaging aspects of VTO technologies positively influence PE. By providing immersive experiences—such as customization and real-time feedback—these technologies increase consumer engagement and satisfaction, enhancing ATW (Yim et al., 2017; Merle et al., 2012; Lee et al., 2021). The following hypotheses further explore these dynamics:

➔ **Hypothesis 6.** VTO technology exposure will positively influence consumers' Attitude Toward Webpage Usage [ATW] via the …
- **a.** Perceived Usefulness [PU]
- **b.** Perceived Ease of Use [PEOU]
- **c.** Perceived Accuracy [PA]
- **d.** Perceived Privacy Risk [PPR]
- **e.** Perceived Enjoyment [PE]

4.1.4 Moderating Role of Bracketing Behaviour

As noted in Study One, prior literature has given limited attention to individual characteristics and behaviors in evaluating attitudes toward VTO technologies. Bracketing Behaviour (BB)—where consumers purchase multiple sizes or variations of a product to find the best fit—emerged as a critical theme. This behavior stems from consumers' efforts to maximize benefits and utilize liberal return policies offered by online retailers (Roberts et al., 2023).

Study Two revealed that BB intensified during the COVID-19 pandemic. Interview #4 highlighted how size inconsistencies between brands fueled the practice of ordering multiple sizes:

> *"People would end up buying three of everything. They would buy the size they thought they were, the size they might be, and the size they hoped not to be."*

This consumer uncertainty, exacerbated by the inability to try on garments in physical stores, reflects a systemic issue of inconsistent sizing across manufacturers. As the participant noted:

> *"Until you can somehow get standardized sizing across the industry, it will be hard for the consumer not to want to buy several things because they just do not know what will fit and will not fit."*

The participant also expressed skepticism about size recommendation algorithms that rely on limited data inputs (e.g., weight, height, age):

> *"It is about as successful as finding somebody on Tinder. They are just guessing because they do not know if the person's biceps are a certain size or where they carry their weight."*

These findings highlight the complexity of BB and its implications for VTO adoption. While VTO technologies aim to reduce uncertainty and returns by offering better size recommendations, rooted habits like BB may moderate their effectiveness. Thus, to assess its potential moderating role, BB will be incorporated within the conceptual model; accordingly, the following hypotheses are proposed:

➔ **Hypothesis 7.** Bracketing Behavior [BB] will moderate the influence of VTO technology exposure on …
- **a.** Perceived Usefulness [PU]
- **b.** Perceived Ease of Use [PEOU]

c. Perceived Accuracy [PA]
d. Perceived Privacy Risk [PPR]
e. Perceived Enjoyment [PE]

➔ **Hypothesis 8.** Bracketing Behavior [BB] will moderate the relationship between …
a. Perceived Usefulness [PU]
b. Perceived Ease of Use [PEOU]
c. Perceived Accuracy [PA]
d. Perceived Privacy Risk [PPR]
e. Perceived Enjoyment [PE]
… and Attitude Toward Webpage Usage [ATW].

4.1.5 Attitude toward Virtual Try-On & Adoption Intention

As the *Theory of Reasoned Action* (Ajzen & Fishbein, 1977) and *TAM* (Davis, 1989) suggest, consumers' attitudes are crucial in shaping their behavioral intentions. Studies show that positive attitudes toward shopping interfaces, especially those with VTO features, correlate with stronger AI (Hua et al., 2024; Jiang et al., 2023; Kim & Forsythe, 2008; Plotkina & Saurel, 2019; Hassanein & Head, 2007; Gonçalves et al., 2023). In online fashion shopping, consumers' attitudes toward using VTO technologies motivate them to adopt these tools and engage with the platform (Heider, 1946; Reardon et al., 2006). Well-designed webpages with effective VTO solutions can help mitigate purchase-related uncertainties and enhance the overall shopping experience (Miell et al., 2018). Thus, promoting positive ATW is essential for driving AI. Based on these insights, the following hypothesis is proposed:

➔ **Hypothesis 9.** Consumers with a positive attitude toward webpage usage [ATW] will demonstrate a greater intention to adopt [AI], regardless of the presence of VTO technology.

4.1.6 Visualization of the Hypotheses

This study formulates nine hypotheses (as summarized in Table 5) to examine the impact of factors like PA, PPR, and PE on consumer attitudes and behaviors. The primary independent variable is exposure to VTO technology, represented by three webpage versions: (1) a control group without VTO technology, (2) a treatment group with basic VTO technology, and (3) a treatment group with advanced VTO technology. The dependent variables are consumers' ATW and AI. Age and gender are control variables, while online shopping and product return behavior are external variables. BB has been added as a potential moderating variable to understand consumer response variations better. Figure 10 illustrates the relationships among these variables, as outlined in hypotheses H1-H9.

FIGURE 10. *Conceptual Model of Study Three*

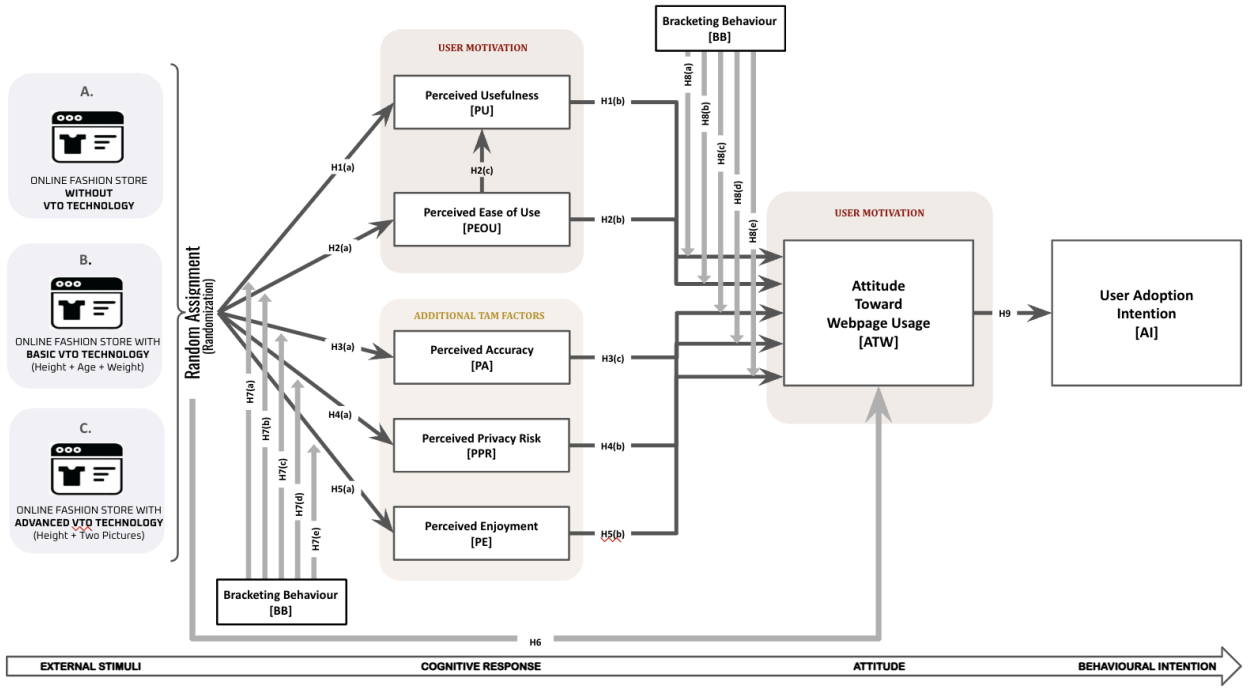


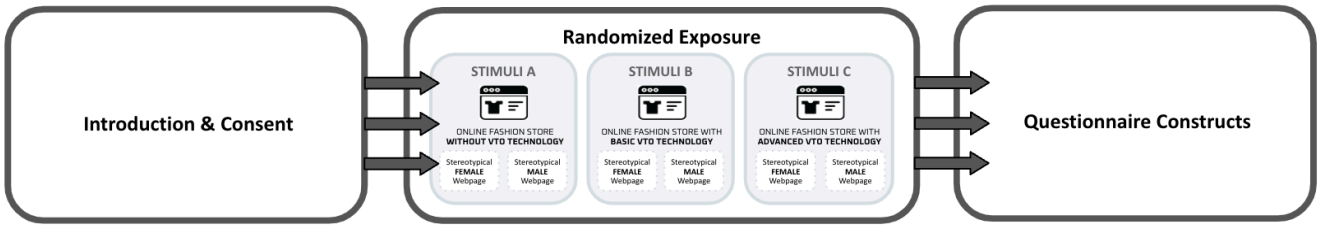
TABLE 5. *Summary of the Proposed Hypotheses*

CONSTRUCT	NR.	HYPOTHESES
Direct Effects of Stimuli on Antecedents [Stimuli → Antecedents]	**H1(a)**	Consumers exposed to VTO Technology (as opposed to no VTO Technology, on a web page) will experience greater PU.
	H2(a)	Consumers exposed to VTO Technology (as opposed to no VTO Technology, on a web page) will experience greater PEOU.
	H3(a)	Consumers exposed to VTO Technology (as opposed to no VTO Technology, on a web page) will experience greater PA.
	H4(a)	Consumers exposed to VTO Technology (as opposed to no VTO Technology, on a web page) will experience greater PPR.
	H5(a)	Consumers exposed to VTO Technology (as opposed to no VTO Technology, on a web page) will experience greater PE.
Direct Effects of Antecedents on Attitude [Antecedents → Attitude]	**H1(b)**	PU will positively affect consumers' ATW.
	H2(b)	PEOU will positively affect consumers' ATW.
	H3(b)	PA will positively affect consumers' ATW.
	H4(b)	PPE will negatively affect consumers' ATW.
	H5(b)	PE will positively affect consumers' ATW.
Interaction Between TAM Antecedents [Ease of Use → Usefulness]	**H2(c)**	PEOU of the webpage will positively affect consumers' PU, regardless of whether VTO Technology is present.
Mediating Effects of Antecedents [Stimuli → Antecedents → Attitude]	**H6(a)**	VTO technology exposure will positively influence consumers' ATW via the PU.
	H6(b)	VTO technology exposure will positively influence consumers' ATW via the PEOU.
	H6(c)	VTO technology exposure will positively influence consumers' ATW via the PA.
	H6(d)	VTO technology exposure will negatively influence consumers' ATW via the PPR.
	H6(e)	VTO technology exposure will positively influence consumers' ATW via the PE.
Moderation Effects of Bracketing Behavior [Stimuli → Antecedents]	**H7(a)**	Bracketing behavior will moderate the influence of VTO technology exposure on PU.
	H7(b)	Bracketing behavior will moderate the influence of VTO technology exposure on PEOU.
	H7(c)	Bracketing behavior will moderate the influence of VTO technology exposure on PA.
	H7(d)	Bracketing behavior will moderate the influence of VTO technology exposure on PPR.
	H7(e)	Bracketing behavior will moderate the influence of VTO technology exposure on PE.
Moderation Effects of Bracketing Behavior [Antecedents → Attitude]	**H8(a)**	Bracketing behavior will moderate the relationship between PU and ATW.
	H8(b)	Bracketing behavior will moderate the relationship between PEOU and ATW.
	H8(c)	Bracketing behavior will moderate the relationship between PA and ATW.
	H8(d)	Bracketing behavior will moderate the relationship between PPR and ATW.
	H8(e)	Bracketing behavior will moderate the relationship between PE and ATW.
Interaction Between Attitude & Intention [Attitude → Adoption]	**H9**	Consumers with a positive ATW will demonstrate a greater AI, regardless of the presence of VTO Technology.

4.2 Methodology

Study Three tested the proposed hypotheses (Table 5) using an experimental design with a self-administered Qualtrics questionnaire (see Appendix D). Participants were randomly assigned to one of three groups to compare a standard e-commerce page with two different version of VTO technology, both on a mock retailer webpage branded as *&Fashion* (details in Section 4.2.2). The experiment comprised three key components (as visualized in Figure 11(a)): First, the experiment included an *introduction with consent*; second, a *simulated shopping experience* with one of the stimuli; and third, *a post-interaction survey* to evaluate participants' perceptions. A pilot test was conducted to ensure a robust framework for examining the impact of VTO technologies on consumer interactions in fashion e-commerce. In the first round, 12 participants completed the survey and provided feedback on the stimuli and questions. A second round followed, with 6 participants re-taking the survey and offering additional feedback to further enhance the study's design.

FIGURE 11(a). *A Visualization of the Third Study's Central Parts*

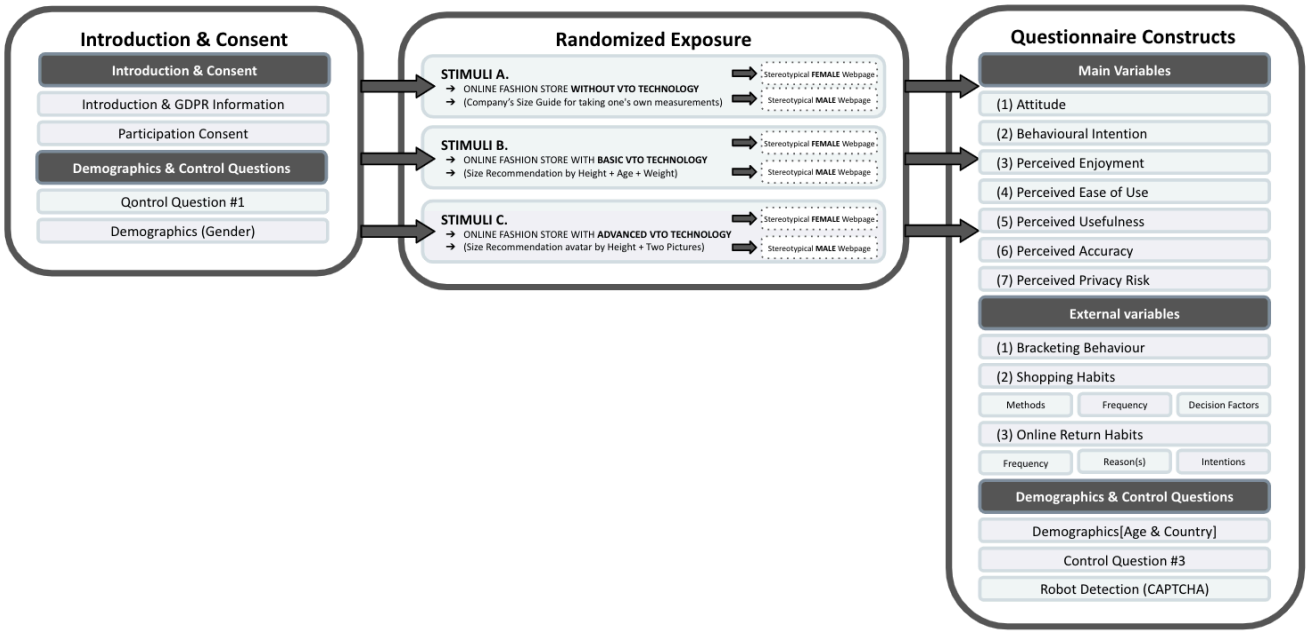


4.2.1 Participants & Data Collection

The survey was distributed via Qualtrics between October 31st and November 9th, 2024, through the researchers' social media channels, with participants sharing it to expand reach. A combination of convenience and snowball sampling was employed. This non-probability method includes easily accessible target population members (Etikan, 2016; Bell et al., 2022, p. 394). While it limits generalizability due to the lack of a representative sample, time constraints made random sampling infeasible. The online survey enabled rapid distribution, global reach, and efficient data collection (Evans & Mathur, 2005). Further, a large sample was critical due to six distinct survey versions testing three stimuli designs for female and male consumers, as larger sizes ensure sufficient statistical power. Initially, 272 responses were collected, but strict data-cleaning criteria excluded

respondents who failed to complete the survey, did not pass captcha verification[3], or failed attention checks. After filtering, 189 participants remained for analysis (see Appendix E for additional demographic details). Figure 11(b) summarizes the study's main components and questionnaire design.

FIGURE 11(b). *The Study's Main Components and Contents of the Questionnaire*



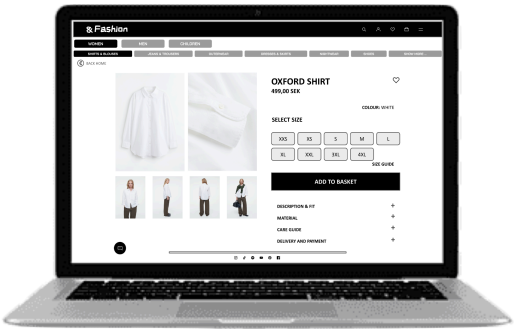
4.2.2 Experimental Design: Justification for Stimuli Creation

This study examines how different levels of VTO technology affect consumer attitudes and behaviors in online apparel shopping. The experimental stimuli consisted of three conditions: (a) *an online shopping webpage without VTO*, (b) *an online shopping webpage with basic VTO*, and (c) *an online shopping webpage with advanced VTO*. These conditions were designed to assess their incremental effects on our extended TAM's five key variables (PU, PEOU, PA, PPR, and PE).

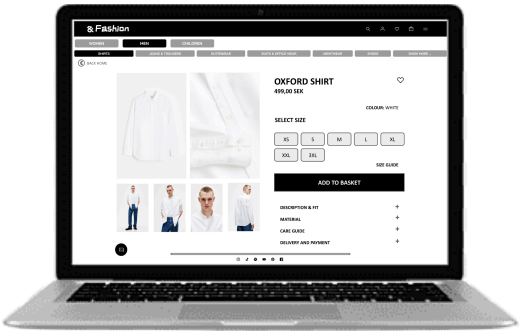
Research highlights the importance of isolating variables to effectively assess the impact of technological innovations on consumer perceptions (Yang & Xiong, 2019; Pantano et al., 2017). To achieve this, controlled stimuli with varying levels of sophistication were developed to isolate the specific effects of VTO technology. Additionally, mock shopping pages were designed using Canva, featuring a fictional retailer, "*&Fashion*," to eliminate brand bias while maintaining realism and design consistency (see Figure 12(a)). This approach balances realism and experimental control, a method recognized as crucial in consumer behavior studies (Van Herpen et al., 2016; Taufik & Onwezen, 2021).

FIGURE 12(a). *Mockup Design for the Apparel Retailer "&Fashion"*

If participants answered that they identified as a **FEMALE/WOMEN**, their product page for the product i.e. the white shirt, looked like this



If participants answered that they identified as a **MALE/MAN**, their product page for the product i.e. the white shirt, looked like this



[3] *To ensure the integrity of our survey responses, we employed CAPTCHA verification (Completely Automated Public Turing Test to Tell Computers and Humans Apart) as a quality control measure. Respondents who failed this verification were automatically excluded from the dataset. CAPTCHA is a widely used web technique that helps distinguish between human respondents and automated bots by presenting simple challenges for humans that are difficult for bots to solve. This step was crucial given the incentive structure of the survey, helping to mitigate the risk of spam responses. Google reCAPTCHA provides the CAPTCHA service used, and no respondent information was shared with Google as part of this process. For more information on CAPTCHA, visit Qualtrics [https://www.qualtrics.com/support/survey-platform/survey-module/editing-questions/question-types-guide/advanced/captcha-verification/] or Google's reCAPTCHA page [https://www.google.com/recaptcha/about/].*

The choice to create a mock retailer is supported by studies showing that realistic yet controlled stimuli like mock websites yield more reliable results by reducing bias and enhancing external validity (Morales et al., 2017; Geuens & De Pelsmacker, 2017). Consistent visual designs across stimuli limited differences in VTO features' presence and sophistication, minimizing confounding effects related to aesthetics or product presentation. Each condition aimed to evoke distinct consumer responses based on extended TAM variables:

- ***Perceived Usefulness [PU]:*** Advanced VTO, with realistic size recommendations and dynamic visualizations, is expected to enhance PU more than basic or no VTO (Kim & Shim, 2002; Lee et al., 2021).
- ***Perceived Ease of Use [PEOU]:*** While basic VTO reduces cognitive effort compared to no VTO, advanced VTO may present usability challenges depending on interface complexity (Venkatesh, 2000; Liu et al., 2019).
- ***Perceived Accuracy [PA]:*** Advanced VTO technologies like 3D avatars or AR-based fittings are anticipated to surpass basic VTO and no VTO in size and fit accuracy (Riar et al., 2021).
- ***Perceived Privacy Risk [PPR]:*** Advanced VTO may heighten privacy concerns due to its use of personal data like body scans or measurements (Lavoye et al., 2021; Chidambaram et al., 2023).
- ***Perceived Enjoyment [PE]:*** Immersive features in advanced VTO are expected to offer a more engaging shopping experience than basic VTO or static product pages (Merle et al., 2012).

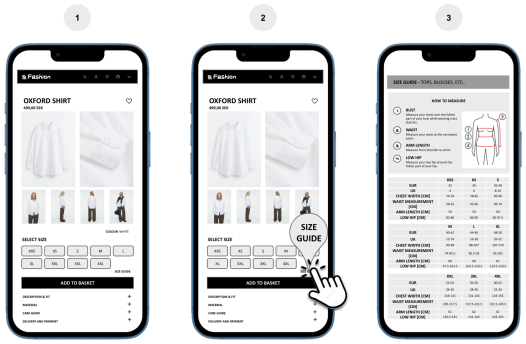
This research builds on previous work by systematically evaluating the effects of different VTO sophistication levels on consumer attitudes and behaviors through the TAM-lens. By addressing gaps in understanding VTO technology's incremental impacts, this study provides valuable insights for retailers looking to implement VTO solutions to enhance customer experience and reduce return rates. The following section outlines the three stimuli conditions designed for this study.

STIMULUS #1

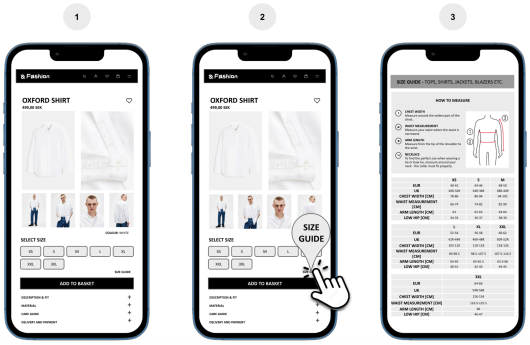
This stimulus features a traditional online shopping experience for an Oxford Shirt, lacking VTO functionality. The page displays multiple images of the shirt from various angles and size options (XXS to 4XL) as clickable buttons. A "Size Guide" link offers a detailed chart with measurements for the bust, waist, arm length, and hips (see Figure 12(b)). This setup reflects standard e-commerce practices, where consumers rely on static visuals and textual size guidance, often leading to fit uncertainty and purchasing dissatisfaction (Gallino & Moreno, 2018; Hilken et al., 2017).

FIGURE 12(b). *Online Apparel Website Showcasing Stimuli Version: WITHOUT VTO TECHNOLOGY*

STIMULI VERSION #1 - WITHOUT VTO TECHNOLOGY
If participants answered that they identified as a FEMALE/WOMEN, their experimental condition webpage shown was the one below



STIMULI VERSION #1 - WITHOUT VTO TECHNOLOGY
If participants answered that they identified as a MALE/MAN, their experimental condition webpage shown was the one below



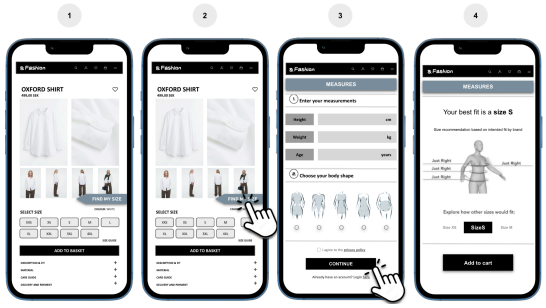
STIMULUS #2

This stimulus adds basic VTO features to the Oxford Shirt page. Alongside standard images and size options, a "Find My Size" button lets users input height, weight, age, and body type via silhouette options. The system recommends a size and displays a static 3D model wearing the shirt in that size (see Figure 12(c)). This interactivity enhances the visualization of fit and improves the shopping experience compared to traditional methods. Studies indicate that basic VTO features boost PU and PE by increasing engagement and convenience (Gallino & Moreno, 2018; Merle et al., 2012; Zhao et al., 2024).

FIGURE 12(c). *Online Apparel Website Showcasing Stimuli Version: BASIC VTO TECHNOLOGY*

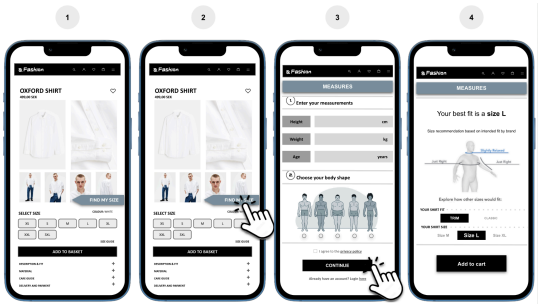
STIMULI VERSION #2 - BASIC VTO TECHNOLOGY

If participants answered that they identified as a FEMALE/WOMEN, their experimental condition webpage shown was the one below



STIMULI VERSION #2 - BASIC VTO TECHNOLOGY

If participants answered that they identified as a MALE/MAN, their experimental condition webpage shown was the one below



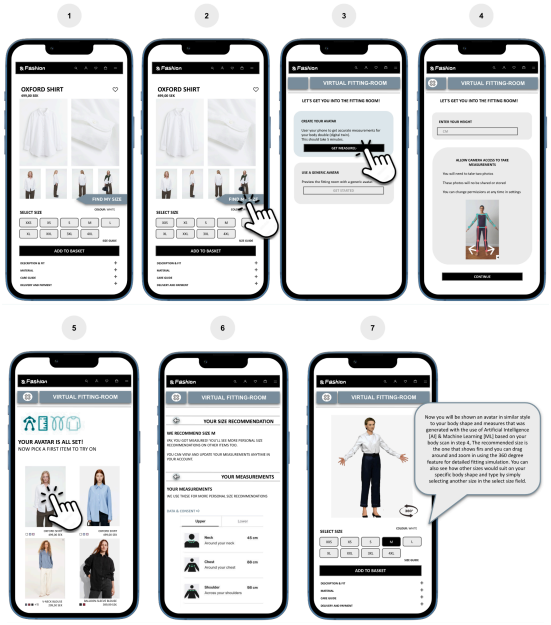
STIMULUS #3

This stimulus showcases advanced VTO technology for a personalized shopping experience. Users upload two photos of themselves, allowing the system to estimate body measurements and create a digital avatar that matches their proportions. The avatar wears the recommended shirt size and can be rotated for a 360-degree view or resized to explore other options (see Figure 12(d)). Research shows that advanced VTO systems with 3D avatars and AR enhance size accuracy and offer an immersive shopping experience (Hilken et al., 2017; Shin et al., 2023). These features improve PEOU and PE, making the process more engaging (Venkatesh, 2000; Merle et al., 2012). However, privacy concerns may arise due to the personal data required for avatar creation (Lavoye et al., 2021).

FIGURE 12(d). *Online Apparel Website Showcasing Stimuli Version: ADVANCED VTO TECHNOLOGY*

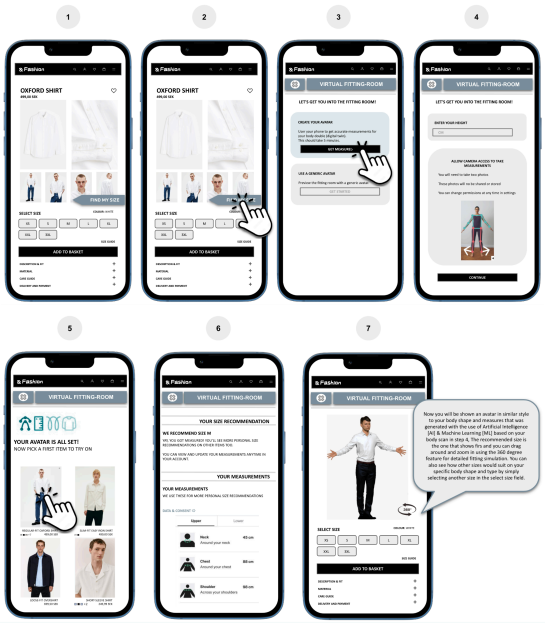
STIMULI VERSION #3 - ADVANCED VTO TECHNOLOGY

If participants answered that they identified as a FEMALE/WOMEN, their experimental condition webpage shown was the one below



STIMULI VERSION #3 - ADVANCED VTO TECHNOLOGY

If participants answered that they identified as a MALE/MAN, their experimental condition webpage shown was the one below



4.2.3 Measures

The measurement items for each construct were adapted from established scales in the literature to fit the VTO context. Adaptations included rephrasing items, such as replacing "*system*" or "*technology*" with "*size recommendation service/tool.*" Below is an overview of the constructs and their sources (see Table 6 for details):

- ***Perceived Usefulness (PU) & Perceived Ease of Use (PEOU):*** Scales by Davis (1985), refined by Plotkina and Saurel (2019) and Zhang et al. (2019), capturing attitudes toward technology adoption.
- ***Perceived Accuracy (PA)*:** Measures from Gonçalves et al. (2023), Vasic et al. (2019), and Limbu et al. (2011) evaluate trust in VTO technology accuracy.
- ***Perceived Privacy Risk (PPR):*** Informed by Rauschnabel et al. (2018) and Malhotra et al. (2024), reflecting data security concerns with VTO technology.

- ***Perceived Enjoyment (PE):*** Scales by Kim and Forsythe (2009), Childers et al. (2001), Van der Heijden (2020), Plotkina and Saurel (2019), and Bauer et al. (2006) assessing enjoyment in the VTO experience.
- ***Bracketing Behavior (BB):*** Measures from Saarijärvi et al. (2017) and Langåsdalen (2024), tailored to assess ordering multiple sizes or colors of the same product.
- ***Attitude Toward Usage of the Webpage (ATW):*** Measured following Kim and Forsythe (2009), Zhang et al. (2019), and Chidambaram et al. (2023).
- ***Adoption Intention (AI):*** Scales adapted from Gonçalves et al. (2023), Fishbein and Ajzen (1975), and Liu et al. (2010), capturing future VTO use likelihood based on attitudes and perceptions.

This study employs a seven-point Likert scale for all items to enhance reliability and validity. Research indicates that six or more response options improve measurement validity (Chang, 1994; Hancock & Klockars, 1991; Preston & Colman, 2000). A seven-point scale offers nuanced responses, improving consistency and reliability (Churchill & Peter, 1984). Additionally, it does not affect factor analysis results (Barnes et al., 2015) and allows greater precision than a five-point scale (Dawes, 2008). Historical research supports that seven categories maximize reliability (Symonds, 1924; Miller, 1956), while fewer than five or more than seven points may decrease accuracy (Johns, 2010). Thus, the seven-point scale balances reliability, valid distinctions, and comparability with other research.

TABLE 6. *Factor Loadings, Cronbach's Alpha, Composite/Construct Reliability, and Average Variance Extracted*

CONSTRUCT	MEASUREMENT ITEMS	FACTOR LOADINGS [λ]	CRONBACH ALPHA [α]	COMPOSITE RELIABILITY [CR]	AVERAGE VARIANCE EXTRACTED [AVE]
ADOPTION INTENTION					
AI_1	I intend to start using this type of size recommendation service/tool when online shopping in the future.	0.729			
AI_2	I intend to frequently use this type of size recommendation service/tool when online shopping in the future.	0.776	α = .941	0.796	0.566
AI_3	Assuming I have access to this type of size recommendation service/tool for online shopping, I will use it.	0.750			
ATTITUDE TOWARD WEBPAGE USAGE					
ATW_1	Using this type of size recommendation service/tool would be a good/bad idea.	0.578			
ATW_2	Using this type of size recommendation service/tool would be superior/inferior.	0.650	α = .938	0.774	0.465
ATW_3	Using this type of size recommendation service/tool would be pleasant/unpleasant.	0.771			
ATW_4	Using this type of size recommendation service/tool would be appealing/unappealing.	0.712			
PERCEIVED USEFULNESS					
PU_1	Using this size recommendation service/tool would improve my shopping productivity.	0.697			
PU_2	Using this size recommendation service/tool would enhance my effectiveness in shopping.	0.714	α = .931	0.682	0.422
PU_3	Using this size recommendation service/tool would be useful in buying what I want.	0.519			
PERCEIVED EASE OF USE					
PEOU_1	This size recommendation service/tool would be clear and understandable.	0.709			
PEOU_2	This size recommendation service/tool would not require a lot of mental effort.	0.795	α = .865	0.807	0.583
PEOU_3	This size recommendation service/tool would be easy to use.	0.783			
PERCEIVED ENJOYMENT					
PE_1	Using this size recommendation service/tool to shop for clothing online would be fun for its own sake.	0.876			
PE_2	Using this size recommendation service/tool to shop for clothing online would be exciting.	0.843	α = .916	0.870	0.629
PE_3	Using this size recommendation service/tool to shop for clothing online would be enjoyable.	0.730			
PE_4	Using this size recommendation service/tool to shop for clothing online would be interesting.	0.710			
PERCEIVED ACCURACY					
PA_1	Using this size recommendation service/tool would give me access to more information about the product (fit, size, style).	0.792			
PA_2	Using this size recommendation service/tool would enable me to have more accurate information (fit, size, style).	0.817	α = .914	0.835	0.627
PA_3	This size recommendation service/tool would present adequate and truthful information about the clothing item (fit, size, style).	0.767			
PERCEIVED PRIVACY RISK					
PPR_1	I would be concerned about my privacy when using this type of size recommendation service/tool.	0.924			
PPR_2	I would have doubts about how well my privacy is protected while using this type of size recommendation service/tool.	0.949	α = .938	0.954	0.839
PPR_3	My personal information could be misused when using this type of size recommendation service/tool.	0.891			
PPR_4	This type of size recommendation service/tool would collect too much information about me.	0.897			
BRACKETING BEHAVIOUR					
BB_1	When online shopping, I order many sizes of the same product with the intention of keeping only one.	0.861			
BB_2	When online shopping, I order the same product in many different colors with the intention of keeping only one.	0.874	α = .823	0.894	0.738
BB_3	When online shopping, I order alternative products for the same need with the intention of not keeping them all.	0.842			

Note: *For the entire sample size (n = 189), see Appendix I for the Cronbach's alpha values for the variables in terms of the experimental groups.*

4.2.4 Quality of the Research: Reliability & Validity

Survey validity is essential for accurate participant responses. Risks such as misinterpretation of questions or noncompliance (Evans & Mathur, 2018) were minimized by creating clear, specific items and using established, validated measures (Churchill, 1979). A comprehension check was included to ensure understanding of the survey's objectives, enhancing participant engagement and identifying factors affecting data accuracy.

A multi-item scale approach was employed to reliably measure complex constructs like consumer ATW (Jacoby, 1978; Churchill, 1979). This method addresses the limitations of single-item measures, improving data reliability and construct validity. As Churchill (1979) and Söderlund (2005) noted, reliability is crucial for consistent research findings. This study evaluated reliability through multi-item scales for each construct: PU, PEOU, PA, PPR, PE, BB, ATW, and AI. Internal reliability was assessed using Cronbach's alpha, Composite Reliability (CR), and Average Variance Extracted (AVE). All constructs showed Cronbach's alpha values above 0.7 (Churchill, 1979), indicating good internal consistency. As shown in

Table 6, these values ranged from *0.865* to *0.954*. CR for all constructs exceeded *0.6*, signifying acceptable convergent reliability (Fornell & Larcker, 1981). However, some AVE values fell below the recommended *0.5*: PU [$AVE=0.422$] and ATW [$AVE=0.465$]. According to Fornell and Larcker (1981), this is acceptable if $CR>0.6$; thus, convergent validity is satisfactory.

Per the Fornell-Larcker criterion, discriminant validity requires that the AVE square root ($\sqrt{AVE}$) for each latent construct exceeds its correlations with other constructs, ideally, AVE should be above *0.5* ($AVE>0.5$) (Fornell & Larcker, 1981; Fornell & Cha, 1994; Hair et al., 2014). Table 7 illustrates that the square root of AVE values (*italicized* on the diagonal) reflects the internal variance explained by each construct. Some issues with discriminant validity emerged: the correlation between AI and ATW [$r=0.780$] surpasses AI's AVE square root [$\sqrt{AVE}=0.752$], suggesting an overlap between these constructs. Similarly, ATW's correlations with AI [$r=0.780$] and PU [$r=0.755$] exceed its own AVE square root [$\sqrt{AVE}=0.682$], while PU's correlations with AI [$r=0.738$], ATW [$r=0.755$] and PEOU [$r=0.663$] exceed its AVE square root [$\sqrt{AVE}=0.650$]. These findings indicate that AI, ATW, and PU may not be distinct constructs, raising questions about their discriminant validity and suggesting potential multicollinearity. Hence, warranting further refinement or redefinition of these variables should be addressed in future analysis. Finally, while convenience sampling has practical benefits, it limits the generalizability of the findings; thus, results should be interpreted cautiously regarding other populations.

TABLE 7. *Correlations, Descriptive Statistics, and Discriminant Analysis*

		AI	ATW	PU	PEOU	PE	PA	PPR	BB
ADOPTION INTENTION	AI	*(0.752)*							
ATTITUDE TOWARD WEBPAGE USAGE	ATW	0.780***	*(0.682)*						
PERCEIVED USEFULNESS	PU	0.738***	0.755***	*(0.650)*					
PERCEIVED EASE OF USE	PEOU	0.577***	0.658***	0.663***	*(0.763)*				
PERCEIVED ENJOYMENT	PE	0.625***	0.664***	0.655***	0.565***	*(0.793)*			
PERCEIVED ACCURACY	PA	0.671***	0.701***	0.722***	0.594***	0.537***	*(0.792)*		
PERCEIVED PRIVACY RISK	PPR	-0.053	-0.087	-0.023	-0.115	0.089	-0.008	*(0.916)*	
BRACKETING BEHAVIOUR	BB	0.036	0.112	0.187**	0.108	0.101	0.217**	0.012	*(0.859)*
MEAN		5.076	5.437	5.004	5.078	4.733	5.487	3.616	2.741
STANDARD DEVIATION		1.362	1.255	1.474	1.264	1.352	1.131	1.629	1.572

Note: *For the Total Sample Size [n= 189]; Significance at: *p < 0.10, **p < 0.05 and ***p < 0.001. AVE square roots are shown in italics on the correlation matrix diagonal*

4.2.5 Data Analysis

Upon closing the survey, data was exported from Qualtrics to Microsoft Excel for re-coding and variable creation to compare the experimental and control groups. The re-coded data was analyzed using IBM SPSS Statistics Version 29.0.0.0 (241), including descriptive statistics, reliability analysis, and hypothesis testing. Incomplete responses were excluded to improve data quality. With more than 30 participants per group, normality was assumed based on the Central Limit Theorem (Kwak & Kim, 2017). Descriptive statistics (means and standard deviations) assessed central tendency and variability, while reliability analysis followed the procedure detailed earlier (Tables 6-7). A one-way ANOVA compared user perceptions across the three experimental groups (Basic VTO, Advanced VTO, and Without VTO), evaluating whether differences arose from VTO technology rather than pre-existing group variations. Post-hoc analyses using Scheffé's test examined specific group differences, controlling for Type I errors. All tests were two-sided, with $p\leq.05$ set as the significance threshold, a standard convention in business research. While the $p\leq.05$ threshold is widely accepted (Alifieris, 2020), it is arbitrary. Although raising the p-value increases the risk of Type I errors, the potential benefits of reduced constraints may outweigh the minor economic costs of such errors. As Thiese et al. (2016) and Holmberg (2024) state, they recognize values under 0.10 as 'trending towards significance,' particularly in studies with limited samples and/or smaller studies; this may be clinically relevant. Consequently, $p\leq.05$ indicates significance for this study, while $p<.10$ was considered a tendency toward significance.

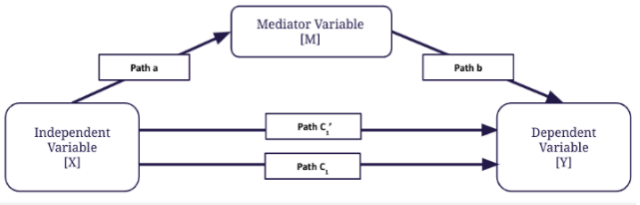
Dummy coding was applied to analyze the multicategorical independent variable, which consists of three categories of VTO stimuli: Basic VTO, Advanced VTO, and Without VTO. In this analysis, "Without VTO" served as the reference category. Binary variables were created to facilitate the comparison between the different categories. Specifically, D1 was created to represent the difference between "Basic VTO" and "Without VTO," while D2 was established to represent the difference between "Advanced VTO" and "Without VTO." Although Hayes' PROCESS macro (Hayes, 2018) inherently supports indicator coding for multi-categorical predictors, manual dummy coding was utilized for hypotheses requiring customized comparisons, particularly for hypotheses H2c and H9.

Hypothesis Testing

Mediation and moderated mediation analyses were conducted using Hayes' PROCESS macro. To test for Hypotheses H1-H6, mediation analysis was conducted using Hayes' PROCESS macro Model 4 (Hayes, 2018), as visualized in Figure 13(a)[4]. Following Hayes (2018), mediation paths were analyzed using Ordinary Least Squares (OLS) regression with the following three models:

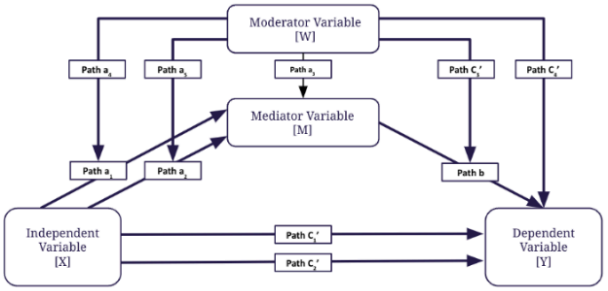
- ➔ **Model 1:** Estimates the relationship between the VTO stimuli [X] and the hypothesized antecedent factors: PU [M_1], PEOU [M_2], PA [M_3], PPR [M_4], and PE [M_5] - *path's a* (H1a–H5a).
- ➔ **Model 2:** Examines the influence of these antecedent factors [M_1-M_5] on the ATW [Y] - *path's b* (H1b–H5b).
- ➔ **Model 3**: Evaluate the relative direct effect of VTO stimuli [X] on ATW [Y] - *path c'* - while controlling for the five mediating antecedent factors [M_1-M_5], and calculate the relative total effects - *path c*.

FIGURE 13(a). *Conceptual & Statistical Diagram - Hayes PROCESS Model 4*
Hayes (2018) PROCESS mediation Model 4 template used for Hypotheses 1–6.



Path a = X predicting M
Path b = M predicting Y, controlling for X
Path a × b = Indirect / Mediation Effect of X on Y via M [**c - c' = ab**]
Path c' = Direct Effect, X predicting Y controlling for M [**c' = c - ab**]
Path c = Total Effect, X predicting Y [**c = ab + c'**]

FIGURE 13(b). *Conceptual & Statistical Diagram - Hayes PROCESS Model 58*
Hayes (2018) PROCESS moderated mediation Model 58 template used for Hypotheses 7(a)–7(e) and 8(a)–8(e).



a-paths: Describe how the independent variable [X] (and its interactions with the moderator [W]) influence the mediator(s) [M].

b-paths: Explain how the mediator(s) [M] influences the dependent variable [Y].

c'-paths: Represent direct effects of X and its interactions with moderators [W] on Y, bypassing the mediator(s) [M].

The moderated mediation occurs when the indirect effect of X on Y via M (***a* × *b***) is conditional upon the values of W. This interaction is analyzed through moderation of either the **a-path**, **b-path**, or both.

Per Hayes (2018), to test H6a–H6e, relative indirect effects of bootstrapping were used to assess mediation effects, ensuring robustness without assuming a normal distribution. A 95% confidence interval (CI) was applied, with mediation considered significant if zero was not included. If the 95% CI includes zero, a 90% CI was used to explore tendencies toward significance, following the $p \leq .05$ threshold and considering $p < .10$ to indicate potential trend towards significance. Mediation is considered substantiated if at least one of these relative indirect effects - $a_1 \times b$ or $a_2 \times b$ - is statistically significant, aligning with the criteria set forth by Hayes (2018, pp. 192–193).

To test H7a–H7e and H8a–H8e, moderated mediation analysis was conducted using Hayes' PROCESS macro (Model 58; Hayes, 2018). This approach estimates conditional indirect effects by incorporating Bracketing Behavior (BB) as a moderator (see Figure 13(b)[5] for a visualization of Model 58). Similar to the mediation analysis (Model 4), the moderated mediation analysis used Ordinary Least Squares (OLS) regression and bias-corrected bootstrapping with 5,000 samples to calculate 95% confidence intervals (CIs) for conditional indirect effects. For cases exploring a trending towards significance, 90% CIs were used. Moderation is considered substantiated (i.e., support for H7a–H7e) if at least one of the conditional indirect effects (a_4 or a_5) is statistically significant, in line with Hayes' (2018, pp. 350–354) criteria. For Hypotheses H8a–H8e, moderation is substantiated if the conditional indirect effect on the c_4' path is statistically significant. For H2c and H9, separate linear regression analyses were performed, with the VTO stimuli (dummy coded) included as a moderator. These models assessed the impact of independent variables (PEOU for H2c and ATW for H9) on dependent variables (PU and AI), including interactions between stimuli and key predictors to explore moderating effects. Hayes' Process (Model 1) was also applied to investigate conditional effects across different VTO stimuli conditions.

[4] *In the results section, the relationships (Figures 14-18) are as follows: solid green arrows indicate statistically significant positive relationships, dashed green arrows indicate partially supported positive relationships and dashed dark blue arrows indicate non-significant relationships.*

[5] For Figures 20, 22, 24, 26, and 28, solid green arrows indicate statistically significant positive relationships, dashed green arrows indicate partially supported positive relationships, solid red arrows indicate statistically significant negative relationships, dashed red arrows indicate partially supported negative relationships and dashed dark blue arrows indicate non-significant relationships.

4.3 Analysis & Results

4.3.1 Descriptive Statistics for Sample Profile

Initially, 272 responses were collected, but strict criteria filtered the data, resulting in 189 participants: 51.3% female, 48.1% male, and 0.5% third-gender/non-binary or not disclosing gender. The median age was 28, ranging from 15 to 75 (see Table 8 and Appendix E). Furthermore, the study used descriptive statistics and one-way ANOVA analysis to compare the experiment group one [$n=60$] exposed to the fashion e-commerce store with ***Basic VTO Technology*** and the experiment group two [$n=78$] exposed to the ***Advanced VTO Technology***, with the treatment group [$n=51$] exposed to the fashion e-commerce store ***Without VTO Technology***. The results indicated no significant differences between the groups regarding demographics (age and gender), primary shopping method for clothing, online clothing shopping frequency, or bracketing behavior[6].

However, in online clothing shopping return frequency, ANOVA revealed a significant difference among the three conditions: no VTO technology, basic VTO technology, and advanced VTO technology [$F(2,186)=4.296$, p$=.015$]. The effect size was small [$\eta^2=0.044$]. Post hoc comparisons showed that the mean return frequency for *advanced* VTO [3.46 ± 1.76] was significantly higher than *without* VTO [2.69 ± 1.14, p$=.019$]; no significant differences occurred between *basic* VTO [2.98 ± 1.46] and the *without* VTO [p$=.590$] or the advanced VTO [p$=.188$] technology condition.

Regarding return intentions when the process is troublesome, ANOVA indicated a significant difference among the three groups [$F(2,163)=3.147$, p$=.046$]. Mean return intention scores were highest for *advanced* VTO [$M_{Advanced}=5.12$, $SD_{Advanced}=1.87$], followed by *basic* VTO [$M_{Basic}=4.44$, $SD_{Basic}=1.79$] and then *without* VTO [$M_{Without}=4.33$, $SD_{Without}=1.24$]. Post hoc comparisons revealed that advanced VTO group intentions were significantly higher than those without VTO [p$=.012$]; effect size was small [$\eta^2=0.037$], suggesting that the VTO technology has a modest impact on return intention when the return process is troublesome. Additionally, for return intention, if the item was cheap, a significant difference among groups was found [$F(2,163)=3.000$, p$=.053$]. *Advanced* VTO participants reported highest intentions [$M_{Advanced}=4.57$, $SD_{Advanced}=2.12$], followed by *basic* VTO [$M_{Basic}=4.25$, $SD_{Basic}=1.96$] and *without* VTO [$M_{Without}=3.61$, $SD_{Withou}=2.12$]. Although statistically significant at p$=.053$, post hoc tests showed no significant pairwise differences; eta-squared indicated a small effect size [$\eta^2=0.036$], suggesting a minor influence of VTO technology on return intentions when item price is low.

TABLE 8. *Demographic Characteristics of the Sample (N = 189)*

Variable	Characteristics	N	%
Gender	Female	97	51.3%
	Male	92	48.6%
Generation	Gen Z	104	55.0%
	Gen X	50	26.5%
	Gen Y	26	13.8%
	Baby Boomers	9	4.8%
Shopping Method	Completely online	7	3.7%
	Mostly online, rarely in-store	29	15.3%
	More online than in-store	47	24.9%
	Both online and in-store equally	46	24.3%
	More in-store than online	36	19.0%
	Mostly in-store, rarely online	22	11.6%
	Completely in-store	2	1.1%
Shopping Frequency	Never	4	2.1%
	A couple of times a year	68	36.0%
	Every few months	65	64.4%
	Once a month	26	13.8%
	Several times a month	20	10.6%
	Once a week	5	2.6%
	Several times a week	1	0.5%
Return Frequency	Never return items	23	12.2%
	Rarely return items	60	31.7%
	Occasionally return items	42	22.2%
	Sometimes return items	23	12.2%
	Frequently return items	26	13.8%
	Often return items	10	5.3%
	Almost always return items	5	2.6%

Note: *Gender is for the second gender question, i.e. for the purpose of what online shopping page to be shown in the experiment. Gen Z: Born 1995–2012 (Ages 12–29); Millennials: Born 1980–1994 (Ages 30–44); Gen X: Born 1965–1979 (Ages 45–59); Baby Boomers: Born 1946–1964 (Ages 60–78)*

4.3.2 Direct & Mediated Effects of Virtual Try-On Exposure

Perceived Usefulness (PU)

Results for PU (Table 9a, 9b, Figure 14) show that the mean PU score for *basic* VTO [$M_{Basic}=5.022$, $SD_{Basic}=1.447$] exceeded the control group's [$M_{Without}=4.712$, $SD_{Without}=1.516$], though the direct effect of *basic* VTO on PU was insignificant [p$=.270$]. Similarly, *Advanced* VTO [$M_{Advanced}=5.179$, $SD_{Advanced}=1.455$] exceeded the control, yet, trending towards significance [$a_2=0.467$, $t(186)=1.765$, p$=.079$], partially supporting H1(a). PU significantly and positively influenced ATW [$b=0.642$, $t(185)=15.552$, p$<.001$], fully supporting H1(b). For every one-unit increase in PU, ATW rose by 0.642 units, highlighting PU as a key ATW determinant.

TABLE 9(a). *Descriptive Statistics for the Perceived Usefulness [PU] of the Webpage*

	Perceived Usefulness [M_1]		Attitude Toward Webpage Usage [Y]		
	Mean [M_1]	*SD [M_1]*	*Mean [Y]*	*SD [Y]*	*Mean [$\bar{Y}$*]*
WITHOUT VTO Technology *[n=51]*	4.712	1.516	5.186	1.284	5.374
BASIC VTO Technology *[n=60]*	5.022	1.447	5.542	1.165	5.531
ADVANCED VTO Technology *[n=78]*	5.180	1.455	5.519	1.296	5.407
All Groups Combined *[n=189]*	5.004	1.474	5.437	1.255	5.437

Note: *$\bar{Y}$*= Adjusted mean, adjusted to the sample mean of perceived usefulness [M_1]*

[6] *See Appendix E for further details on the external variables and Appendix F for antecedents, i.e., Perceived Usefulness (PU), Perceived ease of Use (PEOU), Perceived Accuracy (PA), Perceived Privacy Risk (PPR), and Perceived Enjoyment (PE). See Appendix G for attitude (ATW) and intention (AI) variables and Appendix H for bracketing behavior (BB).*

Indirect effects of VTO exposure on ATW via PU (*VTO→PU→ATW*) were tested for both basic and advanced VTO. Indirect effects were insignificant at the 95% CI for *basic* VTO [$a_1 \times b = 0.199$, $SE = 0.181$, $CI_{95\%} = -0.148, 0.574$] and *advanced* VTO [$a_2 \times b = 0.300$, $SE = 0.170$, $CI_{95\%} = -0.005, 0.649$]. However, *advanced* VTO showed a trend toward significance at the 90% CI [$CI_{90\%} = 0.024, 0.592$], partially supporting H6(a). When PU was included as a mediator [M_1], neither *basic* [$p = .323$] nor *advanced* VTO [$p = .825$] showed significant direct effects on ATW compared to the control. Including PU improved the model's explanatory power, explaining 57.3% of ATW variance [$R^2 = .573$, $F(3,185) = 82.763$, $p < .001$]

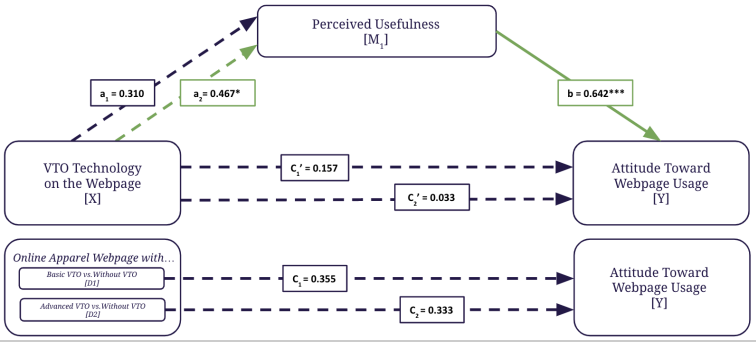
The total effect of VTO exposure on ATW was insignificant for both *basic* [$p = .138$] and *advanced* VTO [$p = .142$]. Mean ATW ratings showed no significant differences across the three groups (Table 9a), suggesting that VTO exposure, whether *basic* or *advanced*, did not directly influence ATW. For descriptive statistics on ATW, see Appendix G.

TABLE 9(b). *Regression Coefficients, Standard Errors, and Model Summary Information for Perceived Usefulness [PE] Mediation Analysis*

		Perceived Usefulness [M_1]					***Attitude Toward Webpage Usage [Y]***					***ADJUSTED [$\bar{Y}$*]***			
Antecedent		*Coeff.*	*SE*	*t-value*	*P-value*		*Coeff.*	*SE*	*t-value*	*P-value*		*Coeff.*	*SE*	*t-value*	*P-value*
Basic vs. Without [D1]	*Path c_1*	0.355	0.239	1.490	0.138	*Path a_1*	0.310	0.280	1.107	0.270	*Path c'_1*	0.157	0.158	0.991	0.323
Advanced vs. Without [D2]	*Path c_2*	0.333	0.226	1.476	0.142	*Path a_2*	0.467*	0.265	1.765	0.079	*Path c'_2*	0.033	0.150	0.221	0.825
Perceived Usefulness [M_1]		-----	-----	-----	-----		-----	-----	-----	-----	*Path b*	0.642***	0.041	15.552	0.000
Constant	i_V	5.186***	0.175	29.568	0.000	i_M	4.712***	0.206	22.907	0.000	$i_{\bar{Y}*}$	2.162	0.226	9.552	0.000
		$R^2 = 0.015$, $F(2,186) = 1.399$, $p = 0.249$					$R^2 = 0.017$, $F(2,186) = 1.566$, $p = 0.212$					$R^2 = 0.573$, $F(2,185) = 82.763$, $p = 0.000$			

Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

FIGURE 14. *Summary of Results for Hypothesis 1(a), 1(b), and 6(a)*



Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

Perceived Ease of Use (PEOU)

Results for PEOU (Table 10a, 10b, Figure 15) show that the mean PEOU score for *basic* VTO [$M_{Basic} = 5.228$, $SD_{Basic} = 1.224$] was significantly higher than for the reference group *without* VTO [$M_{Without} = 4.732$, $SD_{Without} = 1.410$; $a_1 = 0.496$, $t(186) = 2.078$, $p = .039$]]. Similarly, participants exposed to *advanced* VTO reported significantly higher PEOU scores [$M_{Advanced} = 5.188$, $SD_{Advanced} = 1.163$] compared to the reference group [$a_2 = 0.456$, $t(186) = 2.022$, $p = .045$]. These findings support H2(a), demonstrating that *basic* and *advanced* VTO enhances PEOU. A strong positive relationship was observed between PEOU and ATW, with each one-unit increase in PEOU corresponding to a 0.652-unit improvement in ATW [$b = 0.652$, $t(185) = 11.688$, $p < .001$]. This strongly supports H2(b), highlighting PEOU as a key determinant of ATW.

TABLE 10(a). *Descriptive Statistics for the Perceived Ease of Use [PEOU] of the Webpage*

	Perceived Ease of Use [M_2]		**Attitude Toward Webpage Usage [Y]**		
	Mean [M_2]	*SD [M_2]*	*Mean [Y]*	*SD [Y]*	*Mean [$\bar{Y}$*]*
WITHOUT VTO Technology *[n=51]*	4.732	1.410	5.186	1.284	5.413
BASIC VTO Technology *[n=60]*	5.228	1.224	5.542	1.165	5.445
ADVANCED VTO Technology *[n=78]*	5.188	1.163	5.519	1.296	5.449
All Groups Combined *[n=189]*	5.078	1.264	5.437	1.255	5.437

Note: *$\bar{Y}$*= Adjusted mean, adjusted to the sample mean of perceived ease of use [M_2]*

Mediation analysis showed that PEOU significantly mediates the relationship between VTO exposure and ATW (*VTO→PEOU→ATW*). For *basic* VTO, the indirect effect of VTO on ATW through PEOU was significant [$a_1 \times b = 0.323$, $SE = 0.165$, $CI_{95\%} = 0.009, 0.654$], as the 95% CI excluded zero. For *advanced* VTO, the mediation effect was not significant at the 95% CI [$a_2 \times b = 0.297$, $SE = 0.153$, $CI_{95\%} = -0.010, 0.593$] but showed a trend toward significance at the 90% CI [$CI_{90\%} = 0.047, 0.557$], partially supporting H6(b).

When accounting for PEOU as a mediator [M_2], neither *basic* [$p = .861$] nor *advanced* VTO [$p = .837$] directly influenced ATW compared to the reference group, indicating full mediation by PEOU. Including PEOU as a mediator

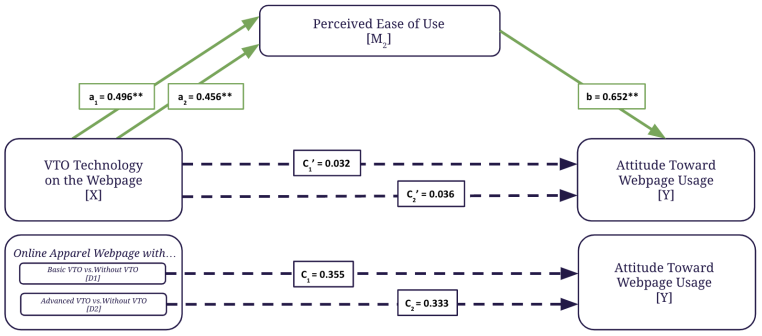
significantly improved the model's explanatory power, explaining 43.3% of ATW variance [R^2=.433, $F(2,186)$=47.150, p<.001]. Overall, these results underscore PEOU's central role in shaping consumer ATW when using VTO technology.

TABLE 10(b). *Regression Coefficients, Standard Errors, and Model Summary Information for Perceived Ease of Use [PEOU] Mediation Analysis*

		Perceived Ease of Use [M_2]				*Attitude Toward Webpage Usage [Y]*					*ADJUSTED [$\bar{Y}$*]*			
Antecedent		*Coeff.*	*SE*	*t-value*	*P-value*		*Coeff.*	*SE*	*t-value*	*P-value*		*Coeff.*	*SE*	*t-value*	*P-value*
Basic vs. Without [D1]	*Path c_1*	0.355	0.239	1.490	0.138	*Path a_1*	0.496**	0.239	2.078	0.039	*Path c'_1*	0.032	0.184	0.176	0.861
Advanced vs. Without [D2]	*Path c_2*	0.333	0.226	1.476	0.142	*Path a_2*	0.456**	0.226	2.022	0.045	*Path c'_2*	0.036	0.036	0.206	0.837
Perceived Ease of Use [M_2]		-----	-----	-----	-----		-----	-----	-----	-----	*Path b*	0.652**	0.056	11.688	0.000
Constant	i_Y	5.186***	0.175	29.568	0.000	i_M	4.732***	0.175	26.980	0.000	$i_{\bar{Y}*}$	2.102***	0.296	7.109	0.000
		R^2 = 0.015, F(2,186) = 1.399, p = 0.249					R^2 = 0.028, F(2,186) = 2.676, p = 0.072					R^2 = 0.433, F(2,186) = 47.150, p = 0.000			

Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

FIGURE 15. *Summary of Results for Hypothesis 2(a), 2(b), and 6(b)*



Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

Perceived Accuracy (PA)

Results for PA (Table 11a, 11b, Figure 16) show that the mean PA score for *basic* VTO [M_{Basic}=5.657, SD_{Basic}=1.023] was higher than for the control group [$M_{Without}$=5.242, $SD_{Without}$=1.052], with the effect approaching significance at the 95% CI [a_1=0.414, $t(186)$=1.930, p=.055]. *Advanced* VTO also resulted in higher PA scores [$M_{Advanced}$=5.517, $SD_{Advanced}$=1.241] compared to the control group, but it was insignificant at a 95% CI [p=.176]. These findings partially support H3(a). PA had a strong positive effect on ATW [b=0.776, $t(185)$=13.229, p<.001], fully supporting H3(b). Higher perceptions of accuracy significantly enhance consumer ATW.

TABLE 11(a). *Descriptive Statistics for the Perceived Accuracy [PA] of the Webpage*

	Perceived Accuracy [M_3]		**Attitude Toward Webpage Usage [Y]**		
	Mean [M_3]	*SD [M_3]*	*Mean [Y]*	*SD [Y]*	*Mean [$\bar{Y}$*]*
WITHOUT VTO Technology *[n=51]*	5.242	1.052	5.186	1.284	5.377
BASIC VTO Technology *[n=60]*	5.656	1.023	5.542	1.165	5.411
ADVANCED VTO Technology *[n=78]*	5.517	1.241	5.519	1.296	5.496
All Groups Combined *[n=189]*	5.487	1.131	5.437	1.255	5.437

Note: *$\bar{Y}$*= Adjusted mean, adjusted to the sample mean of perceived accuracy [M_3]*

Mediation analysis showed that the indirect effect of *basic* VTO on ATW through PA (*VTO→PA→ATW*) was significant [$a_1 \times b$=0.321, SE=0.159, $CI_{95\%}$=0.023, 0.652], indicating that *basic* VTO positively influences ATW via PA. For *advanced* VTO, the indirect effect was insignificant, as the 95% CI includes zero [$a_2 \times b$=0.214, SE=0.160, $CI_{95\%}$=−0.094, 0.542], and no trend toward significance was observed at the 90% CI.

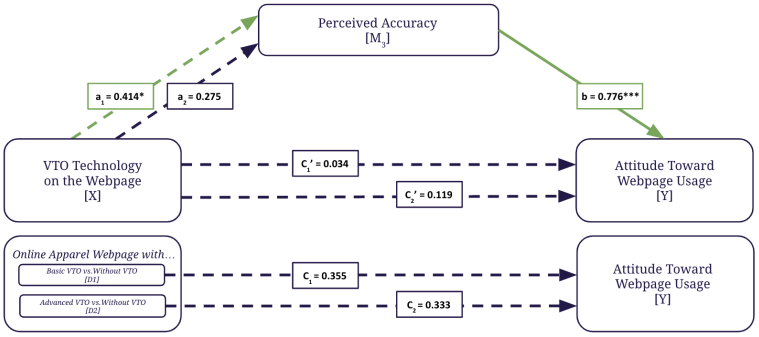
When PA was included as a mediator (M_3), neither *basic* [p=.843] nor *advanced* VTO [p=.465] directly affected ATW, suggesting that PA fully mediates the relationship between VTO exposure and ATW, supporting H6(c). Including PA as a mediator significantly increased the model's explanatory power, explaining 49.4% of the variance in ATW [R^2=.494, $F(2,186)$=60.145, p<.001]. These findings highlight that while VTO stimuli (basic or advanced) alone may not directly influence ATW, PA is a critical determinant of positive consumer attitudes.

TABLE 11(b). *Regression Coefficients, Standard Errors, and Model Summary Information for Perceived Accuracy [PA] Mediation Analysis*

		Perceived Accuracy [M_3]				*Attitude Toward Webpage Usage [Y]*					*ADJUSTED [$\bar{Y}$*]*			
Antecedent		*Coeff.*	*SE*	*t-value*	*P-value*		*Coeff.*	*SE*	*t-value*	*P-value*		*Coeff.*	*SE*	*t-value*	*P-value*
Basic vs. Without [D1]	*Path c_1*	0.355	0.239	1.490	0.138	*Path a_1*	0.414*	0.214	1.930	0.055	*Path c'_1*	0.034	0.173	0.199	0.843
Advanced vs. Without [D2]	*Path c_2*	0.333	0.226	1.476	0.142	*Path a_2*	0.275	0.203	1.358	0.176	*Path c'_2*	0.119	0.163	0.465	0.465
Perceived Accuracy [M_3]		-----	-----	-----	-----		-----	-----	-----	-----	*Path b*	0.776***	0.059	13.229	0.000
Constant	i_Y	5.186***	0.175	29.568	0.000	i_M	5.242***	0.158	33.253	0.000	$i_{\bar{Y}*}$	1.119**	0.032	3.369	0.001
		R^2 = 0.015, F(2,186) = 1.399, p = 0.249					R^2 = 0.020, F(2,186) = 1.919, p = 0.151					R^2 = 0.494, F(2,186) = 60.145, p = 0.000			

Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

FIGURE 16. *Summary of Results for Hypothesis 3(a), 3(b) and 6(c)*



Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

Perceived Privacy Risk (PPR)

The results for PPR (Table 12a, 12b, Figure 17), show that participants rated PPR higher with *basic* VTO [M_{Basic}=*3.550,* SD_{Basic}=*1.663*] compared to the control group [$M_{Without}$=*2.985,* $SD_{Without}$=*1.382*], with the effect approaching significance [a_1=*0.565, t(186)=1.883,* p=*.061*]. *Advanced* VTO [$M_{Advanced}$=*4.080,* $SD_{Advanced}$=*1.622*] led to significantly higher PPR ratings than the control group [a_2=*1.095, t(186)=3.861,* p<*.001*], supporting H4a.

TABLE 12(a). *Descriptive Statistics for the Perceived Privacy Risk [PPR] of the Webpage*

	Perceived Privacy Risk [M_4]		Attitude Toward Webpage Usage [Y]		
	Mean [M_4]	*SD [M_4]*	*Mean [Y]*	*SD [Y]*	*Mean [$\bar{Y}$*]*
WITHOUT VTO Technology *[n=51]*	2.985	1.382	5.186	1.284	5.125
BASIC VTO Technology *[n=60]*	3.550	1.663	5.542	1.165	5.534
ADVANCED VTO Technology *[n=78]*	4.080	1.622	5.519	1.296	5.563
All Groups Combined *[n=189]*	3.616	1.628	5.437	1.255	4.435

Note: $\bar{Y}$**= Adjusted mean, adjusted to the sample mean of perceived privacy risk [M_4]*

No significant relationship was found between PPR and ATW *[*p=*.101]*, providing no support for H4(b). Mediation analysis (*VTO→PPR→ATW)* showed no significant indirect effects for either *basic* VTO [a_1×*b=0.054, SE=0.048,* $CI_{95\%}$=*-0.165, 0.017*] or *advanced* VTO [a_2×*b=-0.105, SE=0.078,* $CI_{95\%}$=*-0.284, 0.029*] as the 95% CI included zero for both. No trend toward significance was observed at the 90% CI level, leaving H6(d) unsupported.

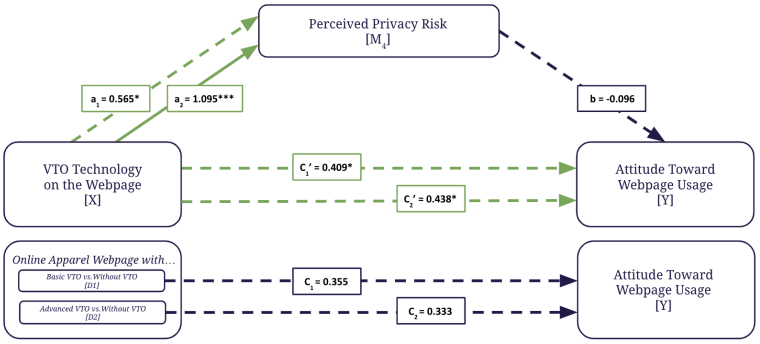
Relative direct effects of *basic* and *advanced* VTO compared to the control group were also insignificant but showed marginal tendencies [c'_1=*0.409, t(185)=1.708,* p=*.089*] and [c'_2=*0.438, t(185)=1.876,* p=*.062*]. These results suggest that PPR may not strongly influence consumer attitudes in the context of VTO. Adding PPR as a predictor (M_4) did not significantly improve the model's explanatory power [R^2=*.029, F(2, 186)=1.848,* p=*.140*], indicating that PPR was not a significant predictor of ATW, and the model performed better without it.

TABLE 12(b). *Regression Coefficients, Standard Errors, and Model Summary Information for Perceived Privacy Risk [PPR] Mediation Analysis*

		Perceived Privacy Risk [M_4]					***Attitude Toward Webpage Usage [Y]***					***ADJUSTED [$\bar{Y}$*]***			
Antecedent		*Coeff.*	*SE*	*t-value*	*P-value*		*Coeff.*	*SE*	*t-value*	*P-value*		*Coeff.*	*SE*	*t-value*	*P-value*
Basic vs. Without [D1]	*Path c_1*	0.355	0.239	1.490	0.138	*Path a_1*	0.565*	0.300	1.883	0.061	*Path c'_1*	0.409*	0.240	1.708	0.089
Advanced vs. Without [D2]	*Path c_2*	0.333	0.226	1.476	0.142	*Path a_2*	1.095***	0.284	3.861	0.000	*Path c'_2*	0.438*	0.233	1.876	0.062
Perceived Privacy Risk [M_4]		-----	-----	-----	-----		-----	-----	-----	-----	*Path b*	-0.096	0.058	-1.649	0.101
Constant	i_Y	5.186***	0.175	29.568	0.000	i_M	2.985***	0.221	13.539	0.000	$i_{\bar{Y}*}$	5.472***	0.246	22.243	0.000
		R^2 = 0.015, F(2,186) = 1.399, p = 0.249					R^2 = 0.075, F(2,186) = 7.532, p = 0.001					R^2 = 0.029, F(2,186) = 1.848, p = 0.140			

Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

FIGURE 17. *Summary of Results for Hypothesis 4(a), 4(b), and 6(d)*



Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

Perceived Enjoyment (PE)

The results for PE (Table 13a, 13b, Figure 18) show that *basic* VTO slightly increased PE [M_{Basic}=*4.650,* SD_{Basic}=*1.341*] compared to the control group [$M_{Without}$=*4.304,* $SD_{Without}$=*1.383*], but the difference was insignificant [p=*.170*]. In contrast, *advanced* VTO significantly increased PE [$M_{Advanced}$=*5.077,* $SD_{Advanced}$=*1.262*] compared to the control group [a_2=*0.773, t(186)=3.251,* p=*.001*], supporting H5(a). PE had a strong, significant positive effect on ATW [*b=0.631, t(185)=12.113,* p<*.001*], with each unit increase in PE corresponding to a 0.631-unit increase in ATW, fully supporting H5(b).

TABLE 13(a). *Descriptive Statistics for the Perceived Enjoyment [PE] of the Webpage*

	Perceived Enjoyment [M_5]		Attitude Toward Webpage Usage [Y]		
	Mean [M_5]	*SD [M_5]*	*Mean [Y]*	*SD [Y]*	*Mean [$\bar{Y}$*]*
WITHOUT VTO Technology *[n=51]*	4.304	1.383	5.186	1.284	5.457
BASIC VTO Technology *[n=60]*	4.650	1.341	5.542	1.165	5.594
ADVANCED VTO Technology *[n=78]*	5.077	1.262	5.519	1.296	5.302
All Groups Combined *[n=189]*	4.733	1.351	5.437	1.255	5.437

Note: $\bar{Y}$*= Adjusted mean, adjusted to the sample mean of perceived enjoyment [M_5]*

Mediation analysis (*VTO→PE→ATW*) showed no significant indirect effect for *basic* VTO compared to the control group [a_1×*b=0.218, SE=0.164,* $CI_{95\%}$=*-0.095, 0.548*], with no tendency toward significance at 90% CI. However, *advanced* VTO showed a significant mediation effect [a_2×*b=0.488, SE=0.167,* $CI_{95\%}$=*0.181, 0.838*], supporting H6(e).

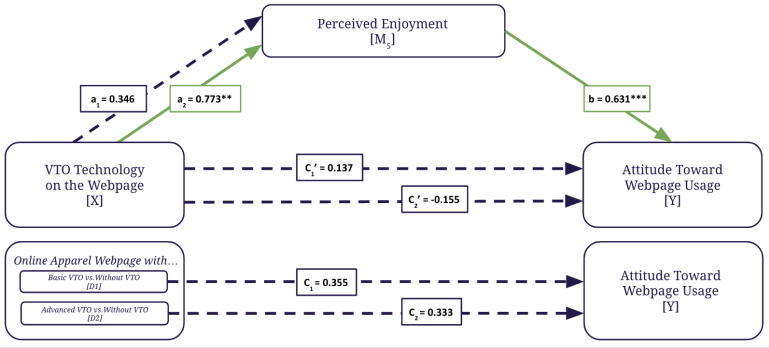
When controlling for the mediator (PE), neither *basic VTO* [p=*.446*] nor *advanced* VTO [p=*.374*] directly influenced ATW, indicating that PE fully mediated the relationship between VTO exposure and ATW. Including PE as a mediator (M_5) significantly improved the model's explanatory power [R^2=*.451, F(2, 186)=50.573,* p<*.001*], explaining 45.1% of the variance in ATW. These findings highlight that PE is a key determinant of ATW, suggesting that consumer attitudes are driven more by enjoyment than by VTO type alone.

TABLE 13(b). *Regression Coefficients, Standard Errors, and Model Summary Information for Perceived Enjoyment [PE] Mediation Analysis*

		Perceived Enjoyment [M_5]				***Attitude Toward Webpage Usage [Y]***					***ADJUSTED [$\bar{Y}$*]***				
Antecedent		*Coeff.*	*SE*	*t-value*	*P-value*		*Coeff.*	*SE*	*t-value*	*P-value*		*Coeff.*	*SE*	*t-value*	*P-value*
Basic vs. Without [D1]	*Path c_1*	0.355	0.239	1.490	0.138	*Path a_1*	0.346	0.252	1.376	0.170	*Path c'_1*	0.137	0.180	0.763	0.446
Advanced vs. Without [D2]	*Path c_2*	0.333	0.226	1.476	0.142	*Path a_2*	0.773**	0.238	3.251	0.001	*Path c'_2*	-0.155	0.174	-0.891	0.374
Perceived Enjoyment [M_5]		-----	-----	-----	-----		-----	-----	-----	-----	*Path b*	0.631***	0.052	12.113	0.000
Constant	i_Y	5.186***	0.175	29.568	0.000	i_M	4.304***	0.185	23.275	0.000	$i_{\bar{Y}*}$	2.471***	0.260	9.512	0.000
		R^2 = 0.015, F(2,186) = 1.399, p = 0.249					R^2 = 0.055, F(2,186) = 5.456, p = 0.0.005					R^2 = 0.451, F(2,186) = 50.573, p = 0.000			

Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

FIGURE 18. *Summary of Results for Hypothesis 5(a), 5(b),, and 6(e)*



Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

4.3.3 Moderating Effects of Bracketing Behaviour

Perceived Usefulness (PU)

Outcome Variable: Perceived Usefulness

This analysis examined whether BB moderates the relationship between VTO exposure and PU (Table 14a). Direct effects of VTO on PU were insignificant for both *basic* VTO [p=*.138*] and *advanced* VTO [p=*.232*], as was the direct effect of BB on PU [p=*.284*]. However, interaction terms for *VTO×BB* were significant for *basic* [a_4=*0.444, t(183)=2.306,* p=*.022*] and *advanced* VTO [a_5=*0.389, t(183)=2.310,* p=*.022*], indicating that BB moderates the effect of VTO exposure on PU.

Post-hoc analysis (Table 14b) revealed that VTO exposure did not significantly affect PU at low-to-neutral BB levels. At moderate BB levels, both *basic* [θ_{D1}=*1.172, t(183)=2.509,* p=*.013*] and *advanced* VTO [θ_{D2}=*1.144, t(183)=2.786,* p=*.006*]

significantly enhanced PU. As visualized in Figure 19a, these findings support H7(a), suggesting BB amplifies the positive effects of VTO on PU at higher BB levels. The model explained 8% of the variance in PU [R^2=.080, $F(5,183)$=3.179, p=.009].

TABLE 14(a). *Model Coefficients for the Conditional Process Model*
Moderated mediation results link between STIMULI, Bracketing Behaviour, Perceived Usefulness, and Attitude Toward Webpage Usage (N=189).

		Perceived Usefulness [M_1]					*Attitude Toward Webpage Usage [Y]*			
Antecedent		*Coeff.*	*SE*	*t-value*	*P-value*		*Coeff.*	*SE*	*t-value*	*P-value*
Basic VTO vs. Without VTO [D1]	*Path* a_1	-0.842	0.565	-1.490	0.138	*Path* c'_1	0.141	0.160	0.879	0.381
Advanced VTO vs. Without VTO [D2]	*Path* a_2	-0.619	0.517	-1.199	0.232	*Path* c'_2	0.023	0.153	0.150	0.881
Bracketing Behaviour [W]	*Path* a_3	-0.150	0.140	-1.074	0.284	*Path* c'_3	-0.144	0.161	-0.899	0.370
Basic VTO vs. Without VTO [D1] x Bracketing Behaviour [W]	*Path* a_4	0.444**	0.193	2.306	0.022		-----	-----	-----	-----
Advanced VTO vs. Without VTO [D2] x Bracketing Behaviour [W]	*Path* a_5	0.389**	0.168	2.310	0.022		-----	-----	-----	-----
Perceived Usefulness [M_1]		-----	-----	-----	-----	*Path b*	0.587***	0.087	6.767	<0.001
Perceived Usefulness [M_1] x Bracketing Behaviour [W]		-----	-----	-----	-----	*Path* c'_4	0.022	0.029	0.778	0.437
Constant	i_M	5.089***	0.404	12.594	<0.001	i_Y	2.524***	0.479	5.270	<0.001
		R^2 = 0.080, F(5, 183) = 3.179, p = .009					R^2 = 0.575, F(5, 183) = 49.566, p < .001			

TABLE 14(b). *Conditional Effects of STIMULI on the Perceived Usefulness at Different Levels of Bracketing Behaviour*

Bracketing Behaviour	*Comparison*	*Effect*	*SE*	*t-value*	*P-value*
Minimal Agreement *(BB = 1.000)*	Basic VTO vs. Without VTO (D1)	-0.398	0.407	-0.977	0.330
	Advanced VTO vs. Without VTO (D2)	-0.230	0.381	-0.604	0.546
Neutral-to-Moderate Agreement *(BB = 2.333)*	Basic VTO vs. Without VTO (D1)	0.194	0.277	0.702	0.483
	Advanced VTO vs. Without VTO (D2)	0.289	0.266	1.085	0.279
Moderate Agreement *(BB = 4.533)*	Basic VTO vs. Without VTO (D1)	1.172*	0.467	2.509	0.013*
	Advanced VTO vs. Without VTO (D2)	1.144**	0.411	2.786	0.006**

Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

Outcome Variable: Attitude Toward Webpage Usage

Table 14(a) shows the conditional process model results linking stimuli, BB, PU, and ATW. Direct effects of VTO exposure on ATW were insignificant for both *basic* [p=.389] and *advanced* VTO [p=.881], as was BB's direct effect on ATW [p=.370]. However, PU significantly predicted ATW [b=0.587, $t(183)$=6.767, p<.001], fully supporting H8(a). The interaction between PU and BB was insignificant [p=.437], indicating that PU consistently influences ATW regardless of BB level. The model (Figure 19b) explained 57.5% of the ATW variance [R^2=.575, $F(5,183)$=49.566, p<.001], exhibiting strong explanatory power.

FIGURE 19(a). *Conditional Effects of VTO Stimuli on Perceived Usefulness by Bracketing Behavior Habits*

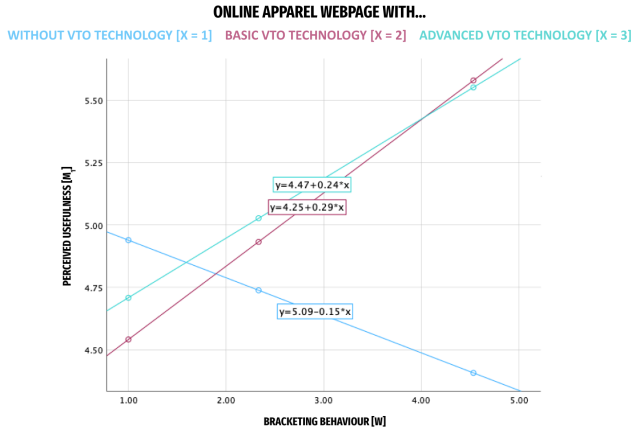
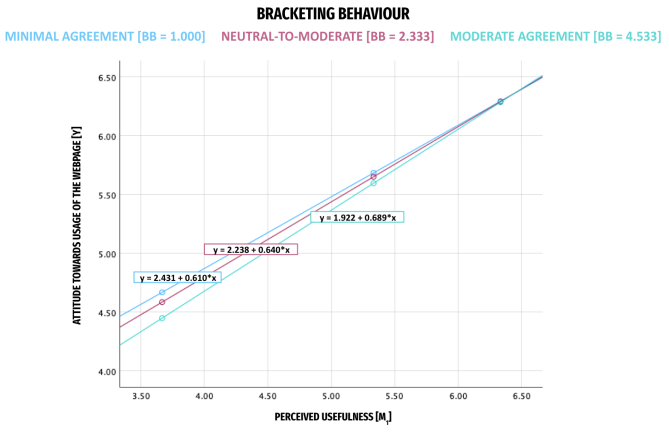


FIGURE 19(b). *Moderating Effect of Bracketing Behavior on the Relationship Between Perceived Usefulness and Attitude Toward Webpage Usage*



Conditional Indirect Effects of VTO on ATW (Y) Through PU (M_1)

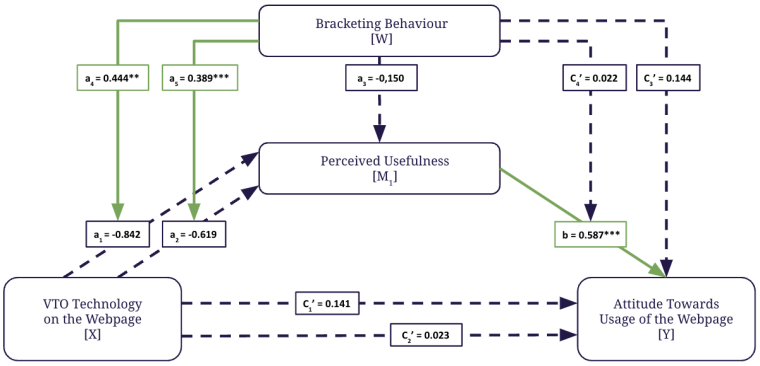
The conditional indirect effects of VTO on ATW via PU (Table 14c) varied with BB levels. At minimal and neutral-to-moderate BB levels, *basic* and *advanced* VTO effects were insignificant. At higher BB levels, significant conditional indirect effects emerged for *basic* VTO [$\theta_{D1\rightarrow Y}$=0.807, *Boot* $CI_{95\%}$=0.133, 1.647, p<.05] and *advanced* VTO [$\theta_{D2\rightarrow Y}$=0.788, *Boot* $CI_{95\%}$=0.180, 1.564, p<.05]. These findings suggest that BB amplifies the conditional indirect effects of VTO exposure on ATW through PU at higher BB levels without directly moderating the *PU–ATW* relationship. (See Figure 20)

TABLE 14(c). *Conditional Indirect Effects of STIMULI on Attitude Toward Webpage Usage Through Perceived Usefulness (Moderated Mediation)*

Bracketing Behaviour	*Comparison*	*Effect*	*Boot SE*	*95% Bootstrap Confidence Interval*	
				Lower Level	*Upper Level*
Minimal Agreement *(BB = 1.000)*	Basic VTO vs. Without VTO (D1)	-0.242	0.230	-0.717	0.190
	Advanced VTO vs. Without VTO (D2)	-0.140	0.223	-0.599	0.281
Neutral-to-Moderate Agreement *(BB = 2.333)*	Basic VTO vs. Without VTO (D1)	0.124	0.177	-0.224	0.476
	Advanced VTO vs. Without VTO (D2)	0.184	0.175	-0.164	0.531
Moderate Agreement *(BB = 4.533)*	Basic VTO vs. Without VTO (D1)	0.807**	0.382	0.133	1.647
	Advanced VTO vs. Without VTO (D2)	0.788**	0.351	0.180	1.564

Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

FIGURE 20. *Summary of Results for Hypothesis 7(a) and 8(a)*
Moderated Mediation Model: Bracketing Behavior as a Moderator of VTO Technology's Impact on Perceived Usefulness and Webpage Usage Attitude



Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

Perceived Ease of Use (PEOU)

Outcome Variable: Perceived Ease of Use

This analysis tested whether BB moderates the relationship between VTO exposure and PEOU (Table 15a). Direct effects of VTO exposure on PEOU were insignificant for both *basic* [p=*.927*] and *advanced* VTO [p=*.907*]. BB's direct effect on PEOU [p=*.683*] and interaction terms for *BB×VTO* (*basic* [p=*.219*], *advanced* [p=*.331*]) were also insignificant. Thus, H7(b) was not supported, and the overall model was insignificant [p=*.128*]. Figure 21(a) illustrates that BB did not significantly affect the *VTO–PEOU* relationship across BB levels.

TABLE 15(a). *Model Coefficients for the Conditional Process Model*
Moderated mediation results link between STIMULI, Bracketing Behaviour, Perceived Ease of Use, and Attitude Toward Webpage Usage (N=189).

		Perceived Ease of Use [M_2]				***Attitude Toward Webpage Usage [Y]***				
Antecedent		*Coeff.*	*SE*	*t-value*	*P-value*		*Coeff.*	*SE*	*t-value*	*P-value*
Basic VTO vs. Without VTO [D1]	*Path a_1*	-0.045	0.494	-0.092	0.927	*Path c'_1*	0.015	0.183	0.080	0.937
Advanced VTO vs. Without VTO [D2]	*Path a_2*	0.053	0.451	0.117	0.907	*Path c'_2*	0.012	0.174	0.071	0.944
Bracketing Behaviour [W]	*Path a_3*	-0.050	0.122	-0.409	0.683	*Path c'_3*	-0.289	0.195	-1.485	0.139
Basic VTO vs. Without VTO [D1] x Bracketing Behaviour [W]	*Path a_4*	0.208	0.168	1.233	0.219		-----	-----	-----	-----
Advanced VTO vs. Without VTO [D2] x Bracketing Behaviour [W]	*Path a_5*	0.143	0.147	0.975	0.331		-----	-----	-----	-----
Perceived Ease of Use [M_2]		-----	-----	-----	-----	*Path b*	0.482***	0.112	4.289	< 0.001
Perceived Ease of Use [M_2] x Bracketing Behaviour [W]		-----	-----	-----	-----	*Path c'_4*	0.060*	0.035	1.698	0.091
Constant	i_M	4.857***	0.353	13.761	< 0.001	i_Y	2.927***	0.607	4.824	< 0.001
		R^2 = 0.045, F(5, 183) = 1.739, p = 0.128					R^2 = 0.444, F(5, 183) = 29.191, p < 0.001			

Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

Outcome Variable: Attitude Toward Webpage Usage

BB's moderating role in the *PEOU–ATW* relationship was tested (Figure 21b). Direct effects of VTO on ATW were insignificant for both *basic* [p=.937] and *advanced* VTO [p=*.944*], as was BB's direct effect on ATW [p=*.139*]. However, PEOU significantly influenced ATW [*b=0.482, t(183)=4.289,* p<*.001*], supporting H8(b). The interaction term for *BB×PEOU* was marginally significant [*c'_4=0.060, t(183)=1.698,* p=*.091*], suggesting limited moderation by BB. The model explained 44.4% of ATW variance [*R^2=.444, F(5,183)=29.191,* p<*.001*].

FIGURE 21(a). *Conditional Effects of VTO Stimuli on Perceived Ease of Use by Bracketing Behavior Habits*

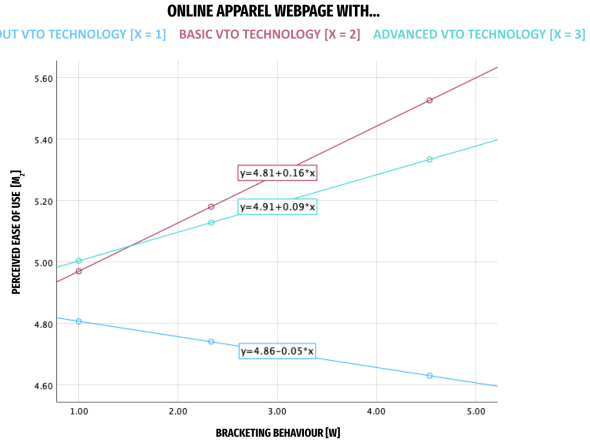
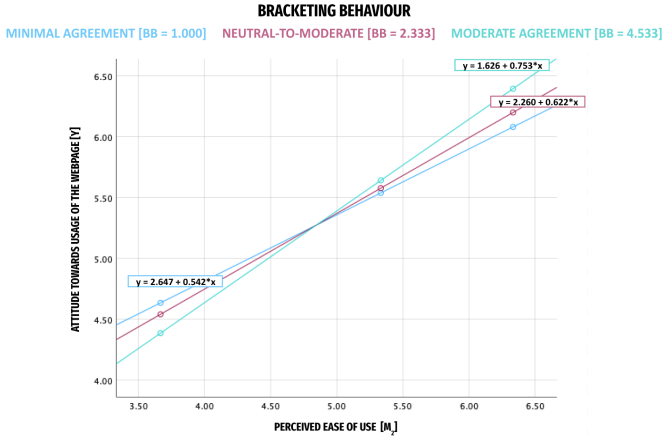


FIGURE 21(b). *Moderating Effect of Bracketing Behavior on the Relationship Between Perceived Ease of Use and Attitude Toward Webpage Usage*



Conditional Indirect Effects of VTO Exposure on ATW (Y) Through PEOU (M2)

Table 15(b) shows that the conditional indirect effects of VTO on ATW via PEOU varied by BB level. At minimal and neutral-to-moderate BB levels, conditional indirect effects for both *basic* and *advanced* VTO were insignificant. At higher BB levels, the indirect effect of basic VTO became significant [$\theta_{D1\rightarrow Y}$=*0.674, CI*$_{95\%}$*=0.017, 1.505,* p<*.05*], while the effect for advanced VTO approached significance. These findings suggest that BB enhances the *VTO→PEOU→ATW* relationship at higher BB levels, with users who exhibit stronger BB tendencies experiencing greater PEOU and more positive ATW. Figure 22 visually summarizes these results.

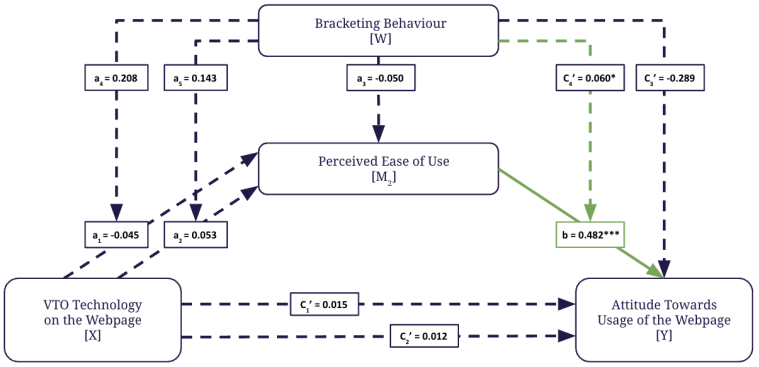
TABLE 15(b). *Conditional Indirect Effects of STIMULI on Attitude Towards Usage of the Webpage Through Perceived Ease of Use (Moderated Mediation)*

Bracketing Behaviour	*Comparison*	*Effect*	*Boot SE*	*95% Bootstrap Confidence Interval*	
				Lower Level	*Upper Level*
Minimal Agreement	Basic VTO vs. Without VTO (D1)	0.088	0.191	-0.323	0.443
(BB = 1.000)	Advanced VTO vs. Without VTO (D2)	0.106	0.176	-0.249	0.447
Neutral-to-Moderate Agreement	Basic VTO vs. Without VTO (D1)	0.273	0.157	-0.032	0.594
(BB = 2.333)	Advanced VTO vs. Without VTO (D2)	0.241	0.150	-0.046	0.539
Moderate Agreement	Basic VTO vs. Without VTO (D1)	0.674**	0.377	0.017	1.505
(BB = 4.533)	Advanced VTO vs. Without VTO (D2)	0.529	0.351	-0.084	1.299

Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

FIGURE 22. *Summary of Results for Hypothesis 7(b) and 8(b)*

Moderated Mediation Model: Bracketing Behavior as a Moderator of VTO Technology's Impact on Perceived Ease of Use and Attitude Toward Webpage Usage



Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

Perceived Accuracy (PA)

Outcome Variable: Perceived Accuracy

This analysis examined whether BB moderates the relationship between VTO exposure and PA (Table 16a). Direct effects of VTO exposure on PA were insignificant for both *basic* [p=*.471*] and *advanced* VTO [p=*.791*], as was BB's direct effect on PA [p=.426]. Interaction terms for BB with *basic* VTO [p=*-.825*] and *advanced* VTO [p=*.881*] were also insignificant. Thus, H7(c) was not supported. The model explained 7% of the variance in PA [*R²=.070, F(5,183)=2.739,* p=*.021*]. Figure 23(a) shows that VTO exposure does not significantly affect PA across BB levels.

TABLE 16(a). *Model Coefficients for the Conditional Process Model*

Moderated mediation results link between STIMULI, Bracketing Behaviour, Perceived Accuracy, and Attitude Toward Webpage Usage (N=189).

		Perceived Accuracy [M$_3$]					***Attitude Toward Webpage Usage [Y]***			
Antecedent		*Coeff.*	*SE*	*t-value*	*P-value*		*Coeff.*	*SE*	*t-value*	*P-value*
Basic VTO vs. Without VTO [D1]	*Path a_1*	0.315	0.436	0.723	0.471	*Path c'$_1$*	0.032	0.172	0.188	0.851
Advanced VTO vs. Without VTO [D2]	*Path a_2*	-0.106	0.399	-0.266	0.791	*Path c'$_2$*	0.110	0.163	0.676	0.500
Bracketing Behaviour [W]	*Path a_3*	0.086	0.108	0.797	0.426	*Path c'$_3$*	-0.541**	0.247	-2.193	0.030
Basic VTO vs. Without VTO [D1] x Bracketing Behaviour [W]	*Path a_4*	0.033	0.149	0.221	0.825		-----	-----	-----	-----
Advanced VTO vs. Without VTO [D2] x Bracketing Behaviour [W]	*Path a_5*	0.115	0.130	0.881	0.380		-----	-----	-----	-----
Perceived Accuracy [M$_3$]		-----	-----	-----	-----	*Path b*	0.571***	0.120	4.737	<0.001
Perceived Accuracy [M$_3$] x Bracketing Behaviour [W]		-----	-----	-----	-----	*Path c'$_4$*	0.086**	0.042	2.069	0.040
Constant	i_M	5.089***	0.312	16.113	<0.001	i_Y	2.402**	0.688	3.492	0.001
		R^2 = 0.070, F(5, 183) = 2.739, p = 0.021					R^2 = 0.507, F(5, 183) = 37.704, p < 0.001			

Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

Outcome Variable: Attitude Toward Webpage Usage

BB's moderating role in the *PA–ATW* relationship was tested (Figure 23b). VTO exposure had no significant direct effect on ATW for *either* basic [p=*.851*] or *advanced* VTO [p=*.500*]. However, BB negatively affected ATW [*c'$_3$=-0.541, t(183)=-2.193,* p=*.030*], indicating higher BB reduces ATW. The mediation pathway *PA→ATW* was significant [*b=0.571, t(183)=4.737,* p<*.001*], supporting H8(c). The interaction term for *BB×PA* was significant [*c'$_4$=0.086, t(183)=2.069,* p=*.040*], but with small moderating effect. The overall model explained 50.7% of ATW variance [*R²=.507, F(5,183)=37.704,* p<*.001*].

FIGURE 23(a). *Conditional Effects of VTO Stimuli on Perceived Accuracy by Bracketing Behavior Habits*

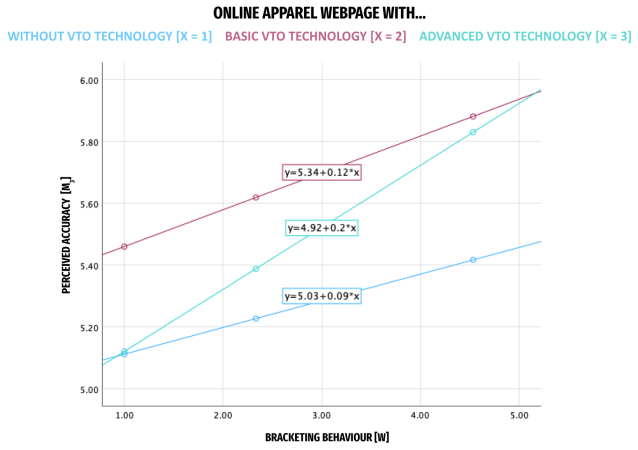
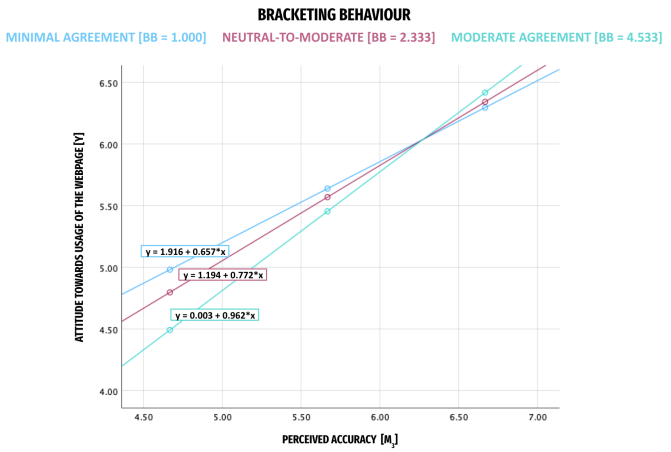


FIGURE 23(b). *Moderating Effect of Bracketing Behavior on the Relationship Between Perceived Accuracy and Attitude Toward Webpage Usage*



Conditional Indirect Effects of VTO Exposure on ATW (Y) Through PA (M_3)

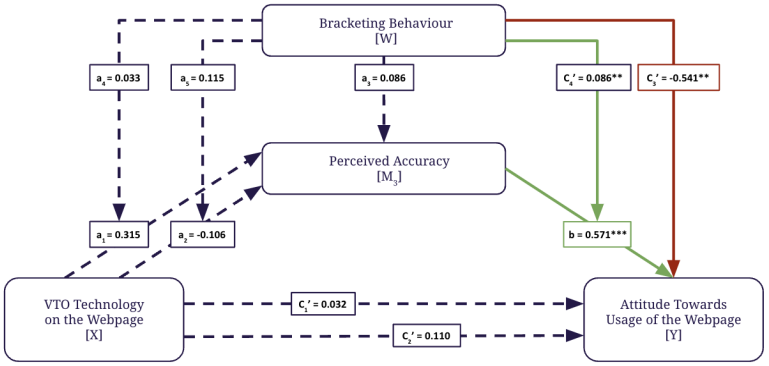
Table 16(b) shows that the conditional indirect effects of VTO exposure on ATW via PA were insignificant at minimal BB levels. At neutral-to-moderate BB levels, the effects increased but remained insignificant. At moderate BB levels, the conditional indirect effects of both *basic* and *advanced* VTO remained insignificant, suggesting limited moderation by BB. However, as BB levels increased, the conditional indirect effects grew, especially for *basic* VTO. (See Figure 24 for summary.)

TABLE 16(b). *Conditional Indirect Effects of STIMULI on Attitude Towards Webpage Usage Through Perceived Accuracy (Moderated Mediation)*

Bracketing Behaviour	*Comparison*	*Effect*	*Boot SE*	*95% Bootstrap Confidence Interval*	
				Lower Level	*Upper Level*
Minimal Agreement *(BB = 1.000)*	Basic VTO vs. Without VTO (D1)	0.229	0.180	-0.145	0.568
	Advanced VTO vs. Without VTO (D2)	0.006	0.198	-0.400	0.374
Neutral-to-Moderate Agreement *(BB = 2.333)*	Basic VTO vs. Without VTO (D1)	0.303	0.156	-0.004	0.619
	Advanced VTO vs. Without VTO (D2)	0.124	0.164	-0.194	0.450
Moderate Agreement *(BB = 4.533)*	Basic VTO vs. Without VTO (D1)	0.446	0.335	-0.144	1.183
	Advanced VTO vs. Without VTO (D2)	0.397	0.319	-0.166	1.095

Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

FIGURE 24. *Summary of Results for Hypothesis 7(c) and 8(c)*
Moderated Mediation Model: Bracketing Behavior as a Moderator of VTO Technology's Impact on Perceived Accuracy and Attitude Toward Webpage Usage.



Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

Perceived Privacy Risk (PPR)

Outcome Variable: Perceived Privacy Risk

This analysis tested whether BB moderates the relationship between VTO exposure and PPR (Table 17a). Direct effects of VTO on PPR were insignificant for both *basic* [p=*.868*] and *advanced* VTO [p=*.994*]. BB's direct effect on PPR approached significance [a_3=*-0.284, t(183)=-1.857,* p=*.065*], suggesting a potential reduction in PPR. The interaction between BB and *advanced* VTO was significant [a_5=*0.412, t(183)=2.237,* p=*.026*] indicating moderation by BB for *advanced* VTO. The interaction for *basic* VTO was insignificant [p=*.368*]. The model explained 10.2% of the variance in PPR [R^2=*.102, F(5,183)=4.139,* p=*.001*].

Post-hoc analyses (Table 17b) revealed that at moderate BB, *basic* VTO approached significance [θ_{D1}=*0.936, t(183)=1.888,* p=*.061*], while *advanced* VTO significantly increased PPR [θ_{D2}=*1.870, t(183)=4.170,* p<*.001*] compared to no VTO. At neutral-to-moderate BB, *basic* VTO showed a marginal effect [θ_{D1}=*0.545, t(183)=1.803,* p=*.073*], while *advanced*

VTO significantly increased PPR [θ_{D2}=*0.965, t(183)=3.323,* p=*.001*]. At minimal BB, neither VTO type had significant effects on PPR. These results, visualized in Figure 25(a), support H7(d) and show that the positive impact of VTO exposure on PPR strengthens as BB levels increase.

TABLE 17(a). *Model Coefficients for the Conditional Process Model*

Moderated mediation results link between STIMULI, Bracketing Behaviour, Perceived Privacy Risk, and Attitude Toward Webpage Usage (N=189).

		Perceived Privacy Risk [M_4]					***Attitude Toward Webpage Usage [Y]***			
Antecedent		*Coeff.*	*SE*	*t-value*	*P-value*		*Coeff.*	*SE*	*t-value*	*P-value*
Basic VTO vs. Without VTO [D1]	*Path* a_1	0.102	0.617	0.166	0.868	*Path* c'_1	0.400*	0.240	1.668	0.097
Advanced VTO vs. Without VTO [D2]	*Path* a_2	0.005	0.564	0.008	0.994	*Path* c'_2	0.408*	0.236	1.727	0.086
Bracketing Behaviour [W]	*Path* a_3	-0.284*	0.153	-1.857	0.065	*Path* c'_3	0.134	0.141	0.950	0.343
Basic VTO vs. Without VTO [D1] x Bracketing Behaviour [W]	*Path* a_4	0.190	0.210	0.902	0.368		-----	-----	-----	-----
Advanced VTO vs. Without VTO [D2] x Bracketing Behaviour [W]	*Path* a_5	0.412**	0.184	2.237	0.026		-----	-----	-----	-----
Perceived Privacy Risk [M_4]		-----	-----	-----	-----	*Path b*	-0.055	0.111	-0.493	0.622
Perceived Privacy Risk [M_4] x Bracketing Behaviour [W]		-----	-----	-----	-----	*Path* c'_4	-0.014	0.034	-0.416	0.678
Constant	i_M	3.697***	0.441	8.377	<0.001	i_Y	5.111***	0.470	10.886	<0.001
		R^2 = 0.102, F(5, 183) = 4.139, p = 0.001					R^2 = 0.040, F(5, 183) = 1.524, p = 0.184			

TABLE 17(b). *Conditional Effects of STIMULI on the Perceived Privacy Risk at Different Levels of Bracketing Behaviour*

Bracketing Behaviour	*Comparison*	*Effect*	*SE*	*t-value*	*P-value*
Minimal Agreement	Basic VTO vs. Without VTO (D1)	0.292	0.445	0.657	0.512
(BB = 1.000)	Advanced VTO vs. Without VTO (D2)	0.416	0.416	1.001	0.318
Neutral-to-Moderate Agreement	Basic VTO vs. Without VTO (D1)	0.545*	0.302	1.803	0.073
(BB = 2.333)	Advanced VTO vs. Without VTO (D2)	0.965**	0.290	3.323	0.001
Moderate Agreement	Basic VTO vs. Without VTO (D1)	0.936*	0.510	1.888	0.061
(BB = 4.533)	Advanced VTO vs. Without VTO (D2)	1.870***	0.449	4.170	<0.001

Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

Outcome Variable: Attitude Toward Webpage Usage

The analysis also tested whether BB moderated the *PPR–ATW* relationship (Figure 25b). VTO exposure had marginally significant direct effects on ATW for both *basic* [c'_1=*0.400, t(183)=1.668,* p=*.097*] and *advanced* VTO [c'_2=*0.408, t(183)=1.727,* p=*.068*], suggesting a positive influence on ATW. BB showed no significant direct effect on ATW [p=*.343*], and PPR did not significantly influence ATW [p=*.622*]. H8(d), which proposed that BB moderates the *PPR–ATW* relationship, was not supported [p=*.678*]. The overall model was not significant [p=*.184*].

FIGURE 25(a). *Conditional Effects of VTO Stimuli on Perceived Privacy Risk by Bracketing Behavior Habits*

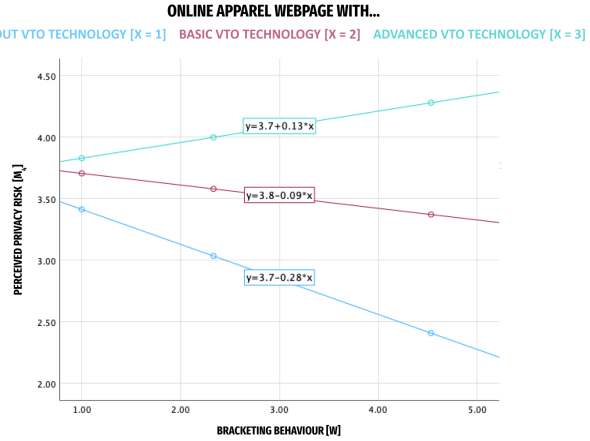
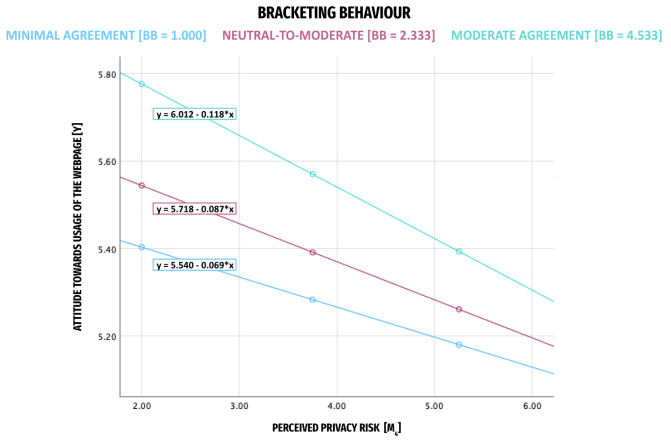


FIGURE 25(b). *Moderating Effect of Bracketing Behavior on the Relationship Between Perceived Privacy Risk and Attitude Toward Webpage Usage*



Conditional Indirect Effects of VTO Exposure on ATW (Y) Through PPR (M_4)

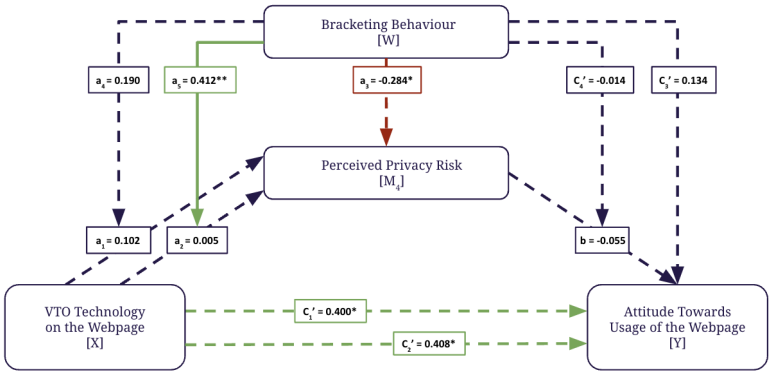
Table 17(c) shows that the conditional indirect effects of VTO exposure on ATW through PPR were insignificant at all BB levels. At minimal BB, both *basic* and *advanced* VTO had insignificant effects. At neutral-to-moderate BB, effects increased but remained insignificant. At moderate BB levels, effects were more pronounced but not significant, suggesting that PPR plays a limited mediating role in the *VTO→ATW* relationship, with BB's moderating effect stronger for *advanced* VTO at higher BB levels. Figure 26 summarizes these findings.

TABLE 17(c). *Conditional Indirect Effects of STIMULI on Attitude Towards Usage of the Webpage Through Perceived Privacy Risk (Moderated Mediation)*

Bracketing Behaviour	*Comparison*	*Effect*	*Boot SE*	*95% Bootstrap Confidence Interval*	
				Lower Level	*Upper Level*
Minimal Agreement	Basic VTO vs. Without VTO (D1)	-0.020	0.054	-0.166	0.061
(BB = 1.000)	Advanced VTO vs. Without VTO (D2)	-0.029	0.057	-0.171	0.058
Neutral-to-Moderate Agreement	Basic VTO vs. Without VTO (D1)	-0.048	0.047	-0.162	0.022
(BB = 2.333)	Advanced VTO vs. Without VTO (D2)	-0.084	0.070	-0.242	0.036
Moderate Agreement	Basic VTO vs. Without VTO (D1)	-0.114	0.098	-0.331	0.048
(BB = 4.533)	Advanced VTO vs. Without VTO (D2)	-0.220	0.158	-0.557	0.079

Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

FIGURE 26. *Summary of Results for Hypothesis 7(d) and 8(d)*
Moderated Mediation Model: Bracketing Behavior as a Moderator of VTO Technology's Impact on Perceived Privacy Risk and Webpage Usage Attitude



Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

Perceived Enjoyment (PE)

Outcome Variable: Perceived Enjoyment

This analysis tested whether BB moderates the relationship between VTO exposure and PE. As shown in Table 18(a), the direct effects of VTO on PE were insignificant for both *basic* [p=*.260*] and *advanced* VTO [p=*.822*]. BB had no significant direct effect on PE [p=*.217*]. However, the interaction between *basic* VTO and BB was significant [a_4=*0.361, t(183)=2.044,* p=*.042*], indicating BB moderates the relationship between *basic* VTO and PE, supporting H7(e). The effect of *basic* VTO on PE became more positive with increasing BB, while *advanced* VTO had an insignificant [p=*.108*] stable effect. The model explained 8.3% of the variance in PE [R^2=*.083, F(5,183)=3.294,* p=*.007*].

TABLE 18(a). *Model Coefficients for the Conditional Process Model*
Moderated mediation results link between STIMULI, Bracketing Behaviour, Perceived Enjoyment, and Attitude Toward Webpage Usage (N=189).

		Perceived Enjoyment [M_5]					***Attitude Toward Webpage Usage [Y]***			
Antecedent		*Coeff.*	*SE*	*t-value*	*P-value*		*Coeff.*	*SE*	*t-value*	*P-value*
Basic VTO vs. Without VTO [D1]	*Path* a_1	-0.584	0.517	-1.129	0.260	*Path* c'_1	0.132	0.181	0.729	0.467
Advanced VTO vs. Without VTO [D2]	*Path* a_2	0.107	0.473	0.226	0.822	*Path* c'_2	-0.173	0.176	-0.983	0.327
Bracketing Behaviour [W]	*Path* a_3	-0.159	0.128	-1.240	0.217	*Path* c'_3	0.041	0.181	0.229	0.819
Basic VTO vs. Without VTO [D1] x Bracketing Behaviour [W]	*Path* a_4	0.361**	0.176	2.044	0.042		-----	-----	-----	-----
Advanced VTO vs. Without VTO [D2] x Bracketing Behaviour [W]	*Path* a_5	0.249	0.154	1.615	0.108		-----	-----	-----	-----
Perceived Enjoyment [M_5]		-----	-----	-----	-----	*Path b*	0.626***	0.107	5.854	<0.001
Perceived Enjoyment[M_5] x Bracketing Behaviour [W]		-----	-----	-----	-----	*Path* c'_4	0.000	0.035	0.014	0.989
Constant	i_M	4.702***	0.370	12.706	<0.001	i_Y	2.384***	0.553	4.313	<0.001
		R^2 = 0.083, F(5, 183) = 3.294, p = 0.007					R^2 = 0.454, F(5, 183) = 30.277, p < 0.001			

Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

Outcome Variable: Attitude Toward Webpage Usage

Regarding ATW, VTO exposure did not directly affect ATW for either VTO [p_{Basic}=*.467*; $p_{Advanced}$=*.327*], nor did BB [p=*.819*]. However, PE positively influenced ATW [*b=0.626, t(183)=5.854* p<*.001*], but BB did not moderate this relationship, [$p_{PE\times BB}$=*.989*], thus H8(e) not supported (see Figure 27(a)). Figure 27(b) visually confirms the significant role of PE as a predictor of ATW but suggests its effect is stable regardless of BB levels. The model explained 45.4% of the variance in ATW [R^2=*.454, F(5,183)=30.277,* p<*.001*].

FIGURE 27(a). *Conditional Effects of VTO Stimuli on Perceived Enjoyment by Bracketing Behavior Habits*

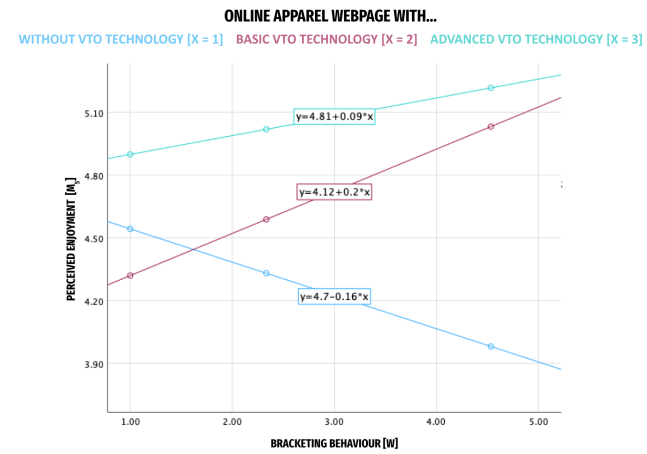
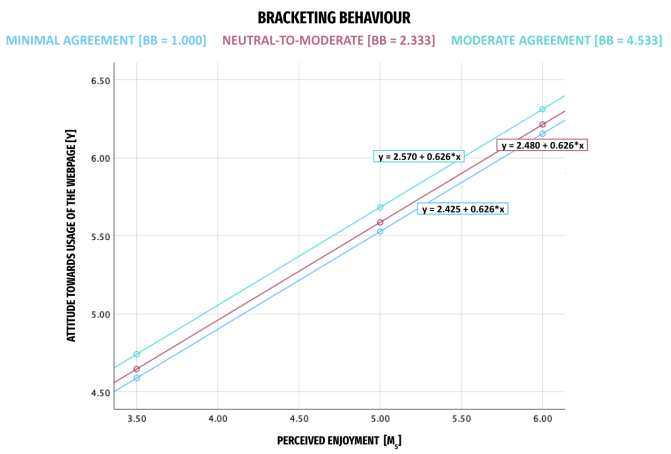


FIGURE 27(b). *Moderating Effect of Bracketing Behavior on the Relationship Between Perceived Enjoyment and Attitude Toward Webpage Usage*



Conditional Indirect Effects of VTO Exposure on ATW (Y) Through PE (M_3)

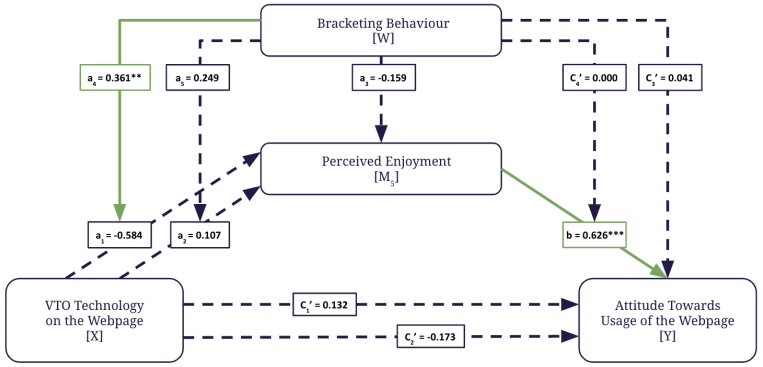
Regardless of VTO Technology, conditional indirect effects of VTO exposure on ATW through PE (Table 18b) were insignificant at minimal BB levels. At neutral-to-moderate BB, the effect for *advanced* VTO was significant [$\theta_{D2\rightarrow Y}$*=0.431, Boot* $CI_{95\%}$*=0.122, 0.771,* p<*.05*], but *basic* remained in-significant. At higher BB levels, both basic [$\theta_{D1\rightarrow Y}$*=0.660, Boot* $CI_{95\%}$*=0.092, 1.408,* p<*.05*], and advanced VTO [$\theta_{D2\rightarrow Y}$*=0.776, Boot* $CI_{95\%}$*=0.219, 1.537,* p<*.05*] showed significant conditional indirect effects. Figure 28 visualizes and highlights the growing importance of PE as BB levels increase.

TABLE 18(b). *Conditional Indirect Effects of STIMULI on Attitude Toward Webpage Usage Through Perceived Enjoyment (Moderated Mediation)*

Bracketing Behaviour	*Comparison*	*Effect*	*Boot SE*	*95% Bootstrap Confidence Interval*	
				Lower Level	*Upper Level*
Minimal Agreement	Basic VTO vs. Without VTO (D1)	-0.140	0.235	-0.620	0.308
(BB = 1.000)	Advanced VTO vs. Without VTO (D2)	0.223	0.200	-0.189	0.607
Neutral-to-Moderate Agreement	Basic VTO vs. Without VTO (D1)	0.161	0.164	-0.150	0.496
(BB = 2.333)	Advanced VTO vs. Without VTO (D2)	0.431**	0.163	0.122	0.771
Moderate Agreement	Basic VTO vs. Without VTO (D1)	0.660**	0.337	0.092	1.408
(BB = 4.533)	Advanced VTO vs. Without VTO (D2)	0.776**	0.336	0.219	1.537

Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

FIGURE 28. *Summary of Results for Hypothesis 7(e) and 8(e)*
Moderated Mediation Model: Bracketing Behavior as a Moderator of VTO Technology's Impact on Perceived Enjoyment and Webpage Usage Attitude



Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

4.3.4 Interactions between Perceived Ease of Use and Usefulness, & Between Attitudes and Adoption Intention

Perceived Ease of Use (PEOU) & Perceived Usefulness (PU)

Linear regression and Hayes' Process Model One were employed to test H2c, positing that PEOU positively influences PU and exploring the moderating role of VTO stimuli (without, basic, and advanced). As shown in Table 19, the model explained 44.8% of the variance in PU [R^2*=.448, F(5, 183)=29.700,* p<*.001*], with PEOU being a strong positive predictor of PU [*B=0.701, t(183)=6.295,* p<*.001*]. Interaction terms for *basic* [$p_{PEOU\times D1}$*=.907*] and *advanced* [$p_{PEOU\times D2}$*=.239*] were insignificant, indicating PEOU consistently enhances PU regardless of VTO condition. Hayes' Process Model confirmed these findings. Figure 29 shows a stable positive relationship between PEOU and PU across all stimuli conditions. These results strongly support H2(c).

TABLE 19. *Regression Coefficients for Perceived Usefulness Based on Perceived Ease of Use at Different Levels of VTO Technologies*

	B	SE	β	95% Confidence Interval for B		t-value	P-value
				Lower Level	*Upper Level*		
MODEL SUMMARY: R^2 = 0.488, F(5,183) = *29.700* , p < 0.001							
Constant	1.396	0.549		0.488	2.304	2.541	0.012
Perceived Ease of Use [PEOU]	0.701	0.111	0.601	0.517	0.885	6.295	<.001
Basic VTO vs. Without VTO [D1]	-0.137	0.839	-0.043	-1.523	1.250	-0.163	0.871
Advanced VTO vs. Without VTO [D2]	-0.807	0.797	-0.270	-2.125	0.511	-1.012	0.313
Interaction: PEOU × D1	0.019	0.162	0.033	-0.249	0.287	0.117	0.907
Interaction: PEOU × D2	0.184	0.156	0.333	-0.073	0.441	1.182	0.239

Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

Consumer Attitude (ATW) & Adoption Intention (AI)

H9 proposed that ATW positively influences AI, regardless of VTO presence or type. Table 20 shows the regression model explained 61.5% of the variance in AI [R^2*=.615, F(5, 183)=58.489,* p<*.001*], with ATW as the strongest predictor of AI [*B=0.839, t(183)=8.898,* p<*.001*]. Interaction terms for *basic* [$p_{ATW\times D1}$*=.717*] and *advanced* [$p_{ATW\times D2}$*=.835*] VTO were insignificant, suggesting ATW consistently enhances AI across all VTO conditions. Hayes' Process Model confirmed these

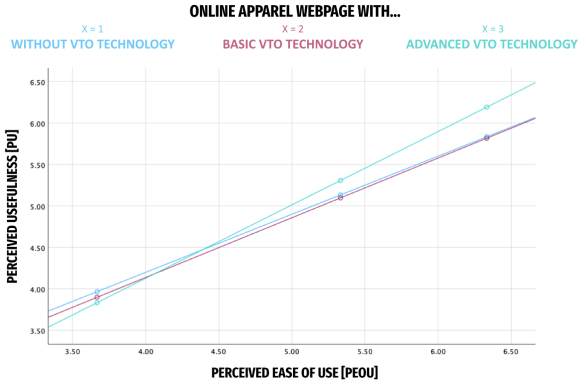
results, with ATW remaining the only significant predictor of AI. Figure 30 illustrates a consistent positive relationship between ATW and AI across stimuli conditions. These findings strongly support H9.

TABLE 20. *Regression Coefficients for Adoption Intention Based on Attitudes Toward Usage of a Webpage with Different Levels of VTO Technologies*

	B	SE	β	95% Confidence Interval for B		t-value	P-value
				Lower Level	*Upper Level*		
MODEL SUMMARY: $R^2 = 0.615$, $F(5,183) = 58.489$, $p < 0.001$							
Constant	0.432	0.504		-0.400	1.265	0.858	0.392
Attitude Toward Webpage Usage [ATW]	0.839***	0.094	0.773	0.683	0.995	8.898	<.001
Basic VTO vs. Without VTO [D1]	-0.042	0.740	-0.014	-1.265	1.181	-0.056	0.955
Advanced VTO vs. Without VTO [D2]	0.161	0.660	0.058	-0.931	1.252	0.243	0.808
Interaction: ATW × D1	0.049	0.134	0.096	-0.173	0.271	0.363	0.717
Interaction: ATW × D2	-0.025	0.121	-0.053	-0.225	0.174	-0.209	0.835

Note: *Significance at *p < 0.10, **p < 0.05, and ***p < 0.001.*

FIGURE 29. *Interaction Effects of Perceived Ease of Use (PEOU) and Stimuli Conditions on Perceived Usefulness (PU)*

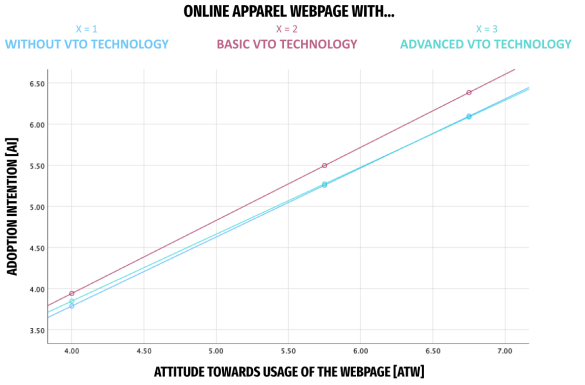


A graphical representation illustrating a stable positive relationship between PEOU and PU across all stimuli conditions, the regression lines for each condition were as follows:

- Without VTO: *PU = 1.4 + 0.7(PEOU)*
- Basic VTO: *PU = 1.26 + 0.72(PEOU)*
- Advanced VTO: *PU = 0.59 + 0.89(PEOU)*

These findings strongly support H2(c), demonstrating that PEOU significantly predicts PU, with no moderating effects from VTO stimuli.

FIGURE 30. *Interaction Effects of Attitude Toward Webpage Usage (ATW) and Stimuli Conditions on Adoption Intention (AI)*



A graphical representation illustrating a consistent positive relationship between ATW and AI across stimuli conditions, the regression lines for each condition were as follows:

- Without VTO: *AI = 0.43 + 0.84 (ATW)*
- Basic VTO: *AI = 0.39 + 0.89(ATW)*
- Advanced VTO: *AI = 0.59 + 0.81(ATW)*

Overall, these results strongly support H9, highlighting the central role of ATW in enhancing AI, independent of VTO presence or type.

4.3.5 Summary of Hypotheses Testing

Figure 31 summarizes the direction and significance of relationships among the investigated variables. *Green solid arrows* represent significant positive relationships; gray *dashed arrows* indicate insignificant relationships; green *dashed arrows* denote partially supported relationships. Further, Table 21 provides a summary of all tested hypotheses and their results.

FIGURE 31. *Updated Conceptual Framework & Research Model*

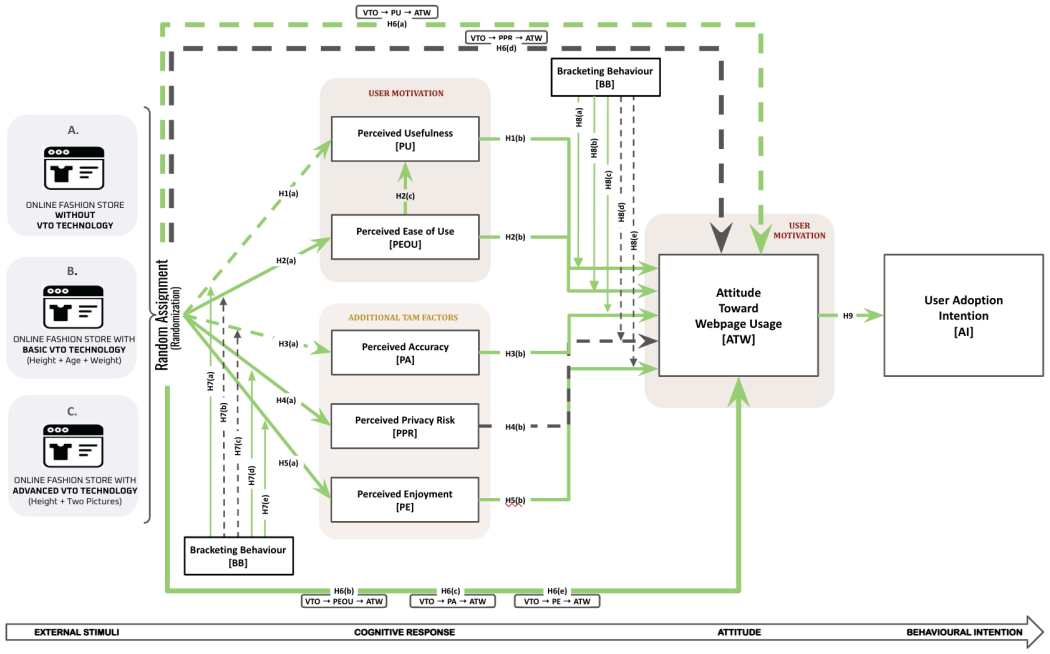


TABLE 21. *Summary of the Hypotheses Testing*

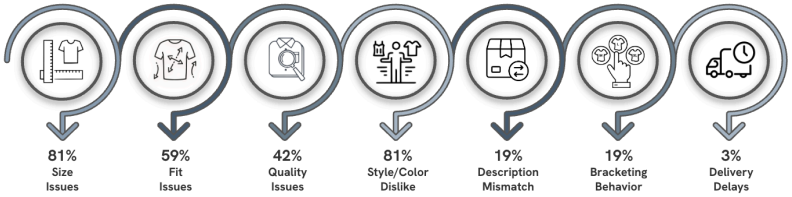
Nr.	HYPOTHESES	RELATIONSHIP	FINDINGS
HYPOTHESIS 1	**(a)** Consumers exposed to VTO technology (as opposed to no VTO) on a web page, will experience greater perceived usefulness.	*VTO STIMULI → PU*	PARTIALLY SUPPORTED
	(b) Perceived usefulness will positively affect consumers' attitudes toward webpage usage.	*PU → ATW*	SUPPORTED
HYPOTHESIS 2	**(a)** Consumers exposed to VTO technology (as opposed to no VTO) on a web page, will experience greater perceived ease of use.	*VTO STIMULI → PEOU*	SUPPORTED
	(b) Perceived ease of use will positively affect consumers' attitudes toward webpage usage.	*PEOU → ATW*	SUPPORTED
	(c) Perceived ease of use will positively affect consumers' perceived usefulness, regardless of whether VTO technology is present.	*PEOU → PU*	SUPPORTED
HYPOTHESIS 3	**(a)** Consumers exposed to VTO technology (as opposed to no VTO) on a webpage will experience greater perceived accuracy.	*VTO STIMULI → PA*	PARTIALLY SUPPORTED
	(b) Perceived accuracy will positively affect consumers' attitudes toward webpage usage.	*PA → ATW*	SUPPORTED
HYPOTHESIS 4	**(a)** Consumers exposed to VTO technology (as opposed to no VTO) on a webpage, will experience greater perceived privacy risk.	*VTO STIMULI → PPR*	SUPPORTED
	(b) Perceived privacy risk will negatively affect consumers' attitudes toward webpage usage.	*PPR → ATW*	NOT SUPPORTED
HYPOTHESIS 5	**(a)** Consumers exposed to VTO technology (as opposed to no VTO) on a webpage will experience greater perceived enjoyment.	*VTO STIMULI → PE*	SUPPORTED
	(b) Perceived enjoyment will positively affect consumers' attitudes toward webpage usage.	*PE → ATW*	SUPPORTED
HYPOTHESIS 6	**(a)** VTO technology exposure will positively influence consumers' attitudes toward webpage usage via the perceived usefulness.	*VTO STIMULI → PU → ATW*	PARTIALLY SUPPORTED
	(b) VTO technology exposure will positively influence consumers' attitudes toward webpage usage via the perceived ease of use.	*VTO STIMULI → PEOU → ATW*	SUPPORTED
	(c) VTO technology exposure will positively influence consumers' attitudes toward webpage usage via the perceived accuracy.	*VTO STIMULI → PA → ATW*	SUPPORTED
	(d) VTO technology exposure will negatively influence consumers' attitudes toward webpage usage via the perceived privacy risk.	*VTO STIMULI → PPR → ATW*	NOT SUPPORTED
	(e) VTO technology exposure will positively influence consumers' attitudes toward webpage usage via the perceived enjoyment.	*VTO STIMULI → PE → ATW*	SUPPORTED
HYPOTHESIS 7	**(a)** Bracketing behavior will moderate the influence of VTO technology exposure on perceived usefulness.	*VTO Stimuli × BB → PU*	SUPPORTED
	(b) Bracketing behavior will moderate the influence of VTO technology exposure on perceived ease of use.	*VTO Stimuli × BB → PEOU*	NOT SUPPORTED
	(c) Bracketing behavior will moderate the influence of VTO technology exposure on perceived accuracy.	*VTO Stimuli × BB → PA*	NOT SUPPORTED
	(d) Bracketing behavior will moderate the influence of VTO technology exposure on perceived privacy risk.	*VTO Stimuli × BB → PPR*	SUPPORTED
	(e) Bracketing behavior will moderate the influence of VTO technology exposure on perceived enjoyment.	*VTO Stimuli × BB → PE*	SUPPORTED
HYPOTHESIS 8	**(a)** Bracketing behavior will moderate the relationship between perceived usefulness and attitude toward webpage usage.	*PU × BB → ATW*	SUPPORTED
	(b) Bracketing behavior will moderate the relationship between perceived ease of use and attitude toward webpage usage.	*PEOU × BB → ATW*	SUPPORTED
	(c) Bracketing behavior will moderate the relationship between perceived accuracy and attitude toward webpage usage.	*PA × BB → ATW*	SUPPORTED
	(d) Bracketing behavior will moderate the relationship between perceived privacy risk and attitude toward webpage usage.	*PPR × BB → ATW*	NOT SUPPORTED
	(e) Bracketing behavior will moderate the relationship between perceived enjoyment and attitude toward webpage usage.	*PE × BB → ATW*	NOT SUPPORTED
HYPOTHESIS 9	Consumers with a positive attitude toward webpage usage will demonstrate a greater intention to adopt, regardless of VTO technology.	*ATW → AI*	SUPPORTED

4.4 Conclusion & Relevance

Study Three underscores the positive impact of VTO technology on consumers' experiences and adoption intentions. The findings demonstrate that exposure to VTO technology significantly enhances perceived usability (PU), perceived ease of use (PEOU), and perceived enjoyment (PE). Collectively, these factors contribute to a more favorable attitude toward website use (ATW), increasing adoption intentions (AI). Furthermore, bracketing behavior (BB) emerged as a critical moderating variable in the study. Specifically, BB influences the relationship between VTO exposure and PU, PE, and perceived privacy risk (PPR). Consumers who exhibit higher levels of BB—characterized by ordering multiple sizes—perceive VTO technology as more valuable and enjoyable while simultaneously reporting more significant privacy concerns. This suggests that consumers with high BB tendencies derive amplified benefits from VTO technology but are also more attuned to its potential privacy implications.

As part of the survey, participants were asked to identify the primary causes of returns in online fashion retail. The results highlight that size and fit issues were the leading factors, with 81% of respondents citing size issues and 59% pointing to fit issues. Other notable causes included quality concerns, dislike of style or color, and bracketing behavior. These findings are summarized in Figure 32, visually representing the primary causes of consumer returns in online fashion retail. This is particularly relevant in VTO technology, as addressing sizing and fit issues could significantly reduce returns and enhance consumer satisfaction. Despite increased PPR, privacy risks were not found to directly hinder either ATW or AI, aligning with the "*privacy paradox*." This phenomenon illustrates that while consumers may acknowledge privacy concerns, these do not necessarily deter them from adopting VTO technology. The study further highlights the pivotal roles of perceived accuracy (PA) and PE as key determinants of ATW and, by extension, AI. Engaging and highly accurate VTO solutions are critical for fostering trust and enhancing user experiences. Importantly, ATW was confirmed to be a strong predictor of AI, regardless of the presence of VTO technology. This underscores the necessity of cultivating a positive perception of the website as a whole to drive the adoption of VTO.

FIGURE 32. Primary Causes of Consumer Returns in Online Fashion Retail



Note. *For the entire sample size; See Appendix E for more details.*

5.0 DISCUSSION & IMPLICATIONS

The findings of the three complementary studies collectively contribute to a deeper understanding of how Virtual Try-On (VTO) technologies influence consumer attitudes, adoption intentions, and return behaviors in the fashion e-commerce sector. Study One establishes the foundational theoretical framework for examining the dynamic and multifaceted nature of VTO technologies, highlighting their transformative potential in enhancing consumer experiences, reducing return rates, and improving fit confidence. However, it also underscores significant gaps, particularly in addressing individual consumer differences, such as demographic factors and the growing "return culture" in fashion e-commerce.

Study Two expands on these insights through expert and company interviews, revealing both the promise and the barriers to the widespread adoption of VTO technologies, including issues related to accuracy, data privacy concerns, and technological limitations. Through a consumer survey, Study Three validates the positive impact of VTO exposure on perceived usability, enjoyment, and adoption intentions while also introducing the critical role of bracketing behavior as a moderating factor. The study highlights key drivers of consumer returns, such as size and fit issues, which VTO technology has the potential to address, offering actionable insights for both retailers and technology developers.

This chapter synthesizes these findings to explore their broader implications for fashion e-commerce, VTO adoption strategies, and consumer behavior while also discussing the practical considerations and future directions for research in this rapidly evolving field. Subsequent sections will explore the theoretical and managerial implications of these findings, elaborate on the study's overall limitations, and provide suggestions for future research.

5.1 Theoretical Implications

This study contributes to VTO technology research by extending the Technology Acceptance Model (TAM) with new insights. It reaffirms the relationships between perceived ease of use, perceived usefulness, attitude toward technology usage, and adoption intention, consistent with the foundational tenets of TAM (Davis, 1985). The results confirm that consumer perceptions of ease of use and usefulness are integral to VTO adoption, supporting findings from previous studies (Jiang et al., 2023; Kalpoe, 2020; Venkatesh et al., 2003). Additionally, emotional and functional elements, such as perceived enjoyment and accuracy, enhance attitudes toward VTO technologies, echoing the findings of Hsu et al. (2021) and Kowalczuk et al. (2020). While prior research highlights privacy risk as a barrier to technology adoption (Featherman & Pavlou, 2003), this study finds that exposure to VTO increases privacy concerns. However, these concerns do not significantly impact attitudes toward webpage usage. This suggests that the perceived benefits of convenience and enjoyment may outweigh privacy risks, aligning with the Privacy Paradox (Bélanger & Crossler, 2011). Thus, this research extends theoretical insights into how perceived trade-offs between privacy and convenience influence consumer decisions regarding VTO technologies. However, it is essential to note that these findings focus on adoption intentions and not actual behavior, and the intention-behavior gap should be considered in future research when examining the impact of privacy concerns on VTO adoption.

Moreover, a key contribution of this research is introducing bracketing behavior as a moderating variable within the TAM framework. To the authors' knowledge, this is the first study to examine how bracketing influences VTO adoption. The findings suggest that technology adoption is shaped by universal constructs like perceived usefulness and ease of use and consumer-specific behaviors, such as shopping habits and attitudes toward returns (Saarijärvi et al., 2017; Stöcker et al., 2021). This extends TAM by emphasizing the importance of individual characteristics in technology adoption. The study shows that bracketing behavior moderates the relationship between VTO exposure and perceived usefulness, suggesting that consumers who engage in bracketing find VTO technologies more valuable. This aligns with studies by Gustafsson et al. (2021) and Stöcker et al. (2021), indicating that bracketers benefit from more accurate fit visualizations, reducing uncertainty. Bracketing also partially influences perceptions of privacy risk and enjoyment, with bracketers being more privacy-conscious but deriving greater enjoyment from VTO technology. However, no moderation was found in the relationships between VTO exposure and perceived ease of use or accuracy, suggesting these features are universally significant.

While the findings indicate that VTO technologies may enhance perceived usefulness and enjoyment, it is crucial to clarify that these results reflect adoption intentions, not actual adoption behavior. The intention-behavior gap remains a key area for future research. Specifically, the question of whether the features of VTO technology—such as accurate size recommendations and fit visualization—can lead to significant reductions in bracketing behavior or returns is still uncertain. Given the lack of direct evidence on actual purchasing behavior, the implications regarding reduced returns and minimized bracketing behavior should be considered as potential outcomes rather than definitive conclusions.

Furthermore, the study's findings suggest that privacy concerns do not significantly affect adoption intentions. This highlights that, while privacy may remain a concern for some users, its impact on adoption is less significant than previously expected. Therefore, the recommendation for retailers to prioritize privacy measures should be reconsidered, as the findings suggest that consumers may be more concerned with the overall user experience and perceived benefits than with privacy risks, as long as those benefits (such as improved fit and enjoyment) are clear. This underscores the need for a user-centric design approach that balances convenience, privacy, and enjoyment.

In conclusion, the study extends TAM by incorporating individual traits like bracketing behavior, offering new insights into the factors influencing VTO adoption. While perceived usefulness and ease of use remain foundational in shaping adoption intentions, integrating factors such as perceived enjoyment, privacy concerns, and bracketing behavior provides a more nuanced understanding of consumer interactions with VTO technologies. Future research should explore the intention-behavior gap further, examining how adoption intentions translate into actual usage and how features like fit visualization influence behavior over time. This research also lays the groundwork for further exploration into how individual characteristics, such as shopping habits and privacy concerns, impact technology adoption in the context of VTO.

5.2 Managerial Implications

The overall findings of this study offer valuable insights for fashion and apparel retailers considering integrating VTO technology into their online shopping experiences. However, as already mentioned, it is important to acknowledge that the study relies on consumer perceptions and intentions, which may not directly translate to actual behavior. Consequently, the following sections outline how retailers can leverage VTO technology, recognizing the study’s limitations, including the intention-behavior gap and the lack of empirical data on real-world adoption.

5.2.1 Consumer Segmentation and Tailored Approaches to VTO Adoption

Effective segmentation of consumers based on their return behaviors is crucial for optimizing the adoption and utility of VTO technology. While previous research emphasizes the importance of understanding consumer return behaviors (Hjort et al., 2013; Rintamäki et al., 2021), it is important to note that this study does not empirically confirm that VTO can significantly alter these behaviors. Segmenting consumers based on their return patterns allows for more tailored VTO experiences. However, one must remain cautious in making conclusions about the precise impact on bracketing behavior, especially since the study has not measured actual behavior post-adoption. Nevertheless, two primary groups have emerged as especially relevant for VTO integration: *Planned Returners* and *Unplanned Returners*.

Planned Returners, also referred to as "bracketers," tend to prioritize the functional aspects of Virtual Try-On (VTO) technology, such as accuracy and its ability to assist in making informed decisions about sizing and fit. This focus on utility and precision likely stems from the fact that these consumers often plan to return items that do not meet their expectations, as bracketers typically order multiple sizes or styles, intending to return those that fail to meet their fit or aesthetic requirements. While VTO technology can enhance the perceived usefulness of the shopping experience by offering more accurate size recommendations, it does not necessarily guarantee a reduction in bracketing behavior. Although it could be hypothesized that decreasing fit uncertainty might discourage excessive returns, further empirical evidence is needed to confirm any significant changes in return behaviors or adoption rates post-VTO adoption.

On the other hand, *Unplanned Returners*, or "non-bracketers," tend to prioritize the emotional or experiential aspects of Virtual Try-On (VTO) technology, such as ease of use and overall enjoyment. These consumers may be more inclined to make impulsive purchases and will likely value a seamless, enjoyable virtual shopping experience, regardless of whether they return the items. Non-bracketers typically return products due to size-related issues. Accordingly, for this group, the emotional engagement features of VTO—such as ease of use, aesthetic appeal, and user-friendly interfaces—could significantly enhance the overall shopping experience. However, since this study primarily relies on self-reported intentions, it cannot definitively conclude that these features will lead to lower return rates or greater VTO adoption. Still, by considering these differentiated consumer segments, retailers can better design VTO technology to suit each group's unique preferences. Nonetheless, without further longitudinal studies, the actual impact on return rates and adoption remains speculative.

5.2.2 Personalization to Reduce Returns and Enhance Consumer Loyalty

Personalization is important in optimizing VTO technology, particularly for minimizing returns and fostering loyalty. VTO can offer tailored experiences based on consumer data, such as past return behavior. However, it is essential to recognize that while personalization could improve perceived satisfaction and convenience, we cannot conclude with certainty that it will significantly reduce returns. While previous studies (Hjort et al., 2019) suggest that better product information and visualization may decrease uncertainty, the link between VTO personalization and reduced return rates remains hypothetical at this stage. Retailers should be cautious in overstating the effects of personalization, acknowledging that further studies on actual behavior would provide more robust evidence.

5.2.3 Sustainability and VTO Technology Integration

Sustainability is a growing concern for consumers, and VTO technology allows retailers to align with sustainability goals. VTO can potentially reduce the need for bracketing behavior and minimize returns, which in turn could lower environmental impact and logistical costs. However, while the study suggests that VTO could reduce return-related waste, it is important to temper these claims due to the speculative nature of the results. As the study does not measure real-world behavior, the assumption that VTO will lead to substantial sustainability benefits must be approached cautiously. Nevertheless, retailers can communicate the potential environmental benefits of VTO technology to enhance consumer engagement with sustainability initiatives. However, claims regarding significant reductions in returns and waste should be framed as opportunities that require further empirical testing.

5.2.4 Addressing Privacy Concerns and Building Consumer Trust

Despite the study's findings that privacy concerns did not significantly affect adoption intentions, privacy remains a complex and critical issue when adopting new technologies. While privacy concerns did not emerge as a direct barrier in this study, retailers should continue addressing consumer data security and privacy concerns. Transparency in consumer data usage and clear communication about data handling practices can help build trust and encourage adoption in privacy-conscious consumer segments. Moreover, retailers should consider offering consumers greater control over their personal data, possibly exploring Web3 technologies. While the study did not establish a direct link between privacy concerns and adoption intentions, proactive measures to safeguard consumer data will help mitigate latent concerns and foster a positive relationship with VTO technology.

5.3 Limitations & Suggestions for Further Research

The present research provides valuable insights into the adoption and impact of VTO technology in fashion e-commerce, particularly its potential to reduce returns. However, several limitations across the three studies should be considered when interpreting the findings, and suggestions for future research should be made.

5.3.1 General Limitations

The study was conducted under a constrained time frame, which limited the depth of analysis and exploration of evolving trends, consumer preferences, and technological advancements. A more extended research period would enable longitudinal data collection, providing a more dynamic and comprehensive understanding of VTO adoption over time. Furthermore, this thesis focuses exclusively on virtual fitting technology within online fashion retail, limiting the generalizability of the findings to other industries or product categories. Future research should explore VTO applications in other areas, such as footwear, accessories, and even other clothing categories apart from a basic T-shirt (e.g., jeans, Dresses, etc.), to assess its broader market potential. Additionally, the cross-sectional nature of this study restricts conclusions regarding the evolution of consumer attitudes. Longitudinal designs would offer valuable insights into how repeated interactions and the increasing prevalence of VTO technologies influence consumer perceptions and adoption.

5.3.2 Study-Specific Limitations

The ***first study***, i.e., the literature review, primarily relied on Scopus and Google Scholar, potentially overlooking relevant studies from other databases or research perspectives. Future reviews should incorporate a broader range of sources, including those from alternative databases and non-English-language research, to provide a more global perspective on VTO adoption. The lack of standardized terminology in the VTO field also complicates cross-study comparisons. To address this, future reviews should advocate for a unified lexicon to facilitate more transparent communication and more consistent research outcomes across studies. Additionally, while the field has predominantly focused on quantitative methods, incorporating qualitative approaches could deepen the understanding of consumer experiences, particularly psychological factors like bracketing behavior, which remains underexplored.

The ***second study,*** i.e., the company and expert interviews, was limited by a few expert and company interviews, which constrained the diversity of perspectives. Future research should include a broader sample of experts from diverse regions and industries at various stages of VTO implementation to enhance the generalizability and richness of the findings. Reflexive approaches to data analysis could help mitigate researcher bias, while ethical considerations regarding confidentiality and anonymity should be clearly articulated to build trust with participants.

Regarding the ***third study,*** i.e., the consumer survey, its sample size was small and drawn primarily from personal networks, limiting the generalizability of the findings to broader populations. Future studies should strive for a more diverse and randomized sample to enhance external validity. Variations in return-related behaviors across demographic groups may have influenced the results, emphasizing the need for balanced experimental samples in future research. Furthermore, overlaps between constructs such as perceived usefulness, attitudes toward webpage usage, and adoption intention suggest a need for refined survey instruments to improve discriminant validity. While this study uniquely explored bracketing behavior as a moderating variable, further research should investigate additional psychological drivers such as consumer confidence, risk aversion, and product familiarity. Expanding the scope to include cross-cultural comparisons and emerging technologies like haptic feedback, AI-driven avatars, and photorealistic 3D rendering could provide new insights into VTO adoption and effectiveness. Moreover, the study's key limitation is its focus on consumer intentions rather than observed behaviors. The intention-behavior gap, well-documented in technology adoption research, highlights the role of situational barriers, context, and habit formation in mediating the transition from intention to action. Future research should employ longitudinal designs to track real-world interactions with VTO technologies over time, clarifying how consumer intentions evolve into actual adoption behaviors. Experimental studies that simulate realistic shopping scenarios could also offer valuable insights into the barriers and enablers of VTO adoption.

5.3.3 Broader Considerations & Future Directions

Ethical implications related to VTO technology’s role in fast fashion and overconsumption merit further exploration. While VTO may reduce waste by lowering return rates, it could also inadvertently encourage over-purchasing due to convenience and

enjoyment. Future research should investigate whether VTO fosters sustainable consumption or exacerbates overconsumption, employing longitudinal methods to track behavioral changes over time.

Additionally, future studies should focus on bridging the intention-behavior gap by tracking real-world consumer behavior rather than relying solely on stated intentions. Longitudinal studies could examine how VTO adoption impacts long-term consumer behavior, customer loyalty, and shifts in purchasing patterns. Experimental designs that simulate shopping experiences could further enhance understanding of the barriers and enablers of VTO adoption. Finally, research should explore VTO applications in diverse product categories and leverage emerging technologies to expand the understanding of its broader market potential.

Overall, while the present study advances knowledge of VTO technology's role in fashion e-commerce, addressing its limitations and exploring new avenues for research will be essential for refining theoretical frameworks and practical applications. Longitudinal studies focusing on behavioral outcomes, psychological factors, and ethical dimensions will be key to shaping sustainable, consumer-centric innovations in the VTO landscape.

5.4 Conclusion & Final Remarks

By integrating findings from the three studies and employing TAM as a theoretical foundation, this research underscores the significance of key constructs such as perceived usefulness, ease of use, accuracy, and enjoyment in shaping consumer attitudes and adoption intentions. These insights highlight the importance of both functional and emotional dimensions when designing effective VTO solutions.

Theoretically, this study extends the TAM framework by incorporating a behavioral dimension, contributing to the academic discourse on consumer technology adoption. Additionally, this research sheds light on the privacy paradox, where privacy concerns are acknowledged but do not significantly deter consumers. This phenomenon can likely be attributed to the convenience and enjoyment associated with VTO technologies, further illustrating the complexity of consumer behavior with emerging technologies. While this study provides actionable insights into the drivers of VTO adoption intentions, the findings should be interpreted cautiously due to the intention-behavior gap. Without real-world observational data, how these intentions translate into actual VTO adoption and usage remains uncertain. Future research should integrate behavioral tracking techniques to bridge this gap, such as monitoring user interactions with VTO applications over time. Cross-sectional studies considering different demographics and cultural contexts could also reveal how external factors shape the transition from intention to behavior. By addressing these gaps, future research can build a more comprehensive understanding of VTO adoption, ultimately supporting the development of more effective and impactful technologies.

From a practical standpoint, this study provides actionable insights for retailers on leveraging VTO technologies to address key challenges in online fashion retail. By balancing functionality, enjoyment, and privacy assurance while tailoring solutions to different consumer behaviors, retailers can better bridge the gap between online and offline shopping experiences, enhancing customer satisfaction and reducing return rates.

Finally, this research lays the groundwork for future studies by identifying key avenues for further exploration, such as the impact of demographic, cultural, and technological differences on VTO adoption and examining consumer behaviors related to sustainability-conscious shopping. As VTO technologies evolve, their transformative potential in shaping the future of online fashion retail remains significant, offering opportunities to align consumer expectations with industry goals. In conclusion, this study contributes valuable insights to the literature, provides actionable recommendations for practitioners, and emphasizes the role of VTO technologies in creating more engaging, sustainable, and consumer-centric online shopping experiences.

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Zhao, L., Guo, W., Fang, S.-C., andAn, Q. (2024). Enhancing supply chain coordination through transparency initiatives to mitigate product returns. *Journal of Retailing and Consumer Services*, 78, 103756-. https://doi.org/10.1016/j.jretconser.2024.103756

Note on AI Tools & Their Contribution

Throughout the thesis writing process, several AI tools were utilized to streamline tasks and improve the quality of the work:

- ➔ ***Klang AI*** [https://klang.ai/] was employed for automatic transcription of interviews. This tool significantly speeds up the process of analyzing interview data by providing a foundational transcription, which was later reviewed and corrected manually.
- ➔ ***Grammarly Premium*** [https://www.grammarly.com/] was used to ensure accurate spelling and grammar throughout the writing process. Its suggestions enhanced not only the technical correctness but also the clarity and coherence of the text.
- ➔ ***ChatGPT*** [https://chatgpt.com/] was occasionally used to provide advice on paragraph structure, helping to reduce repetition and elevate the overall quality of the language.

While AI tools offer significant advantages, they also present certain risks, particularly in accuracy and reliability. Hence, all AI-generated outputs were carefully reviewed to address this. Necessary adjustments were made to ensure the final text remained accurate and aligned with the authors' intentions. Furthermore, transcriptions generated by Klang AI were not entirely accurate. They were used as a foundation for listening to recordings and manually correcting errors, ensuring the final transcripts were precise.

AI can occasionally introduce inaccuracies or provide additional information not requested in the original prompt. As such, outputs must always be double-checked for correctness and relevance. When used correctly, AI tools can reduce time and effort for specific tasks, such as transcription, grammar checking, and structural editing. AI tools should complement, rather than replace, human judgment and expertise. AI tools proved useful in certain aspects of the thesis process, but they require careful oversight and critical evaluation to ensure integrity and quality.

APPENDIX

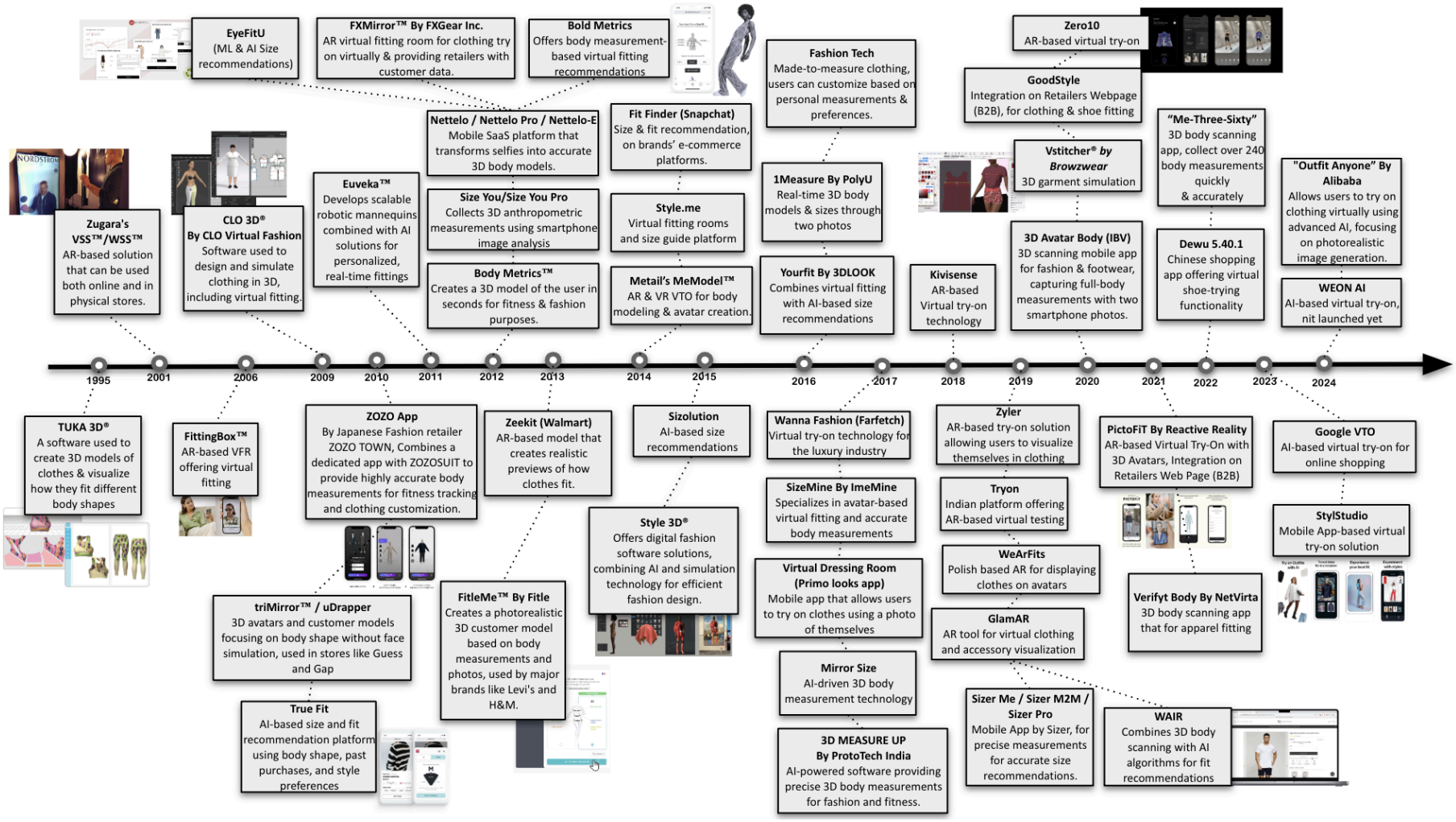
Appendix A. Study One: Available Virtual Try-On Technologies

TABLE A1. Available Try-On Technologies Today Found in the Literature Review

APPLICATION NAME	COUNTRY OF ORIGIN	FOUNDED	TYPE OF APPLICATION	URL	SHORT DESCRIPTION
Yourfit *3DLOOK*	USA & Ukraine	2016	Free App to download on iOS/Android	https://3dlook.me/	Combines virtual try-on with AI-driven size recommendations to boost purchase confidence and minimize returns. It allows customers to try on clothes virtually while receiving accurate size recommendations.
Nettelo / Nettelo Pro / Nettelo-E *Nettelo*	USA & France	2012	Free App to download on iOS	http://nettelo.com/	A mobile and SaaS platform that transforms selfies into accurate 3D body models, enabling remote measurements for personalized fitting and reduced returns.
Me-Three-Sixty *Side Stream*	USA	2022 (2012)	Free App to download on iOS/Android	https://www.sizestream.com/technology	Offers 3D body scanning solutions, enabling users to collect over 240 body measurements quickly and accurately using smartphones or tablets.
Mirrorsize	India	2017	Free App to download on iOS/Android	https://www.mirrorsize.com/#/	Innovates in AI-driven 3D body measurement technology, providing precise measurements to enhance garment fitting and health monitoring across various industries.
Verifyt Body *By NetVirta*	USA & Singapore	2021	Free App to download but with in-app purchases, Android	https://www.netvirta.com/	Smartphone-based 3D body scanning technology that enhances fitting for brands and retailers, offering accurate size recommendations to reduce returns.
3D Avatar Body (IBV)[7]	Spain	2020	Free App to download but with in-app purchases, Android/Google Play	https://www.ibv.org/en/3d-avatar-body-3/	Provides 3D scanning technologies for fashion and footwear, capturing full-body measurements with two smartphone photos.
Sizer Me / Sizer M2M / Sizer Pro	Israel	2019	Free App to download on Windows, iOS/Android	https://sizer.me/	Focuses on advanced digital sizing solutions, capturing precise measurements for accurate size recommendations to reduce returns.
SizeYou/Size You Pro *By Size You*	Italy	2012	Free App to download on iOS/Android	https://www.sizeyou.it/en	Collects 3D anthropometric measurements using smartphone image analysis, enhancing precision in body measurements.
1Measure *PolyU*[8]	China	2016	Free App to download on iOS	https://jp.emtailor.com/1measure_tozi/	Users can obtain real-time 3D body models and sizes through two photos, applied in online clothing customization and fitting.
Fashion Tech *Mondial Atelier Holdings Lim.*	China	2016	Free App to download on iOS/Android	https://apps.apple.com/us/app/fashion-tech/id1119634435	Specializes in made-to-measure clothing, allowing users to customize based on personal measurements and preferences.
ZOZO App *By Fashion retail website*	Japan	2010	Purchase equipment ZOZO Suit 2, iOS/Android	https://corp.zozo.com/measurement-technology/	Combines a dedicated app with ZOZO SUIT to provide highly accurate body measurements for fitness tracking and clothing customization.
3D MEASURE UP *By ProtoTech India*	India	2017	API based delivers measurements from external 3D Body Scanners, Available on All platforms	https://3dmeasureup.com/	AI-powered software providing precise 3D body measurements for enhanced customer experiences in fashion and fitness.
Bold Metrics	USA	2012	Integration on Retailers Webpage (B2B) with Size & Fit Recommendation for Apparel	https://boldmetrics.com/	Offers size and fit recommendations based on body measurements to enhance the online shopping experience.
PictoFiT *By Reactive Reality*	Austria	2021 (2014)	AR-based Virtual Try-On with 3D Avatars, Integration on Retailers Webpage (B2B)	https://www.reactivereality.com/pictofit	A leading Virtual Try-On plugin used by major brands, integrating seamlessly with e-commerce platforms and offering customizable scenes and avatars.
Zyler	UK	2019	SaaS (Software as a Service), offered as a plug and play or API solution	https://business.zyler.com/	Advanced Virtual Try-On technology allowing users to visualize clothing accurately with easy integration into e-commerce platforms.
GlamAR	India	2019	Integration on Retailers Webpage (B2B) - AR-based Fashion Try-On	https://www.glamar.io/	Recognized as a top Virtual Try-On tool, it visualizes clothing and accessories in real time across multiple platforms.
SizeMine *By ImeMine*	South Korea	2017	Integration on Retailers Webpage (B2B) for Size recommendations	https://imemine-us.imweb.me/	Specializes in avatar-based virtual fitting and accurate body measurements through AI algorithms.
Google Virtual-Try on	USA	2023	Google Shopping	https://blog.google/products/shopping/ai-virtual-try-on-google-shopping/	Shows lifelike clothing on real models using diffusion-based AI, allowing for realistic visualization of garments.
Sizolution	Germany	2015	AI-driven size recommendation consultation and solution implementation for online fashion retailers	https://www.sizolution.ai/	Next-gen AI-driven platform for personalized garment size suggestions, enhancing customer experience and reducing returns.
Kivisense	China	2018	AR-based Virtual Try-On for Retail for shoes, watches, jewelry, & clothing. Found on the Shopify App Store	https://tryon.kivisense.com/ https://apps.shopify.com/kivisense-try-on	Specializes in virtual fitting for various products, providing accurate body and facial tracking for a seamless experience.
Zero10	USA	2020	Integration on Retailers Webpage (B2B) & IRL with AR Mirror	https://zero10.ar/	Offers real-time virtual try-on experiences with their AR Mirror, enhancing customer engagement and sales conversions.
StylStudio	USA	2023	Application on Appstore & Google Play, upload a photo of you and then try on clothes	https://stylstudio.app/	A virtual try-on app that allows users to try on the latest fashion trends using just a selfie, enhancing online shopping experiences.
Wanna Fashion *(Farfetch)*	USA	2017	AR-based Fashion Try-On Available on the Farfetch webpage	https://wanna.fashion/blog/virtual-try-on-technology-for-luxury-industry	An immersive platform that personalizes virtual fitting by scanning the body, predicting outfits' appearance and fit in real time.
GoodStyle	Estonia	2020	Integration on Retailers Webpage (B2B), for clothing & shoe fitting	https://www.instagram.com/goodstyle_app/	A virtual fitting-room app using AR technology, allowing users to try on clothes and shoes from various brands easily.
Virtual Dressing Room *(Primo looks app)*	Japan	2017	Free App to download but with in-app purchases, Google play/IOS	https://play.google.com/store/apps/details?id=com.PrimoLook.App&hl=en&gl=US	A mobile app that allows users to try on clothes using a photo of themselves. It helps reduce returns by providing a realistic preview of how clothes will fit, allowing users to experiment with different styles without the hassle of returns.
Bodymetrics™	UK	2012	Full 3D Body Scanner	https://www.bodymetrics.com/	A pioneering body-mapping solution that creates a 3D model of the user in seconds, offering hundreds of measurements and allowing tracking of body data for fitness and fashion purposes.
FXMirror™ *FXGear Inc.*	South Korea	2012 (2004)	AR-based Virtual Try-On for Retail	https://www.fxgear.net/vr-fashion	An augmented-reality fitting room solution that allows shoppers to try on clothes virtually while providing retailers with customer data.
Metail's MeModel™	UK	2014	3D avatars and customer models	https://metail.com/projects/etryon/ https://metail.com/about-us/	Develops a virtual fitting experience using AR and VR technology for body modeling and avatar creation.
FitleMe™ *Fitle*	France	2013	3D avatars and customer models	https://fitle.com/	Creates a photorealistic 3D customer model based on body measurements and photos, used by major brands like Levi's and H&M.
triMirror™ *(Today: uDrapper)*	Canada	2010	3D avatars and customer models	https://udraper.com/	Similar to FitleMe™, focusing on body shape without face simulation, used in stores like Guess and Gap.
Euveka™	France	2011	Robotic Mannequins for Fashion Fitting	https://www.euveka.com/en/	Develops scalable robotic mannequins combined with AI solutions for personalized, real-time fittings, aimed at improving sustainability in garment production.
FittingBox™	France	2006	AR-based Virtual Try-On for Retail	https://www.fittingbox.com/	Leading provider of virtual try-on solutions for the eyewear industry, featuring a large database of 3D frames and generating millions of virtual fittings annually.
Zugara's VSS™/WSS™	USA	2001	AR-based Virtual Try-On for Retail	https://www.zugara.com/	Develops AR software that overlays digital information onto the real world, focusing on intuitive human-like interactions through gestures and voice.
Zeekit *(Walmart)*	Israel	2013	AR-based Virtual Try-On for Retail, available on the Walmart webpage	https://corporate.walmart.com/news/2022/03/02/walmart-launches-zeekit-virtual-fitting-room-technology	Allows customers to preview how clothes will fit using AR-based models that match their body shape, acquired by Walmart in 2021.
Outfit Anyone *Alibaba*	China	2024 (1999)	AI-based Virtual Try-On	https://outfitanyoneai.org/ https://huggingface.co/spaces/HumanAIGC/OutfitAnyone	Developed by Alibaba, it allows users to try on clothing virtually using advanced AI, focusing on photorealistic image generation.
WeArFits	Poland	2019	Integration on Retailers Webpage (B2B), VTO that uses AR to display clothes on an avatar	https://wearfits.com/	A VTO that uses AR to display clothes on an avatar, providing realistic try-on experiences and detailed size fitting analytics.
TryOn	USA	2019	Integration on Retailers Webpage (B2B), AI-first company specialized in AR technology for jewelry e-commerce	https://tryon.technology/	Creates a virtual dressing room for customers to try on garments before buying, emphasizing seamless and immersive experiences.
Style.Me	Taiwan	2014	Integration on Retailers Webpage (B2B) that offers virtual fitting rooms and size guides	https://style.me/	An online virtual fitting room application that uses AI to help users find the perfect fit and offers advice on outfit matching.
CLO3D® *CLO Virtual Fashion*	South Korea	2009	Virtual clothing design software	https://www.clo3d.com/en/	Software for designing and simulating clothing in 3D, enabling realistic garment visualization before production.
Style 3D®	China	2015	Virtual clothing design software	https://www.linctex.com/	Offers digital fashion software solutions, combining AI and simulation technology for efficient fashion design.
Vstitcher® *Browzwear*	USA	2000	Virtual clothing design software	https://browzwear.com/products/v-stitcher	A 3D fashion design software that enables garment creation and prototyping in a digital environment, enhancing design efficiency.
TUKA 3D® *Tukatech*	USA / India	1995	Virtual clothing design software	https://tukatech.com/tuka3d/	Provides 3D fashion technology solutions for garment design, focusing on sustainability and innovation in the apparel industry.
Fit Finder *Fitanalytics (Snapchat)*	Germany	2014 (2010)	Integration on Retailers Webpage (B2B)	https://fitanalytics.com/fit-finder	Uses large datasets to provide size and fit recommendations, integrated into fashion brands' e-commerce platforms.
True Fit	USA	2010	AI Based Virtual Try on solution for retailers, Integration on Retailers Webpage (B2B)	https://www.truefit.com/	Personalization-focused platform using AI to create a tailored shopping experience by analyzing user behavior and brand data.
WAIR	USA	2019	AI Based Virtual Try on solution for retailers	https://www.getwair.com/	Offers body scanning technology to create 3D body replicas and provide fit recommendations based on customer data.
EyeFitU	Switzerland	2012	AI Based Virtual Try on solution for retailers, Integration on Retailers Webpage (B2B)	https://www.eyefitu.com/	Size-as-a-Service solution enhancing personalization and online shopping confidence through advanced AI and data analytics.
WEON AI	Sweden	2024	Integration on Retailers Webpage (B2B) - but not launched yet	https://weon.ai/	Aiming to revolutionize online shopping with AI-driven virtual try-on technology, focusing on creating a confident and sustainable purchasing experience.

[7] *By Universitat Politècnica de València Instituto de Biomecánica*
[8] *The Hong Kong Polytechnic University*

FIGURE A1. *Timeline of Virtual Try-On Technology Companies, Platforms, Applications, or Similar*



Appendix B. Study One: Common Theoretical Frameworks in Virtual Try-On Technology Research

TABLE B1. Theories, Sources, and Purpose of the studies
[Inspiration from: Batool & Mou (2024)]

CORE THEORY APPLIED	SOURCES	PURPOSE OF THE STUDIES
Technology Acceptance Model [TAM]	Zhang & Wang (2023)	Examine the effects of the characteristics of VTOs on the intention to use.
	Hua et al. (2024)	Examine consumers' characteristics and their influence on post-use feelings, subsequently affecting their attitude towards Virtual Try-On technologies and their intention to use them.
	Jiang et al. (2023)	Examine the influencing factors for users' intentions to use AR virtual shoe-try-on.
	Li & Xu (2020)	Examine the influence of two relevant personality traits, fashion leadership and technology anxiety, on consumers' VFRs adoption.
	Nayak et al. (2021)	Examine the influence of interactivity and customer involvement on the online shopping experience.
	Goncalves et al. (2023)	Examine the acceptance by consumers of the virtual try-on artificial systems when buying apparel online.
	Kalpoe (2020)	Examine the customers' technology acceptance of four technological alternatives designed to prevent unnecessary apparel returns.
	Plotkina & Saurel (2019)	investigate how attitudes towards AR apps contribute to customer perceptions of brand personality.
Unified Theory of Acceptance and Use of Technology 2 [UTAUT2]	Chidambaram et al. (2023)	Examine the consumers' online apparel purchasing behavior.
	Qasem (2021)	Identify and examine the design and individual characteristics that influence centennials to adopt virtual try-on systems.
	Ivanov et al. (2023b)	Examine privacy concern, body image and social value as antecedents to adoption intention towards an apparel Virtual Try-On.
Technology Continuance Theory	Foroughi et al. (2024)	Investigate the determinants of intention to reuse augmented reality (AR) apps.
Consumer Decision-Making Models	Almousa (2020)	Explore female consumers' experiences using 3D body scanning technology and their level of acceptance.
	Zhao et al. (2024)	Explore the pricing and marketing strategies considering transparency efforts to reduce product returns in a supply chain.
	Tandon et al. (2021b)	Examine virtual try-on technology, return policies, pay-on-delivery (POD) mode of payment, vendor-specific guarantees, and free shipping policy of online retailers as antecedents of trust.
	Beck & Crie (2018)	Highlight the effects of an online VTOs on consumer's exploratory behavior and intention to purchase, both online and offline contexts.
	Ivanov et al. (2023a)	Develop and test a general model that explains the formation of decision comfort (DC) in the majority of AR try-on experiences for mobile shopping.
	Gallino & Moreno (2018)	Explore mechanisms through which providing virtual fit information helps customers and retailers.
Hierarchy of Effects Model [HOE]	Arachchi & Samarasinghe (2023)	Explain the influence of fashion retail autonomy avatar on consumers' acceptance of fashion retail service and examine the moderating impact of precision toward avatar acceptance.
Consumer Mental Imagery	Kim et al. (2024)	Explore the influence of personalized virtual try-on technology on consumer behavior in the apparel industry, focusing on decision comfort.
	Ambika et al. (2022)	Focus on the self-augmentation experiences through the virtual product try-on apps.
Self Determination Theory	Tandon & Ertz (2024)	Examine the impact of virtual try-on technology and e-logistics service quality on customer satisfaction in online shopping.
Stimulus-Organism-Response Theory [S-O-R]	Voicu et al. (2023)	Examine the factors influencing consumers' experience and satisfaction using AR apps in makeup e-shopping.
	Maryani et al. (2023)	Investigate how information quality affects immersion.
	Baytar et al. (2020)	Examine whether AR conveys reliable apparel product information in terms of fit, size, and product performance; and how AR affects attitudes toward apparel and purchase intentions when shopping online.
	Gabriel et al. (2023)	Determine the effect of implementing AR on beauty and fashion products on the intention to continue using AR and shopping in e-commerce.
	Wang & Jiang (2024)	Investigate how to increase user willingness to use virtual try-on services for Gen Z.
User and Gratification Theory	Yaoyuneyong et al. (2018)	Explore the relationships between shopping enjoyment, economic motivation, apparel shopping self-confidence, perceived informativeness, perceived irritation and buying intention.
Theory of Interactive Media Effects [TIME]	Chung & Tan (2024)	Enhance the understanding of consumers' psychological state when shopping with VTOs.
	Tawira & Ivanov (2023)	Examine the effects from personalization and customization affordances adoption intention.
Signaling Theory	Plotkina et al. (2021)	Investigate product presentation and the extent to which it should exhibit human visuals corresponding to consumers' appearance.
	Tandon et al. (2021a)	Examine virtual-try-on technology, return policy, and pay-on-delivery (POD) mode of payment as predictors of trust in an online context.
Extended Self-Theory	Lavoye et al. (2023)	Investigate spatial presence, social presence, and self-presence to clarify the impact of virtual try-ons on consumers' purchase intentions. We demonstrate that the three dimensions of presence have varying effects on purchase intentions.
Desirability-Feasibility Framework	Lee et al. (2022)	Unveil consumer perceptions and adoption intention toward virtual fitting rooms for their online apparel shopping.
Other	Hernández et al. (2019)	Compare the size selections based on primary measurements and size charts, virtual garments, and real garments.
	Zhang et al. (2019)	The Role of Virtual Try-On Technology in Online Purchase Decision from Consumers' Aspect.
	Park & Kim (2023)	Explore the barriers and enablers that influence the consumer adoption of virtual try-on and 3D virtual stores.
	Hwangbo et al. (2020)	Explore the fundamental meaning of virtual `try-on' as a customer experience and examine the effects of 3D virtual try-on on online sales.
	Chi et al. (2024)	Propose a parametric design method for garment pattern.
	Negri et al. (2020)	Propose a new way of creating a digital twin.
	Shin et al. (2023)	Explore consumers' experiences toward the custom-fit T-shirts and online mass customization services using the Virtual Try-On technology found in online consumer reviews.
	Srivastava & Pal (2024)	Measure the importance consumers attach to AI-based attributes, namely, chatbots, face recognition, virtual fitting room, smart parking and cashier-free station in retail stores.
	Heiman et al. (2022)	Analyze how changes in market demand and supply conditions following the outbreak of COVID-19 accelerated the adoption of VDR technologies.
	Stöcker et al. (2021)	Investigate potentially suitable measures to avert or avoid returns in the pre-purchase, purchase, and post-purchase phases.
	Bozzi et al. (2022)	Trace the processes behind the elaboration of the prod-uct page and map the shopping journey to identify ways to reduce returns.
	Xu et al. (2023a)	Develop profit-maximizing models for retailers facing bracketing customers.
	Saarijärvi et al. (2017)	Explore and analyze online returning behavior in the context of fashion merchandise.
	Karadayi-Usta (2024)	Examine 'AI- and AR -powered mobile applications from a consumer point of view.
	Ornati et al. (2022)	Analyze the effect of three types of virtual try-on technologies on the datafication of dress embodiment.
	Rausch et al. (2021)	Investigate the importance of sustainable online shop attributes according to consumers.
	Ahmad et al. (2024)	Integrate methodologies from two distinct studies to advance the comprehension of immersive virtual experiences within the realms of fashion and e-commerce.
	Won et al. (2024)	Investigate the influence of information system qualities (ISQs) on consumer responses related to sustainable fashion consumption in the context of comparing 3D VR stores and 2D websites.
	Yang & Xiong (2019)	Examine whether and how VTO influences sales and post-sales outcomes.
	Wang et al. (2024)	Investigate whether to use AI technology in e-commerce operations in the presence of showrooming effect and consumer returns.
	Gustafsson et al. (2021)	Investigate how fit uncertainty impacts product return costs in online retailing and how digital product fitting, a pre-sales fitting practice, can reduce fit uncertainty.
	Hilpert & Zumstein (2023)	Determine the drivers and barriers of AR in fashion e-commerce from the consumers and fashion retailers perspective.
	Holte (2020)	Evaluate virtual dressing room's impact on the return rate of garments purchased online.
	Casciani et al. (2022)	Provide an overview of the digital transformation of the fashion industry.
	Rintamäki et al. (2021)	Examine how customers perceive the returning process depending on whether the returns are planned or unplanned.
Systematic Review	Idrees et al. (2024)	Mobile 3D body scanning applications: a review of contact-free AI body measuring solutions for apparel
	Wang et al. (2023)	Examine the literature related to online shopping cart abandonment.
	Huang & Chung (2024)	Explore how to achieve close psychological distance and experiential value in Martech servicescape.
	Boughlala & Smelik (2024)	Trace the not-yet-written history of digital fashion and its emergence and development in the last few decades.
	Liu et al. (2021)	Examine the literature related to digital twins.
	Berman & Pollack (2021)	Present a six-step process for successful planning and implementation of AR in retail.
	Ghodhbani et al. (2022)	Provide a comprehensive and structured overview of extensive research on the advancement of virtual try-on.
	Lee & Xu (2020)	Conduct a classification of available VTO technologies from the perspective of consumer experience, particularly cognitive vs. affective experiences.
	Wojciechowski et al. (2023)	Review the state of the art of presentation of clothing textiles in e-commerce in the world to emphasize the problem of size matching in the context of returns.
	Mohammadi & Kalhor (2021)	Provide an overview of the research on modern fashion-related applications such as virtual try-on.
	Batool & Mou (2024)	Organizing and categorizing the relevant literature on virtual try-on technology.
	Lee & Leonas (2018)	Examine how omni-channel retailers utilize and manage several virtual technologies and provide practical implications to brick-and-mortar retailers.
	Daanen & Psikuta (2018)	Provide an overview of 3D scanning technology.
	Kuzmichev & Yan (2022)	Present an overview of the digital twin building architecture.
	Karlsson et al., (2023)	Identify key return management components in developing more effective return management strategies.
	Mesjar et al. (2023)	Review the intersecting topics of fashion, immersive technologies, and sustainability to determine the trends, examine the solutions offered, and discuss the implications of immersive technologies for sustainability.
	Roberts et al. (2023)	Examine why companies engage in this highly unsustainable and resource-inefficient behavior and to explore the potential policy interventions required to effectively address the issue.
	Nestler et al. (2021)	Introduce a probabilistic Bayesian model in order to reduce size-related returns.
	Phamthi et al. (2024)	Review the current state of research on the impact of perceived risk on purchase intention (PR&PI) in e-commerce.
	Rana (2024)	Explore the dynamic interplay between ethical AI integration and marketing strategies in the context of sustainable e-commerce fashion designing.

Appendix C. Study Two: Expert & Company Interviews

Interview Questions / Guide

This appendix outlines the guiding interview questions used during the conversations with industry experts and representatives from companies specializing in virtual try-on technology, digital twins, and online retail solutions. The aim was to capture a wide-ranging perspective on the current landscape and the future potential of these innovations.

In total, seven semi-structured interviews were conducted involving a diverse group of professionals, including company founders, technology developers, and academic researchers. This approach allowed for exploring the standardized topics of interest and adapting our questions based on each participant's unique expertise and insights. Key areas of inquiry included the state and potential of virtual try-on technology, barriers to consumer adoption, sustainability impacts, and anticipated digital retail trends.

The insights gathered from these conversations are invaluable, providing a rich context for the analysis and theoretical framework to investigate the transformative role of virtual try-on technology in shaping the future of fashion e-commerce. Below, the general interview guide that informed our discussions is presented, acknowledging the dynamic nature of the dialogue that allowed for a deeper exploration of specific topics.

TABLE C1. Generalized Interview Guide for Virtual Try-On Technology in Fashion E-commerce

About Us
Hi [XYZ]! ***Thank you so much for taking the time to meet with us – we truly appreciate it!***
➢ **A bit about us:** We are Hannah Gustafsson and Maja Stark Jansson, currently master's students in our second year of the Business and Management program at the Stockholm School of Economics. ◦ **Hannah:** I completed my bachelor's degree in Retail Management at Stockholm School of Economics from 2020 to 2023 and began my master's studies right after. ◦ **Maja:** I have a bachelor's degree in Business and Economics from the Stockholm School of Economics (2015–2019) and a background in growth marketing, which I studied at Berghs School of Communication (2019–2020). Afterward, I gained industry experience working as a Business Developer and Project Manager at Tourn International. In 2023, I returned to SSE to pursue my master's degree.
➢ **About our thesis:** We are exploring the future of the fashion e-commerce industry, focusing specifically on virtual try-on technologies and their impact on consumer experiences, as well as the potential effects on retailers. A significant part of our research addresses the environmental and financial impact of consumer returns, especially in fashion e-commerce, which is an area where we believe virtual try-on solutions could make a meaningful difference.
Thank you again for joining us, and we're excited to learn from your insights!
GDPR & Consent
First, do we have your consent to record and transcribe this meeting?
• This recording will only be used by us to accurately remember what is said and will be deleted at the end of the project (15 December). You can withdraw your consent at any time, and no names or company names will be included in the thesis, unless you're comfortable with the industry and title being mentioned.
About the Participant
• Could you give us a brief introduction to yourself and your background in the fashion industry? // Could you tell us a bit about yourself, your role at [Company XYZ], and your main responsibilities?
Topic 1 - Industry Evolution and Future of Fashion E-commerce
• How do you envision the future of fashion e-commerce retail over the next 5-10 years? • What do you believe are the biggest challenges facing the fashion e-commerce retail industry today? • How do you see virtual try-on technology evolving, and what impact do you think it will have on fashion e-commerce?
Topic 2 - Role and Potential of Virtual Try-On Technology
• In your view, what role does virtual try-on technology play in enhancing customer satisfaction and confidence in online shopping? • How accurate and effective do you believe virtual try-on technologies are in reducing return rates? • What specific types of virtual try-on technologies do you think have the most potential to improve customer satisfaction and reduce returns? • Do you believe there are generational, gender, or regional differences in the adoption and effectiveness of virtual try-on solutions?
Topic 3 - Consumer Behavior & Attitudes
• How do virtual fitting solutions influence customer purchase behavior, and how do you assess their effectiveness? • What trends have you observed in customer attitudes toward virtual try-on technology? • How does the personalization aspect of virtual try-on influence customer trust and engagement?
Topic 4 - Technical and Consumer-Related Challenges
• What do you see as the main barriers to adoption for virtual try-on technologies, from both consumer and retailer perspectives? • How do privacy concerns affect the adoption of virtual try-on technology, and what can retailers do to address these concerns? • What technical challenges are faced in developing or implementing these technologies?
Topic 5 - Impact on Sustainability
• How do you believe virtual try-on technology contributes to sustainability efforts, such as reducing returns or minimizing waste? • What solutions do you see as effective in addressing the environmental impact of fashion e-commerce?
Topic 6 - Future Directions & Technological Advancements
• What role do you see digital twin and virtual fitting technologies playing in the future of fashion retail, both online and offline? • Are there any emerging trends or innovations in this space that you're particularly excited about? • What do you think is currently missing from the research on technological solutions in fashion e-commerce?
Topic 7 - Additional Insights & Open Discussion
• Do you have any final thoughts on the evolution of virtual try-on technology and its impact on the fashion industry? • Is there anything else you believe would be valuable for us to consider in our research?
Thank you so much for your time and your valuable insights for our research project!

TABLE C2. Pre-Study Company & Expert Interviews - Details

INTERVIEW	SHORT DESCRIPTION OF THE PARTICIPANTS BACKGROUNDS
INTERVIEW #1: ***Virtual Try-On Company***	• The participant is the Head of Product Strategy and Partnerships at a body data technology company, where they have worked for over five years. With a strong background in apparel innovation, including nine years at Columbia Sportswear and consulting roles with brands like Levi's and Lululemon, they bring extensive experience in physical product development. They joined the company once its AI technology for predicting body measurements was ready for market applications beyond custom clothing. • Their expertise involves expanding the company's AI-driven solutions, which accurately estimate body measurements to improve apparel fit, reduce returns, and promote sustainability. They believe this technology has wide-reaching potential beyond the apparel industry, offering valuable data-driven insights for organizations across sectors. The company's mission focuses on both enhancing sustainability in retail and empowering organizations with scalable, new data to make more informed decisions.
INTERVIEW #2: ***Virtual Try-On Company***	• The participant is the founder and CEO of a company based in Zurich. With a background in finance rather than fashion, they studied economics, completed a master's in marketing, and worked in banking, most recently as a broker in derivatives and stocks. Their experience spans various industries, but they became particularly interested in retail due to the need for change in consumer behavior. Observing the high volume of fashion returns, especially from major online retailers, inspired them to develop a solution aimed at reducing waste and promoting sustainability in online fashion shopping.
INTERVIEW #3: ***Virtual Try-On Company***	• The participant is an artist and musician who moved into digital media and e-commerce, focusing on interactive visuals to improve online product displays. Early in the rise of e-commerce, they experimented with ways to make viewing products online more engaging, leading to expertise in 360-degree product views and interactive elements. This work naturally connected them with the fashion industry, given its rapid, seasonal product turnover. • In 2016–2017, they launched a project initially focused on implementing "spins" for brands' websites, which evolved into a social commerce platform. This platform allows users to create and share interactive product views, blending features similar to Instagram, Pinterest, and Tumblr. More recently, they have integrated camera functionality to further enhance the interactive experience.
INTERVIEW #4: ***Previous CTO at large corporations***	• The participant is a seasoned technology executive with extensive experience in retail and consumer goods, including recent roles as Chief Technology Officer (CTO) and Co-Head of Business Technology at a global retail company. Over the past 20 years, they have led groundbreaking projects that integrated emerging technologies such as augmented reality (AR), virtual reality (VR), and digital twins to transform customer experiences. • In earlier positions, the participant spearheaded digital transformation initiatives, embracing AR and VR well before these technologies became widespread. They have a proven track record of aligning advanced technologies with consumer needs, such as redefining wearable devices to support both current lifestyles and aspirational goals. • Most recently, their work has involved leveraging AI models and other advanced algorithms to create personalized, predictive solutions for consumers. Their perspective on deploying AR, VR, and digital twin technology reflects a deep understanding of their potential applications and challenges within the retail industry. The participant expressed a willingness to explore the interview's specific focus areas while offering insights from their extensive background in digital innovation.
INTERVIEW #5: ***Virtual Try-On Company***	• The participant is the founder of a company that provides a virtual try-on solution designed to help fashion e-retailers reduce returns by giving customers a more accurate sense of how clothing will look on their unique body type. They identified that many customers return clothes because traditional models don't represent real-world body diversity, as they are often tall, slim, and photoshopped. Their technology addresses this by allowing customers to select a model with similar body measurements or even try on different sizes virtually, seeing how a garment would appear either fitted or oversized. • Their approach relies on a model bank, where each model's measurements are known. Combined with the clothing dimensions provided by their clients, their AI technology creates a realistic visual of how each size will look on the chosen model. This method offers an accurate representation, allowing users to experiment with different fits. • Though competitors have emerged, such as a Tel Aviv-based company acquired by Walmart, they have since closed, and the participant's company remains unique in providing size-testing options.
INTERVIEW #6: **Researcher & Professor**	• The participant is a professor with an extensive background in virtual fashion simulations, bringing over 20 years of research experience in this field. Her work centers on digital garment simulation and virtual try-on solutions, with experience tracing back to pioneering projects at a European university lab, which developed one of the first virtual try-on technologies in the early 2000s. • At her current institute, her research encompasses virtual simulations for diverse applications beyond retail, including robotics in garment manufacturing, design, and prototyping. Her work also addresses sustainability, focusing on biomaterials, secondary raw materials, and the reuse and redesign of garments as steps toward more sustainable production. She emphasizes the role of AI in advancing virtual try-on technology, viewing it as essential for the future of digital fashion and manufacturing. One notable project she referenced, a large European initiative, aimed to achieve accurate digital representations of garments for online fitting.
INTERVIEW #7: ***Expert on Digital Solutions in Fashion***	• The participant has accumulated over five decades of experience in fashion and technology, beginning their career in manufacturing during the 1970s before transitioning to pioneering digital innovations. Early contributions included introducing color graphic systems for design, computer-aided manufacturing (CAM) for pattern making, and numerically controlled cutting systems. In the 1980s, they co-invented Product Data Management (PDM) systems for fashion, laying the foundation for modern Product Lifecycle Management (PLM). • By the late 1990s, the participant had transitioned PLM solutions to cloud-based platforms, integrating them into a SaaS model. More recently, they have worked on advancing 3D modeling technologies in fashion tech, collaborating with global teams to develop cutting-edge solutions. Their current focus includes machine learning, AI, and virtual try-ons, where they emphasize improving algorithms to enhance the accuracy and usability of these technologies. • The participant's career has been marked by a focus on sustainability, innovation, and the practical application of technology to solve industry challenges. They continue to work with leading research institutions to drive advancements in digital fashion and AI.

Appendix D. Study Three: Design & Questions

Study Three - Questionnaire Constructs and Design

Introduction & GDPR

This survey is part of a Master's thesis on consumers' attitudes toward Virtual Try-On technology and will take around 5 minutes to complete. Your response is invaluable to our research!

- ***Participation:*** *Voluntary; you may exit at any time. Only completed surveys are recorded.*
- ***Risks:*** *No risks associated with participation*
- ***Anonymity:*** *Your participation and choices are anonymous to other participants and to the experimenter. Individual choices will not be looked at.*
- ***Contact:*** *This study is conducted by the following students from the Stockholm School of Economics; Hannah Gustafsson and Maja Stark Jansson. Supervised by Dr. Karina T Liljedal at the Stockholm School of Economics. For questions or data inquiries, email 23505@student.hhs.se. All data will be deleted after December 2024.*

*By selecting **"I consent"** below, you indicate that you have read & understood these conditions.*

- ○ *Yes, I consent.*
- ○ *No, I do not consent.*

Control Question #1

Have you purchased any type of clothing online before?

- ○ *Yes,*
- ○ *No*

What gender do you identify as?

- ○ *Male*
- ○ *Female*
- ○ *Non-Binary / Third Gender,*
- ○ *Prefer not to say*

Which product page version would you prefer to view for this survey?

[For the purpose of this study, we only have two web page versions available: one designed with a stereotypically "female" shopping experience and one with a "male" experience. If you identify as non-binary or prefer not to select male or female, please choose which version you'd like to view.]

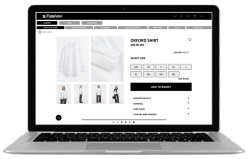
- ○ *Online shopping page showing a stereotypical **"man".***
- ○ *Online shopping page showing a stereotypical **"woman".***
- ○ *None, I prefer to exit this survey.*

Intro Stimuli - Female

Imagine browsing a fashion e-commerce store looking for a white shirt for yourself. You want a shirt that fits well and suits your style and preferences. The following page shows a website view with options to explore product details, sizes, and fit recommendations.

Please take a moment to explore the page as if you were shopping for this shirt, paying attention to any features that might help you choose the right fit and style. You may encounter features related to product recommendations or try-on options you can interact with. Once ready, click the purple arrow to continue and see your shopping scenario.

If you identify as a **FEMALE/WOMEN** your product page will look like this

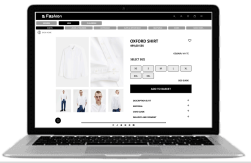


Intro Stimuli - Male

Imagine browsing a fashion e-commerce store looking for a white shirt for yourself. You want a shirt that fits well and suits your style and preferences. The following page shows a website view with options to explore product details, sizes, and fit recommendations.

Please take a moment to explore the page as if you were shopping for this shirt, paying attention to any features that might help you choose the right fit and style. You may encounter features related to product recommendations or try-on options you can interact with. Once ready, click the purple arrow to continue and see your shopping scenario.

If you identify as a **MALE/MAN** your product page will look like this



Stimuli Women #1

This page displays an Oxford Shirt product listing, featuring several images of the shirt from various angles and details. Size options (XXS to 4XL) are available as buttons beneath the images. There is a "Size Guide" link next to the size selection, which, when clicked, opens a detailed size chart. The chart provides measurements for each size and instructions on how to measure different body parts, including bust, waist, arm length, and hip. *[For stimuli image, see p. 39]*

Stimuli Women #2

This product page for an Oxford Shirt includes multiple images of the shirt and size options for selection. A "Find My Size" button is visible next to the size options. When clicked, a form appears asking for information like height, weight, age, and body type, with silhouette options to choose from. After entering this information, the page displays a recommended size and a 3D model wearing the shirt in that size. *[For stimuli image, see p. 40]*

Stimuli Women #3

This scenario includes a multi-step process to help you visualize the fit of an Oxford Shirt. The product page displays different views of the shirt and a size selection area. To get a personalized fit recommendation, you are prompted to take two photos of yourself following on-screen instructions. Using machine learning and artificial intelligence, the system analyzes these photos to estimate your measurements and creates a digital avatar with your body proportions. This avatar is then displayed wearing the shirt in your recommended size. You can rotate the avatar for a 360-degree view and see how the shirt fits. If desired, you can also switch to other sizes to see how they would look on your avatar *[For stimuli image, see p. 40]*

Stimuli Male #1

This page displays an Oxford Shirt product listing, featuring several images of the shirt from various angles and details. Size options (XXS to 4XL) are available as buttons beneath the images. There is a "Size Guide" link next to the size selection, which, when clicked, opens a detailed size chart. The chart provides measurements for each size and instructions on how to measure different body parts, including bust, waist, arm length, and hip. *[For stimuli image, see p. 39]*

Stimuli Male #2

This product page for an Oxford Shirt includes multiple images of the shirt and size options for selection. A "Find My Size" button is visible next to the size options. When clicked, a form appears asking for information like height, weight, age, and body type, with silhouette options to choose from. After entering this information, the page displays a recommended size and a 3D model wearing the shirt in that size. *[For stimuli image, see p. 40]*

Stimuli Male #3

This scenario includes a multi-step process to help you visualize the fit of an Oxford Shirt. The product page displays different views of the shirt and a size selection area. To get a personalized fit recommendation, you are prompted to take two photos of yourself following on-screen instructions. Using machine learning and artificial intelligence, the system analyzes these photos to estimate your measurements and creates a digital avatar with your body proportions. This avatar is then displayed wearing the shirt in your recommended size. You can rotate the avatar for a 360-degree view and see how the shirt fits. If desired, you can also switch to other sizes to see how they would look on your avatar *[For stimuli image, see p. 40]*

Control Question #2

What did you see?

- ○ *An online shopping product page with size chart*
- ○ *An online shopping product page with a size recommendation tool*
- ○ *An online shopping product page with a size scanning tool for creation of an avatar*

Dependent & Independent Variables

What is your opinion in terms of the following statements (based on the shopping webpage scenario you saw in the previous slide)?

ATTITUDE TOWARDS WEBPAGE USAGE

Using this type of size recommendation service/tool would be …

A bad idea	○	○	○	○	○	○	○	A good idea
Inferior	○	○	○	○	○	○	○	Superior
Unpleasant	○	○	○	○	○	○	○	Pleasant
Unappeling	○	○	○	○	○	○	○	Appealing

ADOPTION INTENTION

I intend to start using this type of size recommendation service/tool when online shopping in the future.

(1) Strongly Disagree	(2) Disagree	(3) Somewhat disagree	(4) Neither agree nor disagree	(5) Somewhat agree	(6) Agree	(7) Strongly Agree

I intend to frequently use this type of size recommendation service/tool when online shopping in the future.

(1) Strongly Disagree	(2) Disagree	(3) Somewhat disagree	(4) Neither agree nor disagree	(5) Somewhat agree	(6) Agree	(7) Strongly Agree

Assuming I have access to this type of size recommendation service/tool for online shopping, I will use it.

(1) Strongly Disagree	(2) Disagree	(3) Somewhat disagree	(4) Neither agree nor disagree	(5) Somewhat agree	(6) Agree	(7) Strongly Agree

PERCEIVED ENJOYMENT

Using this size recommendation service/tool to shop for clothing online, would …

	Strongly disagree						Strongly agree
… be fun for its own sake	○	○	○	○	○	○	○
… be exciting	○	○	○	○	○	○	○
… be enjoyable	○	○	○	○	○	○	○
… be interesting	○	○	○	○	○	○	○

PERCEIVED EASE OF USE

This size recommendation service/tool would …

	Strongly disagree						Strongly agree
… be clear and understandable.	○	○	○	○	○	○	○
… not require a lot of mental effort.	○	○	○	○	○	○	○
… be easy to use.	○	○	○	○	○	○	○

PERCEIVED USEFULNESS

Using this size recommendation service/tool would …

	Strongly disagree						Strongly agree
… improve my shopping productivity.	○	○	○	○	○	○	○
… enhance my effectiveness in shopping.	○	○	○	○	○	○	○
… be useful in buying what I want.	○	○	○	○	○	○	○

PERCEIVED ACCURACY

Using this size recommendation service/tool would give me access to more information about the product (fit, size, style).

(1) Strongly Disagree	(2) Disagree	(3) Somewhat disagree	(4) Neither agree nor disagree	(5) Somewhat agree	(6) Agree	(7) Strongly Agree

Using this size recommendation service/tool would enable me to have more accurate information (fit, size, style).

(1) Strongly Disagree	(2) Disagree	(3) Somewhat disagree	(4) Neither agree nor disagree	(5) Somewhat agree	(6) Agree	(7) Strongly Agree

This size recommendation service/tool would present adequate and truthful information about the clothing item (fit, size, style).

(1) Strongly Disagree	(2) Disagree	(3) Somewhat disagree	(4) Neither agree nor disagree	(5) Somewhat agree	(6) Agree	(7) Strongly Agree

PERCEIVED PRIVACY RISK

I would be concerned about my privacy when using this type of size recommendation service/tool.

(1) Strongly Disagree	(2) Disagree	(3) Somewhat disagree	(4) Neither agree nor disagree	(5) Somewhat agree	(6) Agree	(7) Strongly Agree

I would have doubts about how well my privacy is protected while using this type of size recommendation service/tool.

(1) Strongly Disagree	(2) Disagree	(3) Somewhat disagree	(4) Neither agree nor disagree	(5) Somewhat agree	(6) Agree	(7) Strongly Agree

My personal information could be misused when using this type of size recommendation service/tool.

(1) Strongly Disagree	(2) Disagree	(3) Somewhat disagree	(4) Neither agree nor disagree	(5) Somewhat agree	(6) Agree	(7) Strongly Agree

This type of size recommendation service/tool would collect too much information about me.

(1) Strongly Disagree	(2) Disagree	(3) Somewhat disagree	(4) Neither agree nor disagree	(5) Somewhat agree	(6) Agree	(7) Strongly Agree

Based on your general shopping habits and preferences, please indicate your response to the statements below.

BRACKETING BEHAVIOUR

When online shopping, I order many sizes of the same product with the intention to keep only one.

(1) Strongly Disagree	(2) Disagree	(3) Somewhat disagree	(4) Neither agree nor disagree	(5) Somewhat agree	(6) Agree	(7) Strongly Agree

When online shopping, I order the same product in many different colors with the intention to keep only one.

(1) Strongly Disagree	(2) Disagree	(3) Somewhat disagree	(4) Neither agree nor disagree	(5) Somewhat agree	(6) Agree	(7) Strongly Agree

When online shopping, I order alternative products for the same need with the intention not to keep them all.

(1) Strongly Disagree	(2) Disagree	(3) Somewhat disagree	(4) Neither agree nor disagree	(5) Somewhat agree	(6) Agree	(7) Strongly Agree

External Variables - Shopping Habits

Please answer the following questions based on your general shopping habits and preferences:

How do you primarily shop for clothes?

- ○ *Completely online*
- ○ *Mostly online, rarely in-store*
- ○ *More online than in-store*
- ○ *Both online and in-store equally*
- ○ *More in-store than online*
- ○ *Mostly in-store, rarely online*
- ○ *Completely in-store*

How frequently do you purchase clothes online?

- ○ *Never*
- ○ *A couple of times a year*
- ○ *Every few months*
- ○ *Once a month*
- ○ *Several times a month*
- ○ *Once a week*
- ○ *Several times a week*

What factors most influence your decision to purchase clothing online?

(you can choose a maximum of three options, but you have to mark at least one)

- ☐ *Price*
- ☐ *Brand*
- ☐ *Fit & size*
- ☐ *Return policy*
- ☐ *Shipping speed*
- ☐ *Customer reviews*
- ☐ *Product Quality*
- ☐ *Other*

External Variables - Online Returns

How frequently do you return clothing items bought online?

- ○ *Never return items*
- ○ *Rarely return items (e.g., only for major fit or quality issues)*
- ○ *Occasionally return items (e.g., every few purchases)*
- ○ *Sometimes return items (e.g., about 1 in every 5 purchases)*
- ○ *Frequently return items (e.g., about 1 in every 3 purchases)*
- ○ *Often return items (e.g., almost every other purchase)*
- ○ *Almost always return items*

What is your main reason for returning items?

(Please, select all that apply)

- ☐ *Wrong size*
- ☐ *Didn't like the item (style/color)*
- ☐ *Item didn't match the description on the website*
- ☐ *Didn't like the item (fit on my body)*
- ☐ *Quality didn't match expectations*
- ☐ *Issues with delivery time (arrived too late)*
- ☐ *Ordered multiple sizes and returning the ones that didn't fit*
- ☐ *Other*

For each of the following statements, please use the sliders to indicate your level of agreement, from 1 (Strongly Disagree) to 7 (Strongly Agree).

(1) Strongly Disagree — (7) Strongly Agree

(i) Even if the return process is troublesome, I will choose to return.

(ii) I only use the return to deal with inappropriate products purchased online.

(iii) As long as the product doesn't fit, I intend to return it.

(iv) Even if I buy something cheap, I will choose to return it.

(VI) I think it is the right decision to return the unsuitable product.

Demographics

How old are you?

Please state your country of residence below.

(i.e. the country where you reside for the majority of your time)

What was this survey about?

- ○ *Horseback Riding Tours*
- ○ *Facebook marketplace*
- ○ *Online Grocery Shopping*
- ○ *Online Fashion Shopping*
- ○ *Restaurant Menus*

Please verify that you are not a robot :)

I'm not a robot — reCAPTCHA Privacy - Terms

We thank you for your time spent taking this survey.
Your response has been recorded.

Appendix E. Study Three: Additional Descriptive statistics for the Sample population

TABLE E1. *Descriptive statistics of Control variables & Independent Samples T-test*

EXPERIMENTAL GROUP, SORTING		WITHOUT VTO TECHNOLOGY [n = 51]			BASIC VTO TECHNOLOGY [n = 60]			ADVANCED VTO TECHNOLOGY [n = 78]			TOTAL [n = 189]		Mean Difference
Variable	**Item**	**N**	**%**	**mean$_{No\ VTO}$**	**N**	**%**	**mean$_{Basic\ VTO}$**	**N**	**%**	**mean$_{Adv.\ VTO}$**	**N**	**%**	**p-value**
Gender	Female	24	47.1%	1.5294	28	46.7%	1.5333	45	57.7%	1.4231	97	51.3%	0.344
	Male	27	52.9%		31	51.7%		33	42.3%		91	48.1%	
	Non-binary / Third-Gender / prefer not to say	0	0.0%		1	1.7%		0	0.0%		1	0.5%	
Gender 2.0	Female	24	47.1%	1.5294	28	46.7%	1.5333	45	57.7%	1.4231	97	51.3%	0.344
	Male	27	52.9%		32	53.3%		33	42.3%		92	48.6%	
	Non-binary / Third-Gender / prefer not to say	0	0.0%		0	0.0%		0	0.0%		0	0.0%	
Age / Generation	Gen Z	28	54.9%	1.6863	33	55.0%	1.7167	43	55.1%	1.6538	104	55.0%	0.918
	Gen X	14	27.5%		14	23.3%		22	28.2%		50	26.5%	
	Gen Y	6	11.8%		10	16.7%		10	12.8%		26	13.8%	
	Baby Boomers	3	5.9%		3	5.0%		3	3.8%		9	4.8%	

Note: Significance at: *p < 0.10, **p < 0.05 and ***p < 0.001. *Mean Difference: Represents the mean difference Between the three groups: No VTO, Basic VTO, Advanced VTO*

TABLE E2. *Descriptive statistics of External variables & Independent Samples T-test*

EXPERIMENTAL GROUP, SORTING		WITHOUT VTO TECHNOLOGY [n = 51]			BASIC VTO TECHNOLOGY [n = 60]			ADVANCED VTO TECHNOLOGY [n = 78]			TOTAL [n = 189]		Mean Difference
Variable	**Item**	**N**	**%**	**mean$_{No\ VTO}$**	**N**	**%**	**mean$_{Basic\ VTO}$**	**N**	**%**	**mean$_{Adv.\ VTO}$**	**N**	**%**	**p-value**
Online Shopping Method	Completely online	2	3.9%	3.7255	2	3.3%	4.0333	3	3.8%	3.6410	7	3.7%	0.239
	Mostly online, rarely in-store	5	9.8%		5	8.3%		19	24.4%		29	15.3%	
	More online than in-store	16	31.4%		16	26.7%		15	19.2%		47	24.9%	
	Both online and in-store equally	14	27.5%		14	23.3%		18	23.1%		46	24.3%	
	More in-store than online	10	19.6%		13	21.7%		13	16.7%		36	19.0%	
	Mostly in-store, rarely online	4	7.8%		9	15.0%		9	11.5%		22	11.6%	
	Completely in-store	0	0.0%		1	1.7%		1	1.3%		2	1.1%	
Online Shopping Frequency	Never	0	0.0%	3.1200	1	1.7%	2.9500	3	3.8%	3.0641	4	2.1%	0.729
	A couple of times a year	20	39.2%		23	38.3%		25	32.1%		68	36.0%	
	Every few months	16	31.4%		22	36.7%		27	34.6%		65	64.4%	
	Once a month	7	13.7%		7	11.7%		12	15.4%		26	13.8%	
	Several times a month	5	9.8%		6	10.0%		9	11.5%		20	10.6%	
	Once a week	2	3.9%		1	1.7%		2	2.6%		5	2.6%	
	Several times a week	1	2.0%		0	0.0%		0	0.0%		1	0.5%	
Online Shopping Return	Never return items	5	9.8%	2.6863	8	13.3%	2.9833	10	12.2%	3.4615	23	12.2%	0.015**
	Rarely return items	22	43.1%		19	31.7%		19	24.4%		60	31.7%	
	Occasionally return items	14	27.5%		14	23.3%		14	17.9%		42	22.2%	
	Sometimes return items	4	7.8%		8	13.3%		11	14.1%		23	12.2%	
	Frequently return items	6	11.8%		8	13.3%		12	15.4%		26	13.8%	
	Often return items	0	0.0%		2	3.3%		8	10.3%		10	5.3%	
	Almost always return items	0	0.0%		1	1.7%		4	5.1%		5	2.6%	

Note: Significance at: *p < 0.10, **p < 0.05 and ***p < 0.001. *Mean Difference: Represents the mean difference Between the three groups: No VTO, Basic VTO, Advanced VTO*

TABLE E3. *Descriptive statistics of External variables & Independent Samples T-test*

EXPERIMENTAL GROUP, SORTING			WITHOUT VTO TECHNOLOGY [n = 51]			BASIC VTO TECHNOLOGY [n = 60]			ADVANCED VTO TECHNOLOGY [n = 78]			TOTAL [n = 189]		Mean Difference
Variable	**Construct**	**Item**	**N**	**%**	**mean$_{No\ VTO}$**	**N**	**%**	**mean$_{Basic\ VTO}$**	**N**	**%**	**mean$_{Adv.\ VTO}$**	**N**	**%**	**p-value**
Online Return Intention	*Even if the return process is troublesome, I will choose to return.*	*Strongly Disagree*	5	10.9%	4.33	5	9.6%	4.46	3	4.4%	5.12	13	7.8%	0.046**
		Disagree	4	8.7%		2	3.8%		6	8.8%		12	7.2%	
		Somewhat Disagree	4	8.7%		9	17.3%		8	11.8%		21	12.7%	
		Neither Agree nor Disagree	9	19.6%		8	15.4%		4	5.9%		21	12.7%	
		Somewhat Agree	12	26.1%		11	21.2%		9	13.2%		32	19.3%	
		Agree	6	13.0%		10	19.2%		18	26.5%		34	20.5%	
		Strongly Agree	6	13.0%		7	13.5%		20	29.4%		33	19.9%	
	I only use the return process for products that do not meet my needs or expectations.	*Strongly Disagree*	4	8.7%	5.33	3	5.8%	5.25	3	4.4%	5.09	10	6.0%	0.774
		Disagree	0	0.0%		3	5.8%		1	1.5%		4	2.4%	
		Somewhat Disagree	4	8.7%		6	11.5%		10	14.7%		20	12.0%	
		Neither Agree nor Disagree	3	6.5%		5	9.6%		11	16.2%		19	11.4%	
		Somewhat Agree	8	17.4%		5	9.6%		11	16.2%		24	14.5%	
		Agree	12	26.1%		9	17.3%		12	17.6%		33	19.9%	
		Strongly Agree	15	32.6%		21	40.4%		20	29.4%		56	33.7%	
	As long as the product doesn't fit, I intend to return it.	*Strongly Disagree*	5	10.9%	5.37	2	3.8%	5.73	1	1.5%	5.69	8	4.8%	0.519
		Disagree	1	2.2%		1	1.9%		3	4.4%		5	3.0%	
		Somewhat Disagree	3	6.5%		3	5.8%		3	4.4%		9	5.4%	
		Neither Agree nor Disagree	1	2.2%		3	5.8%		6	8.8%		10	6.0%	
		Somewhat Agree	9	19.6%		8	15.4%		14	20.6%		31	18.7%	
		Agree	7	15.2%		12	23.1%		10	14.7%		29	17.5%	
		Strongly Agree	20	43.5%		23	44.2%		31	45.6%		74	44.6%	
	Even if I buy something cheap, I will choose to return it.	*Strongly Disagree*	11	23.9%	3.61	5	9.6%	4.35	9	13.2%	4.57	25	15.1%	0.053*
		Disagree	9	19.6%		5	9.6%		7	10.3%		21	12.7%	
		Somewhat Disagree	3	6.5%		9	17.3%		6	8.8%		18	10.8%	
		Neither Agree nor Disagree	6	13.0%		10	19.2%		6	8.8%		22	13.3%	
		Somewhat Agree	4	8.7%		4	7.7%		11	16.2%		19	11.4%	
		Agree	7	15.2%		9	17.3%		12	17.6%		28	16.9%	
		Strongly Agree	6	13.0%		10	10.2%		17	25.0%		33	19.9%	
	I think it is the right decision to return the unsuitable product.	*Strongly Disagree*	2	4.3%	5.70	1	1.9%	5.87	1	1.5%	6.03	4	2.4%	0.511
		Disagree	2	4.3%		1	1.9%		1	1.5%		4	2.4%	
		Somewhat Disagree	2	4.2%		2	3.8%		2	2.9%		6	3.6%	
		Neither Agree nor Disagree	4	8.7%		5	9.6%		4	5.9%		13	7.8%	
		Somewhat Agree	5	10.9%		8	15.4%		11	16.2%		24	14.5%	
		Agree	8	17.4%		9	17.3%		13	19.1%		30	18.1%	
		Strongly Agree	23	50.0%		26	50%		36	52.9%		85	51.2	

Note: Significance at: *p < 0.10, **p < 0.05 and ***p < 0.001. *Mean Difference: Represents the mean difference Between the three groups: No VTO, Basic VTO, Advanced VTO*

TABLE E4. Online Shopping Decision Focus

[Distribution between Test Group (Without VTO Technology) and Experiment Groups (Basic VTO Technology & Advanced VTO Technology) and Total Sample Size]

Alternatives:	**Price**		**Brand**		**Price & Fit**		**Return Policy**		**Shipping speed**		**Customer reviews**		**Product Quality**		**Other**	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
WITHOUT VTO TECHNOLOGY	35	68.6%	19	37.3%	33	64.7%	7	13.7%	9	17.6%	5	9.8%	23	45.1%	4	7.8%
BASIC VTO TECHNOLOGY	49	81.7%	24	40.0%	25	41.7%	16	26.7%	10	16.7%	8	13.3%	24	40.0%	3	5.0%
ADVANCED VTO TECHNOLOGY	58	74.4%	29	37.2%	36	46.2%	27	34.6%	13	16.7%	14	17.9%	34	43.6%	2	2.6%
TOTAL	**142**	**75.1%**	**72**	**38.1%**	**94**	**49.7%**	**50**	**26.5%**	**32**	**16.9%**	**27**	**14.3%**	**81**	**42.9%**	**9**	**4.8%**

Note: *The question this table refers to is the following: What factors most influence your decision to purchase clothing online? (you can choose a maximum of three options, but you have to mark at least one)*

TABLE E5. Online Shopping Return Reasons

[Distribution between Test Group (Without VTO Technology) and Experiment Groups (Basic VTO Technology & Advanced VTO Technology) and Total Sample Size]

Alternatives:	Wrong size		Didn't like the item (style/color)		Item didn't match the description on the website		Didn't like the item (fit on my body)		Quality didn't match expectations		Issues with delivery time (arrived too late)		Ordered multiple sizes, returning the ones that didn't fit		Other	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
WITHOUT VTO TECHNOLOGY	39	84.8%	15	32.6%	9	19.6%	23	50.0%	15	32.6%	2	4.3%	7	15.2%	1	2.2%
BASIC VTO TECHNOLOGY	40	76.9%	19	36.5%	9	17.3%	29	55.8%	25	48.1%	0	0.0%	5	9.6%	2	3.8%
ADVANCED VTO TECHNOLOGY	56	82.4%	30	44.1%	14	20.6%	46	67.6%	29	42.6%	3	4.4%	19	27.9%	2	2.9%
TOTAL	**135**	**81.3%**	**64**	**38.6%**	**32**	**19.3%**	**98**	**59.0%**	**69**	**41.6%**	**5**	**3.0%**	**31**	**18.7%**	**5**	**3.0%**

Note: *The question that this table refers to is the following: What is your main reason for returning items? (Select all that apply)*

FIGURE E1. *Online Shopping Decision Focus*

[Total sample size results]

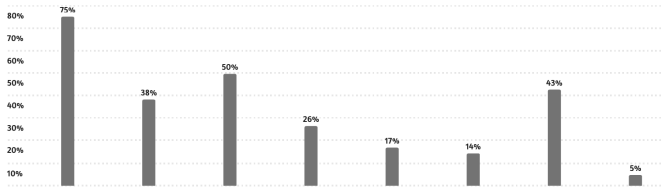
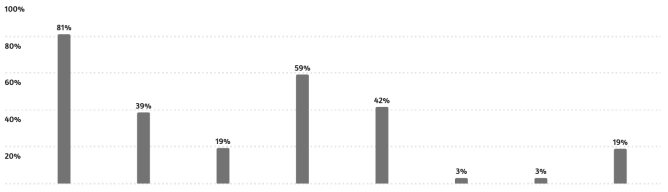


FIGURE E2. *Online Shopping Return Reasons*

[Total sample size results]



Appendix F. Study Three: Additional Descriptive Statistics, The Antecedents

TABLE F1. Perceived Usefulness [PU]

Perceived Usefulness [PU]

Items [N = 3]	*Percentage of participants who indicated …* (1) *Strongly Disagree*	(2) *Disagree*	(3) *Somewhat Disagree*	(4) *Neither Agree nor Disagree*	(5) Somewhat Agree	(6) *Agree*	(7) *Strongly Agree*	Cronbach Alpha	Index mean value	Std. Deviation
WITHOUT VTO TECHNOLOGY [n= 51]										
$PU1_{NO\ VTO}$ Using this size recommendation service/tool would … ***improve my shopping productivity.***	3.9%	9.8%	5.9%	25.5%	23.5%	23.5%	7.8%			
$PU2_{BNO\ VTO}$ Using this size recommendation service/tool would … ***enhance my effectiveness in shopping.***	3.9%	11.8%	5.9%	21.6%	17.6%	27.5%	11.8%	.928	4.7124	1.51587
$PU3_{NO\ VTO}$ Using this size recommendation service/tool would … ***be useful in buying what I want.***	3.9%	9.8%	0.0%	23.5%	17.6%	31.4%	13.7%			
BASIC VTO TECHNOLOGY [n= 60]										
$PU1_{Basic\ VTO}$ Using this size recommendation service/tool would … ***improve my shopping productivity.***	1.7%	5.0%	11.7%	16.7%	25.0%	23.3%	16.7%			
$PU2_{Basic\ VTO}$ Using this size recommendation service/tool would … ***enhance my effectiveness in shopping.***	1.7%	5.0%	13.3%	18.3%	23.3%	18.3%	20.0%	.927	5.0222	1.44695
$PU3_{Basic\ VTO}$ Using this size recommendation service/tool would … ***be useful in buying what I want.***	1.7%	5.0%	13.3%	5.0%	23.3%	30.0%	21.7%			
ADVANCED VTO TECHNOLOGY [n= 78]										
$PU1_{Adv.\ VTO}$ Using this size recommendation service/tool would … ***improve my shopping productivity.***	2.6%	6.4%	10.3%	15.4%	14.1%	35.9%	15.4%			
$PU2_{Adv.\ VTO}$ Using this size recommendation service/tool would … ***enhance my effectiveness in shopping.***	1.3%	7.7%	9.0%	11.5%	17.9%	37.2%	15.4%	.934	5.1795	1.45514
$PU3_{Adv.\ VTO}$ Using this size recommendation service/tool would … ***be useful in buying what I want.***	1.3%	6.4%	5.1%	7.7%	19.2%	35.9%	24.4%			

TABLE F2. Perceived Ease of Use [PEOV]

Perceived Ease of Use (PEOU]

Items [N = 3]	*Percentage of participants who indicated …* (1) *Strongly Disagree*	(2) *Disagree*	(3) *Somewhat Disagree*	(4) *Neither Agree nor Disagree*	(5) *Somewhat* Agree	(6) *Agree*	(7) *Strongly Agree*	Cronbach Alpha	Index mean value	Std. Deviation
WITHOUT VTO TECHNOLOGY [n= 51]										
$PEOU1_{NO\ VTO}$ This size recommendation service/tool would … ***be clear and understandable.***	2.0%	5.9%	9.8%	17.6%	19.6%	35.3%	9.8%			
$PEOU2_{BNO\ VTO}$ This size recommendation service/tool would … ***not require a lot of mental effort.***	3.9%	9.8%	5.9%	27.5%	21.6%	21.6%	9.8%	.932	4.7320	1.40952
$PEOU3_{NO\ VTO}$ This size recommendation service/tool would … be ***easy to use.***	0.0%	13.7%	2.0%	27.5%	19.6%	31.4%	5.9%			
BASIC VTO TECHNOLOGY [n= 60]										
$PEOU1_{Basic\ VTO}$ This size recommendation service/tool would … ***be clear and understandable.***	0.0%	0.0%	8.3%	16.7%	21.7%	30.0%	23.3%			
$PEOU2_{Basic\ VTO}$ This size recommendation service/tool would … ***not require a lot of mental effort.***	1.7%	10.0%	6.7%	8.3%	33.3%	26.7%	13.3%	.877	5.2278	1.22358
$PEOU3_{Basic\ VTO}$ This size recommendation service/tool would … be ***easy to use.***	0.0%	1.7%	10.0%	11.7%	30.0%	26.7%	20.0%			
ADVANCED VTO TECHNOLOGY [n= 78]										
$PEOU1_{Adv.\ VTO}$ This size recommendation service/tool would … ***be clear and understandable.***	0.0%	2.6%	6.4%	11.5%	30.8%	32.1%	16.7%			
$PEOU2_{Adv.\ VTO}$ This size recommendation service/tool would … ***not require a lot of mental effort.***	1.3%	5.1%	14.1%	11.5%	24.4%	28.2%	15.4%	.782	5.1880	1.16291
$PEOU3_{Adv.\ VTO}$ This size recommendation service/tool would … be ***easy to use.***	1.3%	5.1%	3.8%	15.4%	28.2%	24.4%	21.8%			

TABLE F3. Perceived Accuracy [PA]

PERCEIVED ACCURACY [PA]

Items [N = 3]	WITHOUT VTO TECHNOLOGY [n= 51]						BASIC VTO TECHNOLOGY [n= 60]						ADVANCED VTO TECHNOLOGY [n= 78]					
	$PA_{NO\ VTO}$	Mean	Std. Dev.	Cronbach Alpha	Index Mean	Std. Dev.	$PA_{Basic\ VTO}$	Mean	Std. Dev.	Cronbach Alpha	Index Mean	Std. Dev.	$PA_{Adv.\ VTO}$	Mean	Std. Dev.	Cronbach Alpha	Index Mean	Std. Dev.
Using this size recommendation service/tool would give me access to more information about the product (fit, size, style)	**$PA1_{NO\ VTO}$**	5.27	1.168				**$PA1_{Basic\ VTO}$**	5.78	1.027				**$PA1_{Adv.\ VTO}$**	5.67	1.402			
Using this size recommendation service/tool would enable me to have more accurate information (fit, size, style)	**$PA2_{NO\ VTO}$**	5.35	1.146	.891	5.2418	1.05215	**$PA2_{Basic\ VTO}$**	5.82	1.112	.898	5.6556	1.02321	**$PA2_{Adv.\ VTO}$**	5.76	1.301	.934	5.5171	1.24101
This size recommendation service/tool would present adequate and truthful information about the clothing item (fit, size, style)	**$PA3_{NO\ VTO}$**	5.10	1.171				**$PA3_{Basic\ VTO}$**	5.37	1.221				**$PA3_{Adv.\ VTO}$**	5.13	1.252			

TABLE F4. Perceived Enjoyment [PE]

PERCEIVED ENJOYMENT [PE]																	
	WITHOUT VTO TECHNOLOGY [n= 51]						BASIC VTO TECHNOLOGY [n= 60]						ADVANCED VTO TECHNOLOGY [n= 78]					
Items [N = 4]	$PE_{NO\ VTO}$	Mean	Std. Dev.	Cronbach Alpha	Index Mean	Std. Dev.	$PE_{Basic\ VTO}$	Mean	Std. Dev.	Cronbach Alpha	Index Mean	Std. Dev.	$PE_{Adv.\ VTO}$	Mean	Std. Dev.	Cronbach Alpha	Index Mean	Std. Dev.
Using this size recommendation service/tool to shop for clothing online, would be … ***fun for its own sake.***	$PE1_{NO\ VTO}$	4.14	1.536	.932	4.3039	1.38322	$PA1_{Basic\ VTO}$	4.43	1.701	.895	4.6500	1.34053	$PE1_{Adv.\ VTO}$	5.03	1.503	.915	5.0769	1.26215
Using this size recommendation service/tool to shop for clothing online, would be … ***exciting***	$PE2_{NO\ VTO}$	4.02	1.530				$PA2_{Basic\ VTO}$	4.30	1.555				$PE2_{Adv.\ VTO}$	4.73	1.420			
Using this size recommendation service/tool to shop for clothing online, would be … ***enjoyable***	$PE3_{NO\ VTO}$	4.41	1.551				$PE3_{Basic\ VTO}$	4.67	1.410				$PE3_{Adv.\ VTO}$	4.85	1.442			
Using this size recommendation service/tool to shop for clothing online, would be … ***interesting***	$PE4_{NO\ VTO}$	4.65	1.454				$PE4_{Basic\ VTO}$	5.20	1.471				$PE4_{Adv.\ VTO}$	5.71	1.280			

TABLE F5. Perceived Privacy Risk [PPR]

PERCEIVED PRIVACY RISK [PPR]																	
	WITHOUT VTO TECHNOLOGY [n= 51]						BASIC VTO TECHNOLOGY [n= 60]						ADVANCED VTO TECHNOLOGY [n= 78]					
Items [N = 4]	$PPR_{NO\ VTO}$	Mean	Std. Dev.	Cronbach Alpha	Index Mean	Std. Dev.	$PPR_{Basic\ VTO}$	Mean	Std. Dev.	Cronbach Alpha	Index Mean	Std. Dev.	$PPR_{Adv.\ VTO}$	Mean	Std. Dev.	Cronbach Alpha	Index Mean	Std. Dev.
I would be concerned about my privacy when using this type of size recommendation service/tool	$PPR1_{NO\ VTO}$	2.88	1.532	.930	2.9853	1.38150	$PPR1_{Basic\ VTO}$	3.33	1.875	.944	3.5500	1.66329	$PPR1_{Adv.\ VTO}$	4.21	1.868	.931	4.0801	1.62193
I would have doubts about how well my privacy is protected while using this type of size recommendation service/tool	$PPR2_{NO\ VTO}$	2.88	1.465				$PPR2_{Basic\ VTO}$	3.38	1.833				$PPR2_{Adv.\ VTO}$	4.17	1.790			
My personal information could be misused when using this type of size recommendation service/tool	$PPR3_{NO\ VTO}$	3.25	1.547				$PPR3_{Basic\ VTO}$	3.80	1.783				$PPR3_{Adv.\ VTO}$	4.12	1.751			
This type of size recommendation service/tool would collect too much information about me	$PPR4_{NO\ VTO}$	2.92	1.534				$PPR4_{Basic\ VTO}$	3.68	1.692				$PPR4_{Adv.\ VTO}$	3.83	1.716			

Appendix G. Study Three: Additional Descriptive Statistics, Attitude & Adoption Intention

TABLE G1. Attitude towards VTO Technology [ATU]

ATTITUDE TOWARDS VTO TECHNOLOGY [ATU]											
Items [N = 4]		Percentage of participants who indicated …							Cronbach Alpha	Index mean value	Std. Deviation
		(1)	(2)	(3)	(4)	(5)	(6)	(7)			
WITHOUT VTO TECHNOLOGY [n= 51]											
$ATU1_{NO\ VTO}$	*Using this type of size recommendation service/tool would be …* **(1) A bad idea --- A good idea (7)**	2.0%	3.9%	2.0%	11.8%	29.4%	21.6%	29.4%	.938	5.1863	1.28437
$ATU2_{NO\ VTO}$	*Using this type of size recommendation service/tool would be …* **(1) *Inferior* --- *Superior* (7)**	2.0%	3.9%	3.9%	19.6%	33.3%	25.5%	11.8%			
$ATU3_{NO\ VTO}$	*Using this type of size recommendation service/tool would be …* **(1) *Unpleasant* --- *Pleasant* (7)**	2.0%	3.9%	2.0%	19.6%	31.4%	25.5%	15.7%			
$ATU4_{NO\ VTO}$	*Using this type of size recommendation service/tool would be …* **(1) *Unappealing* --- *Appealing* (7)**	2.0%	3.9%	7.8%	13.7%	27.5%	27.5%	17.6%			
BASIC VTO TECHNOLOGY [n= 60]											
$ATU1_{Basic\ VTO}$	*Using this type of size recommendation service/tool would be …* **(1) A bad idea --- A good idea (7)**	0.0%	3.3%	3.3%	6.7%	18.3%	31.7%	36.7%	.916	5.5417	1.16460
$ATU2_{Basic\ VTO}$	*Using this type of size recommendation service/tool would be …* **(1) *Inferior* --- *Superior* (7)**	0.0%	0.0%	5.0%	16.7%	30.0%	30.0%	18.3%			
$ATU3_{Basic\ VTO}$	*Using this type of size recommendation service/tool would be …* **(1) *Unpleasant* --- *Pleasant* (7)**	1.7%	3.3%	5.0%	11.7%	21.7%	31.7%	25.0%			
$ATU4_{Basic\ VTO}$	*Using this type of size recommendation service/tool would be …* **(1) *Unappealing* --- *Appealing* (7)**	0.0%	3.3%	5.0%	15.0%	18.3%	30.0%	28.3%			
ADVANCED VTO TECHNOLOGY [n= 78]											
$ATU1_{Adv.\ VTO}$	*Using this type of size recommendation service/tool would be …* **(1) A bad idea --- A good idea (7)**	2.6%	1.3%	2.6%	9.0%	16.7%	34.6%	33.3%	.950	5.5192	1.29608
$ATU2_{Adv.\ VTO}$	*Using this type of size recommendation service/tool would be …* **(1) *Inferior* --- *Superior* (7)**	2.6%	1.3%	3.8%	9.0%	28.2%	34.6%	20.5%			
$ATU3_{Adv.\ VTO}$	*Using this type of size recommendation service/tool would be …* **(1) *Unpleasant* --- *Pleasant* (7)**	3.8%	2.6%	2.6%	12.8%	15.4%	43.6%	19.2%			
$ATU4_{Adv.\ VTO}$	*Using this type of size recommendation service/tool would be …* **(1) *Unappealing* --- *Appealing* (7)**	2.6%	1.3%	1.3%	19.2%	17.9%	30.8%	26.9%			

TABLE G2. Adoption Intention [AI]

ADOPTION INTENTION [AI]											
Items [N = 3]		Percentage of participants who indicated …							Cronbach Alpha	Index mean value	Std. Deviation
		(1)	(2)	(3)	(4)	(5)	(6)	(7)			
WITHOUT VTO TECHNOLOGY [n= 51]											
$BI1_{NO\ VTO}$	*I intend to start using this type of size recommendation service/tool when online shopping in the future.*	0.0%	7.8%	9.8%	13.7%	25.5%	35.3%	7.8%	.936	4.7843	1.37246
$BI2_{NO\ VTO}$	*intend to frequently use this type of size recommendation service/tool when online shopping in the future.*	2.0%	9.8%	17.6%	17.6%	31.4%	15.7%	5.9%			
$BI3_{NO\ VTO}$	*Assuming I have access to this type of size recommendation service/tool for online shopping, I will use it.*	0.0%	9.8%	5.9%	17.6%	21.6%	27.5%	17.6%			
BASIC VTO TECHNOLOGY [n= 60]											
$BI1_{Basic\ VTO}$	*I intend to start using this type of size recommendation service/tool when online shopping in the future.*	0.0%	1.7%	13.3%	6.7%	30.0%	28.3%	20.0%	.941	5.3111	1.26501
$BI2_{Basic\ VTO}$	*intend to frequently use this type of size recommendation service/tool when online shopping in the future.*	0.0%	5.0%	10.0%	16.7%	31.7%	21.7%	15.0%			
$BI3_{Basic\ VTO}$	*Assuming I have access to this type of size recommendation service/tool for online shopping, I will use it.*	0.0%	3.3%	6.7%	5.0%	21.7%	35.0%	28.3%			
ADVANCED VTO TECHNOLOGY [n= 78]											
$BI1_{Adv.\ VTO}$	*I intend to start using this type of size recommendation service/tool when online shopping in the future.*	3.8%	3.8%	6.4%	3.8%	30.8%	37.2%	14.1x%	.943	5.0855	1.40750
$BI2_{Adv.\ VTO}$	*intend to frequently use this type of size recommendation service/tool when online shopping in the future.*	5.1%	7.7%	6.4%	11.5%	34.6%	25.6%	9.0%			
$BI3_{Adv.\ VTO}$	*Assuming I have access to this type of size recommendation service/tool for online shopping, I will use it.*	2.6%	3.8%	6.4%	3.8%	32.1%	35.9%	15.4%			

***Note**: The scale ranges from 1 (Strongly Disagree) to 7 (Strongly Agree), with intermediate levels indicating varying degrees of agreement or disagreement.*

Appendix H. Study Three: Additional Descriptive Statistics, Bracketing Behaviour

TABLE H1. Bracketing Behaviour [BB]

BRACKETING BEHAVIOUR [BB]											
Items [N = 3]		Percentage of participants who indicated …							Cronbach Alpha	Index mean value	Std. Deviation
		(1)	(2)	(3)	(4)	(5)	(6)	(7)			
WITHOUT VTO TECHNOLOGY [n= 51]											
$BB1_{NO\ VTO}$	*When online shopping, I order …* ***many sizes of the same product with the intention to keep only one.***	43.1%	13.7%	3.9%	7.8%	23.5%	5.9%	2.0%	.823	2.5033	1.44587
$BB2_{NO\ VTO}$	*When online shopping, I order …* ***the same product in many different colors with the intention to keep only one.***	47.1%	25.5%	11.8%	5.9%	9.8%	0.0%	0.0%			
$BB3_{NO\ VTO}$	*When online shopping, I order …* ***alternative products for the same need with the intention not to keep them all.***	39.2%	17.6%	11.8%	7.8%	17.6%	5.9%	0.0%			
BASIC VTO TECHNOLOGY [n= 60]											
$BB1_{Basic\ VTO}$	*When online shopping, I order …* ***many sizes of the same product with the intention to keep only one.***	25.0%	31.7%	8.3%	6.7%	18.3%	8.3%	1.7%	.780	2.6389	1.41060
$BB2_{Basic\ VTO}$	*When online shopping, I order …* ***the same product in many different colors with the intention to keep only one.***	40.0%	36.7%	6.7%	3.3%	10.0%	3.3%	0.0%			
$BB3_{Basic\ VTO}$	*When online shopping, I order …* ***alternative products for the same need with the intention not to keep them all.***	30.0%	31.7%	6.7%	1.7%	20.0%	8.3%	1.7%			
ADVANCED VTO TECHNOLOGY [n= 78]											
$BB1_{Adv.\ VTO}$	*When online shopping, I order …* ***many sizes of the same product with the intention to keep only one.***	30.8%	20.5%	5.1%	0.0%	16.7%	19.2%	7.7%	.840	2.9744	1.74638
$BB2_{Adv.\ VTO}$	*When online shopping, I order …* ***the same product in many different colors with the intention to keep only one.***	39.7%	30.8%	9.0%	1.3%	10.3%	6.4%	2.6%			
$BB3_{Adv.\ VTO}$	*When online shopping, I order …* ***alternative products for the same need with the intention not to keep them all.***	29.5%	24.4%	6.4%	9.0%	11.5%	14.1%	5.1%			

***Note**: The scale ranges from 1 (Strongly Disagree) to 7 (Strongly Agree), with intermediate levels indicating varying degrees of agreement or disagreement.*

TABLE H2. Bracketing Behaviour [BB]

SUMMARY: DESCRIPTIVE STATISTICS]					
Groups	**Samples [n]**	**Sum**	**Mean**	**Std. Deviation**	**Std. Error**
WITHOUT VTO TECHNOLOGY	*51*	*51*	2.5033	1.44587	.20246
BASIC VTO TECHNOLOGY	*60*	*60*	2.6389	1.41060	.18211
ADVANCED VTO TECHNOLOGY	*78*	*78*	2.9744	1.74638	.19774
ONE WAY ANOVA					
Source of Variance	**Sum of Squares**	**df**	**Mean Square**	**F**	**P-Value**
Between Groups	*7.756*	2	3.878	1.579	.209
Within Groups	*456.763*	186	2.456		
TOTAL	*464.519*	188			

Appendix I. Study Three: Correlation Matrix

Moreover, the correlation matrices in Table XI highlight the relationships between Adoption Intention (AI) and various key factors under three conditions: Without VTO Technology, Basic VTO Technology, and Advanced VTO Technology. Across all conditions, Attitude Toward Webpage Usage (ATW), Perceived Usefulness (PU), and Perceived Accuracy (PA) emerge as the strongest predictors of adoption intention. Notably, ATW consistently shows a strong positive correlation with AI across all conditions [$r_{Without}$*=0.785,* r_{Basic}*=0.817,* $r_{Advanced}$*=0.750*], emphasizing that users' favorable perceptions of the webpage's usability are central to driving adoption. PU [$r_{Without}$*=0.790,* r_{Basic}*=0.779,* $r_{Advanced}$*=0.681*] and PA [$r_{Without}$*=0.623,* r_{Basic}*=0.720,* $r_{Advanced}$*=0.656*] are also consistently significant, reflecting the importance of functionality and accuracy in influencing user behavior and adoption.

The results further indicate a shift in the relative importance of other factors as VTO technology becomes more advanced. While Perceived Ease of Use (PEOU) and Perceived Enjoyment (PE) are moderately significant predictors of AI without VTO [$r_{Without}$*=0.702 and* $r_{Without}$*=0.824, respectively*], their influence diminishes in advanced VTO scenarios [$r_{Advanced}$*=0.501 and* $r_{Advanced}$*=0.475, respectively*]. This suggests that, as users become more familiar with VTO systems, functional attributes such as usefulness and accuracy outweigh the ease of use and enjoyment in driving adoption. Additionally, Perceived Privacy Risk (PPR) consistently exhibits weak or negative correlations with AI, indicating that privacy concerns do not pose a significant barrier to adoption. PPR correlations are weakest in the basic and advanced VTO conditions, where the values are [r_{Basic}*=-0.314,* $r_{Advanced}$*=-0.158*], compared to the without VTO condition [$r_{Without}$*=0.213*]. Similarly, Bracketing Behavior (BB) has minimal influence on AI across all conditions, with negligible or weak correlations observed [$r_{Without}$*=-0.147,* r_{Basic}*=0.210,* $r_{Advanced}$*=0.025*], suggesting that behavioral constraints do not significantly affect adoption decisions.

Overall, the findings suggest that functional factors (usefulness, accuracy, and attitude) are the most critical in influencing adoption intention, particularly as the technology matures. Enjoyment and ease of use play a supporting role, but their importance decreases as users become more accustomed to the technology. Privacy risks and behavioral constraints have little impact on adoption decisions, reinforcing the importance of focusing on functional benefits and user attitudes to drive adoption.

TABLE I1 *Correlation Matrix - VTO Technology & Main Variables*

Behavioral Intention [**BI**] | Attitude towards VTO [**ATU**] | Perceived Usefulness [**PU**] | Perceived Ease Of Use [**PEOU**] | Perceived Enjoyment [**PE**] | Perceived Accuracy [**PA**] | Perceived Privacy Risk [**PPR**] | Bracketing Behavior [**BB**]

	WITHOUT VTO TECHNOLOGY [n= 51]									**BASIC VTO TECHNOLOGY [n= 60]**									**ADVANCED VTO TECHNOLOGY [n= 78]**								
	BI	**ATU**	**PU**	**PEOU**	**PE**	**PA**	**PPR**	**BB**		**BI**	**ATU**	**PU**	**PEOU**	**PE**	**PA**	**PPR**	**BB**		**BI**	**ATU**	**PU**	**PEOU**	**PE**	**PA**	**PPR**	**BB**
BI	1								**BI**	1								**BI**	1							
ATU	.785**	1							**ATU**	.817**	1							**ATU**	.750**	1						
PU	.790**	.769**	1						**PU**	.779**	.698**	1						**PU**	.681**	.781**	1					
PEOU	.702**	.733**	.652**	1					**PEOU**	.529**	.561**	.609**	1					**PEOU**	.501**	.660**	.707**	1				
PE	.824**	.707**	.671**	.571**	1				**PE**	.674**	.688*	.571**	.475**	1				**PE**	.475**	.623**	.696**	.619**	1			
PA	.623**	.647**	.663**	.671**	.508**	1			**PA**	.720**	.643**	.730**	.629**	.538**	1			**PA**	.656**	.759**	.757**	.515**	.567**	1		
PPR	.213	.194	.191	.133	.331*	.028	1		**PPR**	-.198	-.314*	-.208	-.296*	.495	-.103	1		**PPR**	-.151	-.158	-.091	-.251*	-.060	-.018	1	
BB	-.147	-.124	-.144	-.051	-.166	.119	-.297*	1	**BB**	.210	.195	.286*	.182	.212	.164	-.080	1	**BB**	.025	.174	.286*	.140	.125	.283*	.137	1
α	0.936	0.938	0.928	0.932	0.932	0.891	0.930	0.823	**α**	0.941	0.916	0.927	0.877	0.895	0.898	0.944	0.780	**α**	0.943	0.950	0.934	0.782	0.915	0.934	0.931	0.840
MEAN	4.784	5.186	4.712	4.732	4.304	5.242	2.985	2.503	**MEAN**	5.311	5.542	5.022	5.228	4.650	5.656	3.550	2.639	**MEAN**	5.086	5.519	5.180	5.177	5.077	5.517	4.080	2.974
SD	1.372	1.284	1.516	1.410	1.383	1.052	1.382	1.446	**SD**	1.265	1.155	1.447	1.224	1.341	1.023	1.663	1.411	**SD**	1.408	1.1296	1.455	1.163	1.262	1.241	1.622	1.746

Note: *Significance at: *p < 0.05 and **p < 0.001.*