Barriers and enablers for adopting virtual reality and augmented reality in apparel retailing: Insights from Generation Z and Millennials

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Introduction. The global pandemic has accelerated the adoption of augmented reality (AR) and virtual reality (VR) in digital retailing (Hackl, 2020). In apparel retailing, one of the most popular applications of AR is virtual try-on, which allows consumers to try on the product virtually using a webcam on a computer or mobile apps (Scholz & Smith, 2016). By overlaying a product image with a consumer's reflection, this technology allows consumers to view themselves as if they have actually put on the clothes. As for the VR applications, a 3D virtual store allows consumers to walk into the store in an immersive, virtual environment. Despite the recent growth and popularity of AR and VR in the apparel retail environment, there is a lack of research on how these technologies are received by consumers and increase consumer adoption. To fill the gaps in literature, this study explores the barriers and enablers that influence the consumer adoption of virtual try-on (AR hereafter) and 3D virtual stores (VR hereafter) using empirical data from Generation Z and Millennials.

Literature Review. Prior research has indicated that AR is an effective e-commerce tool that elicits positive behavioral responses, such as purchase intentions and brand relationships, through its experiential values (Kang, 2014), media characteristics (e.g., interactivity, vividness, telepresence) (Baytar et al., 2020; Huang, 2019; Yim et al., 2017), and perceptual curiosity about the product (Beck & Crié, 2018). However, the quality of product images used in virtual try-on and interactivity speed may inhibit consumer adoptions of AR (Yim et al., 2017). Especially, the 2D product images that do not wrap around the body negatively affect consumers' ability to examine the fit of the garment through AR (Baytar et al., 2020). With regard to VR, prior research suggests that consumers' perceived control and enjoyment during the virtual experience affect their shopping intentions positively (Domina et al., 2012). VR also enhances brand attitudes and purchase intentions though telepresence, vividness, enjoyment, and intellectual experiences (Baek et al., 2020; Park et al., 2018). However, high costs and social acceptability associated with VR headsets may inhibit consumers' acceptance of VR applications in retailing (Bonetti et al., 2018). Technical difficulties in creating the details and texture of apparel products in the virtual store can be another barrier that affects consumer experiences with VR negatively (Park et al., 2018).

Methodology. Two mock e-commerce websites for a fictitious apparel brand were developed to embed the AR and VR technology. The AR site featured a virtual try-on button on every product page so participants could try on the garment they wanted virtually using a webcam. The VR site

presented the brand's virtual store in which participants navigate with a mouse and click on different hot spots to move around the space in a fully immersive environment using a head-mounted display. Two websites were identical except the type of technology used (AR vs. VR). A total of 194 female students from a large Southwestern U.S. university participated in the lab experiment. Participants aged 19 to 40 with the average age of 22, representing Generation Z and Millennials. Participants were assigned one of the two conditions (AR or VR) and instructed to explore the assigned technology while completing a shopping task for about 10 minutes. After that, they completed the survey that included two open-ended questions asking the specific features of the assigned technology that they liked/disliked and the reasons for liking/disliking. The survey responses were content analyzed by two researchers. Each researcher independently coded the positive (enablers) and negative (barriers) aspects of AR/VR to group them into the relevant categories based on the literature. The researchers then reviewed the coding tables and refined the initial list of themes/categories. Through an iterative analysis of concepts and themes, modifications were made to determine the final list of themes.

Results. Four key enablers and barriers for each technology emerged from the data analysis. These concepts are presented with sample comments from the survey in Table 1 and 2. While each technology exhibited a different set of enablers and barriers, we were able to classify them into the comparable categories as below. For example, the most prominent concept emerged as an enabler of AR and VR was consumption vision, which is a self-included mental process of envisioning oneself in the product use (Yim et al., 2018). The specific dimensions forming this multi-dimensional construct were different across AR and VR (see the sub-dimensions in Table 1). Overall, while consumer experiences with AR are centered around products, VR experiences affect a general brand experience that covers a store, brand images, as well as products.

Table 1. Enablers for adopting AR and VR

	AR	VR
Consumption vision (Yim et al., 2018)	"I could imagine what I would look like in the apparel." (**self-projection**), "I was able to see the fit of the garments." (**fit examination**)	"It helped me to visualize the apparel." (**mental fluency**), "I felt that I was in a store." (**engrossment**), "The visual features of the store were vivid and well designed." (**image quality**)
Interactivity (Klimmt et al., 2007)	"I was able to control the position and size of the clothing."	"I was able to walk around the store and get close to the garments."
Enjoyment (Nicholas et al., 2000)	"I had fun for using a virtual try-on."	"The experience with the VR was very exciting."
Novelty (Massetti, 1996)	"I liked it because it is a new, unique kind of technology that I have not seen before."	"I had never experienced any sort of virtual store so it was a cool experience."

Table 2. Barriers for adopting AR and VR

	AR	VR
Difficult to use (Domina et al., 2012)	"It took me a little bit to understand how it worked."	"It was a little tough to figure out because I am not familiar with VR."
Lack of realism (Park et al., 2018)	"Some clothes did not look realistic when virtually trying them on."	"The store did not seem very realistic."
Image quality issue (Pantano et al., 2017)	"The quality of the video/photo was not ideal."	"I dislike the blurry view of the products."
Technological limitations (Baytar et al., 2020)	"It does not provide an actual representation of how it might fit my body in reality." (**size/fit issues**), "I disliked how far away I had to get from the camera to have it proportional to my body." (**inconvenience**)	"I couldn't pick up the clothes nor interact with them." (**lack of interactivity**), "There isn't a way to click on individual products." (**lack of product info**), "It made me a little dizzy."

Discussion. Theoretically, the concepts identified in this study provide empirical evidence for the constructs that have been employed in the new technology/media research, such as consumption vision, interactivity, and novelty, and demonstrate how such constructs are applied in AR and VR. Findings from this study also provide managerial implications for online apparel retailers as to what aspects of AR/VR may need to be enhanced or emphasized to enhance consumer experiences, particularly for Generation Z and Millennials, which will become the dominant consumer groups for these technologies (Harrison, 2017).

References available upon request