

Exploring VR Conference Attendees' Perceptions and Experiences: Gender Differences and Barriers to Adoption



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Abstract This study investigates the discrepancy between attendees' perceived and actual experiences of virtual reality (VR) conferences, focusing on gender differences and barriers to future participation. Using a mixed-methods approach, 23 participants attended a simulated VR conference. The study evaluated four factors: ease of use, usability, interactivity, and comfortableness of head-mounted displays (HMDs). Results revealed that males consistently rated the VR experience more positively than females, particularly in terms of ease of use and comfort. While participants showed a positive attitude towards VR conferences, concerns about eye strain and limited social interaction emerged as significant barriers to adoption. The study highlights the potential of VR conferences as a hybrid solution for business events but emphasizes the need for improved hardware comfort and enhanced social interaction features, especially considering the observed gender differences in perceptions and experiences, to increase adoption and satisfaction among attendees.

Keywords VR conference · Attendee's perception · Gender difference · HMD

1 Introduction

Events are a spatial–temporal phenomenon, all created for a purpose. Each is unique because of interactions among the setting, people, design elements, and the program. Event management is the applied field of study and area of professional practice devoted to the design, production, and management of planned events, including festivals, entertainment, recreation, and sport, those in the domain of business and corporate affairs (including meetings, conventions, fairs, and exhibitions), and those in the private domain (including rites of passage such as weddings and parties, and social events for affinity groups) [1]. The conference provides an interactive platform for group discussions. After the pandemic, organizations increasingly recognize the

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benefits of virtually participating in conferences. These events eliminate geographical limitations, making them accessible to attendees with travel constraints. Therefore, organizations can reduce business travel frequency and costs by encouraging virtual participation. However, virtual conferences have limitations, such as reduced face-to-face interaction, challenges in showcasing products, and limited economic impact on host cities.

Therefore, having a hybrid model might resolve this issue. Recently, popular online conference platforms such as Zoom, Microsoft Teams, and Google Meets overcome geographical barriers, but interaction among participants was limited to only participants and speaker interaction but not among conference attendees. VR offers seamless human-to-human interaction through an immersive environment so participants can feel physically present in a conference hall and explore and interact freely with other conference attendees. VR as a consumer medium is still in its infancy [2]. Recently, to participate in the VR conference, attendees must wear a head-mount display device (HMD) to immerse in the virtual environment. HMD is not ubiquitous like mobile phones; therefore, it is uncommon among business users. A review of 22 HMD experience studies revealed that none had examined changes in perception before and after HMD use [3]. Moreover, to the best of the author's knowledge, no existing studies have investigated the barriers to HMD adoption in VR conference participation. Consequently, the research objectives of this study are: (1) To identify the difference between the perceived and actual VR conference experience; (2) To identify the barriers that affect the intention to participate in future VR conferences.

2 Literature Review

2.1 Enhancing Experience for Participating in Online Conferences via VR

Motivation factors for a conference attendee to participate in an event can be divided into two dimensions. The first dimension is related to push motivation related to event participants' personal needs, including event organisers and the event quality, event theme, keynote speakers, personal needs fulfilment, and networking opportunities [4–7]. The second dimension was related to the pull factors on destination characteristics, including the image, climate, safety, accommodation facilities, the language used, sightseeing opportunities, food and restaurant facilities, travel distance, and accessibility [4, 7]. According to the attendee's motivations and behaviours [8], a successful virtual conference setting must provide an easy, relaxed and enjoyable environment to interact with all participants. The virtual platform should enable communication channels for both formal presentation sessions and casual networking. Pazour et al. [9] proposed a personalized, immersive VR conference environment setting, including a realistic conference room, personalized 3D avatars of each attendee, and a face and lip tracking system. It can detect facial and lip movements and reflect

real-time facial expressions on the avatar and mouth animation for voice chat. These experiences could enormously enhance the experience of participating in the virtual conference.

Unlike traditional user interfaces, VR offers the 3Is (immersion, imagination, and interaction) features to simulate the user's five senses and enhance user experiences. The 3Is environment is suitable for organising the virtual event because the immersion feature makes participants feel like being physically present in the venue; the interaction features enable participants to control the sight angle and interact with other attendees on the VR platform using controllers; and suppression of disbelief leads to the imagination and the authenticity of the environment on VR environment [10]. Prior studies have shown that these three VR features significantly enhance users' experiences [11, 12]. The relationship between immersion and interactions has been unpacked; users have undergone virtual environments with the strongest immersion and interaction that would positively influence the user's intention to use VR with HMD [13]. Interaction and realism are the two main factors that affect the quality of spatial presence users can experience. The Higher quality of spatial presence positively increased the enjoyment for users [14]. With these characteristics, attendees enjoy the interaction and networking opportunities when attending the conferences.

VR provided sensation simulations to users. Immersion, sensation-seeking, enjoyment, creative freedom, and audio and visual aesthetics are critical in enhancing users' VR experience [14, 15]. However, many VR users are worried about the negative effects of using HMD because wearing the HMD for a long time could cause cybersickness [14] and health problems, such as heart rate increase and vision damage [16]. The problem of users getting cybersickness while using HMD is not a technological issue but is about sensory conflict. Sensory conflict is the key point that causes users to feel dizzy [14]. Therefore, studies have explored the user's perception in different fields, but no research has investigated the user's perception of using HMD to participate in a VR conference.

2.2 User Acceptance Model for Virtual Reality

The technology acceptance model (TAM) has been used for decades to examine users' acceptability and intention to use technology. However, most models mainly focused on individuals' perceptions of traditional user interfaces on flat-screen display systems but not on the recent immersive online multi-user VR platform. The rapidly growing interest in virtual platforms leads to their integration into daily lives and strongly influences the consumer market. An earlier study on user acceptance of the 3D virtual environment was modified from TAM, which included social influence and hedonic consumption behaviours for measuring multi-sensory and emotional aspects of the user experience [17]. The major characteristics of VR are immersive and interactivity, and conference attendees are also looking for networking opportunities. These traditional TAM models mainly examine the usage of technologies,

but a single person on a computer screen mainly uses these technologies. Interactivity is an important factor when participating in a VR conference. The visualisation capability of immersive VR provides the user with a realistic feeling of being at the conference venue. Factors included telepresence, usefulness, ease of use, attitude toward VR, and behavioural intention [18]. The telepresence feeling represents the degree to which the user has the perceived sense of being in the virtual rather than in physical reality [19].

Furthermore, VR requires HMD to isolate users from reality and display virtual images for interacting activities. Physical conferences last a few hours to a few days; therefore, the usage time was longer than playing games. One of the considerations of novice VR users towards VR head-mounted devices was cybersickness. Their prior experience using an early version of VR head-mounted devices could drive them to suffer from motion sickness. Rebenitsch and Owen [20] presented a series of cybersickness induced by the VR system, including general discomfort, headache, eyestrain, difficulty focusing, and increased salivation. Manis and Choi [21] proposed a revised TAM model to evaluate the VR hardware acceptance model (VR-HAM), which confirmed that the user's age plays a role in ease of use and intention to use; however, gender did not show a significant difference.

3 Methodology

3.1 Research Design

This study attempted to explore the overall experience of attending the VR conference. The research design included examining the perception changes before and after participating in the VR conference and the barriers that hinder attendees' future intention to participate in the VR conferences. In addition, exploring the relationship between the perceived comfortableness of HMD and the VR experience received during the conference would positively influence the intention to participate in future VR conferences. Mixed methods were adopted to unpack the general perception of using VR HMD. The data was collected in the laboratory, and participants were invited to participate in a researchers-arranged VR conference. The research framework consists of eight stages, as illustrated in Fig. 1.

3.2 Laboratory Setup and the Mock Conference Rundown

The researchers assessed five options to evaluate online meeting platforms for business conferences: Spatial, Horizon Workroom, MeetinVR, FrameVR, and VIVE Sync. While all platforms offered essential tools, the first four were limited by



Fig. 1 The research design (*Source* Authors' own)

small meeting rooms and legless avatars. Given the professional and authentic business conference environment required for this study, VIVE Sync, with its full-body avatars, was the most suitable choice. Participants were recruited through email and social media posts. The VR conference lasted approximately 30–40 min. Each participant received a task sheet with three randomly assigned tasks (see Table 1). Upon entering the conference platform, participants completed these tasks in their preferred order within the first 10 min. Subsequently, they were asked to listen to a 10-min presentation, which included a PowerPoint presentation and a YouTube video. After the presentation, participants were invited to interact with the presenters and other attendees.

Participants completed two sets of questionnaires to measure changes in perceptions: one before and one after the VR conference. The questions focused on four areas: ease of use (EU), perceived usefulness (USE), interactivity (INT), and comfortableness of the HMD (COM). The EU, USE, and INT questions were adapted from Manis and Choi [21]. The COM questions were reverse-coded to assess participants' concerns about using VR HMDs, such as cybersickness and vision damage. Participants rated their opinions on a five-point Likert scale (1 = Strongly Disagree to 5

Table 1 Tasks required the virtual conference presenter and participants to complete

Role	Tasks
Participant	Walk around the conference area and read the signage Stand up and sit down at the conference table Make a private chat with Participant X Hi-Five and shake hand with Participant Y Raise hand and ask question to the presenter Use emoji during the presentation Use sticky note to write a sentence Use the pen to draw
Presenter	Open the power point file and start the presentation Use the laser pointer Click the link in the power point file and play a video Interact with the participants

Source Authors' own

= Strongly Agree). After the conference, volunteers were invited to participate in 10–15 min focus group interviews. Researchers conducted open-ended interviews to gather participants' overall experiences, concerns, and barriers to VR conferences. Participants were also encouraged to discuss their preferences for VR or physical events.

4 Findings and Discussions

4.1 Demographics of VR Conference Participants

A total of 23 volunteers were recruited via social media, with 11 female and 12 male. The experiment divided the volunteers into five groups. Three groups were undergraduate students, one group was professors from the researchers' university, and the last group was master's students from a public university located in the same city. None of the participants received any financial awards or academic credits. Half of the participants indicated they have prior VR experience, and the gender distribution was also evenly distributed. Four teachers and six senior year students have participated in online academic conferences, so they have general ideas about the rundown.

4.2 Gender Differences Before and After Participate VR Conference

The study analysed the impact of a VR conference on four factors, including ease of use (EU), usability (USE), interactivity (INT), and comfortableness (COM). While a small sample size precluded formal statistical tests, descriptive statistics were calculated to examine changes in mean scores before and after participating the conference. Overall, the results indicated minimal mean scores change among the four areas. However, when analysing by gender, notable differences emerged. Table 1 indicates that males consistently had higher mean scores than females for all factors except COM. The result suggests that the VR conference may have had different effects on males and females, with males potentially favouring VR more.

4.3 Ease of Use, Usability, and Interactivity of VR Conference

The overall mean scores for male participants were higher than females for EU and USE. After participating in the VR conference, the mean score for males dropped,

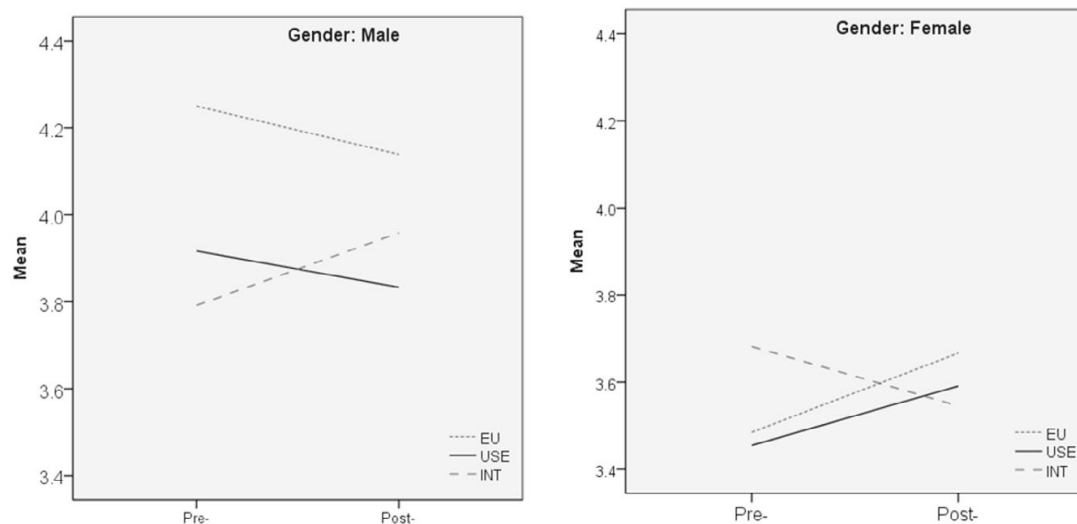


Fig. 2 Gender difference of perception changes—EU, USE and INT (Source Authors' own)

and the female's scores rose (Fig. 2). This reflects that the conference operation may not be as simple as the male thought, but the females found the system was not as difficult as they thought. During the focus group interview, several participants mentioned that some meeting functions were not smooth. For example, *"It is hard to control the ppt when someone stands in front of the screen (A04)"* and *"Hard to delete what I have drawn, so the environment looks very messy after few of us keep drawing (A15)"*.

Networking and interaction are the key activities for conference attendees. From the interview, the current VR platform was not performing as well as the participants expected. For example, *"I cannot see people's facial expressions from the avatar, which makes me feel difficult to understand the other person's emotion when talking to them (A01)"*. *"I cannot hear other people talk, and the conference platform is hard for me to interact with people (A04)"*. A06 and A07 both had prior academic conference experience, and they both expressed that attending the virtual conference could be useful when travelling is not possible, but not for social networking.

Virtual conferences could save us lots of time to travel, but the interaction between attendees still needs to be improved... I don't feel it is an easy and comfortable social environment for networking (A07)

I feel good to meet old friends on a virtual platform, but not ideal for making new friends since it is hard to approach people by just seeing the avatar (A06).

Interestingly, VR can create a comfort zone for introverted individuals with social difficulties, allowing them to interact with others more easily. For example, A23 mentioned, *"I am shy, I like VR because it protects me from direct contact with people, and I just talk to them using an avatar, so I feel more comfortable speaking to stranger."* As a result, if the functionality of VR in social interaction improved, more attendees would support using it.

4.4 Comfortableness of HMD

The items related to the HMD were reverse-coded, meaning higher scores indicated greater discomfort. As shown in Table 2, female participants generally rated the HMD as more uncomfortable than male participants. Figure 3 highlights three key items related to comfortableness.

Initially, male participants reported lower discomfort levels for COM1, indicating minimal concerns about vision damage. However, male and female participants experienced increased discomfort levels after participating in the VR conference, suggesting growing concerns about eye health. For example, A05 and A22 mentioned, “*My eyes start feeling uncomfortable after wearing the VR headset for*

Table 2 Means score of pre- and post-conference survey by gender

	Male (N = 12)		Female (N = 11)		Overall (N = 23)	
Factors	Pre-mean (Std)	Post-mean (Std)	Pre-mean (Std)	Post-mean (Std)	Pre-mean	Post-mean
EU	4.25 (0.712)	4.14 (0.502)	3.49 (0.405)	3.67 (0.365)	3.88	3.91
USE	3.92 (0.417)	3.83 (0.537)	3.46 (0.350)	3.59 (0.491)	3.70	3.72
INT	3.79 (0.656)	3.96 (0.722)	3.68 (0.815)	3.55 (0.850)	3.74	3.76
COM	2.86 (1.020)	2.78 (0.891)	3.58 (0.818)	3.70 (0.586)	3.20	3.22

Source Authors' own

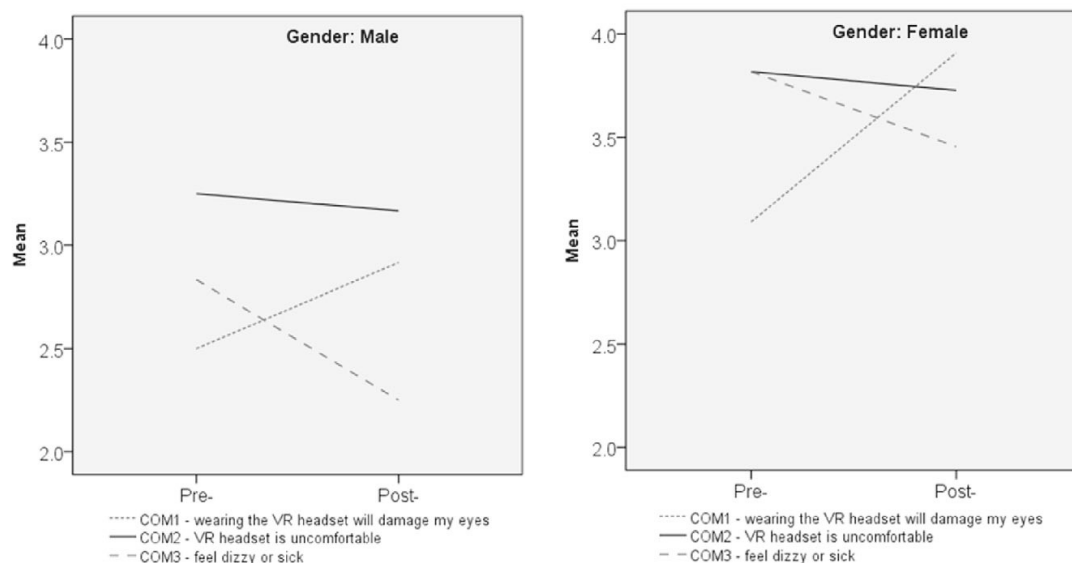


Fig. 3 Gender difference in perception changes for three COM items (Source Authors' own)

15 min” and *“I had to remove the VR headset and take a few minutes rest because of dry eyes.”* These findings align with previous research on HMD brightness, which can contribute to eye strain and long-term usage concerns [22]. The extended duration of conferences makes participants’ worries about potential vision damage understandable. The discomfort caused by the VR headset was a notable concern for some participants.

The perceived dizziness decreased after the conference. Prior research indicated sensory mismatch, such as room-scale environment, is the main reason for cybersickness [23]. Early VR prototypes with head-mounted displays and other immersive technologies caused many users to experience nausea, dizziness, and other symptoms characteristic of motion sickness [24]. Even after many years, this concept of cybersickness or virtual reality sickness is still around in users’ minds. Therefore, after the participants tried the VR platform, most found out that the current HMD did not cause any sicknesses; therefore, the mean score of COM3 increased significantly for both genders.

5 Conclusions

Hybrid business conference is the future direction as conference attendees could participate without geographical barriers and time constraints. This study explored the potential and challenges of VR conferences, focusing on gender-specific perceptions and experiences. The findings, while limited by a small sample size, offer valuable insights into the future of hybrid business events.

The study revealed that male participants initially perceived the VR platform as easier to use than female participants, but this difference diminished after actual participation. This suggests that while initial technical familiarity may influence early perceptions, hands-on experience can mitigate gender disparities. Although no significant differences were found in perceived usefulness, the study highlighted challenges in social interaction and networking, potentially impacting the perceived value of VR conferences for both genders. Compatibility with personal needs and preferences also varied by gender. Some female participants found the VR headset more uncomfortable, potentially affecting their compatibility perception. A significant concern that emerged among both genders was eye strain associated with prolonged VR use. This is a critical factor to consider when planning and implementing VR conferences, as it can negatively impact user comfort and potentially lead to long-term health issues.

To fully realize the potential of VR conferences, it is essential to address the identified gender differences and challenges. This includes developing more ergonomic and comfortable HMD, incorporating features that facilitate natural communication, facial expressions, and gestures, and offering training and support to help users. By addressing these factors, VR conferences can become more inclusive, engaging, and effective tools for hybrid business events, benefiting both male and female participants.

6 Implications

This study proposed a new variable, "comfortableness of HMD", to the existing TAM model to evaluate the acceptance level of VR. The results also reflected an obvious difference between males and females. If any organization would like to organize a VR conference in the future, they need to use two different approaches to draw the awareness of different genders. To overcome gender differences when planning hybrid events, event organizers should provide targeted training and assistance to address any perceived technological barriers that can help bridge the gender gap, and designing VR experiences that consider diverse user needs and preferences can enhance overall satisfaction for both genders. Further research with larger sample sizes and statistical tests would be necessary to confirm these findings and explore the underlying reasons for these gender disparities.

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