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Gender expression and gender identity in virtual reality: avatars, role-adoption, and social interaction in VRChat

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Introduction: This study examines the complex relationship between gender, virtual reality, and social interaction.

Methods: Utilizing unobtrusive observations and interviews within the VRChat platform, this research explored avatar choices, interactions, and full-body tracking (FBT) technology utilization as they related to users' expressions and perceptions of gender in virtual reality (VR).

Results: The findings revealed that cultural background plays a significant role in shaping gender expression and perception. Results demonstrated the fluidity of gender expression in virtual environments, highlighting how users can challenge and subvert traditional gender norms, and the potential of virtual reality as a tool for experiential learning, fostering cross-cultural understanding, and promoting inclusive and diverse gender expressions.

Discussion: This study contributes to the emerging body of literature on virtual reality and gender, providing insights that can inform future research and technology development.

KEYWORDS

virtual reality, gender expression, gender identity, culture, avatars, role-adoption, social interaction

Introduction

An increasing number of individuals are demonstrating interest in immersing themselves within social virtual environments. This includes corporate interest, such as with Facebook's *Metaverse*, a platform that allows individuals to explore virtual 3D spaces and interact with others using custom avatars. In social VR environments, which allow multiple users to interact with each other in a shared virtual environment, individuals can explore aspects of their identity, such as their gender, and challenge established societal norms through self-expression and exploration (Gunkel et al., 2018). These experiences offer an intricate and dynamic interplay between identity formation and social interaction in virtual environments. Individuals' experiences in social VR can have significant implications for their understanding of themselves and their relationships, both online and offline, which includes aspects such as gender identity, psychological wellbeing, and social skill development (Freeman and Acena, 2021). While previous research has touched upon the relationship between identity expression in social VR environments, there is little work examining how users perceive others' gender and how individuals navigate and negotiate their gender identity in virtual spaces.

Using VR powered by full-body tracking (FBT, alternatively referred to as six point + tracking), in which users wear trackers, users can interact with others through voice, full-body gestures, proxemics, gaze, and facial expressions (Freeman and Acena, 2021). FBT technology plays a pivotal role in synchronizing user and digital movements, leading to enhanced feelings of agency over users' virtual representations. This synchronization establishes a robust connection between the user and their avatar, significantly contributing to the immersive experience (Peck et al., 2013; Desai et al., 2014; Jiang et al., 2016). FBT technology therefore can facilitate authentic connections within virtual spaces. Users perceive and express nonverbal cues in real-time for more effective communication and collaboration (Gravano and Hirschberg, 2011).

FBT bridges the divide between the virtual and real worlds, enhancing users' sense of presence and connection with their virtual avatars (Peck et al., 2013). FBT has the potential to increase users' willingness to express themselves and enhance social interactions by breaking free from normative social constructions.

VR and gender identity

Gender, as a social construct, is intricately linked to the interactions and relationships individuals establish within their social milieu (Butler, 2004). Gender performativity suggests that gender identity is acquired and shaped throughout one's life through social constructs and interactions. Queer theory, as a subversive framework that challenges the heteronormative and binary gender systems prevalent in society, posits that gender should be seen as a fluid concept, allowing individuals to reimagine and reshape their gender identity (Jagose, 1996). In VR, rather than submissively accepting the traits imposed by the binary gender stereotype, individuals can explore the possibilities of their own gender identity (Nowak and Rauh, 2005).

The embodied experience of social VR allows individuals to perform their gender and gain emancipatory experiences, the feeling of liberation that arises when overcoming or confronting systematic oppression, as well as recognizing factors that have impeded personal progress (Kemper, 2017). These experiences, stemming from a transfer between players' in-game activities and real-life behaviour, emotions, and experiences, foster a deep sense of self-understanding (Bowman and Lieberoth, 2018).

Types of social interactions

Social interaction plays a pivotal role in shaping gender perceptions and expressions, and this becomes especially salient in VR environments, where individuals engage in social exchanges and form connections with other users (Gunkel et al., 2017). The immersive quality of VR, along with the sense of presence it affords, can heighten the influence of social interactions on individuals' comprehension and the manifestation of gender (Bailenson et al., 2003). As users engage with one another in virtual spaces, they might question traditional conceptions of gender or embrace alternative gender expressions that diverge from their real-world identities (Freeman and Acena, 2022).

Avatars

Users often view their relationship with their avatars depending on the context, purpose, and level of immersion in the virtual environment. While some players might perceive their avatar as a tool to navigate and achieve goals in the gaming environment, others may develop a deeper emotional connection and identify more closely with their virtual representations (Bowman and Banks, 2021). A range of factors, such as personal preferences, gameplay styles, and virtual world contexts, can impact users' connection with their avatars, influencing the position they take within the sociality continuum. Users might focus on optimizing their avatar as a play tool, which can lead to increased play intensity but decreased emotional intimacy with the character (Banks, 2015). Some users establish a more profound and emotional connection with their avatars, treating them as "people in a world," while other users identify avatars as real themselves (Bowman and Banks, 2021).

Body movement

The role of nonverbal communication in social interactions is well documented (Gravano and Hirschberg, 2011). Mimicry, imitation, and backchanneling are essential components of effective communication that contribute to feelings of liking and belonging (Leander et al., 2012; Kämpf et al., 2018). VR can present three-dimensional representations of users' bodies (Wiederhold et al., 2016). This can lead to a more accurate and satisfying body image, potentially impacting users' experience of gender within the virtual space, which can positively impact users' emotional states (Baylor, 2009). For example, the perceived masculinity or femininity of avatars, along with their anthropomorphism, can significantly influence users' perceptions and interactions in virtual spaces. This, in turn, may affect the ways in which individuals' own behaviours in virtual reality (such as trying out a variety of avatars) utilize an embodied method to discover themselves (Nowak and Rauh, 2005).

Voice

With strong links between voice pitch, masculinity, and dominance, voices may have a substantial effect on final judgments (Rezlescu et al., 2015). Users may be more likely to perceive and evaluate others' gender identities based on the congruence between their avatars and vocal cues in social VR environments. Research has shown that there is a face-voice gender consistency preference in gender categorization, which can be a significant factor for users in social VR environments to express and perceive others' gender (Rezlescu et al., 2015). Verbal communication in social VR environments is facilitated by real-time voice chat features, allowing users to express themselves through tone, pitch, and cadence. This mode of communication creates opportunities for users to experiment with or express different gender identities verbally.

VRChat

Among social VR platforms that allow users to use FBT, VRChat stands out as a unique and increasingly popular medium for social interaction and self-expression, which has the largest and most active user base, representing a diverse range of cultural, social, and demographic backgrounds (Poetker, 2019). The key differences between VRChat and other social VR platforms are its emphasis on user-generated content, allowing users to construct unique

environments that cater to specific interests, themes, or communities, where users can interact with one another using highly customizable avatars (Poetker, 2019). This may include, for example, particular pieces of clothing that may be more or less expressive of gender and/or culture.

VRChat also provides a level of anonymity to its users. Unlike other social VR platforms that require users to link their accounts to their real-world social platform or require their real-life information, *VRChat* allows users to remain anonymous (VRChat, 2014). This anonymity can encourage users to experiment with different avatars, identities, and gender expressions that they may not experiment with in other social contexts.

Current study

This study examines the complex relationship between gender, virtual reality, and social interaction. Using *VRChat*, we investigate the significance of avatar FBT technology in VR for identity practices and the role of virtual reality in exploring diverse non-cisgender identities. Drawing from queer theory and gender performativity theory, we used unobtrusive observations and interviews across various countries and cultures to examine the following research questions:

RQ1) Under what circumstances are users more willing to express themselves (both verbally and non-verbally) in VR?; RQ2) How do users perceive others' gender in social VR?; and RQ3) How do users perform their gender using full-body tracking technology in social VR?

To answer the research questions, we conducted semi-structured interviews within *VRChat*. This context was chosen due to its participant familiarity, encrypted rooms, available writing tools, in-world text input functionality, and encrypted voice chat channels. The interview questions included participants' backgrounds, gender identities, *VRChat* experiences, avatar preferences, gender perceptions, and the use of FBT technology. To complement the interviews, we conducted unobtrusive observations in *VRChat*'s random worlds, friends + worlds, and public worlds.

Owing to the anonymity, we predicted that users might be more inclined to express themselves within VR contexts with familiar friends or familiar environment, and choose avatars that correspond to their gender identity, experiment with diverse gender representations, or choose non-human or androgynous avatars as a means of contesting conventional gender paradigms (Nowak and Rauh, 2005). The findings of this study can facilitate a deeper understanding of how others perceive gender in VR environments, providing insights for personal gender exploration as well as more inclusive and diverse avatar design and social interactions.

Method

Unobtrusive observations

Participants

We observed 95 participants (details found in Supplementary Table S1). Participants in the unobtrusive observations were users of *VRChat* observed in event sessions in random worlds and friends +

worlds. Their demographics, such as age, gender, and nationality, were unknown due to the nature of the unobtrusive observation method.

Observations relied on naturally occurring interactions within *VRChat*'s virtual environment. We used a sample of convenience to join ongoing activities in random worlds, friends + worlds, and public worlds and observed users who happened to be present at the time. This sampling technique allowed us to explore user interactions in authentic and uncontrolled environments, aligning with the research questions on understanding avatar-based gender expression in *VRChat*.

To protect the participants' privacy, all data gathered during observation sessions was anonymised, and potentially identifying information was removed. The methods and protocol of the study were conducted in accordance with the standards specified in the 1964 Declaration of Helsinki.

Materials

Observations

We conducted unobtrusive observations, a method of observing without the knowledge of the observed (Given, 2008), by participating in activities and observing users interacting in *VRChat*'s random worlds, friends + worlds, and public worlds. We carried out online observations by adopting the role of passive or nonreactive observers (Babbie, 2020). We did not interact or speak with the participants but focused on observing and recording their interactions. A transparent avatar was used to remain inconspicuous and minimise other players interacting with the researcher. Observations were made at 16:00 (CET) on weekdays, when most *VRChat* events occur, based on *VRChat* Event Calendar (<http://vrceve.com/>). The researcher remained present throughout the entirety of the events. Observation events were digitally recorded using OBS software and anonymised.

VRChat

We chose random worlds, friends + worlds, and public worlds. Random worlds are worlds that *VRChat* promotes randomly to the users, in which users can explore and interact with others and encounter different avatars and experiences. Friends + worlds are most often used as event places, such as dancing and spaces for socializing with friends. Public worlds are open-access worlds that welcome any user to join and participate in various activities, such as gaming, dancing, and chatting, which often feature a much higher number of users than the other worlds.

Within VR users of *VRChat* there are two main types of tracking technologies: three -point tracking and six-point + tracking. Three -point tracking captures the position and orientation of a user's head and hands by VR headsets and controllers, which allow users to perform basic gestures, such as waving and pointing but limits the movement of their lower body. While six-point + tracking extends beyond the head and hands to track additional points on a user's body, such as hips, knees, and feet, which enables users to express all kinds of body language and gestures in *VRChat*. The six-point + tracking requires additional hardware or software to capture a user's movements. We determined the tracking type of users (PC, three or four-point tracking, or six-point + tracking) based on their observable behaviors, as the behaviors available to users is determined by the type of tracking available to them. This

method is reliably accurate, as users cannot move or mimic the movements of other tracking types that are not available to them. See [Supplementary Figure S1](#) for an example of a commonly used avatar and various actions.

Procedure

Friends + worlds were randomly selected based on an event schedule, while public worlds took into account in-world population (instances with the highest number of users). We used a transparent avatar and positioned ourselves at a comfortable distance from the group to observe without disrupting interactions.

During the observation period, we determined the tracking type of users (PC, three -point tracking, or six-point + tracking) based on their movements and gestures during the observations. Observations were conducted for varying durations, ranging from 5 min to 2 h, depending on the event and the natural interactions within the virtual environment. We recorded the video, including date, time, world name, number of participants, and a detailed description of the observed interactions.

Data analysis

After collecting observation notes and videos, the data was transcribed and compiled. All personal identifiable information was removed to ensure anonymity. We classified the observations based on factors and detailed accounts of the interactions. We performed a thematic analysis of the data, which involved identifying and interpreting recurring patterns, themes, and relationships among the observations ([Braun and Clarke, 2006](#)).

Semi-structured interviews

Participants

Interviews were conducted with six participants (see [Supplementary Table S2](#)). Participants were recruited from students at [anonymized for review] in Sweden using convenience sampling, and were not in the observation sessions. Informed consent was obtained by all participants and all methods and protocol of the study were conducted in accordance with the standards specified in the 1964 Declaration of Helsinki. Participants were compensated with a month of VRC+ (*VRChat's* premium subscription service) for their participation in the study.

All participants provided written informed consent to participate in the study. All participants approved recording of the whole interview for the use of note-taking and data analysis and the interviews were anonymized. The methods and protocol of the study were conducted in accordance with the standards specified in the 1964 Declaration of Helsinki and approved by the local ethics committee, The Swedish Ethical Review Authority (2023-04552-02).

Materials

Equipment

The materials used for the interviews included a laptop with *VRChat* installed, a Vive Pro Eye VR headset, a Vive facial tracker, two Index controllers, three Tundra trackers, OVR Toolkit software, and a OBS recording software. Note taking used the OVR Toolkit software, which allowed access to computer-based documents while remaining immersed in the VR environment.

Interviews

Interviews were conducted within the *VRChat* world named “SuRoom.” We chose SuRoom as the interview location due to participant familiarity, encrypted rooms, available writing tools, in-world text input functionality, and encrypted voice chat channels. These features provided a secure and comfortable environment for conducting the interviews.

Interview questions

Interviews were semi-structured, with a primary leading question and follow-up questions (see [Supplementary Table S3](#)).

Procedure

Participants were invited and scheduled to SuRoom individually. The instance of the world was set to invite only. After the participants joined, we changed the instance status to “red,” which means the participants are hidden in the “world,” requests and invitations to join were not accepted. We first introduced the study’s objective and confirmation of participants’ informed consent. Then, we asked the primary interview questions, followed by the follow-up questions, to facilitate a consistent and in-depth discussion of the topics across all participants. During the interviews, we reminded participants to share their honest thoughts and experiences. We took notes during the interview using the OVR Toolkit software. Interviews lasted 30 min on average.

Data analysis

All interviews we transcribed from the recordings, noting any non-verbal cues, such as pauses or emphasis, which could provide additional context or insights into the participants’ responses. We provided the participants with a copy of the transcription for review to ensure accuracy. All participants confirmed that the transcriptions accurately represented their thoughts and experiences.

We used thematic analysis to identify common themes and patterns in the participants’ responses ([Braun and Clarke, 2006](#)). This process began with a thorough reading of the transcripts to generate major themes. We then utilized a bottom-up, inductive approach to coding, allowing the data to guide the identification of themes rather than imposing any preconceived notions or theoretical assumptions to ensure that the results accurately represented the participants’ experiences and perspectives.

After coding, we grouped the coded themes into broader categories based on their similarities and differences. We took into account potential relationships or hierarchies among the themes, which could provide a deeper understanding of the participants’ experiences and perceptions of avatar-based self-expression and gender performance in social VR environments. Finally, we analysed the resulting themes in comparison to relevant literature to contextualize and interpret the findings, examining participants’ experiences and perceptions of avatar-based self-expression and gender performance in social VR environments ([Strauss, 1987](#)).

Results

Observation results

Results from the observations were categorized into four emergent themes from thematic analysis in order to address RQ1. These themes were: user ranking and avatar choice, community and communication type choice, activities and interactions, and risk. In *VRChat*, RQ2 and RQ3 could not be directly observed as gender does not have to be displayed. Users can choose to change the gender they want to express by changing their behaviours, voices, and avatars. In this case, there was no way to know whether the gender they want to present matched the avatar's gender without conducting interviews.

User ranking and avatar choice

In *VRChat*, the safety and trust system offer a user ranking hierarchy, ranging from “visitor,” “new user,” “user,” “known user,” “trusted user,” and “friend.” In many observations, we noted that the majority of users were ranked between visitor and user. Simultaneously, these users predominantly used public avatars, which were mostly non-human characters. In contrast, other observations revealed that the majority of users who were ranked as trusted users employed personalized, anime girl avatars.

Community and communication type

Results revealed that by selecting communities with shared interests and trust, users found like-minded individuals and develop meaningful connections. They tended to choose to engage in relaxing environments and activities. Without any compulsory verbal communication in the virtual environment, users had the flexibility to interact using their preferred communication methods and receive real-time feedback from other users, allowing for responsive and dynamic interactions. In worlds with more users, they preferred to mute themselves and use body language to interact with others, which may be caused by a safety consideration.

We found that selecting communities with shared interests and trust was important in *VRChat*. Users tended to gravitate towards others with similar interests and tracking types, where the shared experiences and interactions created an atmosphere where users felt safe and comfortable, creating a sense of belonging and trust within the community.

It is worth noting that avatar style influenced users when choosing communities based on shared interests in *VRChat*. Observations revealed that in the worlds where most users prefer anime-style avatars, users who adopt avatars from the same base tend to position themselves closer to one another. Simultaneously, those using more realistic or minimalist cartoon-styled avatars may find it challenging to integrate into that community. In contrast, in trust-based communities, harmonious interactions were observed among users regardless of their avatar style.

Actions and interactions

In random worlds, users engaged in diverse activities such as chatting, sharing personal stories, and listening to the design story of a virtual world. Users in a friends + game world engaged in various activities such as playfully interacting with each other, playing games

like *Mahjong*. Users with different tracking types communicated about the games, their experiences, and their avatars' features, such as phantom sense in FBT users (phenomenon where FBT users experience physical sensations when their avatar's body parts are touched).

One observation took place in a friends + dancing world where users participated in a kawaii (cute) dance event. Participants gradually muted their microphones as more people joined and started to use body language to interact with one another; coded behaviors included hugging each other, giving a thumbs-up after a song ended, and using gestures like patting each other's heads, making cute movements, and taking selfies with their fellow dancers.

FBT users seemed to prefer interacting with other dancing users. FBT users also exhibited more relaxed and comfortable body language, indicating attentiveness to their friends' conversations. In public worlds, users participated in activities like singing, dancing, and chatting about their avatars. The interactions were mostly verbal and focused on specific activities or experiences, with limited physical interaction. Users gather in groups based on shared interests, tracking types, or avatar preferences, emphasizing the significance of selecting communities where users can connect and interact with like-minded individuals in a comfortable and trusting environment.

Users in a friends + chatting world formed smaller groups to chat and interact. PC users (users without VR devices and FBT) used the chatbox and verbal communication. In chat-centric worlds, the level of verbal communication varied between users with different tracking types. PC players primarily used chatbox and speech for interaction, while 3-point tracking users could move their hands, make adorable poses, and engage in touch-based interactions. FBT users were observed lying on the ground or sitting while chatting, changing their sitting positions from time to time. Their body orientation and facial expressions indicated that they were attentively listening to their friends.

Users listened to a FBT user's story about their emotional experiences in *VRChat*, in which non-verbal communication played a significant role. Users expressed empathy, support, and understanding through their avatars' movements and gestures, which created a sense of camaraderie among users and allowed them to connect on a deeper level, providing users with meaningful social interactions in VR environments without relying solely on verbal.

Two FBT users were playing with each other, both using avatars with animal ears. They discussed their “phantom sense” experiences and how they felt when their avatar's ears were touched, despite the difference in position from their real ears. This exchange facilitated bonding and shared understanding among participants.

In other observations, users expressed their appreciation for various aspects of social VR environments, such as world designs and avatars. Real-time feedback from users serves as a valuable resource for designers, helping them understand how their creations impact user experiences.

Risk

We observed an instance of virtual trash actions, which serve to spoil others' experiences but do not fit into five types of emerging virtual risks (Zheng et al., 2023). A PC user approached an FBT user who was in the middle of dancing. The PC user walked up to the FBT

user and jumped. However, the FBT user ignored the PC user's gesture. The PC user continued to advance toward the FBT user until their avatars were almost touching. Reacting to the intrusion, the FBT user stepped two steps back and to the right, then tilted their head to continue watching the dance on the screen. The PC user remained standing in place, motionless, until the break time arrived. At that point, the FBT user reached out and patted the PC user's head, prompting the PC user to finally retreat to an area behind the mirror where their presence would not interfere with the dancing. This observation highlights the nuances of social interactions and personal boundaries within *VRChat*.

Semi-structured interview results

Using the responses from the semi-structured interviews, we addressed RQ2 and RQ3 by analyzing the gender perception and expression and the factors in shaping these experiences.

Behaviour-based gender perception and expression

In VR, users relied on a variety of cues to perceive and express gender. One aspect that influenced these judgments was behaviour. Some certain behaviours appear to impact users' perceptions of gender in *VRChat* and users intentionally modified their behaviours to convey or hide specific gender identities. Direct quotes from the interviews corresponding to the results below can be found in [Supplementary Table S4](#).

P1a highlights the role of fidgeting and purposeless behaviours in shaping assumptions about one's gender. This user suggests that individuals might attribute specific gender identities to others based on these subtle actions. These behaviours were made with conscious decisions, indicating that users may be aware of the impact of their actions on gender perception and choose to employ them to create a specific impression.

P3a expands on the impact of specific postures and mannerisms on gender perception, using an example of Safety knickers (similar to boxer-style underwear, worn outside the underwear as a precaution to prevent accidental exposure of one's underwear when wearing skirts). The contrast between P3's behaviour in *VRChat* and real life suggests that virtual environments might encourage users to pay more attention to their own self-presentation and to engage in self-monitoring or self-regulation to create a particular impression.

P4a emphasizes the significance of gender-specific body language in social VR.

Users tend to associate specific actions or postures with particular gender identities, reinforcing the idea that behaviour plays a crucial role in shaping gender perception. The emphasis on different sitting positions for men and women highlights how seemingly mundane actions can carry significant symbolic weight in terms of gender expression.

P6a further supports the importance of posture in gender perception. Certain postures are commonly associated with specific genders and that users might rely on these cues to make judgments about others' identities, indicating that users in *VRChat* may internalize and reproduce traditional gender norms and expectations through their behaviour.

P3b adopts behaviours from external sources, such as anime, to enhance his gender performance. By emulating these behaviours, he could reinforce or challenge the expectations associated with a particular gender.

P3c also mentioned the popularity of "kawaii moves" in the platform. Some users adopted specific gestures or mannerisms to fit in with the dominant culture of *VRChat* or to create a more appealing online persona. The widespread use of "kawaii moves" also indicates a shared cultural practice within the community, contributing to the establishment of certain norms or expectations regarding gender expression.

P2a adds that some male users intentionally adopt stereotypically feminine behaviours in *VRChat*. This statement implies that users might deliberately challenge or subvert traditional gender norms by engaging in behaviours typically associated with another gender. However, P2b also acknowledged that these behaviours are part of gender stereotypes and do not necessarily represent the actions of all women. This recognition of the limitations of stereotypes indicates users are critical of the assumptions they make about gender based on behaviour, recognizing the diversity of gender expression.

P2c mentioned she consciously adjusts her behaviours to conceal her actual gender, a strategic use of behaviour in *VRChat* as a means of controlling one's perceived gender identity; users are able to use FBT technology to undo gender, which is harder to achieve in real life because of established social norms. P2's stated her desire to hide her real gender. Virtual environments provide spaces for users to experiment with different aspects of their identity or to escape the expectations and constraints she may face in her offline lives.

Avatar-based gender perception and expression

Results from the respondents showed an importance of avatar-based gender perception and expression, particularly the significance of avatar choices, FBT technology's impact, and the customization process in determining and displaying gender.

In social VR environments, users had diverse reasons for selecting specific types of avatars. The connection between a player and their avatar encompasses four dimensions: 1) identification, where players see themselves as similar to or the same as the game character, 2) control, which involves a powerful sense of governance over the avatar's actions, 3) suspension of disbelief, where players accept the virtual world as real, and 4) responsibility, which entails feeling obligated to ensure the avatar's wellbeing ([Bowman et al., 2012](#)).

P1b and P2d mentioned that they prefer human avatars because they feel more natural when moving. This choice reflected a desire to maintain a human identity while engaging with others in the virtual world.

P2e also mentioned that her avatar is more like a character she borrows in the game. Avatars can also be seen as distinct characters or extensions of the user's personality, rather than direct representations of their real-life selves.

When meeting new people in virtual environments, users may place greater emphasis on avatars due to the absence of real-life interactions. P4b shared that his avatars often have non-human features, such as cat ears and tails because he finds it fun. P4c and P5a also mentioned that his avatars represent some part of his taste of what is fun.

Results show that avatars can influence users' perceptions of others and shape their social interactions in virtual environments, and the importance of high mobility in social VR. P6b shared how his avatar preference influences his perception and interactions with others, since avatars serve as visual representations of users in social VR settings. P3d mentioned that he was more likely to interact with users whose avatars he found particularly appealing. P2f explained that she would avoid interacting with certain users based on the avatars.

P1c highlighted the impact of FBT on avatar perception, stating that different users with the same avatar model could evoke different feelings. P3e also mentioned that he started to strongly identify with his avatar after using FBT. P4d and P1e noted that they would perceive one's gender based on their avatar's appearance. P6c commented on the diversity of customization options for both human and non-human avatars, and how his avatar preferences affect his openness towards others.

P2g explained that she dedicated a significant amount of time to avatar customization.

Similarly, P3f talked about the effort and resources required to customize avatars. P3g also mentioned the difficulties and expenses involved in avatar customization, particularly for newcomers. P1d shared his appreciation for both realistic avatars and those with fantasy and cute themes.

Voice-based gender perception and expression

Results revealed the importance of voice-based gender perception and expression and the role of vocal cues in shaping users' understanding and performance of gender.

P3h shared that he would speculate about others' gender out of curiosity if he were interested in someone and had verbal communication with them and would change his language expression based on his perception of the other person's gender.

P3i also pointed out that he would try to determine if someone is using a voice changer when he were curious about an individual who said they were generally mute on their bio and then started speaking. P2h mentioned that some people try to guess if others are using voice changers after hearing their voices, considering it is a malicious behaviour. Moreover, P3j noted that some male users learn to produce feminine voices, but these voices often sound similar and can be differentiated.

Finally, P4e simply stated that when he heard a feminine voice, he assumed it belonged to a girl, indicating that voice plays a significant role in shaping users' perceptions of others' gender within social VR environments.

Experience-based gender perception and expression

Results revealed that users' prior experiences and assumptions about gender distribution in social VR spaces influenced their perception of others. Participants sometimes relied on their personal experiences to perceive and express gender within *VRChat*.

A notable phenomenon reported within *VRChat* was the *babiniku* (バビニク) culture, in which users who identify as man in real life adopt woman avatars or personas. P3k mentioned variations in voices (natural, falsetto, otokonoko) and noted the preference avatars of *babiniku* users are anime girls. *Babiniku* culture shows the fluidity of gender expression within *VRChat*,

where users have the freedom to explore different gendered identities and appearances. The presence of *babiniku* users also influences how other users perceived and interacted with their peers within *VRChat*.

Results showed that experience-based gender perception and expression plays a significant role in shaping users' understanding and expectations of gender within *VRChat*. P2i shared her belief that 80% of *VRChat* users are men, which influences her default assumption about others' gender before hearing their voices.

Impact of social VR and FBT on users

Findings from the interviews showed specific effects of social VR and FBT technology on user interactions, self-expression, and experiences in virtual environments. Results also showed a particular interest in the unique experiences users can have in VR that may not be possible in real life, as well as the potential transfer of these experiences to their offline lives. Finally, results show how social VR and FBT enabled users to engage in mutual interactions and identity exploration beyond the limitations imposed by societal norms and expectations, pointing toward a transformative potential of social VR and FBT on users' experiences, interactions, and identities.

Selective socialization and enhanced self-expression in virtual worlds

P1f and P2j emphasized the value of being in familiar or controlled social environments, such as worlds where only friends are allowed, and the impact of avatar appearances on initiating interactions, they favoured worlds with fewer people or more private settings, as they found larger groups to be anxiety-inducing. In one-on-one settings, P4f reported feeling more at ease. P4g expressed that *VRChat* allows users to choose the worlds and people he wants to engage with, making self-expression easier. P5b expressed preferences for worlds with familiar people or where he could have more control over his social interactions. P6d also mentioned his preference for smaller, cosier worlds where he feels less observed. P4h also emphasized the importance of being able to choose worlds and interact with like-minded individuals in *VRChat*.

Respondents stated that this freedom of choice allows users to build meaningful connections, develop deeper emotional bonds, and engage in more authentic self-expression, without the constraints of societal expectations and norms. P2k and P3l highlighted the importance of engaging in activities and worlds that facilitate self-expression without the need for verbal communication and worlds that did not require verbal interaction were more appealing and comfortable. P1g expressed that he could communicate more comfortably in gaming worlds, where he could engage in activities with people whom he may not know well without feeling awkward. P2l and P3m felt more at ease in specific environments.

Experiencing the unattainable in VR and transferring it to real life

Results showed the significant impact of participants' *VRChat* experiences and FBT on their real-life interactions, behaviours, and self-perception, which provides a unique platform for self-

expression, experimentation, and skill development, which may ultimately contribute to users' personal growth and wellbeing.

P1h mentioned the flexibility and anonymity of *VRChat* enabled them to create and inhabit avatars that represent his ideal self. P3n also expressed a desire to adopt the gender represented by his anime girl avatar in real life. The fact that participants can create and control their avatars allowed them to explore their desired self-image in a safe and non-judgmental space, which can foster self-acceptance and self-discovery. Moreover, P1i stated that the interactive nature of *VRChat*, as a game and a social VR platform, allowed them to try to do the things he might not feel comfortable doing in real life, because of the social norms or the costs.

P4i also mentioned he can engage in activities like dancing in *VRChat*, which he would not do in real life. P1j, P4j, and P6e noticed improvements in their real-life communication abilities. Participants reported that *VRChat* can provide users with opportunities to practice their communication skills in a less intimidating and more controlled environment and help users develop new social skills.

Participants reported that their experiences in *VRChat* and the use of FBT carried over into their real-life interactions. P1k, P2m, P3o, and P5 mentioned adopting new gestures and behaviours from their virtual experiences.

Engaging in mutual interactions and identity exploration beyond societal constraints

Participants shared their experiences about the immersive nature of *VRChat* and its impact on their social interactions, which shows the use of FBT allows users a more authentic expression of themselves, and contributes to more engaging and immersive experiences in social VR environments.

P1l and P2n both highlighted the benefits of using a VR headset in *VRChat*, which allows users to gauge whether others are paying attention and receive immediate feedback and the difference between using VR and FBT in *VRChat* and playing on a PC. P1m and P3p emphasized the increased sense of presence and intimacy with others in *VRChat*. P3q discussed the physicality of these interactions can enhance the emotional bond between users, allowing them to establish closer connections and facilitate a sense of community within the virtual environment (using the example of “sugar お砂糖” in Japanese *VRChat* community, referring to the partner relationships in *VRChat*).

Discussion

From the results of observations and interviews, we found that cultural differences play an important role in gender performativity with FBT in social VR. First, users in social VR environments were more willing to express themselves (both verbally and non-verbally) when they feel comfortable and safe, which were achieved through factors such as shared interests, smaller groups, trust systems, customised worlds, and supportive communities (RQ1). Second, users perceived others' gender in social VR through a range of strategies including behaviour, avatar appearance, voice, and experience-based assumptions; however, these strategies are not without their limitations, such as restricted avatar design options,

potential for harassment, and normative expectations related to voice (RQ2). Last, users performed their gender using FBT technology by engaging in immersive embodied events, acting out their identity, and visualising their identity through avatar creation and design, which can influence their self-awareness, self-confidence, and community-building experiences both online and offline (RQ3).

Asian female users tended to conceal their gender and reduce their movements to avoid drawing attention to themselves as women, possibly because women are perceived to have more movement when communicating (Helweg-Larsen et al., 2004). This may also be due to the male-dominated user base in *VRChat* and the potential for unwanted attention or malicious behaviour that might arise when revealing their gender in public spaces. Violence against women, including sexual harassment and cyberbullying, is a more prominent issue in the Asia-Pacific region that may contribute to women's discomfort in being surrounded by male users in VR environments (Facts and Figures: Ending Violence Against Women and Girls, 2022). Furthermore, media representations in these societies often portray women as victims or perpetrators of violence, perpetuating the association between women and vulnerability (Dong and Xu, 2017). This negative portrayal may exacerbate the feeling of unease experienced by Asian women in social VR environments when they find themselves the focus of male users' attention.

Confucian culture, which has a profound impact on mainstream societal values in East Asia, emphasizes the values of family and marriage, with women playing primary roles as wives and mothers (Slote and De Vos, 1998). This cultural context may lead Asian women to feel additional pressure to uphold their modesty and adhere to traditional gender expectations in social interactions, as straying from the norm could be perceived as selfish (Kemper, 2017); but in virtual spaces, they can choose to not act as a woman that catering the social norm, which may let them feel more comfortable in VR.

It was not uncommon to observe communities and circles formed by individuals who share the same cultural background. While these groups can offer a sense of familiarity and belonging to their members, they may inadvertently reinforce existing social norms within the virtual space (Rossano, 2012). As a result, the influence of these norms could become more pronounced, potentially inhibiting cross-cultural interactions and exchanges. Such a dynamic may inadvertently create barriers for individuals seeking to explore and express their gender identity beyond the confines of their own culture, as they may feel constrained by the prevailing expectations within their virtual community.

The norms and social expectations imposed on women in Eastern cultures result in users unconsciously adding many requirements and new pressures when role-adopting as women in VR environments. As these pressures are pervasive in the lives of East Asian women, non-female users playing as women in social VR can gain a more authentic understanding of the challenges women face in real life and use their experiences to improve women's status. At the same time, users who want to transition to women can experience these cultural pressures in a safer environment, develop coping mechanisms, and apply their experiences to real-life gender transitions.

Cultural influence, availability, and ease of customization might be significant factors contributing to the choice of avatars in *VRChat*. The anonymity provided by platforms such as *VRChat*, combined with the immersive capabilities of FBT, enables users to express emotions and adopt personalities that are entirely different from their real-life personas. By allowing users to break free from the constraints of their cultural background, FBT in *VRChat* creates opportunities for individuals to explore new ways of expressing themselves and interacting with others. This encourages a more open and diverse exchange of ideas and experiences, ultimately enriching the social dynamics within the virtual reality environment. Therefore, cultural influence, availability, and ease of customization are important factors for game designers to consider when implementing an avatar system.

The freedom to choose one's environment and social circle, as well as the ability to customize avatars, enables users to experiment with different gender expressions and presentations at a lower emotional and social cost. This helps to accelerate the gender affirmation process, as users can take the confidence and self-understanding they have gained in the virtual world and apply it to their real lives. Moreover, the blending of virtual and real-life experiences in *VRChat* can lead to stronger connections and friendships, which can provide valuable support for individuals undergoing gender affirmation. The ability to meet people with similar experiences and share stories, advice, and encouragement can make the journey of self-discovery and affirmation less daunting and more empowering.

Fostering relationships in social VR

VR provides a more inclusive space for users to form connections, enabling them to overlook factors that might be more significant in real life, such as appearance, financial status, and nationality. VR creates an environment that allows users to remain anonymous and express themselves comfortably without the constraints of real-world identities, such as physical appearance, ethnicity, socioeconomic status, and location. By creating safe spaces, social VR platforms can play a vital role in exploring and expressing gender identity across diverse cultural contexts.

As users engage in social VR experiences, they may choose to alter their voices using voice changers or voice training to perform their gender or present their desired gender identity. In doing so, they may encounter malicious users or those who maintain traditional assumptions about gender and voice. By offering more flexible and private settings, enhancing blocking mechanisms, and fostering a more inclusive and diverse virtual experience, social VR platforms can better accommodate users' needs for safety, privacy, and authentic self-expression.

Judgments and assumptions about gender based solely on voice can be limiting and may not fully capture the complexity of gender identity. However, it is essential to acknowledge that the appearance of avatars, movements, and voice remain significant criteria for some users in the process of making friends and choosing communities in *VRChat*. This can be both a benefit and a risk. On the one hand, these aspects can facilitate users' search for potential friends and communities as they can easily identify those with similar interests or characteristics based on

their avatars. On the other hand, the reliance on avatar aesthetics could lead to a form of digital discrimination where users might be excluded or marginalized based on the appearance of their avatars, their voice or their gender. While enabling diverse expressions of selfhood, virtual communities and users need to promote greater awareness of inclusivity. At the same time, social VR platforms should continue to improve their designs to enhance users' sense of security when socializing in VR.

Designs for enhancing users' expression

Based on the current results, we recommend that social VR platforms improve their design for enhancing user's expression by, first, simplifying the process of acquiring and customising avatars and simplifying the modification and distribution of avatar models. Additionally, platforms should offer a diverse range of built-in avatar customisation features or plugins could enable more users to engage in avatar customisation as a form of expression.

As some individuals may face difficulties using voice changers due to hardware limitations, adding in-game voice changers in social VR platforms can help mitigate these issues. Offering a built-in voice modulator can reduce the learning curve for users who wish to experiment with different vocal identities without resorting to third-party applications or undergoing voice training, which can empower users to experiment with a wider range of vocal expressions, fostering a more inclusive and customizable virtual experience. In addition, a real-time in-game translator could enable users to communicate with users from various cultural backgrounds, which is conducive to the promotion of high-quality user-generated content and unique concepts in each community, attracting more new users to know about social VR, and thus facilitating cultural adaptation and integration.

Ultimately, the development of features that promote a sense of security and control over one's virtual presence is crucial for the continued growth and success of social VR platforms. Features such as user blocking or allowing users to choose specific individuals who can hear their voice, may help alleviate the occurrence and impact of harassment. By enabling users to navigate their gender expression and interactions with others in a more supportive and adaptable environment, these platforms can empower individuals to explore their identities, form meaningful connections, and break free from the constraints of societal expectations and cultural stereotypes.

Future studies should continue to examine the relationship between gender, VR, and social interactions and incorporate additional methods. For example, The current study focused on qualitative methodologies, allow participants to openly express and/or share behaviors, information, and experiences with the researchers from their own perspectives, rather than attempting to fit those perspectives into preconceived ideas or categories, or attempt to measure and quantify them. However, additional quantitative methods, larger sample sizes, other VR contexts, and more demographic samples could all significantly contribute to the exploration and conversation around the topics of gender and culture.

Conclusion

This research investigated the relationship between gender, VR, and social interaction in the context of *VRChat*, a social VR platform. Combining observation and interview approaches provided a more holistic understanding of identity in *VRChat*, and facilitated a richer understanding of this complex phenomena. The results obtained during the observations provided the basis for the interviews, and allowed participants to express their own perspectives, which may not have been fully captured through observation alone.

The findings of this study show that social VR provides a safe and controlled environment for experience and use their virtual experiences as guidance when facing challenges in real life, and the use of avatars with FBT technology enhances user engagement and allows for greater self-expression. One factor in self-expression is the importance of social and cultural backgrounds in shaping users' gender expressions within social VR platforms. Consistent with gender performativity theory, the distinct gender expression patterns exhibited by users from different cultural backgrounds support the notion that gender is not a fixed, static category, but rather a dynamic performance influenced by social norms and expectations. Gender can be formed or transformed through continuous, iterative practice influenced by individual experiences and broader cultural frameworks. Users can engage in persistent gender performances in VR environments and, through virtual experiences, question social norms in real life, thereby gaining the courage to express their gender more authentically and becoming more inclusive of non-binary identities.

In line with queer theory, this research reveals that users can challenge and subvert traditional gender norms by portraying avatars that do not conform to their real-life identities. By customizing avatars, altering their voices, learning gender-specific behaviours, or minimizing actions that convey masculine or feminine qualities, users demonstrate the fluidity of gender expression in virtual environments. This encourages a dialectical reconsideration of conventional notions of gender and identity.

By exploring users' gender expression patterns and perceptions, as well as the influence of cultural backgrounds on these aspects, the research not only contributes to a theoretical understanding of gender performativity theory, queer theory, and emancipatory experiences, but also has practical implications for the design and development of virtual reality platforms, avatar technology, and FBT systems. The findings can help game designers, artists, and users to better understand the factors influencing users' willingness to express themselves in social VR environments, facilitating more inclusive and diverse avatar design and social interactions. As virtual reality continues to evolve and become more integrated into our daily lives, it is crucial to recognize the significance (and opportunities) of these virtual spaces in shaping our identities and social interactions.

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Data availability statement

The original contributions presented in the study are included in the article/[supplementary material](#), further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by the Swedish Ethical Review Authority (etikprövningsmyndigheten). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

JZ: Conceptualization, Data curation, Investigation, Writing—original draft. JJ: Methodology, Resources, Supervision, Writing—review and editing.

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/frvir.2024.1305758/full#supplementary-material>

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