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Gender identity and perception in virtual spaces: the impact of avatar gender transition on the ZEPETO platform

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This study examines how avatar gender transitions in the metaverse influence user identity and gender perception, focusing on the cultural and social implications of these experiences. Conducted on the ZEPETO platform, the research involved female participants adopting male avatars to explore the effects on identity confirmation and self-identification. The study analyzes how metaverse elements, such as avatar representation, embodiment perception, and avatar-space interaction, contribute to identity formation and challenge traditional gender norms. Results indicate that transitioning to male avatars enhances avatar identification and identity confirmation, with these effects extending to users' real-world gender identities. These findings highlight the metaverse's potential as a transformative space for exploring and reshaping gender identities, emphasizing the need for further research into the cultural and spatial dynamics of virtual environments.

KEYWORDS

virtual environment, ZEPETO, gender identities, identity confirmation, avatar experiences

Highlights

- Analyzed the impact of gender transition through avatars on identity in the metaverse.
- Conducted experimental study on the ZEPETO platform with female users using male avatars.
- Found positive effects on avatar identification and real-world gender identity confirmation.
- Demonstrated the role of metaverse IT artifacts in shaping user identity and gender sensitivity.
- Emphasized the metaverse as a platform for promoting diversity and inclusivity through avatar experiences.

1 Introduction

1.1 Background

The COVID-19 pandemic has significantly highlighted the importance of remote communication, leading to an increased focus on the metaverse as a new Frontier for

social interaction. The metaverse, an integrated virtual community, blends physical and digital existences, enabling individuals to work, socialize, relax, and interact within a unified virtual space. Within this space, users assume the role of avatars, digital representations of their identities. Initially prevalent in gaming and chat services, avatars have evolved to influence various aspects of both online and offline life, becoming crucial tools for self-representation and identity exploration.

Today, avatars extend their utility beyond mere user-character creation, playing pivotal roles in diverse domains. For instance, in cyber shopping malls, avatars enhance the online shopping experience by allowing users to virtually try on clothes and accessories (Wang et al., 2019). In education, avatars represent students and teachers in virtual classrooms, facilitating interactive learning environments (Sundar et al., 2020). In corporate settings, avatars simulate the presence of participants in virtual meetings, fostering collaboration in shared digital spaces (Microsoft, 2021).

As digital spaces become integral to personal identity exploration, the metaverse offers unique opportunities to experiment with and challenge traditional concepts of identity, particularly gender identity. According to a survey conducted by Statista (2022), 23% of U.S. adults cited the desire to become someone different from their real selves as a motive for participating in the metaverse. Additionally, 24% expressed interest in embodying a different identity in the metaverse, highlighting a significant inclination to explore alternate versions of themselves.

Previous research, such as that by Turkle (1995) and Taylor (1999), suggests that individuals strive to fulfill social desires or ideals in virtual worlds that remain unattainable in reality, often maintaining multiple identities across different virtual contexts. This human inclination to embody diverse identities in the metaverse is further underscored by the practice of avatar gender-swapping, where users freely create and customize avatars to explore different gender identities, often in ways that challenge conventional norms (Ducheneaut et al., 2009).

Despite the opportunities for identity exploration, the metaverse is not entirely free from social constraints. Virtual environments often reproduce and even amplify existing social norms and hierarchies. For instance, Nakamura (2002) and Kendall (2002) highlighted how race, gender stereotypes, and social hierarchies are perpetuated in online spaces, suggesting that users bring their biases and prejudices into the virtual world. Similarly, Bullingham and Vasconcelos (2013) applied Goffman's (1959) theory of self-presentation to online identity construction, illustrating how users carefully curate their avatars to fit social expectations, which are influenced by both virtual and real-world social pressures. Moreover, Papacharissi (2010) pointed out that economic disparities present in the metaverse can mirror and exacerbate real-world inequalities.

Given these dynamics, the phenomenon of avatar gender-swapping in virtual spaces like ZEPETO is particularly significant. It challenges traditional gender roles and offers a platform for users to explore and affirm diverse gender identities in a relatively safe and accepting environment. This study seeks to provide a nuanced understanding of the motivations and outcomes of female gender-swapping activities within the ZEPETO platform. By focusing on how avatar experiences in the metaverse influence real-world perceptions of gender identity, this research aims to contribute to broader societal discussions on gender equality and inclusivity in the digital age.

1.2 Research questions

Grounded in Symbolic Interactionism and Self-Presentation theories, this study empirically investigates the factors influencing identity confirmation and self-identification as projected onto avatars within the metaverse, particularly focusing on their impact on gender identity. Specifically, we analyze how female users' gender identity is affected when they transition to male avatars on the ZEPETO platform. This research first examines whether metaverse IT artifacts, experienced during these gender transitions, influence avatar identity confirmation and self-identification. Additionally, we explore how these factors in turn affect the users' real-world gender identity, particularly concerning their gender awareness and understanding.

1.2.1 Research questions

RQ1: What are the specific impacts on user identity confirmation and self-identification when female users experience gender transition by adopting male avatars in the metaverse?

RQ2: How do metaverse users perceive the recognition of their intended identity by others in the metaverse when they portray avatars of different genders?

RQ3: In what ways does self-identification and identity confirmation through avatars of different genders in the metaverse influence users' sensitivity to gender identity in the real world, particularly in terms of gender awareness and understanding?

1.3 Theoretical background

1.3.1 Symbolic interactionism and self-identity

The concept of self-identity has been a central topic in social sciences, with roots tracing back to classical thought. Socrates' timeless assertion, "Know thyself," and Montaigne's reflections on Socratic reasoning—claiming that "every human possesses within themselves the conditions necessary to become human"—underscore the enduring inquiry into the nature of the self (Coulmas, 2019). Theories from philosophers and psychoanalysts such as Hegel, Freud, and Lacan have further contributed to our understanding of self-identity over the centuries. However, this study focuses on self-identity from the perspective of symbolic interactionism, particularly in relation to gender identity within virtual environments like the metaverse.

Symbolic interactionism emerged in the mid-20th century as a response to the dominance of empirical methods that prioritized objective facts, regularities, and causal relationships. This approach, championed by sociologists such as George Herbert Mead, emphasizes understanding society by observing the actions and interactions of individuals at the micro-level. Mead's work highlights the importance of language and symbols in constructing social reality, arguing that self-identity is shaped through social interactions (Mead, 1934). He extended concepts

like James's (1890) differentiation between the "I" and the "Me," and Cooley's (1902) "looking-glass self" to explore how individuals develop a sense of self through the perspectives of others.

Mead's theory of symbolic interactionism is particularly relevant in the context of virtual environments, where the self is constructed and expressed through avatars. The "I" represents the subjective, dynamic aspect of the self, while the "Me" encompasses the objective, socialized self, shaped by external interactions (Do et al., 2024). In virtual spaces, avatars function as symbolic extensions of the self, allowing users to explore and express different identities, including gender identities that may differ from their real-world selves.

Cooley's "looking-glass self" theory further contributes to understanding self-identity in virtual spaces. Cooley posits that identity is formed through the reflection of oneself in the eyes of others, emphasizing the critical role of social interactions and symbolic communication in identity formation (Cooley, 1902). In the metaverse, this process is mediated through avatars, where appearance, clothing, and gestures serve as symbols conveying identity and intentions to others. These visual elements enable users to project specific identities and engage in meaningful social interactions, despite the absence of a physical presence.

Symbolic interactionism provides a theoretical foundation for examining the fluid and dynamic self in the expanded spatiotemporal dimensions of virtual spaces (Do et al., 2024). It also helps explain the increasing interdependence between self-development and societal systems, driven by advancements in information and communication technology (Carter and Miller, 2016). Theorists like Mead, Cooley, and Dewey suggest that individuals perceive their actions by imagining how others see them, forming self-identity through interactions mediated by symbols and language (Freeman et al., 2016). In the absence of physical entities, virtual spaces rely heavily on symbolic communication for self-expression and identity formation.

In virtual environments, where avatars are the primary medium of self-expression, symbolic interactionism offers a nuanced understanding of how individuals construct and negotiate their identities. By analyzing how users attribute meaning to their self-identity in virtual contexts and how they engage in symbolic communication, this study provides deeper insights into the processes of identity formation and gender identity in the metaverse (Park, 2005).

1.3.2 Information technology (IT)

In this study, Information Technology (IT) encompasses the use of computers, networks, and electronic systems to store, retrieve, transmit, and manipulate data, particularly within virtual environments like the metaverse. IT includes a range of technologies such as hardware, software, telecommunications, and information management systems that are critical to facilitating communication and data processing in these immersive digital spaces (Beynon-Davies, 2013; Rouse, 2021).

The metaverse, an interconnected network of immersive virtual environments, is deeply reliant on advanced IT infrastructure for its operation and development. This infrastructure allows users to interact with each other and their digital surroundings through avatars, enabling a dynamic and immersive experience (Dionisio, Burns and Gilbert, 2013). Recent technological advancements, including enhanced graphics processing units (GPUs), cloud computing, artificial intelligence (AI), and machine learning (ML), have significantly contributed to the evolution of the metaverse, making it more immersive, interactive, and personalized (Kim et al., 2023; Mystakidis, 2022).

In the context of the metaverse, IT artifacts refer to the technological elements that enable users to create, customize, and interact with avatars. These artifacts include avatar creation tools, virtual reality (VR) and augmented reality (AR) devices, and social interaction platforms. Supporting these IT artifacts is essential for reducing response bias and enhancing perceived identity verification in virtual environments (Heider, 1958; Jones and Davis, 1965). The capacity to customize avatars and engage in various activities within the metaverse allows users to express their identities more accurately and interact meaningfully in these virtual spaces (Goffman, 1959).

Recent research has underscored the critical role of IT in shaping user experiences in the metaverse. For example, Turkay and Kinzer (2015) highlighted how advanced communication tools facilitated by IT enable users to form meaningful connections in virtual environments. Similarly, Zhu and Yi (2024) demonstrated that avatar customization tools significantly enhance users' self-perception and identity verification, further illustrating IT's pivotal role in user interactions within the metaverse.

1.3.3 Gender sensitivity

In this study, gender sensitivity is defined as the awareness, understanding, and responsiveness to gender differences and issues. It involves recognizing and respecting these differences, promoting equality, and fostering inclusivity across various contexts, including virtual environments like the metaverse. Gender sensitivity is particularly critical in these digital spaces, where users can explore and express different aspects of their identities, including gender identity.

Gender sensitivity holds particular significance in the metaverse due to its influence on user interactions and identity formation. Virtual environments offer a unique platform for users to experience diverse gender expressions, which can, in turn, influence their attitudes and behaviors in real life. Promoting gender sensitivity within these spaces is essential for cultivating inclusive and supportive virtual communities.

Rao and Kelleher (2005) define gender sensitivity as an acute awareness of how gender impacts individuals' experiences, opportunities, and interactions. This awareness is crucial in virtual environments, where social and cultural constructs of gender can be both challenged and reinforced. The metaverse provides users with opportunities to engage with different gender identities through their avatars, fostering a deeper understanding of gender diversity and promoting more respectful interactions (UNESCO, 2015).

Research suggests that engaging with diverse gender representations through avatars can enhance users' gender sensitivity. For example, Kim et al. (2023) found that avatar customization and gender expression in virtual spaces significantly impact users' gender awareness and identity formation. By enabling users to experiment with different gender identities, virtual environments can promote a more inclusive and empathetic understanding of gender issues.

Advancements in VR and AR technologies have further emphasized the importance of gender sensitivity. These technologies enable more immersive and realistic representations of diverse gender identities, offering users experiential learning opportunities that challenge existing stereotypes and biases (Mystakidis, 2022).

Chiang (2021) demonstrated that virtual environments could serve as powerful tools for increasing gender sensitivity by allowing users to experience life from different gender perspectives. This experiential learning can lead to a more profound understanding of gender diversity, fostering an inclusive and empathetic worldview. Enhancing gender sensitivity in virtual spaces can contribute to more positive and respectful interactions, both online and offline.

In conclusion, gender sensitivity is a crucial aspect of user interaction and identity formation in the metaverse. By promoting awareness and understanding of gender differences, virtual environments can foster more inclusive and respectful interactions. As the metaverse continues to evolve, incorporating gender sensitivity into its design and user experiences will be essential for supporting diverse and equitable virtual communities.

2 Symbolic interactionism and virtual space self-identity

In virtual spaces, self-identity is constructed and maintained primarily through symbolic interactions, allowing for a fluidity that often surpasses that found in physical spaces (Adler and Adler, 2008; Pearson, 2009; Turkle, 1995). Goffman's (1959) dramaturgical approach within symbolic interactionism is particularly useful in understanding this fluidity. He conceptualizes self-identity as a series of performances across different social contexts, distinguishing between "front stage" and "back stage" regions. The front stage is where individuals consciously manage their presentation according to social norms, striving to influence how they are perceived by others. Here, impression management is crucial, as individuals selectively reveal or conceal aspects of their identity to align with societal expectations. In contrast, the back stage offers a private space where individuals can express aspects of their identity that may contradict their public persona, free from the pressures of societal scrutiny.

In virtual environments like the metaverse, this front-back distinction becomes more flexible and dynamic. Unlike physical spaces, where the body and its attributes are fixed, virtual spaces allow users to manipulate their avatars to reflect a desired identity. This ability to customize one's appearance, gender, and other characteristics makes virtual spaces particularly conducive to experimentation with self-identity. For example, users can engage in gender-swapping or adopt entirely different personas that may not be possible in real life. The anonymity provided by virtual spaces further enhances this flexibility, making these environments akin to Goffman's back stage, where individuals have greater freedom to experiment with and express different facets of their identity.

Building on Goffman's theory, scholars like Picone (2015) have explored how the controlled self-representation common on social media platforms enhances front-stage performances. However, the lack of immediate feedback in these environments can lead to exaggerated self-presentation or indiscriminate sharing. This dynamic is also evident in the metaverse, where users curate their avatars and digital personas with great care, yet may behave in ways that are inconsistent with their real-world identity due to the perceived distance and anonymity of the virtual space.

Judith Butler's (1990) theory of gender performativity provides an additional layer of understanding to the concept of self-identity in virtual spaces. Butler argues that gender is not a stable, inherent identity but rather a performance that is continuously enacted. This idea resonates strongly within the metaverse, where users can experiment with different gender identities through their avatars. By framing gender as a performative act, we can better understand how users navigate and negotiate their identities in virtual environments. The metaverse thus becomes a stage for exploring and expressing gender in ways that challenge traditional norms, aligning with Goffman's notion of impression management, where identity is fluid and constructed through interaction.

Sherry Turkle (1995) extends these concepts by introducing the idea that virtual spaces allow for the exploration of multiple selves. In her seminal work *Life on the Screen: Identity in the Age of the Internet,* Turkle argues that cyberspace provides a unique opportunity for individuals to experiment with aspects of their identity, such as gender, in ways that may not be possible in the physical world. Through avatars, users can experience different facets of themselves, achieving a sense of vicarious satisfaction. This is particularly relevant for female users in the metaverse who, as this study explores, are able to experiment with male identities through their avatars, engaging in experiences that might be inaccessible or socially restricted in real life.

In summary, symbolic interactionism, particularly Goffman's dramaturgical theory, provides a robust framework for understanding self-identity in virtual spaces. These environments allow for a fluid and flexible construction of identity, where users can engage in impression management and explore different facets of their self, including gender, in ways that challenge traditional norms. The combination of Goffman's insights with Butler's theory of performativity and Turkle's analysis of the virtual self offers a comprehensive view of how identity is navigated and negotiated in the metaverse.

Self-Presentation Theory, as outlined by Goffman (1959), posits that individuals are motivated by two primary goals when presenting themselves to others (Schlenker, 2003). First, individuals aim to influence others and secure social or material rewards through self-representation (Kim and Sundar, 2012). For instance, individuals may emphasize positive traits to gain favor or approval, thereby securing future benefits from those who perceive them positively. The second motivation is to establish and maintain relationships with individuals who share similar identities (Kim and Sundar, 2012). This notion is supported by research conducted by Ma and Agarwal (2007), which demonstrated that self-representation in online communities serves to build and strengthen relationships among community members. In such contexts, features like virtual copresence, persistent labeling, self-presentation, and deep profiling contribute to a heightened sense of perceived identity verification. As individuals perceive greater identity verification, they are more likely to engage and contribute within the community.

Perceived identity verification refers to the extent to which individuals believe that their identity is recognized and confirmed by others within a social group. Research on this concept has

predominantly focused on online communities (Cheung, Chiu and Lee, 2013; Huang et Park, 2021; Ma and Agarwal, 2007; Zhao, Grasmuck and Martin, 2008), blogs (Tan and Teo, 2011), and virtual teams (Wilson, Straus and McEvily, 2006). However, there is limited research on perceived identity verification within the context of the metaverse. Identity in the metaverse differs significantly from general online identity. Lin and Wang (2014) observed that users often create multiple avatars in virtual environments, each embodying different aspects of their identity. Neustaedter and Fedorovskaya (2009) further argued that avatars are not merely representations but reflect users' identities based on their roles and interactions. Ipsos (2022) suggested that the identities expressed in the unrestricted space of the metaverse are more fluid, potentially differing significantly from real-world identities.

Given the focus on avatars in this study, it is important to emphasize their impact on user identity and social interactions. Avatars serve as dynamic tools for self-representation and identity experimentation, enabling users to explore various facets of their personality and social roles. Yee and Bailenson (2007) demonstrated the "*Proteus* effect," wherein the characteristics of an avatar influence the behavior and attitudes of its user. For instance, users who embodied taller avatars exhibited more confident behavior in virtual interactions. This underscores the significant role of avatars in shaping user experiences and interactions within virtual environments.

Furthermore, Ducheneaut et al. (2009) found that the personalization of avatars enhances social presence and engagement in virtual worlds. The ability to customize avatars allows users to project their desired identities, fostering deeper connections with others. This process of customization and feedback reinforces the user's self-concept and enhances the sense of immersion and identity verification.

In this study, we extend the concept of perceived identity verification to the metaverse by defining it as perceived avatar identity verification. For female users in the metaverse, this concept refers to the extent to which they believe that the identity they intend to convey through their avatars is accurately perceived and confirmed by other users. Building upon Ma and Agarwal's (2007) research on online communities, this study explores how metaverse-specific IT artifacts influence perceived avatar identity verification. Specifically, we examine how these artifacts affect users' beliefs about whether their intended avatar identity is effectively communicated and validated by others in the metaverse.

2.1 Conceptualizing the metaverse

The term "metaverse" was first popularized by Neal Stephenson in his 1992 novel *Snow Crash*, where it described a virtual world where characters interact through avatars—digital representations of their physical selves. However, the idea of virtual worlds predates this term. In William Gibson's 1984 novel *Neuromancer*, the term "cyberspace" was used to describe a computer-generated virtual space, contributing to the broader public recognition of the concept of "cyber."

Since then, the metaverse has evolved into a complex and multifaceted concept, extending beyond a single virtual world. According to the Acceleration Studies Foundation (ASF), the metaverse is defined as the "convergence of physically enhanced reality and a virtually persistent virtual space" (Smart et al., 2007). This definition emphasizes the metaverse as both an existing space and one that integrates with reality. However, the boundaries of what constitutes the metaverse *versus* traditional virtual spaces remain ambiguous, largely due to ongoing technological advancements and the evolving nature of related services.

ASF's classification of the metaverse into various types, based on technological aspects like augmented reality and simulation, as well as internal-external characteristics such as intrinsic and extrinsic elements, provides a framework for understanding the concept. However, given the rapid pace of technological change, this classification serves more to explain the complexity of the metaverse than to offer a precise definition (Smart et al., 2007).

Recent academic discourse further refines the metaverse as an interconnected network of immersive virtual environments where users interact with each other and digital surroundings through avatars (Dionisio, Burns and Gilbert, 2013). This definition underscores the metaverse as both a technological and social construct, characterized by its persistence, immersiveness, and interactive nature.

Despite these efforts, the conceptualization of the metaverse remains a topic of debate. Some scholars view it as a specific virtual space, similar to platforms like Second Life or ZEPETO, where users participate in social, economic, and cultural activities (Boellstorff, 2008). Others argue that the metaverse is a broader concept encompassing various digital experiences and interactions that extend beyond individual platforms, with the potential to integrate and augment real-life experiences (Mystakidis, 2022). While studies on platforms like Second Life contribute to understanding the metaverse, they do not necessarily equate to research on the metaverse as a whole.

To navigate the ongoing debate and lack of consensus, this study adopts a hybrid approach. The metaverse is conceptualized here as a continuum of immersive virtual environments that enable complex interactions among users and between users and their virtual surroundings. These environments range from specific virtual worlds to augmented reality applications, unified by their capacity to support rich, persistent, and embodied user experiences.

2.2 ZEPETO as part of the metaverse

ZEPETO is a significant component of the metaverse, offering immersive, interactive, and persistent virtual environments that differentiate it from conventional social network sites. Unlike traditional platforms, which rely on text and image-based interactions, ZEPETO provides fully immersive 3D environments where users can explore, socialize, and participate in various activities, fostering a sense of presence and engagement that extends beyond typical online interactions (Dionisio et al., 2013).

A key feature of ZEPETO is its extensive avatar customization options, allowing users to modify avatars' physical appearance, including facial features, hairstyles, clothing, and accessories. This high level of customization supports self-expression and identity exploration, enabling users to experiment with different gender and personality traits—hallmarks of metaverse platforms (Mystakidis, 2022).

ZEPETO also supports a dynamic virtual economy where users can create, buy, and sell virtual items, contributing to the platform's persistence and interactivity. This virtual economy enhances the immersive experience and fosters community collaboration, aligning ZEPETO with key metaverse characteristics (Boellstorff, 2008).

In addition to economic activities, ZEPETO facilitates rich social interactions through various communication tools, such as text and voice chat, and animated gestures. These features enable users to form virtual communities, participate in events, and collaborate on projects, fostering deeper connections and shared experiences (Hennig-Thurau et al., 2022).

Moreover, ZEPETO integrates augmented reality (AR) features that blend virtual avatars with real-world settings, bridging the gap between digital and physical spaces. This AR integration enhances the immersive quality of the platform and offers novel ways for users to express their identities (Turkle, 1995).

ZEPETO's unique affordances significantly shape user interactions and avatar construction, enabling deeper self-expression and identity exploration. The platform's immersive environments, advanced customization tools, and social interaction features encourage users to experiment with various aspects of their identities, contributing to a richer and more engaging metaverse experience.

2.3 The relationship between the metaverse, online spaces, and real life

The relationship between the metaverse, online spaces, and real life is increasingly complex and intertwined. Recent studies suggest that the boundaries between these spaces are becoming increasingly blurred, with experiences in virtual environments being regarded as extensions of real-life activities rather than separate entities.

One perspective views the metaverse and online spaces as distinct from real life, offering unique environments where users can escape daily routines and explore new identities. This view suggests that virtual worlds provide a space for experimentation and identity exploration without the constraints of reality (Boellstorff, 2008).

Conversely, a growing body of research supports the idea that the metaverse and online spaces are integrated into the continuum of real life. This perspective argues that activities and interactions in virtual environments have tangible effects on users' real-world identities, relationships, and behaviors. For instance, Bailenson (2018) demonstrated that immersive virtual experiences could have lasting impacts on users' attitudes and behaviors outside the virtual environment, highlighting the significance of virtual experiences as extensions of real-world identity formation.

Hennig-Thurau et al. (2022) further examined how interactions in the metaverse influence social behaviors and attitudes in real life, finding that experiences in the metaverse can enhance or transform social interactions in the physical world. Similarly, Triberti et al. (2017) explored how avatar experiences in virtual spaces contribute to users' self-perception and identity formation, revealing that virtual world experiences significantly impact users' self-awareness and behaviors in real life.

These findings suggest that the metaverse and online spaces are not merely separate realms but integral parts of users' holistic life experiences. The interplay between virtual and real environments underscores the need to consider the metaverse as a vital component of modern social and identity processes, breaking down the boundaries between these spaces and viewing them as parts of a unified life experience.

2.4 Identity representation through avatars in the metaverse

In the metaverse, avatars function as pivotal representatives of individual identity, enabling users to express their desired personas through various customization features, including facial characteristics, clothing, hairstyles, and poses (Talaifar and Swann, 2020). This digital embodiment allows users to seek confirmation and validation of their identities from others in the virtual environment.

Research on the metaverse and avatar usage has been ongoing since the inception of platforms like Second Life, one of the pioneering metaverse environments. Studies have explored factors influencing users' intentions to engage with the metaverse, identifying key drivers such as perceived enjoyment (Mäntymäki and Merikivi, 2010), alignment of expectations (Jung and Pawlowski, 2014), satisfaction, emotional commitment (Zhou et al., 2012), system and information quality (Shiau and Huang, 2022), and subjective norms along with perceived behavioral control (Hung et al., 2014).

Avatars play a significant role in shaping users' intentions to use the metaverse. Kim et al. (2023) found that avatars resembling the user positively influence self-awareness and presence, leading to sustained engagement with the metaverse. Huang et al. (2023) highlighted the positive impact of avatars on social presence, while Agag et al. (2019) demonstrated that social interactions mediated through avatars in game-like metaverses significantly influence continued usage. Bessière et al. (2007) observed that users often create game characters reflecting their ideal self-image, particularly those with lower psychological wellbeing. Additionally, Bullingham and Vasconcelos (2013) revealed that users often recreate themselves in Second Life, and Lin and Wang (2014) found that users maintain multiple avatars in virtual environments, each configured differently to reflect varying motivations and contexts.

Despite extensive research on the factors influencing metaverse usage and the role of avatars in self-concept projection, there is a notable gap in understanding how projecting different gender identities onto avatars, particularly among female users, impacts their real-world gender identity. This study addresses this gap by exploring the identity dynamics involved when female users in the metaverse adopt male avatars. It investigates how these experiences of embodying a male avatar influence the users' real-world gender identity through processes of identity confirmation and role play.

3 Research model and hypotheses

The research model utilized in this study is depicted in Figure 1. Building on the framework established by Ma and Agarwal (2007) in their study of avatar identity within online communities, this model

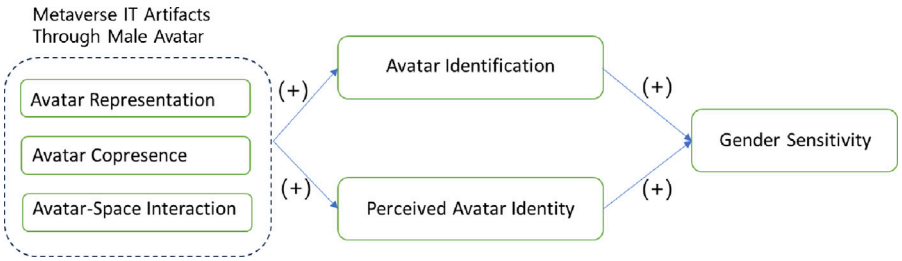

FIGURE 1
Metaverse IT artifacts affecting perceived avatar identity verification.

TABLE 1 Metaverse IT artifacts affecting perceived avatar identity verification.

Variable	Avatar representation	Avatar copresence	Avatar-space interaction
Operational definition	The degree to which an avatar's appearance is expressed through an artifact that supports avatar representation	The degree to which you feel like you exist with other avatars through communication support artifacts between avatars	How much an avatar interacts with a virtual space through space artifacts in a metaverse space
ZEPETO Artifact Example	- Customizing Avatar's face, hairstyle, costumes, etc - Avatar's representation, pose (default setting)	- Text and Voice Chat - Facial representations, poses, gestures between avatars (if they change in communication) - Enjoy games or participate in events with other avatars	- Access to the world - Interacting with objects in the world (e.g., sitting in a chair, opening doors, touching objects, etc.) - Move within the world (walking, running, etc.) - Perform quests within the world (participate in games, take photos, etc.)

identifies three key metaverse artifacts—avatar presentation, avatar copresence, and avatar-space interaction—as independent variables. These variables are posited to influence perceived avatar identity verification within the metaverse, a concept critical to understanding how users identify with and confirm their avatar identities.

We hypothesize that these metaverse artifacts will positively affect both avatar identification and perceived avatar identity confirmation. In turn, these factors are expected to exert a positive influence on users' gender sensitivity, reflecting an enhanced awareness and responsiveness to gender-related issues as mediated by their experiences in the metaverse. To control for potential confounding factors, the research model includes age, sex, education level, usage frequency, and usage duration as control variables. These demographic and behavioral factors are accounted for to isolate the effects of the independent variables on gender sensitivity.

3.1 IT artifacts of the metaverse through avatar

According to self-representation theory, individuals express their identity through various signals, including facial expressions and gestures (Goffman, 1959). In the metaverse, however, traditional offline identity representations may be limited or unavailable, leading to potential errors such as correspondence bias. This bias occurs when the behavior of an individual is misattributed to internal factors, such as personality traits, rather than external social influences (Heider, 1958; Jones and Davis, 1965). Such misinterpretations can arise due to the arbitrary interpretation of incomplete signals transmitted through information technology (IT) within the metaverse.

To mitigate response inference bias and enhance perceived identity verification, it is crucial to support a variety of IT artifacts in online environments like the metaverse. The ability to freely customize avatars on metaverse platforms, including facial features, poses, and expressions, allows users to express their desired identity. This customization, coupled with the platform's capacity to support diverse activities such as socializing, gaming, and exploration, facilitates alignment between the projected avatar identity and the user's self-perception. Moreover, the ability to interact with the virtual environment through avatars aids others in confirming the avatar's identity.

In this study, we categorize metaverse IT artifacts related to avatars into three primary variables, as detailed in Table 1. These variables are avatar presentation, avatar copresence, and avatar-space interaction, all of which are essential for reducing response inference bias and enhancing the accuracy of perceived identity verification within the metaverse.

3.1.1 Avatar representation

In the metaverse, avatars act as proxies for users, allowing them to express their identities and seek confirmation from others (Talaifar and Swann, 2020). By customizing various features of their avatars—such as facial features, hairstyles, clothing, accessories, and poses—users convey the identities they wish to present. These customizable elements, collectively referred to as avatar representation features, play a crucial role in both self-presentation and how users are perceived by others.

Research has shown that users often customize their avatars to reflect either their actual selves or an idealized version. Bullingham

and Vasconcelos (2013) found that users of Second Life frequently design their avatars to resemble their real-world appearance. In contrast, Bessière et al. (2007) and Lemenager et al. (2020) explored how users in game-based virtual environments create avatars in more idealized forms. According to Bessière et al. (2007), individuals with lower psychological wellbeing are more inclined to create idealized avatars, suggesting that users are motivated to configure their avatars in ways that align with their desired self-presentation.

The term "avatar representation" in this context refers to the various customizable aspects of an avatar, including:

Facial Features: Users can modify the shape, size, and expressions of their avatar's face to either closely match their own or to explore entirely different looks.

Hairstyle: Customizing the avatar's hair—including color, length, and style—allows users to experiment with different aesthetic identities.

Clothing and Accessories: Users choose from a diverse range of clothing styles and accessories, often reflecting their fashion preferences or exploring new styles.

Poses and Gestures: Avatars can be animated to perform various poses and gestures, enhancing the expressiveness of the user's virtual presence.

The ability to customize avatars according to personal preferences is expected to significantly influence how users identify with their avatars and how effectively they convey their intended identity to others. This leads to the following hypotheses:

H1: The use of metaverse IT artifacts to support avatar representation has a positive impact on avatar identification.

H2: The use of metaverse IT artifacts to support avatar representation has a positive impact on perceived avatar identity verification.

3.1.2 Avatar copresence

In the context of this study, copresence refers to the subjective sensation of being in the presence of others within a shared virtual environment, as described by Slater et al. (2000). Khalifa and Shen (2004) proposed that interactivity and the speed of interaction are key factors influencing the perception of others' presence. They argue that IT artifacts facilitating immediate interactions, such as chat and instant messaging functionalities, significantly enhance the sense of copresence. Empirical studies have supported this, demonstrating the positive impact of mobile chat (Ogara et al., 2014) and social networking sites (Gao et al., 2017) on the perception of others' presence. Additionally, Ma and Agarwal (2007) found that copresence plays a crucial role in perceived identity confirmation.

Within the metaverse, users manipulate their avatars to interact with others, with avatars serving as proxies for communication, activities, and relationship building. While the user operates behind the avatar, it is the avatar that engages with others within the metaverse. Users control their avatar identities by employing different avatars as needed in various contexts. Therefore, artifacts that facilitate avatar copresence—such as engaging in text or voice chats with other avatars or participating in activities like dancing—are likely to influence both the user's avatar identification and how others perceive the identity projected onto the avatar. Based on these considerations, the following hypotheses are proposed:

H3: The use of metaverse IT artifacts that induce avatar copresence positively influences avatar identification.

H4: The use of metaverse IT artifacts that induce avatar copresence positively influences perceived avatar identity confirmation.

3.1.3 Avatar-space interaction

In metaverse environments, avatars engage in various activities within virtual spaces, connecting to themed sub-worlds, creating new worlds, and interacting with objects within these environments. Milligan (1998) posited that individuals develop attachment to a space through interactions that involve spatial awareness and sensory perception. This concept extends to virtual worlds, where Goel et al. (2011) suggested that spatial attachment forms similarly, with individuals who develop strong attachments to a virtual space likely seeking similar spaces for comparable experiences.

Positive experiences in virtual spaces increase the likelihood of revisitation (Xu et al., 2019), and positive interactions with objects within these spaces lead to favorable emotions toward the space (Shiau and Huang, 2022). Self-verification theory, articulated by Burke and Stets (1999), suggests that individuals strive for consistency between their self-concept and their experiences. When feedback aligns with their self-concept, individuals experience positive emotions; the absence of self-verification, however, can result in negative emotions. This theory is particularly relevant in virtual environments, where avatars serve as extensions of the self.

Persistent revisitation of a specific space implies satisfaction with the spatial experiences facilitated by avatars. The alignment of virtual interactions with users' self-concept through their avatars leads to positive emotional outcomes, reinforcing their attachment to these spaces. Moreover, as users form their identities based on the roles assigned to their avatars (Triberti et al., 2017), interactions with specific spaces and objects are essential for maintaining avatar self-consistency and identity confirmation.

Through consistent and meaningful interactions within virtual spaces, users achieve a sense of self-verification via their avatars, enhancing both their identification with the avatars and the perceived avatar identity. Based on this, the following hypotheses are proposed:

H5: The use of IT artifacts related to interaction within virtual spaces positively affects avatar identification.

H6: The use of IT artifacts related to interaction within virtual spaces positively impacts perceived avatar identity confirmation.

3.2 Identifying avatar

Identification theory posits that identification involves adopting another's identity, internalizing their image and role, and forming emotional bonds through shared goals (Kim, 2016; Koulouris et al., 2020; Meissner, 1973; Olds, 2006; Strachey, 1969). Traditionally, identification was explored in media such as books, TV, and movies

to explain the connection between characters and audiences. Oatley (1994) suggests that identification arises from empathizing with emotions linked to adopting others' goals. Maccoby and Wilson (1957) describe it as the illusion of experiencing another's situation as if it were one's own, imagining oneself in the place of the object of identification, understanding their circumstances, and sharing their emotions (Knutzen and Kennedy, 2012).

Expanding identification theory to avatars, users can recognize themselves through their avatars, establishing emotional and cognitive connections with them (Cohen, 2001; Van Looy et al., 2012). Initially, avatars were simple computer-generated images representing users in online interactions (Nowak and Rauh, 2005). However, metaverse spaces transcend traditional online environments by integrating daily life and economic activities (Dionisio et al., 2013). Avatars have evolved from mere visual proxies to complex virtual entities that connect users' realities with virtual environments, serving as surrogates for users' identities and desires (Doyle, 2009; Lin and Latoschik, 2022).

Users value the anonymity provided by virtual spaces, which allows them to explore different identities and fulfill unmet desires through their avatars. Anonymity, particularly in gender swapping contexts, enables users to maintain privacy while experimenting with different identities, enhancing their attachment and identification with their avatars (Wang et al., 2019). This anonymity, combined with self-expression through avatars, reflects a shift from material pursuits to seeking self-actualization and vicarious satisfaction in virtual spaces. Avatars, as visual extensions of personal identity, are essential tools for self-representation, allowing users to create alternate selves, build relationships, and transcend social boundaries.

In platforms like ZEPETO, users align their avatars with the image they aspire to, leading to emotional attachment and a strong sense of identification. In this study, identification refers to the extent to which users perceive their avatars as counterparts in the metaverse. Based on identification theory, this study hypothesizes that avatar identification influences users' future activities and responses in the metaverse. Building on Van Looy et al. (2012), the study examines factors influencing users' identification with avatars and how this identification affects gender sensitivity when female users engage with male avatars in ZEPETO.

H7: Among female users, self-identification with a male avatar within ZEPETO significantly impacts their perception of traditional gender roles and openness to gender diversity.

3.3 Perceived self-identity

Self-verification theory posits that individuals experience an increased sense of belonging when their self-presentation is understood and acknowledged by others within a group (Swann et al., 2000). Additionally, self-verification enhances active participation in relationships, as individuals are more engaged when their identities are validated by others (Swann et al., 1992; Swann and Read, 1981). In online gaming environments, research indicates that team members who achieve identity confirmation are more likely to increase their participation (Teng, 2017). This dynamic extends to virtual worlds like Zepeto, where users who receive recognition for the identity they establish through their avatars are likely to experience a heightened sense of belonging within the metaverse. As users engage more deeply with their male avatars, they are expected to develop a stronger sense of belonging in these roles, which may, in turn, influence their gender sensitivity.

Based on this theoretical framework, we propose the following hypothesis:

H8: The confirmation of an avatar identity perceived as being of a different gender will have a significant impact on a user's gender sensitivity.

3.4 Perceived gender sensitivity

Gender sensitivity refers to the ability to detect and understand gender imbalances, particularly in recognizing discriminatory elements in everyday life. This sensitivity involves a heightened awareness of societal issues, including gender-based violence, discrimination, and inequality (Bae and Jeong, 2024). Enhancing perceived gender sensitivity entails increasing individuals' understanding of gender dynamics, raising awareness of discrimination, and fostering a commitment to act for change (Kroese, 2022).

Gender sensitivity is critical across all social institutions, with gender-related discrimination often rooted in gender-based privileges. Women, in particular, are frequently perceived as facing social disadvantages. To address this, gender sensitivity training is widely implemented, particularly in workplaces, to raise awareness of gender issues and promote equality (Brisolara, 2014). This type of training has gained popularity, especially in sectors like healthcare and education in the United States (Kroese, 2022).

Efforts to enhance gender sensitivity often involve education or training programs, commonly referred to as "gender training." Gender training is defined as providing formal learning experiences aimed at increasing public awareness of gender issues (Prasanna, 2021). According to Oxfam's gender training manual, gender training involves understanding gender inequality and enhancing the capacity to recognize and respect women's unique contributions (Williams et al., 1994). While gender training is a component of broader gender equality education, it specifically emphasizes understanding gender, recognizing discrimination, and promoting self-reflection. Since the 1990s, international organizations have increasingly conducted gender training, particularly targeting practitioners and policymakers, recognizing that development efforts are not gender-neutral and that women's participation is essential to the development process.

In recent years, South Korea's Ministry of Education has made concerted efforts to improve gender sensitivity education. For example, the 2015 revision of sexual education standards aimed to correct distorted perceptions of gender roles and prevent internet-related sexual crimes, such as online child sexual abuse (Choi and Lee, 2023). The increasing need for non-face-to-face online sexual education is also reflected in growing parental demand for revised sexual equality education curricula and the implementation of virtual sex education programs. Consequently, this study hypothesizes that gender sensitivity can be enhanced through the

use of IT artifacts within metaverse platforms, allowing users to virtually experience different gender roles. This study aims to validate this hypothesis.

4 Research methodology

4.1 Data collection

In this study, data were collected using a survey targeting users with experience using ZEPETO, South Korea's largest metaverse service. ZEPETO, launched in 2018, has accumulated 300 million users, created 4.1 million items, and achieved a cumulative item sales volume of 68 million USD as of 2022, making it the largest metaverse platform in the country. The global average Monthly Active Users (MAU) of the ZEPETO application (Android + iOS) in 2023 was recorded at 23.16 million (KED Global, 2022). Considering that 75.8% of ZEPETO users are female (Madtimes, 2023), it was deemed suitable to limit the study participants to females. As ZEPETO is widely used by females in both domestic and global markets, this study aims to enhance its reliability. Data collection was conducted online using Google Forms from June 15 to 28 July 2023, over a 2-week period. The participants were required to use a male avatar in ZEPETO during this timeframe and then respond to the survey. Response data were collected from 29 July 2023 for 1 week.

This study targeted 150 adult women (aged 18–40 years), known for their extensive use of metaverse platforms. The sample size was determined using G*power 3.1.9 program. For the multiple regression analysis with a significance level of 0.05, power of 0.95, and effect size of 0.10 as criteria, the minimum sample size was estimated to be 135. Considering a 10% dropout rate (owing to unreliable responses), 150 participants were included in the study. The study was approved by the Ewha Womans University Institutional Review Board (Reference ewha-202306-0004-01).

4.2 Development of measurement tools

The survey measurement tools were either adapted from existing studies or newly developed to fit the context of this study. The independent variable of Avatar Embodiment was adapted from Ma and Agarwal's (2007) measurement tool, and modified to suit the context of this study. The Avatar-Space Interaction variable was modified based on Mennecke et al. (2011). A new survey was developed for avatar representations.

Items related to Avatar Identification, the dependent variable reflecting the users' sense of avatar identification, were modified from Li et al. (2013) to align with the context of this study. The measurement tool for Perceived Avatar Identity Confirmation was adapted and modified from Ma and Agarwal (2007). In their research, respondents were asked to answer the question "In this online community, I am __" five times before being asked about perceived identity confirmation. Considering respondent fatigue, we adapted the measurement tool to ask twice, "In ZEPETO, my avatar is __," and presented the measurement tool for perceived avatar identity confirmation.

The measurement tool for the perceived avatar identity confirmation was developed based on Zimmermann et al. (2023) and Chou and Lu (2021). The survey on sexual awareness was adapted from the items provided by the Seoul Metropolitan Office of Education (Seoul Metropolitan Office of Education, 2020) for sexual awareness measurement, modified to fit the context of this study.

The measurement tools developed in this study were designed based on feedback from university students, graduate students, and professors with experience in using ZEPETO. Before conducting the main survey, a pilot survey was conducted with 50 participants including university students, graduate students, and professors with experience in ZEPETO. From the pilot survey, 45 valid responses were obtained. The measurement tools were revised based on the feedback received during the pilot survey to develop the final measurement tools. All measurement tools were constructed on a 5-point Likert scale, and the measurement tools utilized are summarized in the Appendix. To ensure the reliability of the responses, an attention check item was added in the middle of the survey.

The survey participants were recruited through blogs, social media, and other online platforms targeting ZEPETO users. An online survey link was distributed via email. Prior to initiating the survey, participants were provided with a thorough explanation of the research purpose, and those interested in participating were encouraged to click on a link to join the study. Subsequently, the participants were instructed to use male avatars and experience ZEPETO for 2 weeks before completing the survey.

4.3 Respondent analysis

Of the 150 survey participants, data from 144 individuals who successfully passed the attention check were included in the final analysis. All respondents were female. The majority (n = 78, 54.2%) were in their 20s, with 33 respondents (22.9%) in their 30s, 23 respondents (16%) in their teens, and 10 respondents (7%) in their 40s. Regarding ZEPETO usage frequency, 59 participants (41%) reported using the platform 1–3 times per week, and 45 participants (31.3%) used it 4–5 times per week, indicating high engagement among users. In terms of session duration, 52 respondents (36.9%) reported spending 30 min to less than 1 hour per session, while 44 respondents (31.2%) reported using ZEPETO for less than 30 min per session. This data suggests that over half of the respondents typically engage with the platform for less than 1 hour per session.

4.4 In-depth interviews

To complement the quantitative survey data, we conducted in-depth online interviews to gain a deeper understanding of participants' experiences and perceptions related to avatar gender transition. This qualitative component provided rich, contextual data that quantitative methods alone could not fully capture, particularly concerning the shifts in perceptions and behaviors before and after using male avatars on ZEPETO.

4.4.1 Participant selection for in-depth interviews

From the 144 survey respondents, 20 participants were purposively selected for in-depth interviews. The selection criteria

aimed to ensure diversity in age, gender perceptions, and engagement levels with the ZEPETO platform, thereby capturing a wide range of perspectives. Participants who indicated their willingness to engage in follow-up interviews were considered for selection.

4.4.2 Timing of the interviews

The in-depth interviews were conducted approximately 2 weeks after the survey completion. This interval allowed participants time to reflect on their experiences, providing a sufficient gap to observe any changes in perceptions and behaviors resulting from the avatar gender transition.

4.4.3 Purpose of in-depth interviews

The primary objective of the in-depth interviews was to qualitatively explore changes in participants' perceptions and experiences before and after using male avatars. This approach aimed to capture how avatar gender transition influenced their self-identity, gender perceptions, and motivations for choosing a different gender for their avatars, along with the broader implications for their real-world interactions and self-perception.

4.4.4 Interview procedure

The interviews were conducted online using Zoom, providing flexibility and convenience for participants. Each session lasted approximately 45–60 min and followed a structured interview protocol designed to elicit detailed and reflective responses.

4.4.5 Interview guide

The interview guide was structured to explore various aspects of avatar gender transition, motivations for choosing a male avatar, and the impact on identity and gender perceptions. Key questions included:

4.4.5.1 Experience with gender transition

> "Can you describe your experience of using a male avatar on the ZEPETO platform over the past two weeks?"

> "What were your initial thoughts and feelings when transitioning your avatar's gender to male?"

> "How did your interactions within the ZEPETO platform change after switching to a male avatar?"

4.4.5.2 Impact on self-perception and identity

> "How has using a male avatar affected your perception of your identity and gender?"

> "Have you noticed any changes in how you perceive yourself or how you believe others perceive you since using the male avatar?"

> "In what ways, if any, did the male avatar allow you to express aspects of your identity that you might not normally express in real life?"

4.4.5.3 Motivations for choosing a male avatar

> "What motivated you to choose a male avatar for this experiment?"

> "Did you have any specific goals or expectations when deciding to use a male avatar?"

> "How do these motivations compare to your reasons for creating or customizing avatars in other virtual environments?"

4.4.5.4 Social interactions and perceptions

> "How do you think others within the ZEPETO platform perceived your male avatar?"

> "Did you experience any differences in social interactions or acceptance when using a male avatar compared to using a female avatar?"

> "Can you share any specific instances where being perceived as male influenced your virtual interactions?"

4.4.5.5 Real-world implications

> "How, if at all, has your experience with a male avatar on ZEPETO influenced your real-world interactions or self-perception?"

> "Have you found yourself thinking differently about gender roles or identities in your daily life as a result of this experience?"

> "Do you believe this experience has had any long-term effects on your understanding or sensitivity towards gender identity issues?"

4.4.5.6 Reflective insights

> "Looking back on the two-week period, what are the most significant insights or takeaways from using a male avatar?"

> "If given the opportunity, would you continue to use a male avatar, and why or why not?"

> "How do you think virtual experiences like this can contribute to broader societal understanding and discussions about gender identity?"

These questions were designed to elicit rich, contextual responses that provide a deeper understanding of participants' experiences, helping to compensate for the absence of a control group by offering qualitative insights.

4.4.6 Data collection and analysis

All interviews were recorded with the participants' consent and transcribed verbatim for analysis. The qualitative data were analyzed using thematic analysis, a method that involves identifying, analyzing, and reporting patterns (themes) within the data

TABLE 2 Results of confirmatory factor analysis.

Variable		Acronym	Question	Factor loading	AVE	CR
Avatar Representation		AP1	I customize the features of my avatar on ZEPETO, such as facial features, height, body shape, and leg length, according to my preferences	0.749	0.526	0.766
		AP2	I have the ability to personalize the style of my avatar on ZEPETO, including hairstyles, accessories, clothing, and shoes, as I desire	0.813		
		AP3	I express my avatar the way I want through poses and gestures on ZEPETO.	0.597		
Avatar Copresence		AC1	I feel the presence of being with other avatars on ZEPETO.	0.762	0.540	0.778
		AC2	I sense that I am in the same space with other avatars on ZEPETO.	0.682		
		AC3	While using ZEPETO, I experience the feeling of coexisting with other avatars	0.758		
Avatar-space Interaction		ASI1	I feel that my avatar is interacting with objects in the world as I desire	0.686	0.528	0.817
		ASI2	I believe that my avatar is interacting with objects in the world as I intend	0.697		
		ASI3	I sense that my avatar is interacting with the world as I wish	0.747		
		ASI4	I think that my avatar is interacting with the world as I intend	0.772		
Avatar Identification		AI1	My ZEPETO avatar is like me in many ways	0.885	0.768	0.908
		AI2	I identify with my ZEPETO avatar	0.830		
		AI3	My ZEPETO avatar is an extension of myself	0.912		
Perceived Avatar Identity		PAI1	I think others know the identity I want to show through my avatar	0.806	0.614	0.864
		PAI2	Others have a good understanding of the identity I was trying to show through my avatar	0.816		
		PAI3	Others are well aware of the identity I want to show through my avatar	0.758		
		PAI4	In ZEPETO, others understand the identity of my avatar well	0.751		
Gender Sensitivity	Gender Equality Awareness	GS1	I have thought about starting attendance numbers from number 1 for male students and 31 for female students	0.882	0.710	0.924
		GS2	Men are more suitable than women for executive-level positions responsible for decision-making			
		GS3	It is natural that men have more sexual curiosity than women			
	Organizational Culture	GS4	My community is in an atmosphere of evaluating a friend's appearance or sexual attractiveness	0.706		
		GS5	In my community, if someone has different expectations and evaluations (gender discrimination) by sexual joke or gender, it's an atmosphere where I can point out wrongdoing			
		GS6	I have trust that my community will help my colleagues when they discuss issues such as sexual harassment and sexual violence			
	Willingness to practice gender equality	GS7	I think men are more suitable in science and technology fields such as engineering/industrial industry than women	0.860		

(Continued on following page)

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TABLE 2 (*Continued*) Results of confirmatory factor analysis.

Variable	Acronym	Question	Factor loading	AVE	CR
Cyber Sexual Violence	GS8	I will tell anyone who says sexual jokes or sexist things around me not to do that	0.884		
	GS9	It is a problem to review other people's bodies and share body photos in private spaces such as kakaotalk rooms with acquaintances			
	GS10	When you take a picture or video, you should always ask the other person for permission and take it			
	GS11	Sexual violence that occurred online is no more serious than sexual violence that occurred offline			
	GS12	Even if the victim's real name (name) is not mentioned, those who spread or divulge secrets about sexual violence and sexual harassment cases may be punished			
Sexual Violence Legislation	GS13	It is a problem if you do not distribute sexual activity videos or physical exposure videos of children and adolescents	0.867		
	GS14	Photos or videos that have been approved for filming can be distributed freely			
Model's goodness of fit			χ^2 (df) = 282.776 (194), CFI = 0.962, TLI = 0.950, RMSEA = 0.057		

(Braun and Clarke, 2006). The analysis process included familiarization with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the final report.

4.5 Integration of quantitative and qualitative data

The integration of quantitative and qualitative data provides a comprehensive understanding of the research questions. While the survey data offered a broad overview of trends and patterns, the interview data provided depth and context, revealing personal and emotional aspects of avatar gender transition experiences. This mixed-methods approach allowed for a richer, more nuanced understanding of how avatar gender transition affects gender identity and sensitivity, addressing the limitations associated with the absence of a control group.

5 Results

5.1 Evaluation of measurement items

To assess whether the measured items in the study adequately explain the conceptual framework, a Confirmatory Factor Analysis (CFA) was conducted using AMOS 21.0. Confirmatory Factor Analysis is a method that utilizes structural equation modeling to verify the construct validity of concepts and is commonly employed when researchers have a theoretically grounded understanding of the relationships between measurement items and concepts (Hu and Bentler, 1999). CFA uses the chi-square statistic and degrees of freedom to indicate how well the model, as formulated by the researchers, reflects the characteristics of the collected data. Various indices can be used to measure model fit, but TLI, CFI, and RMSEA are less sensitive to sample size and parameters according to previous studies, making them more appropriate for assessing model fit (Hair et al., 2010). Additionally, TLI and CFI values above 0.90 and RMSEA values below 0.08 are considered indicative of an excellent model fit (Hu and Bentler, 1999).

In the CFA stage, item parceling was performed on the variables used in this study. Item parceling is an effective method to address the potential problem of decreased model fit due to the large number of measurement items (Little et al., 2002). Specifically, when numerous measurement items are employed for a construct, item parceling involves creating new item groupings by calculating the average or factor scores of the items within each construct, thereby mitigating the complexity of the model (Hair et al., 2010). Therefore, an item-parceling approach was applied to address the complexity of the model.

The results of the Confirmatory Factor Analysis are presented in Table 1. Examining the fit indices of the measurement model, CFI = 0.962, TLI = 0.950, and RMSEA = 0.057 indicated an excellent model fit. Furthermore, all factor loadings for both items and parcels were above 0.5, indicating satisfactory validity. The average variance extracted (AVE) and Composite Reliability (CR) values were each above 0.5 and 0.7, respectively, indicating no issues with convergent

TABLE 3 Descriptive statistics and correlation coefficients.

Variable	Mean	Standard deviation	1	2	3	4	5	6
1. Avatar Representation	4.294	0.587	1					
2. Avatar Copresence	3.956	0.581	0.558***	1				
3. Avatar-Space Interaction	3.986	0.593	0.501***	0.717***	1			
4. Avatar Identification	3.778	0.592	0.604***	0.816***	0.745***	1		
5. Perceived Avatar Identity	3.727	0.690	0.578***	0.714***	0.699***	0.860***	1	
6. Gender Sensitivity	4.082	0.638	0.538***	0.738***	0.715***	0.861***	0.808***	1

N = 144.
*p < .05.
**p < .01.
***p < .001.

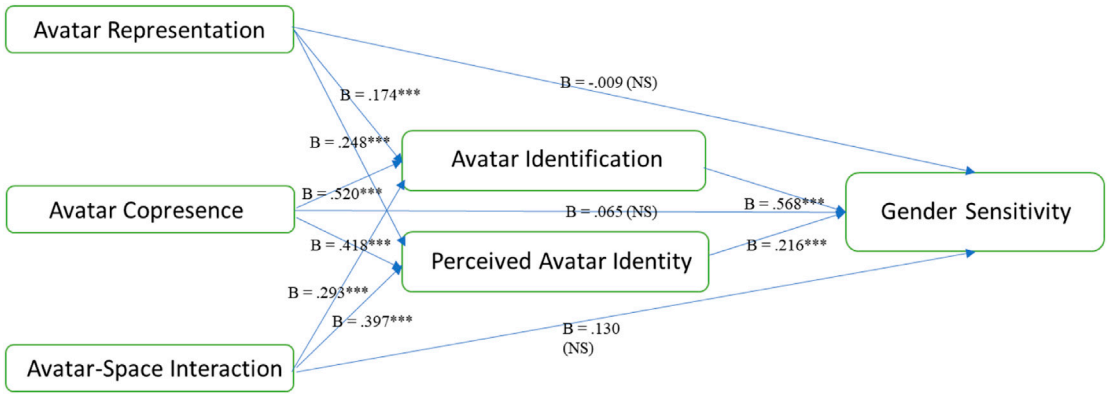

FIGURE 2
Path analysis of the relationships between avatar characteristics, avatar identification, perceived avatar identity, and gender sensitivity.

validity. Thus, the reliability and validity of the measurement tools used in this study were confirmed.

5.2 Descriptive statistics and correlation analysis

The results of the confirmatory factor analysis are provided in Table 2, which ensures the reliability and validity of the measurement model. Descriptive statistics and correlation coefficients for the key variables are presented in Table 3.

5.3 Research hypotheses

This study aimed to examine the impact of the three characteristics of Metaverse IT artifacts on avatar identification and perceived avatar identity through the use of male avatars. Additionally, the study explored the effects of these variables on gender sensitivity. To assess both direct and mediating effects, a path analysis was conducted using AMOS 21.0. The significance of the mediating effects was evaluated through bootstrapping, a method suitable for cases where the coefficients of the mediating effects are often non-normally distributed. Figure 2 illustrates the path analysis model, highlighting the relationships between avatar characteristics, avatar identification, perceived avatar identity, and gender sensitivity. This visual representation aids in understanding the structural relationships and significance of the tested variables. Bootstrapping generates a distribution of coefficients directly from the collected data, allowing for a robust evaluation of significance (Preacher et al., 2007). This procedure involved 5,000 iterations, and phantom variables were utilized for the analysis of mediating effects.

The results of the path analysis are presented in Table 4. Firstly, avatar representation (B = 0.174, $p < 0.001$), avatar copresence (B = 0.520, $p < 0.001$), and avatar-space interaction (B = 0.293, $p < 0.001$) had statistically significant positive effects on avatar identification. Additionally, avatar representation (B = 0.248, $p < 0.001$), avatar copresence (B = 0.418, $p < 0.001$), and avatar-space interaction (B = 0.397, $p < 0.001$) exhibited statistically significant positive effects on perceived avatar identity. Thus, Hypotheses 1, 2, 3, 4, 5, and 6 are supported.

Both avatar identification (B = 0.568, $p < 0.001$) and perceived avatar identity (B = 0.216, $p < 0.001$) had statistically significant positive effects on gender sensitivity. In contrast, the effects of avatar

TABLE 4 Path analysis results.

Path	B	SE	C.R.
Avatar Representation → Avatar Identification	0.174	0.053	3.291***
Avatar Copresence → Avatar Identification	0.520	0.066	7.841***
Avatar-space Interaction → Avatar Identification	0.293	0.062	4.698***
Avatar Representation → Perceived Avatar Identity	0.248	0.075	3.298***
Avatar Copresence → Perceived Avatar Identity	0.418	0.094	4.436***
Avatar-space Interaction → Perceived Avatar Identity	0.397	0.089	4.478***
Avatar Representation → Gender Sensitivity	−0.009	0.058	−0.164
Avatar Copresence → Gender Sensitivity	0.065	0.084	0.777
Avatar-space Interaction → Gender Sensitivity	0.130	0.072	1.807
Avatar Identification → Gender Sensitivity	0.568	0.085	6.694***
Perceived Avatar Identity → Gender Sensitivity	0.216	0.060	3.618***

*$p < .05$.
**$p < .01$.
***$p < .001$.

representation (B = −0.009, $p > 0.05$), avatar presence (B = 0.065, $p > 0.05$), and avatar-space interaction (B = 0.130, $p > 0.05$) on gender sensitivity were all non-significant. Consequently, Hypotheses 7 and 8 are supported.

In summary, Metaverse IT artifacts exert a significant influence on users' avatar experiences and identity formation. Specifically, avatar identification and perceived avatar identity have a profound impact on users' gender sensitivity. These findings suggest that experiencing avatars of a different gender through Metaverse IT artifacts may lead users to indirectly experience and engage with different gender identities, influencing their avatar identification and identity formation related to a different gender. Through this process, users perceive and identify with avatars of different genders, enhancing their understanding and empathy towards different genders, which positively impacts their gender sensitivity.

The results of the analysis of the mediating effects are presented in Table 4. Additionally, Table 5 presents the mediation analysis results, providing detailed insights into the indirect effects of avatar characteristics on gender sensitivity through avatar identification and perceived avatar identity. Avatar representation had a significant positive indirect effect on gender sensitivity through avatar identification (B = 0.099, 95% CI = [0.039, 0.180]). Avatar copresence also had a significant positive indirect effect on gender sensitivity through avatar identification (B = 0.295, 95% CI = [0.194, 0.429]). In addition, avatar-space interaction had a significant positive indirect effect on gender sensitivity through avatar identification (B = 0.166, 95% CI = [0.088, 0.267]). These results indicate that the three characteristics of Metaverse IT artifacts through male avatars have significant indirect effects on gender sensitivity via avatar identification.

Avatar representation had a significant positive indirect effect on gender sensitivity through perceived avatar identity (B = 0.053, 95% CI = [0.015, 0.125]). Avatar copresence also exhibited a significant positive indirect effect on gender sensitivity through perceived avatar identity (B = 0.090, 95% CI = [0.033, 0.181]). Furthermore, avatar-space interaction had a significant positive indirect effect on gender sensitivity through perceived avatar identity (B = 0.086, 95% CI = [0.032, 0.174]). These findings indicate that the three characteristics of Metaverse IT artifacts through male avatars are correlated with significant indirect effects on gender sensitivity through perceived avatar identity.

Moreover, when combined with the earlier path analysis results, it may be suggested that avatar representation, avatar copresence, and avatar-space interaction demonstrate complete mediation in the relationship with gender sensitivity. This implies that avatar identification and perceived avatar identity act as mediating factors that influence the overall impact of a user's gender sensitivity in the context of Metaverse IT artifacts through male avatars.

It is important to note that due to the absence of a control group and the observational nature of our study, these results should be interpreted as indicative of potential relationships rather than definitive causal effects. The qualitative insights gained from the in-depth interviews provide additional context and support for these findings by offering a richer understanding of participants' experiences and perceptions.

TABLE 5 Mediation analysis results.

Path	B	SE	95% CI	
			LLCI	ULCI
Avatar Representation → Avatar Identity → Gender Sensitivity	0.099	0.035	0.039	0.180
Avtar Copresence → Avatar Identity → Gender Sensitivity	0.295	0.060	0.194	0.429
Avatar-space Interaction → Avatar Identity → Gender Sensitivity	0.166	0.045	0.088	0.267
Avatar Representation → Perceived Avatar Identification → Gender Sensitivity	0.053	0.027	0.015	0.125
Avatar copresence → Perceived Avatar Identification → Gender Sensitivity	0.090	0.037	0.033	0.181
Avatar-space Interaction → Perceived Avatar Identification → Gender Sensitivity	0.086	0.035	0.032	0.174

6 Analysis and results of in-depth interviews

To complement the quantitative data and address the absence of a control group, we conducted in-depth interviews with 20 selected participants, aged 18-40. This qualitative component provided rich, contextual insights into the experiences and perceptions of participants who used male avatars on the ZEPETO platform. The following sections present the key findings from these interviews, supported by relevant literature.

6.1 Experience with gender transition

Participants generally reported a diverse range of experiences when using male avatars. Initial reactions varied from curiosity and excitement to discomfort and awkwardness. Many participants noted significant changes in how they interacted within the ZEPETO platform after transitioning their avatars to male. This aligns with prior research on virtual identity experimentation, suggesting that users often experience behavioral and social interaction shifts when assuming different virtual identities (Turkle, 1995).

6.1.1 Participant quotes

> "Initially, seeing myself as a male avatar was quite disorienting, but I quickly adapted and started exploring this new perspective." (Participant, 24)

> "Using a male avatar made me more confident in virtual interactions; it felt like I had a different kind of social freedom." (Participant, 32)

6.2 Impact on self-perception and identity

The use of male avatars led to notable shifts in participants' self-perception and identity. Many participants reported feeling more empowered and less constrained by traditional gender roles. This reflects the findings of Yee and Bailenson (2007), who highlighted the potential of virtual environments to alter self-perception and identity. Participants noted changes in their understanding and expression of gender, indicating a deeper exploration of their gender identity.

6.2.1 Participant quotes

> "Using a male avatar allowed me to explore parts of my identity that I usually suppress." (Participant, 29)

> "I felt a sense of liberation and confidence that I do not typically experience with my female identity." (Participant, 21)

6.3 Motivations for choosing a male avatar

Participants' motivations for choosing male avatars were diverse, ranging from curiosity to specific goals such as exploring gender dynamics or experiencing greater social freedom. These motivations align with broader trends in virtual identity experimentation, where users seek to explore aspects of their identity in a safe and controlled environment (Bessière et al., 2007).

6.3.1 Participant quotes

> "I wanted to understand how being male might change my interactions and experiences in a virtual world." (Participant, 34)

> "My goal was to test whether being male would affect my social acceptance and interactions differently." (Participant, 28)

6.4 Social interactions and perceptions

The majority of participants noticed differences in social interactions and acceptance when using male avatars. Many reported experiencing more positive interactions and greater social acceptance, which they attributed to the perceived advantages of being male in both virtual and real-world contexts (Nakamura, 2002).

6.4.1 Participant quotes

> "People were more responsive and friendly when I was using a male avatar." (Participant, 22)

> "There was a noticeable shift in how others interacted with me, often with more respect and openness." (Participant, 31)

6.5 Real-world implications

Participants indicated that their experiences with male avatars had real-world implications, including changes in their perceptions of gender roles and greater sensitivity towards gender identity issues. These findings support the notion that virtual experiences can significantly impact real-world attitudes and behaviors (Bailenson, 2018). The experiment highlighted the disparities in gender perceptions and prompted reflections on societal gender norms.

6.5.1 Participant quotes

> "Using a male avatar made me more aware of the subtle gender biases we encounter daily." (Participant, 27)

> "I started thinking more critically about gender roles and how they shape our interactions in both virtual and real environments." (Participant, 35)

6.6 Reflective insights

Reflecting on their experiences, participants shared significant insights and takeaways. Many expressed a desire to continue using

male avatars, citing the benefits of exploring different identities and gaining new perspectives. These reflections underscore the value of virtual experiences in fostering a broader understanding of gender identity (Mystakidis, 2022).

6.6.1 Participant quotes

> "This experience was transformative; I would definitely use a male avatar again to further explore this aspect of my identity." (Participant, 30)

> "Virtual experiences like this can play a crucial role in promoting gender inclusivity and understanding." (Participant, 23)

7 Discussion

The integration of qualitative insights from in-depth interviews with quantitative survey data provided a comprehensive understanding of how avatar gender transition within the ZEPETO platform influences users' self-perception and gender sensitivity. These findings underscore the capacity of virtual environments to significantly shape real-world attitudes and behaviors. The qualitative data revealed nuanced shifts in participants' gender sensitivity, with many reporting heightened awareness of gender biases and a deeper understanding of gender dynamics, both online and offline. These insights align with previous research that suggests virtual experiences can foster empathy and challenge traditional gender norms (Turkle, 1995; Yee and Bailenson, 2007).

7.1 Implications for Gender Sensitivity

The use of male avatars by female participants provided a unique vantage point for exploring gender roles and identities, leading to increased gender sensitivity. This aligns with self-verification and identification theories, which propose that aligning one's virtual identity with their self-concept can drive significant attitudinal changes (Burke and Stets, 1999). Participants expressed a sense of liberation when embodying male avatars, which enabled them to explore aspects of identity previously constrained by societal norms, fostering a deeper understanding of gender fluidity and diversity.

7.1.1 Participant reflections

> "The experiment made me more empathetic towards the challenges faced by different genders. I now approach gender issues with a more open and understanding mindset." (Participant, 25)

> "Experiencing life as a male avatar opened my eyes to the privileges and biases associated with gender, making me more sensitive to these issues in my daily life." (Participant, 33)

> "Using a male avatar allowed me to act in ways I would not normally consider in real life. This freedom helped me realize how much of my behavior is influenced by societal expectations of gender." (Participant, 29)

> "I found that people treated my male avatar differently, which highlighted the subtle ways gender affects social interactions. This was eye-opening and made me more aware of gender biases." (Participant, 35)

7.2 Broader implications for virtual environments

The findings from this study emphasize the pivotal role of virtual environments in facilitating identity exploration and enhancing gender sensitivity. Platforms like ZEPETO offer users a safe and controlled space to experiment with different gender identities, leading to increased empathy and understanding in real-world contexts. The customization and embodiment of avatars across gender spectrums serve as powerful tools for education and social change, enabling users to gain a deeper appreciation for the challenges and experiences associated with different genders. This, in turn, contributes to fostering a more inclusive and equitable society.

The integration of quantitative and qualitative data in this study provided a comprehensive view of the research questions. While the survey data revealed broad trends and patterns, the interview data added depth and context, uncovering the personal and emotional dimensions of avatar gender transition experiences. These findings underscore the significant influence of virtual experiences on real-world perceptions and behaviors, particularly regarding gender identity and sensitivity. The mixed-methods approach effectively addressed the limitations posed by the absence of a control group, offering a richer, more nuanced understanding of how avatar gender transitions impact gender identity and sensitivity.

By delving into the detailed insights from participants' experiences, this study highlights the transformative potential of virtual environments in shaping societal norms and promoting inclusivity. The results suggest that virtual platforms are valuable tools for fostering empathy, challenging traditional gender norms, and enhancing gender sensitivity in real-world contexts.

8 Conclusion

This study conducted an in-depth analysis of the factors influencing avatar identity confirmation and self-identification in the metaverse, focusing on the experience of gender transition through avatars. Specifically, the research empirically examined how these experiences affected the real-world gender identity of female users who transitioned to male avatars on the ZEPETO platform. The identified factors were categorized into avatar representation, avatar copresence perception, and avatar spatial interaction, each analyzed for their impact on avatar identity confirmation and self-identification. Additionally, the study explored whether these factors influenced users' real-world gender identities through an online survey targeting women aged 18–40 years with experience in the metaverse.

8.1 Key Findings

The study found that metaverse IT artifacts, such as avatar representation, avatar copresence perception, and avatar spatial

interaction, positively influenced identity confirmation and self-identification during avatar gender transitions. This aligns with previous studies (e.g., Bullingham and Vasconcelos, 2013; Bessière et al., 2007; Loewen et al., 2021), demonstrating that female users who recreated and modified avatars to reflect an idealized image experienced enhanced self-identification and identity confirmation. The sense of copresence, especially when interacting with other avatars through a male avatar, also contributed positively to these outcomes, as highlighted by Ma and Agarwal (2007).

Avatar identification, where users recognize themselves as avatars and establish emotional and cognitive connections, was confirmed as a temporary phenomenon consistent with earlier studies (Cohen, 2001; Van Looy et al., 2012). Female users reported experiencing a transformation into male avatars, supported by metaverse artifacts like avatar representation, copresence, and spatial interaction, further validating avatar identification in virtual environments.

According to self-verification theory, individuals are more likely to engage actively in relationships when their self-image is understood and acknowledged by others, increasing their sense of belonging (Swann et al., 2000). Consistent with this theory, female users who transitioned to male avatars experienced positive effects on representation, copresence perception, and spatial interaction, leading to greater identity confirmation and perceived identity.

The in-depth interviews provided further insights, revealing that many participants gained heightened self-awareness and gender sensitivity after using male avatars. Participants reported a deeper understanding of gender dynamics and biases, as well as increased empathy toward different gender experiences.

8.2 Implications for Gender Sensitivity

Unlike prior research focused primarily on avatar identification and identity confirmation, this study extended the exploration to include the impact of avatar gender experiences on real-world gender sensitivity. Gender sensitivity, which involves awareness of societal gender imbalances, was found to be positively influenced by experiences with avatars of different genders in the metaverse. These findings suggest that the metaverse can serve as a critical platform for enhancing gender sensitivity by allowing users to identify with avatars of different genders, leading to increased understanding and awareness of gender diversity.

8.3 Limitations and Future Directions

Despite its contributions, this study had several limitations. First, the absence of a traditional control group limits the ability to directly compare findings against a baseline. Future studies should incorporate control groups to enhance the validity and reliability of the results. Second, reliance on self-reported data introduces potential biases, such as social desirability and recall bias. Future research should consider using objective measures or corroborating self-reported data with behavioral data. Third, the study's sample was limited to Korean female users, which may affect the generalizability of the findings. Cross-cultural studies are recommended to explore potential variations in outcomes. Fourth, the study primarily examined the short-term effects of avatar gender transition, leaving the long-term impacts unexplored. Longitudinal studies are needed to assess the enduring effects on identity formation. Lastly, while the study focused on the ZEPETO platform, future research should explore whether similar outcomes are observed in other virtual environments with different features.

8.4 Conclusion

In summary, this study confirmed that metaverse IT artifacts significantly influence users' avatar experiences and identity formation, with positive effects on gender sensitivity. These findings suggest that metaverse environments offer valuable opportunities for users to explore diverse identities and enhance gender sensitivity through avatar identification and identity formation. The results underscore the potential of the metaverse as a transformative platform for promoting diversity, inclusivity, and positive social change in gender perceptions and relationships.

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

Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

JK: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualization, Writing–original draft, Writing–review and editing. HR: Project administration, Resources, Supervision, Writing–review and editing.

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The author declares 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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The author(s) declare that no Generative AI was used in the creation of this manuscript.

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References

Adler, P. A., and Adler, P. (2008). "The cyber self: the self-ing project goes online," in *Handbook of sociological theory*. Editor J. H. Turner (Springer), 531–543.

Agag, G., El-Masry, A. A., and Alharbi, N. S. (2019). Understanding online gamers' intention to play games online and effects on their loyalty: an integration of IDT, TAM, and TPB. *Inf. Technol. and People* 32 (6), 1341–1369. doi:10.1108/ITP-06-2018-0270

Bae, Y., and Jeong, J. (2024). The effectiveness of a brief video-based intervention in reducing gender bias in Korea. *Front. Psychol.* 15, 1331460. doi:10.3389/fpsyg.2024.1331460

Bailenson, J. N. (2018). *Experience on demand: what virtual reality is, how it works, and what it can do*. W. W. Norton and Company.

Bessière, K., Seay, A. F., and Kiesler, S. (2007). The ideal elf: identity exploration in World of Warcraft. *CyberPsychology and Behav.* 10 (4), 530–535. doi:10.1089/cpb.2007.9994

Beynon-Davies, P. (2013). *Information systems: an introduction to informatics in organizations*. Palgrave Macmillan.

Boellstorff, T. (2008). *Coming of age in Second Life: an anthropologist explores the virtually human*. Princeton University Press. doi:10.2307/j.ctvc77h1s

Braun, V., and Clarke, V. (2006). Using thematic analysis in psychology. *Qual. Res. Psychol.* 3 (2), 77–101. doi:10.1191/1478088706qp063oa

Brisolara, S., Seigart, D., and SenGupta, S. (Eds.). (2014). Feminist evaluation and research: theory and practice. New York, NY: Guilford Press.

Bullingham, L., and Vasconcelos, A. C. (2013). The presentation of self in the online world: Goffman and the study of online identities. *J. Inf. Sci.* 39 (1), 101–112. doi:10.1177/0165551512470051

Burke, P. J., and Stets, J. E. (1999). Trust and commitment through self-verification. *Soc. Psychol. Q.* 62 (4), 347–366. doi:10.2307/2695833

Butler, J. (1990). *Gender trouble: feminism and the subversion of identity*. New York, NY: Routledge.

Carter, M. J., and Miller, S. A. (2016). Symbols, meaning, and action: the past, present, and future of symbolic interactionism. *Curr. Sociol.* 64 (6), 931–961. doi:10.1177/0011392116638396

Cheung, C. M. K., Chiu, P.-Y., and Lee, M. K. O. (2013). Online social networks: why do students use Facebook? *Comput. Hum. Behav.* 27 (4), 1337–1343. doi:10.1016/j.chb.2010.07.028

Chiang, T. H.-C. (2021). Investigating effects of interactive virtual reality games and gender on immersion, empathy and behavior into environmental education. *Front. Psychol.* 12, 608407. doi:10.3389/fpsyg.2021.608407

Choi, K.-S., and Lee, H. (2023). The trend of online child sexual abuse and exploitations: a profile of online sexual offenders and criminal justice response. *J. Child Sex. Abuse* 33 (1), 804–823. doi:10.1080/10538712.2023.2214540

Cohen, J. (2001). Defining identification: a theoretical look at the identification of audiences with media characters. *Mass Commun. and Soc.* 4 (3), 245–264. doi:10.1207/S15327825MCS0403_01

Cooley, C. H. (1902). *Human nature and the social order*. New York, NY: Scribner's.

Coulmas, F. (2019). *Identity: a very short introduction*: Oxford University Press.

Dionisio, J. D., Burns, W. G., and Gilbert, R. (2013). 3D virtual worlds and the metaverse: current status and future possibilities. *ACM Comput. Surv.* 45 (3), 1–38. doi:10.1145/2480741.2480751

Do, T. D., Protko, C. I., and McMahan, R. P. (2024). Stepping into the right shoes: The effects of user-matched avatar ethnicity and gender on sense of embodiment in virtual reality. *J. ArXiv preprint.*, 2402.03279. doi:10.48550/arXiv.2402.03279

Doyle, D. (2009). The body of the avatar: rethinking the mind-body relationship in virtual worlds. *J. Gaming and Virtual Worlds* 1 (2), 131–141. doi:10.1386/jgvw.1.2.131/1

Ducheneaut, N., Wen, M. H., Yee, N., and Wadley, G. (2009). "Body and mind: a study of avatar personalization in three virtual worlds," in *Proceedings of the SIGCHI conference on human factors in computing systems*, 1151–1160. doi:10.1145/1518701.1518877

Freeman, G. Z., Bardzell, J., and Bardzell, S. (2016). Intimate experiences in virtual worlds: the interplay among hyperpersonal communication, avatar-based systems, and experiential drives. *IConference 2016 Proc.* doi:10.9776/16239

Gao, W., Liu, Z., Guo, Q., and Li, X. (2017). The dark side of ubiquitous connectivity in smartphone-based SNS: an integrated model from information perspective. *Comput. Hum. Behav.* 78, 57–69. doi:10.1016/j.chb.2017.09.003

Gibson, W. (1984). *Neuromancer*. New York, NY. Ace Books.

Goel, L., Johnson, N. A., Junglas, I., and Ives, B. (2011). From space to place: predicting users' intentions to return to virtual worlds. *MIS Q.* 35 (3), 749–771. doi:10.2307/23042807

Goffman, E. (1959). *The presentation of self in everyday life*. Garden City, NY: Anchor Books.

Hair, J. F., Black, W. C., Babin, B. J., and Anderson, R. E. (2010). *Multivariate data analysis*. 7th ed. Upper Saddle River, NJ: Pearson.

Heider, F. (1958). *The psychology of interpersonal relations*: Wiley.

Hennig-Thurau, T., Wiertz, C., Feldhaus, F., and Houston, M. B. (2022). Social interactions in the metaverse: framework, initial evidence, and research roadmap. *J. Acad. Mark. Sci.* 50 (4), 880–910. doi:10.1007/s11747-022-00908-0

Hu, L.-T., and Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct. Equ. Model. A Multidiscip. J.* 6 (1), 1–55. doi:10.1080/10705519909540118

Huang, J., Kumar, S., and Hu, C. (2021). A literature review of online identity reconstruction. *Front. Psychol.* 12, 696552. doi:10.3389/fpsyg.2021.696552

Huang, T., Li, Y., and Liang, H.-N. (2023). "Avatar type, self-congruence, and presence in virtual reality," in *Proceedings of the eleventh international symposium of Chinese CHI* (ACM), 61–72. doi:10.1145/3629606.3629614

Hung, S.-Y., Chen, C. C., and Huang, N.-H. (2014). An integrative approach to understanding customer satisfaction with e-service of online stores. *J. Electron. Commer. Res.* 15 (1), 40–57. Available at: https://libres.uncg.edu/ir/asu/f/Chen_charlie_2014_An_integrative_approach_To_understanding_orig.X.pdf.

Ipsos (2022). The fluidity of identity in the metaverse. *Ipsos*. Available at: https://www.ipsos.com/.

James, W. (1890). *The principles of psychology*. Henry Holt and Company.

Jones, E. E., and Davis, K. E. (1965). "From acts to dispositions: the attribution process in person perception," in *Advances in experimental social psychology*. Editor L. Berkowitz (Academic Press), 2, 219–266. doi:10.1016/s0065-2601(08)60107-0

Jung, Y., and Pawlowski, S. D. (2014). Understanding consumption in social virtual worlds: a sensemaking perspective on the consumption of virtual goods. *J. Bus. Res.* 67 (10), 2231–2238. doi:10.1016/j.jbusres.2014.01.002

KED Global (2022). ZEPETO: metaverse platform's global growth. *KED Glob.* Available at: https://www.kedglobal.com/metaverse/newsView/ked202203040009.

Kendall, L. (2002). *Hanging out in the virtual pub: masculinities and relationships online*. University of California Press.

Khalifa, M., and Shen, N. (2004) "System design effects on social presence and telepresence in virtual communities," in *Proceedings of the international conference on information systems (ICIS 2004)*, 547–558. Available at: https://aisel.aisnet.org/icis2004/43/.

Kim, D. Y., Lee, H. K., and Chung, K. (2023). Avatar-mediated experience in the metaverse: the impact of avatar realism on user-avatar relationship. *J. Retail. Consumer Serv.* 73, 103382. doi:10.1016/j.jretconser.2023.103382

Kim, H. (2016). Identification in media: from character alignment to audience engagement. *Media Psychol.* 19 (3), 327–348. doi:10.1080/15213269.2015.1060085

Kim, K., Lee, S., and Suh, K. (2023). Factors influencing avatar identity confirmation in the metaverse. *J. Inf. Syst.* 29 (2), 189–210. doi:10.13088/jiis.2023.29.2.189

Kim, Y., and Sundar, S. S. (2012). Can interfaces affect self-presentation? The impact of cosmetic customization on impression management in avatars. *J. Commun.* 62 (5), 1026–1043. doi:10.1111/j.1460-2466.2012.01683.x

Knutzen, K. B., and Kennedy, D. M. (2012). Designing the self: the transformation of the relational self-concept through social encounters in a virtual immersive environment. *Interact. Learn. Environ.* 20 (3), 271–292. doi:10.1080/10494820.2011.641680

Koufaris, M. (2002). Applying the technology acceptance model and flow theory to online consumer behavior. *Inf. Syst. Res.* 13 (2), 205–223. doi:10.1287/isre.13.2.205.83

Koulouris, J., Jeffery, Z., Best, J., O'Neill, E., and Lutteroth, C. (2020). "Me vs. Super(wo)man: effects of customization and identification in a VR exergame," in Proceedings of the 2020 CHI conference on human factors in computing systems, 1–17. doi:10.1145/3313831.3376661

Kroese, I. (2022). Is employee training really gender-neutral? Introducing a sex/gender-sensitive model of training. *Hum. Resour. Manag. Rev.* 32 (4), 100890. doi:10.1016/j.hrmr.2021.100890

Lemenager, T., Neissner, M., Sabo, T., Mann, K., and Kiefer, F. (2020). "Who am i" and "how should i be": a systematic review on self-concept and avatar identification in gaming disorder. *Curr. Addict. Rep.* 7, 166–193. doi:10.1007/s40429-020-00307-x

Li, D. D., Liau, A., and Khoo, A. (2013). Player–avatar identification in video gaming: concept and measurement. *Comput. Hum. Behav.* 29 (1), 257–263. doi:10.1016/j.chb.2012.09.002

Lin, H., and Wang, H. (2014). Avatars in virtual worlds: self-identification and its effects on behavior. *Comput. Hum. Behav.* 34, 95–102. doi:10.1016/j.chb.2014.01.015

Lin, J., and Latoschik, M. E. (2022). Digital body, identity and privacy in social virtual reality: a systematic review. *Front. Virtual Real.* 3. doi:10.3389/frvir.2022.974652

Little, T. D., Cunningham, W. A., Shahar, G., and Widaman, K. F. (2002). To parcel or not to parcel: exploring the question, weighing the merits. *Struct. Equ. Model. A Multidiscip. J.* 9 (2), 151–173. doi:10.1207/S15328007SEM0902_1

Loewen, M. G. H., Burris, C. T., and Nacke, L. E. (2021). Me, myself, and not-I: self-discrepancy type predicts avatar creation style. *Front. Psychol.* 11, 1902. Article 1902. doi:10.3389/fpsyg.2020.01902

Ma, M., and Agarwal, R. (2007). Through a glass darkly: information technology design, identity verification, and knowledge contribution in online communities. *Inf. Syst. Res.* 18 (1), 42–67. doi:10.1287/isre.1070.0113

Maccoby, E. E., and Wilson, W. C. (1957). Identification and observational learning from films. *J. Abnorm. Soc. Psychol.* 55 (1), 76–87. doi:10.1037/h0043015

Madtimes (2023). 75.8% of ZEPETO users are female: an analysis of its user demographics. *Madtimes.* Available at: https://www.madtimes.org/news/articleView.html?idxno=18022.

Mäntymäki, M., and Merikivi, J. (2010). Investigating the drivers of the intention to use social virtual worlds: hedonic enjoyment and sociability. *Int. J. Technol. Hum. Interact.* 6 (3), 14–29. doi:10.4018/jthi.2010070102

Mead, G. H. (1934). *Mind, self, and society: from the standpoint of a social behaviorist*. University of Chicago Press.

Meissner, W. W. (1973). The conceptualization of identification. *Psychoanal. Q.* 42 (3), 319–344. doi:10.1080/21674086.1973.11926434

Microsoft (2021). *Microsoft Mesh: transforming the virtual meeting experience*. Redmond, WA: Microsoft Press. Available at: https://www.microsoft.com/mesh.

Milligan, M. J. (1998). Interactional past and potential: the social construction of place attachment. *Symb. Interact.* 21 (1), 1–33. doi:10.1525/si.1998.21.1.1

Mystakidis, S. (2022). Metaverse. *Encyclopedia* 2 (1), 486–497. doi:10.3390/encyclopedia2010031

Nakamura, L. (2002). *Cybertypes: race, ethnicity, and identity on the internet*. New York, NY: Routledge.

Neustaedter, C., and Fedorovskaya, E. A. (2009). "Presenting identity in a virtual world through avatar appearances," in *Proceedings of graphics interface 2009*, 183–190. doi:10.5555/1555880.1555921

Nowak, K. L., and Rauh, C. (2005). The influence of the avatar on online perceptions of anthropomorphism, androgyny, credibility, homophily, and attraction. *J. Computer-Mediated Commun.* 11 (1), 153–178. doi:10.1111/j.1083-6101.2006.tb00308.x

Oatley, K. (1994). A taxonomy of the emotions of literary response and a theory of identification in fictional narrative. *Poetics* 23 (1-2), 53–74. doi:10.1016/0304-422X(94)P4296-S

Ogara, S. O., Koh, C. E., and Prybutok, V. R. (2014). Investigating factors affecting social presence and user satisfaction with mobile instant messaging. *Comput. Hum. Behav.* 36, 453–459. doi:10.1016/j.chb.2014.03.064

Olds, D. D. (2006). Identification: psychoanalytic perspectives. *J. Am. Psychoanal. Assoc.* 54 (3), 741–767. doi:10.1177/00030651060540030301

Papacharissi, Z. (2010). *A private sphere: democracy in a digital age*. Cambridge, UK: Polity Press.

Park, S. (2005). Self identity and Internet community site using behavior. *J. Broadcast. Telecommun. Res.* 61, 255–285. doi:10.22876/kjbtr.2005.61.010

Pearson, E. (2009). All the world wide web's a stage: the performance of identity in online social networks. *First Monday* 14 (3). doi:10.5210/fm.v14i3.2162

Picone, I. (2015). "Impression management in social media," in *The international encyclopedia of digital communication and society*. Editors R. Mansell and P. H. Ang (Wiley), 469–476.

Prasanna, K. (2021). A study of gender sensitization: contemporary challenges. *J. Gend. Stud.* 9 (2), 150–162. http://ijmer.in.doi./2021/10.07.144

Preacher, K. J., Rucker, D. D., and Hayes, A. F. (2007). Addressing moderated mediation hypotheses: theory, methods, and prescriptions. *Multivar. Behav. Res.* 42 (1), 185–227. doi:10.1080/00273170701341316

Rao, A., and Kelleher, D. (2005). Is there life after gender mainstreaming? *Gend. and Dev.* 13 (2), 57–69. doi:10.1080/13552070512331332287

Rouse, M. (2021). *Information technology (IT) definition*: TechTarget. Available at: https://www.techtarget.com/searchdatacenter/definition/IT.

Schlenker, B. R. (2003). "Self-presentation," in *Handbook of self and identity*. Editors M. R. Leary and J. P. Tangney Malden, MA (Guilford Press), 492–518.

Seoul Foundation of Women and Family (2020). A study on actual status of sexual harassment among adolescents and policy support plan. Available at: https://www.seoulwomen.or.kr/sfwf_eng/contents/sfwfeng-policysearch.do?id=522&page=1&schM=view&viewCount=5.

Shiau, W. L., and Huang, Y. K. (2022). Understanding the influence of system and information quality on metaverse usage intentions. *J. Inf. Syst.* 36 (1), 45–62. doi:10.2308/jis-2019-0251

Slater, M., Sadagic, A., Usoh, M., and Schroeder, R. (2000). Small-group behavior in a virtual and real environment: a comparative study. *Presence Teleoperators Virtual Environ.* 9 (1), 37–51. doi:10.1162/105474600566600

Smart, R., Heppel, D., and Dalton, M. (2007). *Digital citizenship: The Internet, society, and participation*. London, UK: Routledge

Statista (2022). *Motivations for participating in the metaverse in the United States*. Statista. Available at: https://www.statista.com/statistics/1352343/us-adults-metaverse-participation-motivations/.

Strachey, J. (1969). The nature of identification. *Int. J. Psychoanal.* 50 (1), 53–61. doi:10.1037/h0041338

Sundar, S. S., Kang, H., and Oprean, D. (2020). Being there in the midst of the virtual: avatars and the online education experience. *Commun. Res.* 47 (4), 517–538. doi:10.1177/0093650218765106

Swann, W. B., Jr., Milton, L. P., and Polzer, J. T. (2000). Should we create a niche or fall in line? Identity negotiation and small group effectiveness. *J. Personality Soc. Psychol.* 79 (2), 238–250. doi:10.1037/0022-3514.79.2.238

Swann, W. B., Jr., and Read, S. J. (1981). Self-verification processes: how we sustain our self-conceptions. *J. Exp. Soc. Psychol.* 17 (4), 351–372. doi:10.1016/0022-1031(81)90043-3

Swann, W. B., Stein-Seroussi, A., and Giesler, R. B. (1992). Why people self-verify. *J. Personality Soc. Psychol.* 62 (3), 392–401. doi:10.1037/0022-3514.62.3.392

Talaifar, S., and Swann, W. B., Jr. (2020). Identity fusion and its role in extreme group behavior. *Nat. Hum. Behav.* 4 (6), 587–593. doi:10.1038/s41562-020-0855-z

Tan, W. K., and Teo, H. H. (2011). "Impact of blog design features on blogging satisfaction: an impression management perspective," in *Online communities and social computing*. Editors A. A. Ozok and P. Zaphiris (Springer Berlin Heidelberg), 130–139. doi:10.1007/978-3-642-21796-8_14

Taylor, T. L. (1999). Life in virtual worlds: plural existence and multi-modalities. *Inf. Soc.* 15 (3), 227–234. doi:10.1080/019722499128731

Teng, C.-I. (2017). Impact of avatar identification on online gamer loyalty: perspectives of social identity and social capital theories. *Int. J. Inf. Manag.* 37 (6), 601–610. doi:10.1016/j.ijinfomgt.2017.06.006

Triberti, S., Durosini, I., Aschieri, F., Villani, D., and Riva, G. (2017). A frame effect in avatar customization: how users' attitudes towards their avatars may change depending on virtual context. *Annu. Rev. CyberTherapy Telemedicine* 15, 92–97.

Turkay, S., and Kinzer, C. K. (2015). "The effects of avatar-based customization on player identification," in *Gamification: concepts, methodologies, tools, and applications*. Hershey, PA (IGI Global), 247–272.

Turkle, S. (1995). *Life on the screen: identity in the age of the internet*. New York, NY. Simon and Schuster.

UNESCO (2015). *Gender sensitivity: a training manual*. Paris, France. UNESCO. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000232801.

Van Looy, J., Courtois, C., De Vocht, M., and De Marez, L. (2012). Player identification in online games: validation of a scale for measuring identification in MMOGs. *Media Psychol.* 15 (2), 197–221. doi:10.1080/15213269.2012.674917

Wang, Y., Zhang, H., and Zeng, J. (2019). The impact of virtual try-on technology on online clothing shopping. *J. Interact. Mark.* 45, 42–59. doi:10.1016/j.intmar.2018.07.003

Williams, S., Seed, J., and Mwau, A. (1994). *The Oxfam gender training manual*. Oxford, UK. Oxfam Publications.

Wilson, J. M., Straus, S. G., and McEvily, B. (2006). All in due time: the development of trust in computer-mediated and face-to-face teams. *Organ. Behav. Hum. Decis. Process.* 99 (1), 16–33. doi:10.1016/j.obhdp.2005.08.001

Wu, J., Wang, S., and Tsai, H. (2010). The role of avatars in online games: the impact on game players' behavior and attitudes. *J. Interact. Advert.* 10 (2), 1–15. doi:10.1080/15252019.2010.10722171

Xu, X., Luo, G., and Feng, Y. (2019). An empirical study of user satisfaction and continuance usage of virtual reality applications. *Digital Innovation and Manag.* 19, 100057. doi:10.1016/j.dim.2023.100057

Yee, N., and Bailenson, J. N. (2007). The Proteus effect: the effect of transformed self-representation on behavior. *Hum. Commun. Res.* 33 (3), 271–290. doi:10.1111/j.1468-2958.2007.00299.x

Zhao, S., Grasmuck, S., and Martin, J. (2008). Identity construction on Facebook: digital empowerment in anchored relationships. *Comput. Hum. Behav.* 24 (5), 1816–1836. doi:10.1016/j.chb.2008.02.012

Zhou, Z., Jin, X. L., and Fang, Y. (2012). Moderating role of gender in the relationships between perceived enjoyment, satisfaction, and loyalty in the online gaming context. *Int. J. Inf. Manag.* 32 (4), 364–374. doi:10.1016/j.ijinfomgt.2011.12.003

Zhu, R., and Yi, C. (2024). Avatar design in Metaverse: the effect of avatar-user similarity in procedural and creative tasks. *Internet Res.* 34 (1), 39–57. doi:10.1108/INTR-08-2022-0691

Zimmermann, D., Wehler, A., and Kaspar, K. (2023). Self-representation through avatars in digital environments. *Curr. Psychol.* 42, 21775–21789. doi:10.1007/s12144-022-03232-6