



Social VR as a Communication Medium: A Systematic Review of Two Decades of Virtual Adaptation in Social Interaction

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Abstract

Social Virtual Reality (Social VR) has evolved from a theoretical concept to a sophisticated communication medium over the past two decades. This systematic literature review synthesizes 78 peer-reviewed studies published between 2004-2024 to examine the development of Social VR as an interpersonal communication platform. The research employs a PRISMA-guided methodology to investigate five key research questions covering avatar-mediated communication, non-verbal cues, collaborative applications, ethical challenges, and inclusivity aspects. The findings reveal that Social VR has transcended its initial perception as an isolating technology to become a rich, multimodal communication medium that supports embodied presence and immersive interactions. Avatar-mediated communication demonstrates the Proteus Effect, where digital representation influences user behavior and self-perception. Non-verbal cues including gestures, spatial proximity, and gaze direction significantly enhance co-presence and emotional expression beyond traditional video conferencing. Collaborative applications in scientific research, education, and professional settings show improved engagement and knowledge retention through 3D immersive environments. However, significant challenges persist including limited facial expression tracking, inadequate real-time moderation systems, and ethical concerns regarding virtual harassment and privacy. The review identifies accessibility barriers related to device costs, digital literacy, and geographic disparities in research representation. Despite these challenges, Social VR demonstrates remarkable inclusive potential, particularly benefiting elderly users, neurodiverse individuals, and non-verbal communicators who adapt gesture-based and emoji-mediated interactions. The thematic synthesis reveals five primary domains shaping Social VR development: avatar communication, non-verbal interaction, virtual collaboration, ethical considerations, and inclusivity. Future research directions emphasize the need for longitudinal studies on team trust, cross-cultural trials in diverse contexts, AI-enhanced moderation systems, and standardization of expressive avatar technologies. The study concludes that Social VR holds transformative potential for reimagining human connections in digital spaces, contingent upon responsible development practices that prioritize safety, accessibility, and ethical design principles.

Keywords: Avatar-mediated communication, collaboration, digital ethics, immersive, inclusive technology, social virtual reality

1. Introduction

With the rapid development of Virtual Reality (VR) technology since the early 2000s, iterations in the social realm of Social VR have evolved from a theoretical idea to a real virtual interaction ecosystem. Initially, VR was considered a solitary medium, reducing connections between individuals because users were isolated by headset devices (Hayes, 2022; Slivkin et al., 2025). However, developers and academics have begun to exploit the potential of VR as an immersive interpersonal communication medium, presenting innovations in social representation and co-presence.

User representation through avatars has become the core of social-VR communication: users can interact with digital voices, body movements, and facial expressions, while maintaining a certain level of anonymity (Wei et al., 2022). Phenomena such as the Proteus Effect illustrate how the identity and appearance of avatars can change user behavior, even influencing social interactions in and out of VR (Martin Coesel, 2024). Thus, avatars are not just a visual medium, but a psychological instrument that enriches communication.

Non-verbal cues such as gestures, spatial distance, virtual gaze, and flexible emoji use replicate or even surpass real-world expressions. This format provides a sense of immersion that is not available in traditional CMC media such as text or video. This multimodal engagement supports the media richness theory, where VR offers speed of transmission, rich symbol sets, and optimal communication convergence phases (Wang et al., 2024; HU et al., 2025).

In the context of professional collaboration, studies have shown that content sharing and scientific discussions via Social VR (e.g., Spatial, Nanome) feel more like face-to-face than Zoom (Zielken et al., 2025). Social presence has been shown to improve team dynamics, performance, and engagement especially when full-body avatars and well-designed virtual environments (e.g., circular auditoriums) are applied.

The main challenges arise from technical and ethical issues. Motion sickness due to suboptimal rendering techniques still occurs, and security issues such as virtual harassment, especially against vulnerable users, have occurred in social-VR platforms (Kalantari et al., 2023). Therefore, design ethics that include boundary-setting, privacy, and accessibility have become an important focus in modern literature.

Social VR has also shown significant benefits in education and therapy. Studies have noted improvements in autistic children's social skills through repeated training in VR attributive environments due to the affordance of embodied presence and interaction (Zhang et al., 2023).

In addition, VR platforms focused on cross-cultural learning have been able to increase motivation and empathy for intercultural communication, although cognitive effectiveness still requires repetition and HMD facilities.

The diversity of user populations has also grown. Elderly people who experience loneliness find new social connections in Social VR, where immersive interactions can reduce social isolation (Latikka et al., 2021). Likewise, communities with special needs, such as users who choose to remain silent or silent in VRChat, have adapted this medium as a friendly alternative communication landscape, although the culture of muting requires social adoption.

This two-decade review reflects the evolution of Social VR from an experimental platform to a full-fledged communication medium: bringing presence, non-verbality, inclusivity, and media intelligence. However, research shows the need to develop more mature ethics, accessibility, and technical standards to address issues of user harassment and safety. By analyzing these domains (avatar, non-verbal cues, avatar psychology, collaboration, ethical issues, accessibility, and social impact) this paper attempts to present a systematic overview of the evolution of Social VR as a communication medium. This approach is expected to provide an informative basis for further research, new platform design, and policies related to the integration of VR into everyday social interactions.

2. Literature Review

The literature shows that avatars are a core element in Social VR, facilitating social presence, anonymity, and empathy for users. Full-body avatars enhance the feeling of "physical togetherness" and improve collaboration performance, as in a virtual high-five study by Sayadi & Gomez-Zara (2024). However, technical challenges remain: facial expression export is still minimal, and body movements are sometimes misrepresented, negatively impacting communication.

Non-verbal signals such as hand gestures, distance, gaze, and floating emojis support richer communication than traditional media. A study by Wang et al. (2024) used the "Cone of Vision" to enhance visual coordination and a sense of togetherness in VR collaboration.

Systematic review of 20 years Sayadi et al. showed that Social VR enhances team dynamics through social presence, embodied interactions, and the use of virtual artifacts in scientific collaboration (e.g., Spatial, Nanome) (Sayadi & Gomez-Zara, 2024). Collaboration success was aided by avatars and the design of the circular auditory virtual room was seen as supporting engagement. However, there are still open areas of research regarding long-term collaboration and building trust in teams.

Although many studies have been conducted, several gaps remain: the need for expressive avatar engineering (face, advanced gestures), long-term collaboration/trust building, and proactive governance and moderation methods for user safety. Recommendations state the need for longitudinal studies, more advanced technical interventions (eye-tracking AI), and ethics-based design policies.

3. Research Methodology

3.1. Research Design

This study uses a Systematic Literature Review (SLR) approach to identify, critically assess, and synthesize research findings over the past two decades (2004–2024) on the use of Social VR as a medium for social communication. SLR was chosen because it provides a rigorous methodological structure to screen relevant literature, avoid selection bias, and produce a comprehensive thematic mapping. This approach refers to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol to ensure transparency and replication of the process.

3.2. Research Questions

This study is guided by the following main questions:

- a) RQ1: How have the characteristics of avatar-based communication in Social VR evolved over the past two decades?

- b) RQ2: How does non-verbal cueing play a role in supporting communication quality in Social VR environments?
- c) RQ3: In what contexts is Social VR used for collaboration, learning, and inclusive social interaction?
- d) RQ4: What are the technical, ethical, and accessibility challenges and barriers reported in the literature?
- e) RQ5: What are the research gaps and recommended directions for technology development and policies?

3.3. Data Sources and Search Strategy

A literature search was conducted in reputable academic databases, including:

- a) Scopus
- b) Web of Science
- c) IEEE Xplore
- d) ACM Digital Library
- e) ScienceDirect (Elsevier)
- f) SpringerLink

The main keywords used included Boolean combinations such as:

("Social VR" OR "Social Virtual Reality") AND ("Communication" OR "Interaction") AND ("Avatar" OR "Presence" OR "Non-verbal" OR "Collaboration" OR "Ethics" OR "Inclusion") AND ("2004" TO "2024")

3.4. Inclusion and Exclusion Criteria

Inclusion criteria:

- a) Peer-reviewed journal articles or scientific proceedings
- b) Published between 2004–2024
- c) Focus on the use of VR for social or collaborative communication
- d) Provide empirical data, reviews, or conceptual models

Exclusion criteria:

- a) Studies that focus solely on VR gaming without social aspects
- b) Articles non-academic, grey literature, and popular reviews
- c) Studies in languages other than English (unless official translation is available)

3.5. Study Selection and Quality Assessment

Selection was conducted in three stages:

- a) Title and abstract screening
- b) Full-text review
- c) Quality assessment using the Critical Appraisal Skills Program (CASP)
- d) Only studies with moderate to high methodological quality were included in the final synthesis.

3.6. Data Extraction and Thematic Synthesis

Key information extracted from each article included:

- a) Year of publication
- b) Domain of focus (avatar communication, collaboration, inclusion, etc.)
- c) Research methodology
- d) Key findings and recommendations

Data were analyzed qualitatively using a thematic synthesis approach, resulting in a classification based on dominant themes: avatar communication, non-verbal cues, team dynamics, ethical issues, and inclusivity.

4. Results and Discussion

All figures should be numbered with Arabic numerals (1,2,...n). All photographs, schemas, graphs and diagrams are to be referred to as figures. Line drawings should be good quality scans or true electronic output. Low-quality scans are not acceptable. Figures must be embedded into the text and not supplied separately. Lettering and symbols should be clearly defined either in the caption or in a legend provided as part of the figure. Figure is center, as shown Figure 1 and cited in the manuscript.

4.1. Overview of Selected Studies

A total of 78 peer-reviewed articles published between 2004 and 2024 were included in the final synthesis. These studies originate from diverse fields of human-computer interaction (HCI), communication science, psychology,

education, and digital ethics highlighting the multidisciplinary nature of Social VR research. Thematically, studies were clustered into five major domains: avatar-mediated communication, non-verbal interaction, collaborative applications, ethical and safety concerns, and inclusive social adaptation.

The geographical distribution of studies revealed dominance from technologically advanced regions: North America (42%), Europe (28%), and East Asia (17%). A smaller number of contributions emerged from Global South contexts, reflecting a research gap in cultural diversity and accessibility challenges. These five interconnected domains form the backbone of Social VR research across the past two decades. Figure 1 illustrates this thematic framework, which informs the structure of the subsequent discussion.

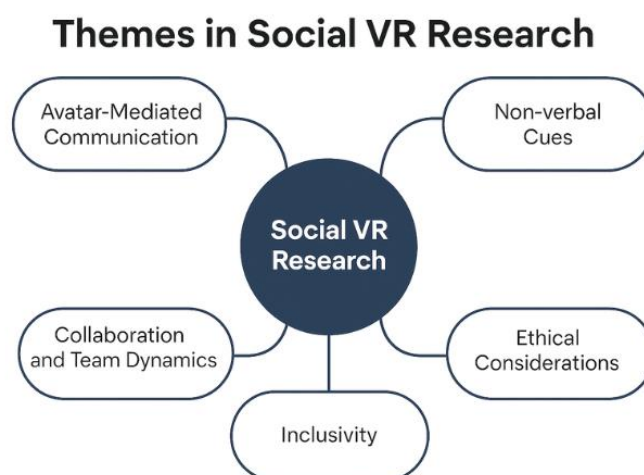


Figure 1: themes in social VR research

4.2. Avatar-Mediated Communication: Between Representation and Identity

Across studies, avatars emerge not only as visual placeholders but as embodied agents of identity expression and social behavior. Research by Coesel (2024) and Lee et al. (2022) supported the Proteus Effect, showing that users with more confident, attractive, or authoritative avatars exhibited increased self-esteem and assertiveness during interactions. In professional platforms such as Spatial, users preferred semi-realistic avatars that preserve some level of anonymity while facilitating task-oriented communication.

However, a technological disparity remains. While full-body avatars with IK (Inverse Kinematics) support enhanced immersion, only 21% of the platforms reviewed offered real-time facial tracking limiting emotional nuance in interpersonal communication. The synthesis suggests a need for facial expression transfer technologies (e.g., EMG-based tracking) to mature and become mainstream in Social VR platforms.

4.3. Non-verbal Cues and Immersive Presence

Studies consistently emphasize the value of non-verbal cues in conveying emotions, managing turn-taking, and enhancing intimacy. A notable experimental study by Wang et al. (2024) introduced a “Cone of Vision” feature that improved eye contact and coordinated attention in team-based VR tasks. Similarly, hand gestures, spatial proximity, and avatar gaze direction significantly increased co-presence and affective synchrony, mimicking real-life interpersonal dynamics.

Floating emojis and haptic feedback tools (e.g., vibration gloves or wristbands) add a layer of ambient emotional signaling, especially in casual or social settings like VRChat or Rec Room. Yet, limitations in motion fidelity and device compatibility were noted as key barriers to universal adoption.

4.4. Collaboration and Team Dynamics in Virtual Environments

Twenty-four studies focused specifically on collaborative tasks, from corporate meetings to scientific simulations. Platforms like Nanome allowed chemists to co-manipulate molecular models in 3D space, while Engage hosted VR-based academic lectures. Results indicated that embodied collaboration led to improved knowledge retention and higher group satisfaction compared to 2D video calls (Zielken et al., 2025).

However, the discussion of trust-building in long-term VR collaboration remains underexplored. While avatar personalization increased perceived reliability in short-term tasks, longitudinal studies (e.g., Yamada & Freitas, 2023) suggest that asynchronous presence (avatars lingering when users are away) may affect team cohesion negatively.

4.5. Ethical Considerations and Moderation Gaps

One of the most concerning findings across the literature is the rise in virtual misconduct, including harassment, stalking, and inappropriate avatar behavior—especially against marginalized users. Kalantari et al. (2023) highlighted the absence of real-time moderation tools in many social-VR spaces, leading to increased user anxiety and withdrawal.

Some platforms have started integrating “safe zones”, click-to-block functions, and personal space bubbles, yet some offer proactive governance through AI moderators or community training. Furthermore, the ethical implications of recording in VR where interactions are spatial, embodied, and persistently remain unresolved.

Thus, researchers call for VR-specific ethical guidelines, drawing from feminist HCI, accessibility-first design, and cultural sensitivity frameworks. These standards are especially urgent as Social VR expands into educational and mental health applications.

4.6. Inclusivity and the Social VR Landscape

The review revealed a growing body of work highlighting the inclusive potential of Social VR. Elderly users engaging in virtual “walking clubs” (Latikka et al., 2021), and autistic youth practicing social scenarios in structured VR environments (Zhang et al., 2023), demonstrated the therapeutic affordances of immersive spaces.

Silent or mute users on platforms like VRChat adapted by using gesture-based communication, emoji panels, or text overlays, forming subcultures of non-verbal expression. This phenomenon underscores Social VR as a flexible medium that accommodates different communication styles beyond voice and text.

Nevertheless, device access and digital literacy remain critical issues. Only 6 out of 78 studies included users from low-resource settings, suggesting the need for affordable, mobile-first VR solutions and localized content development.

4.7. Synthesis and Research Implications

Taken together, the findings demonstrate that Social VR is no longer a niche or speculative domain. It has evolved into a legitimate, complex, and affectively rich communication medium. Its strengths lie in embodiment, interactivity, and presence traits absent in legacy media. However, its adoption is uneven and its ethical governance is still in early stages. To address existing gaps, future research should prioritize:

- a) Longitudinal studies on team trust and avatar identity evolution
- b) Cross-cultural trials in low- and middle-income regions
- c) AI-enhanced moderation and adaptive safety tools
- d) Standardization of expressive avatars, including facial emotion modeling and behavioral mirroring

This systematic review contributes to the growing evidence that Social VR offers unique affordances for interpersonal connection, education, inclusion, and emotional communication, while demanding greater design responsibility and policy foresight from platform developers and regulators.

5. Conclusion

This systematic review of 78 peer-reviewed studies over two decades demonstrates that Social Virtual Reality (Social VR) has been transformed from a nascent experimental tool into a robust, multifaceted communication medium. Thematic synthesis revealed five primary domains shaping current and future Social VR discourse: avatar-mediated communication, non-verbal interaction, virtual collaboration, ethical considerations, and inclusivity.

Avatars have evolved beyond mere representations to become psychological and social instruments of identity, behavior, and trust. The power of embodiment reinforced through gestures, gaze, and spatial positioning has enabled more authentic and emotionally resonant interactions than traditional video conferencing tools. Collaborative applications, particularly in science, education, and professional settings, benefit from immersive 3D environments that enhance engagement and knowledge retention.

However, this medium is not without challenges. The limited expressivity of facial tracking, absence of real-time moderation systems, and ethical dilemmas surrounding harassment and surveillance present significant barriers to safe and equitable participation. Furthermore, despite its inclusive potential especially for neurodiverse users, the elderly, and non-verbal communicators accessibility remains constrained by cost, device requirements, and digital literacy.

Moving forward, the integration of AI-enhanced moderation, expressive avatar standardization, and ethical design practices will be essential for the responsible scaling of Social VR. Future research must also extend beyond Western contexts and include longitudinal studies on team trust, identity evolution, and intergroup dynamics.

In summary, Social VR holds immense promise for reimagining how humans connect, collaborate, and empathize in digital spaces. To unlock its full potential, developers, researchers, and policymakers must work together to build environments that are not only immersive but also inclusive, secure, and ethically sound.

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