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Exploring Avatar Utilization in Workplace and Educational Environments: A Study on User Acceptance, Preferences, and Technostress

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Abstract: With the rise of virtual avatars in professional, educational, and recreational settings, this study investigates how different avatar types—varying in realism, gender, and identity—affect user perceptions of embodiment, acceptability, technostress, privacy, and preferences. Two studies were conducted with 42 participants in Study 1 and 40 in Study 2, including professionals and students with varying VR experiences. In Study 1, participants used pre-assigned avatars they could control during interactions. In Study 2, an interviewer used different avatars to interact with participants and assess their impact. Questionnaires and correlation analyses measured embodiment, technostress, privacy, and preference variations across contexts. Results showed that hyper-realistic avatars resembling the user enhanced perceived embodiment and credibility in professional and educational settings, while non-realistic avatars were preferred in recreational contexts, particularly when interacting with strangers. Technostress was generally low, though younger users were more sensitive to avatar appearance, and privacy concerns increased when avatars were controlled by others. Gender differences emerged, with women expressing more concern about appearance and men preferring same-gender avatars in professional environments. These findings highlight the need for VR platform designers to balance realism with user comfort and address privacy concerns to encourage broader adoption in professional and educational applications.

Keywords: avatar; virtual reality; human–computer interaction

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1. Introduction

In recent years, remote work has experienced a significant increase, driven by the need to balance personal and professional life. This shift has been made possible by technological advances that allow employees to perform their tasks from anywhere [1]. However, remote work also presents major challenges, such as lack of face-to-face interaction, distraction, difficulty in creating a suitable work environment, and blurred boundaries between personal and professional life [2]. To address these challenges, virtual reality (VR) has emerged as a promising technology. VR not only improves understanding of the environment in remote meetings [3], but also facilitates access to otherwise difficult-to-obtain resources [4] and allows for the creation of immersive training scenarios [5,6]. In addition, VR increases immersion and the sense of embodiment [7,8], which can improve efficiency and reduce

distractions during virtual meetings. However, integrating VR also has drawbacks, such as virtual motion sickness and other issues associated with prolonged use of VR hardware, including eye strain, stress, and mental overload [9,10]. These symptoms may depend on factors such as demographics, movement illusion, and viewing mode [11–15]. These issues can also increase technostress, which refers to stress and anxiety caused by the adoption and use of new technologies. In the context of VR, technostress can manifest in various ways, such as frustration with unintuitive interfaces, the cognitive effort required to adapt to complex digital environments, or sensory overload from prolonged immersion [16,17].

A relevant approach to increasing immersion in virtual environments is the use of avatars, digital representations of users, which facilitate interaction [18]. An avatar is a virtual representation of a user within a digital environment. It can range from highly realistic models to stylized or abstract figures [19]. Its design and appearance shape how users perceive both their own presence and that of others in virtual spaces, influencing communication, interaction, and overall comfort. However, using avatars can introduce additional challenges that affect the user experience and modify behavior and attitudes [20,21]. Hyper-realistic avatars, while more closely resembling real people, can create insecurities in users [22], while avatar personalization can influence behavior or even trigger psychological issues, such as body dysmorphia [23–25]. Body dysmorphia in VR refers to how much a user feels their avatar represents them, influencing interaction realism [26]. It includes self-identification (feeling the avatar as part of oneself), motor control (intuitive movement), and presence perception (sense of being in the virtual world). Opting for realistic avatars without reaching hyper-realism can mitigate some of these issues while preserving an acceptable sense of embodiment and control over the avatar [27].

Despite advances in VR and avatar design, there is limited research on how different types of avatars affect user experience in professional environments using VR. While previous studies [28–31] have examined embodiment and technostress in general VR use, few have specifically analyzed these factors in the context of virtual meetings, where social and professional interactions are crucial. Understanding how avatar realism, gender representation, and customization influence perceived embodiment, technostress, usability, and privacy is essential for improving VR-based communication tools. This study aims to bridge this research gap by investigating the impact of avatar characteristics on user experience in virtual meetings.

To better understand these effects, two studies on the use of avatars have been conducted:

- Study 1 examines how users relate to different types of avatars that they control themselves. The study evaluates four avatar conditions: (1) hyper-realistic, (2) non-realistic, (3) an avatar representing another person of the same gender, and (4) another person using the user's avatar. The study measures embodiment, technostress, usability, and privacy concerns.
- Study 2 investigates how users perceive interactions when the interviewer, rather than the participant, uses different types of avatars. This study includes hyper-realistic, non-realistic, and different-gender avatars, as well as an avatar that mirrors the participant. The goal is to analyze how these representations affect interviewer credibility, participant comfort, technostress, and privacy perceptions.

To guide the research, the following questions are addressed:

1. How do different types of avatars influence users' perceived embodiment in VR meetings?
2. What is the impact of avatar realism and representation on technostress and usability?
3. How do avatars affect perceptions of privacy and social comfort in virtual meetings?
4. Does the avatar used by the interviewer influence the credibility and engagement of the participants?

The study is based on the following hypotheses:

H1. *Users will experience greater perceived embodiment with realistic avatars compared to non-realistic avatars.*

H2. *Hyper-realistic avatars will increase technostress compared to stylized avatars.*

H3. *Users will report fewer privacy concerns when controlling their own avatars compared to being represented by others.*

H4. *Participants will perceive the interviewer as more credible when using realistic avatars compared to non-realistic avatars.*

H5. *Gender-incongruent avatars (i.e., an avatar of a different gender than the user) will negatively impact perceived embodiment and comfort.*

By addressing these research questions and hypotheses, this study aims to provide a preliminary understanding of the benefits and limitations of avatars in VR-based professional interactions. Given the exploratory nature of this research and the limited sample size, the findings should be interpreted as a foundation for future studies rather than definitive conclusions. The results will help identify key factors that warrant further investigation in larger and long-term studies. Ultimately, this study seeks to contribute to the development of more effective and user-friendly avatar designs for virtual meetings, balancing usability, perceived embodiment, and user comfort.

2. Study Design

The study was structured into two parts, each with a different focus on evaluating the use of avatars in virtual meetings. In Study 1 (SE1), participants controlled their own avatars, while in Study 2 (SE2), the interviewer used different types of avatars. Both studies were conducted in a controlled environment that simulated virtual meeting scenarios. Avatars were always introduced in the same order, instructions remained identical across all participants, and interviewers followed a structured set of questions to maintain uniformity in interactions. Investigators supervised only the questionnaire responses to minimize bias.

2.1. Participants

Inclusion criteria included individuals between 18 and 65 years of age from Spain and Germany with previous experience in online meetings or virtual reality systems. The study was conducted in both countries to increase participant variability. Participants were required to have sufficient cognitive, auditory, and/or visual abilities to read, write, or engage in conversations in the language of the study. Exclusion criteria included no or very limited computer skills and sensory disorders that would prevent participation in the study (e.g., blindness or deafness). Individuals with no or very limited computer skills were excluded due to the need for participants to interact with the technology independently, preventing basic technical difficulties from affecting the study results. The final sample consisted of the following.

- Study 1: 42 participants (22 men and 20 women) between the ages of 22 and 62, with an average age of 32.4 years (SD = 9.3). Most participants had a high educational level, with 71.5% (30 participants) holding a university degree or higher.
- Study 2: 40 participants, equally divided into 25 men and 15 women, aged between 20 and 38 years old, with an average age of 28.2 (SD = 4.7). All participants had a high level of education, with 83% having a university degree or pursuing a degree.

Given the exploratory nature of this study, participation was open to the public and advertised on the bulletin boards of research labs in Spain and Germany. Due to this recruitment method, the final participants in both countries belonged to a university setting, including students, professors, and researchers. The total sample size was determined by the number of volunteers who signed up. This approach allowed for an initial investigation into avatar perception in virtual meetings, providing preliminary insights that can guide future research with larger and more diverse samples. Both studies were approved by the university ethical committee (Ref. CEISH/25/2022). All data were collected anonymously, no photographs of participants were stored, and all participants signed an informed consent form before taking part in the study. While the sample size is limited, the findings help identify key factors that warrant further investigation in more extensive and long-term studies.

2.2. Materials

To simulate the use of avatars with varying appearances in an online meeting, the Geometry-Guided GAN for Face Animation (G3FA) was utilized [32]. This model, which has shown superior performance compared to other state-of-the-art real-time facial animation methods, enables the integration of 3D information into face animation using only 2D images. This significantly enhances the image generation capabilities of the talking head synthesis model.

In Study 1, participants used three types of avatars: a hyper-realistic avatar of the participant; a non-realistic avatar (cartoon of the participant); a hyper-realistic avatar of another person of the same gender; and a final test where another person used the participant's avatar. In Study 2, the interviewer used the following avatars: a hyper-realistic avatar of a person of the same gender as the participant; a hyper-realistic avatar ostf a person of the opposite gender; a non-realistic (cartoon) avatar; a hyper-realistic avatar of another person; and a hyper-realistic avatar representing the participant. For the hyper-realistic images, real photographs were used, while for the non-realistic images, the VToonify tool [33] was used, allowing the creation of animated-style images from real photographs. To generate this image, the cartoon (beautiful) option was selected based on a clear photograph of the participant, while the remaining settings were left at their default values.

2.3. Variables and Measurement Instruments

The evaluation protocol consists of three parts: user information collected before the study; information collected during each test; and data collected at the end of the study.

2.3.1. User Profile

Before starting the test, demographic information (gender, age, educational background) and previous experience with online meetings and virtual reality technology in various contexts (work, education, leisure) were collected.

2.3.2. Measures Obtained at the End of Each Test

In Study 1, a 5-point Likert scale questionnaire based on the response format of the System Usability Scale (SUS) [34], was used to collect user feedback at the end of each test. In addition, a psychometric approach assessed the embodiment [35] toward the avatar's face, focusing on ownership, agency, and change [36]. Questions on privacy were also included, adapted from a validated technostress test [37]. All questions were tailored for each study to refer to the user or the interviewer.

In Study 2, it was not possible to assess Change in Embodiment, as the user did not have control over the avatar. However, Agency and Ownership were evaluated using the

questions from Study 1, with the exclusion of those that could not be adapted. To assess the impact of the avatar on the interviewer's credibility and the participant's trust in the interaction, seven questions were introduced. These questions were adapted from previous studies on trust in virtual characters and online communication. Research has shown that the appearance and expressiveness of avatars significantly influence user trust [38,39]. Furthermore, studies have examined how the presence of avatars in virtual interactions affects perceived credibility and trust [40].

Additionally, two questions on privacy concerns, adapted from Study 1, were included to explore how the avatar influenced participants' perceptions of privacy and data security. Based on these studies, the questions were designed to evaluate distraction, conversational difficulty, and perceived privacy when interacting with the avatar. In the final test of Study 2, these questions also focused on the use of an avatar of a different gender.

Appendix A presents the questions used to collect data on embodiment, privacy, and technostress in Study 1 (Table A1), as well as embodiment, technostress, and gender in Study 2 (Table A2).

2.3.3. Final Study Measures

At the end of all tests, participants completed a final assessment. In Study 1, Technostress caused by avatar use was evaluated using a 5-point Likert scale, based on the response format of the System Usability Scale (SUS) and adapted from a validated test [36]. In Study 2, Technostress was not assessed, as it is more closely related to self-representation, which was not applicable in this context. Additionally, four open-ended questions were included to evaluate participants' general experience, any discomfort caused, and their perception of avatars of different genders.

The acceptability of using these types of avatars in different contexts—work, education, and leisure—was assessed in both studies. Given that the focus was on evaluating the use of the avatar itself rather than the system used, the questions were reduced to measuring future intention to use and perceived usefulness of the avatar. To achieve this, they were adapted from a validated acceptability questionnaire [41–43]. Responses were collected using a 5-point Likert scale and analyzed independently.

Finally, preferences for avatar type were evaluated in six scenarios: team meetings or interactions with external participants, educational settings as a student or teacher, and recreational activities with strangers or friends.

2.4. Method of Analysis

For the analysis, the arithmetic mean was used to aggregate responses. When analyzing individual questions, the mean was calculated across all participants to determine overall trends. For constructs measured by multiple items (e.g., Agency), a composite score was obtained by averaging the participant's responses to the corresponding questions. This method ensured comparability across participants and facilitated correlation analyses with other variables.

The statistical analysis was conducted using SPSS software (version 29.0.1.0). To evaluate the relationships between the study variables, Spearman's correlation was employed, with a significance threshold set at $p < 0.05$. The choice of Spearman's correlation was based on the observation that the relationship between the variables did not appear to be strictly linear, making this test more suitable for capturing associations without assuming a specific linear structure. Due to the exploratory nature of the study and the limited sample size, no corrections for multiple comparisons were applied. The primary objective of this work is to identify preliminary patterns and key factors that can be further investigated in future studies with larger samples and more robust statistical analyses.

2.5. Hardware

The studies were carried out on computers equipped with NVIDIA RTX3060 graphics cards in Spain and RTX3080 in Germany, ensuring smooth performance and low latency in avatar rendering.

2.6. Procedure

The study for each participant was conducted through the following phases:

2.6.1. Pre-Study

Participants were informed about the study's purpose and signed an informed consent form. Then, they completed an initial questionnaire to gather demographic data and previous experience.

2.6.2. Study

In both studies, participants interacted with the interviewer in several different tests, each featuring a different type of avatar. The interactions lasted between 2 and 3 min, simulating conversations in virtual meetings.

- Avatar Familiarization: Before each interaction, participants were briefly introduced to the avatar that either the interviewer or the participant would use in the session.
  - S1: Hyper-realistic, non-realistic, hyper-realistic avatar of another person, and a test as a spectator while another user used their avatar.
  - S2: Hyper-realistic, non-realistic, hyper-realistic avatar of another person of the same gender, hyper-realistic avatar of a person of a different gender, and a hyper-realistic avatar of the participant.
- Simulated Interview: Participants engaged in a conversation with the interviewer, designed to make them focus on the interaction rather than on the avatar. They were allowed to change the topic or avoid questions if they wished. In S1, the interviewer positioned themselves behind the users to minimize distraction, allowing users to maintain focus on the avatar. The interview aimed to stimulate conversation and divert attention from the avatar by asking personal questions where participants could expand freely. In S2, the interview took place via video conference in separate rooms, with questions structured to simulate a job interview.
- Post-interaction Questionnaire: At the end of each interaction, participants completed a brief questionnaire to evaluate each avatar type.

2.6.3. Post-Study

After completing all tests, participants completed the final questionnaire.

3. Results

3.1. User's Prior Experience

Regarding prior experience with video calls and virtual reality systems, the following results were obtained:

- Study 1: Regarding video conferencing experience, 69% reported frequent use, 23% had regularly used VR
- Study 2: Systems, while 14.3% had never used VR before this study. Regarding video conferencing use, 58% reported frequent use and 43.5% had occasionally used a virtual reality system.

3.2. User's Perception of Embodiment

In both studies, embodiment perception was a key dimension in measuring the effectiveness of avatars. The questionnaire elements were classified into three properties that influence this perception: ownership, agency, and change (the latter not applicable to Study 2). In terms of ownership, Figure 1 illustrates that both hyper-realistic avatars in both studies achieved a greater resemblance to human faces than the non-realistic avatar (Q2). Participants particularly attributed a stronger sense of facial ownership to their hyper-realistic avatars in questions about facial features (Q1 and Q3).

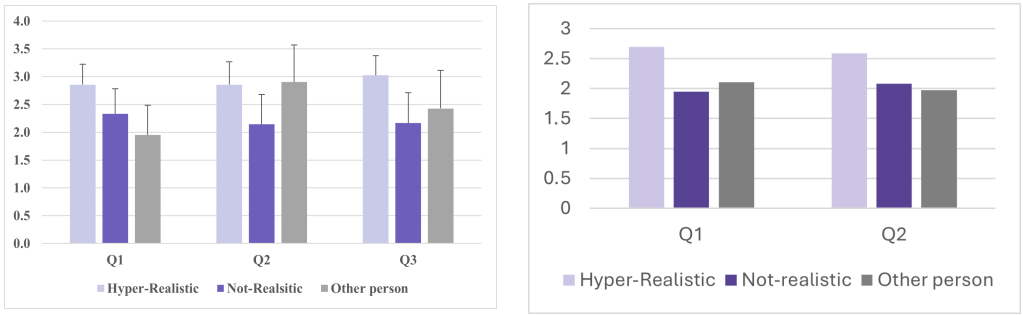

Figure 1. Property. **Left**: Study 1; **Right**: Study 2.

For agency, Figure 2 shows that, in Study 1, users' own avatars received higher scores across all questions. The hyper-realistic avatar scored highest on questions related to avatar movement (Q4, Q7, and Q8), while the non-realistic avatar scored higher on questions related to enjoyment (Q5) and comfort (Q6). Conversely, the avatar representing another person did not score significantly high in any question, except for comfort. In Study 2, the difference between avatar types was much more balanced, although the participant's own hyper-realistic avatar retained slightly higher values. It is notable that the question about feeling like they were speaking with a real person rather than a representation (Q4) received a clearly lower value.

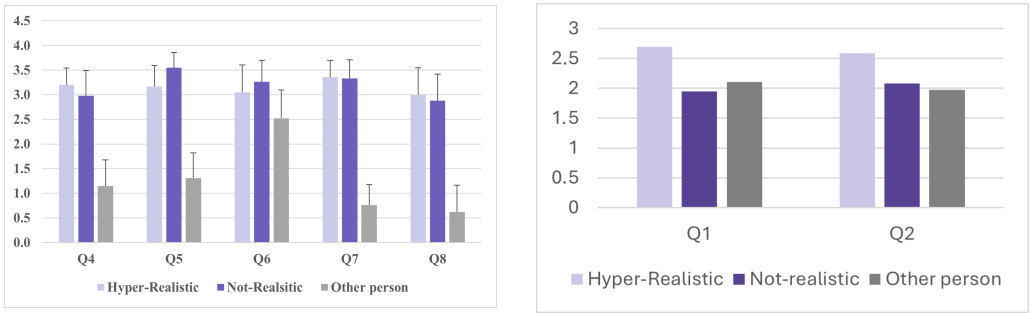

Figure 2. Agency. **Left**: Study1; **Right**: Study 2.

Lastly, the results for change in Study 1 are presented in Figure 3. In all three cases, the values remained relatively low (below 2.5). However, the non-realistic avatar showed a pronounced sense of change. Interestingly, the hyper-realistic avatar led more users to question changes in their own face (Q10). Additionally, the avatar that did not belong to the user received the lowest scores across the three questions.

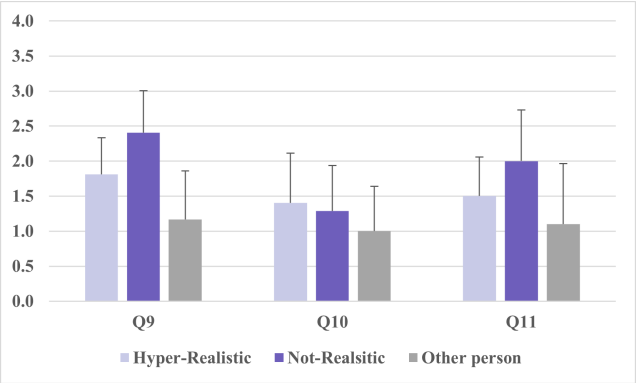

Figure 3. Change. Study 1.

A correlation analysis with sociodemographic data and prior experience was performed using Spearman's correlation. Results indicated no significant correlation with age, gender, education level, or previous videoconferencing experience. However, prior experience with virtual reality showed a correlation, as displayed in Table 1, where the Agency factor in Study 1 demonstrated improvement with prior VR experience, suggesting a greater sense of control over the avatar with increased VR exposure. No significant correlations were found in Study 2.

Table 1. Correlation between virtual reality experience and video conference experience. The values in bold indicate significant values.

		Study 1		**Study 2**	
		r	***p***	**r**	***p***
Property	H	0.252	0.107	0.101	0.638
	N	0.191	0.227	0.022	0.92
	O	−0.076	0.631	0.096	0.655
Agency	H	**0.469**	**0.002**	0.034	0.874
	N	**0.329**	**0.003**	0.067	0.757
	O	**0.411**	**0.007**	0.128	0.398
Change	H	0.141	0.373	0.018	0.132
	N	−0.062	0.697	0.181	0.41
	O	0.104	0.51	0.087	0.551

3.3. Credibility and Confidence

As shown in Figure 4, in Study 2, participants generally felt that the avatar did not cause a notable lack of credibility or trust. However, the participant's own hyper-realistic avatar scored below average on all questions. On the other hand, the lowest-scoring avatar was the non-realistic one. In a Spearman correlation analysis between results and prior experience, a negative correlation was again found between prior VR experience and question Q5 (r = −498; p = 0.008), indicating that users with VR experience had greater confidence when interacting with an avatar. Regarding the relationship between credibility and trust with embodiment properties, a significant negative correlation was found with the sense of ownership. The resulting values are shown in Table 2, suggesting that the greater the sense that the avatar belongs to the interlocutor, the higher the credibility and confidence.

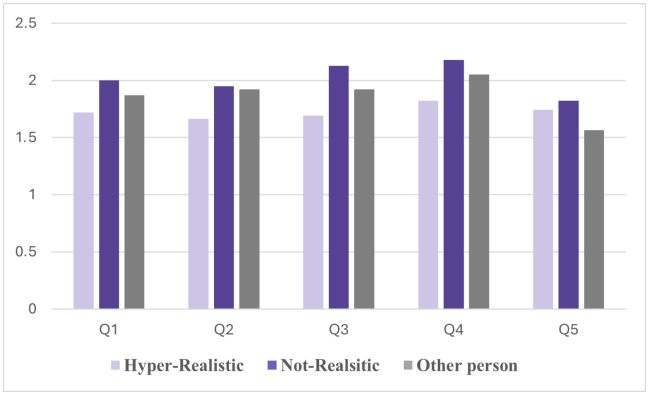

Figure 4. Values obtained in credibility and confidence from Study 2.

Table 2. Correlation between presence properties and credibility and confidence. The values in bold indicate significant values.

	Property	Agency
Hyper-Realistic	−**0.404; 0.011**	−0.214; 0.190
Not Realistic	−0.01; 0.95	−0.430; 0.795
Other person	−**0.371; 0.009**	−0.524; 0.620
User	−**0.367; 0.021**	−**0.330; 0.04**

3.4. Privacy

In Study 1, users did not express concern about privacy for the first three avatars (with values below 0.5 on a scale of 0 to 4). However, this increased to 1.5 when they saw that others could use their avatar. In Study 2, higher privacy concerns were evident from the first avatar. Figure 5 (left), which presents the results of the second study, shows that hyper-realistic avatars generated more concern than the non-realistic ones, with concerns increasing with the use of the participant's own avatar and gender changes.

To further explore the correlation between privacy concerns and embodiment perception, a Spearman correlation analysis was conducted. In Study 1, there was a notable correlation between hyper-realistic avatars and the sense of change (r = 0.575; p = 0.001) and, to a lesser extent, the sense of control (r = 0.397; p = 0.014). In Study 2, a stronger correlation was found between the sense of control and avatars representing another person (r = 0.377; p = 0.018) and the participant's own avatar (r = 0.460; p = 0.003). Despite being a low correlation, both types of avatars negatively correlated with the sense of ownership. However, the most notable correlation was with the use of an avatar of a different gender, showing discomfort (r = 0.745; p = 0.0001).

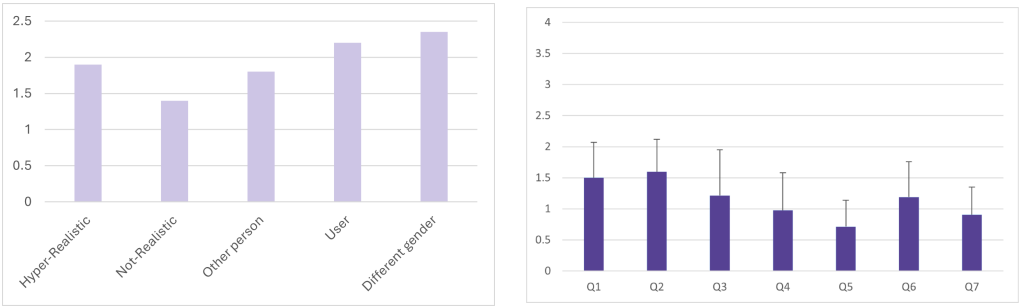

Figure 5. Left: Privacity results in Study 2; **Right**: Visual comparison of technostress questionnaire responses in Study 1.

3.5. Technostress

Figure 5 (right) provides a visual comparison of questionnaire responses, as shown in Table A1, offering insights into levels of technostress. Specifically, Questions 4, 5, and 7, related to privacy, fati gue, and self-esteem while using avatars, showed the lowest values, all below 1. In contrast, Questions 1 and 2, focused on the avatar's appearance, scored higher, exceeding 1.5. These findings suggest that merely using avatars does not inherently induce high levels of technostress. However, additional analysis using Spearman's correlation revealed significant associations:

- Gender correlated with Questions 6 (r = 0.359; p = 0.05) and 7 (r = 0.298; p = 0.018), indicating a greater concern among women regarding possible judgment or discrimination based on avatar appearance, aligning with previous research on appearance-related anxiety in video conferencing.
- Age correlated with Questions 1 through 5 (Average: r = 0.319; p = 0.045), indicating higher concerns among younger participants regarding avatar appearance, privacy, and fatigue, consistent with existing literature.
- Videoconferencing experience correlated with apprehension about expressing one's true personality (r = 0.377; p = 0.014), suggesting that more experience amplifies concerns in this domain.

3.6. Acceptability

As shown in Figure 6, users perceived avatar technology as useful in both educational and leisure settings in both studies, with ratings above 2.5. However, uncertainty remains about their effectiveness in the workplace, although users still recognize their utility (S1: 2.3; S2: 2). For the intention to use, the effect is similar: scores are higher than for utility, but the same trend persists, with leisure scoring the highest and work the lowest.

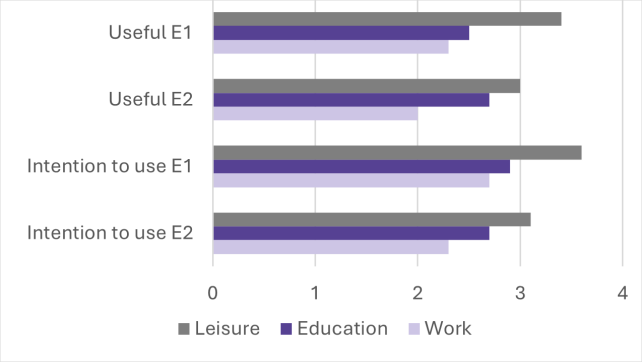

Figure 6. Perceived utility and intention to use.

To discern factors influencing users' willingness to adopt avatar systems, a Spearman correlation analysis was conducted. Initially, the analysis considered prior experience and demographic data. In the first study, a positive correlation with previous VR experience was observed in the first study (Work: r = 0.397, p = 0.009; Education: r = 0.399, p = 0.009; Leisure: r = 0.339, p = 0.009). In contrast, in the second study, this correlation was only significant for education and leisure (Education: r = 0.459 p = 0.024; Leisure: r = 0.417, p = 0.004). For embodiment factors, ownership emerged as significant in determining perceived usefulness of avatars in both work and educational contexts, thus influencing the intention to use them. Detailed results are provided in Table 3.

Table 3. Correlation between usability and property factor.

	S1 r	S1 *p*	S2 r	S2 *p*
Useful in work	0.446	0.003	0.351	0.008
Useful in education	0.312	0.048	0.281	0.033
Intention to use in work	0640	0.001	0.343	0.012
Intention to use in education	0.336	0.029	0.294	0.041

3.6.1. Avatar Preferences

Figure 7 (left) presents a comparative analysis of avatar preferences across different settings in Study 1. In workplace scenarios, users preferred avatars representing themselves, ideally with the highest possible image quality. This preference increased with the seriousness of meetings. Similarly, in educational contexts, particularly regarding educators, users favored a hyper-realistic avatar of themselves (47.6%). For students, self-representation was also preferred as they progressed. In leisure activities, preferences varied depending on the activity. When interacting with friends, users prioritized their hyper-realistic avatars. Conversely, in settings requiring interaction with both acquaintances and strangers, such as gaming environments, users preferred non-realistic avatars (52.4%).

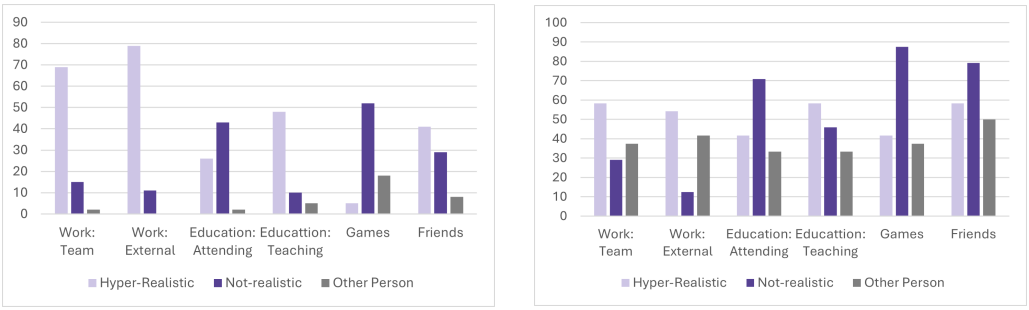

Figure 7. Avatar preferences comparative. **Left**: Study 1; **Right**: Study 2.

Similarly, in Study 2, users preferred interacting with a hyper-realistic avatar in work settings, ideally a real-life likeness. In educational settings, as students, they preferred non-realistic avatars, while as teachers, they chose hyper-realistic avatars of themselves. In leisure settings, users preferred interacting with non-realistic avatars, although the difference between a non-realistic avatar and hyper-realistic avatars was smaller when interacting with friends. This comparison is shown in Figure 7 (right).

3.6.2. Use of Different-Gender Avatars

In Study 2, an additional test involved using an avatar of a different gender. Results showed that this test scored lower than the others on both embodiment properties (below 1.5 on a scale of 0 to 4), particularly the question about feeling like they were speaking with a real person (0.85). Regarding questions on credibility and trust, results are displayed in Figure 8, showing that users experienced more issues interacting with the interviewer (2.6), felt increased discomfort (2.2), and had higher privacy concerns (2.3).

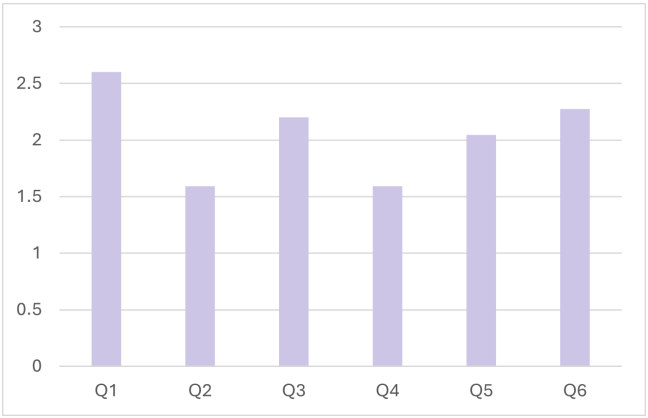

Figure 8. Credibility and confidence with other gender avatar.

Additionally, to better understand user preferences when interacting with another person, participants could select whether they preferred interacting with a male or female avatar. Results based on user gender are found in Table 4. For men: in the workplace, they preferred interacting with a male avatar; in education, they mostly preferred male avatars; and in leisure, where the preference for another person's avatar increased, the preference was for both genders, with a greater tendency toward female avatars when interacting with strangers. For women, the number of users who preferred another person's avatar was considerably lower. Notably, in leisure, there was no gender preference for the avatar they interacted with, but in other settings, they preferred either both genders or male avatars.

Additionally, most users mentioned in open-ended questions that interacting with an avatar whose voice did not match the appearance felt less serious and initially distracting until they grew accustomed to it.

Table 4. User preferences depending on gender.

		Total	Both	Man	Woman
Work Team	Men	9	2	7	
	Women	3	3		
Work External	Men	12	1	8	
	Women	3	1	2	
Education Attending	Men	10	7	2	1
	Women	3	1	2	
Education Teaching	Men	6		4	2
	Women	3	1	2	
Games	Men	15	8	2	4
	Women	6	6		
Friends	Men	12	8	3	1
	Women	8	8		

4. Discussion

This study examined the use of different types of avatars in work, educational, and recreational settings, evaluating user perceptions of embodiment, acceptability, technostress, privacy, and preferences. Two studies were conducted: in the first, participants controlled their own avatars, while in the second, an interviewer used various avatars. Both studies included hyper-realistic and non-realistic avatars with variations in gender and identity.

Findings indicate that hyper-realistic avatars enhance the sense of embodiment, especially when they closely resemble the user. This perceived embodiment positively

influenced the perceived usefulness and intention to use avatars in work and educational settings, where users preferred avatars that resembled themselves. However, in recreational contexts, participants favored non-realistic avatars, particularly for informal interactions or engagements with strangers.

The study reinforced the importance of embodiment in avatar use, showing that a stronger sense of embodiment improves perceived utility and intention to use. This result aligns with previous studies on embodiment in VR [12,13], which suggest that similarity to the user enhances identification and the sense of presence in virtual environments. Therefore, implementing strategies that enhance ownership and control while minimizing perceptions of bodily distortion in avatars is crucial. Avatars that closely match the user's appearance improved the sense of control and reduced discomfort related to appearance changes.

Although technostress related to avatar use was relatively low, concerns about avatar appearance emerged, especially among younger users, reflecting potential insecurities about body image, which is consistent with previous studies [34,41]. Privacy concerns also arose, particularly when avatars were used by others. While initial privacy concerns were minimal, they may increase over time due to the perception that data used to create avatars could be sold or stolen. In environments where confidentiality is critical, such as the workplace, ensuring transparency in data usage and maintaining security will be essential for the widespread adoption of avatar technology.

Results also showed that the type of avatar used by the interviewer influenced participants' perceptions of credibility and trust. Hyper-realistic avatars—whether resembling the user or another person of the same gender—were perceived as more credible, while non-realistic avatars generated discomfort and a lower perception of professionalism. This suggests that, in professional settings such as job interviews or formal presentations, selecting avatars that enhance credibility and trust is crucial.

Although a general preference for hyper-realistic avatars was observed in professional settings, the preference for non-realistic avatars in recreational environments aligns with previous research on virtual identity, such as the studies by Yee and Bailenson [44], who found that in informal contexts, users tend to choose more stylized or abstract representations to foster creativity or maintain anonymity.

This phenomenon can be explained through self-presentation theory [45], which suggests that individuals adjust their appearance based on the social context. In professional environments, where credibility and professionalism are essential, users prefer avatars that reflect their own image. In contrast, in recreational settings, aesthetic flexibility allows for the exploration of different aspects of identity without the constraints of the physical world.

Additionally, the results suggest gender differences in participant preferences. Women showed greater concern about the avatar's appearance and its impact on how they were perceived by others, whereas men felt more comfortable interacting with same-gender avatars in work and educational settings. These differences should be considered in avatar design to ensure that all users feel comfortable and confident when engaging with this technology.

Furthermore, cultural background and prior experience with virtual reality may have influenced participant perceptions of avatars. Since the study was conducted in Spain and Germany, differences in technology adoption, self-representation, and privacy concerns could have played a role in avatar preferences. While cultural influences were not explicitly analyzed, future studies should explore how regional differences and attitudes toward virtual interactions impact avatar selection. Additionally, prior VR experience may have shaped participants' comfort levels and perceived embodiment. Those familiar with VR might have adapted more easily to hyper-realistic avatars, while less experienced users

may have felt greater discomfort or uncertainty. Expanding future research to include individuals with minimal or no VR exposure would help clarify how familiarity with immersive technologies affects user perception and adoption.

Personalizing one's representation can negatively affect self-perception. Jawad et al. [46] found that AI-driven personalization algorithms can influence self-image, group identity, and online social interactions.

An important concern emerging from the findings is the psychological impact of excessive avatar customization, particularly the risk of body dysmorphia. The ability to modify avatar appearance may heighten body image insecurities, especially among younger users, suggesting the need to establish limits on customization to prevent unrealistic expectations. This underscores the importance of designing balanced avatars that faithfully represent users without negatively affecting self-esteem.

Given the exploratory nature of this study, its small sample size, and the fact that both studies were conducted in a single session, the findings should be interpreted as preliminary insights rather than definitive conclusions. As a result, the study has several limitations.

First, since all participants had at least basic technological knowledge, it remains unclear how individuals with minimal or no experience with technology would engage with avatars. Additionally, the limited sample size and the study's focus on only two countries restricted the ability to fully assess potential cultural differences in avatar preferences. Expanding the sample to include a broader and more diverse range of participants and cultural backgrounds would improve the generalizability of the results.

Second, the long-term effects of avatar-based interactions remain uncertain. Investigating the prolonged use of this technology and its impact on group dynamics would provide valuable insights into its sustainability and effectiveness over time.

Another limitation is the lack of consideration for psychological and social factors that may influence avatar preferences, which could have affected the findings. Incorporating physiological measures, such as heart rate or skin conductance, would allow for a more objective assessment of stress levels. Additionally, qualitative approaches, such as post-study interviews, could help identify specific stressors, including the uncanny effect of certain avatars or the pressure to perform in virtual interactions.

Furthermore, a dedicated study on the potential risks associated with avatars could offer deeper insights into privacy concerns and inform the development of effective mitigation strategies. Addressing issues such as data misuse, identity theft, and user control over personal information would be essential for the widespread adoption of avatar-based technologies.

Finally, these studies have been conducted exclusively in a professional setting. Future research should explore how these findings translate to other contexts, such as training simulations or customer service interactions, where avatar perception and perceived embodiment could influence user experience and performance in distinct ways.

5. Conclusions

Avatars hold significant potential for enhancing virtual interactions, particularly in professional and educational settings. The findings suggest that perceived embodiment plays a crucial role in avatar utility and acceptance. To maximize their benefits, it is essential to prioritize strategies that enhance the sense of ownership and control while minimizing perceptions of bodily alteration.

Addressing concerns regarding privacy and appearance will also be key to widespread avatar adoption. Ensuring transparency in data usage and providing balanced customization options can help reduce risks related to body dysmorphia and self-presentation anxiety. Additionally, future research should investigate specific privacy risks, such as data misuse

and identity theft, and propose mitigation strategies. User-controlled data permissions, anonymization techniques, and increased transparency in platform policies—such as clear guidelines on data storage and usage—could help alleviate user concerns and improve trust in avatar-based technologies.

Furthermore, ethical risks, particularly those related to excessive avatar customization and its potential to contribute to body dysmorphia, require further attention. Over-customization may lead to unrealistic body standards, negatively impacting users' self-esteem. To address this, future avatar design should incorporate guidelines that limit unrealistic body modifications, promote inclusive avatar options, and encourage representations that reflect diverse and authentic identities. Developers bear a responsibility to protect user well-being, ensuring that avatar customization tools enhance self-expression without reinforcing harmful beauty standards.

Finally, further research is needed to assess the impact of avatars on gender perception, trust in interactions, and group dynamics in virtual environments. Exploring long-term effects and considering individual and cultural differences will contribute to a more inclusive and effective development of avatar technologies in the future.

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Appendix A

Table A1. Study 1 questions.

	Questions used in the Study 1
	Property
Q1	It felt like the virtual face was my face.
Q2	The virtual face felt like a human face.
Q3	I had the feeling that the virtual face belonged to me.
	Agency
Q4	The movements of the virtual face seemed to be my own movements.
Q5	I enjoyed controlling the virtual face.
Q6	I have felt comfortable using the virtual face.
Q7	I felt as if I was causing the movement of the virtual face.
Q8	The movements of the virtual face were synchronous with my own movements.

Table A1. *Cont.*

	Change
Q9	I had the illusion of owning a different face from my own.
Q10	I felt the need to check if my face really still looked like what I had in mind.
Q11	I felt as if the form or appearance of my face had changed.
	Privacy
Q12	I feel that the use of this type of avatar is an intrusion into my privacy.
Q13	I feel that this kind of avatar reveals private personal information without my consent.
	Technostress
Q1	Do you feel or would you feel pressured or stressed about maintaining a "perfect" image or appearance through your avatar?
Q2	Do you feel or think you would feel anxiety or stress when comparing your avatar to other people's avatars in virtual environments?
Q3	Do you experience or think that you would experience difficulties in expressing your true identity or personality through your avatar?
Q4	Do you or would you feel uncomfortable or stressed about the lack of privacy or the potential exposure of your real identity while using an avatar?
Q5	Do you feel or think you would feel that using avatars in virtual environments exhausts you emotionally or mentally?
Q6	Do you experience or think you would experience worries or stress related to the possibility of your avatar being judged or discriminated against by other users?
Q7	Do you feel or think that you would feel that the use of avatars in virtual environments negatively affects your self-esteem or self-confidence?

Table A2. Study 2 questions.

	Questions used in the Study 2
	Property
Q1	It felt like the virtual face was the other person.
Q2	The virtual face felt like a human face.
	Agency
Q3	The movements and expressions of the virtual face felt real.
Q4	I felt that the virtual face was not a representation but the real person.
Q5	Overall, I felt like I was talking to the other person.
	Credibility and confidence
Q1	The avatar has distracted me from the conversation.
Q2	I found it more difficult to maintain the conversation with the avatar than with the real person's face.
Q3	I felt that it was more difficult to speak with the virtual face than with the real person.
Q4	I felt that it was more difficult for me to look at the virtual face during the conversation than with the real person.
Q5	Overall, I felt stressed or uncomfortable talking with the virtual face.
Q6	I feel that the use of this type of avatar is an intrusion into privacy.
Q7	I feel that this kind of avatar reveals private personal information without consent.
	Gender
Q1	I feel it affected my interaction with the interviewer.
Q2	It made me feel uncomfortable during the conversation.
Q3	I found it more challenging to maintain the conversation.
Q4	I feel it affected my confidence with the interviewer to answer their questions.
Q5	I feel the credibility and/or authority of the interviewer changed.
Q6	I was concerned about sharing private information while using avatars.

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