Towards Understanding Harassment in Social Virtual Reality: A Study Design on the Impact of Avatar Self-Similarity

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Abstract

In social virtual reality (VR), harassment persists as a pervasive and critical issue. Prior work emphasizes its perceived realness and emotional impact. However, the influence of avatar design, particularly the role of self-similarity, remains underexplored. Self-similar avatars can enhance user identification and engagement, yet potentially intensify the psychological and physiological effects of harassment. Existing studies often rely on interviews or user-generated content, lacking systematic analysis and controlled comparisons. To address these gaps, we present a process for creating realistic VR harassment scenarios. We built a scenario based on existing literature and validated it with expert reviews and user feedback. We propose a 2 x 2 between-subjects design to systematically examine users' emotional and physiological states, their identification with avatars, and the effects of avatar self-similarity. The study design will deepen the understanding of harassment dynamics in VR. Additionally, it can provide actionable insights for designing safer, more inclusive virtual environments that promote user well-being and foster equitable communities.

Index Terms: Social Virtual Reality, Harassment, Avatar Design, Self-Similarity, Personalization, Identification, Embodiment.

Content Warning: This paper includes detailed descriptions of harassment, quotes of offensive verbal insults, and other potentially triggering content.

1 Introduction

Social VR refers to immersive digital spaces where users meet, interact, and socialize with one another [25, 26]. These spaces enable lifelike and engaging experiences, leveraging embodiment and real-time communication [14, 28]. Avatars, as visual representations of users, play a central role in these interactions. They allow users to communicate, collaborate, and participate in shared activities [23]. Social VR often allows users to create, craft, and customize their avatars [15, 18]. Users can create representations ranging from abstract designs to highly personalized avatars that closely resemble their real-world appearance. It allows users to express their identity and shape their representation in ways that align with their self-perception [15, 18, 24]. This can create a deeper emotional connection to the avatar and a more engaging, intimate, and personal experience [15, 24, 44, 45]. However, social VR applications introduce new challenges concerning safety, inclusivity, and potential harm.

Harassment stands out as a pressing issue in social VR [6, 17, 48]. Many incidents are documented in media [5, 42, 43] and the growing problem is stated by various researchers [4, 6, 7, 17, 34, 38, 48]. Although harassment is not a new phenomenon in digital spaces, embodiment can increase the intensity in VR, making the experience feel disturbingly real [6, 17, 38, 48]. Harassment in social VR can evoke emotional and physiological responses that closely mirror those triggered by real-world aggressions [38]. It can evoke disturbing and negative experiences of anxiety, panic, and unsafety [17]. However, the role of avatar design - particularly the impact of self-similar avatars on users' vulnerability - remains underexplored.

Self-similar avatars, which mirror users' real-world appearance, have been shown to intensify elicited emotions [30]. They increase the identification and connection between one's physical body and the avatar [15, 24, 44]. While these attributes can impact experiences positively, they may also amplify the negative effects of harassment, making the aggression feel more personal and impactful. Additionally, marginalized users face unique risks, as avatar customization can both affirm their identity and expose them to targeted abuse [6, 16, 17, 38, 39]. Understanding the interplay between harassment experiences and avatar design is crucial, as avatars are a central part of social VR platforms and are users' representation. This leaves a critical gap in our understanding of how experiences of harassment influence users' identification with their avatars and how avatar design might affect their vulnerability in social VR settings.

To address these gaps, we investigate two key research questions:

RQ1 How does harassment affect the users' emotional and physiological state and their identification with their avatars?

RQ2 How does self-similarity affect the emotional and physiological effects of harassment?

This paper presents a method for creating VR harassment scenarios that can similarly occur in commercial social VR applications. Based on a realistic scenario, we propose a study to systematically investigate the dynamics of harassment in a controlled setting. We assess emotional responses, physiological arousal, and avatar identification by employing both quantitative and qualitative methods.

By advancing the understanding of harassment dynamics in VR, we aim to provide actionable insights for designing safer and more inclusive virtual spaces. These insights are intended to guide the development of tools and policies that balance personalization with user protection. Therefore, we advance ethical practices in XR, fostering VR environments where all users feel safe and can participate free from harm.

2 Related Work

Harassment in social VR refers to disruptive behaviors intended to harm, disturb, or discomfort others [6, 17]. A growing body of research documented such experiences by interviewing social VR users, observing VR spaces, and analyzing user-generated videos [6, 7, 17, 34, 38, 48]. These reports reveal the severe emotional and psychological strain that such incidents can have on individuals.

In those interviews, researchers identified similar harassing actions, which can be classified into three categories, as summarized by Blackwell et al. [6]:

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1. **Verbal harassment** includes insults, slurs, and spoken abuse, amplified by the real-time voice chat.

2. **Physical harassment** is characterized by violations of personal space or simulated touching, which can feel alarmingly real due to the embodied nature of VR interactions.

3. **Environmental harassment** refers to disruptive actions within the shared virtual space, such as obstructing activities, throwing objects, or displaying offensive content.

While these behaviors are not new to online platforms, their impact in VR is heightened due to the focus on embodiment. Body tracking, synchronous voice conversations, and a high sense of presence can make such incidents feel disturbingly real [6, 17, 38, 48].

Prior work further indicates that realistic situations and experiences in VR can intensify people's emotional and physiological reactions, with harassment often triggering anxiety, panic, and feelings of unsafety [6, 17, 38]. These findings align with literature on real-world harassment, which associates repeated victimization with increased stress and physiological arousal, reduced self-esteem, and compromised emotional well-being [1, 8, 9, 29]. Identifying and understanding these stress markers is critical for designing interventions that mitigate harm and promote user safety.

Victims of harassment employ various coping strategies, including changing their behavior or disassociating from the situation [2, 36]. Qualitative studies indicate that marginalized users alter their avatar design to minimize identity-revealing visual cues, such as gender, skin color, or religious attire [4, 6, 17, 38]. While these coping mechanisms may reduce targeted abuse, they can also diminish users' connection and identity with their avatars and their overall VR experience. However, the personalization of avatars can also have positive effects on user engagement and experience [12, 13, 15, 24, 35, 44]. Therefore, the behavioral changes as a coping mechanism require further investigation.

Avatars and their design play a central role in shaping users' experience in social VR. By embodying and controlling an avatar, users can perceive its body as their own and strengthen their identification with it [40, 41]. This is called the sense of embodiment [21]. Users often create avatars that closely mimic their real-world appearance or idealized versions of themselves, e.g., by customizing or personalizing their avatar [16, 18, 24, 44]. Personalized avatars - also referred to as avatars with high self-similarity - can foster a closer connection, stronger identity, and more engaging VR experiences [12, 13, 15, 19, 24, 35, 44, 45]. While personalization can enhance positive experiences and emotions [30, 45], it may also intensify negative emotions. Marginalized users face complex trade-offs between identity expression and vulnerability to harm. This underscores the need for further evaluation of avatar design and its impact on user experience during harassment.

Despite a growing literature on harassment in VR and avatar design, much of it relies on interviews, observational studies, or user-generated videos [6, 7, 17, 34, 38, 48]. These methods shed light on real-world incidents and offer valuable qualitative insights, but they rarely control for specific factors, such as avatar design. Controlled experimental settings help to overcome these limitations as used by Fiani et al. [10, 11]. It allows us to isolate how self-similarity affects users' responses to harassment and how personalized avatars may inadvertently heighten vulnerability to harm.

3 A Representative Harassment Scenario

To study the dynamics of harassment in a controlled environment, we designed a representative social VR scenario that includes realistic interactions between a user and a harasser. This scenario can be a standardized framework for systematically investigating factors that influence harassment in social VR. The creation of the scenario followed a systematic process, as visualized in Figure 1.

Figure 1: The figure shows the scenario development process.

First, we conducted a review of relevant literature, including studies that documented and classified harassment through interviews with social VR users [6, 7, 17, 38], observations of VR spaces [34], and analyses of user-generated videos [48]. Additionally, we reviewed existing studies simulating VR harassment [10, 11] to identify best practices for designing controlled yet realistic experimental conditions, e.g., for framing the VR experience. To supplement these theoretical insights, we undertook an exploratory search on YouTube, similar to previous work by Zheng et al. [48], combining the names of common social VR platforms (e.g., "VRChat", "Rec Room", "Altspace VR", "Horizon Worlds") with harassment-related keywords such as "harassing", "trolling", and "bullying". From the retrieved videos, we selectively watched examples that captured a range of disruptive behaviors, gaining a deeper understanding of realistic behaviors and interactions in social VR.

Building on these sources, we drafted an initial harassment scenario that incorporated the three types of harassment [6] and mimicked real-world behavior. Two constraints guided the design. First, the scenario should last 4-5 minutes, allowing participants to experience the full range of harassment without being overwhelmed or disengaged. Second, we pre-scripted all dialogue and actions, allowing us to implement an agent rather than using a live actor. This approach ensured consistency and addressed ethical considerations. Consequently, we need to avoid phrases in the interaction that allow follow-up questions.

The validation process of the scenario involved two steps. First, we consulted two social VR experts and one bullying prevention expert to evaluate the scenario's conceptual design. They assessed the authenticity of harassment behaviors, the escalating progression, and the interactions' overall realism. Their insights guided us in crafting a scenario that mirrors typical patterns of harassment in social VR environments. In the second stage, three VR users iteratively reviewed the harasser's dialogue and actions. They identified exaggerated expressions or unrealistic phrasing, which were refined to enhance the authenticity and natural flow of the interaction.

In the final design, the user is tasked to engage in a block-building activity. This activity provides context and sets the stage for the harasser's behaviors. The task involves assembling virtual blocks into specific configurations based on visual templates. These configurations are designed to be straightforward and achievable, emphasizing skill and patience rather than imposing time constraints or creating a sense of competition. This task provides a structured context for the harasser's disruptive actions commonly experienced in social VR environments.

The harassment begins subtly, with the harasser expressing mild complaints about the VR scene. As the interaction progresses, the harassment intensifies. The verbal attacks directly target the user, and the harasser throws virtual objects at them. This escalation is reinforced by a deliberate progression in the harasser's tone, which becomes increasingly aggressive. The harasser steps up to the user and overturns their constructed building, disrupting the user's activity. They then move even closer, invading the user's personal space, blocking their view, and continuing to hurl insults. The excerpt highlights the intensity of the harasser's remarks:

> *The harasser speaks in a mocking tone.*
> "So, what's your deal? Standing there like a loser. ... Is that how you're doing it? Seriously? That looks completely wrong."
> *The harasser's tone becomes more aggressive.*
> "Ugh, people like you really get on my nerves. But you think you're so great, huh? Like you're doing everything perfectly?"
> *The harasser looks the participant up and down.*
> "But have you looked at yourself? I wouldn't dare go out looking like that. You look like crap."
> *The harasser pauses briefly, seemingly distracted before resuming their remarks.*
> "And you honestly think anyone takes you seriously? You're such a joke."
> *The harasser throws an object at the participant.*
> "Here... catch!"
> *The harasser sneers, scanning the participant again.*
> "Hahaha, I've rarely seen someone as useless as you. You're just a total waste of space. Hahaha."

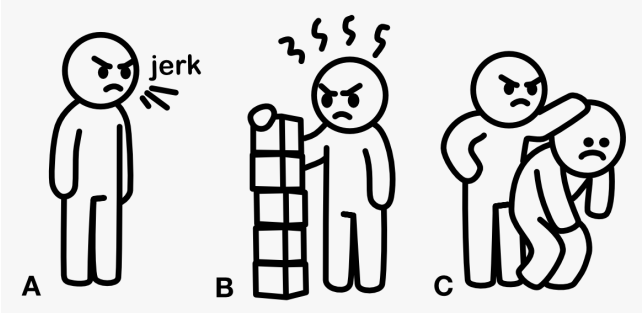

Figure 2: The three types of harassment addressed in the scenario are: (A) Verbal, (B) Environmental, and (C) Physical Harassment.

The scenario was intentionally designed to provoke feelings of discomfort, anxiety, and unsafety within a controlled setting. It incorporates verbal, environmental, and physical harassment (see Figure 2) and simulates realistic interactions commonly experienced in social VR environments. The scenario can be performed by a live actor or actual user, or pre-recorded. A pre-recorded scenario ensures consistency and eliminates the variability introduced by a live one. In addition, this approach protects individuals from the psychological toll of performing the harasser role, thus ensuring ethical integrity. The voice and design of the harasser can be adjusted to fit specific research goals. A generic-looking avatar can be used for general scenarios. Alternatively, gender- and ethnicity-specific designs can be created by pairing suitable voice recordings with matching avatars. This allows to explore potential differences in user responses based on the harasser's characteristics.

By grounding the scenario in prior work, real-world behavior, and iterative expert and user feedback, we developed a controlled but realistic context for studying VR harassment. The scripted design provides a standardized framework, allowing researchers to systematically evaluate the impact of various factors - such as avatar design or individual coping strategies - on the experience of harassment in social VR environments.

4 Methods

4.1 Study Design

The proposed study follows a 2 x 2 between-subjects design, with participants pseudo-randomized into one of four conditions varying by user-avatar self-similarity (personalized or generic) and behavior of another social VR user (neutral behavior or harassment). This design allows to systematically evaluate our research questions: (RQ1) How harassment affects the users' emotional and physiological condition and their identification with their avatars, and (RQ2) how self-similarity affects the emotional and physiological effects of harassment.

For our first research question (RQ1), we expect that participants will experience a negative impact when exposed to harassing behavior, compared to neutral behavior [1, 6, 8, 9, 17, 29]. With our second research question (RQ2), we expect participants with high self-similar avatars to experience the harassment more intense than with low self-similar avatars [30, 45].

By assigning each participant to only one condition, this design eliminates carryover effects that could occur if participants were exposed to multiple conditions. Emotional and physiological responses are especially vulnerable to such confounding effects, as prior exposure to harassment may bias reactions in subsequent conditions [36]. The between-subjects design ensures a more precise and valid assessment of the impact of the harassment experience.

4.2 Measures

To evaluate the effects of harassment and avatar self-similarity on participants, the study employs a combination of quantitative and qualitative measures. These measures focus on capturing emotional, physiological, and behavioral responses, as well as participants' perception of their avatars. Additionally, control measures and manipulation checks ensure the validity and reliability of the results.

Emotional responses are assessed using the Positive and Negative Affect Schedule - Expanded Form (PANAS-X) [46], which captures a broad range of emotional states. Self-esteem is measured using the Rosenberg Self-Esteem Scale (RSES) [32]. To examine physiological arousal, the heart rate is monitored in real-time using a Polar H10 chest strap.

Avatar identification and sense of embodiment are evaluated using the Virtual Embodiment Questionnaire + Self-Identification (VEQ+) [12, 33]. This questionnaire measures the degree of embodiment, including agency, virtual body ownership, change, and identification with the avatar. Additionally, the Inclusion of Other in the Self Scale (IOS) [3] is employed to assess the perceived closeness between the participant and their avatar, offering a complementary perspective on avatar connection.

A semi-structured interview complements the quantitative measures by exploring the psychological impact of harassment, coping strategies, preferences for avatar design and usage, and potential safety features in the VR environment. These interviews provide rich, qualitative insights into participants' experiences, adding depth to the investigation.

Several additional measures are included to control for potential confounding factors. Symptoms of simulator sickness are monitored using the VR Sickness Questionnaire (VRSQ) [22], and personality traits are assessed with the Big Five Inventory-10 (BFI-10) [31]. To ensure participants' sense of presence experienced in the VR setting, spatial presence is measured using the Igroup Presence Questionnaire (IPQ) [37].

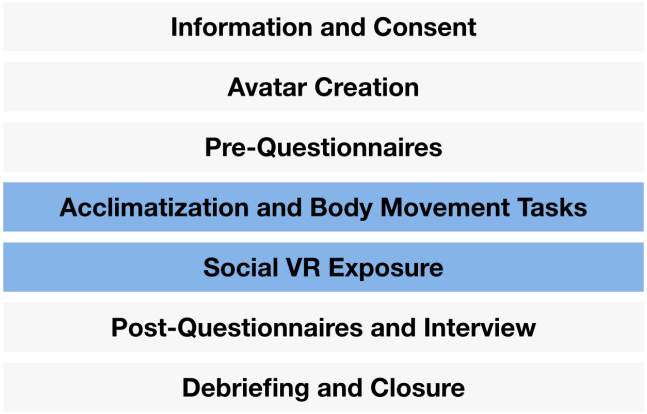

Figure 3: The figure shows the procedure of our study. Blue boxes highlight the parts in VR.

To confirm the effectiveness of the experimental manipulations, two checks are conducted. First, participants rate the similarity between their real-world appearance and their assigned avatar before the exposure to the other user on a 7-point Likert scale, validating the manipulation of self-similarity. Second, participants' perception of the behavior they were exposed to (neutral vs. harassment) are analyzed by calculating the two higher-order dimensions of the PANAS-X.

4.3 Implementation

The social VR-like experience was implemented using Unity 2022.3.52f1. The behavior of the other user (the harasser as well as the one behaving neutral) was pre-scripted to ensure consistency and address ethical considerations. The dialogue was recorded by voice actors. The user is represented by a generic-looking avatar designed using Ready Player Me[1]. This avatar has average facial features and common hair and eye colors, in line with similar VR studies [30]. The harasser's movements and actions were recorded using the Meta Movement SDK and Reality Stack Character Processors [27] to ensure fluid and realistic animations. These animations are synchronized with the pre-recorded audio dialogue, allowing the user to perform actions that seamlessly match the verbal comments, e.g., gesturing aggressively, throwing objects, and stepping into the user's personal space.

Participants are represented by full-body avatars, also created using Ready Player Me. These avatars can be either generic-looking or personalized to closely resemble the user's real-world appearance, creating self-similar avatars. The VR experience is designed to be compatible with devices such as the Meta Quest and Meta Quest Pro, using full-body tracking supported by the Meta Movement SDK in combination with the Reality Stack I/O [20] and Reality Stack Character Processors [27].

4.4 Procedure

The study follows a standardized procedure, as visualized in Figure 3. Participants begin by consenting to participate. For those assigned to the personalized avatar condition, a photograph is taken and used to generate an avatar closely resembling their real-world appearance. Participants in the generic avatar condition are assigned a pre-designed avatar with neutral facial features. Next, participants are equipped with the heart rate monitor and complete a series of pre-experience questionnaires, including a demographic survey, the Big Five Inventory-10 (BFI-10), and the VR Sickness Questionnaire (VRSQ). They are then introduced to the VR environment through a brief training session in a private space to familiarize them with the VR equipment and controls. Participants are embodied in a full-body avatar and perform body movement tasks in front of a mirror adapted from prior research [45, 47]. These tasks establish a sense of embodiment, and participants rate the perceived similarity of the assigned avatar to their own real-world appearance. The main experimental phase begins as participants enter the social VR environment where the other user is already present. During the block-building task, the other user either interacts neutrally or engages in scripted harassment behaviors, depending on the experimental condition. The interaction lasts approximately five minutes. Following the VR session, participants complete a set of post-experience questionnaires to evaluate the effect of the interaction. These measures include the Positive and Negative Affect Schedule - Expanded Form (PANAS X), Rosenberg Self-Esteem Scale (RSES), Virtual Embodiment Questionnaire + Identification (VEQ+), Inclusion of Other in the Self Scale (IOS), VR Sickness Questionnaire (VRSQ), and Igroup Presence Questionnaire (IQP). A semi-structured interview is then conducted to gather detailed qualitative insights into their experience, including emotional responses, coping strategies, and preferences for avatar design. Finally, participants are thoroughly debriefed and informed about the purpose of the study. They are provided with resources for psychological support, ensuring their well-being is prioritized throughout and following their participation.

4.5 Ethics

The study design adheres to strict ethical guidelines to ensure the safety and well-being of participants. It complies with the principles of the Declaration of Helsinki and was rated as ethically unobjectionable by the ethics committee of the Institute for Human-Machine-Media (MCM) at the University of Würzburg.

To minimize potential risks, we exclude individuals with a history of severe harassment or emotional trauma, who may be particularly vulnerable to distress. Participants are briefed about the use of a social VR application in the study and informed of the potentially distressing interactions they may encounter in social VR. They are also assured of their right to withdraw from the study at any point without providing a reason.

Throughout the study, we monitor participants' well-being, including real-time observation by researchers and regular check-ins to address any signs of discomfort. Following the experiment, participants receive a thorough debriefing, explaining the study's purpose, the scripted harassment, and the broader research objectives. This ensures transparency and allows them to contextualize their experience. To further support participants, resources for psychological support are provided, including contact information for counseling services and mental health professionals.

The use of pre-scripted harassment interactions ensures consistency while eliminating the ethical concerns associated with live actors performing harassing behaviors. This approach protects both participants and researchers, maintaining a controlled and ethical framework for examining sensitive topics in social VR research.

By implementing these comprehensive ethical safeguards, the study design strikes to balance the need for scientific investigation and the responsibility to protect and prioritize participant welfare.

5 Expected Study Contribution

This study is expected to advance the understanding of harassment dynamics in social VR, particularly the interplay between avatar design and users' emotional and psychological responses. By building on a controlled harassment scenario, researchers can examine how negative social interactions affect users' well-being and identification with avatars. These insights bridge gaps in the current literature on harassment experiences and avatar personalization in VR.

[1] https://readyplayer.me

We aim to highlight the potential risks and benefits of avatar personalization in social VR, offering guidelines to balance self-similarity with user safety. These insights can inform the development of adaptive avatar creation options, privacy settings, and harassment detection mechanisms that prioritize user well-being. Beyond practical implications, the study can contribute to the theoretical understanding of embodiment and identification in VR in the context of harassment. It explores how users' identification with avatars influences their vulnerability to negative experiences, expanding our knowledge of how virtual environments and interactions impact psychological states.

Ultimately, the study seeks to contribute to the broader effort of addressing harassment in social VR by offering insights that guide the design of safer and more inclusive virtual spaces. By combining theoretical perspectives with practical recommendations, this research aims to support the development of social virtual environments where all users engage freely, safely, and equitably.

6 Conclusion

This work aims to advance the understanding of harassment dynamics in social VR, focusing on how avatar self-similarity shapes user experiences. To this end, we created a controlled yet realistic harassment scenario. It was designed based on previous research and validated through expert and user feedback. The scenario provides a framework for the systematic study of emotional, physiological, and behavioral responses to harassment in VR. The proposed study will examine how avatar design influences user vulnerability and well-being, while exploring the balance between personalization and safety. Expected outcomes include theoretical insights and practical guidelines to guide the creation of safer, more inclusive virtual spaces that prioritize user well-being.

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