# Understanding "Mutes" in Social Virtual Reality

Qijia Chen
Department of Computer Science
University of Helsinki
Helsinki, Finland
qijia.chen@helsinki.fi

Andrea Bellucci
Department of Computer Science and Engineering
Universidad Carlos III de Madrid
Leganés, Spain
abellucc@inf.uc3m.es

Jie Cai
Department of Computer Science and Technology
Tsinghua University
Beijing, China
jie-cai@mail.tsinghua.edu.cn

Matti Nelimarkka
Centre for Social Data Science
University of Helsinki
Helsinki, Finland
Department of Computer Science
Aalto University
Espoo, Finland
matti.nelimarkka@helsinki.fi

Giulio Jacucci
Department of Computer Science
University of Helsinki
Helsinki, Finland
giulio.jacucci@helsinki.fi

## ABSTRACT

In social Virtual Reality (VR), particularly within VRChat, a significant group of users often referred to as "mutes" refrain from voice communication. This study analyzes 4212 discussion entries, including both original submissions and comments, from the `r/VRchat` subreddit to explore the experiences and reasons behind this practice. Our findings indicate that muteness is an integral aspect of social VR culture, yet mute users face challenges, including exposure to abusive behaviors and communication barriers in a fast-paced environment. Factors of social VR like harassment, heightened social anxiety from the immersive presence, and the complexities of identity management can discourage voice communication, leading many to adopt "muteness" as a response. This behavior can be seen within the broader context of social disability, challenging normative communication assumptions. We highlight the risks of generalizing marginalized communities and emphasize the need for further research to address and support the unique needs of these groups in social VR spaces.

## CCS CONCEPTS

• **Human-centered computing** → **Human computer interaction (HCI)**; *Collaborative and social computing*; **Virtual reality**.

## KEYWORDS

virtual reality, social VR, online harassment, mute, disability

**ACM Reference Format:**
Qijia Chen, Andrea Bellucci, Jie Cai, Matti Nelimarkka, and Giulio Jacucci. 2025. Understanding "Mutes" in Social Virtual Reality. In *CHI Conference on Human Factors in Computing Systems (CHI '25), April 26-May 1, 2025, Yokohama, Japan.* ACM, New York, NY, USA, 18 pages. https://doi.org/10.1145/3706598.3714244


*CHI '25, April 26-May 1, 2025, Yokohama, Japan*

ACM ISBN 979-8-4007-1394-1/25/04
https://doi.org/10.1145/3706598.3714244

## 1 INTRODUCTION

Social Virtual Reality (VR) enables individuals to interact with each other through Head-Mounted Display (HMD) devices in multi-user, three-dimensional environments [57]. Unlike other avatar-based systems like Massively Multiplayer Online Role-Playing Games (MMORPGs), which primarily support on-screen avatar communication, social VR features full-body tracked avatars that facilitate real-time, immersive interactions akin to face-to-face communication [47]. Social VR supports a range of communication modes, including verbal and non-verbal interactions such as voice, gestures, proxemics, gaze, and facial expression [33], creating environments that transcend virtual gatherings to enable activities such as gaming, dancing [64], watching events together[26, 59], dating [88], and even unconventional practices like sleeping [80] or consuming alcohol while wearing HMDs [17]. These diverse practices underline how social VR has become a unique cultural and social phenomenon, where virtual and physical realities intersect to enable shared activities and relationships.

On platforms like VRChat [76], users can explore a wide array of user-generated environments while embodying highly customizable avatars. These social interactions, while rich and varied, are shaped by the platform's affordances and cultural norms, with voice communication serving as a primary mode of engagement [67], fostering immersion and real-time connections. Within this context, a distinct group known as "mutes" has emerged–users refrain from using voice communication.

The term "mute" in this setting appears to have evolved from its historically negative connotations associated with speech disabilities. In VRChat, many users refer to themselves as "mutes" without hesitation, and this self-identification in the virtual space does not carry the same implications as its use in the physical world, redefining the term within this virtual culture. The practice of muteness in social VR adds complexity to avatar-mediated communication. While voice aims to replicate the immediacy of interaction in the

physical world, it can inadvertently marginalize individuals who are unable or choose not to use it [16, 77]. Although the presence of mute users has been acknowledged in prior research [55], the underlying reasons of their non-use of voice, along with the cultural and interpersonal implications of this practice, remain underexplored. The design challenges, opportunities and broader implications of this phenomenon are still unclear. Gaining a deeper understanding of these dynamics offer valuable insights into how social VR platforms shape communication and inclusion.

This study investigates the experiences of mute users and examines the reasons that lead them to not use voice communication, whether as a personal choice, a response to a disabling environment, or due to physical disabilities. Specifically, we address the following two research questions:

**RQ1)** How do users experience being "mutes" in social VR?
**RQ2)** What are the reasons users refrain from voice communication in social VR?

To answer these questions, we collected and analyzed 4212 discussion entries, comprising both original submissions and comments, focused on the mute user group from the `r/VRchat` subreddit, one of the biggest online forums for VRChat users. This dataset offers a rich perspective into into the challenges and opportunities faced by marginalized communities, laying the foundation for platform-wide design improvements that extend beyond mute users to foster more inclusive and supportive virtual spaces.

We make several contributions to HCI research: (1) Our findings reveal that social VR platforms often replicate societal ableist norms, creating disabling environments with harmful effects on users. By highlighting mute users' practices of resistance and interpersonal power dynamics, we emphasize the need for proactive approaches that center user agency, enabling diverse users to engage with virtual worlds on their own terms.(2) This research sheds light on the transitions from individual decisions to remaining mute to form a collective identity, leading to stereotyping and targeted harassment. It underscores the risks of overgeneralization and the lack of understanding of a community experiencing systemic barriers that uniquely emerges in social VR environments, emphasizing the need for nuanced support and protection. (3) We propose design suggestions to promote safety and inclusivity for marginalized communities.

## 2 RELATED WORKS

To contextualize our findings, we review the literature on the opportunities and challenges of social VR as a prominent immersive space for meaningful activities and examine research on marginalized groups in virtual worlds.

### 2.1 Navigating Shared Experiences and Diverse Interactions in Social VR

With the rise of affordable VR devices, large-scale social VR experiences have become more accessible, allowing geographically distant users to engage in 3D virtual spaces via avatars using VR headsets [52, 57]. Social VR facilitates immersive, life-like interactions through verbal and non-verbal communication, including voice, gesture, gaze, facial expression, and proxemics [55, 60, 75, 78]. As of this writing, social VR is available through several platforms, including VRChat[1], RecRoom[2], and HorizonWorlds[3].

Social VR accommodates a broad spectrum of social and leisure activities, catering to varied user needs [18, 31, 55, 74]. For example, Zamanifard and Freeman [83] observed that users replicate common offline interactions in these virtual spaces and Piitulainen et al. [64] found that social VR adds new dimensions to the enjoyment of traditional activities like dancing. Surprisingly, unconventional activities in VR settings, like sleeping and drinking, are common in these spaces [17, 31, 52, 80]. Freeman et al. [33] highlight how social VR platforms, through customizable avatars, offer unique opportunities for marginalized groups to experiment with identity and express themselves beyond their physical appearance, navigating social and personal dimensions in immersive spaces. Additionally, social VR has been recognized as a valuable tool for mental health, particularly in helping overcome challenges like social anxiety [27, 34]. Unique features of social VR, such as the sense of physicality and shared activities, can help individuals with social anxiety disorder reduce their fears and improve social interactions in both virtual and non-virtual settings [84].

However, social VR is not without challenges, as the same features that enable meaningful interactions can also lead to harmful situations [19, 64], particularly harassment [8, 20, 30]. Harassment is prevalent in these virtual spaces [70] and often targets disproportionately groups such as young users and members of the LGBTQ+ community [8, 22, 55]. Factors like gender, sexuality, race, age, and disability can influence the likelihood of experiencing harassment [53, 68, 86]. The immersive nature of VR technology, which intensifies the sense of presence and the perception of face-to-face interaction, can amplify social pressures. VR technology can induce strong social anxiety similar to face-to-face settings [44]. This effect is further intensified by the simultaneous and spontaneous nature of social VR, where unplanned interactions with strangers often heightens feelings of anxiety [17].

Although social VR offers numerous possibilities for interaction, voice communication remains the most common form [34]. The role of non-verbal communication in social VR is nuanced; while it can provide protection and comfort for marginalized users, it can also facilitate non-verbal forms of harassment, such as unconsented touch [21, 55]. In virtual spaces, voice often acts as a key indicator of offline identity, revealing traits like dialect, gender, and other social cues. Research shows that vocal attributes significantly shape user perceptions and interactions, influencing assumptions about a speaker's identity and social role [8, 61]. These dynamics are particularly evident in social VR, raising important concerns about inclusivity and the potential for identity-based biases or harassment [8].

The phenomenon of "mutes" in social VR, particularly within the VRChat community, presents a unique and intriguing aspect of virtual interaction. Mutes are users who opt for non-verbal communication methods, such as gestures or writing with virtual pens, instead of verbal communication [52]. While previous research has acknowledged the existence of the mute community as the most comprehensive group using non-verbal communication in social

[1] https://hello.VRchat.com/
[2] https://recroom.com/
[3] https://www.meta.com/fi/en/horizon-worlds/

VR [5], there has been a lack of focused exploration of this group. This investigation is crucial for understanding the mute community and broader communication dynamics in social VR, especially as these technologies become increasingly integrated into daily life. Our study seeks to inform platform design to better accommodate groups excluded from dominant communication practices, contributing to a more inclusive understanding of social VR.

## 2.2 Investigating Marginalized Groups in Virtual Worlds

Since the inception of embodied virtual spaces like Second Life [49], researchers have explored the potential of interactive virtual worlds for marginalized groups, including people with disabilities [24] and the LGBTQ+ community [13]. These spaces are recognized as sites for communication and identity exploration, where technology can either facilitate or hinder access and participation [16].

Critical Disability Studies (CDS) [56] and Feminist HCI [7][4] provide frameworks for examining how technology design can either foster inclusion or marginalize those who deviate from normative standards, emphasizing the ethical responsibility of designers to create accessible and equitable virtual environments. The CDS framework extends beyond disability to examine broader issues affecting marginalized groups [69], offering HCI tools to interrogate how systemic power dynamics shape technology [72]. Kafer's critique of structural ableism [43] and Hamraie's concept of "crip technoscience" [39] are critical for our examination of mute users in social VR. These perspectives highlight how ostensibly inclusive technologies often reinforce exclusionary norms, particularly in voice- and body-centric designs, while also emphasizing how marginalized users innovate within systems not designed for them [39], reimagining technologies to disrupt normative narratives of "normalcy" and "ability." The design of immersive technologies often assumes able-bodied norms, creating barriers for users with physical disabilities [36]. Features such as voice communication, while enhancing social presence, have historically reinforced normative expectations and marginalized alternative interaction methods [77]. Drawing on CDS perspectives, this highlights the need to expand notions of communication beyond speech to include non-verbal and alternative modalities [4].

Aligned with feminist HCI principles [7], examining underrepresented groups in social VR amplifies marginalized voices and uncovers overlooked insights. Research explores how these platforms shape visibility and identity practices for marginalized users, including individuals with invisible disabilities [38], queer, and transgender communities [1, 32, 65]. Studies on social VR [3, 38, 85] emphasize the importance of inclusive avatars and communication tools that balance user autonomy with protections from stigma and harassment. For LGBTQ+ users, customizable avatars and tailored social practices facilitate self-expression [1]. However, while features like embodiment and customization offer liberating possibilities, they often reflect and reinforce normative biases, marginalizing users who do not conform to expected standards [3].

[4]Feminist HCI goes beyond the scope of gender and computing by incorporating a wider range of methods that challenge traditional scientific approaches. It emphasizes diverse experiences to gain a more holistic understanding of how we engage with the world [82].

Understanding diverse user groups is crucial to avoid oversimplifications that may lead to stigma. For instance, while some research labels mirror dwellers–users who frequently engage with their avatars through virtual mirrors–as disruptive [87], a deeper analysis of their behaviors and motivations reveals valuable design implications, such as user-centered mirror settings and governance strategies that balance individual freedom with community standards [34].

# 3 DATA AND METHODS

Our work utilizes the VRChat platform for several reasons. First, it offers the most sophisticated avatar customization, which intends to enable users to explore different identities [27] and self-presentation [85] through a wide variety of avatars. Moreover, VRChat is ranked as one of the most popular applications on the Steam store, drawing a heterogeneous group of users [54]. Additionally, the academic interest in VRChat as a research subject further validates our choice [27, 34]. Its prominence in social VR research underscores its relevance and potential for yielding insightful findings. This academic attention, combined with its popularity and customization options, positions VRChat as an ideal platform for investigating the experiences of mute users.

We choose to study the discussions people have in online communities related to mutes because we believe that working on discussion data is suitable for our study as employing alternative methods, such as interviewing mute users, could pose its own set of challenges, given that these individuals might be hesitant to engage in verbal communication. The nature of mute users as a group that may prefer non-verbal or limited communication makes online community discussions an ideal data source. Moreover, there are examples in the literature of studies that effectively leverage data from Reddit communities to capture a wide range of lived experiences, providing insights into the the experiences of marginalized user groups [35, 79]. Online communities are often viewed as "safe spaces" where users unsolicitedly share their experiences and genuine opinions [2]. Such platforms provide insights into the experiences and viewpoints of mute users in a more natural and unfiltered way, aligning with our research goals and the unique characteristics of our study population.

## 3.1 Data Collection

In our research, we focused on gathering discussion data from the r/VRchat subreddit, a pivotal online community for VRChat users. Reddit has become a significant resource for researchers in CSCW and HCI, recognized for its extensive user base and dynamic discussions [45, 50]. By the time of our study, r/VRchat had more than 155,000 members, making it an ideal platform for understanding the diverse perspectives and experiences within the VRChat community. The active community and the rich discussions on this subreddit provided an ideal setting for our investigation. Moreover, Reddit's platform policies and API allow data collection for research purposes.

We clarify the words used in the following text. On Reddit, users share content through *submissions*, which are original posts that initiate discussions. A submission serves as the starting point for a conversation, where someone introduces a new topic, question,

or message. *Comments* are responses or remarks made on these submissions or other comments, forming nested discussions. A *thread* includes the entire set of interactions originating from a single submission, encompassing the original post, all comments, and nested replies, thus creating a continuous and connected series of conversations around the shared content.

We used Reddit's API [5] to locate and retrieve discussions related to mute from the forum. The API allows us to collect data by keyword searching and retrieving submissions and associated comments as long as the submissions contain keywords in their titles or content that were searched for. Our primary keyword is "mute", chosen for its direct relevance to our research focus. The term "mute" directly aligns with the study's objective of understanding mute users and their experiences. Using one keyword to collect relevant online discussion data is a common practice [45]. Using this keyword ensures that the collected data is specifically related to the mute phenomenon in social VR, minimizing irrelevant information that may arise from broader or unrelated terms. This search yielded a substantial corpus of 5545 data entries, encompassing submissions, and associated comments, together with pertinent metadata such as the creation time of each post.

Before the data collection, we consulted with our university's Institutional Review Board (IRB) regarding any ethical concerns arising from our research. The IRB deemed that our research was exempt from human subjects review, according to the interpretation shared by other IRBs [66], the data used are all publicly available and expected to be viewed by the public, and they did not involve sensitive information such as physiological signals. Our research is considered to have minimal impact on those involved. However, our authors are aware of the discussion in the HCI community concerning the utilization of publicly available data [29] and guidelines to protect privacy, anonymity, and discoverability [14]. To safeguard the individuals involved, we employed various protective measures throughout our study. We removed all potentially identifying personal information from our dataset. This included usernames and any other details that could be used to trace back the data to individual users. In addition to this, we carefully paraphrased all quotations used in our articles. This was done to reduce the possibility of these quotes being searchable online, thereby preventing the original posts from being easily identified and linked back to specific individuals. Lastly, we ensured that the collected data was securely managed and accessible only to our research team. All the data were stored on password-protected devices.

After the data collection, we embarked on refining our dataset. Our primary focus was eliminating irrelevant data that did not pertain to the mute users. While many submissions mentioned the keyword mute, not all were relevant to discussions about the mute community (e.g., "I mute harassers"). Such submissions and associated comments were identified and removed from our dataset. In the process, we evaluate submissions to decide the threads' relevance rather than individual comments, which streamlines the screening process, as the associated comments generally follow the same thematic pattern as the initial submission. After the filtering process, we compiled a final dataset of 4212 submissions and comments. These data spanned a time frame from 2018 to 2023, providing a broad perspective on the discussions and sentiments within the VRChat community regarding muteness. The starting point of 2018 was chosen because it marks the first instance of a post explicitly mentioning mutes, allowing us to capture the evolution of this phenomenon from its earliest discussions. This dataset formed the foundation of our analysis, offering a rich and varied pool of user-generated content that reflects the complexities and nuances of the mute experience in social VR.

[5]https://www.reddit.com/dev/api/

## 3.2 Data Analysis

We conducted an in-depth inductive thematic analysis [11, 12, 23] to extract insights from the data gathered on mute users. Two researchers were involved in the analysis process following the guidelines outlined by Braun and Clarke [12].

The process began with both researchers immersing themselves in the dataset to gain a deep understanding of the mute users' experience and their reasons for being mute within the virtual community. Each coder independently reviewed the collected posts and comments, recording initial impressions and identifying information relevant to our research objectives. Then, the researchers met up to discuss their understanding and confusion in the context of certain data. After that, they embarked on independent coding to generate initial codes. We employed an iterative coding process, initially generating codes in a data-driven manner. Each data item was examined, and segments of relevant text were coded for their semantic meaning. For example, a comment like "I tend to be mute as my voice is very high pitched... Many harass me for that." was initially coded as 'Avoiding voice-related harassment'.

After completing individual coding, the researchers met up to review and consolidate their codes. They organized these codes into thematic topics pertinent to the research questions and developed sub-themes that emerged concerning users' experiences and motivations for being mute in social VR. For example, codes like 'Avoiding pitch-related harassment, Avoiding accent-related harassment, Avoiding harassment due to sounds too young' emerged into 'Avoiding Harassment Based on Voice Characteristics' as a subtheme. This step went beyond simply grouping similar codes; it was an interpretative process to uncover underlying patterns and meanings in the data. The analysis extended to exploring the internal relationships among these sub-themes, leading to the formation of overarching themes. The researchers engaged in discussions to integrate and refine the themes and sub-themes, ensuring that they accurately reflected the data and provided meaningful insights into the experiences of mute users in the VRChat community. This step involved revisiting the data and themes multiple times to achieve a comprehensive and accurate representation. Finally, the researchers named the set of themes through rounds of discussion.

Throughout this analytical process, the researchers maintained a reflexive approach, constantly questioning their interpretations and staying open to various interpretations within the data. This reflexive stance was key to ensuring that the analysis remained grounded in the data while also being mindful of the researchers' perspectives and potential biases. To ensure a clear and organized presentation of our results, we have provided two tables in Appendix A that systematically display the identified themes, subthemes, and corresponding descriptions of each subtheme.

### 3.3 Positionality Statement

It is crucial to disclose our positionality due to the sensitive nature of our research focus, as it allows for transparency regarding how our intellectual backgrounds and lived experiences might shape our analysis and interpretation of the data [10, 48]. Acknowledging positionality ensures that we are aware of potential biases, fostering trust with our audience and ensuring the validity of our research [10]. Of the five authors of this paper, four have prior experience conducting research with social VR users. Notably, the first author has many years of experience on social VR platforms, including direct interactions with mute users and observing their experiences within these spaces. Additionally, four authors have experience in conducting research with marginalized communities, including groups with impairments, the LGBTQ+ community, and politically marginalized populations. Our collective research background and hands-on experience approach our research with an understanding of the complexities that marginalized populations may face in the social VR context. In addition, it positions us well to conduct a thematic analysis for this study. By sharing our positionality, we emphasize our commitment to reflexivity and accountability, ensuring that our research is both ethically grounded and socially conscious."

## 4 FINDINGS

### 4.1 Experiences of Being Mute (RQ1)

This section highlights the cultural integration of muteness and addresses the challenges mute users encounter, including harassment and communication difficulties. It also demonstrates the practice of "adoption," where mute users rely on vocal users to support and enhance their social interactions. For a detailed breakdown of themes and subthemes, see Table 1 in Appendix A.

*4.1.1 Cultural Integration of Muteness.* In the social VR context, the presence of mute individuals is perceived as both significant and common, forming a distinct cultural aspect within these platforms. A user's comment exemplifies this perspective, *"There's a huge mute community on the platform. It is definitely a VR cultural thing... It is pretty common for users to be mute."*

Social VR platforms, including VRChat, are largely built around user-generated content, such as virtual worlds that offer a wide range of spaces tailored to various interests, themes, and activities. User-generated worlds for sign language are emerging to teach and promote sign language. These worlds are frequented by the mute community and serve as inclusive spaces where users can engage with ASL, fostering cultural exchange and learning. For instance, Figure 1 shows interactive tools offered in these worlds to help users learn ASL. For example,

> "There are numerous ASL [American Sign Langugage] worlds. Simply search ASL; they're fantastic since the mute community frequents them, and you can learn ASL. You'd be surprised how often a private dialogue takes place in a public world, with the mutes secretly giggling."

The account highlights the prominence of ASL worlds and mute users in public VRChat spaces. Public worlds in VRChat are open to all users and typically attract a larger audience than private worlds. ASL worlds, often categorized as public, are accessible through the platform's search function, making them highly visible and available to the broader user community.

Beyond user-generated worlds, the use of alternate communication forms is becoming an integral part of the overall VR experience on the platform. For example, the quote shows users' appreciation for the community embracing and integrating mutes' ways of communication into their everyday communication, *"The community has learned or adopted signing into their VRchat life significantly... and the addition of pens in many environments is considerate."* It reflects two key developments: the adoption of avatar-based gestures, such as signing, as a primary mode of communication, and the incorporation of tools specifically designed to support mute users in expressing themselves. These intentional design elements aims to enhancing accessibility and promote a more inclusive environment for non-verbal interaction.

*4.1.2 Experiencing Rudeness and Harassment.* Despite the integration, mute individuals still face abusive behavior from toxic individuals due to their unique mode of communication or inability to engage verbally, pointing to an occurrence of targeted harassment. These experiences highlight a tension in the space, where the inclusivity fostered by some parts of the community is undermined by toxic behavior from others. For example, when mute users attempt to engage with others using non-verbal means of communication, they might be met with dismissiveness or hostility. A user posts,

> "Some folks can be really rude about it. We don't think you have to talk to us, but instead of doing anything harsh, try to tell us something like, 'Oh sorry, this isn't the type of interaction I want.' It's fine if someone doesn't want to interact with mute users, but some people take that out of per portion and start going off at the individual."

The user expresses expectations for basic politeness, such as kindly declining an interaction, which contrasts with the hostile reactions some vocal users exhibit. Such actions reflect intolerance toward non-normative communication styles. Another individual's experience further highlights the broader issue of intolerance and insensitivity,

> "A lot of other people would bother me; not everyone has the same experience as me, but I have been stopped and cursed out for sitting next to people who were talking. A simple solution is to ask me to leave kindly (which I would do) or to block me without making a fuss about it. They didn't have to be rude to me just because I was sitting next to them. I was called a freak, told to f**ck off, called a c*nt, and told in front of everyone that I was being blocked. I felt very unwanted because I couldn't say anything about it, so I often panicked and left."

In addition, many users in social VR environments report feeling undue pressure to speak. They face expectations to conform to standard modes of communication. This pressure can create a challenging and uncomfortable experience for those who are unable or prefer not to engage in verbal dialogue. For example,

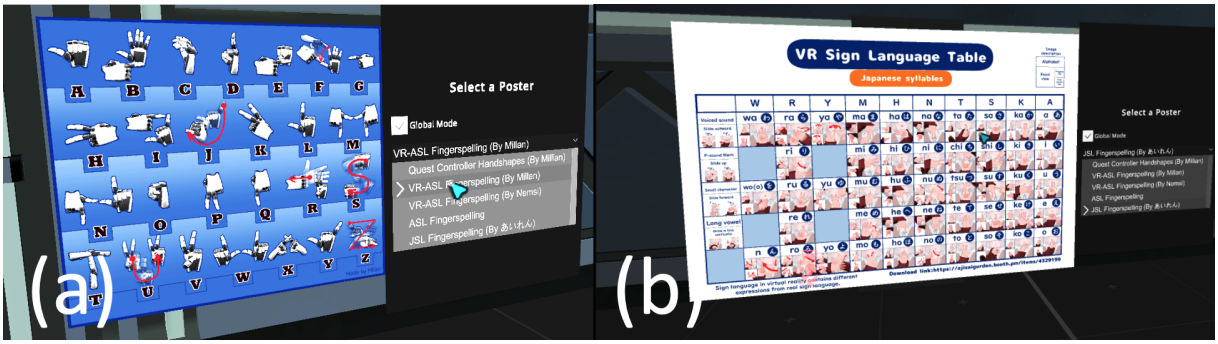


**Figure 1: This set of images shows an interactive poster in the "Experimental Sign Language World" [9], serving as a tool to help users learn ASL. (a) Demonstrates how to say the English alphabet in social VR, and (b) Shows how to spell out Japanese syllables using hand gestures.**

> "I was hanging out with all my friends until some random dude approached me and told me to speak (the thing is, I'm mute irl, and I just hate being harassed by people like them. I've taught my friends some ASL to communicate with me (I did not press them into it; they insisted), but I love all the people who accept mutes."

"IRL" stands for "In Real Life." It is commonly used in social VR to distinguish between things that happen in the physical world (real life) and things that occur online. This account highlights a common form of harassment in which mute individuals are pressured to speak, despite their inability or preference not to do so.

*4.1.3 Facing Difficulties in Communication.* Despite the availability of communication methods such as ASL and other non-verbal strategies, mute users still face significant challenges when interacting in social VR environments. These challenges stem from the limitations of non-verbal communication, especially when compared to verbal communication in fast-paced, voice-dominated VR interactions [34].. A user shared the experience, *"To be honest, I can't recommend being mute for very long unless you don't mind all the communication issues and difficulties it comes with."*

Non-verbal communication often struggles to keep pace with verbal interactions, such as drawing and typing. Although ASL can keep up with verbal communication, its adoption remains limited; not all participants understand it. Moreover, users are less likely to constantly focus on mute individuals, particularly in group discussions, where sustained focus is necessary to understand ASL. For example,

> "In-game typing chat is super slow and a huge hurdle when it comes to communication. The best thing I can think of is really make gestures (and avatar facial expressions) really expressive and show personality, or use ASL. However, during conversations, people won't always watch mute individuals, and many don't understand ASL."

Typing not only lags behind talking but is even slower in VR compared to conventional keyboard typing. While user-generated avatars often include expressive gestures and facial animations, these features are insufficient for communicating detailed information. The limited attention given to mute users during group discussions further highlights the systemic challenges they face in voice-dominated environments.

In addition to group dynamics, non-verbal methods inherently lack the immediacy and impact of verbal communication, making it harder for mute users to gain attention. For example, *"It can be difficult to get people's attention when you have little more to offer than a speech bubble and some gestures."* Another user echoed this sentiment, *"It's harder to get people's attention. I wanna talk so bad and noticed."* Particularly during ongoing conversations, it becomes even more challenging for mute players to chime in using non-verbal means.

The situation often results in poor social experiences for mute users. For example, *"I now no longer want to even boot up VRChat because it's going to just be a few-hour session of me sitting quietly in a corner, watching everyone else enjoy themselves."* The user suffers from the emotional toll of exclusion. Being mute tend to struggle to engage meaningfully with other vocal users despite their efforts to adapt. These experiences illustrate how mute users are often outlined in fast-moving social interactions.

In addition, this communication barrier hinders mute users, particularly in scenarios involving confrontational interactions. Without the ability to verbally assert themselves, defending against criticism or conflict becomes a major challenge. As one user remarked, *"I am mute, so I would not be able to defend myself well a lot of the time."* Without the capacity to verbally articulate their perspective, they often feel defenseless in challenging situations. It shows a particular challenge faced by mute users.

*4.1.4 Adoption Culture and the Associated Controversy.* Due to the above communication limitations, many mute users seek "adoption"—a popular concept in VRChat that refers to a social dynamic where mute users form surrogate familial relationships with vocal users. enhance their social interactions with vocal users, or, through this arrangement, vocal users act as intermediaries, facilitating communication between the mute user and the broader community. For example, a user expresses a desire to be adopted to enhance their social interactions, *"I'd love to play more VRChat, but as mute and being anxious in VR, it's hard for me. Would like to get adopted or*

*invited into a community/group with people who are fine with having me around."*

These adopted mute users are often referred to as "personal mute" or "my mute" by other players, *"I check in from time to time with my mute to see how he's doing. He has his own little friend group and has been doing great."* This phenomenon has evolved into a popular culture, where many players desire to have a personal mute, *"But once the personal mute stuff started, I definitely had random people asking if I wanted to be theirs."*

Conversations on r/VRChat often trivialize and objectify mutes by framing them in ways that emphasize dependency or novelty, with some mutes embracing these portrayals to navigate social acceptance. For instance,

> A: VRChat should have virtual pets, like Tamagotchis, that you can pet, pick up, and give treats to.
> B: You can already do that with your local mute.
> C: Yep, they come in all shapes and sizes and only need attention and head pats.
> D: Where's the mute adoption center?!
> E (mute user): There isn't one—you just find someone like me in the wild, like a Pokémon.

The excerpt likens mutes to "pets" available for adoption, a comparison that some mutes playfully accepted, thereby reinforcing this dynamic to foster inclusion within the community.

However, at the same time, many users find the term "personal mute" offensive. In the following discussion, users with real speech impairments express their discomfort with this usage,

> A: To be fair I got a bit offended when I've heard stuff like "Personal Mute" and so on from people or that they think it's "cute" when someone is mute...
> B: Me too, when the personal mute stuff started I was a little offended too as someone whose disability has been somewhat fetishized already by weird people I've met, but I did realize the vast majority of people didn't mean any harm with saying it and stuff.

The two users express the emotional discomfort caused by the term, which may trivialize muteness. For many, such language can feel dismissive, reducing their identity to a novelty rather than recognizing their presence and individuality.

## 4.2 Reasons for Being a Mute (RQ2)

This section delves into the various reasons why users opt to be mute in social VR platforms like VRChat. Key reasons include discomfort due to the mismatch between voice and avatar, identity management, avoiding harassment, balancing physical and virtual environments, physical disabilities, and social anxiety. For a detailed breakdown of themes and subthemes, see Table 2 and Table 3 in Appendix A[6].

*4.2.1 Due to Voice-Avatar Contrast.* The preference of users to engage in social VR environments with idealized avatars or avatars that significantly differ from their real-life appearance is a notable trend [33]. This preference for avatars serves as a means of self-expression, allowing users to experiment with identities that may be aspirational or distinctly different from their offline selves. However, our data reveals a dynamic where the contrast between these meticulously chosen avatars and the users' natural, unpolished voices creates a sense of discomfort. This dissonance often leads users to opt for muteness as a coping mechanism. For example,

> "I'm typically very talkative, both in person and online, but discomfort hits me wrong and turns me into a depressive mute who can't communicate. It's probably due to the contrast between how I look with an avatar and how I sound when I speak."

The discomfort caused by a visual-auditory mismatch significantly impacts the user's way of engaging socially in VR environments. Transgender individuals are notably active in social VR spaces and, as explored by Freeman et al. [33], they often use avatars that align with their identified gender, enabling them to better explore and express their identity . The transgender community provides a tangible example of the challenges faced by individuals with the mismatch, *"I'm a trans female who hasn't started transitioning yet, so I'm uncomfortable using my voice while using a female avatar."*

In addition, the comparison between the user's avatar and their voice can be a source of self-consciousness about one's voice in social VR, leading many to choose muteness. For example, a user expresses a strong dislike for their voice, *"I'm very self-conscious about how my voice sounds. I hate it so much. It does not match my avatar. It's a lot more chill for me when I am mute."* The user uses the word "hate" to express their dislike of their voice.

In addition to avoiding the discomfort for themselves, many users become mute to engage in identity management on the receiver's side. As shown by previous research [8, 61], voice plays a significant role in self-presentation and can influence social dynamics. To maintain control over their identity, users may strategically choose muteness, thereby avoiding situations where their voice could conflict with or undermine their intended persona. For example,

> "It's ironic that irl people tell me to shut up because I'm always talking, but I do not speak at all on the platform. I believe the major reason I do this is I attempt to conceal my shortcomings or the aspects of myself that I dislike... I can't hide them in real life, so if someone approaches me, I presume they don't mind, but in VRChat, that's a step I have to take instead of happening organically like in real life, which is probably why it's so difficult."

Unlike interactions in the offline world, where perceptions are influenced by a mix of uncontrollable cues and intentional presentation, social VR provides users with greater agency to shape their virtual identities. This level of control requires users to actively and deliberately construct their presence in the virtual world. In this context, muteness becomes a tool to facilitate the presentation of a cohesive virtual identity. Another user further underscores adopting muteness as a strategy to maintain a cohesive virtual identity,

[6]It is worth noting that there are additional, less frequently mentioned reasons, including technical issues (e.g., having a broken mic) and language barriers (e.g., being a non-English speaker). However, due to their limited representation and straightforward nature, these themes are not presented in detail. We include them here to acknowledge their presence in the data and recognize that less frequently mentioned reasons may still hold significance, particularly for individual users.

> "For me, being mute takes away a barrier. I like to be cute, although your avatar is cute, people often rate you based on how you sound. My voice is not cute. If my voice was taken away, I could be a lot cuter, lol."

The user emphasizes how the absence of voice allows them to project a more charming image, free from the potential mismatch between their avatar's appearance and their voice.

*4.2.2 As a Strategy to Avoid Harassment.* Harassment in social VR environments is a significant issue that impacts how users choose to engage and communicate. For many, the decision to remain mute arises as a protective measure against harassment, particularly when it is linked to the sound or characteristics of their voice. For these individuals, muteness is less a choice and more a necessity, driven by a desire to protect themselves from repeated abuse. The harassment is often triggered by the qualities of a user's voice, such as its pitch and tone. For example,

> "When I first started playing VRchat, I talked, but many people insulted me and called me names due to my high-pitched voice. After putting up with that for months, I gave up trying to talk, and I am since mute."

The user often faces ridicule due to their high-pitched voice. The toll of enduring constant insults outweighed the desire to participate verbally in social interactions.

As previously stated, many users stay mute to manage the mismatch between the avatar's appearance and voice. This mismatch often makes users targets for negative behavior, as they face ridicule and harassment from toxic users who notice the disparity. Such negative experiences further discourage users from engaging in verbal communication. An individual shared their experience related to this phenomenon, highlighting the harassment they face due to the disparity,

> "When I spoke with my pals while playing, a lot of rude people called me out since my voice didn't match how I looked. And, while I hope those were isolated events, they occurred more frequently than you can imagine. I don't want to talk anymore after many times of this."

The repeated harassment caused by this mismatch discouraged the individual from speaking altogether. The additional account further highlights the distressing impact of such harassment, *"I became mute after being harassed for my avatar not "representing/matching" my voice to some people's standards; the harassment was so severe that I stopped using voice altogether."*

The toxicity issue in social VR platforms extends beyond specific incidents of harassment based on voice qualities or avatar mismatch. A pervasive atmosphere of toxicity and the potential for encountering aggressive users can create a general sense of apprehension among participants. This fear influences the behavior of a wide range of users, leading even those whose voices are appropriate and align well with their avatars to refrain from speaking. A user's statement exemplifies the cautious approach to interaction,

> "I don't reveal my voice because I want to ensure that the individuals I'm chatting with are decent people. I've been in situations where I thought I'd discovered great individuals, but then they bring up a hot topic, and they become sexist/racist/homophobic, and I'm glad I didn't say anything."

Given the prevalence of harassment, the user takes muteness to avoid toxic users. The preemptive muteness reflects a broad distrust of social VR spaces, where users feel the need to guard themselves against the unpredictable nature of interactions.

The choice to remain mute in social VR is not only a response to past experiences of harassment but also a strategic approach adopted by many users to assess the nature of those they interact with. By opting for muteness, users create an opportunity to observe and evaluate the behavior of others without the immediate commitment of verbal communication. The rationale behind this strategy is that if other users are willing to engage patiently and kindly with someone who is mute, they are likely to be respectful individuals. For example,

> "I usually start mute since it serves as a great people filter. Those who are nice and/or patient are willing to interact with mutes. Those who avoid mutes or openly despise them come across as impatient, insensitive, and often self-centered. And that's not the kind of people I want to hang out with... I can and will continue to communicate with you. It's not my problem if you can't entertain yourself or be patient enough to wait for me to respond."

The user uses muteness as a tool for filtering out toxic or disrespectful individuals. Users who demonstrate kindness and adaptability in their interactions with mutes are seen as more likely to foster positive and supportive relationships.

*4.2.3 Balancing Physical and Virtual Surroundings.* The physical surroundings of users in social VR environments play a significant role in their decision to become mute. Many users are mindful of not wanting to disturb others in their real-life environment while they engage in virtual spaces. Muteness becomes a practical strategy to navigate these overlapping realities while maintaining harmony in both. A user posts,

> "Noise pollution. The beauty of VRChat is that it is global; my VRChat friends are from different time zones. So it's sometimes afternoon on my friend's side, but late night on mine. For hanging out with them, I'm staying up till midnight ndon a regular basis, and I can't very well be waking up folks who have early shifts around me. So, being mute became natural."

Participants navigate not only virtual relationships but also the logistical realities of their physical environment. For this user, muteness emerges as an adaptive solution, allowing them to engage with their virtual community while respecting the needs of those sharing their physical space.

In addition to considering the need to not disturb those in their physical environment, many social VR users also choose to become mute to prevent their real-world surroundings from intruding into the virtual experience of others in VRChat. For example, *"I don't enjoy leaving my mic on because of background noise, and I don't want people to think I'm disrespectful."* For the user, whose decision stems from a recognition that elements of their physical environment

might disrupt the virtual interaction or affect the experience of other users.

*4.2.4 To Manage Social Anxiety.* Social anxiety is a significant factor driving many users to choose muteness in social VR environments, which is further aggravated by the heightened sense of presence and the spontaneous nature of interactions, as highlighted by previous research [17]. This anxiety prompts users to avoid verbal communication, opting instead for non-verbal interaction or silence. For example,

> "On VRChat, I deal with a lot of social anxiety, which is weird because I don't really have that problem on other online games or other social platforms... I think it's because it is VR, where interactions feel way too real—like, with the real-time talking and body language and all that... It's just overwhelming, so I end up staying mute most of the time... ."

The quote offers a perspective on the psychological challenges posed by social VR environments. While this realism is a strength of the medium, it also introduces potential challenges for users in terms of social pressures, pushing them to adopt strategies like muteness to cope. Another quote echos the view, further emphasizing the impact of social anxiety on communication,

> "I'd say it's social nervousness and insecurity... I feel safer, and it's simpler for me to convey myself through body language and facial expressions. When I try to speak, I feel uncomfortable, fumble over my own words"

The mention of "fumbling over words" highlights the potential for speech to exacerbate feelings of insecurity, suggesting muteness as a coping mechanism.

*4.2.5 Due to Individual Impairments.* In addition to those who choose not to speak, there are social VR users who are compelled to remain mute due to speech impairments or hearing difficulties in the non-virtual world, which impact their ability to use voice communication within these virtual spaces. For users with physical impairments, the ability to communicate verbally in VR can be significantly impacted. Individuals with speech impairments may find it challenging or even impossible to use voice chat features effectively. For example,

> "I am essentially physically mute...I'm in the midst of the most challenging phase of my medical voice therapy... I'm unable to participate in the game's main feature, chatting. I just want to meet more people and do stuff in the virtual world, but I don't think I'll be able to because I can't communicate in any way."

Speech impairment prevents the user from participating in verbal interaction, despite the desire to connect with others and explore virtual worlds. The lack of effective communication methods also leads to frustration. Users suffering from stuttering report similar issues. For example,

> "I'm mute because I have a severe stutter, which makes speaking challenging, especially with people who don't understand stuttering and often tell me to just 'spit it out.'"

Individuals who are deaf or hard of hearing may also refrain from speaking in social VR, as exemplified by this statement from a VRChat user who is deaf: *"I'm generally mute in VRChat because talking isn't meaningful for me as I don't hear."* Even when users have the physical capacity to speak, the absence of hearing responses or participating in real-time auditory exchanges reduces the relevance of verbal communication on the platform.

## 5 DISCUSSION

In this section we discuss the implications of our findings, focusing on three interrelated themes: the interplay between disabling norms and practices of resistance in social VR, the interpersonal power dynamics influencing mute users' experiences, and the risks associated with generalization and stereotyping of mute communities. By using muteness as a lens to explore marginalization and the disabling aspects of social VR, we identify pathways toward creating more equitable and empowering virtual environments. We propose design strategies that prioritize inclusivity, address governance challenges, and advocate for systemic changes to enhance user safety and foster inclusive digital spaces.

### 5.1 From disabling environments to practices of resistance

Social VR environments, while celebrated for their immersive and inclusive potential, often replicate societal biases of the physical world by privileging speech and hearing as dominant modes of interaction. This prioritization marginalizes mute users, creating conditions that can transform virtual spaces into exclusionary environments. As Goodley et al. [37] argues, disability is not an inherent trait but a construct shaped by societal and cultural norms, with platforms like VRChat reinforcing these norms through systemic design gaps.

The technological barriers mute users face exemplify these challenges. Typing, a critical alternative for users unable or unwilling to use voice [41], has received insufficient attention from social VR platform developers. The late introduction of typing tools in VRChat[7], nearly a decade after its launch, underscores these systemic oversights. Even with this addition, our findings (Section 4.1.3) highlight that typing in VR remains slow and cumbersome, restricting mute users' ability to participate fully in real-time interactions, engage in group discussions, or avoid harassment. These technological constraints amplify the disadvantages faced by mute users in fast-paced, voice-centric environments.

Social barriers further compound these technological limitations. Mute users often encounter rudeness and discriminatory behaviors resulting from embodied avatar-based interactions, as revealed in our findings (Section 4.1.2), where their silence is misinterpreted or stigmatized. These experiences resonate with Shakespeare and Watson [69]'s argument that disability arises from societal structures rather than inherent traits. Similarly, Kafer [43] critiques structural ableism, which frames disability as a problem to be "fixed" rather than as a natural variation requiring accommodation. Platforms that normalize non-verbal communication as a standard, rather than as an exception, could transform muteness from a perceived limitation into an empowering mode of interaction.

[7]VRChat was founded in 2014 and only introduced a typing-based chat tool in 2022.

Despite these systemic challenges, mute users actively engage in practices that resist ableist norms and reimagine interaction in social VR. Drawing from Hamraie and Fritsch's concept of "crip technoscience" [39], our findings highlight how disabled individuals in social VR repurpose and innovate within systems designed without them in mind. A clear example is the existence of ASL worlds, which our findings (Section 4.1.1) reveal as spaces where mute users (primarily users with a physical impairment in the physical world) create alternative norms centering non-verbal communication. In these user-driven spaces, gestures and signs replace spoken language as the primary means of interaction, offering mute users a sense of agency and belonging. Notably, non-mute users also participate in these spaces (Section 4.1.1), engaging with and adopting non-verbal communication practices, which highlights the potential for mutual learning and cultural exchange. Such practices do not merely adapt to existing constraints but actively reconfigure them, transforming potentially exclusionary spaces into more inclusive environments and challenging ableist assumptions. This ingenuity underscores the potential of disabled users to reshape virtual interactions, aligning with broader critiques of normative design frameworks [25] and emphasizing the importance of user-driven innovation in fostering inclusion.

Resistance also extends to identity construction, as mute users navigate virtual spaces through avatars that serve as more than aesthetic choices. Avatars become tools for exploring and expressing identities beyond the constraints of the physical world. Our findings (Section 4.2.1) complement existing research [3, 38, 85] by showing that muteness often complements avatarization, allowing users to craft cohesive virtual identities aligned with their self-perception. This reimagining of identity resonates with critiques of ableist frameworks [43], which emphasize the need to rethink normative assumptions about communication and ability, highlighting how identity is shaped within social and technological contexts.

Drawing on disability justice principles [39], social VR platforms must adopt proactive measures to center the experiences of marginalized users. These measures include designing accessible non-verbal communication tools, fostering cultural norms that celebrate diverse interaction styles, and implementing robust policies to address harassment and discrimination. By reexamining design and governance practices, platforms have the potential to create virtual spaces that are more inclusive and equitable, addressing the needs of marginalized users and mitigating systemic barriers.

While these practices highlight resistance and empowerment, they also exist within broader interpersonal dynamics, where power imbalances between mute and vocal users can complicate efforts to foster inclusivity. The following section explores how these dynamics manifest and their implications for equitable social interactions in VR spaces.

## 5.2 Interpersonal Power Dynamics

Mute users in social VR navigate intricate interpersonal dynamics that often mirror broader societal power imbalances in virtual worlds as highlighted by recent literature [51]. Our findings contribute to this discourse by showing how ableist structures materialize in interpersonal interactions, often positioning mute users in roles of dependency or marginalization.

A prominent example of power imbalances in VRChat is the practice of "adoption" (Section 4.1.4), where vocal users mediate mute users' social presence. While often presented as supportive, this dynamic reinforces hierarchical relationships by positioning vocal adopters as intermediaries and gatekeepers to social inclusion. These interactions reflect caregiving dynamics observed in physical contexts, where the preferences of carers often overshadow the autonomy of those they support [71]. Such relationships align with Kafer's critique of dependency in ableist systems [43], which highlights how practices framed as inclusive can reinforce power imbalances and sustain marginalization.

The terminology surrounding adoption practices exacerbates these inequities. Terms like "personal mute" and analogies likening mute users to pets trivialize their identities, reducing them to objects of novelty or fetishization. Discussions in VRChat in our dataset often portray mute users as passive participants or collectible objects in need of "adoption," undermining their individuality and reinforcing exclusionary stereotypes. While some mute users humorously engage with these narratives as a strategy for social navigation, such framing perpetuates systemic biases that frame muteness as a deficiency rather than a valid and autonomous mode of interaction. These dynamics illustrate how interpersonal interactions in social VR replicate broader patterns of objectification and marginalization, calling for critical reflection and systemic change.

To mitigate the inequities embedded in interpersonal dynamics, platforms need to actively challenge the hierarchical relationships that reinforce dependency. These efforts should center mute users' autonomy and agency, ensuring that their participation in social VR reflects empowerment rather than marginalization.

With the increasing presence of mute users in social VR, these dynamics may contribute to patterns of generalization and stereotyping. The following section explores how the collective identity of mute users risks being oversimplified, overlooking the diversity of their experiences and motivations.

## 5.3 The challenges of generalization

The phenomenon of muteness in social VR reflects a shift from individual behaviors to the construction of collective identity within digital communities. As prior research suggests, collective identity is actively shaped through interaction, negotiation, and the opposition of differing perspectives [28, 42, 58]. In social VR, the mute community is composed of individuals with diverse motivations and circumstances, including those with physical disabilities (Section 4.2.5), users managing self-presentation (Section 4.2.1), those coping with social anxiety (Section 4.2.4), individuals using silence as a strategy to avoid harassment (Section 4.2.2), and participants balancing virtual engagement with physical-world mindfulness (Section 4.2.3). As muteness gains visibility, it transcends individual circumstances to form a distinct collective identity, even when members do not explicitly identify with or engage in group-building processes. However, the emergence of collective identity introduces complexities into mute practices. At an individual level, muteness often serves pragmatic purposes, such as shielding users from harassment tied to voice characteristics or providing control over virtual interactions. Yet, as visibility grows, so do risks of collective

labeling and stereotyping. For instance, our findings reveal how harassers often assume that muteness is always a deliberate choice, disregarding its multifaceted motivations (4.2.2). This generalization shifts the focus from individual traits to group characteristics, reinforcing stigmatization and perpetuating exclusion. Theoretical critiques from disability studies, including Kafer's exploration of structural ableism [43], emphasize how societal narratives tend to flatten diverse experiences into reductive categories. Generalization, then, can obscure the nuanced social and political factors that shape individuals' lived realities. Within social VR, such generalization risks erasing the diversity of mute users' experiences, fostering stigma and misrepresentation. This dynamic parallels the experiences of other VR communities, such as "mirror dwellers," who engage in prolonged self-reflection in virtual mirrors and are often subject to dismissive or pejorative labels without consideration of their practices' significance [87]. This example illustrates how generalization across VR communities creates vulnerabilities to harm, exclusion, and stereotyping.

Our findings show how the risks of generalization extend beyond interpersonal dynamics to structural levels, potentially influencing how mute users are perceived and supported (e.g., the assumptions that muteness is universally voluntary or performative). For future research and design, it may be important to balance recognizing collective identities with addressing individual needs. Efforts to reduce harassment could benefit from not only protecting users from personal attacks but also addressing broader patterns of group-based discrimination.

As muteness embodies both individual strategies and collective identity, researchers and designers need to embrace complexity, drawing on frameworks like disability justice to develop interventions that support empowerment while resisting oversimplification. Moreover, researchers and platform developers need to critically reflect on their approaches, avoiding oversimplifications and addressing the risks of perpetuating harm [73].

## 5.4 Implications for Inclusive Social VR

The phenomenon of muteness in social VR exposes critical governance challenges and the interplay of systemic structures with interpersonal power dynamics. Our findings (Section 4.1.2 and 4.2.2) show that when users mute themselves to avoid identity-based harassment, it may point to systemic inequities in Social VR and as a failure in platform governance to ensure safety and inclusivity. These shortcomings raise questions about platform accountability, corporate responsibility, and the potential need for external regulatory standards to enforce accessibility and equity. Without effective governance, marginalized groups like mute users face systemic neglect, creating environments that perpetuate exclusion rather than inclusion.

Building on our research, we propose three design suggestions: reducing the reliance on self-protection, formalizing muteness as a recognized role, and enhancing governance structures to promote inclusivity. These implications range from facilitating interaction at the individual level to building collective identity at the community level, and to protecting their individual and collaborative effort at the platform level.

*5.4.1 Reducing the Need to Self-Protection in Social VR.* Muteness in social VR is often employed as a self-protection strategy against harassment. This protective measure, while useful, can inadvertently restrict users' interactional experiences, underscoring the need to address harassment more effectively in social VR contexts.

A viable solution could be the introduction of more sophisticated voice-based interaction controls. These controls would empower users to selectively engage in voice communications, thus fostering connections with individuals they trust and enjoy interacting with. Implementing such a feature not only enhances the safety of social exchanges but also maintains the authenticity and vibrancy of verbal communication. It contributes to a safer, more engaging virtual environment. This direction corresponds to increasing moderation opportunities available on social media users; beyond muting other users, X and Facebook enable users to control who can respond to their posts, adding a layer of user-directed moderation.

However, addressing this issue requires more than just technical fixes. The essence of the challenge is rooted in the design of platform rules and governance. The reliance on extreme self-protective measures like muteness indicates a significant gap in the current moderation systems within social VR. Addressing this effectively requires a comprehensive, multi-layered approach. Considerations could include implementing diverse forms of community moderation, strengthening expert moderation, and ensuring the availability of platform-assisted interventions during harassment incidents. We believe that social VR platforms ought to learn from the various problems current social media platforms are experiencing and focus on building a comprehensive approach to combat harassment.

*5.4.2 Formalizing Mute as a Platform-Recognized Role.* Revamping the role of muteness in social VR to a formally recognized status can be an innovative step toward embracing diversity in communication. Acknowledging muteness as a socially normative behavior, not merely an individual choice, but as a part of a group identity, opens new avenues for engagement and community building within these digital spaces. Designers can take a proactive role in acknowledging this identity by assigning specific role tags to mute users. This approach aligns with the desires of users with certain invisible impairments or conditions who wish to express their identity within social VR, as supported by previous research [38, 85]. By making mute users' presence visibly acknowledged, these tags could enhance interactions within the mute community and foster a deeper sense of belonging. Further, designs can be expanded upon these tags clarifying the various reasons behind choosing muteness, such as social anxiety, speech impediments, or other factors, to promote greater understanding and potentially reduce instances of unintended harassment.

The initiative highlights users' diverse communication styles and preferences, potentially enriching the user experience and shaping social VR into a more inclusive environment. Importantly, these tags should be optional, allowing users to choose them voluntarily, thus respecting their autonomy while ensuring that the platform provides the necessary options to support diverse identities. However, we clarify that adding a tag can potentially lead to a coordinated attack towards the mute group since attackers can also use the tag to identify the targets easily [15]. There is a need to simulate the situation before actually launching the design [63]. How to balance

the visibility of the tag and the mitigation of the potential attack should be further explored.

*5.4.3 Fostering Inclusive Governance and User Engagement.* Social VR platforms need to take deliberate steps to create inclusive environments finding inspiration in disability justice principles [39], ensuring that the voices, needs, and agency of marginalized communities are at the core of platform development and governance. This requires fostering direct engagement, reducing hierarchical relationships, and actively addressing systemic inequities in virtual environments.

First, platforms should conduct regular, independent audits to assess their effectiveness in maintaining inclusivity. For example, effective audit systems are often sought in research examining algorithmic harm [46]. Similarly, on a novel online platform like social VR—unlike the traditional 2D social media that we are more familiar with—such systems are crucial. These audits should evaluate how well the platform adheres to established standards for marginalized groups, such as mute users. Additionally, the audits should investigate whether the platform inadvertently creates new barriers or disabilities for users. Second, developing a systematic process for collecting, analyzing, and integrating user feedback into platform policies and features is important. This process ensures that the voices of users, including those from marginalized communities, are heard and considered in decision-making [62]. Continuous feedback can be gathered through surveys, focus groups, and in-platform reporting tools to align the platform with user needs.

Additionally, organizing participatory workshops that involve users, particularly those from marginalized communities, in the design and development process for new major features is crucial. Participatory design goes beyond considering marginalized communities as merely design partners; it aims to give them greater control over the design process, ensuring their needs, perspectives and experiences directly influence the outcomes [6, 40]. This approach to the design of VR systems has been proven effective in ensuring that outcomes are not only relevant but empowering for marginalized groups [81], thereby helping to better prevent unnecessary harm.

## 5.5 Limitations and Future Works

Our study, while insightful, encounters several limitations. Primarily, the reliance on discussion data from the online forum may not fully represent the diversity of mute users' experiences. This limitation is pertinent for individuals who do not engage with this specific online community. Additionally, Reddit's inherent anonymity introduces challenges in verifying users' demographic information. Such verification can contribute to a nuanced understanding of the contextual factors that shape users' viewpoints. Another limitation lies in our data collection method, which primarily focused on the keyword "mute" and its variations. While this is the most relevant term, this approach may overlook discussions that do not explicitly use this term.

Looking ahead, several research directions emerge from our findings. One particularly interesting discovery is that some users, understanding the social dynamics of VR, align themselves with the mute group not out of necessity, but as a way to assess the behavior of others. By pretending to be mute, they can gauge qualities such as patience and politeness in fellow users, thus navigating the social environment more safely and effectively. While this is a clever and strategic use of muteness, it raises questions about its appropriateness and the potential unintended consequences for the mute community. Further research is needed to explore this topic and its broader implications. Research on the effectiveness and user reception of non-verbal communication tools in VRChat could also yield valuable insights. Such findings would benefit both platform developers and the broader HCI community by highlighting the specific needs and preferences of mute users in social VR environments. Additionally, future studies could examine the experiences of users who regularly interact with mute individuals to better understand the limitations and opportunities presented by non-verbal communication in virtual settings. Finally, while our study acknowledges that many mute users face harassment and have limited means of defending themselves, it does not fully explore their coping strategies. Future research should investigate how mute users respond to harassment, the effectiveness of these strategies, and the emotional labor involved in such interactions. This would offer deeper insights into the challenges mute users face and help identify areas for support and intervention within social VR environments.

# 6 CONCLUSION

This research has explored the experiences and reasons behind the mute phenomenon in social VR, specifically in the VRChat platform. Our findings reveal that social VR can create a disabling environment. Many social VR features drive users to remain mute, which causes them to face significant social challenges. Being mute in social VR challenges normative assumptions and redefines communication in these virtual spaces. Additionally, we observed the formation of a collective identity among mutes, which, while fostering community, also exposes them to stereotyping, harassment, and oversimplification of disability identity. Our study highlights the need for inclusive design practices that address the unique challenges faced by marginalized communities in VR. By acknowledging these experiences and offering design improvements, we can create safer, more supportive virtual environments that enable all users to engage comfortably.

# ACKNOWLEDGMENTS

We extend our gratitude to the anonymous reviewers for their constructive critiques, which significantly improved the paper. This work was financed by the Research Council of Finland (Grant #357270). Andrea Bellucci was funded by the MICINN grant "Convocatoria de la Universidad Carlos III de Madrid de Ayudas para la recualificación del sistema universitario español para 2021-2023, de 1 de julio de 2021" (Orden UNI/551/2021).

# REFERENCES

[1] Dane Acena and Guo Freeman. 2021. "In My Safe Space": Social Support for LGBTQ Users in Social Virtual Reality. In *Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems* (Yokohama, Japan) *(CHI EA '21)*. Association for Computing Machinery, New York, NY, USA, Article 301, 6 pages. https://doi.org/10.1145/3411763.3451673

[2] Nicholas Norman Adams. 2022. 'Scraping' Reddit posts for academic research? Addressing some blurred lines of consent in growing internet-based research trend during the time of Covid-19. *International Journal of Social Research Methodology* 0, 0 (2022), 1–16. https://doi.org/10.1080/13645579.2022.2111816 arXiv:https://doi.org/10.1080/13645579.2022.2111816

[3] Katrin Angerbauer, Phoenix Van Wagoner, Tim Halach, Jonas Vogelsang, Natalie Hube, Andria Smith, Ksenia Keplinger, and Michael Sedlmair. 2024. Is it Part of Me? Exploring Experiences of Inclusive Avatar Use For Visible and Invisible Disabilities in Social VR. In *Proceedings of the 26th International ACM SIGACCESS Conference on Computers and Accessibility* (St. John's, NL, Canada) *(ASSETS '24)*. Association for Computing Machinery, New York, NY, USA, Article 54, 15 pages. https://doi.org/10.1145/3663548.3675601

[4] Christine E Ashby. 2011. Whose" voice" is it anyway?: Giving voice and qualitative research involving individuals that type to communicate. *Disability Studies Quarterly* 31, 4 (2011).

[5] Rasmus Asshoff. 2022. Welcome to VRChat: an ethnographic study on embodiment and immersion in virtual reality.

[6] G. Avram, J. Choi, Stefano De Paoli, A. Light, Peter Lyle, and Maurizio Teli. 2019. Repositioning CoDesign in the age of platform capitalism: from sharing to caring. *CoDesign* 15 (2019), 185 – 191. https://doi.org/10.1080/15710882.2019.1638063

[7] Shaowen Bardzell and Jeffrey Bardzell. 2011. Towards a feminist HCI methodology: social science, feminism, and HCI. In *Proceedings of the SIGCHI conference on human factors in computing systems*. 675–684.

[8] Lindsay Blackwell, Nicole Ellison, Natasha Elliott-Deflo, and Raz Schwartz. 2019. Harassment in social virtual reality: Challenges for platform governance. *Proceedings of the ACM on Human-Computer Interaction* 3, CSCW (2019), 1–25.

[9] Bob64. 2024. Experimental Sign Language World. https://wiki.vrchat.com/wiki/Community:Experimental_Sign_Language_World_(Udon). Accessed: 2024-12-07.

[10] B. Bourke. 2014. Positionality: Reflecting on the Research Process. *The Qualitative Report* 19 (2014), 1–9.

[11] Virginia Braun and Victoria Clarke. 2006. Using thematic analysis in psychology. *Qualitative Research in Psychology* 3, 2 (2006), 77–101. https://doi.org/10.1191/1478088706qp063oa arXiv:https://www.tandfonline.com/doi/pdf/10.1191/1478088706qp063oa

[12] Virginia Braun and Victoria Clarke. 2012. *Thematic analysis.* American Psychological Association.

[13] Robert Alan Brookey and Kristopher L Cannon. 2009. Sex lives in second life. *Critical Studies in Media Communication* 26, 2 (2009), 145–164.

[14] Amy Bruckman. 2002. Studying the amateur artist: A perspective on disguising data collected in human subjects research on the Internet. *Ethics and Information Technology* 4 (2002), 217–231.

[15] Jie Cai, Sagnik Chowdhury, Hongyang Zhou, and Donghee Yvette Wohn. 2023. Hate Raids on Twitch: Understanding Real-Time Human-Bot Coordinated Attacks in Live Streaming Communities. *Proc. ACM Hum.-Comput. Interact.* 7, CSCW2, Article 342 (Oct. 2023), 28 pages. https://doi.org/10.1145/3610191

[16] Diane Carr. 2011. Constructing disability in online worlds; conceptualising disability in online research. In *Reinventing Ourselves: Contemporary Concepts of Identity in Virtual Worlds*. Springer, 177–190.

[17] Qijia Chen, Andrea Bellucci, and Giulio Jacucci. 2024. "I'd rather drink in VRChat": Understanding Drinking in Social Virtual Reality. In *Proceedings of the CHI Conference on Human Factors in Computing Systems* (Honolulu, HI, USA) *(CHI '24)*. Association for Computing Machinery, New York, NY, USA, Article 797, 16 pages. https://doi.org/10.1145/3613904.3642405

[18] Qijia Chen, Andrea Bellucci, and Giulio Jacucci. 2025. Mirror Dwellers in Social VR: Investigating Reasons and Perception of Mirror Watching. *Proc. ACM Hum.-Comput. Interact.* 9, CSCW135 (April 2025), 23 pages. https://doi.org/10.1145/3711033

[19] Qijia Chen, Jie Cai, and Giulio Jacucci. 2024. "People are Way too Obsessed with Rank": Trust System in Social Virtual Reality. *Computer Supported Cooperative Work (CSCW)* (2024), 1–33.

[20] Qijia Chen, Seyed Mahed Mousavi, Giuseppe Riccardi, and Giulio Jacucci. 2025. Investigating the Use and Perception of Blocking Feature in Social Virtual Reality Spaces: A Study on Discussion Forums. *Proc. ACM Hum.-Comput. Interact.* 9, CSCW120 (April 2025), 19 pages. https://doi.org/10.1145/3711018

[21] Qijia Chen, Michiel M. Spapé, and Giulio Jacucci. 2024. Understanding Phantom Tactile Sensation on Commercially Available Social Virtual Reality Platforms. *Proc. ACM Hum.-Comput. Interact.* 8, CSCW1, Article 141 (apr 2024), 22 pages. https://doi.org/10.1145/3637418

[22] Qijia Chen, Qunfang Wu, and Giulio Jacucci. 2025. Democratic Moderation: Exploring the Use and Perception of Votekicking in Social Virtual Reality. In *Proceedings of the CHI Conference on Human Factors in Computing Systems* (Yokohama, Japan) *(CHI '25)*. Association for Computing Machinery, New York, NY, USA, 18 pages. https://doi.org/10.1145/3706598.3713577

[23] Victoria Clarke and Virginia Braun. 2017. Thematic analysis. *The Journal of Positive Psychology* (2017). https://doi.org/10.1080/17439760.2016.1262613

[24] Jennifer Cole, Jason Nolan, Yukari Seko, Katherine Mancuso, and Alejandra Ospina. 2011. GimpGirl grows up: Women with disabilities rethinking, redefining, and reclaiming community. *new media & society* 13, 7 (2011), 1161–1179.

[25] Sasha Costanza-Chock. 2018. Design justice, AI, and escape from the matrix of domination. *Journal of Design and Science* 3, 5 (2018), 1–14.

[26] Francesca De Simone, Jie Li, Henrique Galvan Debarba, Abdallah El Ali, Simon NB Gunkel, and Pablo Cesar. 2019. Watching videos together in social virtual reality: An experimental study on user's QoE. In *2019 IEEE Conference on virtual reality and 3d user interfaces (VR)*. IEEE, 890–891.

[27] Mairi Therese Deighan, Amid Ayobi, and Aisling Ann O'Kane. 2023. Social Virtual Reality as a Mental Health Tool: How People Use VRChat to Support Social Connectedness and Wellbeing. *Conference on Human Factors in Computing Systems - Proceedings*. https://doi.org/10.1145/3544548.3581103

[28] Mario Diani. 1992. The concept of social movement. *The sociological review* 40, 1 (1992), 1–25.

[29] Casey Fiesler. 2019. Ethical Considerations for Research Involving (Speculative) Public Data. *Proc. ACM Hum.-Comput. Interact.* 3, GROUP, Article 249 (dec 2019), 13 pages. https://doi.org/10.1145/3370271

[30] Center for Countering Digital Hate. 2021. *New research shows Metaverse is not safe for kids.* Retrieved Sep 11, 2022 from https://counterhate.com/blog/new-research-shows-metaverse-is-not-safe-for-kids/

[31] Guo Freeman and Dane Acena. 2021. Hugging from A Distance: Building Interpersonal Relationships in Social Virtual Reality. In *ACM International Conference on Interactive Media Experiences* (Virtual Event, USA) *(IMX '21)*. Association for Computing Machinery, New York, NY, USA, 84–95. https://doi.org/10.1145/3452918.3458805

[32] Guo Freeman and Dane Acena. 2022. " Acting Out" Queer Identity: The Embodied Visibility in Social Virtual Reality. *Proceedings of the ACM on Human-Computer Interaction* 6, CSCW2 (2022), 1–32.

[33] Guo Freeman, Divine Maloney, Dane Acena, and Catherine Barwulor. 2022. (Re)Discovering the Physical Body Online: Strategies and Challenges to Approach Non-Cisgender Identity in Social Virtual Reality. In *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems* (New Orleans, LA, USA) *(CHI '22)*. Association for Computing Machinery, New York, NY, USA, Article 118, 15 pages. https://doi.org/10.1145/3491102.3502082

[34] Kexue Fu, Yixin Chen, Jiaxun Cao, Xin Tong, and RAY LC. 2023. "I Am a Mirror Dweller": Probing the Unique Strategies Users Take to Communicate in the Context of Mirrors in Social Virtual Reality. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems* (Hamburg, Germany) *(CHI '23)*. Association for Computing Machinery, New York, NY, USA, Article 385, 19 pages. https://doi.org/10.1145/3544548.3581464

[35] Robert P Gauthier, Mary Jean Costello, and James R Wallace. 2022. "I Will Not Drink With You Today": A Topic-Guided Thematic Analysis of Addiction Recovery on Reddit. In *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems*. 1–17.

[36] Kathrin Gerling and Katta Spiel. 2021. A critical examination of virtual reality technology in the context of the minority body. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. 1–14.

[37] Dan Goodley et al. 2017. Dis/entangling critical disability studies. *Culture–theory–disability* 81 (2017).

[38] Ria J. Gualano, Lucy Jiang, Kexin Zhang, Tanisha Shende, Andrea Stevenson Won, and Shiri Azenkot. 2024. "I Try to Represent Myself as I Am": Self-Presentation Preferences of People with Invisible Disabilities through Embodied Social VR Avatars. In *Proceedings of the 26th International ACM SIGACCESS Conference on Computers and Accessibility* (St. John's, NL, Canada) *(ASSETS '24)*. Association for Computing Machinery, New York, NY, USA, Article 72, 15 pages. https://doi.org/10.1145/3663548.3675620

[39] Aimi Hamraie and Kelly Fritsch. 2019. Crip technoscience manifesto. *Catalyst: Feminism, theory, technoscience* 5, 1 (2019), 1–33.

[40] Christina N. Harrington, Katya Borgos-Rodriguez, and Anne Marie Piper. 2019. Engaging Low-Income African American Older Adults in Health Discussions through Community-based Design Workshops. *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems* (2019). https://doi.org/10.1145/3290605.3300823

[41] Cassandra Hartblay. 2019. After marginalization: pixelization, disability, and social difference in digital Russia. *South Atlantic Quarterly* 118, 3 (2019), 543–572.

[42] Scott A Hunt and Robert D Benford. 1994. Identity talk in the peace and justice movement. *Journal of contemporary ethnography* 22, 4 (1994), 488–517.

[43] Alison Kafer. 2013. Feminist, Queer, Crip. *Indiana UP* (2013).

[44] Tomoko Kishimoto and Xinfang Ding. 2019. The influences of virtual social feedback on social anxiety disorders. *Behavioural and cognitive psychotherapy* 47, 6 (2019), 726–735.

[45] Yubo Kou, Yao Li, Xinning Gui, and Eli Suzuki-Gill. 2018. Playing with Streakiness in Online Games: How Players Perceive and React to Winning and Losing Streaks in League of Legends. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (Montreal QC, Canada) *(CHI '18)*. Association for Computing Machinery, New York, NY, USA, 1–14. https://doi.org/10.1145/3173574.3174152

[46] Michelle S. Lam, Mitchell L. Gordon, D. Metaxa, Jeffrey T. Hancock, J. Landay, and Michael S. Bernstein. 2022. End-User Audits: A System Empowering Communities to Lead Large-Scale Investigations of Harmful Algorithmic Behavior. *Proceedings of the ACM on Human-Computer Interaction* 6 (2022), 1 – 34. https://doi.org/10.1145/3555625

[47] Jie Li, Vinoba Vinayagamoorthy, Julie Williamson, David A. Shamma, and Pablo Cesar. 2021. Social VR: A New Medium for Remote Communication

and Collaboration. In *Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems* (Yokohama, Japan) *(CHI EA '21)*. Association for Computing Machinery, New York, NY, USA, Article 81, 6 pages. https://doi.org/10.1145/3411763.3441346

[48] Calvin A Liang, Sean A Munson, and Julie A Kientz. 2021. Embracing four tensions in human-computer interaction research with marginalized people. *ACM Transactions on Computer-Human Interaction (TOCHI)* 28, 2 (2021), 1–47.

[49] Linden Lab. 2003. Second Life. https://secondlife.com. Accessed: 2024-12-10.

[50] Renkai Ma and Yubo Kou. 2023. "Defaulting to Boilerplate Answers, They Didn't Engage in a Genuine Conversation": Dimensions of Transparency Design in Creator Moderation. *Proc. ACM Hum.-Comput. Interact.* 7, CSCW1, Article 44 (apr 2023), 26 pages. https://doi.org/10.1145/3579477

[51] Cayley MacArthur, Eugene Kukshinov, Daniel Harley, Trisha Pawar, Nirali Modi, and Lennart E Nacke. 2024. Experiential disparities in social VR: uncovering power dynamics and inequality. *Frontiers in Virtual Reality* 5 (2024), 1351794.

[52] Divine Maloney and Guo Freeman. 2020. Falling Asleep Together: What Makes Activities in Social Virtual Reality Meaningful to Users. In *Proceedings of the Annual Symposium on Computer-Human Interaction in Play* (Virtual Event, Canada) *(CHI PLAY '20)*. Association for Computing Machinery, New York, NY, USA, 510–521. https://doi.org/10.1145/3410404.3414266

[53] Divine Maloney, Guo Freeman, and Andrew Robb. 2020. A virtual space for all: Exploring children's experience in social virtual reality. In *Proceedings of the Annual Symposium on Computer-Human Interaction in Play*. 472–483.

[54] Divine Maloney, Guo Freeman, and Andrew Robb. 2021. Social Virtual Reality: Ethical Considerations and Future Directions for An Emerging Research Space. In *2021 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)*. 271–277. https://doi.org/10.1109/VRW52623.2021.00056

[55] Divine Maloney, Guo Freeman, and Donghee Yvette Wohn. 2020. "Talking without a Voice": Understanding Non-Verbal Communication in Social Virtual Reality. *Proceedings of the ACM on Human-Computer Interaction* 4 (10 2020). Issue CSCW2. https://doi.org/10.1145/3415246

[56] Jennifer Mankoff, Gillian R Hayes, and Devva Kasnitz. 2010. Disability studies as a source of critical inquiry for the field of assistive technology. In *Proceedings of the 12th international ACM SIGACCESS conference on Computers and accessibility*. 3–10.

[57] Joshua McVeigh-Schultz, Elena Márquez Segura, Nick Merrill, and Katherine Isbister. 2018. What's It Mean to "Be Social" in VR? Mapping the Social VR Design Ecology. In *Proceedings of the 2018 ACM Conference Companion Publication on Designing Interactive Systems* (Hong Kong, China) *(DIS '18 Companion)*. Association for Computing Machinery, New York, NY, USA, 289–294. https://doi.org/10.1145/3197391.3205451

[58] Alberto Melucci. 2013. The process of collective identity. In *Social movements and culture*. Routledge, 41–63.

[59] Mario Montagud, Jie Li, Gianluca Cernigliaro, Abdallah El Ali, Sergi Fernández, and Pablo Cesar. 2022. Towards socialVR: evaluating a novel technology for watching videos together. *Virtual Reality* 26, 4 (2022), 1593–1613.

[60] Fares Moustafa and Anthony Steed. 2018. A Longitudinal Study of Small Group Interaction in Social Virtual Reality. In *Proceedings of the 24th ACM Symposium on Virtual Reality Software and Technology* (Tokyo, Japan) *(VRST '18)*. Association for Computing Machinery, New York, NY, USA, Article 22, 10 pages. https://doi.org/10.1145/3281505.3281527

[61] Clifford Nass and Li Gong. 2000. Speech interfaces from an evolutionary perspective. *Commun. ACM* 43, 9 (2000), 36–43.

[62] L. Olson, Emitz'a Guzm'an, and Florian Kunneman. 2023. Along the Margins: Marginalized Communities' Ethical Concerns about Social Platforms. *2023 IEEE/ACM 45th International Conference on Software Engineering: Software Engineering in Society (ICSE-SEIS)* (2023), 71–82. https://doi.org/10.1109/ICSE-SEIS58686.2023.00013

[63] Joon Sung Park, Lindsay Popowski, Carrie Cai, Meredith Ringel Morris, Percy Liang, and Michael S. Bernstein. 2022. Social Simulacra: Creating Populated Prototypes for Social Computing Systems. In *Proceedings of the 35th Annual ACM Symposium on User Interface Software and Technology* (Bend, OR, USA) *(UIST '22)*. Association for Computing Machinery, New York, NY, USA, Article 74, 18 pages. https://doi.org/10.1145/3526113.3545616

[64] Roosa Piitulainen, Perttu Hämäläinen, and Elisa D Mekler. 2022. Vibing Together: Dance Experiences in Social Virtual Reality. In *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems* (New Orleans, LA, USA) *(CHI '22)*. Association for Computing Machinery, New York, NY, USA, Article 188, 18 pages. https://doi.org/10.1145/3491102.3501828

[65] Kassie C Povinelli and Yuhang Zhao. 2024. Springboard, Roadblock or "Crutch"?: How Transgender Users Leverage Voice Changers for Gender Presentation in Social Virtual Reality. In *2024 IEEE Conference Virtual Reality and 3D User Interfaces (VR)*. IEEE, 354–364.

[66] Nicholas Proferes, Naiyan Jones, Sarah Gilbert, Casey Fiesler, and Michael Zimmer. 2021. Studying reddit: A systematic overview of disciplines, approaches, methods, and ethics. *Social Media+ Society* 7, 2 (2021), 20563051211019004.

[67] Asshoff Rasmus. 2022. Welcome to VRChat: an ethnographic study on embodiment and immersion in virtual reality.

[68] Kelsea Schulenberg, Guo Freeman, Lingyuan Li, and Bart Knijnenburg. 2024. Does Who You Are or Appear to Be Matter?: Understanding Identity-Based Harassment in Social VR Through the Lens of (Mis) Perceived Identity Revelation. *Proceedings of the ACM on humancomputer interaction* (2024).

[69] Torn Shakespeare and Nicholas Watson. 2001. The social model of disability: an outdated ideology? In *Exploring theories and expanding methodologies: Where we are and where we need to go*. Emerald Group Publishing Limited, 9–28.

[70] Ketaki Shriram and Raz Schwartz. 2017. All are welcome: Using VR ethnography to explore harassment behavior in immersive social virtual reality. In *2017 IEEE Virtual Reality (VR)*. 225–226. https://doi.org/10.1109/VR.2017.7892258

[71] Katta Spiel, Christopher Frauenberger, Os Keyes, and Geraldine Fitzpatrick. 2019. Agency of autistic children in technology research—A critical literature review. *ACM Transactions on Computer-Human Interaction (TOCHI)* 26, 6 (2019), 1–40.

[72] Katta Spiel, Kathrin Gerling, Cynthia L Bennett, Emeline Brulé, Rua M Williams, Jennifer Rode, and Jennifer Mankoff. 2020. Nothing about us without us: Investigating the role of critical disability studies in HCI. In *Extended Abstracts of the 2020 CHI Conference on Human Factors in Computing Systems*. 1–8.

[73] Katta Spiel, Eva Hornecker, Rua Mae Williams, and Judith Good. 2022. ADHD and technology research–investigated by neurodivergent readers. In *Proceedings of the 2022 CHI conference on human factors in computing systems*. 1–21.

[74] Philipp Sykownik, Linda Graf, Christoph Zils, and Maic Masuch. 2021. The Most Social Platform Ever? A Survey about Activities & Motives of Social VR Users. In *2021 IEEE Virtual Reality and 3D User Interfaces (VR)*. 546–554. https://doi.org/10.1109/VR50410.2021.00079

[75] Theresa Jean Tanenbaum, Nazely Hartoonian, and Jeffrey Bryan. 2020. "How Do I Make This Thing Smile?": An Inventory of Expressive Nonverbal Communication in Commercial Social Virtual Reality Platforms. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* (Honolulu, HI, USA) *(CHI '20)*. Association for Computing Machinery, New York, NY, USA, 1–13. https://doi.org/10.1145/3313831.3376606

[76] VRChat Inc. 2024. VRChat. https://hello.vrchat.com/. Accessed: 2024-09-12.

[77] Greg Wadley, Marcus Carter, and Martin Gibbs. 2015. Voice in virtual worlds: The design, use, and influence of voice chat in online play. *Human–Computer Interaction* 30, 3-4 (2015), 336–365.

[78] Julie Williamson, Jie Li, Vinoba Vinayagamoorthy, David A. Shamma, and Pablo Cesar. 2021. Proxemics and Social Interactions in an Instrumented Virtual Reality Workshop. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems* (Yokohama, Japan) *(CHI '21)*. Association for Computing Machinery, New York, NY, USA, Article 253, 13 pages. https://doi.org/10.1145/3411764.3445729

[79] Tian Xu, Junnan Yu, Dylan Thomas Doyle, and Stephen Voida. 2023. Technology-mediated strategies for coping with mental health challenges: Insights from people with bipolar disorder. *Proceedings of the ACM on Human-Computer Interaction* 7, CSCW2 (2023), 1–31.

[80] Michael Yin and Robert Xiao. 2023. Drifting Off in Paradise: Why People Sleep in Virtual Reality. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems* (Hamburg, Germany) *(CHI '23)*. Association for Computing Machinery, New York, NY, USA, Article 498, 13 pages. https://doi.org/10.1145/3544548.3580947

[81] Allan Yong, Ali Arya, and Monique Mantch. 2023. Indigenous Technology Empowerment Model: A Community-based Design Framework. *2023 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC)* (2023), 1–9. https://doi.org/10.1109/ICE/ITMC58018.2023.10332432

[82] Mark Zachry. 2008. An interview with Susan Leigh star. *Technical Communication Quarterly* 17, 4 (2008), 435–454.

[83] Samaneh Zamanifard and Guo Freeman. 2019. "The Togetherness That We Crave": Experiencing Social VR in Long Distance Relationships. In *Conference Companion Publication of the 2019 on Computer Supported Cooperative Work and Social Computing* (Austin, TX, USA) *(CSCW '19)*. Association for Computing Machinery, New York, NY, USA, 438–442. https://doi.org/10.1145/3311957.3359453

[84] Samaneh Zamanifard and Andrew Robb. 2023. Social Virtual Reality Is My Therapist: Overcoming Social Anxiety Disorder Through Using Social Virtual Reality. In *Extended Abstracts of the 2023 CHI Conference on Human Factors in Computing Systems* (Hamburg, Germany) *(CHI EA '23)*. Association for Computing Machinery, New York, NY, USA, Article 252, 6 pages. https://doi.org/10.1145/3544549.3585888

[85] Kexin Zhang, Elmira Deldari, Zhicong Lu, Yaxing Yao, and Yuhang Zhao. 2022. "it's just part of me:" understanding avatar diversity and self-presentation of people with disabilities in social virtual reality. In *Proceedings of the 24th international ACM SIGACCESS conference on computers and accessibility*. 1–16.

[86] Kexin Zhang, Elmira Deldari, Yaxing Yao, and Yuhang Zhao. 2023. A diary study in social virtual reality: Impact of avatars with disability signifiers on the social experiences of people with disabilities. In *Proceedings of the 25th International ACM SIGACCESS Conference on Computers and Accessibility*. 1–17.

[87] Qingxiao Zheng, Shengyang Xu, Lingqing Wang, Yiliu Tang, Rohan C Salvi, Guo Freeman, and Yun Huang. 2023. Understanding safety risks and safety design in social VR environments. *Proceedings of the ACM on Human-Computer Interaction* 7, CSCW1 (2023), 1–37.

[88] Douglas Zytko and Jonathan Chan. 2023. The dating metaverse: Why we need to design for consent in social vr. *IEEE Transactions on Visualization and Computer Graphics* 29, 5 (2023), 2489–2498.

# A APPENDIX – IDENTIFIED THEMES, SUBTHEMES, AND THE ASSOCIATED DESCRIPTIONS

## A.1 Themes, subthemes and description for experience of being "mutes" (RQ1)

| Themes | | Subthemes | | Descriptions |
|---|---|---|---|---|
| 1 | Cultural Integration of Muteness | 1.1 | Significant Presence of Mute Communities | The presence of mute users within the social VR environment is perceived as common. |
| | | 1.2 | Development of Users-generated Worlds for Mute Users | User-generated worlds emerge to cater specifically to the needs of mute communities. |
| | | 1.3 | Integration of mutes' communication methods in Virtual Environments | Communication methods often used by mute users have been incorporated into the VR experience. |
| 2 | Experiencing negative interaction | 2.1 | Rudeness Toward Mute Users | Mute users experience dismissive and disrespectful behavior from others. |
| | | 2.2 | Targeted Harassment of Mute Individuals | Mute users are subjected to targeted harassment and bullying. |
| | | 2.3 | Pressure to Conform to Verbal Communication | Users feel compelled to conform to verbal communication norms, facing pressure to speak. |
| 3 | Facing Difficulties in Communication | 3.1 | Inability to Keep Up with Verbal Communication | Mute users struggle to match the speed and fluidity of verbal communication, making it difficult to fully engage in conversations. |
| | | 3.2 | Limited Ability to Defend Against Harassment | Mute users face challenges in defending themselves against harassment. |
| | | 3.3 | Difficulty in Gaining Attention in Interactions | Being mute is hard to capture the attention of others, particularly in group settings. |
| | | 3.4 | Negative Impact on Social Experience | Being mute frequently results in social isolation or frustration, leading to a negative experience. |
| 4 | Adoption Culture and the Associated Controversy | 4.1 | Adoption as a Social Strategy | Being adopted by vocal users is popular, leading to forming "personal mute" relationships. |
| | | 4.2 | Controversy Over the Practice | The practice has sparked controversy, with mute users feeling objectified, and power imbalance. |

**Table 1: Themes, subthemes, and the associated descriptions for each subtheme for RQ1.**

## A.2 Themes, subthemes and description for reasons for being "mutes" (RQ2)

| Themes | | Subthemes | | Descriptions |
|---|---|---|---|---|
| 1 | Due to Voice-Avatar Contrast | 1.1 | Mitigating Discomfort from Avatar-Voice Dissonance | Users adopt muteness to alleviate the discomfort caused by the contrast between their idealized avatar and unpolished voice. |
| | | 1.2 | Due to Self-Consciousness About Own Voice | The contrast between voices and avatars leads to heightened self-consciousness and dislike toward their own voice. |
| | | 1.3 | Conducting Perception Management | Mute users control perceptions by staying silent, ensuring their identity aligns with their desired self-image. |
| 2 | As a Strategy to Avoid Harassment | 2.1 | Avoiding Harassment Based on Voice Characteristics | Users remain mute to prevent harassment linked to the quality of their voice, such as pitch or tone. |
| | | 2.2 | Avoiding Harassment Due to Voice-Avatar Mismatch | Users stay silent to avoid harassment targeting the mismatch between their voice and avatar appearance. |
| | | 2.3 | Silence as a Response to the Toxic Atmosphere | Users choose to be mute as a defensive measure due to the generally toxic and hostile environment. |
| | | 2.4 | Using Muteness as a Social Filter | Muteness is employed as a strategy to allow users to filter out toxic or impatient individuals. |
| 3 | Balancing Physical and Virtual Surroundings | 3.1 | Preventing Disturbance to Real-Life Surroundings | Users remain mute in social VR to avoid disturbing others in their physical environment. |
| | | 3.2 | Minimizing Real-World Disruptions in Virtual Spaces | Muteness is also adopted to prevent noise or other elements of the user's physical surroundings from affecting other users. |
| 4 | To Manage Social Anxiety | 4.1 | As Coping Mechanism for Social Anxiety | Users adopt muteness in social VR to manage heightened feelings of social anxiety. |
| | | 4.2 | Enhanced social anxiety due to VR | The immersive experience of VR can intensify social anxiety making verbal interactions more daunting. |
| 5 | Due to Individual Impairments | 5.1 | Due to Speech Impairments | Users with speech impairments remain mute in social VR. |
| | | 5.2 | As a Result of Hearing Impairments | Deaf or hard-of-hearing users remain mute in social VR. |

**Table 2: Themes, subthemes, and the associated descriptions for each subtheme for RQ2.**

## A.3 Number of submissions for each theme of RQ2

**Table 3: Numbers of Submissions Identified that Support Each Theme of Reasons for Being a Mute. The descriptive frequency counts illustrates the relative prevalence of themes about the reasons for being mutes across the dataset. These counts were derived directly from the coded data and serve to provide an overview of the distribution of themes but are not intended as measures of importance or statistical significance.**

| |
|---|
| Due to Voice-Avatar Contrast (86) |
| As a Strategy to Avoid Harassment (45) |
| Balancing Physical and Virtual Surroundings (36) |
| To Manage Social Anxiety (116) |
| Due to Individual Impairments (41) |