Breaking the Virtual Ice: Antisocial Behaviors in Social Virtual Reality and How Developers Cope with Them

1 author:

Yasaman Farazan
Technische Hochschule Köln
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Breaking the Virtual Ice:
Antisocial Behaviors in Social Virtual Reality
and How Developers Cope with Them

by

Yasaman Farazan

Student ID: 11130147

yasaman.farazan@smail.th-koeln.de

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Abstract

One of the complicated spaces in which players have a significant agency is virtual reality (VR). The demand for head-mounted displays is rising, and developers discover new potentials in VR, one of which is Social VR. Social VR refers to online applications that focus on socializing in immersive virtual worlds. In these online social environments, various players from different backgrounds, ages, or gender can participate in casual conversations, creating content, and playing games. On the darker side, users of these novel applications face behaviors that are not recommended by the developers or are not acceptable by the scales of real-world social norms. Social VR developers aim for a healthier and welcoming place for as many players as possible and protect individuals' experiences. They have designed multiple social control tools to moderate toxic behaviors. Even though social VR has many characteristics in common with other social media services or digital games, it fosters unique interactions that stem from its immersive quality. Developers are providing more new tools to enable their users to tackle disturbing situations. This study aims to get closer to the social VR community to understand it better. We asked participants what kind of toxic behaviors and violations of terms they have encountered in these applications, how intensely inappropriate they find each of these behaviors, and whether they know about the provided social control tools. We distributed an online survey and collected and analyzed 96 responses from active players to reach this goal.

Keywords: Virtual Reality, Social VR, Digital Game, Toxic Behavior, Digital Survey, Social Control Tools

1. Introduction

Even though VR market success was not as groundbreaking as anticipated, researchers predict that its growth will continue at a more rapid pace, mostly thanks to standalone headsets like Oculus Quest[1]. Playing games, participating in virtual events, and socializing are among the most favorite activities. Social VR, immersive virtual software that enables players to communicate with people worldwide, provides one of the niche experiences one can have in VR. Social features are one of the inseparable parts of these games. Players shape huge communities around these games, each of which comprises different demographics with various focus and purpose. Due to the emergent nature of these applications, players' interactions can be very unpredictable. The more complex these games are, the more unpredictable their social interactions become.

Since the formation of online communities, cyber toxicity has emerged. It dates back to the first decades of the advent of the internet with "LambdaMOO," the oldest MOO (MUD, object-oriented), virtual text-based communities where users are allowed a broad freedom to create. A user called Mr. Bungle did a virtual sexual assault, using a voodoo doll he obtained to commit virtual rapes of female characters[2].

Simplest social systems that allow the players to manipulate something in the game, are prone to become troublesome for the community. Options as simple as entering username can go wrong when players enter inappropriate or offensive inputs. With VR and the freedom it brings, new positive and negative phenomena are becoming evident. Managing these behaviors poses many challenges for developers, both technically and design-wise. There is no doubt that they need to take action against toxicity. Since it is not only good for their community and

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[1] "6.4 Million Consumer VR Headsets Will Be Sold in 2020, with Content Spending Surpassing $1bn Mark, Omdia's New Research Shows," 4, accessed December 25, 2020, https://www.gamasutra.com/blogs/GeorgeJijiashvili/20201130/374385/64_million_consumer_VR_headsets_will_be_sold_in_2020_with_content_spending_surpassing_1bn_mark_Omdias_new_research_shows.php.

[2] Julian Dibbell, "A Rape in Cyberspaceor, How an Evil Clown, a Haitian Trickster Spirit, Two Wizards, and a Cast of Dozens Turned a Database Into a Society," 1994, 237–62, https://doi.org/10.2307/j.ctv1220m2w.14.

publicity, it is also has economic justification; Many players who have ever experienced any type of toxic behavior in games, feel anxious to go back to that game[3]. According to a study by 2017 Pew Research 41% of Americans have been personally subjected to online harassment and 66% have witnessed these behaviors directed at others. Based on this study 62% of Americans consider online harassment a major problem. Women participants were more concerned about feeling welcome and safe online[4]. These facts urges developers to step in and devise proper tools and take the right actions to prevent or control these situations. This concern and how developers deal with it can become complicated and requires a great effort. Sometimes there is a conflict between when people should be able to speak their mind freely without any supervisor overseeing their actions and when they should be controlled.

This research intends to investigate the following research questions:

> **RQ1**: Which forms of antisocial behavior users experience in social VR applications, and how they differ from other social experiences?
>
> **RQ2**: What is the impact of antisocial behavior on VR users' experience?
>
> **RQ3**: Which tools and regulations developers have designed to halt or control antisocial behaviors, and how are they used by the users?

The author surveyed around a hundred social VR players to get more insight into this community and their concerns to answer these questions. The main focus of the survey was on toxic behavior and how social VR members receive them. Furthermore, the survey investigates whether players know and use developers' safety features in these applications.

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[3] Bastian Kordyaka, Katharina Jahn, and Björn Niehaves, "Towards a Unified Theory of Toxic Behavior in Video Games," *Internet Research* ahead-of-print (April 14, 2020), https://doi.org/10.1108/INTR-08-2019-0343.

[4] Maeve Duggan, Aaron Smith, and Tom Caiazza, "Online Harassment 2017," July 11, 2017, https://www.pewresearch.org/internet/2017/07/11/online-harassment-2017/.

2. Background

2.1. Embodiment

Many researchers have embraced virtual reality as an "empathy machine" due to its immersive technology and visceral experiences. It is believed that VR's natural interface can elicit a positive attitudinal change in users and transfer a strong sense of presence[5]. Projects like Oculus's "VR for Good"[6] are formed around this belief that VR technology has the potential to move us in a way that other media failed to. An embodiment of an avatar in VR is more immersive and believable. When wearing a VR headset, the user almost detaches from the real world. In this setting, any abusive or discomforting act is also more tangible and received as being more intense[7].

Embodied virtual reality mimics users' movements onto a photorealistic avatar in a virtual environment while supporting nonverbal behavior alongside verbal communication. More sophisticated accessories can even track a player's full-body motion. Hand tracking also enables users to simulate their precise hand movement on some headsets. Alongside all the opportunities it enables, this visceral nature makes it more potential for cyber harassment and raises questions of accountability among developers. The rise of graphics capabilities and a drop in their prices made VR more accessible to a broader audience and abundant.

Although the feeling of being immersed in a VR environment is impressive for most users, they may not hold themselves accountable for their behavior. Some find this environment a place for escaping from reality, and tend to distance their avatar from their true selves. This is presented as one of the unique features of VRChat on their website to experiment with identity by trying new avatars. It is common for social VR users to use modified microphones to change the apparent

[5] Mila Bujić et al., "'Empathy Machine': How Virtual Reality Affects Human Rights Attitudes," *Internet Research* 30, no. 5 (January 1, 2020): 1407–25, https://doi.org/10.1108/INTR-07-2019-0306.

[6] "VR for Good | Oculus," accessed December 28, 2020, https://www.oculus.com/vr-for-good/.

[7] Lindsay Blackwell et al., "Harassment in Social Virtual Reality: Challenges for Platform Governance," *Proceedings of the ACM on Human-Computer Interaction* 3, no. CSCW (November 7, 2019): 100:1-100:25, https://doi.org/10.1145/3359202.

gender of their voice or role play as other characters. Role-playing, in general, is one of the popular activities among social VR users. Erotic Roleplaying (ERP), the act of users sexually interacting with one another with their consent, is a taboo for most VRChat users, yet feasible and there are even dedicated worlds and avatars for it in VRChat[8]. Some users expressed their interest in enabling their phantom touch sensation on online forums to feel more present in VR.

2.2. Social VR

Social VR is a massively multiplayer online virtual reality social platform where players can meet and communicate with real people. Almost every social VR platform allows its members to create their content and expand their world. VRChat and RecRoom are two of the most famous social VR games. These platforms offer virtual hubs that allow users to engage in social activities, including talking, playing games, conducting meetings, and even hugging each other while embodied as virtual avatars. They are perfect platforms for getting to know new people worldwide and facing new perspectives and stories. Syrmor Youtube channel has dedicated its content to interviews with strangers about their deepest griefs and secrets and has videos with millions of views[9]. VRChat claims that many users report that this game has helped them overcome social anxiety. We got the same feedback from some of our study participants that VRChat has changed their life for good.

On the other hand, many looming social VR problems are exclusive to these platforms. Someone can invade other players' personal space or touch their virtual body while having near-perfect control over their virtual body parts. In contrast, ephemerality and non-standardized application controls make it difficult to escape or report unwanted behavior[10]. These virtual environments thrive on being more

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[8] itsiCarly, *People in VRChat Share Their Thoughts on Erp(Erotic Role Play)*, 2020, https://www.youtube.com/watch?v=RN3VYWQRnX8.

[9]   Syrmor, *Kid in Vrchat Talks about Getting Bullied*, 2019, https://www.youtube.com/watch?v=KZWOXgc7PA4.

[10] Blackwell et al., "Harassment in Social Virtual Reality."

inclusive and tolerable to a great range of people from different ethnicities and backgrounds.

2.3. Toxic Behaviors and Violations

Social platforms are ongoing products and their existence depends on their community. These platforms have been criticized many times for a lack of community management[11]. Usually large gaming companies, whose product life depends on the longevity of its community have a significant budget and experts devoted to managing, analyzing and optimizing their social experience. This not only contributes to the company's reputation and reduces negative publicity around the game, it also has a financial justification. Multiple great game companies joined the Fair Play Alliance[12] to deal with toxicity together. Fair Play Alliance is a community of developers devoted to develop and share practices for healthier communities and player interactions.

Assaults can interrupt the victims experience and stop them from returning to the game or struggling with self-expression and stop using some vulnerable avatars. Many female users have reported that they have started to use voice modifier softwares to be able to use the platform to avoid the risk of experiencing more episodes. These behaviors could make it impossible to bear for many individuals and deprive them from the whole experience, while the virtual world has the potential to be an inclusive space for everyone.

Some of the toxic behaviors in VR settings are visible in other non-immersive platforms. Because of the possibility to engage with others nonverbally through body gestures and the spatial positioning of your avatar, there are some harassments that are exclusive to VR. Even the common toxic behaviors are perceived differently in VR and can be used in a more uncomforting manner, like

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[11] "Twitch Streamer Walks Right into Incredibly NSFW VRChat Scene," Dexerto, June 7, 2019, https://www.dexerto.com/entertainment/twitch-streamer-walks-into-incredibly-nsfw-vrchat-scene-6 96861/.

[12] ml-admin, "Fair Play Alliance," *Fair Play Alliance* (blog), accessed December 25, 2020, https://fairplayalliance.org/.

whispering a threat in an unsettling way and accompanying it with a gesture would be more intense in VR setting.

Virtual toxic behaviors can be roughly divided into three categories of verbal, physical and environmental harassments[13]. Verbal harassments include excessive swearing, explicit sexual language, cyber-bullying, inappropriate terms in usernames, threats to hack or other damages, hate speech, and violent speech. Physical harassment consists of sexual harassment like touching someone in a sexual way, making sexual gestures, stalking or repeatedly following others against their wishes, blocking others' movements intentionally, entering others personal space, and passing through others' avatar. Environmental harassment is done by using virtual objects or showing offensive or violent content or using inappropriate avatars. They are usually intended to ruin others' experience or exploit the system. For instance in a game that is played on a social VR, other players can cheat or act as griefers by interrupting others' game. There are other violations that may not be considered harassment but are not acceptable in most Social VR applications, like children under thirteen using Social VR or without any supervision or privacy violations.

Even though children are the essential users of most online VR games and social VR applications, they are not allowed in these spaces because of safety reasons such as exposure to negative social environments, or harassment and privacy. Though, as a study shows, these users and their families could benefit from these platforms to improve family relations, but how to manage the games while considering young users is still a complicated question for developers and user's experience[14]. Even though RecRoom and VRChat have age restrictions of 13, and most VR headsets' safety guides recommend users to be at least 13, these are neglected by some users and their parents or guardians. Because of its game-centered notion, RecRoom allows users under 13 to open junior accounts.

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[13] Blackwell et al., "Harassment in Social Virtual Reality."

[14] D. Maloney, G. Freeman, and A. Robb, "It Is Complicated: Interacting with Children in Social Virtual Reality," in *2020 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)*, 2020, 343–47, https://doi.org/10.1109/VRW50115.2020.00075.

RecRoom has moderation and evidence systems to detect underage activity on a non-junior account and automatically convert these accounts to a junior account. A junior account should be created by parents and has some limitations in comparison to a regular account. Voice and text chat is not active for juniors; thus, some games that heavily rely on communication is restricted for them; they can only use generated display usernames, they cannot damage teammates in cooperative games (called quests in RecRoom), they are restricted to access some features like attending events or creating custom rooms. Furthermore, non-junior players can choose to avoid being matched in rooms where junior players are present[15]. Despite all these precautions, children can still use non-junior accounts without being detected. Children are also easy targets of harassment, and it is common to make fun of them by calling them names like "squeakers."

The mentioned harassments here is not an exhaustive list. With more technical improvement and popularity of social VR, new problems appear. Different games foster different cultures due to their design or audience, and as a result the intensity and frequency of these behaviors are different for each. Oculus's internal research team's study shows that the potential for abuse is especially high in social VR applications, which focus on general social interaction between users rather than on a shared game or experience[16].

2.4. Regulations and Social Control Tools

When it comes to games, each developer is the legislator and executor of its community and thereby responsible. They also hold the most powerful tools to control and lead their users toward better behaviors. The game industry is paying more attention to this issue to lessen any destructive effect on the victims and pave the way for a place for everyone to practice healthier conversations.

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[15] "RecRoom Junior Accounts," Rec Room, accessed December 25, 2020, https://recroom.happyfox.com/kb/article/19-junior-accounts/.
[16] Blackwell et al., "Harassment in Social Virtual Reality."

The terms of use of a social VR are usually the first encounter of players with community management solutions. But it's usually ignored by most players due to its length that acts like an obstacle between the user and the experience and its passive characteristic. The emergent world of VR requires more care. More tools and options had been provided to change the outcome of a player's unpleasant encounter. One of the best known and common features in all games is the option to contact the game's support to report an misfortune event or a user. Facebook is planning to go further with its Horizon platforms by recording some footage before the report to investigate the report[17]. Oculus launched a new security feature which lets users send video reports to their Safety Center when others have broken the company's code of conduct. Some games offer support inside the virtual world which means the users can contact a virtual community manager avatar to report their case. This could result in the banning of the user or restricting their access for a period of time.

Other social control tools allow players to take action as something unpleasant is happening like muting users, kicking or vote kick users out of a room (see *Figure 1*), personal space bubble (a close barrier around avatar to prevent others from entering your personal space or becoming invisible when entering), and personal safe zone (which isolates you from the happening around you and hide and mute all other avatars present in the room). Each of these features work differently on each platform and there is no standardized interaction for them on VR yet which makes users learn them on each platform. Since using these tools interrupts the immersive behaviors, developers are trying to implement them as intuitively as possible. For instance RecRoom allows players to mute or block a user by holding their hand palm in front of them, instead of using a graphical user interface to access the mute or block menu.

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[17] Oculus, *Horizon Safety Video*, 2020, https://www.youtube.com/watch?v=XpfEw65X7F0.

Figure 1. Safety Options Available on VRChat Social Quick Menu

Developers are still exploring in this realm and they have already implemented other features to make it easier for users to use social control tools in VR. For example, to make it easier for players to realize who is talking in a room, in addition to showing a talking mouth animation they make it clear by showing graphical lines that appear when someone is speaking. This is still far from perfect since some users still report that they find it hard to find the toxic person in a room with so many people present.

Another noble tool is VRChat's trust system. According to VRChat online guide, the trust and safety system is a ranking system to determine players trust level, based on many variables factors like playtime, contribution to content creation, friends count, and other factors (see *Figure 2*). This ranking is not applied to players who are considered friends since it is likely that these players implicitly trust each other. Developers have not shared more details on the trust system's logic to make it harder to exploit. They only mentioned that they could adjust the way this value is calculated to enhance it over time. It is designed to shield users from annoying situations like loud sounds, visually noisy or malicious effects, and

other methods that someone may use to ruin others' experiences. Different settings of this feature allow players to decide what features from other players' avatars are displayed to them, based on their trust rank. VRChat team claims that their goal is to control the user to determine what they want to receive from other users. Players have the option to override this setting per user as well. At the time of writing of this paper, this feature was in beta and may have changed. Ranks are displayed on users' nameplates but are only visible when a user opens her quick menu. If any user with ranks from "Known User" and upward wants to hide their higher rank, they have the option to toggle off the display of their rank on their nameplate. Another rank, called "Nuisance" is dedicated to users that have caused problems for others. They have an indicator to show their status to other users. Their avatars' features are also completely blocked[18].
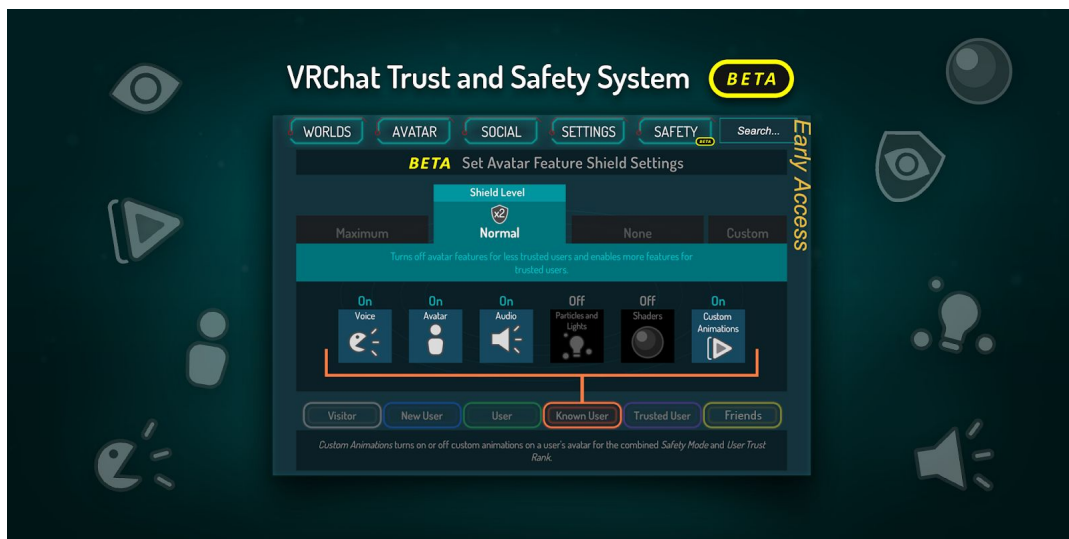
Figure 2. VRChat Trust and Safety System (source: VRChat online documents)

3. Method

The research was conducted entirely online, using a survey made in Google Forms. After multiple revisions, it had 24 questions in 6 sections, with each section focusing on a different aspect of the subject and one section dedicated and

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[18] "VRChat Safety and Trust System," VRChat, accessed December 25, 2020, https://docs.vrchat.com/docs/vrchat-safety-and-trust-system.

only shown to the participants who have ever contacted the game support. Some questions were mandatory and some optional. Most demographic questions and the most relevant questions to the topic of the paper were all mandatory. The research started on the 9th of December 2020, and the first answers have been collected on the same day. The last analyzed answer was submitted on the 20th of the same month. The data was gathered, filtered carefully by the author, and then visualized and analyzed using Google Sheets.

The survey starts with a short description that explains the study without any direct mentioning of the research's primary focus, which is the toxic aspect of these applications. The text also had an additional short explanation of social VR's meaning for this survey (Social VRs are massively multiplayer online virtual reality social platforms where you can meet and communicate with real people. Thanks to VR immersive interface, the sense of presence is enhanced in these environments. VRChat and RecRoom are two of the most famous social VR games). In the end, we clarified that we are not representing any game or company, and we will use the collected data only for educational reasons. We did not ask for any confidential information without the participants' consent.

The survey consisted of quantitative and qualitative data, starting with demographic questions, and continued with general questions about the participants' experience with VR and the next section was more questions on social VR. There have been no questions or mentioning of harassment up to this point of the survey. The next section is about toxic behavior and the knowledge and usage of social control tools. At the end of this part, participants could answer whether they have ever contacted the games' support; If they did, they saw two more questions about this topic in the next section. The final page was dedicated to asking more in-depth and less guided input from the participants with this open question: Is there anything else you would like to share with me regarding this surveys' subject?

3.1. Recruitment

Participants were recruited via popular online social VR Reddit forums (Reddit RecRoom, Reddit VirtualReality, Reddit PSVR, and Reddit VRChat). The author also shared the survey link on her personal Twitter account. Furthermore, she joined RecRoom and VRChat official Discord community servers and asked for participation. The content of the shared text on all of these platforms was very much similar and consisted of a short personal introduction (I am a game development student writing my bachelor thesis on social VR) and asking for participation from the audiences who have played social VR before (if you have played VRChat or any other social VR games, please answer my survey or/and share it with someone who plays this kind of game).

3.2. Participants

The survey got 106 responses. After removing duplicated or incomplete answers, spams, and answers from participants with no prior experience with social VR, it ended up with 96 responses. Participants aged from 12 to 49 (average: 20.8, median: 19, standard deviation: 7.32). Most participants identified their age as 15 years old (n: 14). One participant was under 13 (1%); 45.8% of the participants were teens 13 to 18 years old (n:44). 30.2% of the participants were 19 to 24 years old (n:29). 16.6% of the participants were 25 to 34 years old (n:16). 4.1% of the participants were 35 to 44 (n:4), and two were 45 or older (2%) (see Table 1). Among all the participants, 78 were male, 16 were female, and two were nonbinary.
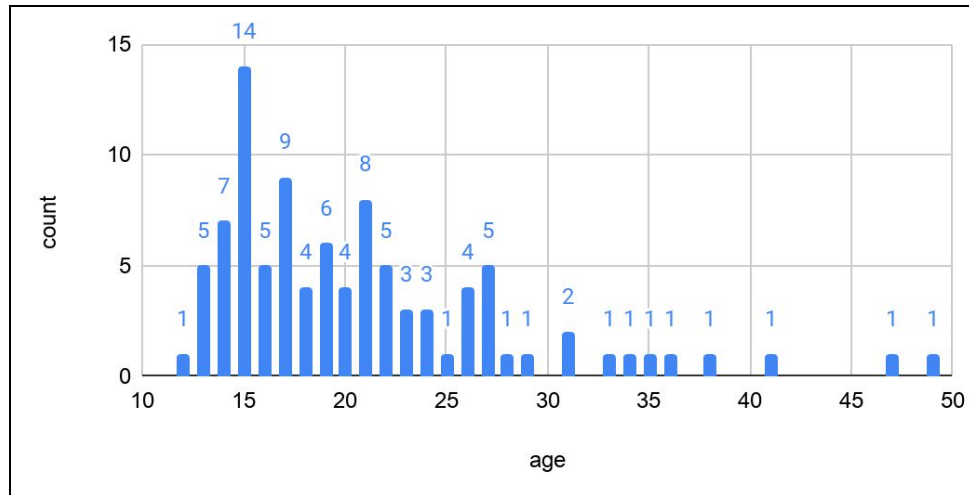
Table 1. Survey participants age chart

Participants were from various countries. Thirty participants were from the United States; 39 were from different European countries, among which ten were from the United Kingdom; 11 participants were from Canada; 7 participants from Australia and New Zealand, 6 were from different Asian countries, and three were from other countries. In answer to the racial and ethnicity question, most participants identified themselves as white (n: 73); 6 as Latin American, eight as Southeast Asian, 4 West Asian, and the rest were from other ethnicities. Besides the younger participants that were students (n:44), the others held various occupations: 9 participants worked in Information Technology, 8 participants were working in retail, 5 participants worked in Art and Entertainment, and others worked in other sectors, including Engineering, Finance, Education, Military, and Management. There were two more questions in this section about the participants' religion and whether they are a person with a disability. Since finding any correlation with other data and the religion question was complicated, it has been removed from the analysis. The disability question was missing a follow-up question about the type of disability and was removed due to the survey mistake.

The survey then asked the participants about their frequency of using VR headsets. Twenty-eight participants (29.1%) answered that they play VR games every day, 43 (44.79%) said that they play many times a week, 18 (18.75%) participants play

once or twice a week, 6 (6.25%) said they play once or twice a month, and 1 (1.04%) participant plays once or twice a year.

Participants indicated that they use VR for various purposes. As expected, almost all participants said that they use VR for gaming (n: 90) and socializing (n: 73), among other things. Creating content (n: 26), virtual travel and exploring (n: 28), participating in virtual events (n: 26), and physical exercise (n:19) were also popular among the participants. For this question with multiple possible answers, 10 participants chose only one activity, and that one activity was playing games for all of them (see Table 2).
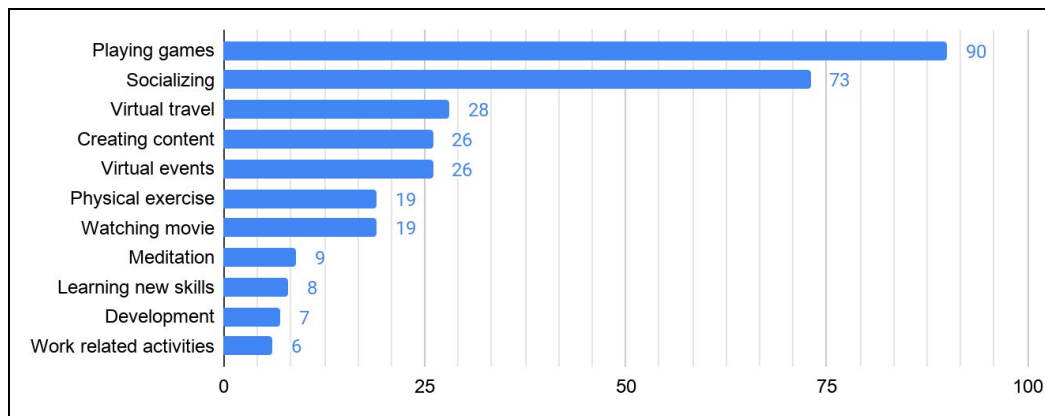
Table 2. Typical activities of participants in VR

VRChat was the most popular social VR platform among the participants, with 85 of them playing the game. RecRoom was the next favorite game with 64 participants. There was an expected result, considering that the researcher shared the survey on these two games' channels. Participants had also used other applications like Bigscreen (n: 36), AltspaceVR (n: 14), PokerStars VR (n: 14), Facebook Horizon (n: 4), and other social VR platforms, including Sansar and ChilloutVR. The research topic required to remove participants who have answered this question with none from the research.

The last question in this section was about the hardware. Thirty participants reported that they own more than one headset; five reported that they have no

headsets. Participants own various headsets, with Oculus Quest being the most popular (n: 30), followed by Oculus Quest 2 (n: 30). Oculus Rift (n: 18), Valve Index (n: 17), Sony PSVR (n:17), HTC Vive (n: 13), Oculus Rift S (n: 12) were also popular. Lenovo Explorer (n: 4) and Oculus Go (n: 3) were other named headsets.

Other survey questions revolve around the participants' social VR experiences and their thoughts and encounters with toxic behavior in these platforms.

4. Results

Most participants rated their social VR experience as being very positive (mean: 4.26) on a scale from 1 (very poor) to 5 (excellent). This question came before any question about harassment; nevertheless, One participant who rated his experience as very poor mentioned that he played VRChat back in 2014 and stopped playing after two years because of screamings and swearings. He was also aware of all the mentioned social control tools and had already used plenty of them. The other participants who gave ratings lower than 4 (n: 8) to this question did not point to toxic behavior in any of their explanatory answers.

The next question asked participants about their favorite activities in social VR. The most commonly mentioned activity was socializing with friends or meeting new people. Playing games with other players is also popular, especially with RecRoom players. Creating content, alone or with other players, and exploring other user-generated content (UGC) was also common. Some interesting answers were about role-playing and acting while using different avatars. One participant mentioned that he enjoys erotic role-playing (ERP) in VRChat. A 13 years old participant mentioned that he enjoys helping new players understand what VR is.

To get more insight into the most frustrating thing players experience in social VR, the next question asks participants to describe what they would change in VR if they could change only one thing. Among 70 usable responses to this question, the

most common theme was toxic behavior (n:20) and requests for fewer children using the platform (n: 16).

Even though this question came before the section on harassment, many answers and behaviors pointed out in this question were about toxic players and abusive actions. One of the participants raised concerns about a distinct issue regarding the players' avatars. He complained about how hackers can lock other people's ability to change their avatar. Some players try to mess with the games and system that could end up being annoying to others. There were a few complaints about the RecRoom reporting system and asking for better moderation. A 15 years old participant claims that he has encountered a few pedophiles in his three years of VR experience. One participant was worried about how the VRChat trust system creates elitism in some people or groups against newer players. There was also a request for a private message system from a VRChat user.

In children using social VR, some participants mentioned that they are annoyed by these users' activities. Many survey participants conveyed their concern about juniors being exposed to contents that are not appropriate for their age. Some were annoyed by the children's behavior.

Other participants pointed out various issues and suggestions: inadequate or delayed audio, support for hand tracking, voices are audible only from a short-range, better immersion and natural user interface, more incentive on user-generated content and ease of access to make or use them, a private message system, text-to-speech feature for the user that can not use a microphone, better movement options, more haptic feedback when interacting with players and objects, more comfortable and more customization of avatars and icons, tools for classifying and adding notes to the users met, making it easier to meet and communicate with new people, widen the player base, more and better games, more realistic experience, and monetization options for content creators.

To better understand each type of toxicity's frequency, in the next question, participants were asked to report which disapproved items they have witnessed in a VR setting. Most participants reported that they had encountered one or many of

the mentioned items. Only 3 participants reported that they had not seen any of the items, even though all three appear to be playing VR games so often. One of these participants claims that he has used muting and kicking features, indicating that he has been exposed to some of these behaviors.

Excessive swearing, children using content that are intended for adults, making a sexual gesture, passing through others' avatar, touching someone sexually, hate speech, entering others personal space, and inappropriate terms in usernames were the most commonly reported cases that more than half of the participants had experienced. The other incidents were also not very rare; Cyber-bullying, display of offensive content, stalking, threats to hack, blocking others movement, violent Content, Privacy violations were all experienced by at least 27% of the participants (see Table 3).

Another analysis of this data shows the gap between participants of different genders (see Table 4). This difference is more intense with stalking (difference: 222%), entering others personal space (difference: 205%), hate speech (difference: 203%), display of offensive content and (difference :200%), privacy violations (difference: 196%), and violent Content (difference: 193%).
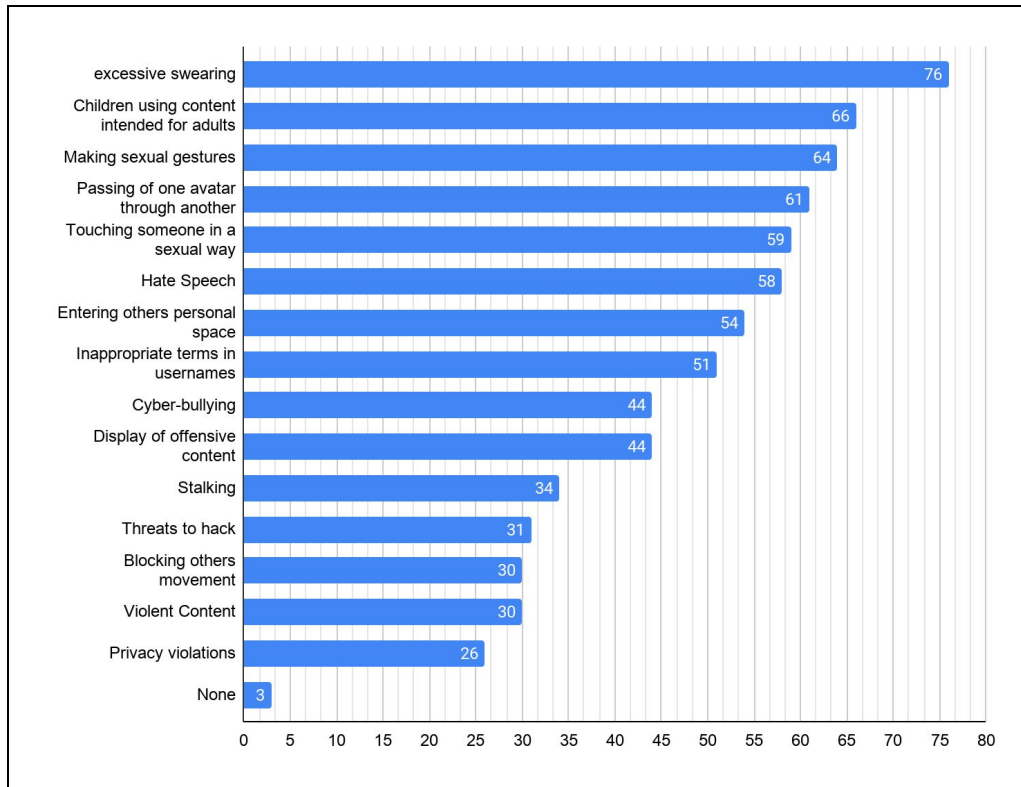
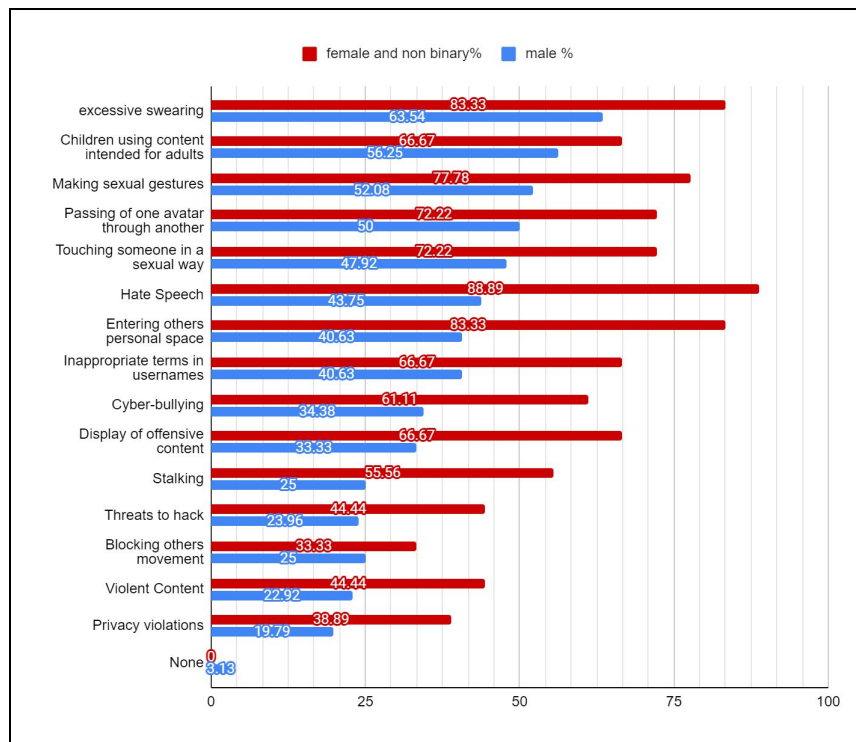*Table 3*. Results of experienced or witnessed behaviors in social VR

Table 4. Percentage of experienced or witnessed behaviors based on gender

One of the most important questions for this study comes next. In this question, participants rated behaviors mentioned in the previous question based on how inappropriate they find them in a virtual world on a scale from not at all, light, moderate, severe, and extreme (see Table 5). Options were not categorized, and they were displayed in the same order to all participants. For a better assessment, we will analyze the results in three different categories based on the Oculus research group study in three categories: verbal harassment, physical harassment, and environmental harassment[19].
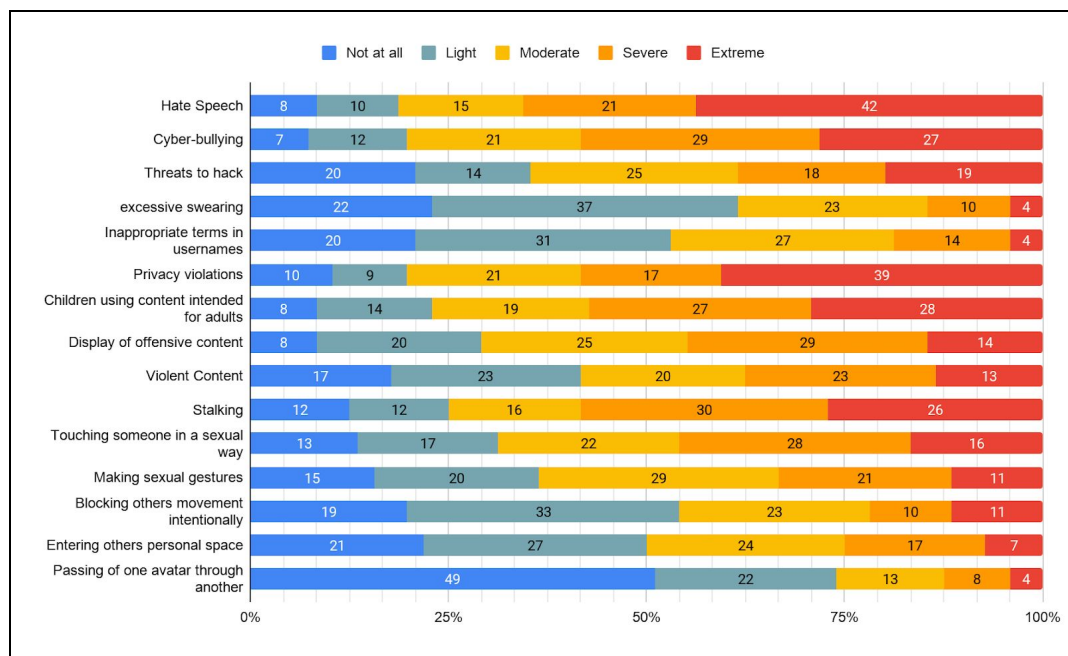
Table 5. How inappropriate participants find each item in Social VR. results for all participants

The results were surprising to some extent. In total, physical harassment got the least ratings in comparison to the other two forms of harassment. Passing of one avatar through another was considered the least inappropriate behavior among all. The other similar physical intruding action, which was entering other personal space, was rated less tolerable but mostly mild. Stalking was rated as the most

[19] Lindsay Blackwell et al., "Harassment in Social Virtual Reality: Challenges for Platform Governance," *Proceedings of the ACM on Human-Computer Interaction* 3, no. CSCW (November 7, 2019): 100:1-100:25, https://doi.org/10.1145/3359202.

severe action among physical harassments. The difference in rating between nonbinary and female participants and male participants was apparent in case of sexual, physical harassments (see table 6 and table 7). Female participants rated harassments like touching someone in a sexual way and making sexual gestures as intolerable and found entering another person's personal space more inappropriate than male participants. One participant mentioned in later questions that she often gets asked questions such as "Can I get your Discord [tag]?", "Are you using a voice changer?", "Nah, you're a 13-year-old boy", "Stop moaning" (When she was yawning while talking to friends in a lobby). She also mentioned that a player told her that he satisfy himself while listening to her voice, or in another case, one of the players took a picture of her avatar and colored over it to make her eyes cry black goop while streaming it on Twitch, or some players threaten her that they would hurt themselves if she did not give them attention. The author believes that the synchronous nature of social VR reinforces occurrences of situations like this.

Verbal harassments like excessive swearing and inappropriate terms in usernames got the least ratings and were considered tolerable, except for hate speech, which is the item that is considered to be the most extreme among all (n: 42), and cyberbullying. The rating pattern was very much similar between female and male participants in case of verbal harassment.

The environmental harassments, like displaying offensive or violent content, were also common concerns among the participants. Other violations like privacy violation and children using the content that was not intended for them were both among the actions that rated most inappropriate. No difference was visible for these items among female and male participants.
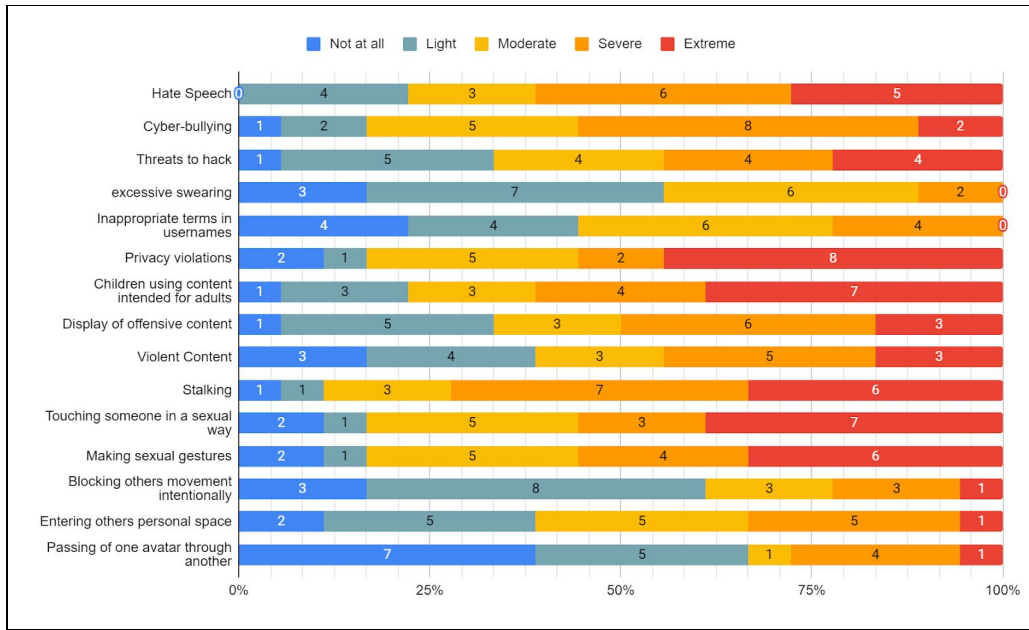
	Not at all	Light	Moderate	Severe	Extreme
Hate Speech	0	4	3	6	5
Cyber-bullying	1	2	5	8	2
Threats to hack	1	5	4	4	4
excessive swearing	3	7	6	2	0
Inappropriate terms in usernames	4	4	6	4	0
Privacy violations	2	1	5	2	8
Children using content intended for adults	1	3	3	4	7
Display of offensive content	1	5	3	6	3
Violent Content	3	4	3	5	3
Stalking	1	1	3	7	6
Touching someone in a sexual way	2	1	5	3	7
Making sexual gestures	2	1	5	4	6
Blocking others movement intentionally	3	8	3	3	1
Entering others personal space	2	5	5	5	1
Passing of one avatar through another	7	5	1	4	1

Table 6. How inappropriate participants find each item in Social VR. results for female and nonbinary participants

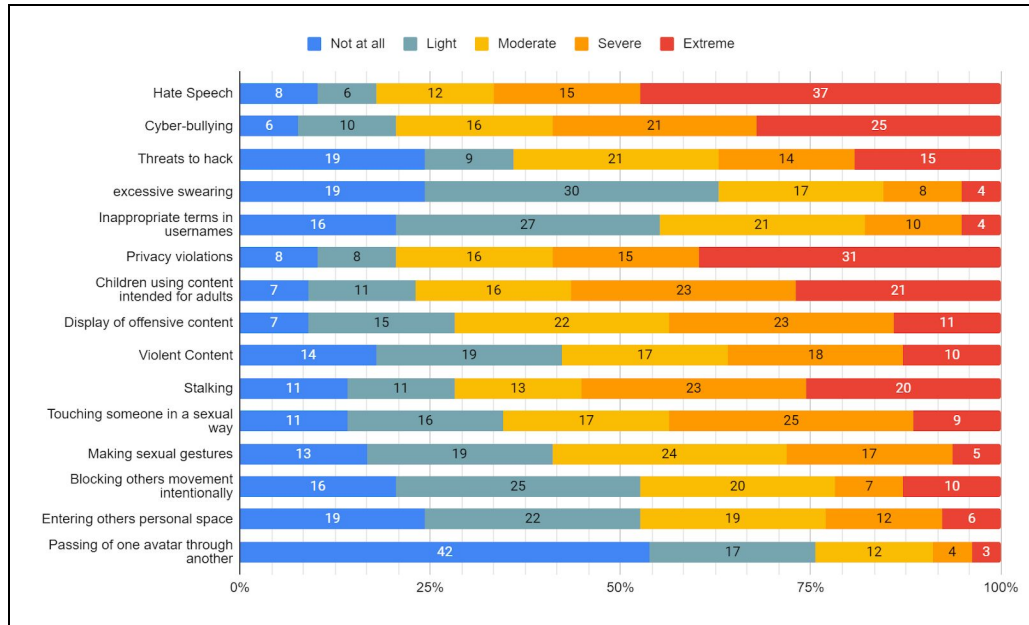|	Not at all	Light	Moderate	Severe	Extreme
Hate Speech	8	6	12	15	37
Cyber-bullying	6	10	16	21	25
Threats to hack	19	9	21	14	15
excessive swearing	19	30	17	8	4
Inappropriate terms in usernames	16	27	21	10	4
Privacy violations	8	8	16	15	31
Children using content intended for adults	7	11	16	23	21
Display of offensive content	7	15	22	23	11
Violent Content	14	19	17	18	10
Stalking	11	11	13	23	20
Touching someone in a sexual way	11	16	17	25	9
Making sexual gestures	13	19	24	17	5
Blocking others movement intentionally	16	25	20	7	10
Entering others personal space	19	22	19	12	6
Passing of one avatar through another	42	17	12	4	3

Table 7. How inappropriate participants find each item in Social VR. results for male participants

Most of these violations and antisocial behaviors are known to social VR community managers, and developers have already provided various tools to enable players to take proper actions whenever necessary. Some of these tools are

exclusive to VR, but most are commonplace in other games or social media. Based on the survey, two of these tools, muting, and reporting, were very well known and used by the participants. (see Table 8). This is not a surprise, considering the frequency of verbal harassment that happens in social spaces. Two of the least recognized tools were about the personal safe zone and voting to suspend a user. This may be due to the wording of the survey and lack of common phrases for these new tools compared to more conventional tools or an actual result of less awareness of the users about them. These options were also less used in comparison to other tools.
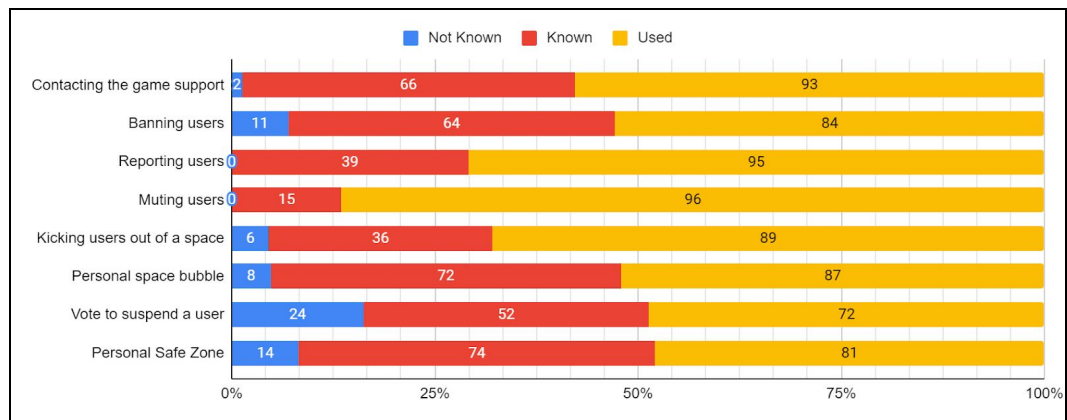

Table 8. Results of knowledge and usage of social control tools in Social VR

This finding confirms that most players are aware of the available tools to protect themselves from imaginable harassment or any unsettling situations. A follow-up question on how severe the participants use each tool could help get more insight into each item's importance. However, overall, participants were satisfied with the VR developers' performance regarding preventing or controlling toxic behaviors and an average rating of 3.15 out of 5.

Most of the unhappy participants were not very satisfied with the support team's performance because after contacting them to report a case, they never got any update or enough feedback on their report. They were not satisfied that they could

never know if their reports had ever made any difference. One participant claimed that the support team does not have a steady response time. They may act swiftly in some cases or never take any action in other cases. Participants also mentioned that they contacted support for some false bans happening to their account but never answered. Participants that were satisfied with the performance of the support found the team friendly and quick to answer. One participant added that they mostly suggest players use available tools like the block button instead of contacting the support.

5. Conclusion And Discussion

This study has limitations. First, though we tried to gather participants from various channels, the sample group could be biased. Second, the games that were the main focus of this study were limited. Each had different features, moderation systems, and players' culture; Thus, the group may not represent the whole social VR audience. Another limitation of the study was that the gender ratio was unbalanced and did not express all populations. The wording of the questions was simple to an extent, but since many young participants answered it without any supervision, they may have had problems understanding some questions.

Furthermore, our study did not distinguish between private and public virtual venues or between received and witnessed toxicity. There were not enough descriptive questions in the survey to make some answers more apparent. Simultaneously, the details of some harassment are essential, taking into account the great possibilities in these immersive games.

This study found out that most players encounter violations of terms and various forms of harassment in their social VR experience. Furthermore, confirming previous findings on other media and games[20] [21], , we found out that female

[20] Maeve Duggan, Aaron Smith, and Tom Caiazza, "Online Harassment 2017," July 11, 2017, https://www.pewresearch.org/internet/2017/07/11/online-harassment-2017/.

[21] Wai Yen Tang and Jesse Fox, "Men's Harassment Behavior in Online Video Games: Personality Traits and Game Factors," *Aggressive Behavior* 42 (February 16, 2016), https://doi.org/10.1002/ab.21646.

players are targeted more for harassment in this environment. Regarding our RQ1, participants' input presented us with new forms of antisocial behaviors that are feasible in this context that may not be achievable in other environments or are received more intensely due to the immersive characteristic of VR. We also saw that theoretically, most players are aware of some of the fundamental social control tools (RQ3) that are available to them and have used them. To enrich this theory, future research may measure how frequently each tool is being used and how often they are used while the player is in the middle of a hostile situation.

Based on the results, our study also found that participants found physical harassment less irritating than some verbal harassments, especially hate speech or violations like privacy violation and age limit neglection. This result may be due to other factors like differences in participants' experiences or the limitations of the studied sample group; as we saw, there were visible distinctions between female and nonbinary participants' answers and the males'.

Answering the second research question about the impact of these antisocial behaviors requires more intel. However, we realized that many players decide to leave a lobby or a game session whenever they encounter any abusive behavior from the participants' input. In the end, as some participants also mentioned, many of these behaviors and how they are received are very subjective, and players could receive them differently based on the mood and people in a lobby. It is aligned with the other research findings[22] that social norms can alter based on the groups' scope and intimacy. As one of the participants pointed out, VRChat has its subcultures, and each subculture or group has its own implicit rules and social norms that may not be acceptable to others. It usually gets more complicated in public hubs since people from different cultures and backgrounds play social VR, and they may find fundamentally different situations more offensive than others. This topic requires more study on its own.

Finally, we believe that we need more input on this matter from the developers' side. Further research can focus on how social control tools helped developers

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[22] Blackwell et al., "Harassment in Social Virtual Reality."

meet their expectations from the players' behaviors and their lessons from managing a VR community. We hope this study inspires more developers to research unhealthy behaviors in social VR to improve everyone's experience.

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Statement of Originality

This is to certify that the content of this paper, documentation, and thesis is my own work. It has not been submitted for any other degree or other purposes. I certify that the intellectual content of my submission is the product of my own work and that all the assistance received in preparing it as well as all sources used have been properly acknowledged.

Yasaman Farazan

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