

Supporting A Safe and Healthy Immersive Environment for Teenagers

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Abstract

Immersive technologies, such as social VR, can revolutionize how people interact with each other, as they sit between the online world and the physical world, blurring the boundary between a virtual world and a real world. However, the dynamics of potential online child sexual exploitation and abuse (CSEA), the norms of a safe immersive environment, and how teenagers navigate themselves through these situations are still understudied. We aim to investigate teenagers' experiences and offenders' digital pathways that lead to online CSEA through immersive technologies (e.g., Virtual Reality) to inform the design of future immersive technologies. This research goal is to enrich the understanding of CSEA in the evolving immersive technologies context and to provide insights and guidance for creating safe and healthy immersive environments for teenagers.

Research Background

Online child sexual exploitation and abuse (CSEA), also known as "Cyber Molestation", is a unique type of online abuse that may involve grooming, live streaming, producing and consuming child sexual abuse material, and coercing and blacking mailing children for sexual purposes [1]. CSEA not only scarves those children who have experienced the abuse physically and mentally but also haunts their family members with a significant feeling of risk and insecurity [2]. Additionally, children's inability to identify risks and the potential re-victimization and its long-term effect can significantly level up the impact [3, 4]. However, existing research on CSEA, although abundant, rarely accounts for the recent technological (e.g., immersive technologies) and societal environments (e.g., children's longer online exposure due to the needs of remote learning and social interaction). The focus of this research is CSEA in immersive technologies, i.e., technologies that blur the lines between the physical and virtual worlds, create a sense of immersion, and enhance the realism of virtual experiences [5, 6].

Compared to other traditional online platforms (e.g., gaming, social media), the blurred boundary between reality and fantasy in an immersive environment through VR devices create many difficulties for children to properly navigate through the virtual world (e.g., making them more vulnerable to harassment [7]). The

blocked-off personal experiences (i.e., only the users who wear the VR headset can see the content) also forbid their parents from understanding their children's experiences in VR (e.g., who they are interacting with, what they are doing, etc.). These risks, unfortunately, are being exacerbated by the trend where the usage of VR and other immersive technologies among children is rapidly rising and more accessible (e.g., through VR headsets and desktop computers). For example, Roblox, one of the most popular VR gaming and social platforms, claims that two-thirds of all U.S. kids between 9 and 12 years old use Roblox, and it is also played by a third of all Americans under the age of 16 [8]. In the meantime, however, the safety measures in these environments have not been standardized. While a few VR platforms are taking measures to ensure a safe environment for children (e.g., Roblox filters inappropriate languages and behaviors [9]), many do not have such policies in place (e.g., Oculus only restricts children under 13 from having an account [10]). The norms, the guardrails, and the authorities are unclear and may still be in development with this new environment.

In this research, we focus on one specific type of immersive environment, i.e., social VR (e.g., AltSpace, VRChat, RecRoom, Roblox, etc.). Social VR refers to any commercial 3D virtual environment where multiple users can interact with one another through VR head-mounted displays [11, 12]. Since social VR includes significantly more interactions in various formats, making CSEA more likely to happen. Yet, the unique user experiences in social VR (e.g., full-body movement through a 360-degree virtual space in real-time [13]; spatial and temporal interaction; verbal and non-verbal communications [14], etc.) make it more attractive to teenagers compared to traditional social platforms. Thus, teenagers may face higher risks of CSEA in social VR. Our research aims to 1) enrich the understanding of CSEA in evolving social VR contexts, 2) identify norms in social VR, and 3) provide guidance for combating CSEA and designing safe and healthy social VR for children.

Technology-Assisted CSEA and Existing Effort to Combat CSEA.

Child Sexual Exploitation and Abuse, or CSEA, has been consistently shown to have a profound impact on children's mental and physical (e.g., anxiety, distress) health as well as the

development of their sexuality and social functioning both in the short term and long term [15]. With the development of modern technologies, technology usage in CSEA has been related to many prevalent cases of child abuse, such as viewing or uploading indecent images of children on the Internet and other child sexual abuse materials (CSAM), some of which may not always be visual, such as text), or more broadly, child pornography [16, 17, 18], cyber-bullying [19, 20, 21], and cyber grooming [22, 23, 24]. Moreover, technologies may also make it easier to initiate, escalate and maintain abuse in various contexts [25, 26, 27], such as mobile phone [28], social media [26, 29], gaming [30, 31], etc.

To combat CSEA and support a safe environment for the next generation, numerous efforts have been made. On the technology side, many technology companies have designed and implemented various mechanisms to detect, prevent, and report CSEA [32, 33, 34, 35]. Research has also demonstrated the possibility of using other computational approaches for risk detection to support children's online safety, such as machine learning and artificial intelligence [36, 37, 38, 39, 40, 41, 42]. On the social side, educational materials and external support have been widely applied to keep teens informed of the potential risky situations and possible actions to take. Researchers also study other ways to encourage teens to take action, such as through peer pressure [43].

VR as a Social Space.

In the context of social VR, users can create their avatars in the virtual space, then interact with others using their body gestures through full-body tracking (i.e., the body movement of a user's avatar corresponds to the body movement of the user in real-time). In a typical social VR context, a user can have social interactions as they would do in their real lives, e.g., walking with others in a park, playing basketball on a basketball court, watching a movie in a movie theater. Because of the real-life experiment, social VR creates a strong sense of embodiment [44] compared to traditional social media or games where users control their characters using a mouse, a keyboard, or joysticks. Research on social VR has been focusing on design methods and approaches [45, 11, 46], interpersonal communications and interactions [47, 14, 12, 48, 49], long-distance couple's interaction experiences [50, 51, 52, 53], privacy concerns [54], etc. In particular, some research focuses on children's perceptions of social VR [53, 52]. However, they also need to deal with the harassment and bullying that came from other minors. Similarly, when adults were involved in the social VR, minors also needed to deal with the possible inappropriate content posed by the adults [52].

Research Plan.

The literature points out an important gap: as social VR is rapidly developing, the occurrence and dynamics of potential CSEA in social VR, how teenagers navigate themselves through these

situations, and the norms of a safe immersive environment remain understudied. To fill the research gap, we rely on a close collaboration between social VR researchers (i.e., CISE side) and a CSEA researcher (i.e., SBE side) and propose the following two research tasks.

As part of this research, one of the tasks is to answer the following research question: **How do teenagers navigate themselves through various CSEA scenarios in social VR?** To answer this research question, we propose a combination of qualitative and quantitative research methods including conducting a survey. It is currently unknown how prevalent CSEA is in various social VR platforms. This survey (a key research activity) aims to address this research question and lay a foundation for the follow-up in-depth interview studies. We will conduct a large-scale online survey to understand the prevalence of CSEA occurrence in various social VR platforms. The survey will contain questions from the following four perspectives, i.e., experiences of social VR, experiences of potential CSEA-related incidents, strategies to combat CSEA-related incidents, and expectations of a safe VR environment.

Both qualitative (e.g., ask respondents to explain the situations they encountered) and quantitative (e.g., ask respondents to rate their perceived intrusiveness of the situations using the Likert scale) data will be collected through the survey. All qualitative data will be analyzed using thematic analysis to identify the hidden themes. The quantitative data will be analyzed in different ways, including obtaining descriptive statistics, testing statistical differences based on some contextual factors (e.g., different VR platforms), etc.

To complement the survey study, the second key activity is to collect data from the online forums and communities that social VR users use to exchange ideas, share experiences, and seek help. We seek to collect publicly available data from relevant public communities, such as Reddit (e.g., subreddit r/virtualreality, r/oculus, r/vrfit, etc.) and Facebook groups (e.g., Soundboxing, VR Fit, HTC Vive, etc.). In particular, we will scrape the posts as well as the associated comments from these communities, then search for posts that discuss CSEA related topics, such as sexual abuse, harassment, grooming, and other inappropriate behavior.

The findings from the first two key activities will inform the design of a follow-up simulation experiment. Our choice of a simulation experiment approach is inspired by prior work where the researchers conducted a participatory observation to observe teenagers' behaviors in a real social VR environment [13]. We consider it unethical to expose teenagers to CSEA scenarios in the real world, yet observing how teenagers react to different CSEA in a social setting can provide first-hand data in understanding their behaviors. Thus, we decide to take advantage of the programmability of VR and conduct a simulation experiment to observe teenagers' reactions to CSEA in a controlled and safe social VR environment.

The proposed work attempts to investigate CSEA in social VR and aims to derive design guidelines and norms for safe and healthy

immersive technologies at large. This research will have a significant and positive societal impact by helping address an important issue related to child safety in emerging technologies. Our simulation approach and ExpVR will enable future research to continue to explore other opportunities to combat CSEA, such as in-situ anti-abuse education and nudging without exposing children to risky situations.

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