Children's Online Safety Risks and Ethical Considerations in XR Games

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ABSTRACT

Emerging extended reality (XR) technologies are reshaping how children play, learn, and socialize—yet they also present serious safety risks. Gaming, a primary form of entertainment for children, is also one of the key applications of XR. While XR platforms offer immersive and engaging gaming experiences, recent news has highlighted safety concerns such as car accidents, lower judgment for real-world situations, and exposure to disturbing content like virtual rape. This research examines how XR game design may lead to online safety risks for children. Through analysis of player forums, game developer forums, and interviews with child players, we identify harmful XR design patterns, explore how developers collaboratively generate and implement risky game ideas, and document children's firsthand experiences of online safety risks. Existing ethical frameworks often fail to address the immersive and socially dynamic nature of XR games. We advocate for a child-centered, design-aware approach to ethical considerations in XR games, urging platforms and policymakers to prioritize children's developmental needs. Our work aims to help shape safer, more inclusive XR environments through research and cross-sector collaboration.

CCS CONCEPTS

• **Human-centered computing** → Human computer interaction (HCI)→ Empirical studies in HCI

KEYWORDS

Online safety risks, Children, XR Game, Game design

POSITION STATEMENT

Emerging technologies such as extended reality (XR) are rapidly transforming how children engage with game play [9], health [4], education [17], and social interaction [1]. XR refers to all real-and-virtual combined environments and human-machine interactions generated by computer technology and wearables (e.g. Virtual Reality, Augmented Reality, and Mixed Reality). These technologies bring joy and expand the boundaries of learning and development.

One prominent application of XR is in gaming. XR platforms now host millions of games that children can explore for entertainment. From mobile AR games like Pokémon Go, which was downloaded over 500 million times in its first year [20], to fully immersive VR systems such as PlayStation VR and Move controllers [21], the landscape of extended reality XR games has expanded rapidly. Major tech companies like Logitech have also joined the ecosystem, offering XR-enhancing tools such as racing wheels and driving force shifts [22]. Game platforms like Rec Room [23] and Roblox [24] are increasingly adapting their ecosystems to XR, opening new forms of social and gameplay experiences.

However, alongside these innovations, XR technologies raise serious ethical concerns for children's well-being. Popular XR games illustrate some of these risks. Pokémon Go, for instance, has been linked to car accidents and pedestrian injuries due to distracted gameplay [25]. Simulated driving experiences may foster a false sense of security, reducing players' ability to react in real-world scenarios that demand quick judgment [8]. More disturbingly, immersive XR environments have enabled virtual reenactments of real-world harms, including instances of virtual rape [14], Nazi roleplay [12], and reenactments of mass shootings [5].

Despite these emerging risks, research on the risks associated with XR-based play remains limited. Scholars have begun to examine the broader implications of XR on children's development, including the erosion of physical community bonds, long-term impacts on health and development, and risks to children's safety and privacy [11]. Parents, educators, and healthcare professionals also express growing unease about how to manage content appropriateness, balance screen time, and monitor behavioral changes resulting from extended XR use [10]. While existing work has examined general concerns with XR technologies—including some within gaming contexts [6, 10, 11]—few studies have systematically explored the specific risks that children face within XR gameplay. As games continue to be a dominant and naturally appealing form of entertainment for children, this oversight represents a critical research gap.

As XR technologies become increasingly embedded in children's everyday play, there is a growing need to examine not

just how these immersive platforms are used—but how they are designed. Design decisions shape what players can do, how they interact, and what kinds of experiences they have—including harmful ones. XR games offer powerful and engaging experiences, but when designed without adequate guardrails, they can expose children—one of the most vulnerable populations—to serious risks. Among the many XR platforms available today, Roblox stands out as both one of the most influential and widely adopted by children—and one of the most controversial.

While often perceived as a traditional online platform, Roblox [26] has rapidly expanded into the XR space. It now supports virtual reality gameplay and is part of a broader XR ecosystem where children can explore, build, and interact in fully immersive 3D environments through computers, mobile devices, or VR headsets. As of 2025, there are nearly 90 million daily active players on Roblox [27]. Approximately 39% of Roblox players are under the age of 13 [27], and 58% are under 16 [2]. Just a week after launching on Meta's Quest VR headset, Roblox was downloaded over 1 million times [15]—signaling its growing presence in the XR ecosystem. These numbers highlight the urgency of understanding how Roblox, as an emerging XR platform, shapes child players' experiences through its game design. Unlike conventional games built by professional studios, most Roblox games are developed by individual game developers. Millions of game developers develop countless XR games on Roblox. This decentralized model has led to an explosion of creativity, but also makes it extremely difficult for Roblox's moderation team to effectively address the hundreds of child safety issues that arise daily across millions of games [3, 16].

In response to the growing safety concerns on Roblox, particularly within its XR game design, our research investigates the children's safety risks embedded in Roblox game designs. We focus on how the design of XR games can lead to harmful experiences for children. Through our ongoing work, we have identified four recurring harmful design patterns: ubiquitous microtransaction design, unconstrained social design, unmoderated expression design, and problematic world design [13].

To better understand how harmful design patterns emerge, we conducted an analysis of Roblox game developers' online forums. Our findings revealed that some developers not only share risky or questionable design ideas but also exchange strategies for implementing them [19]. This discovery raises critical ethical concerns regarding the creation of child-friendly XR games. Specifically, we are prompted to ask: How should ethics be defined in XR games intended for children? And how can game developers and game companies be encouraged—or even required—to recognize and adhere to these ethical considerations?

While scholars and child advocacy organizations have proposed various ethical frameworks to guide digital innovation for young users—such as UNICEF's Responsible Innovation in Technology for Children [28], and the Age-Appropriate Design Code [7]—these initiatives often focus on broader technology

ecosystems or web platforms. Recent scholars have also begun to address ethical concerns specific to XR applications, calling for greater attention to contextual considerations for emerging technologies [10]. However, there is currently no comprehensive ethical framework tailored specifically to XR games designed for children's play.

To further understand the primary players and contribute to the ethical framework of XR games, we examined how children engage with and experience safety risks in these XR games. Through an interview study with child players who play XR games like Roblox and RecRoom, our findings pointed to several safety risks, including exposure to scams, normalization of antisocial behavior, and interactions with adult roleplay that may not be age-appropriate [18]. These conversations offered powerful insights into the ethical considerations in creating child-friendly XR games and underscored the urgent need for platforms and policymakers to prioritize children's values and developmental needs when shaping policy and safety regulations.

I am eager to participate in this workshop because of my ongoing research on children's safety in XR—particularly in XR-based games. As immersive technologies become more deeply embedded in children's everyday play, there is an urgent need to critically examine how design decisions within XR games shape their experiences, including risks and harms. Some XR games like Roblox present especially complex ethical challenges due to their decentralized game development and lack of consistent oversight. While existing digital ethics frameworks offer important guidance, they often fall short when applied to the distinct, immersive, and socially dynamic environments of XR games for children. This workshop presents a timely opportunity to engage with interdisciplinary scholars who are equally committed to shaping the future of XR through a child-centered and design-aware lens.

I bring to the workshop a perspective grounded in empirical research, with a focus on how game design contributes to children's safety and well-being in XR environments. Our work investigates harmful design patterns in XR games; explores how community ideation among game developers on platforms like Roblox can lead to safety risks; understands child players experiences of safety risks in such games. I aim to contribute both a designer's perspective—on how game design structure player experiences—and a child-centered perspective, informed by children's own accounts of harm in immersive games. I hope to broaden the conversation on XR ethics by emphasizing the design-level safety risks embedded in interactive and immersive XR technologies.

Through this workshop, I hope to deepen my understanding of ethical considerations in XR design and explore how existing frameworks might be adapted to better reflect children's developmental needs and lived experiences. I am especially interested in identifying design principles that can guide the creation of safer, more inclusive XR environments and in building collaborations that bridge research, practice, and policy. Ultimately, I aim to help advance a collective vision for ethical

and developmentally appropriate XR design that prioritizes the safety and agency of children.

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REFERENCES

[1] Paola Araiza-Alba, Therese Keane, and Jordy Kaufman. 2022. Are we ready for virtual reality in K–12 classrooms? Technology, Pedagogy and Education 31, 4 (August 2022), 471–491. https://doi.org/10.1080/1475939X.2022.2033307

[2] Backlinko Team. 2023. Roblox User and Growth Stats You Need to Know in 2025. Backlinko. Retrieved April 6, 2025 from https://backlinko.com/roblox-users

[3] Rhiannon Bevan. 2024. Roblox Reportedly Receives "Hundreds" Of Child Safety Reports Every Day. TheGamer. Retrieved April 6, 2025 from https://www.thegamer.com/roblox-child-safety-hundreds-of-reports-a-day/

[4] Dana Blanco, Rachel M Roberts, Anne Gannoni, and Steve Cook. 2024. Assessment and treatment of mental health conditions in children and adolescents: A systematic scoping review of how virtual reality environments have been used. Clin Child Psychol Psychiatry 29, 3 (July 2024), 1070–1086. https://doi.org/10.1177/13591045231204082

[5] Russell Brandom. 2021. Roblox is struggling to moderate re-creations of mass shootings. The Verge (August 2021). Retrieved May 5, 2023 from https://www.theverge.com/2021/8/17/22628624/roblox-moderation-trust-and-safety-terrorist-content-christchurch

[6] Jiaxun Cao, Anupam Das, and Pardis Emami-Naeini. 2024. Understanding parents' perceptions and practices toward children's security and privacy in virtual reality. In 2024 IEEE Symposium on Security and Privacy (SP), 2024. IEEE, 1554–1572. Retrieved April 4, 2025 from https://ieeexplore.ieee.org/abstract/document/10646753/?casa_token=vi-A3-w4ZOEAAAAA:NurD11zV3sMeYb5UZyi5m6XZkvnoRhfYjd7aZ1CI6VQot1xOaqx_wXHq6nKJULuGHIsj83FtTg

[7] Thomas D Grace, Christie Abel, and Katie Salen. 2023. Child-Centered Design in the Digital World: Investigating the Implications of the Age-Appropriate Design Code for Interactive Digital Media. In Proceedings of the 22nd Annual ACM Interaction Design and Children Conference (IDC '23), June 19, 2023. Association for Computing Machinery, New York, NY, USA, 289–297. https://doi.org/10.1145/3585088.3589370

[8] Roman Grunis. 2018. Pros and Cons of Learning to Drive in a Simulator. Medium. Retrieved April 6, 2025 from https://medium.com/@rmgrunis/pros-and-cons-of-learning-to-drive-in-a-simulator-a73b7e90c4f5

[9] Kristan Harris and Denise Reid. 2005. The Influence of Virtual Reality Play on Children'S Motivation. Can J Occup Ther 72, 1 (February 2005), 21–29. https://doi.org/10.1177/000841740507200107

[10] Juan Pablo Hourcade, Summer Schmuecker, Delaney Norris, and Flannery Hope Currin. 2024. Understanding Adult Stakeholder Perspectives on the Ethics of Extended Reality Technologies with a Focus on Young Children and Children in Rural Areas. In Proceedings of the 23rd Annual ACM Interaction Design and Children Conference, June 17, 2024. ACM, Delft Netherlands, 455–468. https://doi.org/10.1145/3628516.3655811

[11] Qiao Jin, Saba Kawas, Stuti Arora, Ye Yuan, and Svetlana Yarosh. 2024. Is Your Family Ready for VR? Ethical Concerns and Considerations in Children's VR Usage. In Proceedings of the 23rd Annual ACM Interaction Design and Children Conference, June 17, 2024. ACM, Delft Netherlands, 436–454. https://doi.org/10.1145/3628516.3655804

[12] Sean Keach. 2018. Roblox kids' game is a haven for twisted Jihadi, Nazi and KKK racist roleplay. The Sun (July 2018). Retrieved May 5, 2023 from https://www.thesun.co.uk/tech/6710158/roblox-game-racist-jihad-nazi-kkk-racism-twin-towers-children/

[13] Yubo Kou and Xinning Gui. 2023. Harmful Design in the Metaverse and How to Mitigate it: A Case Study of User-Generated Virtual Worlds on Roblox. In Proceedings of the 2023 ACM Designing Interactive Systems Conference (DIS '23), July 10, 2023. Association for Computing Machinery, New York, NY, USA, 175–188.

[14] Marilisaraccoglobal. Mom horrified to see her 7-year-old's Roblox character 'gang-raped' in popular online game - National | Globalnews.ca. Global News. Retrieved March 16, 2023 from https://globalnews.ca/news/4316449/roblox-gang-rape-7-year-old-girl/

[15] Jay Peters. 2023. Roblox on Quest VR headsets has gotten "well over" 1 million downloads. The Verge. Retrieved April 6, 2025 from https://www.theverge.com/2023/8/2/23817317/roblox-quest-vr-headsets-ceo-1-million-downloads

[16] Anastasiya Publishing. 2020. Roblox Moderation Flaws. Medium. Retrieved April 6, 2025 from https://medium.com/@AnastasiyaPublishing/roblox-moderation-flaws-d8acbd38863c

[17] Maria Roussou, Martin Oliver, and Mel Slater. 2006. The virtual playground: an educational virtual reality environment for evaluating interactivity and conceptual learning. Virtual Reality 10, 3–4 (November 2006), 227–240. https://doi.org/10.1007/s10055-006-0035-5

[18] Zinan Zhang, Xinning Gui, Junnan Yu, Sunhye Bai, and Yubo Kou. Dangerous Playgrounds: Child Players' Encounters with Design-Mediated Risks on User Generated Game Platforms and Their Safety Practices. In Proceedings of the 25th ACM Conference on Interaction Design and Children, .

[19] Zinan Zhang, Sam Moradzadeh, Xinning Gui, and Yubo Kou. 2024. Harmful Design in User-Generated Games and its Ethical and Governance Challenges: An Investigation of Design Co-Ideation of Game Creators on Roblox. Proc. ACM Hum.-Comput. Interact. 8, CHI PLAY (October 2024), 1–31. https://doi.org/10.1145/3677076

[20] Pokémon GO. Pokémon GO. Retrieved April 6, 2025 from https://pokemongolive.com/

[21] PlayStation Move motion controller. PlayStation. Retrieved April 4, 2025 from https://www.playstation.com/en-us/accessories/playstation-move-motion-controller/

[22] Sim Racing & Gaming Wheel Gear | Logitech G Canada. Retrieved April 6, 2025 from https://www.logitechg.com/en-us/products/driving.html

[23] Creative Directory. Rec Room. Retrieved September 9, 2024 from https://recroom.com/creative

[24] Setting up VR for Roblox. Roblox Support. Retrieved April 4, 2025 from https://en.help.roblox.com/hc/en-us/articles/208260046-Setting-up-VR-for-Roblox

[25] Did Pokémon Go really kill 250 people in traffic accidents? | New Scientist. Retrieved April 6, 2025 from https://www.newscientist.com/article/2154881-did-pokemon-go-really-kill-250-people-in-traffic-accidents/

[26] Home - Roblox. Roblox Corporate. Retrieved April 4, 2025 from https://corp.roblox.com/

[27] Roblox Demographics Statistics 2025. Retrieved April 6, 2025 from https://www.takeaway-reality.com/post/roblox-demographics-statistics

[28] UNICEF Innocenti | Innocenti Global Office of Research and Foresight. Retrieved April 3, 2025 from https://www.unicef.org/innocenti/