CHAPTER 6

Designing for Youth Engagement and Wellbeing in Immersive Experiences

XR ASSOCIATION

XR Association Developers Guide:
An Industry-Wide Collaboration for Better XR

INTRODUCTION

XR technology[1] is rapidly becoming a part of kids' lives — whether it's in the form of AR apps like *Pokémon Go*, virtual field trips with VR headsets, immersive educational experiences at museums, VR therapies in emergency rooms for anxiety or pain management, or gaming at home using various XR platforms. Indeed, the future of XR holds the promise of even more exciting innovations for youth in education, entertainment, healthcare, and beyond.

Data abounds on how youth are already well-versed in immersive experiences. A focus group conducted by the XR Association (XRA) in 2024[2] of mostly 8th-grade students found that 95 percent had tried VR previously, and 86 percent said they would recommend VR to a friend.

As youth are participating more and more in immersive experiences,[3] it's important to consider the safety and wellbeing of younger users as XR programs are being developed.

This guide aims to provide developers with an understanding of how young people might experience XR differently from adults and offer guidance on building engaging and developmentally appropriate XR programs that respect the unique issues that may affect youth wellbeing.

I. UNDERSTANDING YOUTH WELLBEING IN AND AROUND IMMERSIVE ENVIRONMENTS

PSYCHOLOGICAL EFFECTS OF XR ON YOUTH

Academics and scientific institutions have been studying the ability of XR to influence the psychological wellbeing of both adults and youth for more than a decade.

The use of XR technology has shown tremendous promise in helping children and young adults deal with myriad psychological-based issues, such as moderating pain response in medical settings, addressing anxiety symptoms, improving the cognitive and social development of neurodiverse children, and more.

In healthcare, VR experiences have demonstrated remarkable results in reducing pain responses in children. For example, one academic literature review of several studies conducted between 2010 and 2021 concluded that "Children's exposure to VR during burn care procedures was associated with lower levels of pain and pain-related anxiety."[4] Other studies have examined VR's ability to reduce pain responses during IV insertion and other medical procedures. VR rehabilitation therapy has also shown promise in improving the development of social communication and cognitive abilities for children with autism spectrum disorder.[5]

XR experiences have been shown to have a positive impact on youth wellness in various settings. However, the inverse could also be true when care has not been taken to address potential negative psychological impacts. Because XR experiences can feel so "real" to users, software developers must consider the potential psychological impacts their designs may have when creating for a young demographic.

XR's ability to blur a user's sense of reality may be especially acute in younger users, particularly elementary school-age children who are still learning to distinguish between what is real and what is fantasy. Immersive worlds may elicit different cognitive and social responses in youth than non-immersive experiences,[6] making the need for developmentally appropriate content and experiences paramount.

In addition, XR has shown great promise in educational settings for youth. However, studies have shown that learning outcomes may

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differ in low and high cognitive load XR environments. Immersive environments, particularly in VR, may already impose a heavier cognitive load on users' working memory, given the potential for heightened sensory inputs, active interactions and explorations, and the need to manipulate controllers. Studies have shown that highly immersive educational experiences with higher "extraneous" cognitive loads — including complex motor tasks and features that detract or distract from the learning experience — may produce poorer learning outcomes.[7]

As will be discussed further in this chapter, creating developmentally appropriate content for youth and understanding how even seemingly innocuous experiences might be viewed as unsettling by some youth are important considerations.

PHYSICAL EFFECTS OF XR ON YOUTH

While the potential physical effects of XR are varied, several studies have demonstrated that XR programs can have a strong positive impact on physical health in both youth and adults.

In healthcare settings, XR experiences are being utilized as tools for physical rehabilitation and physical therapy for both youth and adults. According to the American Physical Therapy Association, "Virtual reality presents a promising avenue for enhancing physical therapy interventions, offering immersive experiences tailored to individual patient needs."[8]

Physiotherapy may be especially repetitive and boring to children; XR is a potential way to make the experience more engaging. For example, the use of XR is being studied as a way to enhance and improve the physical therapy experience for children with cerebral palsy.[9] XR is also useful for improving physical mobility because the programs can be adjusted to address an individual patient's specific physical therapy and motor skill needs.[10]

In entertainment, exergaming — a whole-body gaming experience that encourages physical activity among users — has the potential to encourage more exercise among youth and adults alike. Studies have shown that exergaming can both promote physical fitness in youth and potentially improve cognitive functions.[11]

Still, software developers should take steps in their designs to mitigate any potential negative physical effects of XR experiences on youth.

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Whether the issue is hardware or software, it's important to consider the known physical effects of XR on users, including youth. For example, some youth who use XR headgear have complained about headaches from the weight of the equipment as well as pressure on their noses and heads. Other well-known potential physical effects of in-app XR use for all ages include nausea, eye strain, double vision, neck strain, disorientation, and dizziness. For those reasons, time limits on use are often recommended by both XR hardware manufacturers and software developers alike.

Chapter 2 of XRA's Developer's Guide, "Creating Safe, Inclusive, and Respectful Environments," provides useful information on addressing in-app user comfort, and many of these suggestions are applicable to both adults and youth.

As discussed further in this chapter, software developers may want to take potential physical environments into consideration as well as encourage time limits on app use to promote physical and psychological youth safety.

DISRUPTIVE BEHAVIORS AND UNWANTED INTERACTIONS

Disruptive behavior and harassment in online environments have been around as long as the internet itself. Unfortunately, young people are no strangers to such behaviors, even as the tech industry has implemented a variety of tools to protect them from accessing or seeing inappropriate content and experiencing intimidation during online interactions.

A 2022 Pew Research Study[12] found that 46 percent of U.S. teens ages 13 to 17 reported experiencing cyberbullying behaviors at some point in their lives. In the Pew study, cyberbullying behaviors were defined as offensive name-calling, spreading of false rumors online, receiving explicit images they didn't ask for, physical threats, constantly being asked where they are, what they're doing, or who they're with by someone other than a parent, and having explicit images of them shared without their consent.

Online harassment — whether experienced by youth or adults — may also include more serious threats such as stalking, trolling, doxxing, swatting, and other similar types of unsafe behaviors associated with some online social activity.

Other unwelcome behaviors in online environments that may not be directed at a specific user but could still negatively impact youth include

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hate speech, foul and inappropriate language, inappropriate imagery, spreading misinformation, cheating in games, and posting sensitive personal information about others without consent, among other things.

XR spaces are not immune to the disruptive user behaviors found on other digital platforms. In XR spaces the user is more present and engaged; as such, there is an increased impact if users infringe on each other's perceived personal space or simulate physical acts or gestures that may be unwelcome, upsetting, or offensive.

Disruptive behaviors in XR also have the potential to spill over into group settings where youth use XR applications in a shared physical space (e.g., schools, arcades, public places, etc.). In such settings, in-person bullying and targeted bodily harm while a user's vision is limited or blocked are also a possibility. Additionally, AR apps that are used in public and provide the approximate locations and/or identifying information of other users could also create risks of in-person bullying and targeted bodily harm.

As discussed in this chapter, software developers can and should take steps to mitigate negative behaviors and cyberbullying when building XR worlds for youth.

II. PROACTIVE, SAFETY-FIRST DESIGN APPROACHES

OVERVIEW

Software developers should proactively address youth wellbeing and safety in their original designs rather than relying on plug-ins or regulatory mandates. Thoughtful, user-centric designs focused on child development standards, accessibility, data collection minimization, and privacy are recommended.

Software developers should partner with trusted youth-centered organizations, educators, and other experts to create age- and developmentally-appropriate content and experiences that align with child development best practices.

YOUTH KNOW WHAT THEY WANT [AND IT'S OFTEN PRO-SOCIAL]

Developers should keep in mind that experiences with well-defined goals, dynamic interactions (whether with environments, items, or characters), and/or creative motivations or directions, rather than superficial explore-world experiences, may be best at engaging youth in both entertainment and educational settings.

As previously noted, XRA assembled a focus group of middle schoolers in Atlanta in 2024 to gauge their feelings and desires regarding XR. The results showed that youth often want experiences that are affirming, educational, and challenging. Youth report that they want environments in XR that are collaborative and pro-social.



Source: *XRA's Limitless Future Workshop*

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Youth have indicated that they want experiences with defined objectives, a clear purpose, and/or incentives or stimuli to create and explore. Youth want to understand their role in achieving those objectives or fulfilling that purpose. Experiences that lack a clear purpose may make youth feel idle or bored and may lead to them creating their own objectives or targeting other users with negative behaviors in multi-user spaces.

Youth also support limits on their use of screens in general. The Wellbeing by Design Fellowship at the Joan Ganz Cooney Center found, through their work with youth focus groups, that teens are mindful of the need for constraints on their use of digital media. That includes recommending "built-in time limits; daily challenges instead of bingeable content; extension activities to continue playing off-screen; [and] thoughtful use of child locks and parental controls."[13]

Importantly, youth want to learn, engage socially with one another, and be challenged in a way that allows them to fail and try again.

FOSTERING POSITIVE INTERACTIONS

Developers should focus on creating experiences and apps that foster positive behaviors and interactions among younger users, as well as among any adults who may access the program.

Fostering positive behavior, rather than addressing disruptive behaviors as they arise, could go a long way toward creating an overall in-app culture that reduces the incidence of unwanted behaviors or inappropriate user-generated content (UGC).

Studies have shown that, just as youth take social cues from encounters in real life, they also are influenced by social cues in the 2D and 3D online worlds they inhabit.

One 2021 study entitled "Children's Out-of-School Learning in Digital Gaming Communities"[14] explains that children in digital settings create a social history of learning that develops as they participate and interact with one another. This social history of learning fosters a community that over time develops into a shared language, ways of doing things, and stories that children must understand and accept to effectively engage with others within the shared community. "Communities develop their *practice* over time through a variety of methods, including problem solving, requests for information, seeking the experiences of others, etc.," the study notes.

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While the study does not specifically address XR experiences, one important conclusion applicable to XR states, "The children align with a community in order to pursue joint enterprises. This appears to be a complex, ongoing process that allows children to learn how to negotiate, collaborate, resist, and align with the collective. Children favour communities in which people support and help each other."

COOPERATIVE EXPERIENCES

To foster pro-social behavior and interactions, developers should consider ways in which their XR program can encourage users to work together through teamwork and/or cooperative gameplay.[15]

In educational settings, cooperative mixed reality (MR) learning experiences can be an effective way to engage and motivate students, while also helping them develop social skills.[16] This shared physical-digital context promotes natural communication cues, such as eye contact, gestures, and spatial awareness, which are critical for developing collaboration and social-emotional learning skills. In classrooms, MR can enable students to physically co-locate around a task, solving problems together without losing the real-world context or their sense of self, which can lead to stronger peer relationships and more authentic teamwork.

Meanwhile, cooperative video games have been shown to reduce aggressive feelings and behaviors in youth. They also help increase pro-social behaviors, collaboration, empathy, feelings of trust toward other users, and more positive attitudes in general. Positive and pro-social behavior displayed during gaming interactions may also increase friendship quality afterwards.[17]

EXAMPLES OF COOPERATIVE XR GAMES

Among Us 3D: VR
Tetris Effect
Roblox
Gorilla Tag
Dimensional Double Shift
Rec Room

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CREATING PRO-SOCIAL AND COOPERATIVE INTERACTIONS

One example of creating pro-social and cooperative user interactions is the "Chapters Method," which advises developers to take a structured approach for session-based multi-user gamified experiences. According to the Digital Thriving Playbook,[18] this method includes three "chapters" or parts that align with the general phases of most session-based game experiences.



First, set the stage for pro-social behavior by establishing expectations for behavior (through tutorials, community guidelines, etc.), making it simple for users to form teams for expected cooperation, providing themes that reinforce pro-social behavior, and establishing that behaving pro-socially is an intended part of the experience.



Second, create opportunities for repeated pro-social behaviors that are integral to the experience. In an adventure game, this might include prompts to "heal" an injured comrade or an offer to aid a teammate in danger. This encourages other users to reciprocate, builds trust among users, and helps to establish the cultural norms of the shared experience.



Prompts should direct users to the desired pro-social behavior, via visual icons and/or verbal cues, to join or assist fellow users. This might be an arrow pointing to a teammate who needs assistance or a textual prompt to "help" a specific user. Importantly, it should also inform the user which button(s) to push or task to perform to complete the pro-social act.



Third, consider including automatic praise or thanks in real time for such pro-social acts and provide users with their own mechanism to acknowledge the pro-social behavior of others.



Another potentially important feature of creating pro-social behaviors is allowing clear communication between users to reduce misunderstandings and reinforce shared goals.

Source: *Digital Thriving Playbook*[19]

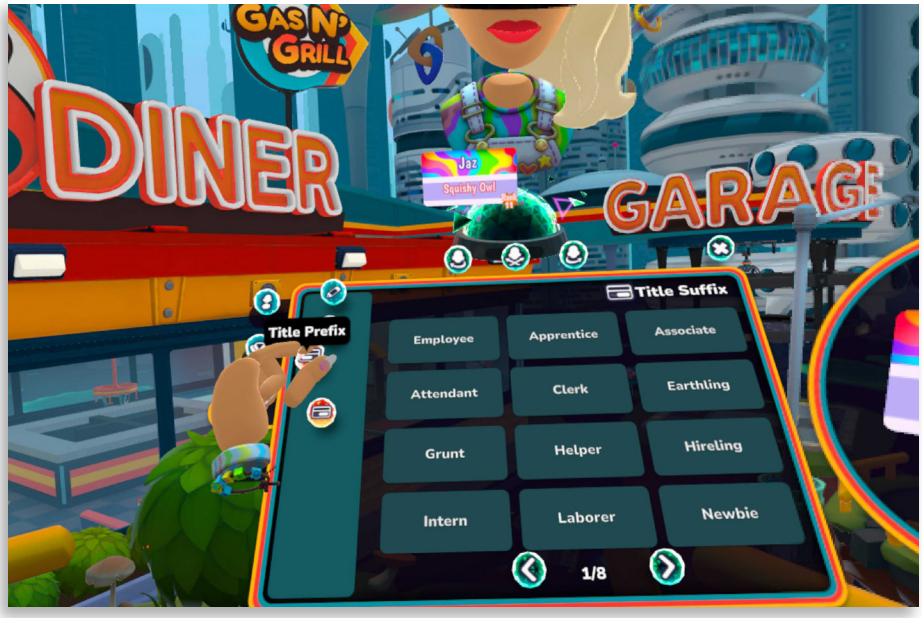
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REWARDS SYSTEMS

Developers should consider creating in-app rewards systems that actively promote and reward pro-social behaviors and adherence to community guidelines.

Pro-social behaviors may include positive feedback and comments, helpful and cooperative behaviors, and/or upvoting other users for positive behaviors or play.

Rewards might include virtual badges, collecting points that can be redeemed for exclusive extra content, privileged or exclusive access to new areas of the experience, special avatars or "skin" customization options, exclusive virtual goods, discounts or points to be spent on various in-app purchases, and/or other perks that users would find valuable or useful to their experience.



Source: Owlchemy Labs

COMMUNITY GUIDELINES

Community guidelines have long been a feature of XR, video games, social media, and other multi-user online applications, serving as a means to ensure users understand what behaviors are acceptable and which behaviors may result in them being prohibited from participating.

For younger users, XR community guidelines help set appropriate expectations for pro-social behavior. Children, perhaps more so than adults,

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are accustomed to having teachers and parents set behavioral expectations, and studies have shown that children benefit from those limits.

In general, setting behavioral expectations[20] (in this context, community guidelines) helps children understand the consequences of violations, provides them with an understanding of their role in a community, fosters a sense of order and consistency, and helps create a sense of safety and security.

There are variations in child development as well as in reading skills (even among older children who may have learning differences). Therefore, children may be better able to comprehend behavioral expectations if they are presented via video or visual displays. (Considerations for children with vision and hearing impairments can be found in this chapter's section on Accessibility and in the XRA's Developers Guide Chapter 3: Accessibility & Inclusive Design in Immersive Experiences.[21])

Community guidelines should outline expectations for the community that are broad enough to capture any and all unwanted behavior, but they should also identify specific categories of abuse that will not be tolerated; they should be clear about the consequences (bans, suspensions, etc.) for violating the guidelines.

Examples of how to set baseline expectations include statements such as *Among Us 3D: VR*'s "This is your community as much as it is ours,"[22] or *Roblox*'s statement that "We want our community to be a place where people can connect with optimism and civility, regardless of their identity or beliefs."[23]

Importantly, community guidelines should outline abusive or toxic behavior that corresponds to the type of content moderation tracking built into the app, as well as the consequences that will be meted out for violations.

It can be helpful to allow users to provide their own feedback on community guidelines, such as suggesting additional guidance or modifications to existing guidelines. Doing so can foster stronger online communities with shared goals for expected behavior and the consequences for violations.

In addition to including guidance on a player's own behavior, community guidelines should include recommendations for how players can proactively shield themselves from others who may be exhibiting unwelcome behaviors. Community guidelines should provide clear examples of pro-social behavior and unwanted behavior.

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Pointing users to in-app tools for reporting and blocking abusive or disruptive behavior is important, and instructions for reporting disruptive and harassing behavior should be clear, easy to understand, and straightforward to use.

Developers may also want to provide users with helpful tips on how to report abusive users who are displaying unwanted behaviors on external apps or forums used in conjunction with an XR experience. For example, Rec Room's Code of Conduct[24] recommends that "If you are being harassed or are receiving direct communications from other players outside of an officially supported Rec Room service or public forum, please take action using that platform's moderation tools or report procedures. This includes direct messages on Discord, Reddit, Steam, and other platforms." Rec Room also provides links on how to report users on those external apps.

Beyond merely posting community guidelines in written form, developers should create resources, such as tutorials, educational videos, and the like, to help users understand what is expected of them upon entering the immersive space. In-app tutorials may be the most effective way to impart both community guidelines and instructions for how to navigate an XR experience.

In-app tutorials may be provided through introductory instruction or throughout the experience as users encounter new obstacles or information. One 2024 study noted that "presence, ability to learn controls, intrinsic motivation, and learning effectiveness are higher for the instruction-screen and context-sensitive tutorials than for no tutorial. … This study asserts the importance of tutorials in VR games, and its findings could improve user experience in future VR games."[25] Tutorials may also contribute to overall physical comfort. The study notes, "On average, users experienced more motion sickness in the no-tutorial case, with a significant difference in nausea items" as compared with those who did or did not have tutorial help.

When devising tutorials for community guidelines and in-app instructions, developers should take care to ensure that they concisely impart the most important behavioral expectations while avoiding interfering with the enjoyment and objectives of the experience. Policies should be understandable to your community and intended audience, rather than being full of legalese.

Software developers may want to make watching and/or agreeing to community guidelines a mandatory function before a user fully enters the XR experience.

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Chapter 2 of XRA's Developer's Guide, "Creating Safe, Inclusive, and Respectful Environments," offers additional tips on how to set community guidelines. For example, the chapter advises that developers should tailor their behavior policies to their product and community. It also advises that developers "consider abuse types that may be uniquely relevant to your specific application and be sure to highlight those." Policies should not be cookie-cutter; they should align with the target community, context, and desired cultural vibe.

For example, *Beat Saber* provides a concise explanation of its content rating system. In their FAQ, they state that the Explicit Lyrics Toggle "empowers players to choose their preferred in-game experience, allowing them to opt in or opt out of songs and music containing explicit lyrics. The toggle is available on all platforms for users aged 13 and above."[26] Straightforward language such as this can help users, including youth, understand and manage content settings.

Additionally, Innersloth, the game development firm behind *AmongUs*, *Stickman*, and *Dig to China*, reminds players: "A game is only as good as its community, and to ensure everyone has fun with each other, remember to cooperate and abide by the rules of participation."

EXAMPLES OF COMMUNITY GUIDELINES IN XR

Innersloth (*Among Us 3D: VR*) Code of Conduct:
https://www.innersloth.com/code-of-conduct/

Roblox Community Standards:
https://en.help.roblox.com/hc/en-us/articles/203313410-Roblox-Community-Standards

Rec Room Code of Conduct:
https://recroom.com/code-of-conduct

Meta Quest Code of Conduct for Virtual Experiences:
https://www.mdpi.com/2076-3417/14/16/7141

Sony PlayStation Network Code of Conduct:
https://www.playstation.com/en-us/support/account/community-code-of-conduct/

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BUILDING AND ENFORCING SOCIAL NORMS

Tools such as blocking and muting have been used successfully to help youth (and adults) silence annoying users and to protect themselves from aggressive and unwanted behaviors in multi-user online spaces. However, the user who has been blocked or muted may not always know that other users have flagged them for such behavior.

Developers may want to incorporate prompts to encourage users who have been muted or blocked to modify their behavior, thereby giving those users an opportunity to self-correct. When notifying users of their disruptive conduct, developers may want to start with gentle nudges that account for users who may not intend to provoke others and/or may need reminders of community guidelines for cooperative, pro-social interactions.

However, developers should also be mindful not to create “badges” or other markers that could be shared with others, allowing bad actors to try to build “clout” based on unwelcome behavior.

III. CONTENT GUIDELINES AND RATINGS

AGE RATINGS

As of the publication of this chapter, there are no XR-specific age ratings standards. Many developers of XR apps and games aimed at youth use existing voluntary age rating standards developed originally by organizations for 2D digital products and games, such as the International Age Rating Coalition (IARC),[27] which is composed of digital product age rating organizations from around the world.

Some platforms, such as Meta Quest and Google Play, have additional age group self-certifications in addition to the ones IARC (and the individual country-based ratings organizations that participate in IARC) has set.

Apps and games that are targeted at youth under 13 years of age or those that include mixed ages of 13 and above may have additional requirements set by law in some jurisdictions around the globe.

For example, in the United States, apps for youth have specific legal requirements set out by the Federal Trade Commission and the Children's Online Privacy Protection Act (COPPA),[28] among other things. And while the United Kingdom uses Pan-European Game Information (PEGI)[29] standards, individual app or game ratings are determined by the Games Rating Authority, a government body.

Parent-centered organizations, such as Common Sense Media,[30] also provide independent ratings for digital products based on age appropriateness. For organizations such as Common Sense Media, ratings are not just based on whether content in a game or app is deemed harmful or inappropriate for certain age groups. Ratings may also include whether the experience has positive messages or good role models, is easy to play, has diverse representations, and/or has educational value. Common Sense Media also includes consumer ratings and comments from both parents and young people on the age appropriateness of digital products.

Additionally, user-generated reviews are often found on YouTube videos and other social media platforms, such as Reddit. Researchers in Canada found that youth often rely on YouTube videos to learn more about the games they want to play and whether they are suitable for their interests and sensitivities.[31]

CONTENT GUIDELINES AND RATINGS

Developers should consider these age requirements as well as the nature of immersive experiences being more engaging and impactful than 2D experiences. Users may more easily disassociate from 2D challenging or suspenseful events than they would be in an immersive experience of the same content. It may behoove the Developer to consider this when designing for youth.

IV. DEVELOPMENTALLY APPROPRIATE CONTENT CREATION IN XR

OVERVIEW

While age appropriateness remains an industry standard for most online apps and games, including XR, additional research has been done on how to ensure that experiences online are appropriate based on a child's individual development, rather than chronological age.

The concept of building developmentally appropriate programs for children is based largely on child development resources for educational settings. These resources can be adapted for digital and immersive spaces, where possible.

Developmentally appropriate practices include those that are "carefully planned, intentional teaching based on what is known about the developmental stages and ages of the children we teach. The goal is to bring children to their full potential—cognitively, socially, emotionally, and physically."[32]

In general, child development is broken into rough age groups, but the level of each child in those age groups can vary widely.[33] In particular, the transition from middle school tween (10-12) to high school teenager (13-18) can have large variances in cognitive ability and social intelligence.[34] Therefore, it should not be surprising that many experts have found that one size does not fit all when it comes to what is appropriate for children in digital environments, even for children of the same age.[35]

A 2024 report from the Children and Age-Appropriate Game Design (CAGD) project – housed at the University of Toronto – found: "While our child participants did see age as a relevant factor in determining whether (or not) a game is 'appropriate,' they said that other factors such as personal preferences and aversions, realism, and maturity are equally or even more important. Some kids said that the presence of 'violence' makes a game inappropriate for them. Others told us that the presence of bad words was a sign that a game was inappropriate. Yet other kids said that games with gory graphics or (some) violence could still be appropriate for them and other kids their age who could 'handle' those types of things. A common thread across the children's varied responses was the sense that even kids of the same numeric age could have very different needs, preferences, and definitions of appropriateness."[36]
In terms of developmental appropriateness, developers should keep

DEVELOPMENTALLY APPROPRIATE CONTENT CREATION IN XR

in mind that, because XR experiences are designed to feel "real," which can enhance both learning and enjoyment, they could also have a psychological impact on some younger users. For example, immersive environments intended to help children experience the wonder of what it might be like to fly like a bird or explore outer space could delight some children, while others of the same age might find such experiences frightening.

CAGD's researchers noted, "Across several [youth] focus group discussions ..., it became clear that most of the children wanted more flexibility and customization options in the games they play so that their exposure to content and other players can be better tailored to their individual preferences, concerns, and maturity levels. This is relevant because it suggests that children's needs are not currently being met by common content management systems like age-based ratings and parental controls."

CAGD's researchers suggest that apps (and advertisements for apps) include more detailed content warnings so that users and responsible adults can make more informed decisions about the experiences and games youth interact with.

While these recommendations aim to provide general guidelines and resources for developing content appropriate for youth audiences, software developers should always partner with relevant subject matter experts, educators, child psychologists, youth audiences, and/or other specialists to help them design experiences for younger XR users that are developmentally appropriate.

DEVELOPMENTALLY APPROPRIATE CONTENT CREATION IN XR

CHILD DEVELOPMENT MILESTONES AND VARIATIONS

Some developmental milestones and issues that may affect children as they grow include:

Physical Development: While school-age children (starting at kindergarten) often have strong motor skills, their hand-eye coordination and fine motor skills, strength and endurance, and balance may vary widely. Other physical differences include their rate of growth, including height, weight, and build. Additionally, puberty in children can begin anywhere between the ages of 8 and 13 in girls and 9 and 14 in boys, but it can also happen earlier or later, affecting physical strength and build as well as psychological maturity.

School Expectations and Challenges: Typical child development standards anticipate that children will be able to begin learning in a school setting by age 5 – where basic education on ABCs and 123s are introduced. By age 8 or 9 (third grade in the U.S.), children are asked to process more complex content in their reading and math.

The ability to pay attention is crucial to success in school settings for young children. The average 6-year-old should be able to focus on a task for 15 minutes, while a 9-year-old should be able to focus for an hour. However, children with learning differences, neurodiversity (such as attention deficit hyperactivity disorder or autism, for example), or who are experiencing mental health challenges may struggle to meet those demands.

Language Development: Children's language development is expected to improve over time, from early school-age children using simple sentences with 5 to 7 words to more complex grammar, vocabulary, and pronunciation tasks as they mature.

Additionally, children's ability to understand spoken and written language should improve over time. An average 6-year-old should be able to follow a series of 3 commands in a row, while a 10-year-old should be able to follow 5 commands. However, children may experience developmental language delays that could be the result of hearing impairments, neurodiversity, or learning differences, which can impact the expected developmental milestones.

Source: *Mt. Sinai Health Library*[37]

DEVELOPMENTALLY APPROPRIATE CONTENT CREATION IN XR

USEFUL RESOURCES FOR DEVELOPMENTALLY APPROPRIATE DESIGN

Responsible Innovation in Technology for Children (RITEC) and the RITEC Design Toolbox (UNICEF): https://www.unicef.org/innocenti/reports/responsible-innovation-technology-children and https://www.unicef.org/childrightsandbusiness/workstreams/responsible-technology/online-gaming/ritec-design-toolbox

Providing Developmentally Appropriate Learning (Resources for Early Learning): http://resourcesforearlylearning.org/educators/module/20/10/39/

International Society for Technology in Education (ISTE) - https://iste.org/standards

Learner Variability Project - https://digitalpromise.org/initiative/learner-variability-project/

Lexile and Quantile Hub - https://hub.lexile.com/

READING AND VERBAL COMPREHENSION

While reading text may not be a major feature of most XR experiences, it may nevertheless be utilized for educational purposes, as an accessibility feature for the deaf or hard of hearing and those with learning differences, in virtual signage, or for applications that otherwise necessitate reading skills. Therefore, developers should take into account that youth may be at different stages of academic development in terms of their reading and verbal comprehension when encountering XR experiences built for them.

Reading comprehension, which studies show is strongly linked to verbal comprehension, can vary among children of the same age and/or academic grade level. While a developer may want to design a program for a typical middle schooler (11-14 years old in the U.S.), the average grade-level reading comprehension levels will understandably vary among that cohort, with some kids reading below their grade level and others reading well above grade level.

DEVELOPMENTALLY APPROPRIATE CONTENT CREATION IN XR

One tool that may assist developers in creating content that is developmentally appropriate is lexile charts, which can give guidance on reading and verbal comprehension levels. (Using quantile levels may be helpful to developers for understanding math skill levels for educational applications or for experiences that incorporate math skills.)

So, for example, developers targeting younger users may want to design for "beginning readers" or "intermediate readers" rather than a specific age group to help responsible adults choose programs appropriate for a youth user's skill levels.

Additionally, because reading and verbal comprehension levels may vary among all ages of youth, developers may want to supplement any text with auditory and visual indicators that can help youth navigate an experience. Providing multiple ways for users to discern the rules and aims of an immersive world is also an important way to build accessibility for youth with cognitive, visual, and hearing difficulties.

V. PARENTAL AND USER CONTROLS

PARENTAL CONTROLS

Parental controls have become standard for games and apps used by youth, and most XR platforms have their own basic parental controls, such as time limits, content blockers, purchase limits, and authorizations, etc.

However, immersive environments designed for youth, particularly those that may be multi-user and social, may want to offer additional parental controls designed for the specific experience. Developers may also want to include time limit prompts or structure the stages of the experiences with specific age-appropriate time limits in mind. These time limits could be controlled by the parent (or a responsible adult, such as a teacher) or be an integral part of the experience, depending on the purpose and function of the application.



Source: Sony

For youth, developers may want to build in restrictions on messages or contacts from strangers by default, and they should consider offering parental controls to manage social interactions.

A 2025 study by the Family Online Safety Institute (FOSI) found that among adults who have used parental controls, 80 percent found them effective. The study also found that, despite the widespread availability of such tools, parents and caregivers often struggled to understand how to implement different parental controls across the various devices and online platforms available to their children. As a result, “just around half

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of parents utilize parental controls on tablets. That percentage drops for other devices such as smartphones, laptops, smart TVs, and game consoles," a summary of the study stated. Lastly, the study found only 35 percent of parents took advantage of parental controls on video game consoles.[38]

To help parents and other responsible adults deploy parental controls more frequently, developers should strive to make implementation simple and easy. For example, when incorporating parental controls into an experience, developers should include various ways to onboard both parents and youth, such as in-app tutorials that users can access, as well as 2D video-based and written tutorials.

EXAMPLES OF PARENTAL CONTROL TUTORIALS

Verizon's Parent's Guide to VR Headsets and VR Games for Kids: https://www.verizon.com/about/parenting/parents-guide-vr-headsets-and-vr-games-kids

Parental Controls on PlayStation: https://www.playstation.com/en-us/parental-controls/

Parent-Managed Meta Accounts (Meta Quest): https://www.youtube.com/watch?v=Rtuin8bSrpA

Steam Families User Guide & FAQ: https://help.steampowered.com/en/faqs/view/054C-3167-DD7F-49D4

CREATING POSITIVE PARENTAL INVOLVEMENT IN YOUTH EXPERIENCE

Because of the divide between youth and non-digital native parents, many parents struggle to understand the impact of the immersive experiences their children may be encountering in XR.

Giving children the ability to share their XR capabilities and accomplishments with their parents could be an effective way to increase parental involvement in children's online and gaming experiences. That might include allowing parents to see in real time what their child is doing via screencasting or alerts that notify parents about positive progress or milestones reached in XR games or apps.

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USER CONTROLS

Research, including XRA's own, suggests that youth regularly employ user controls to protect themselves from negative, harassing, or unwanted behavior online and in multi-user immersive environments.

User controls empower youth to take proactive steps to increase their enjoyment of XR experiences and prevent negative or problematic interactions with other users — both those they know in real life and those they do not.

XR experiences designed for youth or inclusive of youth should include basic protections, such as:



The ability to mute other users.



The ability to block other users.



The ability to create bubbles that protect their personal space.



The ability to pause the experience or enter a safe space when a user is feeling overwhelmed by an intense experience.



Reporting features that allow them to flag another user who might be harassing them or otherwise exhibiting behavior that goes against the experience's community guidelines.

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Other protective features might include:

- providing customizable content filters or interaction permissions, where users can decide who can send them messages, interact with their avatars, or even appear in their field of view.
- providing "polls to remove," which allow users to vote on whether to bar another abusive or harassing user from a virtual room without having to contact or involve administrators or moderators. (While this tool is potentially useful, it should be monitored to ensure it is not used to bully or punish another user for behavior or speech that does not violate community guidelines.)

To help create safe personal space barriers in immersive environments, developers should explore the use of space-based frameworks such as Proxemics,[39] which is based on the notion that people naturally maintain spatial separation from each other in various social and interpersonal situations. These natural spatial separations in real life can be based on cultural norms and/or individual preferences.

Proxemics "categorizes interpersonal space into four zones: public, social, personal, and intimate, with each zone having a proximity and established code of conduct that offers explicit rules for what behaviors are acceptable and unacceptable," according to Meta's developer guidance on this topic.[40] As Meta's guidance further explains, "Understanding these zones and the real-life social norms can help in crafting appropriate virtual interactions for each zone in an immersive social experience."

CONTENT MODERATION FOR UGC

The social aspects of XR could have profound positive impacts on users. As a 2022 Information Technology and Innovation Foundation (ITIF) paper put it, "As personal tools, [multi-user immersive experiences (MUIEs)] can enhance social experiences, encourage creative expression, and create new opportunities for knowledge exchange for a broad, global user base,"[41] and that is true for both adults and youth.

However, the same ITIF paper notes that XR environments can also pose unique challenges for content moderation due to the ephemeral nature of most interactions in online multi-user experiences and the potential for the use of fleeting, offensive gestures or simulated physical intimidation. Unlike 2D social environments, VR, AR, and MR experiences may feel more real, and therefore, potential harms may be felt by users more viscerally.

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As mentioned earlier in this chapter, protecting youth from harmful and harassing behavior in XR experiences is important for their psychological and physical health. Therefore, robust content moderation tools should be included in multi-user XR spaces aimed at youth and where children could be present.

USING AI AS A TOOL FOR IN-GAME MODERATION: AMONG US 3D: VR (SCHELL GAMES, INNERSLOTH LLC, AND ROBOT TEDDY)



Source: *Schell Games*

The popular game *Among Us* is a multiplayer social deduction game in which players, known as "Crewmates," must figure out who among their fellow players are "Impostors" while completing tasks and avoiding being killed by the Impostors. The 3D: VR version of the game is rated by the Entertainment Software Rating Board as suitable for players aged 10 and above.

To promote a positive social atmosphere, Schell Games has implemented a variety of safety features that users can employ to protect themselves against unwanted and harassing behaviors. Those tools include muting functions, vote-to-kick functions that require three players to agree to kick someone out, and reporting features allowing players to report each other for toxic behavior.

The *Among Us 3D: VR* player support team initially assumed that manual reports would be one of the most important factors in whether a player should be banned or suspended from the game. By using AI as a moderation tool, however, they instead found that players were using

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some of those features in improper ways, sometimes to punish or bully other players who had not actually exhibited toxic behavior in the game.

Because the AI moderation gathers all audio instances of potential toxicity, human moderators were able to determine that many instances of reports or calls for a player to be banned were not substantiated. Instead, their safety tools were sometimes being used improperly against other players.

In fact, their AI tool helped them to see that over 90 percent of player-generated reports of toxicity were false and not accompanied by any evidence of in-game toxicity.

As of the publication of this chapter, *Among Us 3D: VR*'s policy is to never ban a player based solely on player reports. While player reports are still a potential factor in any ban or suspension, they are no longer given more weight than the other evidence gathered using AI.

VI. PHYSICAL ENVIRONMENT LOGISTICS

Developers should consider the physical environment(s) in which youth may use their app. XR experiences, while commonly assumed to be the province of in-home gaming systems, are being used widely in other physical, real-world spaces, including:

- Schools
- Hospitals
- Doctor/Therapeutic Offices
- Arcades
- Museums/Aquariums/Other Spaces Open to the Public
- "On the Street"

Developers should consider both which physical spaces they envision the user interacting with while in an immersive environment, as well as how the user might interact with (or avoid) physical objects in that real-world space. Questions developers should ask themselves include:

- How would a user perform an action in physical space?
- How would a user interact with objects both virtual and physical in that space?
- How would those physical and virtual elements interact with a user's real life environment?

Understandably, home and school environments, which may include unique or changeable activity spaces, will differ substantially from a museum or arcade environment, where the museum or arcade have dedicated activity spaces for XR experiences.

In some cases, experiences may need to be tailored for users who are seated or stationary. In contrast, other experiences may invite movement which would require the ability to map physical obstacles to prevent unintended injuries. Hospitals, for example, may offer XR-related therapies that require movement with both seated or standing experiences.

For classrooms and other multi-use settings, it may be necessary to provide guidance on creating a safe physical space to guard against physical injuries or property damage. In some cases, it may be necessary

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to give users the ability to summon virtual objects in their physical or virtual location in order to avoid movement that could endanger the user.

Developers should be familiar with the built-in physical boundary settings that many manufacturers have included in their headsets and platforms. Many devices offer settings for either stationary or roomscale experiences that users can adjust on their own. To ensure a safe experience, developers should provide clear guidance to users on what settings to utilize.

Developers should also consider that younger users move differently, and sometimes less deliberately or more dynamically, than adults. In-app reminders to attach controller wristbands may be helpful to prevent unintended property damage along with reminders and guidance to create safe spaces to move around, before beginning any XR experience.

Developers should beta-test their XR experiences in the types of environments they intend for their app to be used, so that they can build tailored specifications, guidelines, and/or reminders for users about necessary safety precautions for the experience.

ACCESSIBILITY

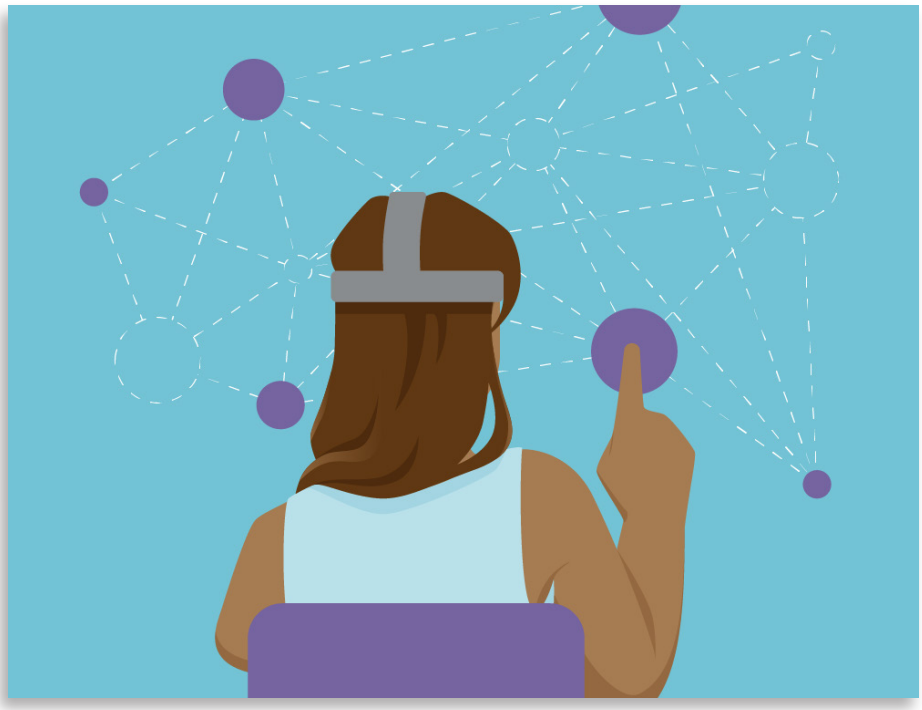
Accessibility in immersive experiences is key to ensuring that users of all abilities can enjoy XR. Inclusive design that supports accessibility can create additional functionality that all users may find advantageous in the experience.

Chapter 3 of XRA Developer's Guide: Accessibility & Inclusive Design in Immersive Experiences includes helpful tips to ensure that users with hearing or visual impairments, physical disabilities (including temporary disabilities due to injury), and cognitive disabilities can fully access XR experiences.

As Chapter 3 explains, "Designing for an 'average' user can lead to designs that are inflexible and constraining for all, while inclusive designs often produce technology that is more adaptable and flexible. Inclusive design goes beyond simply making technology accessible to people with disabilities. Rather than creating a separate experience, tool, or plug-in specifically aimed at a particular disability, inclusive design aims to create a universal XR experience that integrates tools that all users can enjoy."

Designing inclusively can be especially helpful to youth, who, as this chapter has discussed, may have limited language skills, motor skills,

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cognitive understandings, etc., based on their age, development stage, or other factors, such as learning differences or physical disabilities.

Additionally, legal requirements may exist for children in learning environments (such as those laid out in the Individuals with Disabilities Education Act in the U.S.) that require schools and other institutions that serve children to provide accessible educational materials.

VII. DATA PRIVACY AND AGE ASSURANCE/VERIFICATION

Developers designing experiences for children or experiences that are not restricted to adults should be aware of the various legal and regulatory considerations that may apply to them, based on their intended user base and jurisdiction.

Digital privacy laws in several jurisdictions, including the U.S. and the EU, prohibit or limit data collection on minors, particularly for digital products used in educational settings. Some laws also limit whether and how data on minors can be shared with third parties.

More and more, in the United States and elsewhere around the globe, jurisdictions are requiring online platforms and apps to implement features to assess or verify the age of the person using age-restricted apps and games.

VII.

***Important Liability Disclaimer:**
Any mention in this developers guide of a specific product, company, or organization is provided solely as a reference tool and is not intended as an endorsement by XR Association. XR Association makes no express or implied warranty with respect to any third-party products or services.

ACKNOWLEDGEMENTS

ON BEHALF OF ITS BOARD AND MEMBER COMPANIES

The XR Association wishes to extend its sincere thanks to the following individuals and organizations for their assistance, contributions and leadership in the development of the 'Designing for Youth Engagement and Wellbeing in Immersive Experiences' chapter for the *XR Association Developer Guide An Industry-Wide Collaboration for Better XR:*

Meta
Sheila Kroh-Jespersen, *Senior UX Research Scientist*
Natalie Chyi, *Policy Manager*
Sarah Potter, *Product Safety Counsel*
Debbie Girolamo, *Director and Associate General Counsel*

Pearson
Kaylee Seely, (Chair, Education Working Group) *Head of Immersive*

Schell Games
Brooke Morrill, *Senior Director of Education*
Laura Norwicke Hall, *Senior Player Support Specialist*

ReframeXR
Jonathan Teske, *Founder & CEO*

Sony
Sarah Briglia, (Chair, Health and Inclusion Committee) *Senior Corporate Council, Consumer Experience & Online Safety*

Special Thanks
Emily Pierce, *EKP Capitol*

ENDNOTES

1 XR technology refers to virtual reality (VR), augmented reality (AR), and mixed reality (MR).

2 https://xra.org/wp-content/uploads/2023/05/Empowering-Young-People-in-Immersive-Experience-2025.pdf

3 Most hardware manufacturers do not recommend that XR headgear (VR headsets, AR glasses, etc.) be used by very young children, with age recommendations varying by manufacturer. However, this guide recognizes that parents, educators, medical providers, and other responsible adults may want to expose younger children to XR experiences for educational, entertainment, healthcare, or other purposes, and some of those experiences may involve the use of headgear. Additionally, youth of all ages may encounter and participate in XR experiences via headgear in public settings, such as at arcades and museums.

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12 https://www.pewresearch.org/internet/2022/12/15/teens-and-cyberbullying-2022/

13 https://joanganzcooneycenter.org/2025/05/05/2025-youth-design-team/

14 https://designsforlearning.nu/articles/10.16993/dfl.164

15 Cooperative gameplay, or co-op, refers to a type of experience or game where users work together towards a shared goal.

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26 The guidance goes on to say: "Players using a parent-managed account for ages 10-12 on the Meta Platform (Quest 3, Quest 2 and Quest Pro) will not see the toggle and their default setting will be 'Hide Explicit Content' with no option to change it. For all other users, the toggle is first introduced to the player at the start of the game (once). As a default, the player will have explicit content visible, but the player can change this by clicking 'Hide Explicit Content.' Players can always change their preference later in game options" https://beatsaber.com/faq.html

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38 https://fosi.org/wp-content/uploads/2025/05/Connected-and-Protected-Insights-from-FOSIs-2025-Online-Safety-Survey.pdf (The use of XR hardware and software was not specifically noted in the study.)

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