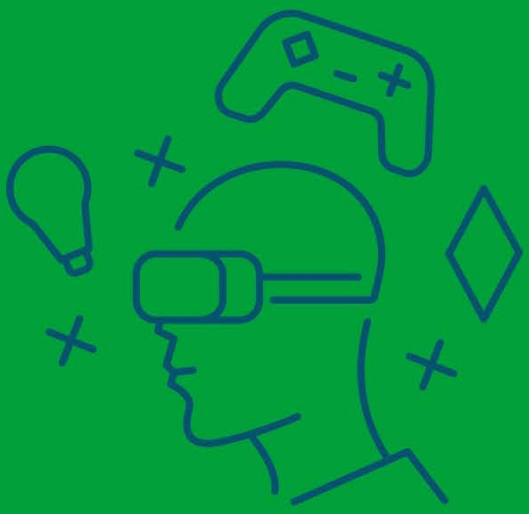
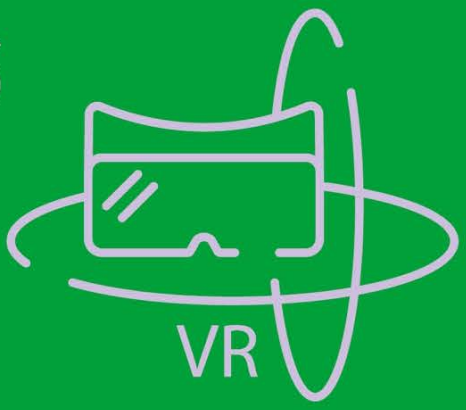
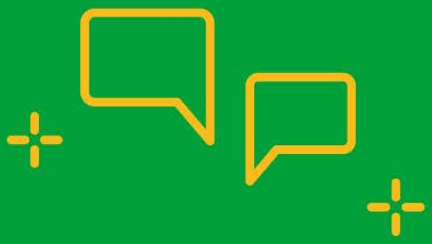
NSPCC



Child Safeguarding and Immersive Technologies

Key Concepts





By Verity McIntosh, University of the West of England
Contributing author and executive producer: Catherine Allen
Commissioned by NSPCC

LIMINA IMMERSIVE

Child Safeguarding and Immersive Technologies

Key Concepts

By Verity McIntosh, University of the West of England
Contributing author and executive producer: Catherine Allen
Commissioned by the NSPCC

Editor: Sian Norris
Research: Verity McIntosh, Catherine Allen, Joanna Henderson and Emma Hughes

Contents

Content advisory **4**
About the paper **4**
Note on reading 4
About the papers' authors 5
Acknowledgements 5
Glossary **6**
Introduction **7**
Are we nearly there yet? 7
Key concepts **8**
What is virtual reality? 8
Virtual reality devices popular in UK households 8
What is augmented reality? 10
Augmented reality mobile devices 10
Augmented reality wearable devices 10
What is an avatar? 10
Deep fake avatars 11
What is the metaverse? 11
What the metaverse looks like today 11
Future qualities of the metaverse 13
User experiences and behaviours **14**
What is phantom touch? 14
What are haptics? 14
What is erotic role play? 15
Regulation, governance and prosecution **16**
Jurisdiction 16
Classification bodies 17
Industry culture and dominant values **18**
Data maximalism 18
Resistance to regulation 18
Accountability ambiguity 19
References **20**

Content advisory

This paper includes content that tackles the issue of child sexual abuse (CSA) in Virtual Reality and immersive environments.

Some of these harms may be new information for the reader. They may be challenging to learn about and take time to process. There are parts of this paper that readers might find upsetting.

Please be aware of this content advisory warning before taking the decision to read on. We also ask you are mindful of this context if you choose to share this document with colleagues.

We also recommend that you consider your own context in which you read this paper, including time and place. If you are concerned about the wellbeing of a child, you can contact the **NSPCC's Helpline** to speak with a dedicated child protection specialist who will be able to provide you with free advice, support, and take action. If your child needs more support, the NSPCC's **Childline** service provides a safe, confidential place for children to speak with trained counsellors at any time.

About the paper

The NSPCC's 2021–2031 organisational strategy has three impact goals we want to achieve by 2031:[1]

1. Everyone plays their part to prevent child abuse
2. Every child is safe online
3. Children feel safe, listened to and supported.

Given the rapid growth of new technologies, including immersive environments, the current generation of extended reality products – Virtual Reality (VR) and Augmented Reality (AR) – and the clear shift towards the development of the metaverse, research is necessary to ensure that the safeguarding community has a clear understanding of the emerging potential impacts of such products.

The NSPCC commissioned Limina Immersive to research the CSA risks in emerging technologies, which would help us identify how these risks might effectively be mitigated.

This paper aims to provide a foundational understanding of key concepts in immersive technologies that we hope will equip readers to adequately unpack the risks identified in *Child Safeguarding & Immersive Technologies: An Outline of the Risks*. **These papers are contextual pieces prepared to provide thought leadership, in this rapidly growing sector, by reflecting the available evidence and experience of the researchers.**

Note on reading

This paper should be read in conjunction with the report ***Child Safeguarding & Immersive Technologies: An Outline of the Risks.***

About the papers' authors

Verity McIntosh
University of the West of England

Verity McIntosh is Associate Professor of virtual and extended realities at the University of the West of England. Verity co-authored the Institution of Engineering and Technology report, *Safeguarding the Metaverse* (2022). She is currently working with UK government and the Council of Europe to develop governance frameworks that support positive human experiences in the 'metaverse'. Verity is a member of the Digital Cultures Research Centre. Her research focuses on the ethics of presence, access and inclusion in immersive experiences, multi-person virtual experiences, and the simulation of unsafe spaces in VR. Verity has written and spoken about immersive tech and the 'metaverse' around the world, including BBC World Service, ITV News and The Sunday Times.

Catherine Allen
Limina Immersive

Catherine Allen is the Founder, CEO, and lead consultant at Limina Immersive. Catherine is most well known as a UK leading expert in immersive technology and its relationship with the public. Catherine co-authored the Institution of Engineering and Technology report, *Safeguarding the Metaverse* (2022).[2] Catherine has also authored several seminal public reports that have influenced policy, for instance the *Immersive Content Formats for Future Audiences* (2018)[3] report, for Innovate UK and Digital Catapult. Catherine's insights having been featured in The Sunday Times, BBC News, Radio 4's Today Programme, Wired Magazine, British Vogue and Bloomberg. Catherine is also one of Creative England's officially recommended consultants.

Before founding Limina Immersive, Catherine led the creation of two of the BBC's first virtual reality experiences in 2015–2016 and worked on the BAFTA-winning children's app, Disney Animated.

Acknowledgements

The NSPCC is an independent charity funded overwhelmingly by voluntary donations. The NSPCC is very grateful for the generous support from the Oak Foundation who made this research possible.

With special thanks to all those who have contributed to our study, including:

- UK National Policing Online CSAE Covert Intelligence team
- Government Communications Headquarters (GCHQ)
- Professor Kathleen Richardson, Director of the Campaign against Sex Robots and Professor of Ethics and Culture of Robots and AI at De Montfort University, Leicester
- Warwickshire Police
- Dr Mohamed Khamis, Associate Professor in the School of Computing Science at the University of Glasgow
- Michael Sheath, independent consultant
- The Lucy Faithfull Foundation
- Professor Emma Barrett, Professor of Psychology, Security & Trust at the University of Manchester
- Karl Hopwood from the Insafe network of Safer Internet Centres
- Eveshnie Reddy, Lecturer & Researcher, at the University of South Africa
- Dr Martina Gillen, Senior Lecturer in Law, UWE Bristol

Glossary

Avatar: a character that the user inhabits in VR and AR spaces. An avatar can represent a user in real life or be a persona. Users sometimes build a backstory for persona avatars. They are usually highly customisable.

Avatar commission: getting a personalised, bespoke avatar designed and produced to use in VR spaces. This commission often involves a payment.

Avatar transference: avatar transference, sometimes referred to as mind or consciousness transfer, is a concept in which a person's mind, consciousness, or personality is transferred from their physical body into a digital or artificial one, such as an avatar in a virtual world, a robotic body, or even another biological body. In practical terms, when using a consumer VR headset, avatar transference is often where a VR avatar temporarily feels as real to a user as their own body.

Blockchain: a **distributed ledger system** that maintains a continuously growing list of 'blocks' linked using cryptography. Each block contains a cryptographic hash of the previous block, a timestamp, and transaction data. With a distributed ledger system, there is no central authority, e.g. a bank or government agency. Instead, all information is encrypted and distributed between all users of the system in an explicitly 'decentralised' manner.

Cryptocurrency: a digital currency in which transactions are verified and records maintained by a decentralised blockchain system using cryptography, rather than by a centralised authority.

Erotic role play (ERP): refers to the act of users engaging in sexually-themed or suggestive interactions while assuming the roles of their chosen avatars within a virtual environment. It can involve various scenarios, characters, and themes.

Ethereum: a decentralised, open-source blockchain with **smart contract functionality.** Smart contracts are programmes that enable transactions and business functions to occur without the involvement of an intermediary, such as a bank.

Haptic technology: the use of tactile sensations to stimulate the sense of touch in a user experience, such as vibration in games console controllers.

Interoperability: the ability of different systems, devices, or software applications to communicate, share, and work with each other effectively.

Non-fungible tokens (NFTs): assets with unique digital identifiers recorded on a blockchain. In immersive environments, NFTs might include user-owned and objects, such as digital fashion, avatar designs, property and artwork.

Online role play (RP): online games based on storytelling where players take on fictional characters.

Phantom touch: the psychological feeling of touch in VR whereby the brain 'fills in the gaps' and believes the person is experiencing physical touch.

Scalability: the capacity for a technology platform to grow its user base, sometimes very fast.

Sideloading: the process of manually downloading and transferring files onto local devices, outside of official app stores, in particular between a personal computer and a device like a virtual reality headset. Often the files/apps are unapproved or from an unapproved retailer. For further detail on sideloading click here.

VR early adopters: people who started using VR technology before it went mainstream.

Introduction

Are we nearly there yet?

The term 'immersive technology', often interchanged with Extended Realities (XR), is the umbrella term for Augmented Reality (AR), Virtual Reality (VR), and other spatial computing technologies.

In recent years, we have seen rapid growth of immersive technologies with some of the world's largest companies having invested billions of dollars[4] in bringing these unfamiliar technologies into the mainstream. Many companies position this new wave of tools as the next generation of the internet and suggest that they could be as potentially transformative as social media has been in regard to how we connect with one another.[5]

More and more people appear to be using immersive technologies for work and leisure and a sharp uptake was observed during and in the years since the arrival of the COVID-19 pandemic. From 2020 to 2021, for example, the proportion of UK adults who had experienced virtual reality more than doubled, from 10 per cent to 22 per cent.[6]

Immersive technologies are also becoming a more familiar part of children's media and technology landscape. From late 2023, the majority of VR headsets will recommend a lower age limit of 10–13 years of age.[7] A 2023 study by the Institute of Engineering Technology (IET) of 1,000 UK parents with children between the ages of 5–13 years found that 66 per cent of children have experienced VR, with 25 per cent doing so on a weekly basis.[8]

The nature of immersive technologies, such as virtual reality headsets, can make it difficult for parents and carers to monitor what their children are experiencing in these virtual environments. Unlike with the 2D internet, caregivers cannot simply look over their child's shoulder and view their computer screen. Instead, the child is immersed in a virtual world only visible to them. Parental control systems and safety features are sometimes made available, but are not well promoted or understood, and often limited in their scope and effectiveness.

More positively, most immersive technologies are still very early in their development and have great potential for positive societal impact. These risks and harms are by no means inevitable and much of the sector remains malleable and open to change.

This paper will provide a guide to the key concepts in immersive technology. It explores the types of technology available to children and young people; current UK law; and attitudes and commercial drivers observed in this growing immersive industry.

Key concepts

What is virtual reality?

Virtual reality (VR) is perhaps the most commonly recognised immersive technology. It places users in the centre of a 3D world where they are completely surrounded. When using a virtual reality headset (sometimes referred to as 'VR goggles'), users experience the sights and sounds of a simulated scenario.

The psychological distinctiveness of VR over traditional media has been well evidenced by researchers, with the main differences being that users frequently report a physical sense of being in the space – this is referred to as 'presence[9] – and that users will often 'respond as if real' (shortened to RAIR) to virtual stimuli.[10] A user's sense of 'presence' in VR is further amplified when they come into contact with other people, such as in multi-person virtual reality spaces.[11] Multi-person virtual reality spaces, in which more than one person can interact, may have particular significance for children who have been shown to experience higher levels of psychological realism in VR, and can therefore experience difficulty distinguishing between events that occur inside and outside of the VR space.[12]

Virtual reality content currently popular with younger people appears to include games, films, exercise, and social VR spaces where they can virtually 'hang out' with other users. These 'other users' may be people they know 'in real life', those they have met online, for example via a Discord server, or those that they know exclusively via the VR simulation. These spaces are frequently used simultaneously by children and adults.

Virtual reality devices popular in UK households[13]

The summaries provided below are based on publicly available information we know on the following main players in VR. However, it is important to note this is not an exhaustive list of VR devices. There are many virtual reality headsets available with new devices frequently being announced.

Unfortunately, producers of VR products do not publicly share information on their products, which prevents thorough comparisons of devices from taking place. Limited publicly available data also presents challenges on understanding exactly how many users are engaging with the devices, and what proportion of these users are children. There is also currently no legal requirement for organisations to publish this information.

Meta Quest 2

One of the largest players in the immersive ecosystem is Meta (formerly Facebook). Meta manufactures the market leading consumer headset for virtual reality, known as the Meta Quest 2. During Christmas 2021, the companion app needed to set up the Quest 2 headset was the most downloaded app on the US Apple App Store,[14] suggesting a significant number of headsets are being given as gifts.

Meta's founder and CEO, Mark Zuckerberg, said in a recent podcast that he couldn't give away specific sales figures, but that in the markets the Quest 2 is sold in, its prevalence in households is similar to an Xbox or a PlayStation.[15] In summer 2022, data firm IDC estimated the Quest 2's sales to be around 15 million devices globally.

Meta currently state that the Quest 2 should not be used by those under 13 years. However, this will be lowered to 10 years old later in 2023. According to Meta's policies, the accounts of children aged 10–13 will be managed by a parent or carer.

In summer 2022, Meta recognised the need to improve safety features and began a phased introduction of 'Parental Supervision Tools'[16] designed to give supervising adults oversight of apps purchased and accessed by children in VR.

Meta controls the majority of content that can be experienced by a Quest 2 headset via its curated App Store. Users can access other content by connecting to a desktop computer or by 'sideloading' content. This means the manual adding of unapproved or user-generated content to the headset's onboard computer.

PlayStation VR

In February 2023, Sony released its latest immersive technology device: the PlayStation VR 2 (PSVR2). The product is a virtual reality headset that can be used in tandem with its popular PlayStation 5 games console. Further to Sony's 2016 offering, the original PSVR, the PSVR2 has enhanced visual, audio and haptic acuity, including tactile feedback on the headset itself (usually reserved for controllers) and has launched with a tranche of new games.

Content for PSVR2 is accessed via Sony's own PlayStation store, similarly to non-VR PlayStation games and all content is approved by Sony prior to publishing in line with its content guidelines and curatorial strategy.

Sony states that their VR headset is not for use by children under 12 years. PlayStation consoles have 'Family Management' settings,[17] which can be used to manage access to specific content.

HTC devices

HTC VIVE offer a range of consumer virtual reality headsets including the VIVE Flow, VIVE Focus and VIVE Pro ranges. The latter technology requires the user to have a high-end computer and to use external, wall-mounted sensors. Content for VIVE headsets can be uploaded or streamed from a range of providers. Most popular is Valve's *Steam VR* publishing platform, or VIVE's own *Viveport* app store.

HTC does not apply an age limit but recommends that young children should not use the platform. However, it does not define what it means by 'young children'. In 2022, HTC introduced 'VIVE Guardian, a Kids Safety Mode in VR',[18] offering a range of tools for supervising adults.

Pico devices

Pico is owned by Chinese tech company, ByteDance. This is best known as the company behind the video social network, TikTok. In countries where Meta is not approved, such as China, Pico already occupies a large part of the virtual reality hardware market. In other territories, such as the UK, it is mostly used in corporate contexts, such as for training purposes, although the recent launch of the Pico 4 headset has prompted a sharp rise in consumer interest.

Content can be accessed via the Pico app store, or via 'sideloading' methods, similar to the Meta Quest 2.

What is augmented reality?

Augmented reality (AR) blends the physical world with digital content through smartphones and wearable devices, such as headsets and smart glasses. Common uses include face filters for social media apps, such as Instagram and Snapchat, and location-based games, such as Pokémon Go.

Augmented reality mobile devices

Android phones

Google's Android operating system, used in a range of smartphones and devices built by various hardware manufacturers, can support augmented reality applications using the device's camera. Children can access AR apps via the Google Play store.

iPhones/iPads

Apple's iOS operating system supports augmented reality apps and experiences that can be viewed using the cameras on each device. Children can access AR apps via Apple's App Store.

Augmented reality wearable devices

There are some augmented reality headsets already on the market, including Microsoft's Hololens 2 and the Magic Leap One. These wearable devices offer a more 'heads up, hands-free' mode of viewing and interacting with these blended experiences. The Meta Pro, and to a limited extent the Meta Quest 2, can be used as either a VR or an AR device using external cameras to create a 'pass through' effect.

This form of immersive technology has not yet fully broken out into the public sphere and is mostly used in business settings, such as for bespoke training or resource management. However, this may change, as in June 2023, Apple announced their upcoming spatial computing device, the Apple Vision Pro, which includes AR and VR capabilities. It will be available in early 2024 and is designed for people aged 13+ years.

What is an avatar?

In many cases, visiting, and feeling present in a virtual space involves using an 'avatar'. A user's avatar is the digital representation of themselves and allows them to interact with people and objects in a virtual world, while giving others within the same space a sense of who they are. A user's avatar becomes a proxy for themselves and can even become an important and integral part of their own sense of self.

Avatars can be a fun and creative way for children to explore the notion of identity and personal expression, essentially 'dressing up' as a broad range of characters that may look something or nothing like them. This can, however, present challenges from a safeguarding perspective as it becomes difficult to ascertain the age of a user based on visual cues.

Many current virtual reality spaces offer a suite of 'in-game' avatar options for users to choose from. Different VR multi-user worlds offer different levels of avatar customisation. Some platforms allow any 3D model while others limit users to take human form. Some aim to match the user's real appearance as closely as possible, while others offer a wider range of options for the user to inhabit including animals, objects and anime characters. There are a number of marketplaces outside of specific platforms where VR users can acquire open source, limited edition or exclusive avatars for use in VR spaces. For those with more technical aptitude, it is also possible to create bespoke avatars using a range of creator tools. Some of the more popular

avatars draw on adult references, such as furry fandom and 'eroge' games (erotic games).

After the avatar has been selected, users can enter a virtual environment where they can interact with other users. The VR space allows the user to interact with others using voice, gesture, posture, body movement, and sometimes facial expression.

Deep fake avatars

A 'deep fake' avatar is one that has been digitally altered to look like a real-life person, such as a celebrity or historic figure. Deep fake avatars can be made to resemble real children, such as a child actor, a family member, or a child in their community, and could potentially be used for malicious purposes (as outlined in the 'Child sexual abuse simulations in VR' section of *Child Safeguarding & Immersive Technologies: An Outline of the Risks*).

What is the metaverse?

There is not always agreement about what does and does not count as a 'metaverse'. It is still very much an emerging and evolving term. A basic definition would describe it as the '3D internet'. Using VR or AR can often feel like the user's body is 'entering' the internet.

Features frequently associated with the metaverse describe it as:

- **Spatial**: 3D environments, usually accessed through VR or AR devices.
- **Multi-user**: virtual spaces experienced by large numbers of people at the same time, connecting from anywhere in the world.
- **Persistent**: always available whether users are present in the space or not. Actions taken and changes made by users will persist even after they have left the space.
- **Connected**: the metaverse is often said to consist of a variety of virtual worlds that are linked in some way, like islands.

Some people in the industry additionally suggest that a metaverse *should* be:

- **Interoperable**: avatars, belongings and resources can be used across platforms, regardless of the hardware (devices) or software (games and apps) involved.
- **Decentralised**: underpinning architecture for the metaverse based on open standards and blockchain technology.

What the metaverse looks like today

There are a number of popular apps that could be considered early or 'proto-metaverse' spaces. These are usually apps or game worlds that offer vast, connected, always-on destinations that can be visited by large numbers of people at the same time.

Virtual reality metaverse apps

There are currently a number of 'social VR' apps available from official curated VR app stores that allow users with virtual reality headsets to spend time with each other regardless of where they are physically. Such immersive technology allows, for example, a child sat in their bedroom in the UK to meet, chat and play in the same virtual space with children and adults from around the world. Unlike online games and video calls, the experience is more spatial and relational, with voice, gesture, movement and the sense of one's personal space bearing closer resemblance to everyday physical interactions.

Sideloaded metaverse apps

Most social VR apps from official curated VR app stores offer age guidance of 13+ years or 18+ years. However, not all VR content comes from official sources. Sideloading allows VR content to be downloaded onto headsets without needing to purchase or download the content from an app store. Software can be transferred to a device from a local source, rather than obtaining it from the platform's official and approved store. When activated in VR, sideloading permits users to execute experimental, tailor-made, and other yet-to-be-released applications in the .apk file format. These programmes are often released by developers directly, ready for download, without a curating intermediary platform. Developers range from full suite studios to individual hobbyists. Most VR headsets allow sideloading, and users need a medium (or higher) level of technical skill in order to sideload.

Desktop computer-based metaverse apps

While this paper focuses on the impact of virtual and augmented reality as access points for the 'metaverse', it is useful to note that there are well established gaming platforms, such as Roblox, Minecraft and Fortnite, which have hundreds of millions of users worldwide,[19] and exhibit some hallmarks of the 'metaverse'.

Second Life and The Sims are also often cited as early forerunners of the modern metaverse, with Decentraland a more recent example of a browser-based virtual world that is underpinned by the Ethereum blockchain.

Many of these games offer 3D worlds that can be visited simultaneously by large numbers of users who then interact with one another. These worlds persist and evolve whether the user is present or not, and users will often invest large amounts of time developing their visual identities, acquiring digital assets and taking part in time-based communal events, such as concerts and missions.

Many of these games are marketed to appeal to children and report high ratios of children using their platforms.[20] This suggests that many young people are growing up familiar and comfortable navigating massively multiplayer online spaces. While children and caregivers may assume that similar VR 'metaverse' games use robust age verification and child safeguarding measures, this is not always the case. In our view, this may lead to something of a 'safety cliff-edge' for those venturing into new, immersive territories.

What is the difference?

The primary difference between the above desktop computer-based 'metaverse' games and social, virtual reality apps is that worlds experienced in virtual reality offer the participant an enhanced sense of 'presence'. The feeling of having experienced something directly can persist long after participants have come out of VR and users tend to speak about their experience in the first person, recounting encounters as though recalling memories rather than describing gameplay or viewing content online.

For children, including those familiar with non-VR multiplayer online gaming, this can be a big psychological shift. In more traditional, screen-based gaming, children can of course become highly immersed and involved with the character they are playing and the game world they encounter. They may even find themselves in a powerful 'flow state' – the mental state where a person performing an activity becomes fully immersed in a feeling of energised focus.[21] Such a state commands their full attention. The difference, however, is that VR further dissolves the boundary between user and device, giving them a first-person perspective, and a compelling sense of being in the centre of the action. In this context, they are no longer *controlling* a character, they have *become* the character.

This first-person perspective, and the psychologically convincing experience that it creates may have profound consequences for the way children experience and make sense of person-to-person encounters in metaverse spaces. Early research has suggested that children under the age of seven find it particularly difficult to distinguish between experiences in virtual reality and in real life and can conflate the two over time.[22]

Future qualities of the metaverse

Connectivity and interoperability

The metaverse is often conceived as a hyper-connected series of spaces that users can traverse more or less seamlessly. Rather than visiting specific apps and having an account with each, users can expect to move between spaces, taking certain digital signifiers with them, such as their avatar, currency and assets that they may have made or purchased in a kind of 'digital wallet'. If this vision of the metaverse becomes a reality, the ability of a user to move from place to place frequently and quickly on these platforms may present challenges to law enforcement when it comes to investigation of abuses and evidence gathering.

Decentralisation, Web3, NFTs and cryptocurrencies

Today's current internet systems are frequently referred to as Web2 or Web 2.0 and are characterised by large amounts of user-generated content, typically shared via social media, such as YouTube, TikTok or Twitter. In this system, a lot of power and control is held by a small number of large tech companies. Many of these companies have business models that rely on extracting and commodifying user data on a massive, global scale.

In the future, the metaverse is more likely to be accessed through Web 3 or Web 3.0. **Web3/ Web 3.0** is often characterised by the concept of **decentralisation**, the idea that the underlying architecture of the 'metaverse', could be built on open standards and **blockchain** technology, a type of long-chain ledger that can log and verify infrastructure, transactions and activity in such a way that is considered by some to be incompatible with centralised power and control.

In this more libertarian model, people might be presumed to be the owners of their own data and could retain some control of their own identity and digital assets, regardless of what platform they are using or what company they are interacting with. In this vision of the metaverse, users would have a so-called 'self-sovereign identity' (SSI) and a private 'digital wallet' containing all of their belongings and data. The digital belongings that they may accumulate over time would be likely to take the form of **non-fungible tokens (NFTs),** purchased with cryptocurrencies, such as the above-mentioned Ethereum or Bitcoin, and would therefore be logged and verified by the same underpinning blockchain technology that sustains the whole system.

Early indications seem to suggest that in order to access games, platforms and services, users will still be expected to consent to terms of service that will enable providers to access, track and accumulate data about them so the perceived benefits may not materialise as some have hoped.

This model of decentralisation has serious consequences for oversight, regulation and child protection in the metaverse. In a fully decentralised system, those who might seek to exploit and abuse children may be able to do so anonymously and reported abuses may not be traceable, making it difficult for platforms and law enforcement to identify and take action against illegal behaviour.

User experiences and behaviours

The following concepts relate to physical and sexual sensations that users may experience in immersive environments. They are included here as they underpin some of the forms of child sexual abuse and exploitation that are described in *Child Safeguarding & Immersive Technologies: An Outline of the Risks.*

What is phantom touch?

When a user's avatar is touched in a VR space, a user will sometimes experience the phenomenon known as 'phantom touch'. This is the psychological feeling whereby the user's brain 'fills in the gaps' and delivers the psychosomatic sensation. The Rubber Hand Illusion[23] illustrates phantom touch – a participant in the Rubber Hand Illusion is stroked with brushes on one real hand and one rubber hand at the same time, successfully inducing the feeling of ownership of a rubber hand's physical touch on corresponding parts of the body. This is the most well-known experiment proving disassociated from the real occluded hand. Such a phenomenon is technically known as 'proprioceptive drift'.[24]

Many people who use VR regularly widely report this 'phantom touch' sensation.[25] They sense that their physical body transfers into their avatar's, and subsequently some physical sensations can be felt in response to digital contact.

Research suggests that the more a virtual or augmented experience engages the user's senses, the more present an individual is likely to feel.[26] As such, adding touch to the audio and visual stimuli of virtual reality may significantly enhance the sense of embodiment and physicality of any virtual encounter.

What are haptics?

Haptics in the context of immersive media refers to a suite of technologies designed to provide users with a sense of touch that corresponds to their experience in the virtual environment. This can be as simple as a subtle vibration of a hand controller when the user's avatar makes contact with a solid object. Vibrohaptic technologies (devices that vibrate) have been widely used in games consoles and gaming chairs for many years and are now a more or less ubiquitous feature of virtual reality hardware.

Less common approaches to integrating haptics into virtual and augmented reality experiences have included wearable options that deliver a nuanced sensation of touch to imply contact with objects that are only present in the virtual space. Some have also demonstrated the use of ultrasonic sound to provide the sensation of touch in mid-air.

There are additionally a range of peripherals in the marketplace designed to simulate intimate and sexual contact, either for a single user, or between two or more users at a distance from one another. These devices tend to be grouped under the term 'teledildonics' and have been available in different forms since the 1990s.

What is erotic role play?

Erotic role play (ERP) consists of sexually-themed or suggestive interactions carried out by VR users while assuming the roles of their chosen avatars. ERP may involve simulating sex acts through avatars' movements and speech and is often combined with real life masturbation. It usually occurs in 1:1 private rooms, scheduled parties, private sex worlds and sometimes strip clubs in VR environments. Users will also ERP in publicly accessible spaces on VR platforms; however, this is becoming increasingly frowned upon by the VR community.

Alongside 'phantom touch', haptic sex toys allow the user to experience physical sensations and real sexual feedback. One leading platform now offers avatars that include physics, so body parts can react to touch and movement, for instance a ponytail can swish, or buttocks can be squeezed. The same platform has just announced hand tracking, so users will be able to touch other users and objects with their bare hands, rather than needing controllers. We believe such technological developments could easily allow for users to sexually assault or abuse other users in VR spaces.

In order to engage in ERP, users often make their own avatar or acquire one made by a 3D modeler, sometimes paid for as a bespoke private commission. The themes of avatars designed for ERP tend to be inspired by pornographic anime comics and cosplay, for instance in researching this paper we encountered multiple instances of cat girls, 'futas' (sexualised women avatars who have both vulvas and penises), furries (animal-like avatars) and 'lolis' (avatars designed to look like young girls). Entire ERP sub-communities will often be formed around particular paraphilias, for instance bondage, discipline, dominance and submission (BDSM) practices and furries (animal impersonation).

ERP on specific platforms often form part of vibrant VR nightlife culture, which includes nightclubs with DJs, paid dancers and private rooms with virtually lockable doors. Real life illegal drugs and heavy alcohol consumption often form a part of this nightlife culture.[27]

Regulation, governance and prosecution

A number of existing UK and international legal frameworks are relevant to the experience of children in VR, AR and the 'metaverse'. These include (but are not limited to):

- Age Appropriate Design Code (2021) (aka Children's Code), Information Commissioners Office
- Data Protection Act (2018) (enshrining General Data Protection Regulation into UK Law)
- Sexual Offences Act (2003)
- Communications Act (2003)
- UN Convention on the Rights of the Child (1989)
- Regulatory Action Policy, ICO (in development)
- Online Safety Bill (in Parliament)

Many of the above have protections built in that are designed to support children, irrespective of what technology they use. Much of the legislation will apply equally to these new contexts. However, it is not explicitly clear yet as to the level of adequacy of these existing frameworks.

In the UK, until specific criminal charges are laid, or civil cases are brought and considered by the courts, it will be difficult to know which existing laws and legal principles will be deemed applicable. There are also questions around how sentencing will be approached given this novel context. As a society, we are yet to accumulate a body of case law and the legal system will face challenges in developing appropriate prosecution and defence strategies as more cases come to court. Pre-emptive guidelines might be considered as a means of supporting this process and assuring consistency of approach across judicial territories.

Given the experiential nature of VR and AR, and the psychological differences identified in this paper, it is also not clear whether current legislation designed to address online activity will appropriately address the physical impact of contact offences in immersive environments. In their 2022 report, *Policing in the metaverse: what law enforcement needs to know*, Europol raises concerns about existing legislation being "inadequate" in responding to the harms on the metaverse.[28] Equally, simulated contact offences committed in VR and AR may not be in-scope of laws addressing offline behaviour. Sources within law enforcement have suggested a reconsideration around what constitutes an assault, a sexual assault or harassment that considers VR.

The Online Safety Bill will provide some legal framework for protecting children for the organisations that operate metaverse services in the UK, and looks to ensure that online services are safe by design. The UK government has confirmed that the metaverse is 'in scope' for the pending Online Safety Bill,[29] with a particular focus on child safety.

Jurisdiction

Understanding jurisdiction in relation to digital and online services can be challenging. A service provider might be based in one territory, utilising infrastructure, such as server farms, in another territory, and linking together users from territories all around the world. When offences take place, it is not always immediately clear which laws apply, and which law enforcement agency has jurisdiction to act.

When applied to VR and AR, there is another layer of ambiguity. Due to the enhanced sense of 'being there' in a virtual world, two people meeting in a multi-user space may feel present, as though they are together in the same place but could physically be thousands of miles apart. There is the illusion of being present in the same place.

In many cases, UK law developed to combat this online complexity applies to the metaverse, at least in theory. In our interviews with UK data protection officials, we have been told that companies providing services that can be accessed in the UK are obliged to adhere to the safety conditions and regulations of the UK. If the services are simultaneously used by people from other jurisdictions, the onus is on the provider to design and uphold a service that is compliant with the laws of all participating countries. The officials we

interviewed make it clear that in regard to UK data privacy laws, UK GDPR must be applied for users in the UK regardless of which country the service is based in.

Failure to comply, regarding data breaches or misuses can result in legal action, as we have seen recently from UK actions against TikTok.[30]

For non-data related offences, however, the application of the law becomes more challenging. We understand, for example, that if UK law enforcement becomes aware of the abuse of children in VR, issues of evidence gathering, investigation, arrest and prosecution, particularly of those not based in the UK, can be complex.[31]

In many ways, this is not a new problem, but an extension of an issue that applies across the online sphere. Global cooperation across borders has improved in recent decades, in part because of the use of cooperative treaties and engagement from bodies like Interpol in order to meet these kinds of challenges and may continue to do so as this new frontier matures.

Some legislation, particularly the *Sexual Offences Act 2003*, has built in an 'extra-territorial' force, allowing UK law enforcement to operate outside of UK borders. However, the efficacy of this may depend upon the existence of a 'Mutual Legal Assistance' treaty between countries, or a willingness to cooperate. A Mutual Legal Assistance treaty is when countries agree to cooperate in assisting one another in the investigation or prosecution of criminal offences.

Additionally, actions that would constitute an offence in the UK are not always equally regarded in all territories. Non-photographic sexual images representing children – something that in the UK is regarded as child sexual abuse material (CSAM) – is one such area where legal approaches and punitive measures diverge significantly. Even when illegality is mutually understood, to whom should an offence be reported? Law enforcement in the victim's home country? The country where the service provider is based? The home country of the offender? Which legal standards should apply and how, and by whom will they be enforced?

Classification bodies

There is currently no UK classification body with specific responsibility for offering classification or content information for virtual reality, augmented reality or 'metaverse' experiences. However, in the broader media landscape, organisations like BBFC and PEGI play an important role in assigning age ratings to published content.

Most social VR apps now offer the above classification, or age guidance of 13+ years or 18+ years. However, there are indications that younger users are accessing the full spectrum of social VR apps (see *Child Safeguarding & Immersive Technologies: An Outline of the Risks*), suggesting that current age verification strategies, where present, are insufficiently effective.

The **British Board of Film Classification (BBFC)** currently sets British film ratings and provides information to assist viewers, particularly families, to choose films that are suitable for particular age groups. The BBFC does not currently review or give classification recommendations to virtual reality content. Its current model involves providing classification for fixed content media and does not engage with questions of emergent harms from interactive and communications platforms.

Pan European Game Information (PEGI) provides age classification ratings for video games in 38 European countries. Many VR apps and games are published with PEGI ratings, which are assessed according to the same criteria as video games. In 2018, PEGI conducted an internal review into whether its criteria should be adapted given the more experiential nature of virtual reality. It concluded that no immediate change was required but that this would be kept under review, particularly in regard to 'fear and horror', which it acknowledges may be experienced differently in VR.

PEGI have recently assigned social VR titles, such as Meta Horizon Worlds, as 'Parental Guidance Recommended'.

Industry culture and dominant values

The Limina Immersive team behind these papers have extensive experience of the immersive technology sector, developed over many years of researching, developing and creating VR and AR content. Below, we outline three attitudes that we have repeatedly encountered within the sector, and which we believe are pertinent to the safeguarding of children in immersive environments.

Data maximalism

To date, we have observed that default settings of digital tools in immersive technologies are set to maximise data collection: collecting information about users, such as where users go, what they do, who they speak to and what they purchase, appears to be an important part of a platform's objectives. Many technology companies' investment models are predicated on the assumption that user engagement equals valuable user data extraction. In direct opposition to this model, the ICO recently released the Children's Code, insisting that providers "cannot collect more data than you need to provide the elements of a service the child actually wants to use."[32]

We believe the excessive collection of data could have significant implications for children who use VR and AR, potentially exposing them to privacy risks and the misuse of their personal information. As immersive environments become more realistic and engaging, the data collected from children's interactions can reveal their habits, preferences, and even emotional states. This level of personal data could potentially be exploited by bad actors.

'Data minimisation', however, can present a challenge for businesses. Limited user data undermines the overarching business model of large platforms and can potentially feel like a precarious design principle for smaller companies. Tools that developers work with, for example software development kits (SDK) and application programming interfaces (APIs), are usually designed to maximise data extraction by default. From what we have seen, businesses view the prospect of switching some of this functionality off and limiting data collection at a developer level as inherently risky: it poses the risk of hostile relationships between hardware, device, and service provider, and is felt to inhibit future opportunities.

Resistance to regulation

Another key theme we have observed in the UK's technology sector is a negative attitude towards regulation. Regulation can be perceived by some members of the industry as a means of stifling innovation. A somewhat contentious paper emanating from the pharmaceutical industry in 2012 suggested that premature regulatory influence over emerging technologies could lead to 'Eroom's Law'[33] (Moore's Law spelled backwards). Moore's Law[34] predicts a doubling of computational capacity every two years and is frequently associated with the rapid development and miniaturisation of digital technologies in recent decades, including those underpinning VR and AR hardware. By contrast, Eroom's Law implies a slowdown, or reversal, of the innovation and growth models proposed by Moore's Law in response to the anticipated cost of regulatory compliance.

Of those who resist regulation in the technology sector, some hold the view that safeguarding measures will organically emerge through learnings from 'failing fast' and often. In order to achieve learnings from 'failing fast,' arguments can be made that new technology needs to be exempt from regulatory scrutiny. However, there is limited evidence to support this argument. Rather, a meta-analysis by Nesta in 2012 concluded that "policy uncertainty causes companies to delay investment and consequently innovation decisions".[35]

There are signs that attitudes may be shifting in the immersive technology sector. The research team have encountered growing acknowledgment from stakeholders that an absence of predictable and consistent regulation creates hesitancy for businesses, as they need to pause to consider potential operational and reputational implications of different global regulatory frameworks. For business viability, transparent and consistent policy

making might be viewed as a means to give market confidence and unblock innovation pipelines.

Accountability ambiguity

We believe that many in the sector – including software and hardware manufacturers, platform owners, content developers, designers, and retailers – feel ambiguous or unclear about where responsibility lies in considering, integrating, and maintaining children's safety in immersive environments. Without greater clarity and transparency over who is responsible for the child safeguarding duties within the company, children's safety is unlikely to be prioritised.

However, there is an opportunity to create change to protect children from existing and future harms. Technology companies can foster the ethos of 'safety by design' into their processes and platforms. Law enforcement can use the tools it currently has at its disposal to find and prosecute offenders. New legislation, including the Online Safety Bill provide a fresh opportunity to mitigate the present and future harms, compelling companies to take action to ensure no more children are put at risk in these spaces.

Governments and tech companies must take action now to improve safety features, prioritise child safeguarding, prosecute offenders who use these spaces to abuse and exploit children and hold platforms to account who consistently ignore or indulge abusive user behaviours. Tech companies can continue to introduce child safety by design as part of their inclusive design practices and recognise that their responsibility to user safety does not end at the point of publish. Safeguarding is not and should never be an afterthought.

References

1 NSPCC (2021) *Preventing child abuse together: Our strategy from 2021 onwards.* London: NSPCC. Available from: www.nspcc.org.uk/globalassets/documents/strategy/strategy-2021-31-summary-booklet.pdf [accessed 21/06/23].

2 The Institution of Engineering and Technology (2022) Safeguarding the metaverse. London: IET. Available from: www.theiet.org/media/9836/safeguarding-the-metaverse.pdf [accessed 21/06/23].

3 Limina Immersive (2018) Immersive Content Formats for Future Audiences. *Bristol: Limina Immersive. Available from:* www.immerseuk.org/wp-content/uploads/2018/07/Immersive_Content_Formats_for_Future_Audiences.pdf [accessed 21/06/23].

4 Rees, K. (2022) *These 8 tech giants have invested big in the metaverse* [online]. Available from: www.makeuseof.com/companies-investing-in-metaverse/ [accessed 21/06/23].

5 Newton, C. (2022) *Mark in the Metaverse* [online]. Available from: www.theverge.com/22588022/mark-zuckerberg-facebook-ceo-metaverse-interview [accessed 21/06/23].

6 Limina Immersive (2021) *Limina's 2021 tracker*. Bristol: Limina Immersive.

7 Meta blog authors (2023) *Introducing new parent-managed Meta accounts for families* [online]. Available from: www.meta.com/en-gb/blog/quest/meta-accounts-parent-managed-families/ [accessed 24/06/23].

8 Institute of Engineering Technology (2023) *Pixels overtake playgrounds for kids' social lives* [online]. Available from: www.theiet.org/media/press-releases/press-releases-2023/press-releases-2023-april-june/8-june-2023-pixels-overtake-playgrounds-for-kids-social-lives/ [accessed 12/07/23].

9 Sanchez-Vives, M. & Slater, M. (2005) From presence to consciousness through virtual reality. *Nature Reviews Neuroscience,* 6 (4), pp332–339.

10 Slater, M. (2009) Place illusion and plausibility can lead to realistic behaviour in immersive virtual environments. *Philosophical transactions of The Royal Society B Biological Sciences*, 364 (1,535), pp3,549–3,557.

11 Lee, K. M. (2004) Presence, explicated. *Communication Theory*, 14(1), pp27–50.
Ratan, R. (2012) *Self-presence, explicated: Body, emotion, and identity extension into the virtual self*. In R. Luppicini (Ed.), Handbook of research on technoself. New York: IGI Global.

12 Liao, T., Jennings, N. et al (2019) Could the Virtual Dinosaur See You? Understanding Children's Perceptions of Presence and Reality Distinction in Virtual Reality. *Journal for Virtual Worlds Research*, 12(2).

13 IDC (2023) *AR & VR Headsets Market Share* [online]. Available from: www.idc.com/promo/arvr [accessed 14/08/23].

14 Kovach, C. (2021) *How the metaverse won Christmas* [online]. Available from: www.cnbc.com/2021/12/27/metas-oculus-virtual-reality-headsets-were-a-popular-holiday-gift.html [accessed 21/06/23].

15 Rogan, J. (2022) *Ep. 1853: Mark Zuckerberg* [online]. Available from: https://open.spotify.com/episode/51gxrAActH18RGhKNza598 [accessed 14/08/23].

16 Meta Quest blog authors (2022) *Introducing future VR parental supervision tools to help support families* [online]. Available from: www.meta.com/en-gb/blog/quest/introducing-future-vr-parental-supervision-tools-to-help-support-families/ [accessed 14/08/23].

17 PlayStation (no date) *Parental controls on PlayStation* [online]. Available from: www.playstation.com/en-gb/parental-controls/ [accessed 14/08/23].

18 HTC Vive (no date) *VIVE Guardian: VR parental control solution.* Available from: www.htc.com/blog/vive-guardian-vr-parental-control-solution/ [accessed 21/06/23].

19 Statista.com (2023) *Consideration of registered users and number of monthly and daily active players as differently reported by Fortnite, Roblox and Minecraft.*

20 Statista.com (2023) *Consideration of registered users and number of monthly and daily active players as differently reported by Fortnite, Roblox and Minecraft.*

21 Csikszentmihalyi, M. (1990) *Flow: The Psychology of Optimal Experience.* Available from: www.researchgate.net/

publication/224927532_Flow_The_Psychology_of_Optimal_Experience [accessed 15/08/23].
22 Bailey, J. & Bailenson, J. (2017) *Immersive virtual reality and the developing child*. In: P. Brooks & F. Blumberg (Eds.), Cognitive Development in Digital Contexts (pp181–200). San Diego, CA: Elsevier.
23 Botvinick, M. & Cohen, J. (1998) Rubber hands "feel" touch that eyes see. *Nature*, 391, 756.
24 della Gatta, F., Garbarini, F., Puglisi, P., Leonetti, A., Berti, A. & Borroni, P. (2016) *Decreased motor cortex excitability mirrors own hand disembodiment during the rubber hand illusion*. eLife 5:e14972
25 Yuan, Y. & Steed, A. (2010) *Is the rubber hand illusion induced by immersive virtual reality?* 2010 IEEE Virtual Reality Conference (VR), Boston, MA, USA, 2010, pp95–102.
26 Cooper, N., Milella, F., Pinto, C., Cant, I., White, M. & Meyer, G. (2018) The effects of substitute multisensory feedback on task performance and the sense of presence in a virtual reality environment. *PLoS ONE* 13(2): e0191846. https://doi.org/10.1371/journal.pone.0191846
27 BrandonFM (2021) *The Secrets of VR Chat*, BrandonFM YouTube channel [online]. (For access to other references, see "Note on reading.")
28 Europol (2022) *Policing in the metaverse: what law enforcement needs to know, an observatory report from the Europol Innovation Lab*. p25. Available from: www.europol.europa.eu/publications-events/publications/policing-in-metaverse-what-law-enforcement-needs-to-know#downloads [accessed 13/07/23].
29 Woods, L. & Perrin, W. (2022) *Regulating the future: the Online Safety Bill and the Metaverse*. Carnegie Trust
30 Information Commissioner's Office (2023) TikTok Information Technologies UK Limited and TikTok Inc (TikTok) monetary penalty notice. Available from: https://ico.org.uk/action-weve-taken/enforcement/tiktok/?s=09 [accessed 21/06/23].
31 Researcher interview with law enforcement sector professional.
32 Children's Code, 2021. Section 8. Data , ICO website.
33 Scannell, J. (2012) *Eroom's Law*, Nature Reviews Drug Discovery.
34 Moore, G. (1965) Cramming more components onto integrated circuits. *Electronics*, April 19, pp114–117.
35 Blind, K. (2012) *The Impact of Regulation on Innovation*. Nesta Working Paper 12/02. Available from: www.nesta.org.uk/report/the-impact-of-regulation-on-innovation/ [accessed 15/08/23].

NSPCC

Together, we can stop child abuse and neglect – by working with people and communities to prevent it, transforming the online world to make it safer for children, and making sure every child has a place to turn for support when they need it.

We campaign for change. We work with schools to help children understand what abuse is and support them to speak out. Childline is here, whenever young people need us. And the NSPCC Helpline is ready to respond to adults with any worry about a child. We develop services in local communities to stop abuse before it starts and help children recover, so it doesn't shape their future.

And, above all, we work together – because everyone has a part to play in keeping children safe. Every pound you raise, every petition you sign, every minute of your time, will make a difference.

Together, we can change children's lives.

nspcc.org.uk

EVERY CHILDHOOD IS WORTH FIGHTING FOR