


Immersive Reality

Virtual Reality (VR) | Augmented Reality (AR) | Extended Reality (XR)

 Digital-Technology-Radar.net

	low	medium	high
Impact			
Complexity			

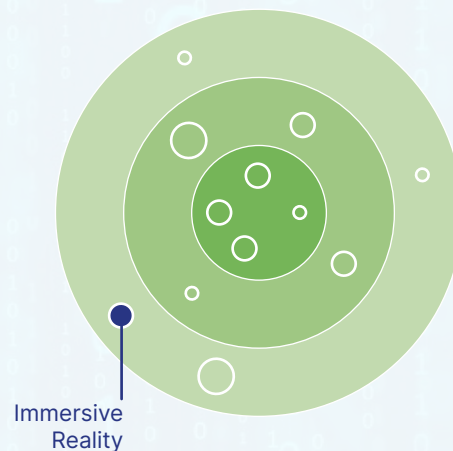
1 INTRODUCTION

Purpose

VR (Virtual Reality), AR (Augmented Reality) and XR (Extended Reality) are immersive technologies designed to create, enhance or simulate experiences by integrating virtual elements into the real world or by creating entirely virtual environments (spatial computing). MR (Mixed Reality) blends elements of AR and VR to create a hybrid experience where digital objects and the real world coexist and interact with each other in real-time. They are used across various fields, including gaming, education, training and remote work, offering users enhanced interactive experiences.

Key benefits

These technologies offer immersive experiences, enhanced engagement and improved training and simulation capabilities, leading to more effective learning, entertainment and communication.



2 KEY CONCEPTS

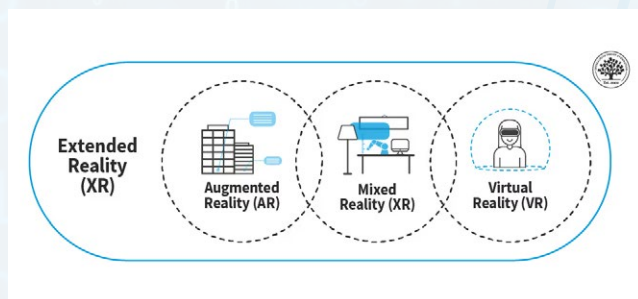
Fundamental principles

- **Virtual Reality (VR):** completely computer-generated environments that users can interact with using VR headsets and controllers.
- **Augmented Reality (AR):** overlaying digital information onto the real-world using devices such as smartphones or AR glasses.
- **Mixed Reality (MR):** a blend of real and virtual worlds where physical and digital objects coexist and interact.
- **Extended Reality (XR):** an umbrella term encompassing VR, AR and mixed reality (MR), combining elements of both physical and virtual worlds.

Terminology

- **Head-Mounted Display (HMD):** a device worn on the head to deliver VR or AR experiences.
- **Tracking:** the process of monitoring user movement and interactions within a VR or AR environment.
- **Spatial Mapping:** creating a digital representation of a physical space to integrate virtual elements seamlessly in AR.
- **Gesture Recognition:** technology that interprets user movements and gestures as input within VR or AR systems.

Overlaps in Extended Realities



Source: www.interaction-design.org

3 POPULAR TOOLS AND FRAMEWORKS

Primary tools

- **Unity:** a popular game engine with robust support for VR and AR development.
- **Unreal Engine:** known for high-quality graphics and VR/AR capabilities.
- **ARKit / ARCore:** frameworks for developing AR applications on iOS and Android, respectively.
- **Oculus SDK:** software development kit for creating VR experiences on Oculus hardware.

Comparison

- **Unity vs Unreal Engine:** Unity offers a more user-friendly interface and extensive asset store, while Unreal Engine excels in high-fidelity graphics and advanced visual effects.
- **ARKit vs ARCore:** both frameworks offer similar features, with ARKit focusing on iOS-specific capabilities and ARCore on Android.

4 APPLICATIONS

Industry use cases

- **Education:** interactive learning tools, virtual field trips, and training simulations. > **Best Practice:** [ClassVR](#).
- **Healthcare:** virtual simulations for surgery training, AR-guided procedures and patient rehabilitation. > **Best Practice:** [Osso VR](#).
- **Remote work:** virtual meetings, collaborative workspaces and remote assistance. > **Best Practice:** [Spatial](#).

Practical examples

- **Oculus Quest:** a standalone VR headset known for its affordability and extensive content library.
- **Microsoft HoloLens:** an AR headset used for enterprise applications and mixed reality experiences.
- **Magic Leap One:** an AR device offering immersive experiences with a focus on spatial computing.

5 IMPLEMENTATION INSIGHTS

Best practices and tips

- **User Comfort:** design experiences that minimise motion sickness and discomfort.
- **Content Optimisation:** ensure high performance and responsiveness for a seamless experience.
- **Hardware Optimisation:** optimise applications to provide a smooth and immersive experience.

Common challenges

- **Motion Sickness:** managing latency and ensuring smooth, natural movement to reduce discomfort.
- **Hardware Limitations:** addressing issues related to device performance, battery life and field of view.
- **User Experience:** ensuring comfort and reducing motion sickness.

6 KEY TRENDS AND PREDICTIONS

Top milestones in VR/AR/XR

- **1968:** [‘The Sword of Damocles’](#), the first head-mounted display, introduced by [Ivan Sutherland](#).
- **1999:** The term ‘Augmented Reality’ was coined by [Thomas Caudell](#).
- **2012:** [Google Glass](#) popularised AR consumer devices.
- **2016:** [Pokémon GO](#) popularised AR gaming among mainstream audiences.

Current trends

- **Social VR:** platforms for virtual social interaction and collaboration.
- **AI Integration:** enhancing VR/AR experiences with artificial intelligence for more dynamic interactions.
- **Metaverse Development:** expansion of virtual worlds and digital environments where users can interact and create.

Future predictions

- **Mixed Reality (MR):** more seamless integration of virtual and physical worlds.
- **Neural Interfaces:** direct brain-to-computer interfaces for more intuitive VR/AR control.
- **Enterprise Applications:** growth in the use of VR/AR/XR for enterprise applications such as remote work, virtual collaboration and training simulations.

Authors



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Torsten established Digital Innovations at Lufthansa, founded the FlyingLab, and was responsible for the digital strategies of Austrian, Lufthansa and Swiss airlines. Today, as the “Inno Doc”, he is digital advisor, coach and catalyst, interim manager and fire fighter for many organisations in their pursuit for digital innovations.

www.inno-doc.com

7 KEY RESOURCES AND MOST HELPFUL LINKS

Websites and blogs

- **Road to VR:** news and insights on VR/AR technology and trends.
- **XR Today:** XR Today is a key resource for news, analysis and insights into the XR space, including AR, VR, and mixed reality. It covers the latest developments in XR technology.
- **ARPost:** ARPost is a site dedicated to AR, VR and XR news. It covers a range of topics.

Online courses

- **Intro to AR/VR/MR/XR:** Technologies, Applications & Issues by University of Michigan.
- **XR Bootcamp:** Learning MR & VR Development.
- **FutureLearn:** Introduction to Virtual, Augmented and Mixed Reality.

Communities and forums

- **VR/AR Association:** industry association providing resources and networking opportunities.
- **AR/VR/MR/XR Community of Practice:** is a tool for locating educational resources.
- **Unity Forum – AR/VR/XR Section:** the Unity Forum’s AR/VR/XR section is a valuable resource for developers and creators.

8 GLOSSARY

Common terms and definitions

- **Field of View (FoV):** the extent of the observable world visible through a VR or AR display, measured in degrees.
- **Latency:** the delay between a user’s action and the system’s response in a virtual or augmented environment, crucial for maintaining immersion.
- **Haptics:** technology that provides tactile feedback, allowing users to feel virtual objects through vibrations or other physical sensations.
- **Six Degrees of Freedom (6DoF):** refers to the ability to move in three-dimensional space with freedom to rotate and translate along the X, Y, and Z axes (up/down, left/right, forward/backward).