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Applications of Immersive Technology in Entertainment and Gaming: A Literature Review

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Abstract: *Games and other forms of digital entertainment are moving off the flat screen and into spaces where the user can look around, move and act. This paper reviews how virtual reality (VR), augmented reality (AR) and mixed reality (MR) are used in gaming and entertainment, and what still holds them back. We drew on thirty-two sources, from journals and conferences to a standards body and industry reports. Our reading suggests that immersive systems can raise participation and open new kinds of play and storytelling, but only when tracking is accurate, delay is low, the hardware is comfortable and the play space is safe. The problems reported most often are cybersickness, eye strain, cost, collisions in the room, harassment in shared worlds and the fact that players can be identified from their motion data. We therefore argue that immersive technology should be judged on comfort, access and careful handling of data as much as on visual realism, and we end with practical suggestions for designers and researchers.*

Keywords: immersive technology; virtual reality; augmented reality; mixed reality; gaming; entertainment; presence; cybersickness

I. INTRODUCTION

A. Background and Motivation

For a long time digital entertainment has been something we watch or control from outside: a film on a screen, a console game steered with a pad, the player on the sofa. Immersive technology tracks where a person looks and moves and updates picture and sound to match, so that the user feels inside the scene. The idea is old. Sutherland built a head-mounted 3-D display in 1968 [1], and the meaning of virtual reality, presence and immersion has been debated ever since [2], [3].

VR replaces what the user sees with a computer-made world, AR adds digital content to the real world through a phone or glasses [4], and MR places digital objects in a real room so that they react to it. The three sit on a continuum rather than in separate boxes [5], and recent work asks for clearer terms [6]. Gaming is the most visible market, but uses now include 360-degree films, virtual concerts, rides and museum visits. The difficulties are just as real: sickness, cost, unpleasant shared worlds, personal data, and VR headset sales that fell in 2025 and early 2026 while AR glasses grew [7], [8].

B. Research Questions

We ask four questions. RQ1: Which forms of immersive technology are used and how do they work? RQ2: Which applications are documented, and on what evidence? RQ3: What benefits and limits appear, especially for comfort, cost, privacy, safety and accessibility? RQ4: Which gaps remain? Sections V to VIII address RQ1 and RQ2, Sections IX to XI RQ3, and Sections XII to XIV RQ4.

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C. Scope and Contribution

Earlier reviews usually cover one technology or problem, such as AR [4], VR and presence [9], cybersickness [10], cultural heritage [11] or the metaverse [12], [13]. We bring these threads together for students and designers, keep research findings apart from product claims, and give the problems as much space as the promise. This is a narrative review with no experiments of our own.

II. LITERATURE REVIEW

The sources fall into four groups: foundations, presence and player experience, comfort, and social use, privacy and accessibility. Table I summarises the main studies.

A. Foundational Concepts and Surveys

Azuma [4] defined AR as combining real and virtual content, interactive in real time and registered in 3-D. Milgram and Kishino [5] placed displays on a continuum from real to virtual, and Rauschnabel et al. [6] updated the vocabulary. Slater and Sanchez-Vives [9] surveyed uses of immersive VR, and LaValle [14] covers tracking, rendering and delay.

B. Presence, Immersion and Player Experience

Slater and Wilbur [3] separated immersion, a property of the system, from presence, the feeling of being there; Slater [15] split presence into place and plausibility illusion; Steuer [2] named vividness and interactivity as its drivers. Cummings and Bailenson [16] found that tracking, stereoscopy and field of view all affect presence, which suggests that responsiveness to the player matters more than detailed graphics.

C. Comfort, Health and Ergonomics

Kennedy et al. [17] developed the sixteen-symptom Simulator Sickness Questionnaire. LaViola [18] discussed the conflict between the eyes and the inner ear, and Rebenitsch and Owen [10] linked cybersickness to individual, device and task factors. Weech et al. [19] found presence and sickness to be negatively related, and Irminanda and Xiong [20] list sickness, eye fatigue, discomfort and collisions as recurring risks in VR gaming.

D. Location-Based AR Games and Health

Pokémon GO brought AR gaming to the mainstream [21]. Hamari et al. [22] found in a survey of 1,190 players that enjoyment, outdoor activity and nostalgia predicted continued play, while privacy concern did not. Howe et al. [23] found about 955 extra steps a day in the first week among 1,182 young US adults, fading over the next five weeks.

E. Social Platforms, Privacy and Safety

Maloney et al. [24] showed that gesture and position are central to communication in social VR, and Blackwell et al. [25] explained why harassment there is harder to govern. Nair et al. [26] identified individual Beat Saber players among more than 55,000 with 94.33% accuracy from 100 seconds of motion, so gameplay data can act as a biometric.

F. Accessibility and Emerging Directions

Zhao et al. [27] built SeeingVR to help low-vision users, Park et al. [28] showed believable language-model agents in a simulated town, and the metaverse literature [12], [13] adds long-term visions with privacy and governance concerns.

G. Synthesis of Agreements, Tensions and Gaps

The studies agree that immersion depends on tracking, delay and interaction [15], [16], that engaging features can also tire or endanger players [10], [20], and that tracking data reveals more than users expect [26]. They disagree on how presence and sickness interact [19], and the AR health benefit is short-lived [23]. Most laboratory work uses short sessions and small samples, unlike real evening-long play.

SUMMARY OF PRINCIPAL REVIEWED STUDIES ON IMMERSIVE TECHNOLOGY IN GAMING AND ENTERTAINMENT

Study and Ref.	Primary Objective	Approach	Scope or Sample	Key Reported Findings	Principal Limitations
Azuma [4]	Define what an AR system needs	Literature survey	AR research up to 1997	Real and virtual content, real-time interaction, 3-D	Pre-dates smartphones

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				registration	
Slater [15]	Explain realistic responses in VR	Theory with experiments	Immersive environments	Place illusion and plausibility illusion	Laboratory evidence
Cummings and Bailenson [16]	Test system features against presence	Meta-analysis	Published experiments	Tracking, stereoscopy and field of view raise presence	Older hardware
Irmiananda and Xiong [20]	Identify ergonomic risks in VR gaming	Literature synthesis	VR gaming studies	Sickness, eye fatigue, discomfort, collisions	No new trial
Hamari et al. [22]	Find why people play AR games	Online survey	1,190 Pokémon GO players	Enjoyment, activity and nostalgia drive play	Self-reported; one game
Howe et al. [23]	Measure effect of Pokémon GO on activity	Cohort study	1,182 US adults aged 18–35	About 955 extra steps a day in week one, then fading	Six-week follow-up
Nair et al. [26]	Identify players from motion	Machine learning on telemetry	55,541 Beat Saber players	94.33% identification from 100 s of motion	One game

Source: Compiled by the authors from the cited publications. Findings are reported as stated by the original authors.

III. OBJECTIVES OF THE STUDY

- Explain the main forms of immersive technology and how they work (Section V).
- Document their uses in gaming (Section VI) and entertainment (Section VII), and compare documented examples (Section VIII).
- Weigh benefits against limits in cost, comfort, privacy, safety and accessibility (Sections IX to XI).
- Identify gaps and give practical recommendations (Sections XII to XIV).

IV. RESEARCH METHODOLOGY

A. Review Design and Information Sources

We followed a narrative review design, reading theory, surveys, experiments and industry reports side by side without pooling results. We began with the student authors' seminar report, built on three core papers [4], [9], [20], and extended it through searches of publisher sites, proceedings and project pages in October 2026.

B. Search Strategy, Screening Criteria and Appraisal

Search terms combined technology and application words, such as VR games, AR games, 360-degree storytelling, virtual concerts, cybersickness and VR privacy. We preferred peer-reviewed work from 2016 onward plus classic papers from 1968 to 2009, and kept a source only if its method and sample were clear. Industry and press reports [7], [8], [29] are used only for market context, and key figures from [7], [8], [22] and [26] were checked against the originals.

V. TECHNOLOGY FOUNDATIONS

A. Historical Development

Sutherland's 1968 display already tracked the head [1], but consumer products waited for cheap phones and sensors. The 1990s gave the field its vocabulary [2], [4], [5], Pokémon GO reached a mass audience in 2016, and attention has since shifted toward lighter wearables [7], [8] (Table II).

TABLE II: SELECTED MILESTONES IN THE DEVELOPMENT OF IMMERSIVE TECHNOLOGY FOR ENTERTAINMENT

Year	Milestone	Why It Matters for Gaming and Entertainment
1968	First head-mounted 3-D display with head tracking [1]	A view that follows the user's head
1992–1997	Definitions of telepresence, mixed reality, AR and	Shared vocabulary for the field

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	immersion [2]–[5]	
2016–2020	Pokémon GO; consumer headsets [9]; Beat Saber, Half-Life: Alyx, Fortnite concert	AR and VR reach mass audiences
2023–2024	Motion-data identification study [26]; Apple Vision Pro released	Privacy becomes a design issue; MR reaches products
2025–2026	VR shipments fall while AR glasses grow [7], [8]; ergonomic synthesis [20]	Shift toward lighter, more comfortable devices

Source: Compiled by the authors from the cited studies and public product history.

B. Virtual Reality

A VR headset shows each eye a slightly different image and tracks head and hands; when it responds correctly, people act as if the world were real [9]. Tethered headsets offer better graphics, standalone ones easier setup.

C. Augmented Reality

AR draws content over the real world on a phone or transparent lenses, registered to the scene as the user moves [4]; location-based games add GPS [21]. It is the cheapest route into immersive play, though less enveloping.

D. Mixed Reality

MR maps floors, walls and furniture so that digital objects respond to the room, often through pass-through cameras that blur VR and MR, which is why the continuum of Milgram and Kishino [5] is still useful (Fig. 1, Table III).

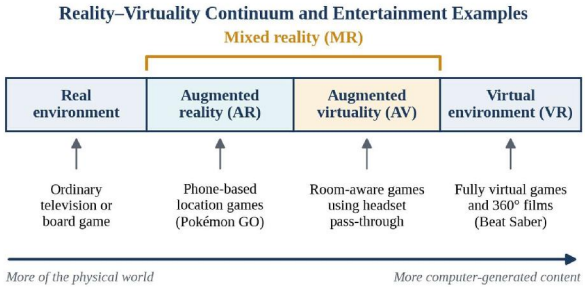


Fig. 1. Reality–virtuality continuum with typical entertainment examples. Adapted from the taxonomy of Milgram and Kishino [5]; the placement of the examples is illustrative.

TABLE III: COMPARISON OF VR, AR AND MR FOR ENTERTAINMENT AND GAMING

Dimension	Virtual Reality (VR)	Augmented Reality (AR)	Mixed Reality (MR)
Equipment	Headset with controllers or hand tracking	Smartphone, tablet or AR glasses	Headset with cameras and depth sensing
Strengths for play	Strongest presence; full control of the world	Low cost; easy to share; tied to real places	Uses the real room as the game space
Main limits	Cost; cybersickness; hides the room	Weaker immersion; outdoor safety	Costly; sensing fails in poor light

Source: Authors' synthesis of the cited literature.

E. System Components and Working Process

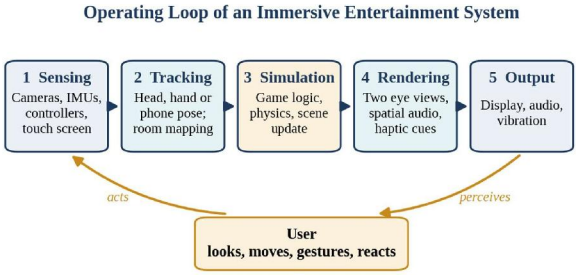
Table IV lists the main components and Fig. 2 the loop of sensing, tracking, simulation, rendering and output. A delay of about 20 ms or less between head movement and image is a common target [14], since longer delays add to sickness [18]. The OpenXR standard [30] gives applications one interface to many headsets.

TABLE IV: MAIN COMPONENTS OF AN IMMERSIVE ENTERTAINMENT SYSTEM

Component	Purpose	Typical quality concern
Display or headset	Shows the virtual or combined scene	Weight, field of view, resolution
Cameras, sensors and controllers	Track movement, map the room, let the user grab and throw	Drift; poor lighting; arm fatigue

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Processor and graphics	Render both eyes at a high frame rate	Heat, battery, dropped frames
Audio, haptics and network	Spatial sound, touch cues, shared views in sync	Tracking accuracy; delay and jitter



Source: Authors' synthesis of the cited literature.

Fig. 2. Operating loop of an immersive entertainment system. Each cycle must finish quickly enough for the scene to keep up with the user's movement.

VI. APPLICATIONS IN GAMING

A. VR Games

Beat Saber, adventure games and simulators use natural movement, and Half-Life: Alyx showed that a full story game can work in VR. Free movement risks sickness [10], so titles use teleportation or snap-turning [31], and the play area must be kept clear [20].

B. AR and Location-Based Games

Pokémon GO got many people walking [21], [22], but the gain was modest and short-lived [23], and players must watch the street while looking at a screen.

C. MR and Room-Scale Games

MR games turn the player's own room or table into the board. They depend on room mapping and are less studied.

D. Motion and Fitness Games

Dance and boxing titles double as exercise, but lasting benefit is unproven [23] and vigorous play risks strain [20].

E. Social and Multiplayer Worlds

VRChat and Rec Room rely on tracked body language [24], which also makes harassment serious [25]; muting, blocking and reporting belong in the core design.

F. Games and Artificial Intelligence

AI characters that plan and remember [28] could replace scripted dialogue once tested for reliability and safety.

VII. APPLICATIONS IN ENTERTAINMENT

A. 360-Degree Video and Cinematic VR

Because viewers choose where to look, directors must guide attention with sound and staging, a new screen grammar [32].

B. Virtual Concerts and Shared Events

Fortnite's "Astronomical" concert in April 2020 reportedly drew over 12.3 million concurrent players [29], though on ordinary screens rather than headsets.

C. Theme Parks and Location-Based Entertainment

VR coasters and free-roam arenas must match what riders see to what they feel, since mismatch causes sickness [18].

D. Interactive Storytelling

When the audience can move inside a story, designers must decide how much freedom to give and how to guide attention.

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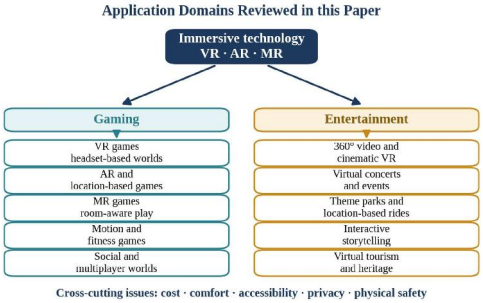


Fig. 3. Gaming and entertainment applications of VR, AR and MR covered in this review, together with the issues that cut across all of them.

E. Virtual Tourism and Cultural Heritage

Virtual museums and reconstructions widen access to heritage [11], although they cannot replace a real visit.

VIII. DOCUMENTED EXAMPLES AND PLATFORMS

Table V separates peer-reviewed evidence from company and press figures that we could not check.

TABLE V: DOCUMENTED EXAMPLES OF IMMERSIVE GAMING AND ENTERTAINMENT AND THE EVIDENCE AVAILABLE FOR EACH

Example (Developer, Year)	Technology	Entertainment Use	What Is Documented	Evidence Type	Reported Constraint
Pokémon GO (Niantic, 2016)	AR on phones with GPS	Location-based game	Player survey [22]; about 955 extra steps a day in week one [23]	Peer-reviewed	Gain not sustained
Beat Saber (Beat Games, 2018)	VR rhythm game	Slashing blocks to music	Motion data of 55,541 players used for identification [26]	Peer-reviewed	Motion reveals identity
Fortnite "Astronomical" (Epic Games, 2020)	Screen-based 3-D event	Virtual concert	More than 12.3 million concurrent players [29]	Public report	Company figure
Social VR (VRChat, Rec Room)	VR and flat screen	Social play and events	Non-verbal communication [24]; harassment [25]	Peer-reviewed	Moderation challenges

Source: Compiled by the authors from the cited studies and public reports.

IX. COMPARATIVE DISCUSSION

A. Traditional and Immersive Experiences

TABLE VI: COMPARISON OF TRADITIONAL AND IMMERSIVE ENTERTAINMENT EXPERIENCES

Feature	Traditional Experience	Immersive Experience	Qualification
Presence	Player outside the scene	Player inside the scene [3], [15]	Depends on field of view and delay
Interaction	Buttons, touch or remote	Hands, body, gesture and voice	Movement can tire the user
Cost and comfort	Lower cost; familiar	Higher cost; possible discomfort	Varies by device and person [10]
Accessibility	Mature options such as subtitles	Emerging tools [27]	Often added late

Source: Authors' synthesis of the reviewed studies.

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B. Immersion Versus Comfort

Better tracking and field of view raise presence [16] but can raise discomfort [10]; since the two are negatively related [19], designers should start with comfortable motion and add intensity gradually [31].

C. Choosing Between VR, AR and MR

AR suits reach on devices people already own, VR suits controlled worlds, and MR suits room-based play; a mix often works best.

D. Cost, Access and the Market

VR and MR shipments were expected to fall 42.8% in 2025 [7], and in early 2026 VR fell 17% while AR glasses grew 136% [8], suggesting that light, affordable devices matter more than spectacle.

E. Quality of the Evidence

Much of the literature is descriptive, samples are often young adults [23], and audience figures come from companies [29].

F. Measuring Immersive Experiences

TABLE VII
COMMON MEASURES USED TO EVALUATE IMMERSIVE ENTERTAINMENT AND GAMING

Aspect	Typical Measure	Example from the Reviewed Studies	Caution
Comfort	Symptom questionnaire	Sixteen-symptom SSQ [17]	Built for simulators
Engagement	Surveys of enjoyment	1,190 Pokémon GO players [22]	Self-reported
Physical activity	Daily step counts	About 955 extra steps a day [23]	Short follow-up
Privacy risk	Identification accuracy	94.33% from 100 s of motion [26]	Shows risk only

Source: Authors' synthesis of the reviewed studies.

X. BENEFITS AND CHALLENGES

A. Benefits

- Natural interaction and strong presence [9], [16]; new storytelling [32] and shared experiences [24]; outdoor activity
  [22] and access to distant sites [11].

B. Challenges

- Cost [7]; sickness and fatigue [10], [20]; tracking errors and delay [4], [14]; identification from motion [26]; harassment [25]; weak accessibility [27].

TABLE VIII: SUMMARY OF CONDITIONAL ADVANTAGES AND CORRESPONDING LIMITATIONS OF IMMERSIVE TECHNOLOGY

Dimension	Conditional Advantage	Corresponding Limitation or Requirement
Presence	Tracking and low delay raise presence [16]	Poor motion design causes sickness [10]
Social play	Avatars let distant people meet [24]	Harassment and moderation problems [25]
Tracking data	Accurate, personalised play	Motion data can identify individuals [26]

Source: Authors' synthesis of the reviewed studies.

XI. PRIVACY, SAFETY, ACCESSIBILITY AND RESPONSIBLE DESIGN

A. Privacy

Motion alone can identify a player among 50,000 [26], so telemetry may not stay anonymous even if players seem unconcerned [22].

B. Physical Safety and Health

Boundaries, clear space and short sessions matter in headsets [20], and AR content should stay away from traffic.

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C. Conduct and Moderation

Abuse feels personal when avatars share space [25], so safety tools must be easy to find from launch.

D. Accessibility and Inclusion

Seated, one-handed, subtitled and reduced-motion options should ship at launch, building on tools such as [27].

E. Governance

Clear consent, limits on keeping motion data and age-appropriate settings can be adopted now [12].

XII. LIMITATIONS, OPEN CHALLENGES AND FUTURE DIRECTIONS

A. Limitations of This Review

This narrative review may miss studies, uses some figures from abstracts and industry sources, and runs no experiments.

B. Principal Challenges

- Established: cybersickness [10], [19]; cost and weight [8].
- Emerging or active: long-term evidence [23]; motion privacy [26]; accessibility [27]; social safety [25]; AI characters [28].

C. Future Directions

Fig. 4 maps the gaps to directions: lighter AR glasses [8], cross-device standards [30], controllable AI characters [28], better accessibility [27], privacy-preserving motion data [26] and, above all, longer studies of ordinary players.

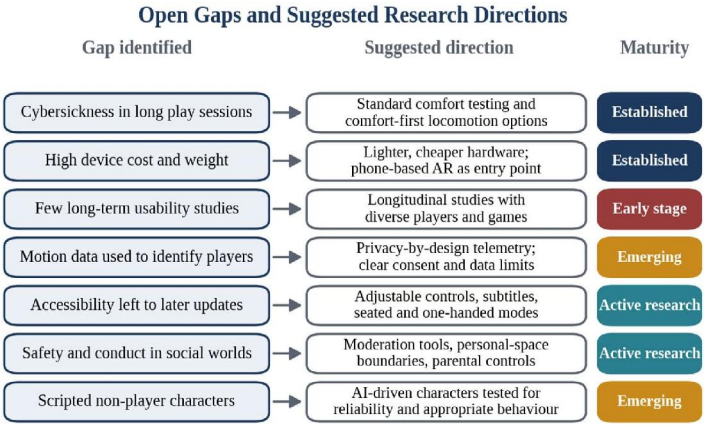


Fig. 4. Gaps identified in the reviewed literature, with suggested research directions and an indication of how mature each topic is.

XIII. CONCLUSION

Across thirty-two sources, immersive technology offers natural interaction, presence, new storytelling and shared experiences [9], [16], [32], but these depend on tracking, low delay, comfort and safety [10], [20], and problems remain in privacy, harassment, accessibility and long-term evidence [25]–[27]. As the market moves toward lighter AR devices [7], [8], usability testing with a wider range of players is the natural next step.

XIV. PRACTICAL RECOMMENDATIONS

A. Guidelines for Designers and Developers

- Design for comfort first [31], keep delay low [18], and add boundaries and break reminders [20].
- Build in accessibility [27], collect minimal tracking data [26], provide safety tools [25] and use OpenXR [30].

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B. Guidelines for Researchers and Educators

- Run longer, more varied studies [23], report devices and questionnaires [17], check company figures [29], [7], and use phone-based AR for low-cost teaching.

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