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Xi (Amelia) Li

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Technology-Infused Gamification in Location-Based Entertainment

Xi (Amelia) Li

Abstract

This article is adapted from the speech titled *Tech-Infused Gamification in LBE Experiences*, delivered at the SATE Asia 2024 conference at Hong Kong Disneyland Hotel, by Xi (Amelia) Li.¹ By integrating AI, XR, and interactive design, gamification increases immersion, social interaction, and player agency. From theme parks to museums, real-world case studies illustrate how cutting-edge technologies create more engaging and memorable experiences. Finally, this article examines the future of LBE, where digital and physical play continue to merge, shaping the next generation of entertainment.

Key Words

Gamification, location-based entertainment, AI, XR, interactive design

Introduction

Location-based entertainment (LBE) has always been about immersing guests in unforgettable experiences. Whether in theme parks, museums, or interactive installations, the goal is to spark wonder, engagement, and connection. As technology evolves, gamification has become a powerful tool to elevate these experiences, making them more interactive, social, and personalized.

As a game designer specializing in interactive, lighting, and experience design, my journey began with a childhood visit to Hong Kong Disneyland. The magic of that moment sparked a passion for creating immersive environments and ultimately shaped my career. In 2024, I had the opportunity to present at the SATE Asia conference at Disneyland Hotel, where I discussed how technology is transforming LBE through gamification.

This article explores the evolving relationship between technology and gamification in LBE, drawing from my experiences and industry case studies. We'll start by examining why gamification is a valuable tool in LBE, then break down key techniques that enhance engagement. Finally, we'll explore how AI and XR are reshaping interactive experiences and what the future may hold for tech-driven LBE.

1. The Value of Gamification in Location-Based Entertainment

Gamification—the application of game design elements in non-game contexts—has proven to be a highly effective strategy for enhancing engagement in LBE. By integrating interactivity, decision-making, and social play, gamification transforms passive experiences into dynamic and participatory ones. This transformation is critical in today's entertainment landscape, where guests seek more than just visual spectacle—they want to be part of the action.

One of the earliest examples of gamification in LBE dates back to 1955 with Disneyland's Autopia. Unlike traditional rides where guests passively experience the attraction, Autopia gives visitors control of a car, allowing them to steer, accelerate, and interact with others on the track.² This exemplifies three core elements of gamification:

1.1. Interactivity: Transforming Guests into Active Participants

Unlike traditional amusement park rides where riders passively move along a track, Autopia puts guests in the driver's seat. Riders had real control over a car, making decisions in real time—how to steer, when to accelerate, and how to navigate the winding road. This active

participation enhances engagement, as players shape their own experience rather than merely observing.

1.2. Agency & Control: Giving Players Meaningful Decisions

A fundamental aspect of gamification is giving players a sense of control over their experience. In Autopia, guests weren't just following a pre-set path; they had agency over their movement. While Disneyland later added a center guide rail in 1965 for safety, the attraction continued to allow for meaningful decisions—riders could adjust speed, react to other drivers, and feel like they were truly in charge of their journey.

1.3. Social Play: Encouraging Shared Experiences

Autopia wasn't just about driving—it was a social experience. With multiple cars on the track at once, guests could race alongside friends or family, creating spontaneous interactions and lighthearted competition. This social dynamic enhances enjoyment and engagement, as players are not only immersed in their own experience but also interacting with others.

The principles demonstrated by Autopia—interactivity, agency, and social play—remain essential components of gamified LBE experiences today. Research

in entertainment psychology suggests that autonomy, mastery, and relatedness are key drivers of engagement.³ Gamification aligns with these psychological needs, making experiences more immersive, memorable, and rewarding.

Beyond boosting engagement, gamification also improves retention and emotional connection. Active participation has been shown to enhance memory more effectively than passive observation. This is especially valuable in educational and cultural LBE settings, where gamification can turn museums, science centers, and heritage sites into interactive spaces that blend learning with play.

Moreover, in an era where digital experiences dominate, LBE must offer something unique to compete with at-home entertainment options. Gamification introduces a layer of personal involvement that cannot be replicated through passive media, reinforcing the distinct appeal of physical, real-world experiences.

2. Key Gamification Techniques in LBE

Gamification in LBE is not a one-size-fits-all approach; rather, it relies on a variety of techniques tailored to the



Figure 1. Cycled out Autopia Mark IVs & Tomorrowland Autopia, Disney History 101.²



Figure 2. Super Mario World at Universal Studios Hollywood (photo by Morgan Overholt/ HeyOrlandocom).⁵

unique characteristics of each attraction. Many of these techniques have their roots in digital games, where mechanics such as goal progression, open-ended play, competition, and exploration have been extensively studied and refined. By adapting these techniques into physical spaces, LBE designers create experiences that feel engaging, interactive, and rewarding, much like playing a video game. Below, we explore four key gamification strategies that enhance interactivity in LBE: goal-setting, open-ended play, competition & cooperation, and exploration & discovery.

2.1. Providing a Goal: The Power of Objectives & Progression

One of the most fundamental game mechanics is the presence of a clear goal, whether it's collecting points, completing challenges, or reaching an endpoint. Goals provide players with a sense of purpose and motivation, which is why many gamified LBE experiences incorporate scoring systems, achievements, or level progression.

For example, at Super Nintendo World, guests use Power-Up Bands to collect digital coins, complete mini-games, and compete for high scores. Their rankings are displayed in a linked app, mirroring the structure of video games. This creates an incentive for guests to engage repeatedly and improve their performance over time.

Even simple goal-setting can drive engagement. Consider interactive museum exhibits where visitors solve puzzles to unlock historical secrets or theme park attractions with hidden Easter eggs that encourage guests to return for multiple visits.

Research suggests that goal-setting increases motivation and engagement,⁴ making this technique a powerful tool for designing interactive LBE experiences.

2.2. Open-Ended Play: Encouraging Creativity & Exploration

Not all gamified experiences need strict objectives. Sometimes, the most compelling form of engagement comes from open-ended, toy-like interactions that



Figure 3. Laser Graffiti at Hopscotch San Antonio, Todd Moyer Design.⁶

encourage creativity and self-expression. In these experiences, guests are given tools to experiment and explore rather than a structured path to follow.

A great example of this approach is interactive digital art installations. At the Hopscotch in San Antonio, Texas, an exhibit allowed visitors to use a paint-sprayer-like device to create digital murals on a projection wall. There were no instructions or objectives—visitors picked up the tool and began experimenting. This sandbox-style interaction fosters intrinsic motivation, allowing participants to play on their terms.

The psychological basis for open-ended play is strong. Studies on self-determination theory (Ryan & Deci, 2000) show that providing players with autonomy and creative freedom enhances engagement and emotional connection to an experience.

2.3. Competition & Cooperation: Social Interaction as a Game Mechanic

One of the most powerful elements of gamification is

its ability to create social engagement. Whether through competitive challenges or cooperative problem-solving, LBE experiences often use social play to deepen immersion and enjoyment.

2.3.1. Competition: Adding Challenge & Variety

Competition introduces stakes and unpredictability, making experiences more dynamic and engaging. Attractions like Toy Story Midway Mania! Disney parks and Universal's upcoming interactive water battle ride both use score-based mechanics to encourage guests to compete with each other. By adding real-time feedback, leaderboards, and variable outcomes, competition increases replay value and excitement.

Beyond amusement parks, competitive gamification is also widely used in esports arenas, location-based VR, and team-based attractions. For instance, VR escape rooms challenge teams to complete objectives faster than rival groups, blending both physical and digital competition.



Figure 4. Photograph of Omega Mart, Meow Wolf Las Vegas.⁷

2.3.2. Cooperation: Strengthening Social Bonds

On the flip side, cooperation encourages teamwork and shared problem-solving. In the video game *Overcooked*, players must work together to manage a chaotic kitchen. This same cooperative mechanic has been adapted into real-world escape rooms, where players collaborate to solve puzzles within a time limit.

Another example is the *Star Wars: Galaxy's Edge* “Batuu Bounty Hunters” experience at Disneyland. Players use AR-enabled MagicBands to locate hidden bounties, requiring teamwork and strategic exploration. Cooperative experiences like these create strong social memories and encourage group participation.

Competitive and cooperative mechanics are often combined in LBE to balance social dynamics. Whether through team-based missions, leaderboards, or shared objectives, social play remains one of the strongest motivators for engagement.

2.4. Exploration & Discovery: Rewarding Curiosity

Another compelling gamification technique is hidden content and interactive exploration. This approach taps into players’ natural curiosity by offering secret interactions, Easter eggs, and non-linear storytelling.

One of the best examples of exploration-based gamification is Meow Wolf’s Omega Mart in Las Vegas. This immersive, interactive art installation turns a seemingly ordinary supermarket into a portal to bizarre, fantastical worlds. Visitors are encouraged to freely navigate the open space, choosing their path to explore. The supermarket setting hides secret doors, puzzles, and hidden narratives behind everyday items, creating a sense of mystery and excitement. Guests are not guided by a set route, allowing them to engage with the space at their own pace, discovering new layers of the story with each visit. This open-ended exploration fosters curiosity and personal connection, making the experience feel unique and rewarding.

The key to successful exploration-based gamification is providing just enough hints to spark curiosity without

revealing too much. This creates a sense of mystery and anticipation, which are powerful engagement drivers.

Exploration also plays a major role in mixed-reality (MR) attractions. For example, a recent MR butterfly trail in Central London allowed guests to discover digital butterflies through their phone cameras, blending real-world landscapes with virtual creatures. These types of experiences demonstrate how technology can enhance traditional gamification techniques by adding interactive digital layers to physical environments.

3. How Technology Enhances Gamification in LBE

Technology plays a key role in enhancing gamification by enabling deeper interactivity, personalization, and immersion. With tools like Artificial Intelligence (AI), Extended Reality (XR), and real-time data tracking, players' interactions with location-based entertainment (LBE) are redefined. These technologies go beyond adding interactivity; they transform how players perceive and engage with their environment, dynamically adjusting to behavior and sustaining immersion.

3.1. Artificial Intelligence (AI) and Personalization

One of the most exciting technological advancements in gamified LBE is Artificial Intelligence (AI). AI enables real-time recognition and response, allowing interactive installations to react intelligently to user behavior.

3.1.1. AI Detection & Recognition

AI enables real-time recognition and response, allowing interactive installations to react intelligently to user behavior. For instance, AI-driven face-tracking technology has been used to create interactive mirrors where guests can see themselves wearing different digital disguises, such as Peking opera masks. This application showcases how AI can personalize interactions in a way that feels natural and engaging. In a broader sense, AI can also facilitate adaptive gameplay by analyzing guest actions and adjusting challenges or rewards accordingly, making every visit unique. Beyond personal engagement, AI-driven NPCs (non-playable characters) enhance immersion by making interactions more responsive and dynamic. For example, in theme parks or interactive theater experiences, AI-powered characters can adapt their dialogue and behavior based on guest input, offering unique story paths and



Figure 5. Eutrosat Coastality - The Phantom of the Opera, Europa Park.⁹

challenges. This level of personalization increases emotional investment and replayability, core elements of successful gamification.

3.1.2. AI-Generated Content (AIGC)

Generative AI is further pushing the boundaries of LBE gamification. Museums, for example, have begun integrating AI systems that allow guests to generate content through play. At the Cooper Hewitt Museum, visitors can search for artworks by sketching shapes, with AI recognizing the patterns and curating relevant results in real time.⁸ Other installations use generative AI to transform visitor input into new digital creations, such as designing personalized virtual artifacts based on drawings or gestures. AI-driven chatbots and virtual assistants can also provide interactive storytelling elements, allowing guests to engage with digital guides that respond dynamically to their choices and actions. These applications emphasize how AI can empower guests as co-creators of their own experiences, reinforcing a sense of agency and discovery.

3.1.3. AI-Driven Procedural Content Generation

AI-driven procedural content generation plays a pivotal role in enhancing gamified LBE experiences by creating dynamic, responsive environments that evolve in real time. Through advanced algorithms, AI can construct unique game settings, puzzles, and challenges, ensuring that each visitor's experience is distinct. For instance, an AI-powered haunted house can analyze guest reactions and modify its scare tactics, puzzles, and enemy behaviors accordingly, crafting a more immersive and personalized horror experience. Beyond haunted attractions, procedural generation can drive engagement in adventure-based LBE experiences by generating quests, storylines, and objectives tailored to guests' preferences and past interactions. This fosters a non-linear, player-driven narrative where each decision actively shapes the environment and interactions. In escape rooms, AI can assess participant strategies and introduce new obstacles or dynamic hints, ensuring the challenge remains engaging without becoming predictable or repetitive. On a larger scale, theme park attractions can leverage AI to generate varied ride experiences, altering settings, NPC interactions, or environmental details for each visit, thereby maintaining freshness and encouraging repeat attendance. By continuously adapting to individual behaviors and external conditions, AI-driven procedural content generation not only enhances immersion but also strengthens long-term engagement, making each encounter feel novel and rewarding.

3.2. Extended Reality (XR): Augmented Reality (AR), Mixed Reality (MR), and Virtual Reality (VR)

Beyond AI, Extended Reality (XR) technologies such as Augmented Reality (AR), Mixed Reality (MR), and Virtual Reality (VR) have significantly enhanced gamified experiences in LBE. The XR technologies discussed in this topic are not limited to headsets or glasses; they encompass any device or system capable of adding digital content to the physical world, according to the definition of XR. These technologies broaden the boundary of traditional LBE, offering new potential to interact with spaces and narratives.

3.2.1. Augmented Reality (AR)

AR overlays digital content onto the real world, allowing guests to interact with virtual objects in physical spaces. A recent example is an AR butterfly trail in Central London, where visitors use their smartphones to see virtual butterflies land on their fingertips. This type of gamification encourages exploration by blending physical and digital elements seamlessly.

3.2.2. Virtual Reality (VR)

Meanwhile, Virtual Reality (VR) takes immersion to the next level by fully transporting guests into entirely digital worlds, visually engaging them with vibrant, interactive environments. However, VR experiences extend beyond just visual immersion by incorporating physical sensations like acceleration, temperature, and even motion, synchronizing the real-world movements of guests with their virtual counterparts. This fusion of sensory input ensures a seamless, multi-sensory experience that enhances the feeling of presence in a digital world. For example, in the Europa-Park VR coaster, the riders not only see themselves in a virtual Paris Opera House but also feel the physical rush of acceleration and the wind as they experience the ride. With the VR headset on, guests are fully immersed in the story, flying through the grand auditorium while experiencing every twist and turn, combining sensory excitement with interactive storytelling. This integration of virtual environments and real-world physical sensations makes the experience far more engaging and immersive, providing a compelling adventure that goes beyond traditional rides.

3.2.3. Mixed Reality (MR)

MR technology blends digital elements seamlessly into the physical world, breaking the boundaries of what is traditionally possible by merging the virtual and real. Unlike AR and VR, MR creates an interactive environment where digital objects can interact with



Figure 6. Embark on The Butterfly Trail, Outernet's Magical Mixed Reality Experience .¹⁰

physical objects, offering a more grounded and immersive experience. MR provides the sensation of “ground truth,” meaning that digital elements are not just superimposed—they are integrated in a way that they feel as if they coexist with the real world.

A compelling example of MR in action is the butterfly trail in Outernet London. Visitors can use their smartphones to see virtual butterflies, which appear to land on their fingertips. The digital butterflies are not simply floating in front of the visitors—they are anchored to real-world surfaces, appearing as if they are physically interacting with the environment. The blend of the real and digital provides an enhanced sense of immersion, where the digital butterflies feel like part of the physical space.

Another striking example of MR is the MR Ferris wheel experience. As guests ride the Ferris wheel, MR glasses overlay digital content onto the real-world cityscape, such as historical reconstructions of landmarks layered over the actual skyline. This form of MR interaction not only enhances the visual experience

but also adds layers of gamified storytelling. Players can solve challenges related to different historical periods as they ascend, engaging with both the real environment and virtual elements in a way that feels seamless and dynamic. The ability to blend digital content with physical surroundings in real time gives MR a unique advantage in creating immersive, interactive experiences that are grounded in reality while pushing the boundaries of what is possible.

3.3. Real-Time Data and Adaptive Interactions

Real-time data tracking is another vital technological element in gamified LBE experiences. By capturing and analyzing player behavior and performance, attractions can adjust gameplay in real time, creating dynamic challenges and personalized rewards. For example, interactive rides or exhibits that monitor guest progress can offer tailored challenges or bonuses based on a player's actions. This personalization fosters deeper engagement, as players are consistently presented with experiences that cater to their skills and preferences.

Real-time data can also enhance social interaction and competition within LBE environments. Gamified attractions often feature leaderboards or real-time progress tracking, allowing guests to compete or cooperate with others. By integrating social features into the experience, such as competitive rankings or shared challenges, technology further amplifies the social aspect of gamification, encouraging players to engage with both the digital and physical worlds around them.

4. The Future of Technology-Infused Gamification in LBE

As we've seen, technology and gamification have the power to elevate Location-Based Entertainment (LBE), making it more immersive, personalized, and engaging. However, this symbiotic relationship works in both directions. Not only does gamification in LBE offer new, dynamic experiences for visitors, but LBE itself is also having a profound impact on the digital game industry and technological development. The evolution of LBE is setting the stage for new markets, new forms of gaming, and new technological innovations that will shape the future of both industries.

4.1. LBE's Impact on the Digital Game Industry

LBE has become a powerful showcase for digital gaming IPs and the next generation of interactive experiences. Companies like Ubisoft are at the forefront of this shift, using LBE to bring their popular digital franchises to life. Ubisoft, for instance, is developing large-scale theme parks based on its successful video game IPs. This move is not just about translating video games into physical attractions; it's about bringing gaming elements into the real world in ways that were previously unimaginable. LBE offers an immersive, interactive environment that amplifies the storytelling, collaboration, and competitive elements of digital games.

By bringing video games into LBE, Ubisoft and others are not only extending the reach of their franchises but also creating new forms of interactive entertainment that appeal to a wider audience. For example, guests can now step into a living, breathing version of their favorite digital world, where they can interact with the environment, solve puzzles, and experience storylines in real-time. This integration of gaming elements into LBE adds a new layer to the gaming experience, turning passive players into active participants.

4.2. Technology as a Showcase in LBE

Beyond gaming IPs, LBE is also becoming a platform for showcasing emerging technologies. New rides and attractions are being designed not only for entertainment but also as demonstrations of cutting-edge technologies. A prime example is Disney's reimagined Test Track ride.¹¹ This ride will celebrate innovation by taking guests on a journey from the past to the future, integrating real-world technological advancements into the experience. Visitors will be able to see and interact with futuristic vehicles and technologies, giving them a taste of what's to come in the world of transportation.

Similarly, LBE environments provide the perfect setting for showcasing emerging technologies. For instance, autonomous vehicles or autopilot systems could be demonstrated in a futuristic LBE attraction where guests experience firsthand how these technologies work, perhaps through a simulated road trip or immersive experience. Other examples might include AI-driven virtual assistants, wearable tech that enhances interaction, or mixed-reality experiences that bring digital and physical worlds together in new ways. These experiences not only entertain but also educate guests about the potential of these technologies, fueling curiosity and excitement for the future.

4.3. A Growing Market of LBE and Technology Integration

As LBE continues to evolve, it's clear that a significant market will emerge, driven by both the demand for more immersive experiences and the need to demonstrate the capabilities of emerging technologies. This growing market will push the development of new attractions, technologies, and gaming experiences that blend physical and digital worlds in ever more sophisticated ways. The integration of gaming elements and interactive technologies into LBE will continue to attract both traditional entertainment fans and technology enthusiasts, making LBE a central space for the showcasing and adoption of new technologies.

5. Conclusion

In conclusion, the integration of gamification and technology has the power to transform Location-Based Entertainment (LBE) into a dynamic and immersive experience. As discussed throughout this paper, techniques like goal-setting, competition, and choice enhance engagement in LBE environments. Meanwhile, technologies such as Artificial Intelligence (AI), Mixed Reality (MR), and Virtual Reality (VR) add

personalization, immersion, and social interaction that elevate guest experiences.

Beyond entertainment, LBE also influences the digital gaming industry and tech development. It brings game IPs to life and showcases emerging technologies in accessible and exciting ways. This convergence points to a new era where gaming, technology, and physical experiences blend seamlessly.

Looking ahead, the growing market for tech-infused LBE will continue to drive innovation. From interactive storytelling to showcasing breakthroughs like autonomous vehicles, LBE offers endless possibilities. It is becoming a unique platform where creativity and technology converge to create lasting memories and

reshape how we experience the world.

Carnegie Mellon University

XI LI graduated from the Master of Entertainment Technology program at Carnegie Mellon University. With an academic background in Digital Media Art from the Communication University of China, her research focuses on the intersection of gamification, interactive design, and emerging technologies in Location-Based Entertainment experiences.

Editor: Yao Xiao

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技術賦能的實地娛樂遊戲化體驗

李希

摘要：本文改編自李希（Amelia Li）於 2024 年 SATE 亞洲論壇在香港迪士尼樂園酒店發表的主題演講《技術賦能的實地娛樂遊戲化體驗》。透過融合人工智慧（AI）、擴增實境技術（XR）與互動設計，遊戲化顯著提升了沉浸感、社交互動以及玩家的自主性。從主題樂園到博物館，多個實際案例展示了前沿技術如何打造更具吸引力與記憶點的體驗。文章最後探討了實地娛樂（LBE）的未來發展趨勢，即數位與實體的融合將持續演進，引領新一代娛樂方式的變革。

關鍵詞：遊戲化；實地娛樂；人工智慧；擴增實境；互動設計