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Technology-Infused Gamification in Location-Based Entertainment

Xi (Amelia) Li

Abstract

This article discusses technology-infused gamification in location-based entertainment (LBE). It first examines the value of gamification in LBE, including how interactivity, agency, and social play can turn visitors from observers into active participants. It then introduces several common gamification techniques for LBE and uses examples to explain goal setting and progression, open-ended play, competition and cooperation, and exploration and discovery. The article further discusses how technology can enhance gamification in LBE, with detailed attention to different applications of AI and XR. Finally, it considers the future of technology-infused gamification in LBE. It suggests that LBE can support the development of the game industry and provide an effective setting for presenting emerging technologies to the public.

Key Words

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

Introduction

People enjoy LBE for different reasons. Some look for large-scale audiovisual experiences or physical excitement, while others mainly want to have fun with the people they visit with. As audiences experience more attractions, their expectations also rise. They want LBE to be more immersive and more enjoyable to play. For this reason, I believe gamification is a direction worth exploring in LBE. The development of new technology can also create more possibilities for gamification.

My interest in LBE began with childhood visits to Disney theme parks. Those visits made me pay attention to the industry before I understood how attractions were designed. My professional work later gave me more ways to think about it. As a game designer, I have used different technologies to design video games. I have also participated in LBE production as a technologist. Based on these experiences, this article discusses how emerging technologies can support gamification and make LBE more engaging and immersive.

1.The Value of Gamification in Location-Based Entertainment

Gamification applies game design methods outside a conventional game and, in LBE, can give a guest a role within an attraction rather than leave the guest as an observer. That role does not need to be complex. A visitor may steer a vehicle, search for a clue, or

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work with another person. The important point is that an action produces a response that the visitor can understand.

Disneyland's Autopia, which opened in 1955, offers an early example. Guests drive small cars along a dedicated roadway. They control the steering and speed instead of watching the attraction from a fixed seat. Other cars share the track, so each ride also includes small social moments.² The design gives guests a simple role that remains clear throughout the attraction.



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

1.1. Interactivity: Transforming Guests into Active Participants

A conventional tracked ride controls most of the rider's movement, whereas Autopia gives part of that control to the guest. The driver decides how to steer and when to accelerate, although the roadway limits how much those choices can affect the ride from moment to moment. As a result, the guest is doing something rather than only receiving a sequence designed in advance.

1.2. Agency & Control: Giving Players Meaningful Decisions

Autopia's freedom is narrow on purpose. The guide rail added in 1965 keeps every car on the roadway, but the steering wheel and pedal still let drivers make small corrections. A child can feel responsible for the car without being able to leave the course. This is a

useful reminder that agency in an attraction can come from a bounded, visible choice; it does not require unrestricted movement.

1.3. Social Play: Encouraging Shared Experiences

The road also produces unscripted play. Drivers close the gap with the car ahead, react when another car slows down, or share the wheel with someone beside them. Parents and children may negotiate who steers and who controls the pedal. These moments are social because several people occupy the same system, not because the attraction announces a multiplayer mode.

Autopia brings together interactivity, agency, and social play, which can also be read through self-determination theory. Ryan and Deci identify autonomy, competence, and relatedness as basic psychological needs.³ In an LBE setting, those needs may be supported when guests have some control, can understand the effect of their actions, and take part with other people.

Active participation can also affect what a visitor remembers. A person who handles an object or solves a problem has more points of contact with the material than someone who only reads a label. This matters in museums and heritage sites. The game mechanic should not distract from the subject, however. It should direct attention back to the object, story, or place.

What a venue adds, then, is not just scale. Everyone is dealing with the same room, timing, and nearby bodies. A mechanic can make use of those conditions, although it can also create congestion or leave one member of a group watching from the edge.

2.Key Gamification Techniques in LBE

The following categories are working lenses, not separate boxes. In actual attractions they overlap, and the venue's operating conditions often matter more than the label.

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

A goal tells guests what they are trying to do. It may be a score to reach, a task to finish, or a place to find. The goal also gives meaning to feedback. A number on a screen matters only when the guest understands what it measures and how to change it.

At Super Nintendo World, Power-Up Bands connect activities across the land as guests collect digital coins and complete mini-games. Their results appear in a linked app, allowing a guest to see what has already been completed and return to improve a score. In this way, the band turns separate activities into parts of one visit.

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A goal can be much smaller. A museum exhibit might ask visitors to find evidence in an image before opening the next section. A themed attraction might hide one object that changes a later scene. In both cases, the objective gives the guest a reason to look more carefully. It does not need a leaderboard or a long reward system.

Locke and Latham connect specific goals with motivation and performance.⁴ In a moving attraction, though, even a good goal fails if it arrives too late or takes several screens to explain. The designer has only a short window in which to make the task readable.



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

2.2. Open-Ended Play: Encouraging Creativity & Exploration

Open-ended play does not begin with a finish line. It gives visitors a tool, then allows the first result to teach them what the tool can do.

Laser Graffiti at Hopscotch makes this visible. The digital hand-held sprayer leaves a projected mark on the brick wall as soon as it is aimed and pressed. Without consulting instructions, a visitor will intuitively explore drawing with different drawing speeds,

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aiming directions, or distances to the wall. Without model images to copy, visitors' creativity is the only drive. We can often see a large abstract drawing and a small carefully-made pattern exist at the same time.

The motivation for creativity and exploration in this example can be explained by autonomy, as described by Ryan and Deci.³ Open-ended interaction can provide that autonomy by giving visitors room to learn, try, and make their own decisions. The key to successfully triggering autonomy is to have an easy-to-discover tool, such as the sprayer in this example. A dependable first response may matter more than the number of later options.



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

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

Social interaction is a widely used game mechanic in location-based experiences. In competition, we usually see scores to define the goal and determine the winner; in

cooperation, the key design is to define how players communicate. In either case, the design needs to make each person's role clear and visible.

2.3.1. Competition: Adding Challenge and Variety

Disneyland's Toy Story Midway Mania gives each rider scores by hitting the targets, setting up a numerical competition. Players are motivated to try hard on their "mission" in order to reach a higher position on the scoreboard. Universal's water battle makes it physical: the targets are other boats. Although no score is recorded, the reward is simply hitting your opponents.

Competition in LBE provides players with positive feedback from other players. It could bring excitement, challenge, and variety in most simple designs. However, the risk of discouragement and failure is inevitable in competition. Negative results should be carefully considered and handled in competitive experiences.

2.3.2. Cooperation: Strengthening Social Bonds

Cooperation usually relies on limitations, dependencies, and conflicts. Each player may be limited in what they can do; tasks often depend on each other; the space or tools are often shared and cause conflicts. The video game "Overcooked" works because tasks have strict sequences and players collide with each other.

Many cooperative escape room experiences merge limitation and dependency into the task design to enhance cooperation. By separating clues or controls in different places, players are encouraged to explore separately and communicate their discoveries. Some tasks require simultaneous actions at different locations, forcing players to coordinate and depend on each other.

Batuu Bounty Hunters at Disneyland can also become a shared search. The MagicBand+ guides a player toward virtual bounties in Galaxy's Edge. Friends may follow the signals together, compare possible locations, and help interpret the result. The system assigns the task to one player, but the surrounding group can still take part.

The broader value of cooperation is to enhance social bonds through solving puzzles and completing tasks together. Cooperative experiences are often more memorable because of the emotions a player had with other people.

2.4. Exploration & Discovery: Rewarding Curiosity

Exploration begins when guests have a reason to look beyond the most obvious path. Often designers deliberately hide a doorway or cave to make the experience explorable.

Omega Mart excels in its use of hidden spaces. Presented as a supermarket, Omega Mart hides routes throughout the space: behind the fridge, over the counter, or inside the closet. Quirky details around the supermarket also attract visitors to search for unusual places.

The design is not to resolve every clue, but to give each player a unique route to explore this space. One visitor may find the backstage through the fridge, while another may discover the secret space over the counter. Visitors will let curiosity lead the way, moving from one discovery to the next.



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

3. How Technology Enhances Gamification in LBE

Gamification design is heavily limited by technological capability in LBE, especially with the need to maintain immersion and practicality. Here are examples of how the latest technologies can transform LBE.

3.1. Artificial Intelligence (AI)

AI can play several roles in LBE, from recognizing a guest's input to producing new material or personalizing an experience. Each use creates a different design problem, because the response must remain understandable to the guest while still being manageable for the operator.

3.1.1. AI Detection & Recognition

Recognition systems respond to inputs that can be observed. These inputs may include a gesture, a voice, or the movement of an object. An interactive mirror could track a guest's face and keep a digital Peking opera mask aligned with it. Cooper Hewitt's Collection Browser used a related form of matching. A visitor could draw a shape on an interactive table, and the system would retrieve a related collection object.⁸ It did not generate a new artwork. It treated the drawing as a search input.

Recognition can also support small changes in difficulty. If a guest repeats an unsuccessful action, the system might reveal a visual cue or change the next line spoken by an NPC. The adjustment should follow behavior that the guest can recognize. A system becomes harder to trust when it reacts to assumptions that remain hidden.

3.1.2. AI-Generated Content (AIGC)

In generative systems, part of the final material is made during the visit. A drawing might return as a creature, or a phrase might alter what a character says. The more important question is whether the guest can recognize what came from them. If the response could have appeared after any input, the interaction soon feels like a demonstration rather than a conversation.

AIGC also creates a basic risk for LBE because its output cannot be fully predicted. A prompt that works during testing may later produce a joke or image that is unsuitable for children or uncomfortable for other visitors. This matters more in a public venue, where the designer cannot choose who will encounter the generated material. Its range should be limited in advance, and the attraction should switch to approved content when the generated response falls outside those limits.

3.1.3. AI-Guided Content Selection and Adaptation

AI-driven procedural content generation creates later game content based on players' previous interactions and behaviors. Instead of giving every group the same experience, the system can change the next puzzle or story event based on their choices and performance. This method provides more variety and keeps the difficulty suitable for different players.

Escape rooms can apply this method after the first few puzzles. If a group solves visual puzzles quickly but struggles with audio clues, the following room can provide more visual information. If players fail the same task several times, the system may

create a simpler version of the next puzzle or add an extra clue. The main story stays the same, while each group may take a different path based on how they play.

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

XR provides a new way of “seeing” an LBE environment. It allows us to move beyond the traditional limitation of displaying only physical objects. AR places digital content over the real-world view, usually through a phone or tablet. VR blocks the physical surroundings and places the visitor inside a virtual world. MR keeps the real space visible while allowing virtual objects to appear and interact with it.

3.2.1. Augmented Reality (AR)

AR can add virtual animations or special effects to an LBE environment. The Butterfly Trail at Outernet London uses smartphone-based AR inside a digital glasshouse. Visitors open the experience in their phone browser and launch virtual nectar toward the chrysalises on the large screen. This releases an animated butterfly and triggers a real-time response in the scene. Through hand tracking, visitors can also see the butterfly resting in their palm on the phone screen.

The virtual butterfly gives the visitor an interesting way to interact and a visible result. Instead of only watching, the visitor is able to make a difference through the AR screen. With the power of AR, the butterfly experience can feel more personal and interactive.

3.2.2. Virtual Reality (VR)

VR can reduce the need to build a complete physical set for an LBE experience. Opposite to play a VR video game, VR in LBE emphasizes the combination with real movement and sharing with other participants.

Eurosat Coastality at Europa-Park combines a VR headset with a roller coaster. The headset presents a journey through the Paris Opera House, while the coaster provides real acceleration, turns, and drops. What is most important is that the VR screen is synchronized with the movement of the ride. This method allows riders to enter a fantasy world that would be difficult to create with physical scenery. A traditional ride is limited by the sets built around its track, while VR can change the location and scale of the scene throughout the same ride. The real movement of the coaster also makes the virtual world feel more convincing.



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

3.2.3. Mixed Reality (MR)

MR combines virtual content with the real environment instead of replacing it. It allows both parts to work as one connected experience. The real environment provides the sense of reality that is lacking in virtual content, while the digital layer adds special effects and interactions that are physically impractical.

In the Ferris wheel experience, visitors wear an MR device during the ride. The program labels buildings and other landmarks within the visitor's real view. It also presents cultural and historical information about these locations. As the wheel rises, new parts of the city become visible and the related information appears. Visitors can enjoy the real city view while learning about what they see. The city scenery remains the main part of the experience, while MR adds explanation to it. In this way, the device works like a portable museum, with the city itself serving as the exhibition.

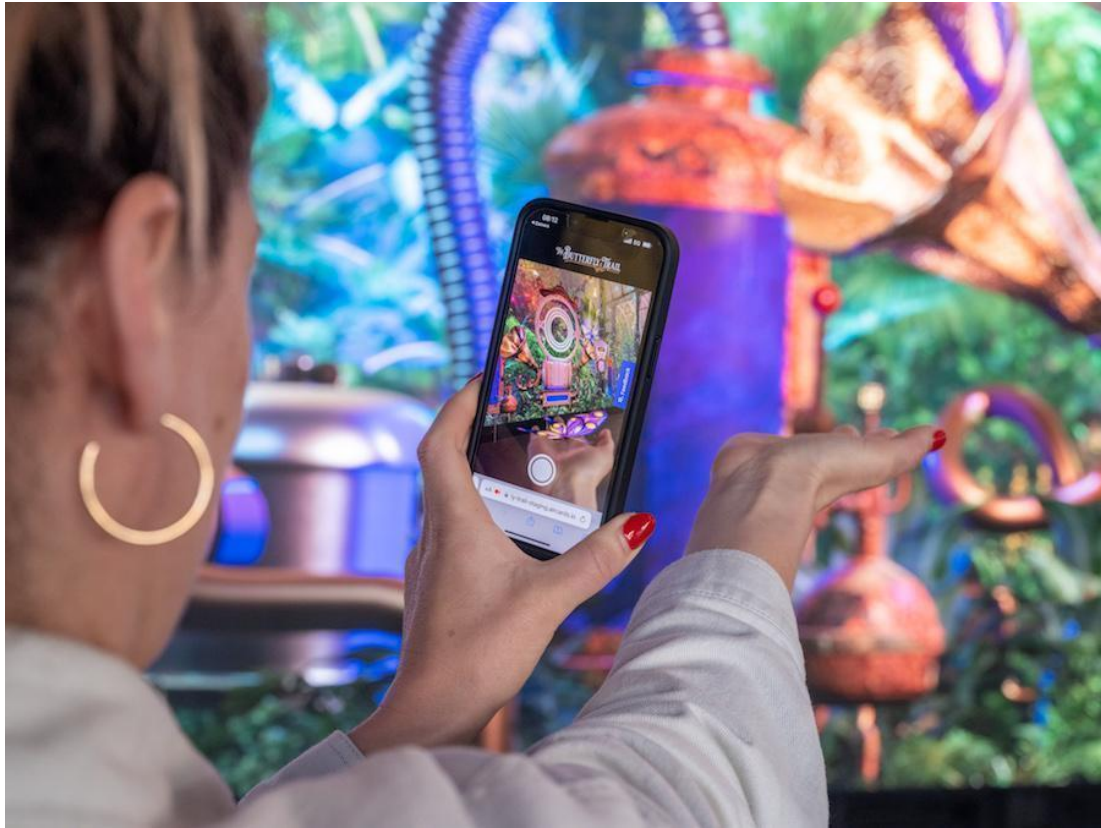


Figure 6. Embark on The Butterfly Trail, Outernet's Magical Mixed Reality Experience.¹⁰

4. The Future of Technology-Infused Gamification in LBE

LBE applies technologies and game design methods to physical experiences. In the other direction, it can also support video game design and provide a public setting for emerging technologies.

4.1. What LBE Can Contribute to Digital Game Design

LBE can support the development of the game industry. Ubisoft has adapted several game series into location-based VR. *Escape the Lost Pyramid* turns *Assassin's Creed* into a cooperative escape game, while *Far Cry VR* allows up to eight players to move and fight together. These projects redesign familiar game worlds around a shared physical space.

Familiar game IP can attract video game fans to LBE venues. Players who already know *Assassin's Creed* or *Far Cry* may want to enter these worlds in person and experience them with friends. This brings an existing game audience into physical entertainment and extends the value of a game beyond its original release. Designers can also observe these group experiences and use what they learn in future multiplayer games.

4.2. Technology as a Showcase in LBE

LBE is an effective way to introduce future technologies to the public. A ride can place a new idea inside a physical experience, making it easier to understand how the technology may be used.

Autopia already served this role when Disneyland opened in 1955. The attraction was inspired by the “freeways of the future,” before the modern U.S. Interstate Highway System was established. By driving miniature cars on its roadway, guests experienced a small version of a future freeway.

The reimagined Test Track at EPCOT continues this idea. One scene shows how cars use cameras and sensors to see the road. Other parts introduce vehicle customization, electric vehicles, and driver-assistance technology. These ideas are presented through the ride instead of a technical presentation. LBE can therefore make future technology more visible and easier for the public to understand.

5. Conclusion

This article has looked at gamification in LBE through the role of the visitor. Its value is not limited to adding scores or rewards. Goals, open-ended play, competition, cooperation, and exploration can all give visitors a reason to act within a physical space. The design is effective when the action is easy to understand and produces a clear result.

Technology expands how these game mechanics can be used. AI can generate or adjust content based on visitor behavior, but its public-facing output needs clear limits. XR provides new ways to see an environment by adding virtual content, replacing physical scenery, or combining digital information with the real world. In both cases, technology should support the experience rather than become its only purpose.

The relationship between LBE, games, and technology is not one-way. LBE uses ideas from video games and emerging technologies, but it can also extend game worlds into physical venues and introduce new technology to the public. Its future value will depend on how well these elements support meaningful visitor participation.

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