

Gamification-Driven Strategies for Exhibition Curation : Integrating Flow, Cognition, and Engagement

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Abstract

Traditional exhibition methods that display collections have the advantage of presenting a variety, but it is difficult to induce emotional-cognitive interactions between visitors and collections. To solve this, interactive exhibitions are being introduced. However, technical approaches alone have limits in inducing active participation and immersion. Therefore, this study aimed to propose a gamification-based exhibition curation strategy that can enhance the immersive experience of visitors and induce active participation. It theoretically examined the literature and case studies. Drawing on the theories of flow, embodied cognition, and experiential learning, the design principles of gamified exhibitions were examined. And the utilization patterns of game elements were derived by analyzing three actual gamification cases from the perspective of the DMC pyramid model. Ultimately, it explores how game elements support learning and psychological immersion in exhibitions and is expected to serve as a foundational reference for strategic design across various types of exhibitions.

Keyword : Interactive exhibiton, Active participation, Immersion, Curation strategy, Gamification

1. Introduction

Exhibition is an interactive mediation of space, collections, and visitors. Museums typically display collections in glass cases or behind ropes, which keeps them at a certain distance from the visitors. While this traditional display method showcases a wide variety of collections, it limits the ability to create emotional and cognitive interactions between visitors and collections. Additionally, the absence of educational programs that help visitors understand the exhibition fails to explore the meaning, value, and historical contexts of the collections. In order to overcome the limitations of these exhibition methods, efforts are being made to create an interactive exhibition environment utilizing projection mapping, Augmented Reality (AR), Virtual Reality (VR), and other technologies. However, these approaches often focus on technological novelty rather than sustained engagement, and thus may fall short in promoting meaningful interaction or repeated participation [1]. What remains underdeveloped is a systematic

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strategy that places visitor experience and behavioral motivation at the center of exhibition design.

Gamification offers a compelling solution by structuring experiences that actively engage users through goal-setting, feedback loops, challenges, and narrative immersion. Unlike one-off digital effects, game elements encourage ongoing interaction and provide a framework for designing emotionally resonant, cognitively engaging, and behaviorally rewarding experiences. Therefore, the objective of this study is to explore a curation strategy that can enhance visitors' immersive experience and induce active participation by using game elements in exhibition planning. To this end, game elements were classified based on the DMC pyramid theory of K. Werbach & D. Hunter, and the possibility of using game elements in exhibition planning was examined against the background of flow, embodied cognition, and experiential learning theories. Furthermore, utilization of game elements was analyzed through case studies of gamified exhibitions, and design methods that can be applied in practice were derived. Ultimately, this study proposes a gamification-based exhibition curation strategy to present the possibility of participation-centered exhibition design and its theoretical foundation.

2. Theoretical Background

2.1 Game and Gamification

User Experience(UX) is a central concept in the design and utilization of digital content, particularly the focus is on turning users into active participants rather than mere visitors in VR environments [4]. Game is not merely a hedonistic recreational activity; it is an active system with a structure in which users actively engage and interact to achieve a specific goal. J. Juul, defined a game as ‘a system of player choice between a fictional world and real-world rules’, and J. McGonigal viewed a game as consisting of rules, goals, active participation, and feedback systems [2][3]. Yoon proposed that a game was originally designed as an instrument for education and training, and identified the elements-users, rules, conflicts, and uncertain outcomes-that must be included in the definition of a game [5]. In summary, a game can be interpreted as ‘goal-directed experiences’ in which players engage in iterative learning and problem solving based on purposes and rules, rather than mere recreational activities.

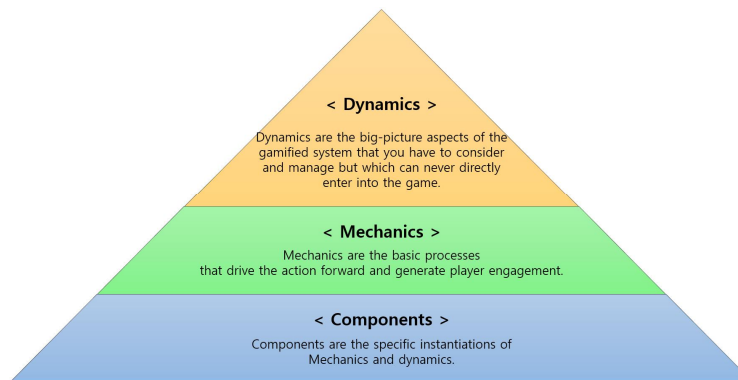
Gamification, a portmanteau of the words ‘game’ and ‘fication’, is a strategy that applies many of the attributes of games to non-gaming fields to make formal and boring thing fun and engage users' participation and drive positive behavior. Generally, the principles of game design include goal setting, narrative, difficulty, immediate feedback, and reward mechanisms, and game elements are selectively utilized to achieve them. In addition, one of the structural devices of gamification is the ‘Rapid

Feedback Loop', which is designed to deliver consequences immediately for user behavior, thereby providing continuous motivation. Such a structure generates a gaming experience by integrating the aforementioned principles with game elements [7]. Accordingly, the selective utilization and design of game elements in the exhibition are a key factors that determines the quality of the gaming experience and the effectiveness of gamification strategies. Game elements are not only functional implementations or visual devices, but also function as mechanisms for inducing user immersion, modifying their behavior, and motivating them to achieve goals. This aspect has important signification that the meaning of realizing gamification strategies and basic units of user experience design. The classification of game elements is challenging due to the lack of a consistent framework. This is because different scholars apply different criteria, such as the definition of the game, the field of application, and functional overlap between empirical results and elements. For instance, S. Deterding's research focused on designing the user experience from a design perspective [8]. S. Nicholson proposed design principles that combine extrinsic rewards and intrinsic meaning, K. Werbach and D. Hunter emphasized the importance of social interaction in a business-service contexts, and K. Huotari and J. Hamari highlighted its significance from a service marketing perspective [9]. This study adopts K. Werbach and Hunter's DMC pyramid model to analyze real cases based on the classification of game elements. The model under consideration organizes game elements according to three layers of Dynamics, Mechanics, and Components, as shown in [Table 1], to present its functions and roles. And [Fig. 1] is a pyramid model organized according to the abstraction level of the aforementioned layers.

[Table 1] Classification of Game Elements Based on the DMC Pyramid Model [9]

Categories	Game Elements	Roles
Dynamics	Constraints	Limitations or forced trade-offs
	Emotions	Curiosity, competitiveness, frustration, happiness, etc.
	Narrative	A consistent, ongoing storyline
	Progression	The player's growth and development
	Relationships	Social interactions generating feelings of camaraderie, altruism, etc.
Mechanics	Challenges	Puzzles or other tasks that require effort to solve
	Chance	Elements of randomness
	Competition	One player or group wins, and the other loses
	Cooperation	Players work together to achieve a shared goal
	Feedback	Information about how the player is doing
	Resource acquisition	Obtaining useful or collectible items
	Rewards	Benefits for some action or achievement
	Transactions	Trading between players, directly or through intermediaries
	Turns	Sequential participation by alternating players
	Win states	Objectives that make one player or group the winner

Components	Achievements	Defined objectives
	Avatars	Visual representations of a player's character
	Badges	Visual representation of achievements
	Boss fights	Especially hard challenges at the culmination of a level
	Collections	Sets of items or badges to accumulate
	Combat	A defined battle, typically short-lived
	Content unlocking	Aspects available only when players reach objectives
Components	Gifting	Opportunities to share resources with others
	Leaderboards	Visual displays of player progression and achievement
	Levels	Defined steps in player progression
	Points	Numerical representations of game progression
	Quests	Predefined challenges with objectives and rewards
	Social graphs	Representation of players' social network within the game
	Team	Defined groups of players working together for a common goal
	Virtual goods	Game assets with perceived or real-money value



[Fig. 1] Game Element Structure Based on the DMC Pyramid Model [9]

Dynamics designs the structural framework of the exhibition experience to provide long-term immersion through narrative and macro game elements such as narrative, emotional flow, and identity formation. Mechanics are the working principles that drive user behavior to achieve goals by designing challenges, reward loops, and interaction rules. Components are the smallest units of game elements, such as badges and points, that are visually and functionally realized and encountered by visitors in effect. K. Werbach and D. Hunter advanced the concept that the crux of gamification design is to incorporate a hierarchical structure within game elements, as shown in [Fig. 1]. Additionally, they emphasized the necessity of a strategy for selecting and incorporating game elements based on situation validity [10]. In the process of designing an exhibition, it is essential to integrate the layout and form

of the collections, the functional structure that guides visitor movement, and the narrative flow throughout the visitor's journey. The classification of game elements based on the DMC pyramid model distinguishes these three pillars to facilitate decision-making during the design phase. Furthermore, it offers a theoretical framework for assessing the correlation between game elements and the effectiveness with which their functions align with the exhibition's objectives.

2.2 Game-based Exhibition Design and Application of Learning Theory

An exhibition based on game elements is a kind of interactive exhibition, it must be designed to facilitate the visitor experience and learning within the exhibition space. This study aims to specify design principles through theoretical considerations to effectively apply gamification in exhibition planning. First, Experiential learning is a concept that encompasses both experiential learning, which emphasizes physical experiences, and action learning, which emphasizes actual behavior. According to the experiential learning theory of Kolb, the learning process begins from experiential engagement. The continuous cycle of learning is completed by observation and reflection from experience to form abstract concepts, which are subsequently derived as generalized principles and put into practice in new situations [11]. In essence, experience-based learning accelerates behavioral modification and development of learners, and it implies that the efficacy of this approach can be amplified through activities that visitors engage with directly in exhibition planning. Second, embodied cognition theory suggests the perspective of that cognitive processes are shaped by the interaction of the body and the environment. Scholars in philosophy, cognitive science, and education have organized that bodily experience underlies the basics of thinking, and the body, senses, activities, and the external environment are interconnected to shape the outcome of cognition [12]. In other words, humans do not merely passively absorb information, they internalize knowledge through physical interactions and sensory experiences. This suggests that museums should be designed as experiential spaces that utilize the body to engage visitors in learning and immersion, rather than simply displaying information. The thing that connects all the processes of experiential learning and embodied cognition into a focused and sustained state is flow. Third, flow can be defined as a state in which an individual blocks out distractions and focuses their mind on a single object of their choosing. According to psychologist M. Csikszentmihalyi's theory of flow, the state of flow is optimized when there is an appropriate balance of challenge and skill level, immediate feedback, and clear goals. Concurrently, the gradual adjustment of difficulty provides sustained motivation by enabling the experience of overcoming challenges and achieving success [12]. The flow state functions as a pivotal mechanism for learning and behavioral modification, encouraging users to actively explore

and internalize knowledge.

To ensure practical relevance, this study mapped these three theoretical constructs-experiential learning, embodied cognition, and flow-onto the specific design choices observed in each of the three exhibition cases. For example, the Nintendo 3DS guide at the Louvre induced flow through challenge-skill matching and real-time navigation feedback; ‘The Healing Garden’ leveraged embodied cognition via spatial narrative exploration in a virtual environment; and the ‘Electric Fairy AR’ exhibition activated experiential learning through interactive storytelling and bodily AR interaction.

A visual matrix has been added [Table 2] to systematically connect the theoretical concepts with design implementations, reinforcing the study’s conceptual grounding and offering guidance for future curatorial applications.

[Table 2] Mapping of Gamification Design Elements to Theoretical Constructs

Exhibition Case	Flow	Embodied Cognition	Experiential Learning
Louvre 3DS Guide	Real-time feedback, spatial challenge	N/A	Self-directed navigation
The Healing Garden (Metaverse)	Adaptive immersion, narrative-driven tasks	Spatial interaction, environmental engagement	Story-driven VR interaction
Electric Fairy AR	Goal-oriented AR path, challenge response	Physical movement via AR overlay	Active reflection through multi-sensory engagement

3. Gamification Case Studies

This study analyzes how game elements are implemented by focusing on three exhibition cases selected for their diversity in genre, technological integration, and user interaction formats. The selection criteria included (1) the incorporation of game mechanics in a museum or cultural exhibition context, (2) the use of different technological media such as VR, AR, and game consoles, and (3) the presence of visitor-driven engagement mechanisms that align with the DMC pyramid framework.

‘The Healing Garden’ at the National Museum of Korea is an example of a virtual exhibition within a Metaverse environment, designed to extend narrative-driven experiences using spatial immersion. The Louvre’s Nintendo 3DS audio guide represents a pioneering attempt to utilize a handheld gaming console for curatorial interaction, offering enhanced autonomy in visitor navigation. The ‘Electric Fairy AR Exhibition’ at the Musée d’Art Moderne de Paris demonstrates the application of augmented reality in a contemporary art context to increase multisensory participation.

These three cases were analyzed using a comparative framework grounded in the DMC pyramid

model, focusing on how Discovery, Manipulation, and Contribution elements were activated. This framework enabled a consistent evaluation of how each case operationalizes gamified experiences, providing an empirical foundation for developing future exhibition curation strategies.

3.1 Representative cases of National and International

3.1.1 ‘The Healing Garden’ of the National Museum of Korea

The National Museum of Korea has constructed a virtual museum on the metaverse platform ‘Zepeto’, providing an augmented digital exhibition experience that enables users to interact with the collection indirectly. It also provided an environment where individual creation and social activities were free, allowing for active exploration uninhibitedly. Users receive feedback and digital badges as rewards upon completing tasks of varying difficulty related to the ‘Gilt-bronze Pensive Bodhisattva’ through their respective avatars. In particular, a personalized leaderboard enables users to visualize their achievements, which enhances their satisfaction in participating in the exhibition. The integration of interactivity with the concept of exhibition, ‘Healing’, promoted emotional engagement and enhanced accessibility through the implementation of a mobile application service. The exhibition garnered significant acclaim for its success in raising global awareness of the ‘Gilt-bronze Pensive Bodhisattva’, with nearly 90% of the initial 950,000 visitors coming from overseas [7][14].

3.1.2 Nintendo 3DS Audio Guide of the Louvre

In 2012, the Louvre Museum in Paris, France, replaced its existing voice audio guides with Nintendo 3DS to help visitors navigate of its extensive collection. The Nintendo 3DS features an intuitive interface, more than 37 hours of audio content, and 3D images of over 700 objects. The system utilizes system signals between the wireless LAN and the console to provide geolocation and navigation to specific collections. Furthermore, users can save specific works to a ‘favorites’ list, which will navigate and guide them, and collect the route as an itinerary. This exhibition experience enhances active exploration and immersion based on visitors’ curiosity about the artworks, and improves exhibition learning. This development signifies a pivotal moment in the evolution of audio guides, marking a significant expansion in the diversity of the media [15].

3.1.3 ‘The Electric Fairy’ AR Exhibition of the Musée d'Art Moderne de Paris

The Musée d'Art Moderne de Paris has organized an exhibition that interprets Raoul Dufy's large-scale mural ‘The Electric Fairy’ to experience the history of electricity from an artistic and

scientific perspective. A simple behavioral task, administered via a tablet, offers content pertaining to the artwork's scientific and artistic narrative along with information regarding 108 individuals. The narratives can be experienced in augmented reality within the context of the works, scientists, and inventions, and the completed experiences are visualized in the form of badges. This exhibit exemplifies a successful example of a gamification strategy, effectively transforming a complex biographical narrative into an engaging and captivating experience for visitors [16].

[Table 3] Analyzing of Game Elements in Gamification Case Studies

Name of the Cases	The Medium of Use	Game Elements		
		Dynamics	Mechanics	Components
The National Museum of Korea 'The Healing Garden'	Applications Personal mobile devices	Narrative, Progression, Relationships	Challenges, Feedback, Resource acquisition, Rewards	Avatars, Badges, Collections, Quests, Leaderboards
The Louvre Nintendo 3DS Audio Guide	Nintendo 3DS Console	Emotions, Narrative, Relationships	Challenges, Chance, Feedback	Collections
The Musée d'Art Moderne de Paris 'The Electric Fairy' AR Exhibition	Tablets	Emotions, Narrative, Progression, Relationships	Feedback, Rewards	Badges, Collections, Quests, Content unlocking

Based on the analysis in [Table 3], the three cases of gamification, despite their different exhibition genres and realized media, share common characteristics in their utilization of game elements.

Initially, a goal-based, task-setting structure was utilized essentially. In all cases, visitors are required to fulfill the exhibition goals through various types of tasks, rather than simply taking in the content. In the case of 'The Healing Garden', the performance of healing conceptual tasks induces interaction between the user and the collection, providing an extended immersive experience. This works as a mechanism to motivate and engage to view, promote self-directed exploration, and enhance understanding. Secondly, it provides an immediate feedback mechanism. This structure offers an immediate response to the user's actions, thereby serving as a primary motivator for subsequent actions. For instance, 'The Healing Garden' quests are rewarded, and progress is tracked. Nintendo 3DS offers audiovisual content, and 'The Electric Fairy' AR exhibit utilizes game-based learning to facilitate narrative comprehension. The results of these Mechanics are visualized with Components, which have been shown to reinforce the user's emotional engagement and behavior and serve as a link to maintain user engagement. Thirdly, the exhibition is predicated on storytelling and narrative. The meaning, value,

and history of the collections, which comprise the exhibition, are organized into one or more narratives to easily convey them to visitors. The emotional narrative of the healing purpose, 'The Healing Garden', the conceptual exploration of the Louvre's collections, and the history of art and electricity in 'The Electric Fairy' all play a main role in immersion, connecting the purpose with the visitor's journey through the exhibition. This is an effective strategy to drive learning through emotional connection and internalization of the experience. Fourthly, a personalized experience or choice-based interaction structure was introduced. In the case of 'The Healing Garden', users can consume content by projecting themselves onto a user-generated avatar to enhance the personalized experience. The Louvre's 'favorites' function-based itinerary creation and route guidance service, and the scenario-based quests at important The Musée d'Art Moderne de Paris, resulted in interactions based on the user's autonomous choices. This design element is important because it connects to theories of embodied cognition and experiential learning, as it allows for autonomy while still engaging with the content.

3.2 Propose a Gamification-based Exhibition Curation Strategy

A close examination of the three exhibition cases revealed commonalities in the features of goal setting, immediate feedback, storytelling, and customized interaction. These findings suggest that visitors are evolving into immersive experience agents and indicate the necessity to expand personalized experiences through immersion-based education, emotional connection, and user-centered design in exhibition environments. This study proposes a gamification-based exhibition curation strategy as shown in [Table 4] and [Fig. 2]. This strategy consists of a four-step cycle of goal setting, game element mapping, interaction design, and feedback evaluation. Each step in this process is designed to reflect the results of theoretical considerations and case analysis.

First, set the goals of the exhibition, clearly presenting the intended visitor experience and exhibition objectives provides a standard for selecting game elements and shaping the narrative structure. Furthermore, the strategic design of the structural framework (Dynamics) of the gamification experience, such as the rules and behavioral flow of the exhibition, has been demonstrated to effectively motivate visitors and derive long-term engagement. To accomplish this, it is necessary to segment the goals according to various characteristics, including age and digital familiarity. The materialization of the exhibition's educational and experiential objectives, along with setting performance indicators for each goal, also serves as the foundation for a cycle of reflection, conceptualization, the and experiential learning.

[Table 4] Gamification-Based Exhibition Curation Strategies

Step	Main Activities	Design Principles
<1 STEP> Goal Setting	Clarify exhibition objectives Segment goals based on visitors characteristics Set performance indicators for each goal	'Clear goals' component of flow theory Starting point of experiential learning cycle
<2 STEP> Game Elements Mapping	Select and arrange game elements by phase Design difficulty and reward structure Review content linkage suitability	Experiential learning cycle Encourage support and active participation Ensure challenge and skill balance
<3 STEP> Interaction Design	Plan exhibition route and stage layout Integrate apps, sensors, AR/VR media Design multisensory stimuli	'Body-Environment interaction' of embodied cognition theory User-driven exploration
<4 STEP> Feedback· Evaluation	Provide real-time points and leaderboards Collect and analyze simple logs Derive improvements based on evaluation results	'Immediate feedback' component of flow theory Reflective and conceptual phases of experiential learning cycle



[Fig. 2] Circular Diagram illustrating the Gamification-based Exhibition Curation Strategy

Second, mapping the game elements phase, they are selected and combined according to the exhibition objectives. The selective utilization and design of game elements are key factors in determining the effectiveness of a gamification strategy. Therefore, it is imperative to assess whether the function of each game element is sufficient for exhibition and implementation purposes. In particular, quests and challenges are effective at providing a sense of direction, sustaining engagement, quests, and

motivating individuals to take action. In the process of designing these elements, it is essential to maintain a balance between the level of challenge and the user's capabilities and adjust the difficulty in phases. This enables the user to experience a sense of overcoming challenges and achieving success, thereby maintaining the motivational effect associated with these actions (Mechanics-Components). Finally, it is also important to consider whether the exhibit content is naturally linked to the game elements to induce psychological and educational effects. Third, the interaction design phase. The exhibition space is organized based on the game elements selected and designed according to the exhibition's objectives. A variety of media, such as touch screens, mobile devices, and AV/VR, can be applied to effectively engage visitors. The combination of game elements with various media has been shown to enhance visitor immersion and experiential engagement at exhibitions by integrating multi-sensory simulation elements-sight, sound, touch, and empathy. Concurrently, game elements must be placed appropriately, taking into account whether the flow of each exhibition space is organically connected and whether it disturbs the movement and immersion of visitors. This design approach is instrumental in enhancing the cognitive experience through the interaction of the body and the environment. Finally, the feedback and evaluation phase means that at all levels, the 'immediate feedback' mechanism is a key driver. The provision of feedback in real-time, concurrent with the visitors' experience of the exhibition, serves to reinforce a sense of autonomy and accomplishment and encourages iterative self-directed learning. Additionally, data such as user logs and engagement patterns can be collected and analyzed to evaluate and improve afterward curation strategies. This strategy goes beyond the integration of the 'fun' element of a game, which is intended to maximize the educational and experiential value of exhibitions and to drive learning outcomes based on visitor immersion and active participation. The integration of game elements throughout the entire exhibition design process is a strategic process that is expected to serve as a practical model that can be flexibly adapted to various types of exhibition environments.

4. Discussion

This study explored gamification as a strategic approach to enhancing visitor engagement in exhibition environments. While the proposed framework presents a compelling alternative to traditional exhibition design, its broader application may be influenced by several contextual challenges. For instance, disparities in infrastructure and digital access-the digital divide-may restrict the feasibility of technologically immersive formats in certain regions. Additionally, the effectiveness of some interactive elements may be driven by novelty effects, producing short-term interest rather than sustained cognitive

or emotional engagement. Without thoughtful experiential layering, such initial excitement may quickly diminish. Furthermore, cultural variability in gaming habits, interaction styles, and aesthetic expectations can shape how gamified exhibitions are perceived and received by different audiences. These limitations highlight the importance of developing context-sensitive and adaptable strategies that can respond to institutional goals, audience diversity, and technological constraints.

In this regard, the proposed strategy may benefit from iterative prototyping and multi-context testing. Future research could investigate how design elements perform across diverse demographic and cultural settings using mixed methods, such as behavioral data tracking, user interviews, and comparative field studies. These ongoing evaluations would contribute to refining gamification approaches that are not only immersive and participatory but also sustainable and inclusive in varying exhibition contexts.

5. Conclusion

This study aimed to address the limitations of conventional exhibitions-namely, their restricted capacity for emotional and cognitive interaction-by proposing a gamification-based curation strategy. Grounded in the theories of flow, embodied cognition, and experiential learning, this research outlined design principles that can enhance visitor immersion and participation. Three representative cases-the National Museum of Korea, the Louvre, and the Musée d'Art Moderne de Paris-were analyzed using the DMC pyramid model, revealing commonalities in goal-setting, feedback systems, narrative engagement, and personalized interaction.

Based on these insights, we propose a four-step gamification-based curation framework consisting of goal setting, game elements mapping, interaction design, and feedback and evaluation. This structured model provides a repeatable cycle that can guide exhibition planning from conception to post-implementation assessment. When applied effectively, it supports not only visitor engagement but also institutional planning, evaluation, and iterative improvement.

To further validate this strategy, future studies should apply it to real-world exhibitions and analyze visitor responses through both quantitative data including log analysis and usage metrics and qualitative feedback including surveys and interviews. This will enable a more comprehensive understanding of the educational and experiential impact of gamified exhibitions.

Finally, this study offers practical guidelines for curators and digital educators. These include setting layered goals, designing personalized and multisensory interactions, providing immediate feedback, and calibrating challenge levels to accommodate different user profiles. By applying these principles,

practitioners can move toward a more participatory, inclusive, and experience-driven model of exhibition design.

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