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MODEL OF TRANSFORMING TRADITIONAL CULTURAL SYMBOLS INTO DYNAMIC VISUAL IMAGES IN THE DESIGN OF MUSEUM MOBILE APPLICATION INTERFACES

Amid the digital revolution, the rapid proliferation of mobile technology has opened up new possibilities for the digital transformation of museums. As vital platforms for user experience, cultural dissemination, and public education, museum mobile applications use digital interfaces to deliver rich cultural resources to a broader audience. Against this backdrop, dynamic visual imagery with its unique expressiveness and interactivity, has become a core element connecting traditional cultural symbols with user perception. Through the use of animation, video, and other dynamic visual techniques, these symbols are infused with new vitality, significantly enhancing the aesthetic appeal and artistic quality of the interface. At the same time, dynamic visual imagery creates immersive interactive experiences that stimulate users' curiosity and interest in learning, while evoking emotional resonance, thereby enabling the reshaping and continuation of traditional cultural symbols within a digital context. Consequently, this study focuses on the innovation and optimization of museum application interface design, exploring how to transform traditional static cultural symbols into vibrant dynamic visual imagery. Starting from the principles of symbol transformation and combining literature reviews with case studies, the study systematically distills three key principles: cultural identity, narrative immersion, and emotional resonance. Building upon this foundation, the study innovatively constructs a design model comprising three layers: the Aesthetic Expression Layer, the Technical Interaction Layer, and the Emotional Experience Layer. This model serves as a systematic, interdisciplinary design framework grounded in semiotics, interaction design, and emotional psychology. It establishes a design pathway that progresses from the visual translation of traditional cultural symbols to the dynamic activation of interactive mechanisms, and ultimately to a deep emotional connection with users. It provides systematic theoretical support and design insights for the dynamic transformation of museum application interface design.

Key words: *Museum Mobile Application; Interface Design; Dynamic Visual Imagery; Transformation of Cultural Symbols; Interaction Design; Emotional Experience.*

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МОДЕЛЬ ТРАНСФОРМАЦІЇ ТРАДИЦІЙНИХ КУЛЬТУРНИХ СИМВОЛІВ У ДИНАМІЧНІ ВІЗУАЛЬНІ ОБРАЗИ У ПРОЄКТУВАННІ ІНТЕРФЕЙСІВ МОБІЛЬНИХ ДОДАТКІВ ДЛЯ МУЗЕЇВ

На тлі цифрової революції стрімке поширення мобільних технологій відкрило нові можливості для цифрової трансформації музеїв. У мобільних додатках музеїв як важливих платформах для забезпечення користувацького досвіду, поширення культури та громадської освіти, використовують цифрові інтерфейси для надання багатих культурних ресурсів широкій аудиторії. На цьому тлі динамічні візуальні образи з їхньою унікальною виразністю та інтерактивністю стали ключовим елементом, що поєднує традиційні культурні символи зі сприйняттям користувачів. Завдяки використанню анімації, відео та інших динамічних візуальних технік ці символи наповнюються новою життєвою силою, що значно підвищує естетичну привабливість та художню якість інтерфейсу. Водночас динамічні візуальні образи створюють імерсивні інтерактивні враження, що стимулюють цікавість та інтерес користувачів до навчання, викликаючи емоційний резонанс, що дозволяє переосмислити та продовжити традиційні культурні символи в цифровому контексті. Відповідно, це дослідження зосереджується на інноваціях та оптимізації дизайну інтерфейсу музейних додатків, досліджуючи, як перетворити традиційні статичні культурні символи на яскраві динамічні візуальні образи. Виходячи з принципів трансформації символів та поєднуючи огляд літератури з конкретними прикладами, дослідження систематично виокремлює три ключові принципи: культурна ідентичність, занурення в наратив та емоційний резонанс. На цій основі у дослідженні сформовано інноваційну модель дизайну, що складається з трьох рівнів: рівня естетичного вираження, рівня технічної взаємодії та рівня емоційного досвіду. Ця модель слугує системною міждисциплінарною дизайнерською основою, заснованою на семіотиці, дизайні взаємодії та емоційній психології. Вона встановлює шлях дизайну, що пролягає від візуального перекладу традиційних культурних символів до динамічної активації інтерактивних механізмів і, зрештою, до глибокого емоційного зв'язку з користувачами. Вона надає системну теоретичну підтримку та дизайнерські ідеї для динамічної трансформації дизайну інтерфейсу музейних додатків.

Ключові слова: *мобільний додаток для музею; дизайн інтерфейсу; динамічні візуальні образи; трансформація культурних символів; дизайн взаємодії; емоційний досвід.*

Problem Statement. With the continuous advancement of digital media technology and interactive platforms, visual communication has gradually shifted from static presentation to dynamic expression, and the way traditional cultural symbols are presented on digital interfaces has evolved accordingly. Users of museum mobile applications are no longer satisfied with static images of artifacts and one-way information delivery; instead, they seek a sense of participation and immersion through digital interactions with the artifacts. Dynamic image art design is an artistic practice that conveys information, emotions, or concepts to audiences in visual form through the medium of moving images. It transcends the limitations of static imagery by introducing the dimension of time and motion effects, thereby providing audiences with a richer, more multidimensional, and captivating visual experience (Yang et al., 2025). However, existing research still has certain limitations, as most studies focus on one-dimensional analysis and lack a systematic research framework. For example, research that focuses solely on the decorative effects, technical feasibility, information transmission efficiency, user engagement, or specific emotional responses of dynamic visual images often results in fragmented findings. This limited research paradigm not only hinders the deepening of museum digital interfaces in terms of cultural dissemination and user experience but also fails to touch upon the core of culture. Against this backdrop, the question of how to transform traditional cultural symbols into dynamic visual imagery has transcended the realm of mere technical or aesthetic design, evolving into a contemporary challenge concerning the preservation and

transmission of national cultural identity. Faced with this challenge, designers are committed to conducting systematic explorations ranging from symbolic extraction and visual reconstruction to interactive storytelling and emotional resonance striving to achieve the creative transformation and sustainable development of traditional culture within digital interfaces.

Analysis of research. In recent years, research on application interface design has explored, from various perspectives, the positive impact of dynamic visual imagery on enhancing user engagement, improving navigation intuitiveness, and optimizing the interactive experience. At the theoretical level, this study draws on an interdisciplinary framework comprising semiotics, interaction design, and emotional psychology to systematically analyze the design logic behind the transformation of traditional cultural symbols into dynamic visual imagery in interface design. Discussions regarding dynamic visual imagery in application interface design can be summarized under the following aspects.

First, from a semiotic perspective, relevant research indicates that dynamic visual imagery serves as a crucial element in the visual expression and functional communication of interfaces. De Souza et al. (De Souza et al., 2001) provided a semiotic foundation for user interface research, shifting the perception of interfaces from mere vehicles for functional operations to media for the transmission of meaning between designers and users. M.Wang and J. Wang (Wang and Wang, 2022) note that dynamic image design not only enriches traditional modes of information expression but also enhances expressiveness, presenting information in a more vivid manner. This, in turn, promotes the diversification of aesthetic expression within the context of digital media. Chinese researchers Y.Hou and P.Ren (Hou and Ren, 2025), drawing on Morris's semiotics, point out that cultural symbols in design can achieve the reproduction of meaning through dynamic translation. Digital visual forms such as dynamic particles can construct interactive narratives imbued with cultural metaphors by deconstructing and reconstructing traditional patterns, thereby enabling cultural symbols to embody multiple values including visual expression, functional communication, and cultural dissemination within a digital context. Yuan (Yuan, 2024) identifies motion graphics design as one of the mainstream trends in visual communication design. As a comprehensive visual form, it combines various visual elements to create works that blend creative imagination with flawless execution.

Second, from the perspective of interaction design, relevant research indicates that dynamic visual imagery is a key design strategy for enhancing the vividness of information presentation and the user experience. Feedback, transitions, and contextual design are used to increase user immersion and engagement. Dessart et al. (Dessart et al., 2011) found that animated transitions help improve users' understanding of and trust in the interface adaptation process, but overly long animations may also create a sense of delay. Tian (Tian, 2020) points out that augmented reality (AR) technology can be used to create scenes with greater depth and realism. Static images, enhanced with dynamic effects and sound, improve the visual interactive experience. This not only adds interest but also attracts audiences and generates positive feedback, thereby enhancing communication effectiveness. K.Boyd and R.Bond (Boyd and Bond, 2021) demonstrate that microinteractions serve a purpose far beyond mere decoration in user interface design; they make significant contributions to enhancing users' perceived usability and overall user experience. Optimizing the design of microinteractions can effectively improve product usability and user satisfaction. Ge et al. (Ge et al., 2024) point out that animation fluidity is a critical factor in the user experience of smartphone applications and examine the impact of click response latency, animation duration, and load completion time on perceived fluidity.

Third, from the perspective of emotional psychology, relevant studies indicate that dynamic visual images are key factors influencing users' emotional perceptions and experience evaluations. D.Park and J.Lee (Park and Lee, 2010) point out that dynamic effects in user interfaces not only enhance the digital media entertainment experience but also play a significant role in shaping the emotional characteristics of the interface. Pei et al. (Pei et al., 2022) found through eye-tracking experiments that dynamic images yield better visual cognitive outcomes and higher visual search efficiency than static images; however, users' emotional experiences are significantly influenced by display duration, indicating that dynamic effects not only impact cognitive processing but also affect users' emotional perceptions. Shu (Shu, 2025) notes that dynamic effects are a key factor influencing the visual impact of interactive interfaces; they not only serve functional purposes but also influence users' psychological and emotional experiences.

This study selects three representative museum mobile applications as the core subjects of analysis: 1) The National Museum of China's "Essentiality of Beauty" Mobile Application; 2) Shanghai Museum Mobile Application; 3) The Palace Museum's "Daily Palace Museum" Mobile Application.

Purpose of the article. This study aims to provide an innovative model for the dynamic translation and application of traditional cultural symbols in digital interfaces. To this end, the research objectives include: 1) Distilling and defining the fundamental principles of symbolic transformation through case studies; 2) Developing a practical and actionable design model for dynamic transformation.

Presentation of the main material. Based on literature reviews and case studies, research indicates that dynamic visual imagery in interface design primarily involves three dimensions: visual expression, enhancement of the interactive experience, and the establishment of emotional connections. Therefore, this study identifies three core principles for implementation: The Principle of Cultural Identity, The Principle of Narrative Immersion, and The Principle of Emotional Resonance.

The Principle of Cultural Identity. The principle of cultural identity refers to the integration of specific cultural elements into design, enabling users to perceive the museum's cultural characteristics and distinctive visual identity through visual, interactive, and content-based experiences. Specifically, when extracting, reconstructing, and animating traditional cultural symbols, designers typically focus on the museum's regional culture, the artistic style of its exhibits, or its cultural themes, emphasizing the preservation of core formal characteristics, typical pattern structures, colour relationships, and intrinsic cultural spirit. These symbols are presented through design transformations, allowing users to accurately identify their cultural origins and symbolic meanings during use. At the same time, this approach avoids design issues such as excessive simplification, arbitrary collage, or overly complex forms that could lead to distortion of the symbols. Through the interface, users experience the museum's cultural atmosphere and historical depth, thereby gaining an initial understanding of the culture.

For example, the "Essentiality of Beauty" mobile application by the National Museum of China (Fig. 1). On the "Eagle-shaped Pottery Tripod" interface, the artifact's form, structure, and textural details are precisely replicated using high-precision 3D modelling technology, ensuring the authentic reproduction of the original artifact's characteristics in the digital translation. Colour calibration technology renders the reddish-brown clay body of the pottery tripod on the smartphone screen with a texture close to that of the physical object, while the play of light and shadow further enhances the material's realism and visual appeal. On screen, the Eagle-shaped Pottery Tripod performs anthropomorphic actions such as slightly turning its head, blinking, and soaring, endowing the artifact with a dynamic beauty as if poised to take flight. These dynamic effects are not arbitrary animations but strictly adhere to the pottery tripod's aesthetic form, imparting a sense of vitality while preserving its original morphological characteristics. At the same time, a first-person voiceover, synchronized with the dynamic movements, bridges the gap between users and the artifacts, allowing these cultural symbols to engage with users in a personified manner. Additionally, users can select their favourite artifacts based on personal preferences and interests to generate personalized posters, and these custom creations can be shared on social media platforms. This design expands the reach of cultural dissemination and attracts more cultural enthusiasts to participate in the interaction.

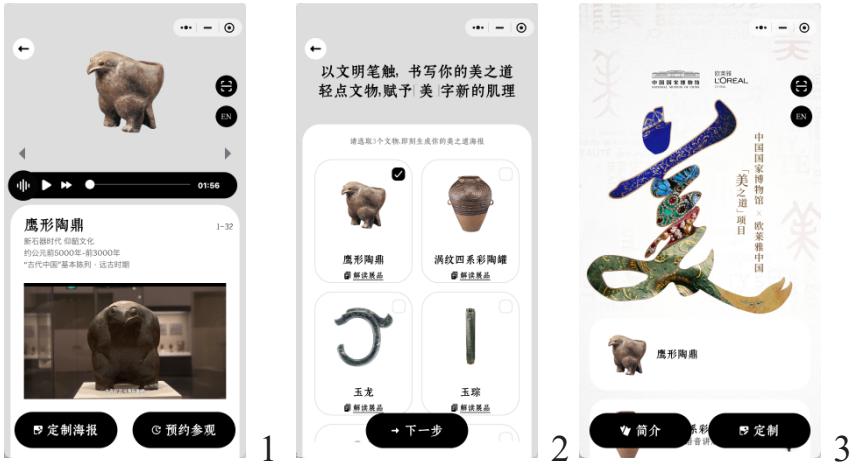

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Fig. 1. "Essentiality of Beauty" Mobile Application, National Museum of China, Beijing, 2025

The Principle of Narrative Immersion. This principle refers to the comprehensive application of digital technologies to transform museum content into a narrative process with a plot progression and depth of experience through various media, such as images, sound, animation, and games. It allows users to immerse themselves in specific cultural contexts while using the interface, thereby enhancing the sense of immersion and exploration. In interface design, content is enriched through storytelling, application scenarios are expanded using multimedia technologies, and the experiential journey is driven by interactive actions. Users explore and engage with museum information through operations such as clicking, swiping, rotating, zooming, scanning, and path selection, thereby deepening their learning and experience of museum culture.

For example, the Shanghai Museum mobile application (Fig. 2). The "AR" navigation feature in this case study is based on centimeter-level visual positioning and 3D spatial reconstruction technology. The complete process from the user's tap to the AR real-world feedback forms a coherent spatial narrative, allowing users to gradually build a holistic understanding of the museum's spatial layout as they explore. Precise targeting of exhibition areas, cultural and creative shops, as well as service facilities such as rest areas and water stations, completely eliminates the problem of "getting lost." Through comprehensive analysis of visitor profiles, historical movement patterns, and real-time congestion data, the application provides personalized exhibition route recommendations for different user groups. This significantly enhances the visitor experience and, to a certain extent, optimizes venue operational efficiency, enabling a smart touring experience where users can "pick up their phone and start exploring, viewing, and listening immediately" (NetEase News, 2025). Additionally, the virtual tour feature offers panoramic viewing services for online exhibition halls. Users can take virtual tours based on specific cultural themes, completing a cultural journey without leaving home. The online exhibition hall is equipped with floor plans, 3D views, search, and sharing functions. By clicking on artifacts displayed on the screen, users can examine them up close and access detailed explanatory notes, enhancing their sense of interaction and immersion. Furthermore, the game module creates diverse narrative themes and scenarios, guiding users to freely select and combine cultural relic elements of interest to create their own artistic works, thereby achieving a perfect blend of entertainment and education. Users can save their creations and share them on social media platforms to showcase their creative expressions, which further enhances their sense of cultural participation and engagement.

The Principle of Emotional Resonance. The Principle of Emotional Resonance refers to the organic integration of exhibit information and cultural memory with users' emotional needs. Through visual expression, narrative construction, and interactive experiences, it aims to evoke emotional responses and foster a sense of shared values among users, thereby cultivating a deeper sense of engagement, identification, and cultural resonance during the user experience. Specifically, dynamic visual design, combined with appropriate personalization, a sense of ritual, and a warm, human touch, creates emotional fluctuations and memorable moments for users during the interaction process, thereby facilitating a transition from cultural cognition to cultural identification.

For example, the Palace Museum's "Daily Palace Museum" mobile application (Fig. 3). The interface is

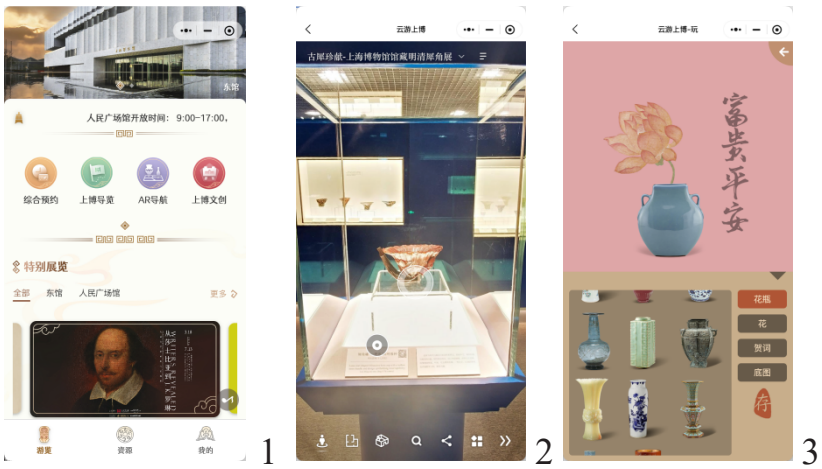

Fig. 2. "Shanghai Museum" Mobile Application, Shanghai Museum, Shanghai

adorned with symbols of traditional Chinese culture, creating a unique cultural atmosphere specific to the Palace Museum. This visual language not only possesses aesthetic appeal but also subtly instills in users a sense of respect for and identification with historical culture during use. At the same time, by utilizing daily scheduled push notifications, the app integrates cultural transmission with daily life, fostering a sense of cultural ritual and creating anticipation for users in their daily routines. Each day, the application features a curated artifact, with Arabic numerals and cultural elements ingeniously fused into graphic designs, enhancing the visual appeal and engagement of the cultural content. Users engage through various actions such as clicking, swiping, saving, and commenting; each interaction triggers dynamic changes in the interface content. In particular, clicking on a graphic opens a cultural relic display screen, complete with rich historical context, explanatory narratives, and classical-style background music. This creates a multi-sensory cultural narrative space that piques users' curiosity, effectively lowering the barrier to understanding cultural relics and making cultural dissemination more engaging and relatable. Additionally, the application features personalized recommendations and interactive functions. Users can not only select content based on their interests but also save their favourite artifacts, leave comments, and share them, thereby deeply integrating personal interests with museum content. This design philosophy which emphasizes everyday relevance, a sense of ritual, and personalization brings traditional culture into daily life, breaking down the barriers between traditional museums and the public. It fosters a closer relationship between the museum and its users, transforming the museum into a cultural companion. Through this interaction, users not only gain knowledge but also deeply experience the unique charm and emotional value inherent in museum culture.

Based on the analysis of the aforementioned transformation principles, this study has developed a three-layer dynamic transformation design model comprising the aesthetic expression layer, the technical interaction layer, and the emotional experience layer. These three layers interact with one another to form a systematic framework for the creative transformation of traditional cultural symbols within digital interfaces, providing theoretical support for museum application interface design that integrates cultural authenticity, interactive adaptability, and emotional resonance.

Layer 1: Aesthetic Expression Layer – Visual Translation of Symbols. The Aesthetic Expression Layer serves as the foundational level of the model, primarily responsible for the visual refinement, formal reconstruction, and interface translation of traditional cultural symbols. This enables users to form a clear cultural impression and overall aesthetic perception from the very first moment of interaction with the digital interface. This layer is grounded in semiotic theory. Barthes (Barthes, 1987) explored how signs are formed through the "signifier" and "signified," extending this framework to the realm of cultural semiotics. It systematically deconstructs and refines the "signifier" (visual forms such as patterns, colours, and shapes) and the "signified" (deep-seated connotations such as historical implications, cultural character, and symbolic meanings) of traditional cultural symbols. Krasner (Krasner, 2013) provides a systematic overview of motion graphic design from the dual perspectives of historical evolution and aesthetic construction. Motion graphic design is, at its core, a fusion of traditional graphic design language with the

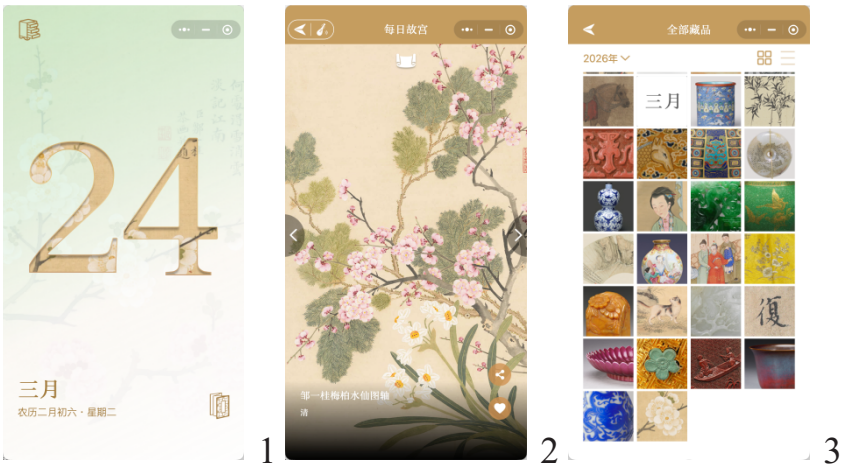

Fig. 3. "Daily Palace Museum" Mobile Application, The Palace Museum, Beijing, 2015

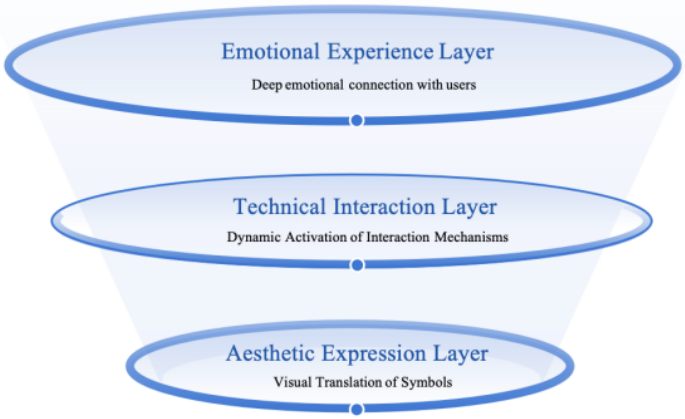

Fig. 4. Design model. Created by the authors

dynamic visual language of film, television, and interactive media, emphasizing the importance of temporal organization, rhythm control, visual storytelling, and communicative impact. Yuan and Skliarenko (Yuan and Skliarenko, 2025) emphasize that the success of museum mobile application interface design lies in striking a balance between information communication and aesthetic expression, with designers striving to create a user experience that is easy to read, easy to use, and easy to perceive.

This layer aims to provide a repository of cultural elements for interface design, enabling traditional cultural symbols to be expressed in ways that are more dynamic and aesthetically compelling, thereby establishing a clear cultural impression and overall aesthetic perception for users. Consequently, designers focus on distilling the intrinsic characteristics of symbols. Using semiotic methods that explore the relationship between "signifier" and "signified," and combining techniques such as visual reconstruction and micro-animations, they transform the visual elements within symbols through dynamic processing into motion graphics that possess a sense of time and rhythm. Patterns, colours, and forms exhibit more vivid aesthetic expressions through movement, thereby creating visual imagery that combines distinctiveness with a sense of cultural belonging, allowing users to form a clear cultural perception the moment they interact with the interface. At the same time, the design must incorporate the media characteristics of digital interfaces to ensure that cultural authenticity and distinctiveness are maintained while aligning with contemporary users' visual cognitive patterns and interface navigation paths.

Layer Two: The Technological Interaction Layer – Dynamic Activation of Interaction Mechanisms. The technological interaction layer serves as the model's connecting layer, focusing on how user actions trigger dynamic responses from cultural symbols. Grounded in interaction design theory, this layer transforms user operations such as clicks, swipes, drags, and augmented reality (AR) interactions within the interface into core mediators that drive the unfolding of cultural content, visual transformations, and the progression of narrative rhythm. By establishing a mapping relationship between user actions and dynamic feedback, and by comprehensively utilizing technologies such as 3D modelling, virtual reality (VR), and augmented reality (AR) (Zidianakis et al., 2021; Nor and Razak, 2021), we construct cultural narrative scenarios characterized by two-way participation and real-time responsiveness. Primarily through visual stimuli, this approach proves more feasible and effective in enhancing memory recognition and eliciting positive emotional responses (Santoso et al., 2022). Kolte and Rao (Kolte and Rao, 2023) demonstrated how micro-interactions enhance user experience and create engaging digital interfaces by infusing them with personalization, responsiveness, and playfulness, thereby providing theoretical guidance and practical foundations for designing more compelling digital interfaces.

This layer aims to reshape interaction logic through technological means, breaking the traditional separation between viewing and operation in interfaces to achieve a seamless integration of online and offline experiences, thereby significantly enhancing users' sense of participation and curiosity. Consequently, designers focus on constructing the interface as a perceptible, participatory, and exploratory interactive space through multimodal interaction methods, instant feedback mechanisms, and scenario-based experience paths. Leveraging technologies such as touch controls, voice commands, virtual tours, and augmented

reality (AR), users can not only view dynamic interpretations of cultural symbols on mobile devices but also participate in cultural experiences within more authentic, open, and exploratory environments through real-time interaction, spatial overlay, scene activation, and online-offline integration.

Layer 3: Emotional Experience Layer – Deep Emotional Connections with Users. The Emotional Experience Layer represents the culmination of the model, focusing on how dynamic visuals and interactive processes permeate and influence users' psychology. Grounded in emotional psychology, this layer employs design techniques such as animated storytelling, gamification mechanisms, and personalized services (Paliokas et al., 2020; Ma & Chen, 2022) to lower the barrier to understanding complex cultural information and to stimulate emotional engagement and meaningful associations. Scholars have proposed two new concepts of virtual museums: the user-centred virtual museum, which emphasizes the audience's interactive experience; and the content-centred virtual museum, which places greater emphasis on the digital presentation of authentic museum collections and content. They evaluated the overall user experience in terms of satisfaction, cognitive load, emotional engagement, sense of presence, interactivity, participation, and potential negative impacts (Li et al., 2025).

This layer aims to examine the comprehensive impact of cultural symbols on users' cognition and emotions during dynamic presentation and interactive engagement. It emphasizes that dynamic visuals and interactive mechanisms can significantly lower the threshold for understanding complex cultural information, enhance information perception efficiency and cognitive clarity, thereby reducing cognitive load and strengthening the interface's readability and users' cultural identity. Consequently, designers use animation to imbue static cultural symbols with a temporal dimension and dynamic expressiveness, enhancing the interface's appeal and narrative quality. This allows users to acquire knowledge and learn subtly during the operation process, thereby deepening their understanding of cultural symbols; By employing gamification mechanisms, cultural exploration is transformed into task-driven and challenge-based experiences, allowing users to derive enjoyment and a sense of accomplishment from the immediate feedback received during interactions such as clicking and swiping, thereby increasing engagement and continuity; combined with ritualized design, the ceremonial nature and positive connotations of specific cultural symbols are reinforced. At the same time, it is essential to adapt to the diverse knowledge backgrounds and interests of different user groups, building personalized services and empathetic environments to awaken their latent cultural memories. Furthermore, through personalized customization and sharing features, users can extend their personal cultural experiences to social platforms, fostering a two-way interaction between cultural dissemination and identity formation, and helping users develop an emotional resonance with and a sense of value in the culture through these interactions.

In summary, based on the research presented in this model (Fig. 4), the aesthetic expression layer provides visual content and cultural elements to the technical interaction layer; the technical interaction layer provides interactive vehicles and perceptual pathways to the emotional experience layer; and the emotional experience layer, in turn, informs the design optimization of both the aesthetic expression layer and the technical interaction layer. This also provides designers with a theoretical foundation and methodological support for constructing dynamic visual expressions in digital interfaces that integrate traditional cultural connotations with contemporary aesthetic sensibilities.

Conclusion. In the context of digital media, this study explores how traditional cultural symbols can transcend the limitations of static displays in museum interface design and achieve a transformation from static to dynamic visual imagery. The study proposes a three-tiered design model comprising an aesthetic expression layer, a technical interaction layer, and an emotional experience layer, and elucidates the design logic of "visual translation – interactive activation – emotional connection." The study indicates that the digital transformation of traditional cultural symbols is not merely a simple overlay of animation techniques, but rather a systematic process encompassing the distillation of cultural connotations, the translation of visual semantics, interactive narrative contexts, and user emotional experiences. Future research will further explore the applicability and scalability of this model across different types of museums and cultural contexts. By integrating emerging technological trends, it aims to expand the expressive dimensions and application scenarios of the dynamic transformation of traditional cultural symbols, thereby providing a solid theoretical foundation for the sustainable dissemination and innovative expression of traditional culture in digital media.

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