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REVIEW ARTICLE

User Experience Design for VR-Based Digital Exhibition of Intangible Cultural Heritage

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Abstract

Intangible cultural heritage is living heritage, and conventional static display cannot convey its intangible character; audiences accordingly register its deeper cultural meaning only weakly. Digitising heritage content so that it can be kept alive is one effective route to safeguarding it. This article examines current cases of VR-based heritage display and explores ways of improving their user experience, so as to advance the digital safeguarding of intangible cultural heritage. By drawing out the interaction characteristics of VR products, the display characteristics of intangible heritage and the elements of user experience, and by analysing empirical cases of VR heritage display, the article studies digitalisation and user experience from three angles: immersive experience, interactive experience and imaginative experience. It finds that the realisation of digital scenes, the multimodality of interactive experience and the internalisation of affective experience can each effectively strengthen an audience's understanding of, and feeling for, the character of intangible heritage and its cultural spirit. The result offers a feasible reference for applying VR technology to the safeguarding and dissemination of intangible cultural heritage.

Keywords: virtual reality, intangible cultural heritage, user experience, digital display

1 Introduction

Intangible cultural heritage (hereafter ICH) is an important component of a nation's cultural soft power and an important form through which a national culture is disseminated at home and exported abroad. As the nation's material strength grows and national self-confidence rises, society has attached increasing weight to cultural soft power such as ICH, year by year [1]. In the nation's cultural reform and development plan for the 14th Five-Year Plan period, the safeguarding of ICH is listed among the key projects, which require a further strengthening and improvement of the ICH safeguarding system so as to achieve 'living transmission and vital reappearance'.

The purpose of safeguarding ICH is to let more people take part in heritage projects, to experience the spirit and the culture they hold, and in this way to maintain heritage's vitality. Driven by digitalisation, the display of ICH content has gradually shifted from a passive, object-centred mode of presentation towards a participatory, person-centred mode of interaction, and the audience's participation and agency now bear more critically on the experience. The display of ICH is a process in which the medium of heritage activity and the audience act upon one another; research into the audience's experience is therefore of real significance for the display and dissemination of ICH.

2 Display Characteristics of Intangible Cultural Heritage

Tangible cultural heritage such as artefacts and monuments is displayed so as to emphasise the beauty, the authenticity and the artistic character of the object and its setting, with information passing one way, from object to viewer. User experience design for tangible heritage products concentrates on building a good cultural space for the audience and on deepening the audience's sense of immersion [2].

Intangible cultural heritage, by contrast, is an invisible, living heritage. Its content is chiefly the dynamic process of human activity — traditional craft, performing art, ritual and festival — rather than a static physical object. In designing ICH products one must grasp heritage's 'cultural image', its 'intangible character' and its 'spiritual meaning' [3] (Figure 1). It is not enough to secure the authenticity of the heritage setting and to build a cultural space; one must also attend to the setting's participability and perform the course of the heritage and the human activity within it as a living enactment [4]. Only then is a good interactive experience created, cultural information and value are presented from several dimensions,

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the quality with which cultural meaning is communicated improves, and the audience arrives at affective resonance.

Museum exhibitions, travelling exhibitions and other conventional physical displays tend to support the safeguarding and dissemination of ICH through tangible carriers, and this object-centred mode of presentation has difficulty accommodating heritage's intangible character. Compared with a physical setting, a digital setting can break through the limits of space and time and, through natural communication and close-range interaction, bring about an entirely new dialogue — between person and object, and between person and setting. In this participatory experience, information passes two ways between the product and the audience, which suits heritage's intangible character better.

3 User Experience in Virtual Reality

User experience runs through the whole of a systematic service — before, during and after — and encompasses users' behaviour, perception, cognition, emotion, preference, and psychology and physiology [5]. User experience in a virtual space can be defined more narrowly as the audience's experience within a physically controlled simulated environment, and it has three important characteristics: immersion, interaction and imagination. The degree to which a simulated environment is faithful is the basis on which immersive experience is formed; multimodal interaction within the virtual environment deepens the audience's sense of participation; and the imaginative space can raise the depth of the audience's understanding of the product's content.

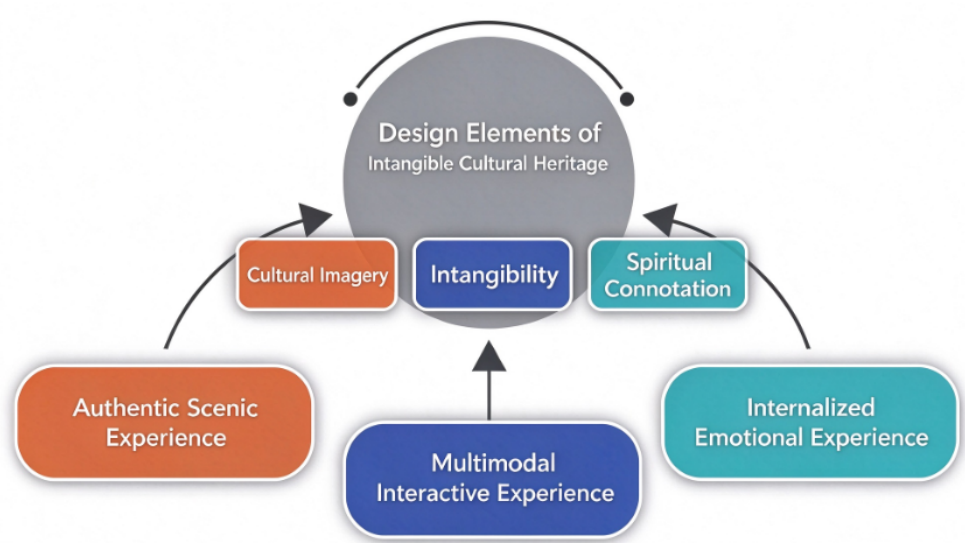


Figure 1 Design elements of intangible cultural heritage (image source: drawn by the authors)

How to strengthen and supplement existing experience modes, deepen immersion in the VR experience, guide the audience into interactive exploration of ICH content, mobilise their emotion and subjective initiative, and at the same time secure comfort of experience — these are the questions that VR-based ICH display products must address.

4 Exploration of Intangible Cultural Heritage Display in Virtual Reality

The application of VR technology to ICH puts people first. Taking the audience's emotion and experience as its direction, it forms a participatory, interactive mode of experience and produces display content that is comprehensive and three-dimensional, holding the whole experience in a process of dynamic development. The cases can be analysed by the characteristic levels of VR experience — immersion, interaction and imagination — and these three characteristics map respectively onto the audience's physical, biological and spiritual levels [6].

4.1 Immersive Experience in VR-Based ICH Display

Immersion is the degree of realness the audience experiences within a virtual situation. Relying on the perceptual capacities the VR system affords, the audience spontaneously takes on a role within the virtual scene, shifting from observer in front of a screen to participant within a virtual world.

Producing VR display through 360-degree video capture is the method in general use for VR-based ICH display today. The VR theatre application launched jointly by Jaunt VR and the Broadway theatre centre, for example, uses 360-degree viewing to give the audience the distinctive sensation of watching a play from the centre of the stage; the limitation of such VR products is that the audience's position is fixed at the point of capture and cannot move freely while viewing.

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Achieving immersion calls for a good user experience. Experience commonly includes sensory experience and cognitive experience. The audience's sensory experience arises from being enveloped by the senses — sight, hearing, touch — and under multi-layered stimulation their memory and imagination are aroused, producing a vivid image that moves them. Cognitive experience, in turn, requires that the form, motion and interaction of things within the virtual space correspond to the real world and accord with the audience's cognitive experience. In the VR project of the Gion Festival Digital Museum in Kyoto, Japan, the designers set out to restore the actual Gion Festival. On the level of cognitive experience of things, they built CG models of live models in ceremonial dress by means of 3D measurement, and captured the performers' movements, gaze and expression by motion capture; they analysed Japanese dance, established a database of bodily movement and restored the actual course of performance. On the level of cognitive experience of environment, they built a digital model of the streets of Kyoto and measured on site the various sound sources along the route of the festival procession, mapping the form and motion of the spectators, so that the VR environment changes markedly in sight and sound as the audience moves. On the level of sensory experience, they built a motion platform on which the audience sits wearing VR equipment; with visual and auditory immersion comes real-time bodily sensation through the platform's vibration, restoring the experience of sitting on a festival float and taking part in the rite [7].

In experience design for VR-based ICH content, one should raise the clarity, form and fidelity of motion of objects, people and settings visually; refine changes in ambient sound aurally; and provide a degree of bodily feedback haptically, so that cognitive experience under multisensory conditions remains consistent with the real world. The immersion of virtual space lets ICH break through the limits of space and lets the audience be present in it, experiencing the setting in which heritage culture came into being.

4.2 Interactive Experience in VR-Based ICH Display

Interactivity is the audience's ability to manipulate objects within a virtual environment, together with the natural feedback those objects and that environment give the user. The flow of information shifts from one-way output from a static object to the audience into high-freedom two-way exchange between the audience and a virtual space and time, and in multimodal, multi-dimensional interaction the readability, usability, guidance and appeal of information become richer and more vivid.

Experience of traditional craft is a category of ICH experience that places comparatively high demands on interactive experience. The VR pottery game *Let's Create Pottery VR*, for example, depicts the controller as a hand; contact between hand and clay yields realistic visual feedback, and the viewing angle makes effective use of the freedom to observe objects that a VR setting affords, so that the audience can observe and touch clay and pottery by sensibility and intuition (Figure 2). The game combines gesture control, voice control and motion-sensing control, raising the audience's operability and sense of experience. At the same time it simplifies the complex skills of throwing and glazing into interaction forms the VR controller can perform, greatly lowering the difficulty of the pottery experience and allowing novices to enter a state of flow quickly. The designers use interactive interface controls — virtual outline lines, a window comparing and evaluating the form — to guide the audience to complete a pottery work fluently and in a relaxed, efficient state, reducing the frustration of learning. The game exploits the fault tolerance of a digital environment: the audience can at any moment raise a hand and smash a half-finished piece, then quickly reset the model, which makes up for exhibits being fragile, hard to protect and distant in feeling. When the audience's ceramic work is finished, virtual figures appear to admire and appraise it, giving the audience a sense of achievement and awakening a love of traditional pottery.



Figure 2 Interactive scene in 'Create Pottery VR' (image source: screenshot from the application)

Interactive guidance is likewise an important part of VR display. In the garden-exploration section of *Xinjing VR*, the designers built an environment the audience may roam freely, using light, motion, sound and interactive controls to draw

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the audience's attention, convey information naturally and lead the audience on to the next heritage experience point. When interaction and the designed plot interlock, the audience's autonomy while roaming can be prevented from disrupting the dynamics of the image and the flow of information. Such guidance reduces misoperation and repeated operation, spares the audience the irritation of the experience, makes them less prone to dizziness and fatigue, and so refines comfort during VR interaction through natural interaction.

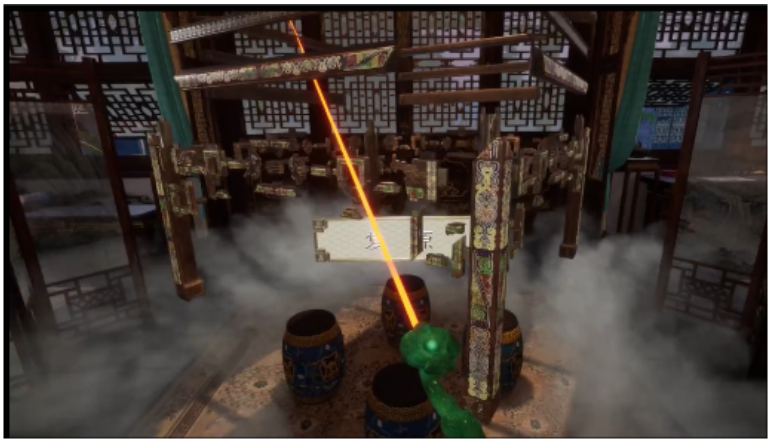


Figure 3 Scene from 'Xinjing VR' (image source: screenshot from the application)

Interactive experience rests on human instinct. It brings about more effective exchange of information between audience and heritage product, presents abstract interaction results within the virtual space, converts visual truth into multimodal sensory truth, and builds a link between tangible object and intangible craft, deepening the audience's understanding of traditional craft and of craft culture.

4.3 Imaginative Experience in VR-Based ICH Display

Imagination is the great space for imagining that a virtual world gives the audience; content conveyed within a virtual space is not bound by the real world. Through immersive and interactive experience, the audience forms imaginings as things and settings change, and extends the range of their cognition.

In *Xinjing VR*, the audience can see the character *kun* that they have written turn into a great blue whale soaring between cloud and sky; see curios on the display shelf come to life and spring before the eyes; see Go stones form the taiji and bagua and encircle them; see timber structures and Ming-style furniture unfold their secrets and reveal the mortise-and-tenon joints within; pluck a guqin and watch blossoms scatter and dance with the playing, mirroring the poignant verses carved beneath the pavilion; and make a paper kite by hand, then in an instant sit upon it and ride the wind into a landscape painting (Figure 3). In the VR film *Shennong: Taste of Illusion*, the audience is drawn into the scene of Shennong tasting a hundred herbs and experiences traditional Chinese medicine culture, where brushwork in the manner of Chinese painting, bronze engraving and porcelain glaze are used to present vividly how herbs act within the body.

In ICH display centred on tangible carriers, understanding of the intangible craft and spiritual meaning behind them is limited by space and time and cannot be fully presented. In a digital space, by contrast, the audience joins in as a participant and experiences 'instantly' and 'in place' the setting and age in which the heritage arose, together with the meaning of craft. Imaginative experience also expresses the designer's own thinking: combined with plot design within the virtual space, it gives the audience freedom to imagine, guides them into active exploration, elicits their creativity and strengthens their agency. It raises the audience's cognitive and learning capacity, lets them appreciate the culture of making and the historical line of heritage, and brings about better affective resonance.

5 Conclusion

The application of VR technology to ICH supplements existing modes of heritage display. The digital restoration of tangible carriers and the re-presentation of intangible craft and spiritual meaning enrich its interactive content, and interaction in several directions binds the audience more deeply to the heritage. Taking the immersive, interactive and imaginative characteristics of VR experience together, user experience is improved by realising digital scenes, by making interaction multimodal and by internalising affective experience, so that the audience roams naturally through the designed plot and arrives at the affective resonance that heritage culture produces. VR breaks the limits of space and time, gives the public a new channel through which to understand heritage and to feel its spiritual value, and further advances the transmission and dissemination of intangible cultural heritage.

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