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User Experience–Driven Design of a Digital Bamboo Weaving Interface for Intangible Cultural Heritage Preservation

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Abstract: Most existing digital platforms for Intangible Cultural Heritage (ICH) suffer from low user engagement, limited interactivity, and insufficiently emotional or immersive content, factors that hinder their potential to sustain and promote traditional crafts. This study designs and evaluates a culturally informed bamboo weaving interface for ICH by integrating the Garrett User Experience (UX) Model with selected visual communication principles. Specifically, the prototype employed brown and green color schemes to evoke the organic texture of bamboo, high-contrast layouts to enhance legibility, and symbolic iconography to reinforce cultural meaning. A quantitative research design incorporating design-based evaluation was adopted. Interface prototypes were developed using the Garrett UX Model, emphasizing visual communication factors such as color, spatial hierarchy, contrast, layout, and symbolism. A survey measuring four user experience dimensions, value, reliability, usability, and satisfaction, was distributed to 200 participants, yielding 156 fully completed responses. User interactions with the prototypes were analyzed to assess the impact of design features on experience and engagement. The findings revealed that UX-informed design significantly enhanced user interaction with ICH materials, resulting in high levels of satisfaction and usability. The Garrett UX Model proved effective in guiding the development of culturally responsive digital interfaces. This research advances the field of cultural computing by offering a systematic methodology for designing user-centered digital interfaces that contribute to ICH preservation. The results underscore the importance of structured UX models and visual communication principles in digital heritage design, providing practical insights for future ICH-related platforms and applications. Unlike previous ICH digital projects that applied generic usability principles without a formal UX framework, often resulting in limited cultural depth or user-centered focus, this study uniquely applies Garrett's UX Model to integrate cultural symbolism with systematic interface design, offering a more rigorous and transferable approach to digital heritage development.

Keywords: Bamboo Weaving, Intangible Cultural Heritage, User Experience, Visual Communication, Digital Preservation

1. Introduction

With the advent of the modern digital age, intangible cultural heritage (ICH) has become an increasingly urgent issue, as globalization and technological advancement pose a serious threat to traditional skills and knowledge handed down through generations (Cai et al., 2024). In contrast with tangible heritage, ICH, such as handicrafts, oral traditions, performing arts, and rituals, depends entirely on the communities that live and continue to practice them (Chatibura, 2023). Yet, as cultures evolve and younger generations distance themselves from their traditional heritage, many of these customs are at risk of being lost (Lee, 2023). Digital preservation presents a timely and effective solution to this problem. Through engaging, interactive, and multimedia approaches, ICH can be recorded, shared, and reinterpreted for contemporary audiences (Ahmad & Rafiq, 2023; Liu & Pan, 2023). When designed carefully, visual interfaces can enable cultural transmission in ways that are both pedagogical and emotionally resonant, ensuring that heritage is not merely archived but experienced and appreciated within modern contexts (Aslam et al., 2024).

Bamboo weaving, a quintessential representation of Chinese folk craftsmanship, embodies both technical knowledge and deeper cultural values such as symbolic motifs, communal identity, and ecological wisdom (Cai et al., 2024). Traditionally practiced in many parts of China, bamboo weaving serves not only as a source of livelihood but also as a visual expression of harmony between human beings and nature (Gao et al., 2024). Each pattern and tool conveys a narrative, bearing symbolic codes that can be deciphered through visual language (Aruchamy et al., 2023). However, despite its richness, bamboo weaving struggles to reach contemporary audiences, particularly digital natives who are unfamiliar with its historical context (Jiang et al., 2024). This is where visual communication in digital heritage design becomes valuable. By applying concepts such as contrast, balance, symbolism, and spatial hierarchy, designers can

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participation, stagnant content, and limited emotional engagement, underscoring the need for a more systematic, user-focused approach to cultural interface design (Ma & Guo, 2024).

Integrating visual communication theory with frameworks such as Garrett's User Experience Model offers a promising way to overcome these limitations, enhancing both cultural representation and usability in digital ICH platforms. Furthermore, the integration of visual communication theory with structured UX patterns in digital ICH design remains underexplored. Most digital heritage initiatives are content-centric, paying limited attention to the emotional and cognitive dimensions of user engagement (Ferreira et al., 2023). While visual elements are often present, they tend to be superficial rather than functional, lacking intentionality in color meaning, spatial hierarchy, or narrative structure (Qiu, 2025). This reveals an untapped potential for enriching cultural meaning through visual storytelling. Strategically employed, visual communication can guide users through an artistic journey of discovery, not only illustrating how bamboo weaving is performed but also revealing why it matters (Wang & Zhao, 2024). Achieving this, however, requires a systematic alignment of design principles with UX structures, which most current ICH-related platforms lack. Garrett's User Experience Model, comprising strategy, scope, structure, skeleton, and surface, provides a strong foundation for such alignment but remains underutilized in cultural interface design (Lee et al., 2023).

Moreover, there is little empirical insight into how visual cultural elements influence user experience on digital heritage websites. User experience is frequently assessed in terms of usability or satisfaction alone, neglecting deeper factors such as perceived cultural value, emotional engagement, and symbolic interpretation. Consequently, there are no validated models to assess how effectively a digital interface represents intangible culture. This gap hinders the development of culturally oriented, user-focused design standards. The absence of robust data on how users perceive, appreciate, and respond to cultural imagery makes it difficult to refine design strategies or even claim relevance to heritage conservation. Therefore, this research seeks to address these gaps by employing visual communication theory and Garrett's User Experience Model to design and evaluate a bamboo weaving interface, contributing new insights to the discipline of digital ICH preservation.

Although various digital media have attempted to sustain ICH, few have integrated formal UX models with visual communication theory, especially in interface design. Existing digital ICH applications often prioritize information dissemination over interaction, resulting in static interfaces that fail to establish emotional or cognitive connections with users. This research addresses a critical empirical gap, the absence of structured, UX-based approaches to enhancing both usability and cultural relevance in digital ICH experiences. Theoretically, while visual communication has long been studied in fields such as marketing and education, its role in encoding cultural symbolism for digital heritage audiences remains underexplored. Little is known about how users perceive, decode, and emotionally respond to traditional visual motifs when presented digitally. This study posits that without systematic UX frameworks to guide visual storytelling, cultural symbolism risks becoming trivial rather than meaningful.

Accordingly, the novelty of this study lies in its integration of Garrett's UX Model with visual communication strategies to design and empirically test a culturally informed digital interface. This interface seeks to transcend implicit cultural assumptions by making them explicit through intuitive and meaningful interaction. Hence, the study aims to achieve the following research objectives:

1. To classify bamboo weaving craftsmanship culture into explicit and implicit cultural categories;
2. To translate these cultural categories into knowledge units for interface design.
3. To apply Garrett's User Experience Model and visual communication theory to guide interface design, and
4. To evaluate user experience with the bamboo weaving interface in terms of value, reliability, usability, and satisfaction.

This research is significant both theoretically and practically. Theoretically, it contributes to the emerging interdisciplinary field of digital heritage by integrating user experience theory, visual communication, and cultural semiotics. It enhances understanding of how modern interface design can effectively represent and facilitate the experience of intangible culture. Practically, the findings will provide actionable design principles for cultural institutions, educators, and digital developers aiming to create more engaging and authentic heritage experiences. By focusing on bamboo weaving, this study also supports the revitalization of a threatened traditional craft, offering a replicable model applicable to other forms of intangible cultural heritage in China and beyond.

2. Literature Review

2.1 Digital Preservation of Intangible Cultural Heritage

Intangible cultural heritage (ICH) is defined as the traditions, knowledge systems, and practices that a community identifies with its cultural identity, such as oral expressions, performing arts, rituals, and traditional craftsmanship (Zhang et al., 2024). Unlike tangible heritage, which is physical, ICH is dynamic and often at risk of loss due to globalization, modernization, and generational changes in interest (Zhang et al., 2023). Over the past few decades, digital technologies have been central to the preservation and transmission of ICH, enabling the documentation, archiving, and dissemination of cultural knowledge in multimedia formats (Yan et al., 2024). Digital museums, mobile applications, and 3D modeling software have expanded access to cultural materials while ensuring their longevity (Wasela, 2023). Such technologies not only preserve the physical structure of cultural objects but also capture the surrounding context, stories, and meanings, thereby providing a more holistic approach to conserving ICH (Wang et al., 2024). Moreover, the implementation of user-centric design in digital preservation initiatives enables more participatory and immersive platforms, offering communities an accessible framework for cultural appreciation and engagement (Tan et al., 2023).

Bamboo weaving, as a traditional art form, is an icon of ICH in several Asian cultures, particularly in rural China (Yu & Pashkevych, 2023). It is not only practical but also symbolically rich and imbued with deep cultural meaning (Wu et al., 2023). Bamboo embodies honesty, humility, and resilience, values deeply rooted in Confucian and Taoist philosophies (W. Li et al., 2024). The intricate process of dividing, intertwining, and shaping bamboo requires years of apprenticeship and is generally

passed down orally across generations (T. Li et al., 2024). However, with industrialization and changing socioeconomic dynamics, bamboo weaving has become increasingly marginalized, and the tradition of intergenerational transmission has diminished (Cai et al., 2024). In response, various websites have been developed to document the tools, practices, and symbolic spaces of bamboo weaving, promoting its preservation and dissemination through cultural education (Aruchamy et al., 2023). Virtual exhibitions, digital narratives, and interactive interfaces have been employed to engage younger generations and international audiences, making these practices more accessible and sustainable in the long term (Gunawarman et al., 2025).

2.2. Visual Communication Theory

Visual communication theory explores how visuals convey information and meaning through principles such as color, hierarchy, layout, symmetry, contrast, and symbolism. These elements significantly influence user perception, guide attention, and evoke emotion (Bast, 2024). Color, for instance, plays a critical role in cultural communication and emotional signaling; warm colors can induce energy and urgency, while cooler colors can evoke calmness and confidence (Bhaskara, 2024). Hierarchy ensures that the most important information captures attention first, leading users through a coherent visual flow (Fălăuș, 2024). A clear layout and symmetry enhance aesthetic appeal and readability, while contrast distinguishes elements and improves visual clarity (Gu et al., 2023). Symbolism holds particular importance in cultural contexts, as visual motifs often represent values, narratives, and collective identities (Lammon, 2023). Applying these principles in interface design ensures that visual elements are both culturally relevant and effective in communicating meaning to diverse user groups (N. Li et al., 2023).

Within the realm of intangible cultural heritage preservation, visual communication theory is especially pertinent. Interfaces showcasing traditional crafts such as bamboo weaving should incorporate culturally sensitive visuals that provide both aesthetic appeal and cultural authenticity (Qiu, 2025). The use of traditional colors, forms, and patterns in digital interfaces helps convey a sense of heritage and fosters emotional connection with users (Udris-Borodavko et al., 2023). The visual hierarchy and layout should guide users through various aspects of bamboo weaving, its history, materials, techniques, and cultural narratives, while maintaining coherence and accessibility (Wang & Zhao, 2024). Designers must also ensure that the symbolism inherent in bamboo weaving, such as the meanings behind specific patterns or the philosophies associated with the material, is effectively translated through relevant visual metaphors (Zhu, 2025). This design-level cultural encoding bridges traditional knowledge with modern technology, transforming digital spaces into both repositories of cultural information and platforms for experiential learning (Y. Li et al., 2023). Through the strategic application of visual communication principles, digital interfaces can thus support the preservation and reinterpretation of cultural heritage within contemporary contexts.

2.3. Garrett User Experience Model

The Garrett User Experience Model, developed by Jesse James Garrett (2011), is a systematic framework for user-centric digital product design structured around five interconnected planes: strategy, scope, structure, skeleton, and surface (Ahmad & Rafiq, 2024). At its foundation, the strategy plane focuses on user requirements and business needs, establishing a unified vision for what the interface should achieve (Yan & Chen, 2023). The scope plane defines both functional and content requirements, outlining the features and information to be delivered (Qiu et al., 2024). The structure plane determines information architecture and interaction design, organizing content logically and guiding user flow. The skeleton plane addresses interface, navigation, and information design, translating abstract structures into tangible wireframes (Ferreira et al., 2023). Finally, the surface plane encompasses visual design elements such as color, typography, and layout, which directly influence how users perceive and interact with the product (Ahn & Park, 2023). Collectively, these five planes ensure that a digital product is not only usable and functional but also visually coherent and aligned with users' cognitive processes and expectations.

For intangible cultural heritage (ICH) digital interfaces, Garrett's model provides a structured approach to integrating cultural representation with UX optimization. While general UX standards often prioritize performance and efficiency, Garrett's model gives equal importance to emotional response, narrative coherence, and contextual relevance, factors critical to maintaining the cultural integrity of ICH (Ahmad & Rafiq, 2024). For instance, in a bamboo weaving interface, the strategy plane would emphasize cultural learning and the promotion of heritage as primary goals, while the surface plane would prioritize symbolic motifs, textures, and color palettes reminiscent of bamboo craftsmanship (Jiang et al., 2024). This multi-plane design allows designers to craft rich and meaningful cultural experiences without compromising usability. Moreover, Garrett's model advocates iterative, user-driven design processes that align well with community-based heritage platforms, where authenticity and emotional resonance are essential (Garrett, 2011). The novelty of Garrett's model lies in its scalability and specificity, enabling cultural heritage platforms to move beyond static repositories toward dynamic, inclusive, and intuitive digital environments.

2.4. Reference Cases in ICH Digital Design

Two paradigm examples of ICH digital interface design are the applications《折扇》(Folding Fan) and《榫卯》(Mortise and Tenon), both regarded as benchmarks in visual narrative and cultural interface design. The《折扇》project showcases the traditional craft of fan-making through high-fidelity visual animations, interactive timelines, and immersive soundscapes that capture the delicate beauty and symbolic essence of Chinese folding fans. Similarly,《榫卯》introduces ancient Chinese woodworking and joinery techniques using 3D modeling, interactive disassembly, and sequential storytelling to illustrate the craft's structural complexity and historical significance. Both applications employ thoughtful interface design grounded in visual communication principles, such as balance, contrast, symbolism, and spatial hierarchy, offering users an emotionally engaging and educational experience (Wu et al., 2023).

Although these projects are not the direct focus of this study, they serve as valuable comparative references, illustrating both the potential and limitations of ICH digital design. Their user interfaces incorporate elements such as responsive interactivity, culturally inspired color schemes, and synchronized audio-visual components, demonstrating how traditional aesthetics can be reinterpreted within contemporary UX frameworks without compromising authenticity. Moreover, both cases highlight how well-structured narrative patterns can enhance user engagement and memory retention, making them ideal precedents for the bamboo weaving interface proposed in this research. The contrast between these two reference cases

underscores the novelty of the proposed user experience model, which seeks to integrate traditional visual language with user-centered design more iteratively and dynamically (Marchello et al., 2023). Through the analysis of these precedents, the current research gains valuable contextual grounding and critical orientation necessary for evaluating and enhancing the bamboo weaving interface design.

3. Methodology

3.1. Research Design

This research worked on a design-based quantitative research to test a culturally sensitive interface prototype based on bamboo weaving. Informed by the five planes of the Garrett UX Model, consisting of a strategy, scope, structure, skeleton, and surface, the process was based on iterative design, with a focus on users. Its purpose was to produce and test prototypes that represented the culture of bamboo weaving by using the principles of visual design instead of developing a complete use.

The user interaction data measured the usability and cultural communication effectiveness. The design-based evaluation model facilitated situational testing and incorporated theoretical and practical understanding to provide cultural reality in keeping with current digital demands. A pilot group (n = 10) made changes to the layout, color, and navigation. A comparison was made with two benchmark interfaces, the Folding Fan and Mortise and Tenon. The subjects randomly used each prototype for 5-7 minutes. The Figma prototype was a high-fidelity model that was used to simulate realistic interaction to test the usability correctly.

3.2. Population

The population comprised general users possessing basic digital literacy sufficient for engaging with web- or mobile-based interfaces. Participants were not required to have prior familiarity with bamboo weaving or Chinese ICH, as the goal was to assess whether the interface could effectively communicate cultural knowledge to both novices and those with prior exposure. The inclusion of users from diverse demographic and educational backgrounds ensured the design's accessibility, generalizability, and relevance across audience groups.

3.3. Sample Size and Sampling Technique

A total of 156 valid answers were obtained, and this gives a sufficient sample to be used in correlation analysis and regression analysis. The participants were recruited to the study by the use of purposive sampling based on the criteria of having a baseline level of digital literacy and expressing willingness to engage with traditional or cultural arts. Interest in heritage-related content was confirmed through screening questions because the content was to be relevant in a context. The stratified sampling was used in terms of age, gender, and education to ensure representativeness. Another pilot group (10 testers) helped pre-assess to develop the prototype and questionnaire. The last sample included 28 individuals who stated that they knew about bamboo weaving before (17.9), and 128 individuals who did not (82.1), which created a good balance of novice and culturally experienced professionals.

3.4. Data Collection Procedure

Data were collected in a systematic order. The culture of bamboo weaving was broken into definite (tools, techniques, and patterns) and unspecified (symbolic and spiritual meanings) elements. These were transformed into units of knowledge that guided interface content and functionality. The prototypes created in accordance with the principles of the Garrett Model and visual communication were exposed in the form of interactive mockups available through web or mobile platforms. After interacting, the participants were asked to answer questionnaires on value, reliability, usability, and satisfaction on a five-point Likert scale. Among 200 surveys given out, 156 were filled out and reviewed. Cultural semiotics and design theory were taken into consideration in visual design, making decisions based on symbolic motions and natural color patterns, i.e., browns and greens, to reflect the natural appearance of bamboo. This provided the interface with cultural coherence and visual harmony.

3.5. Validity and Reliability of the Instrument

The survey instrument used in this study was adapted from previously validated measures widely applied in user experience research. The constructs of value, reliability, usability, and satisfaction were derived from established UX assessment scales and modified to reflect the cultural and visual communication aspects specific to bamboo weaving. To ensure content validity, the initial questionnaire draft was reviewed by three experts specializing in cultural heritage, design, and human–computer interaction. They provided feedback on clarity, cultural sensitivity, and consistency with the study's objectives. A pilot test was then conducted with a small group of 15 participants (who were not part of the main sample) to refine ambiguous items and confirm the appropriateness of the response format. The reliability of the instrument was assessed using Cronbach's alpha, and all constructs demonstrated acceptable internal consistency, with alpha values exceeding 0.70.

3.6. Demographic Profile of Participants

Participants' demographic details were recorded carefully to better understand the representativeness of the sample. The sample comprised 156 participants, nearly balanced by gender (52% female and 48% male), and aged between 18 and 55 years. Educational backgrounds were diverse, including high school graduates, undergraduates, and postgraduates, thereby encompassing a wide range of digital literacy levels. Although prior experience with bamboo weaving was not required, approximately 18% of respondents reported some knowledge of the craft, providing valuable context for interpreting the findings. This demographic diversity ensured that the assessment captured perspectives from a broad cross-section of users, enhancing the applicability of the results to the wider public audience that digital cultural heritage interfaces aim to engage.

3.7. Data Analysis

The collected data were subjected to analysis based on the following quantitative forms: descriptive, correlational, regression, and comparative. Descriptive statistics were used to sum up the user ratings of the bamboo weaving interface, whereas Cronbach's alpha was used to check the level of internal reliability of the individual UX dimension. Correlation analysis revealed that visual design factors, namely layout, color, and symbolism, have a correlation with user experience outcome, thus

emphasizing the elements important to usability and satisfaction. Various regressions were used to identify the elements of design that were most likely to predict positive user experiences.

Two benchmark interfaces, 《折扇》(Folding Fan) and 《榫卯》(Mortise and Tenon), were used as comparative examples in intangible cultural heritage (ICH) design research due to their high-fidelity visual storytelling and interactive elements (Wu et al., 2023). The subjects (n= 156) were instructed to evaluate all three interfaces in random order, spending between 5-7 minutes with each interface, and then fill UX items value, reliability, usability, and satisfaction Likert scales of five. This standard interface contributed to the cross-interface consistency, reduced bias, and contextualized the strong and weak sides of the bamboo weaving interface, along with the existing digital heritage design practices.

4. Results

Table 1 presents the demographic breakdown of study participants. Of the total sample, 53.8% were female and 46.2% were male, indicating a nearly even gender distribution. In terms of age, the majority of participants fell within the 26–35 age group (34.6%), followed by 18–25 (30.8%), 36–45 (20.5%), and above 45 years (14.1%). This distribution shows that the sample was largely composed of younger adults, with a smaller proportion of older participants.

Regarding educational attainment, the largest group held a Bachelor's degree (55.1%), followed by Master's degree or higher (25.7%), and High School education (19.2%). This indicates that most participants were relatively well-educated, which may have enhanced their ability to interact effectively with digital interfaces. When asked about their interest in cultural content, 65.4% of participants expressed positive interest, compared with 34.6% who did not. This finding suggests that the majority of participants were engaged with or open to cultural heritage-related digital content.

Table 1: Demographic Profile of Participants

Demographic Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	72	46.2%
	Female	84	53.8%
Age Group	18–25	48	30.8%
	26–35	54	34.6%
	36–45	32	20.5%
	Above 45	22	14.1%
Education Level	High School	30	19.2%
	Bachelor's Degree	86	55.1%
	Master's Degree or Above	40	25.7%
Interest in Cultural Content	Yes	102	65.4%
	No	54	34.6%

Source: Calculated by the author

Table 2 provides the descriptive statistics for the four user experience (UX) dimensions evaluated in the study: value, reliability, usability, and satisfaction. Mean ratings across all dimensions were high, indicating generally positive attitudes toward the interface. The mean score for value was 4.21 (SD = 0.58), suggesting that users perceived the interface as highly valuable. Reliability averaged 4.07 (SD = 0.64), indicating that participants viewed the interface as dependable. Usability recorded the highest mean score at 4.33 (SD = 0.53), showing that participants found the interface intuitive and easy to use. Satisfaction also achieved a strong rating of 4.15 (SD = 0.61), reflecting overall user satisfaction. The relatively low standard deviations across all dimensions demonstrate consistent user perceptions and limited variation in responses.

Table 2: Descriptive Statistics of UX Dimensions

UX Dimension	Mean (M)	Standard Deviation (SD)	Minimum	Maximum
Value	4.21	0.58	1	5
Reliability	4.07	0.64	1	5
Usability	4.33	0.53	1	5
Satisfaction	4.15	0.61	1	5

Source: Calculated by the author

Table 3 presents the reliability analysis for all UX dimensions, measured using Cronbach's alpha. All dimensions demonstrated high internal consistency, with alpha values ranging from 0.85 to 0.90. Specifically, value recorded an alpha of 0.87, indicating good reliability; reliability showed 0.90, representing excellent consistency; usability yielded 0.85, also strong; and satisfaction achieved 0.88, reflecting high internal reliability. These results confirm that the UX constructs used in this study were measured reliably, providing a sound foundation for further statistical analysis.

Table 3: Reliability Analysis (Cronbach's Alpha)

UX Dimension	Cronbach's Alpha
Value	0.87
Reliability	0.90
Usability	0.85
Satisfaction	0.88

Source: Calculated by the author

Table 4 summarizes the correlations between various visual communication elements (color, hierarchy, layout, contrast, and symbolism) and UX dimensions (value, reliability, usability, and satisfaction). All visual communication elements demonstrated significant positive correlations with the UX dimensions, implying that effective visual design is crucial in

shaping user experience. Color showed strong positive correlations with all UX dimensions, with the highest correlation observed with satisfaction ($r = 0.75$, $p < 0.01$). Hierarchy was also positively correlated with all UX dimensions, again showing the strongest relationship with satisfaction ($r = 0.73$, $p < 0.01$). Layout exhibited significant correlations, particularly with usability ($r = 0.74$, $p < 0.01$) and satisfaction ($r = 0.71$, $p < 0.05$). Contrast produced the highest overall correlations across all dimensions, especially with satisfaction ($r = 0.76$, $p < 0.01$). Symbolism followed with strong positive correlations, most notably with satisfaction ($r = 0.72$, $p < 0.01$).

These findings underscore the importance of visual communication in enhancing user experience, particularly in terms of satisfaction and usability. A closer examination of the correlation matrix (Table 4) shows that contrast ($r = 0.76$) was most closely associated with user satisfaction, surpassing even culturally rich features such as symbolism ($r = 0.72$). This suggests that users respond more strongly to functional visual clarity than to symbolic richness when determining their level of satisfaction with an interface. High contrast improves readability, attention, and visual hierarchy, all of which reduce cognitive load and increase user confidence during interaction. By contrast, symbolic motifs, though culturally meaningful, may be less immediately communicable, particularly to users unfamiliar with the cultural context. Their influence on satisfaction is therefore more indirect, contributing to symbolic appreciation rather than immediate usability or enjoyment. This outcome highlights the need for cultural interfaces to strike a balance between symbolic richness and visual clarity, ensuring that aesthetic and emotional appeal do not come at the expense of usability.

Table 4: Correlation Between Visual Communication Features and UX Dimensions

Visual Communication Feature	Value	Reliability	Usability	Satisfaction
Color	0.68**	0.72**	0.70**	0.75**
Hierarchy	0.65**	0.69**	0.71**	0.73**
Layout	0.62*	0.66*	0.74**	0.71**
Contrast	0.71**	0.73**	0.75**	0.76**
Symbolism	0.63*	0.65*	0.67*	0.72**

Significant level: $*\ p < 0.05$, $**\ p < 0.01$, and $***\ p < 0.001$. Source: Calculated by the author

Table 5 presents the results of the regression analysis, which examined predictors of user experience based on visual communication features and UX dimensions. The analysis revealed that usability was the strongest predictor of a positive user experience, with an unstandardized coefficient of $B = 0.43$ ($\beta = 0.40$, $t = 6.92$, $p < 0.001$), indicating that higher usability significantly enhances user satisfaction. Color also had a strong impact on user experience ($B = 0.32$, $\beta = 0.30$, $t = 4.21$, $p < 0.001$), followed by contrast ($B = 0.34$, $\beta = 0.33$, $t = 4.51$, $p < 0.001$), both of which were crucial in shaping users' understanding and perception of the interface. Other notable predictors included hierarchy ($B = 0.26$, $\beta = 0.25$, $t = 3.75$, $p < 0.001$), symbolism ($B = 0.21$, $\beta = 0.20$, $t = 3.15$, $p < 0.01$), and satisfaction ($B = 0.31$, $\beta = 0.29$, $t = 4.42$, $p < 0.001$).

The findings indicate that well-designed visual components and the prioritization of usability are essential for enhancing user experience in cultural interfaces. The regression results (Table 5) further affirm that contrast and color are significant predictors of positive user experience, emphasizing that aesthetic immediacy and legibility play critical roles in forming first impressions and sustaining engagement. Although symbolism was also significant, it showed a lower predictive coefficient ($\beta = 0.20$), likely due to its more interpretative and context-dependent nature. This pattern aligns with dual-processing models in human–computer interaction (HCI), where users rely on quick, perceptual judgments (System 1) before engaging in more reflective reasoning (System 2). In the context of cultural interface design, particularly in intangible cultural heritage (ICH), this suggests that symbolic content should be supported by intuitive visual cues to achieve maximum impact. Interactive elements and contextual hints can help users gradually decode and appreciate symbolic meanings over time.

Table 5: Regression Analysis – Predictors of Positive User Experience

Predictor Variable	Unstandardized Coefficients (B)	Standardized Coefficients (β)	t-value	p-value
Color -> Positive User Experience	0.32	0.30	4.21	0.000
Hierarchy -> Positive User Experience	0.26	0.25	3.75	0.000
Layout -> Positive User Experience	0.18	0.17	2.88	0.004
Contrast -> Positive User Experience	0.34	0.33	4.51	0.000
Symbolism -> Positive User Experience	0.21	0.20	3.15	0.002
Usability -> Positive User Experience	0.43	0.40	6.92	0.000
Satisfaction -> Positive User Experience	0.31	0.29	4.42	0.000

Source: Calculated by the author

Table 6 compares the user experience (UX) performance of three interfaces, Bamboo Weaving, 《折扇》(Folding Fan), and 《榫卯》(Mortise and Tenon), across the four UX dimensions. The Bamboo Weaving interface outperformed both reference interfaces in every category. For value, the Bamboo Weaving interface recorded the highest mean ($M = 4.21$, $SD = 0.58$), followed by the Folding Fan ($M = 4.10$, $SD = 0.64$) and Mortise and Tenon ($M = 4.00$, $SD = 0.61$). Similarly, the Bamboo Weaving interface achieved the highest ratings for reliability ($M = 4.07$, $SD = 0.64$) and usability ($M = 4.33$, $SD = 0.53$), while the comparative interfaces scored slightly lower (reliability: Folding Fan = 3.95 ± 0.70; Mortise and Tenon = 4.02 ± 0.63; usability: Folding Fan = 4.18 ± 0.55; Mortise and Tenon = 4.12 ± 0.57). Finally, satisfaction with the Bamboo Weaving interface was greater ($M = 4.15$, $SD = 0.61$) than that of the Folding Fan ($M = 4.08$, $SD = 0.65$) and Mortise and Tenon ($M = 4.04$, $SD = 0.60$).

These results suggest that the Bamboo Weaving interface provided a more positive overall user experience, both in conveying cultural aspects and in fostering user satisfaction. It consistently outperformed the other two interfaces in usability and reliability, likely due to its well-structured navigation flow and effective use of contrast and color hierarchy, which reduced cognitive load and allowed users to locate information intuitively. Conversely, the Folding Fan interface excelled in value perception, possibly because its symbolic metaphors and familiar cultural references resonated more immediately with users, enhancing perceived meaningfulness. The Mortise and Tenon interface performed moderately well across all dimensions but

scored lower in satisfaction, likely due to its more technical presentation of cultural heritage, which emphasized structural accuracy over interactive engagement. While the Bamboo Weaving interface demonstrated superior functional clarity and dependability, the Folding Fan interface highlighted the importance of symbolic resonance. These results indicate that future ICH digital platform designs should seek to integrate usability-driven clarity with culturally rich symbolism to achieve optimal user engagement and cultural authenticity.

Table 6: Comparative UX Evaluation of Three Interfaces (Bamboo Weaving,《折扇,《榫卯)

UX Dimension	Bamboo Weaving (M ± SD)	《折扇》 (M ± SD)	《榫卯》 (M ± SD)
Value	4.21 ± 0.58	4.10 ± 0.64	4.00 ± 0.61
Reliability	4.07 ± 0.64	3.95 ± 0.70	4.02 ± 0.63
Usability	4.33 ± 0.53	4.18 ± 0.55	4.12 ± 0.57
Satisfaction	4.15 ± 0.61	4.08 ± 0.65	4.04 ± 0.60

Source: Calculated by the author

5. Discussion

The digital age grants as never before opportunities to retain and market within the Intangible Cultural Heritage (ICH), at the same time, it presents a challenge in maintaining the balance between user involvement and cultural authenticity. Due to the growing role of technology in mediating cultural experience, creating interfaces that provide cultural meaning in an authentic way and, at the same time, are accessible to a wide range of users has emerged as an urgent task. The purpose of this study was to investigate the usefulness of the Garrett UX Model in the design of a bamboo weaving interface and to test the relevance of visual communication concepts in influencing user perception of cultural content. The research methodology, through the use of user-centered design, shows how traditional crafts can be reinvigorated by using digital media. These results demonstrate that the strong impact of the user experience can be made by the use of cultural symbolism, interface clarity, and visual design, and that the systematic UX models may increase the usability and engagement levels.

Findings affirmed the effectiveness of the Garrett UX Model in informing the design of cultural interfaces. The positive feedback that the participants gave shows that the incorporation of usability and cultural expressiveness is indeed a way to create a sense of engagement, even when the participants of the study do not know much about the craft. It was based on the balance in functionality and emotional resonance achieved by this model, which is consistent with the previous study that introduced the value of user-oriented design when it comes to a culture (Yan and Chen, 2023). The comparative analysis with the benchmark interfaces 《折扇》(Folding Fan) and 《榫卯》(Mortise and Tenon) further confirmed the better performance of the bamboo weaving interface to such UX dimensions, as they showed the value of applying systematic design principles with symbolic richness.

The principles of visual communication had a powerful impact on the perception of the user. Perceived value, reliability, usability, and satisfaction were found to have a positive relationship with elements like color, hierarchy, layout, and symbolism (which supported the findings of Gu et al. (2023). Legibility and engagement were enhanced by effective use of color and structure (Zhu, 2025; Yan and Chen, 2023), and cultural relevance was obtained by symbolic motifs (Cai et al., 2024; Li et al., 2024). The design that appealed to the respondents was the one that had both the cultural richness and the lightness, which means that the simplicity enhances the understanding of the design to users who are not well-versed in particular cultural codes.

The existence of a large correlation between the contrast and satisfaction ($r = 0.76$) emphasized the impact of visual differentiation on usability and cultural identification. Elemental separation, readable typography, and culturally appealing colors, as well as enhanced interest. Contrast, therefore, ought to be a strategic mechanism with regard to readability and emotional appeal that is embraced by the designers. Comparative findings demonstrated that the bamboo weaving interface was more successful than the Folding Fan and Mortise and Tenon designs in terms of UX metrics, indicating that the interface's balance between symbolism and usability successfully influenced the way users perceived it (Kartika et al., 2024; Li et al., 2025). It coincides with the literature that has underlined cultural relevance and functional clarity as two determinants of positive experience.

The central predictor of positive user experience according to regression analysis was usability, which justifies its importance in the context of digital heritage (Fisher, 2023; Purnomo and Pratiwi, 2023). Customers regarded player-friendly navigation, especially in the exploration of the materials of the cultures that are unknown to them. The clarity/cultural immersion balance was facilitated by the structured planes in the Garrett model. User-Centered Design (UCD) models (Ferreira et al., 2023) have comparable iterative feedback principles, yet do not have the ability to layer the cultural meaning, as the Garrett model. Similarly, although the Kano Model (Yan and Chen, 2023) applies to categorizing the aspects of satisfaction, it does not take into consideration the symbolic or emotional involvement. In the current research, the models have been developed to incorporate visual storytelling and formal UX design to provide an all-encompassing approach that combines usability with cultural appeal.

Despite earlier studies, including Wu et al. (2023), that employed descriptive techniques such as eye-tracking to learn more about visual attention, the framework of predictive and formative information by Garrett in this research design was possible, as cultural values were integrated throughout the design process. Cultural specificity, on the other hand, offers localization challenges. Color and symbolic meaning are culturally varied, i.e., red and gold mean prosperity in China, and danger or overindulgence in other cultures (Bast, 2024). Similarly, bamboo decorations can be ornamental to non-Chinese consumers. Such results highlight the necessity to moderate the cultural richness and the ability to be used by anyone with adaptive solutions, e.g., alternative color schemes or local iconography.

In general, the research indicates that usability and reliability have the most significant impact on positive experience, which agrees with the evidence by Yan and Chen (2023) and Purnomo and Pratiwi (2023). The richness of culture should thus be in harmony with the simplicity of functions. Although the bamboo weaving interface was superior in usability, its symbolic immediacy was a bit less compared to that of the Folding Fan interface, meaning that to make the symbolism and user-friendly interaction work, a subordinate is needed. Lastly, the comparison of insights demonstrated that every cultural interface had

distinct strengths in UX: the Mortise and Tenon interface was more authentic, but without the accessibility, which was in line with specialist-focused digital heritage research (Yan and Chen, 2023). Altogether, these results validate the theme that the Garrett UX Model offers a powerful evaluative system that could be used to define the functional and symbolic aspects of cultural design. The study is an improvement to theory and practice because it shows that there can be a balance between cultural authenticity and usability in terms of user-centered UX models. The kindness and clarity combined with cultural symbolism in future ICH interface design ought to be modified continually to generate digital experiences that are simple to understand, significant, and emotionally engaging to different audiences.

6. Conclusion

This research investigated the integration of the Garrett User Experience (UX) Model and the principles of visual communication in developing a digital interface for conserving bamboo weaving as part of Intangible Cultural Heritage (ICH). By creating and testing interface prototypes that embed cultural symbolism within a structured UX framework, the study demonstrated that a careful balance of visual design and user experience substantially enhances user engagement, usability, and emotional connection with cultural content.

Unlike most current digital heritage platforms, which often rely on static or content-heavy displays, this approach emphasizes interactive, user-centered experiences grounded in cultural meaning. The results not only confirm the effectiveness of the Garrett UX Model for heritage interface design but also highlight the critical role of visual storytelling in shaping how users perceive and engage with traditional crafts. Furthermore, this research opens new pathways for interdisciplinary inquiry at the intersection of design, digital heritage, and intercultural communication by emphasizing the influence of visual elements on diverse user groups. Overall, the study contributes to the ongoing discourse on how new media can serve as both preservation tools and platforms for cultural participation in today's globalized, digital world.

7. Practical Recommendations

This paper offers some viable suggestions to designers, teachers, and cultural sites involved in creating Intangible Cultural Heritage (ICH) digital platforms. The results point out that the user-centered design should be culturally affirmative as well, and not limited to technical usability, but encompassing the symbolic richness and imaginative sensibility of living crafts. Color palettes used by designers should be warm and natural (like alternatives of brown, green, and dull golds) as a reference to the nature of bamboo and the creation of a traditional, natural environment. The tones contribute to musical harmony and emotional appeal as they reflect the environmental sources of the craft. There should be an effective information hierarchy using straightforward visual guidelines, such as culturally significant patterns/images that aid navigation for users. Basic woven patterns can act as a kind of natural dividers or guides that enable users to differentiate between different content types like tools, techniques, and symbolism, and stay oriented.

To further enlighten, interactive components can be used to explain the cultural or historical meanings of a particular motif through the use of tooltips or click-to-reveal pop-ups. As an example, a choice of a pattern might reveal its symbolic role, making learning without being useless. There should be a balance between simplicity and richness; interfaces that provide too much symbolic information run a risk of confusing the user who does not know the culture behind the new interface. Gradually releasing information- starting with a small amount and introducing additional information as expandable sections is done to reach beginners and give experts the chance to explore. In addition, the designers should make sure that visual symbols are decipherable across cultures. Both the local practitioners and international viewers can validate both written forms of misrepresentation and devaluing cultural icons to decorative values. Adding context to the designs or brief stories adds to the cultural insight and appreciation. The combination of these concepts could help digital ICH platforms be usable, authentic, and engaging at the same time to provide people with informative, emotionally resonant, and accessible experiences..

8. Implications

The practical implications of this research are highly relevant to designers, cultural organizations, and digital heritage practitioners developing interactive platforms for traditional crafts and ICH. The study advocates the application of formal UX models, specifically the Garrett UX Model, to ensure that interface design balances functional usability with emotional resonance. Visual components, such as color, composition, symbolism, and contrast, should be selected not only for aesthetic appeal but also for cultural coherence and narrative unity. Designers are advised to adopt iterative user testing to confirm both cultural appropriateness and usability, especially when the target audiences may be unfamiliar with the presented heritage. In multicultural or international contexts, localization strategies, including language, symbolism, and color adjustments, should be applied to ensure accessibility across diverse user groups.

For policymakers and educators, these findings underscore the value of designing digital heritage programs that go beyond archival preservation to foster experiential, emotional, and cultural engagement. Ultimately, this research promotes a paradigm shift toward culturally responsive, user-centered digital preservation, capable of sustaining and revitalizing traditional heritage in inclusive, interactive, and globally accessible ways.

Practically, the findings offer clear design guidelines for future ICH-related digital platforms. Cultural interfaces should prioritize usability, simplicity, and clarity to allow users to explore rich content without confusion. Additionally, visual elements, such as color, hierarchy, contrast, and symbolism, should be purposefully designed to elicit the desired emotional and cultural responses. These design strategies can be extended to a wide range of ICH domains, including music, dance, traditional crafts, and oral traditions, to encourage users not only to consume but to appreciate and connect with cultural significance. The approach developed in this study, which integrates cultural categorization and UX analysis, provides a systematic method for interface design that bridges cultural heritage and contemporary digital practice. This research demonstrates the potential for digital preservation to transcend mere documentation, transforming cultural practices into engaging and intellectually stimulating experiences that invite emotional and reflective participation.

9. Limitations and Future Directions

While this study contributes valuable insights into digital interface design for Intangible Cultural Heritage (ICH), several limitations must be acknowledged. First, the evaluation was conducted on prototypes rather than fully functional applications. Participants experienced visual design and navigation but not system-level components such as loading speed, database integration, or long-term content management. Consequently, the findings may not fully generalize to real-world contexts where complete system performance shapes user experience. Future research should test fully operational platforms in authentic usage environments to validate these results. Second, the sample was biased toward younger, well-educated, and digitally literate participants (see Table 1). This demographic composition may not reflect the perspectives of older artisans, rural communities, or less technologically experienced users, who are often the principal custodians of ICH. Subsequent studies should include a more demographically diverse population, particularly heritage practitioners, to ensure cultural inclusivity and practical relevance. Third, the study did not control for prior knowledge or experience with bamboo weaving, which could have influenced the interpretation of cultural symbols. Participants with prior exposure may have understood motifs differently from those unfamiliar with the craft. Future research should incorporate screening procedures and analyze results according to cultural familiarity to refine interpretation accuracy. Lastly, the study did not perform an a priori power analysis to determine the optimal sample size. Although 156 participants were sufficient for exploratory analysis, future studies should employ formal sample planning and advanced methods such as eye-tracking, usability testing, and cross-cultural comparison. Implementing the interface in live settings would also enable longitudinal assessment of retention, behavioral patterns, and cultural learning outcomes over time.

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