

Research on Chengdu Lacquerware Customised APP Interface Design Based on User Needs

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ABSTRACT

Objective: The purpose is to explore the digital protection and inheritance path of Chengdu lacquerware traditional crafts, and realize the digital protection of Chengdu lacquerware and the inheritance of Chengdu lacquerware culture and artifact aesthetics by constructing customized APP platform based on user needs. **Methods** Through literature research, field research and search engine, the cultural characteristics of Chengdu lacquerware and the core demands of users in the customization process were systematically sorted out, including the concept of Chengdu lacquerware, personalized customization process and online APP interaction experience. Finally, the customized APP platform of Chengdu lacquerware was constructed based on the development strategy. **Results** According to the principle of interface design, a mapping model of "demand-function-interface" was built, the information architecture and interaction logic in the customization process were optimized, the shape, decoration and color of lacquer ware were extracted, and the extracted design elements were deduced and deformed by parametric design method to obtain new design elements, and the design scheme was generated according to users' requirements. **Conclusion** This study verifies the scientificity and innovation of digital means in the protection and inheritance of Chengdu lacquerware, and promotes the development of digital innovation of traditional crafts.

Keywords: Chengdu lacquer ware, APP interface design, Interactive design, Intangible cultural heritage, User needs.

1. INTRODUCTION

Intangible cultural heritage is the most important expression of a country or nation's culture, and China attaches great importance to the protection of intangible cultural heritage [1]; Chengdu lacquerware, as a national intangible cultural heritage, is famous for its exquisite skills and unique aesthetic value, but it faces the problems of inheritance faults and limited audience in contemporary dissemination and consumption. With the development of Internet technology, apps have become an important carrier for the digital dissemination and personalised consumption of traditional culture, while customised services can meet users' personalised needs for traditional cultural products and enhance cultural identity and consumption experience. Currently, the online communication of Chengdu Lacquerware focuses on information display and lacks interaction design for user customisation, which leads to problems

such as low user participation and cumbersome customisation process. As the core of the interaction between the user and the app [2], the interface design has a direct impact on the user's acceptance and experience of Chengdu Lacquerware customisation service. In order to actively deal with these difficulties and challenges, this study focuses on the interface design of Chengdu Lacquerware Customisation App that focuses on users' needs, combines user experience design theory and the concept of digital protection of non-legacy, and explores the optimization strategies of interface visual language, functional modules and interaction process, so as to provide practical reference for the digital transformation of traditional crafts.

2. RELEVANT CONCEPTS

2.1 Overview of Chengdu Lacquerware

Chengdu lacquerware, also known as ‘halo lacquer’ [3], has a long history, dating back to the ancient Shu period more than 3,000 years ago, and is a national intangible cultural heritage, one of the five major lacquerware in China, known for its core techniques such as carving and inlaying, filling colours, and carving and tin mercerising, etc., and its many crafts, fine workmanship, and time-consuming production are both practical and artistic values of the intangible cultural heritage. It is an intangible cultural heritage with both practical and artistic values. Chengdu lacquerware originated in the Shang and Zhou Dynasties, flourished in the Han and Tang dynasties, to natural lacquer and solid wood as raw materials, after 72 processes refined and made, the products cover the life of appliances and furnishings, 2006 was selected as one of the first batch of national intangible cultural heritage list [4], within the territory of Sichuan, Chengdu, PI County, and Guanghan County, north of the city of lacquerware produced has formed a unique style, self-contained.

2.1.1 Characteristics of Chengdu Lacquerware Craftsmanship

Chengdu lacquerware is fine, mainly handmade, with the use of treated wood as the base, and the production steps mainly include carving, inlaying, filling, sticking, tracing, painting, etc. [5]. In the core technique system, Chengdu lacquerware is famous for ‘three carvings and one moment’, which are the four great techniques, namely, carving silver silk light, carving and filling colours, carving lacquer hidden flowers and razor needle carving, which are fine and complex, and can present rich visual effects. In terms of materials and processes, natural lacquer and solid wood are used, and the unique ‘three grey and three lacquer’ process, with the number of lacquer layers up to 20 or more, requiring 72-100 processes, and the whole process is handmade to ensure the stability and practicability of the objects, and the production cycle lasts for several months. The production process of Chengdu lacquer ware is shown in “Figure 1”. In terms of decorative innovations, the Han Dynasty pioneered the needle scratching and gold filling method, the Tang Dynasty introduced inlays and gold and silver flatware, and the modern integration of eggshell inlay breaks through the colour limitations, forming a unique regional style, and the decorative patterns cover traditional patterns and modern designs, combining both classical beauty and a sense of fashion.

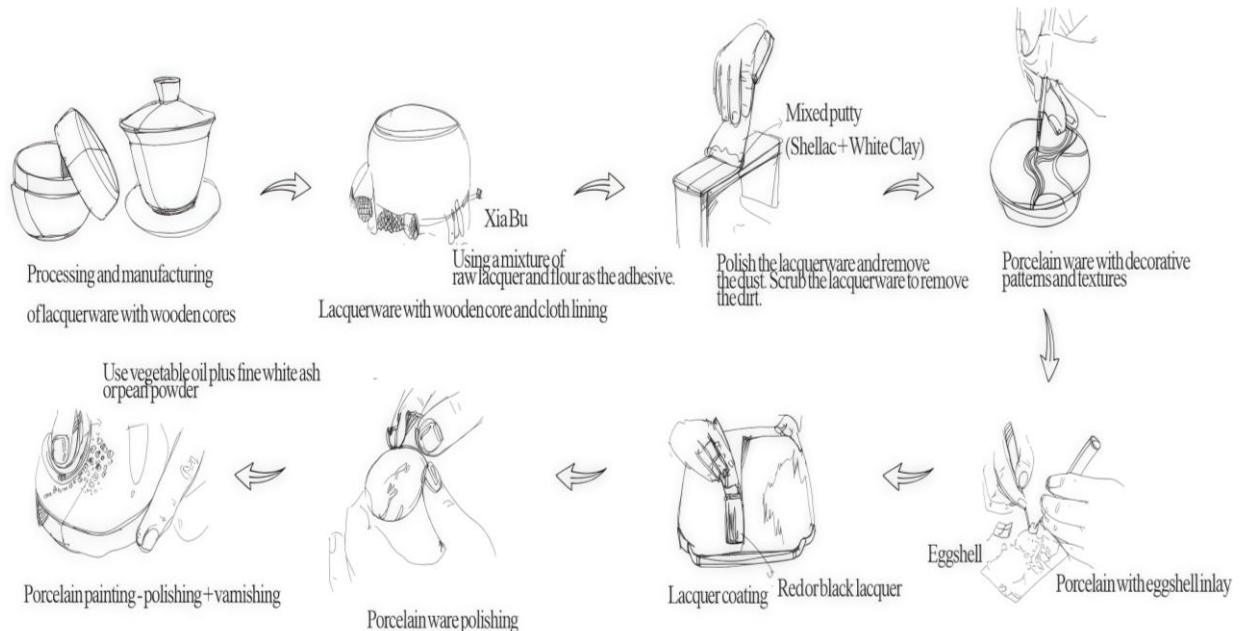


Figure 1 Flow chart of Chengdu lacquerware production process.

2.1.2 Current Development of Lacquerware in Chengdu

2.1.2.1 Technological Inheritance and Innovation

The inheritors strictly follow the ancient core techniques, but the learning cycle of the complex techniques is long, thus leading to the risk of a succession gap. In the modern improvement and cross-border integration, in order to meet the market demand, Chengdu lacquerware and many of the Ba Shu culture, designed a series of cultural and creative products, but also with the cooperation of some well-known enterprises, the launch of lacquer derivatives, to promote the skills of 'broken circle'.

2.1.2.2 Market Performance

Chengdu lacquerware due to the long handmade cycle (single piece of 3 months to 2 years), expensive, lack of practical lacquerware products, so occupy the market competitiveness is weak; and Chengdu lacquerware design style is old, lack of innovative thinking, the existing lacquer works in the shape of the traditional lacquerware, artistic themes to traditional patterns and myths and stories, the shape is relatively single, and there is a certain discrepancy between the modern aesthetics.

2.1.2.3 Challenges and Opportunities

Chengdu lacquerware faces many challenges in the process of inheritance and development, including the shortage of raw materials due to the decline of natural lacquer tree resources, the low retention rate of young practitioners as a result of the long apprenticeship training cycle and high physical requirements, and the contradiction between industrialised production and the preservation of handmade skills. In addition, traditional craftsmanship is old-fashioned, making it difficult to meet the individual needs of modern consumers. However, the introduction of digital technology has brought new transformation opportunities for Chengdu lacquerware. Through digital means, enterprises can accurately locate target customer groups and provide personalised customisation services, enabling customers to participate in product design, choose colours and patterns, etc., so as to create lacquer products that are more in line with their individual needs, and expand the market through online platforms, realising the modernisation, upgrading and sustained development of the traditional crafts.

2.2 User Experience

User experience is the overall feeling generated when users interact with a product, system or service; among the design elements of digital products, user experience is at the core, mainly through the study of user needs and behaviours, optimizing the interaction design, interface layout and information architecture, and enhancing the usability and satisfaction of products [6]. People are increasingly using digital products to engage in production and life, and the user experience has a direct impact on the results and emotions of user interaction. A good 'user experience' can optimise the emotional value of individuals, help business reduce costs and increase efficiency, and promote social service innovation [7].

2.3 Interaction Design

Interaction design is how to make users feel convenient, effective and even happy when using a product, and its fundamental goal is to explore the user group and its needs, to obtain the reaction of users when interacting with similar products, and then to explore the psychological and behavioural characteristics of 'people' themselves [8]. Interaction design needs to combine user psychology, behavioural habits, technical feasibility and other factors, through the process design, interface layout, operation logic planning and other ways to reduce the user's learning costs and operational barriers, to enhance the experience. For this reason, the external performance of a good product in the application, which is far beyond the display of some specific links, but also includes the entire design embodiment of the complete mechanism and design process. Using this complete mechanism, the product design adopts information layout, interactive behaviour experience, ergonomics, user emotion analysis and other methods to build a harmonious dependence relationship between the product and the audience, and then complete the use of the product.

3. ANALYSIS OF CHENGDU LACQUERWARE CUSTOM APP USER REQUIREMENTS

3.1 Cultural Heritage Needs

Chengdu Lacquerware, as one of the Four Great Lacquerware of China, has a long history and unique techniques, and is an important carrier of the Ba Shu culture. Its regional techniques such as

‘carving and inlay painting, tin decoration, inlay painting’ and rare techniques such as ‘plane painting and tracing, razor carving and lacquer piling’ constitute a unique artistic style, which combines the aesthetic taste and life atmosphere of Shu, and has irreplaceable cultural value. It has an irreplaceable cultural value. The inheritance of Chengdu lacquerware is not only the protection of traditional crafts, but also the maintenance of cultural diversity to avoid the disappearance of ancient skills. At the same time, its profound cultural connotation and artistic expression also provide rich inspiration for contemporary design and cultural and creative industries. By combining traditional craftsmanship with modern aesthetics and practical functions, it can promote cultural innovation and industrial development, and realise the double value of culture and economy. More importantly, Chengdu lacquerware carries the wisdom of life, folk customs and craftsmanship of Sichuan, which is not only a handicraft, but also a testimony of history and humanity. Inheriting this culture will help to continue the cultural memory of the region, and enhance the public's understanding and empathy of the historical lineage and cultural identity.

3.2 Artistic Aesthetic Needs

Chengdu Lacquerware, as one of the Four Great Lacquerware of China, is made of natural lacquer and solid wood, with rich and colourful decorative patterns, and the colours of vermilion and black are still dominant, and the workmanship is fine, which is of great artistic value and appreciation value. In terms of materials, Chengdu lacquerware is often made of natural lacquer, together with wood, bamboo, metal and other carcass materials. Natural lacquer has the characteristics of moisture resistance, high temperature resistance, corrosion resistance, etc., and can show a warm luster; wooden carcass gives a sense of natural simplicity, bamboo carcass adds a sense of freshness, and metal carcass brings a unique sense of texture. The beauty of materials of Chengdu lacquerware is not only reflected in the collision of multiple material combinations, but also in the decorative techniques and effects; in terms of decorative techniques, the traditional craftsmanship is innovated, drawing on the halo colouring process and powdering process of traditional paintings, so as to make the lacquerware more artistically expressive. As shown in “Figure 2”. In terms of painting, Chengdu lacquerware has various exquisite techniques such as carving, inlaying and tracing. The carving

technique can make the surface of lacquerware show three-dimensional patterns with smooth lines and clear layers; the inlay technique is to embed materials such as conch shells, gold and silver or egg shells into the lacquerware to add a sense of magnificence; and the depiction technique can draw delicate and vivid pictures with rich colours.



(a) Vignetting (b) Powdering

Figure 2 Haloing and dusting process.

In terms of modelling, Chengdu lacquerware is rich and varied, ranging from practical daily necessities such as plates, bowls and cups to ornaments such as bottles, jars and screens with artistic appreciation. The shapes are either simple and generous, reflecting a sense of rustic beauty, or delicate and chic, showing a unique sense of design. Different shapes meet people's aesthetic and usage needs in different scenes.

3.3 Learning Experience Needs

Contemporary Chengdu lacquerware enthusiasts, especially the younger group, are increasingly inclined to change from mere ‘viewers’ to ‘practitioners’, hoping to participate in the core processes such as lacquer painting, drawing, inlaying, etc., and to experience the techniques and charms of the lacquer art directly. This kind of experiential learning not only enhances their understanding and recognition of traditional crafts, but also stimulates a deeper level of enthusiasm for participation. However, due to the high professionalism of lacquer techniques, such as controlling the dryness and humidity of the lacquer material and adjusting the symmetry of the pattern, it is necessary to carry out the process under the guidance of a professional instructor, so as to avoid any operational errors or learning frustrations that may affect the motivation to participate. In addition, young users are eager to incorporate personalised expressions into traditional skills, such as designing exclusive patterns, applying lacquer to modern living objects, or replacing traditional patterns with abstract elements to show their own aesthetics and creativity. This demand for combining tradition and

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innovation is driving Chengdu Lacquer to become more interactive and personalised.

4. PRINCIPLES OF NON-HERITAGE CULTURE APP DESIGN BASED ON USER EXPERIENCE

4.1 Instinctive Layer - AI Virtual Digital Branding of Chengdu Lacquerware

The core of the module AI Virtual Digital Branding of Chengdu Lacquerware is to break the traditional craft of communication, experience and innovation through technology, so that Chengdu Lacquerware can move from a 'niche non-heritage' to a wider recognition and identity, while preserving its cultural core. The design of the interface layout should be simple and intuitive to ensure that users can clearly find the functions they need during the process. At the same time, the history and culture of Chengdu Lacquerware should be explored in depth, and its characteristic cultural elements should be extracted and integrated into the interface design and content design. The navigation and search function should be combined with intelligent search to facilitate users to find the required information quickly. Therefore, the cultural integration module of the APP will be jointly developed in practice.

4.2 Behavioural Layer - Users Personalise Lacquerware Products

The personalised customisation module will grade users and further refine the customisation functions, aiming to accurately meet the different needs of different users. At the same time, the behavioural layer is particularly important in the design of the whole APP because it has the largest weight value in the guideline layer [10]. The personalised customisation module belongs to the core position in the whole APP design, which stimulates the creativity and participation of users through diversified customisation modes and rich option settings; and enhances the emotional connection between users and products through real-time preview and process tracking functions. Therefore, the above three points should be combined in the design of personalised customisation module to ensure that every step from design to finished product can meet users' expectations.

4.3 Reflective Layer - Maintaining Improved User Favouritism

The user maintenance module aims to provide users with high-quality pre-sales and after-sales services, and enhance their goodwill towards Chengdu Lacquerware. A multi-channel user feedback channel can be set up, a quick response mechanism can be established, and feedback information can be analysed on a regular basis for continuous improvement of products and services, and a user community can be created to promote communication and sharing among users. Meanwhile, in terms of lacquer protection, the APP can set up exclusive areas such as lacquer maintenance guide and online consulting service to help extend the service life of lacquer ware.

5. DESIGN PRACTICE--TAKE "ZHILACQUER WORKSHOP" AS AN EXAMPLE

5.1 Zhilacquer Workshop APP Information Architecture Framework

Information architecture refers to the idea of coordinating, planning, designing, arranging and a series of organic processing of information in a particular content. Information architecture requires us to fully understand the massive needs of the target users, first of all, to see the essence from the phenomenon, to explore the real needs of the users, that is, the core function of the APP [11]; humanised design will make the product have a positive impact on the users, and more consideration of the user's subjective emotions during the design can reduce the cognitive pressure of the users and enhance the user's experience. As shown in "Figure 3".

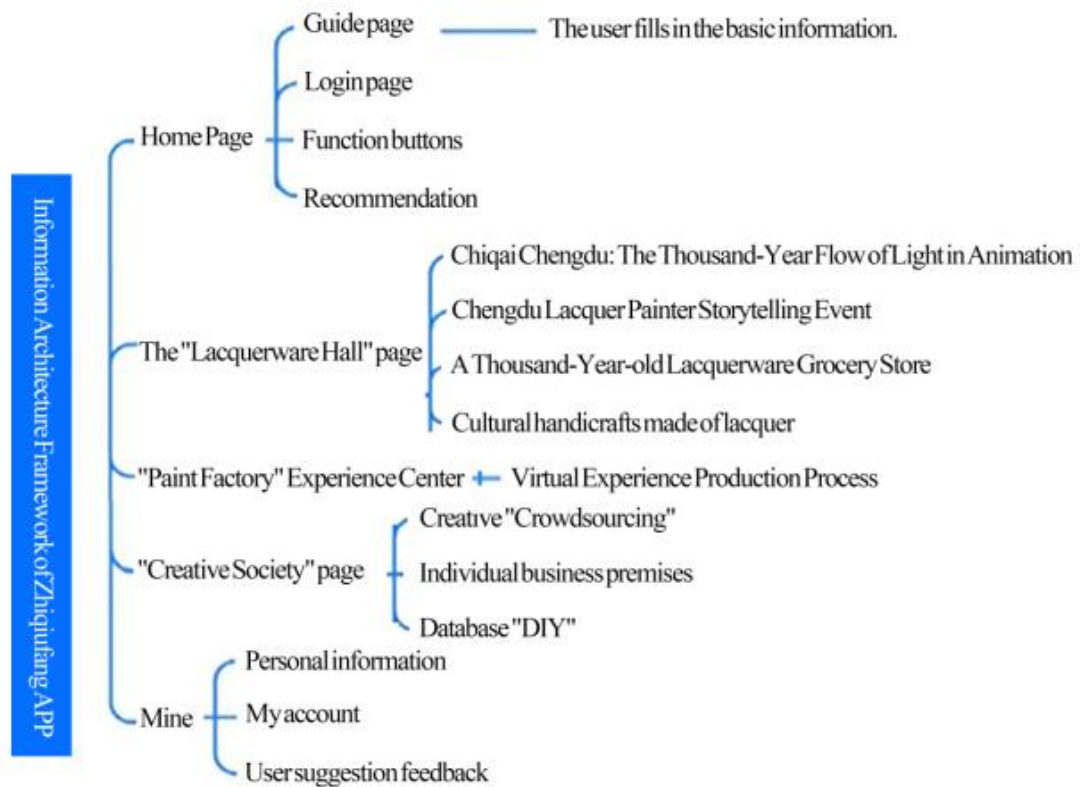


Figure 3 Framework diagram of the information architecture of Zhilacquer Workshop APP.

5.2 Zhilacquer Workshop Interactive Prototype Design

Interaction prototyping is the key process of transforming abstract product requirements into a concrete product model, as shown in "Figure 4", which is centred around 'user requirements', after the steps of 'understanding the user', 'what is the user's goal', 'requirements visualization', "prototyping", 'verification and optimization', etc., to build the product functional framework and interaction flow. As shown in Figure 5, the process is centred around 'user requirements', through the steps of 'understanding the user', 'what is the user's goal', 'visualisation of requirements', "prototyping", and 'validation and optimisation', to build the product's functional framework and interaction flow. In this process, the designer through the page layout, buttons, icons and other elements of the setting, combined with the colour block layout and logical sorting, the formation of the initial interaction logic and product architecture, to show the overall style of the app and user experience [12]. The core of the design is to solve the problem of 'how users operate', to achieve the

unity of efficient guidance and clear logic, to ensure that users can accurately understand the operation and successfully complete the target task, so as to improve the usability and satisfaction of the product. The interactive prototype design of Zhilacquer Workshop is shown in "Figure 5", "Figure 6" and "Figure 7".

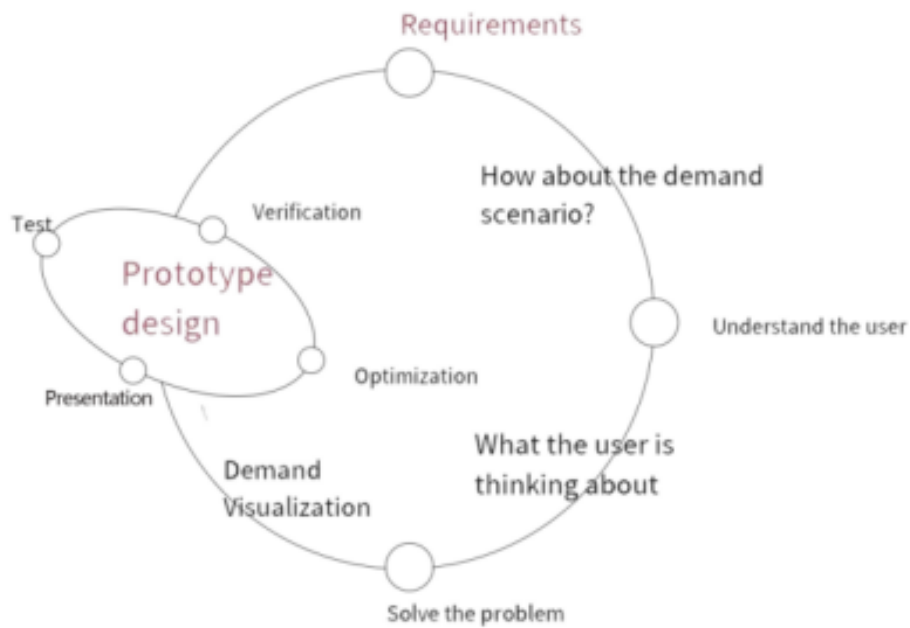


Figure 4 Closed-loop exploration of prototype diagram design and user requirements.



Figure 5 Lead-in and login page interaction prototype.



Figure 7 Interaction prototype of 'My' and 'Idea Club' page.



Figure 6 Interaction prototype of the Paint Factory experience pavilion page.

5.3 Zhilacquer Workshop APP Interface Design

The interface design of Zhilacquer Workshop APP aims to provide users with a convenient and comfortable interactive experience. The overall layout is simple and clear, important function buttons are placed in conspicuous positions, and the core operation buttons on the home page adopt large size and high contrast colour, which is convenient for users to identify and operate quickly; the colour matching is coordinated, the main colour is distinctive, and auxiliary colours are used to highlight key elements or differentiate between different functional areas; red is used to indicate the main information, and green is used to indicate the successful operation prompts; the design of the

navigation bar is clear, with clear hierarchies, which enables users to The navigation bar is designed clearly and the hierarchy is clear so that users can easily switch between various functional pages; the icon design is concise and the ideogram is clear so as to reduce the cost of users' understanding and improve the operation efficiency. At the same time, the interface elements are reasonably spaced to avoid congestion and ensure visual comfort and aesthetics.

The homepage of Zhilacquer Workshop App includes a guide page, a login page, a login button, a function button and a recommendation board. The guide page introduces the main functions and features of the app in a simple and intuitive way, attracting users to explore the app in depth; the login page is for users to enter their account password to complete the authentication process, and the login button serves as a key trigger entry point for the login process; the function button integrates frequently used functions for users' quick operation; and the recommendation board is based on users' interests and behaviours. Based on users' interests and behavioural data, the recommendation panel intelligently pushes popular lacquer works, exciting stories and other related content to enhance user stickiness. As shown in "Figure 8", the 'Lacquerware Pavilion' page is one of the core content modules of the App, which is divided into four sections: 'Lacquer Chengdu: A Thousand Years of Lacquerware in Animation' presents the historical evolution of Chengdu's lacquerware in animation form; 'Chengdu Lacquerware Story Club' tells the journey of craftsmen and the inheritance of their skills to enhance the cultural resonance of users; 'Millennium Lacquerware Grocery' displays lacquerware artefacts according to history and provides in-depth explanations; and 'Playing with Lacquerware in a Trend' incorporates fashion elements. The 'Millennium Lacquer Light Grocery Store' displays lacquerware artefacts and provides in-depth interpretation based on history; 'Tide Play Lacquerware' combines fashion elements to display creative and modern lacquerware works, which users can get inspiration from or purchase online.

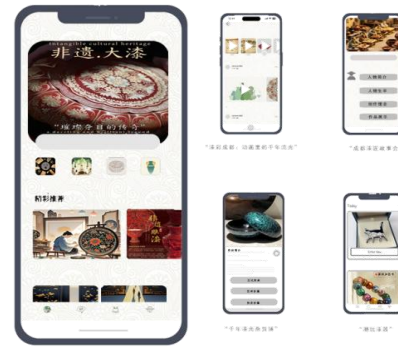


Figure 8 Design of the home page and the 'Lacquerware Museum' page.

The 'Creative Community' page aims to stimulate users' passion for creation and create an interactive community integrating creation, display and exchange. Among them, 'Personal Shop' provides a platform for users to display and sell their homemade lacquerware works, where users can set up shops, upload information about their works and conduct transactions, thus realising the transformation of the value of their creations; 'Database DIY' integrates a wealth of materials and practical tools for the production of lacquerware to facilitate users' personalised creations and meet the needs of different levels and styles of creativity, as well as to meet the needs of different levels and styles of creativity. The 'Database DIY' integrates a wealth of lacquerware materials and practical tools to facilitate personalised creation, meet the creative needs of different levels and styles, and encourage more users to explore and express themselves on the basis of traditional craftsmanship, as shown in "Figure 9".



Figure 9 'Creative Community' interface design.

The 'Lacquer Factory' experience hall creates an immersive virtual lacquer production space for users, fully simulating the complete process of lacquer production from design, material selection to production. Through the virtual technology,

users can personally operate the lacquer making, lacquering, drawing, polishing and other links, to truly restore the traditional lacquerware process and working scene, and enhance the perception and understanding of the technology. In the interactive experience, users can not only give full play to their creativity and imagination to create freely, but also deeply participate in the whole production process through the 'virtual experience of the production process'. More attractive is that the board also supports users to transform virtual works into real physical products, realising the combination of virtual and real, further enhancing the user's sense of participation and sense of achievement, as shown in "Figure 10".



Figure 10 Interface design of 'Paint Factory' Experience Hall.

The "My" section mainly undertakes the user's personal information and account management functions, and is also an important bridge for users to communicate with the platform, as shown in "Figure 11". In "Personal Information", users can view and edit basic information such as nicknames, avatars, contact information, etc.;"My Account" supports viewing account balances, transaction records, etc., which is convenient for users to manage funds and track consumption. The "User Suggestion Feedback" function provides users with a dedicated channel for feedback on opinions and questions, encouraging users to actively put forward optimization suggestions during use, and helping the App to continuously improve. In addition, this plate is also equipped with online customer service, which can respond to users' questions about use or lacquer maintenance in real time; for complex or professional problems, the platform will introduce professional lacquer maintenance team, regularly update maintenance guidelines, and provide online consultation and necessary offline maintenance services. At the same time, regular user return visits are carried out through emails, short messages or messages in APP, so as to build a long-term and efficient user

feedback mechanism to enhance user participation and platform trust.



Figure 11 'My' section interface design.

6. CONCLUSION

Chengdu Lacquerware was once a stunning piece of art with its 'thousands of languages, thousands of Hua, skilful craftsmanship', but it has gradually become silent in the fast-paced world. The popularity of the Internet has paved the way for its revitalisation. The decline of traditional craftsmanship is irreversible if it cannot accurately meet the needs of the times, and digital innovation is the key to this revival. This study verifies the scientific and innovative nature of digital means in the preservation and inheritance of Chengdu lacquerware through the construction of a customised APP platform. With the help of the 'demand-function-interface' mapping model and parametric design, it not only realises the digital protection of traditional crafts, but also inherits the culture and aesthetics of Chengdu lacquerware, provides a useful exploration and practical path for the digital innovation and development of traditional crafts, builds a bridge for the inheritors to communicate and promote, facilitates the transformation of the traditional lacquerware industry, and makes it easier for Chengdu lacquerware to be revived, and also makes it easier for the traditional lacquerware industry to be revived. It provides a useful exploration and practical path for the digital innovation development of traditional crafts, builds a bridge for the inheritors to communicate and promote, and facilitates the transformation of traditional lacquerware industry.

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