# Digital Education and Dissemination of Cantonese Opera Culture in Guangfu under the Framework of Information Space Theory

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**Abstract.** With the accelerating pace of globalization, the original ecological environment of the intangible cultural heritage has deteriorated sharply, and plenty of precious cultural treasures are dying out. Cantonese opera, as the representative of Lingnan intangible cultural heritage, has been declining since globalization as well as industrialization. Although the application of digital technology has gradually become an important means for the education and dissemination of traditional culture, traditional digital methods still suffer from issues such as simplicity in digital forms and lack of relevant theoretical support.To this end, through the in-depth exploration and digital display of the theme content of "intangible cultural heritage", the designers make the intangible cultural heritage glow with new vitality in the contemporary society. This study is based on the Max H. Boisotz's information space theory, using the means of interaction design and digital virtual technology, which selects intangible (opera) cultural heritage of Wanfutai in Guangdong province and creates a real, restorative interaction experience scene. On this basis, combined with the actual situation of Wanfutai, this study proposes interactive design based on the Cantonese opera intangible under the theory of information space. The aim of this study is to achieve digital education, dissemination, and promotion of traditional non-material cultural heritage through new media technology, and to explore the possibilities of educating and productizing non-material cultural heritage in the information era.

**Keywords:** Information Space Theory; Cantonese Opera; Intangible Cultural Heritage; Digitalized Design; Education promotion

## 1    Introduction

With the advent of the digital revolution, the life of people has changed significantly. In this context, youner generations are not willing to learn intangible cultural heritage techniques, but are more willing to follow the tide of the times, and learn new science and technology. Therefore, many cultural heritage inherited by oral teaching are dying out[1]. The development of media technology has provided a new developmental path for the education popularization and inheritance of intangible cultural heritage. It is understood that in order to protect the intangible cultural heritage, Guangdong Province

takes the construction of the Guangdong-Hong Kong-Macao Greater Bay Area cultural heritage trail as an important measure to implement the national development strategy of the Guangdong-Hong Kong-Macao Greater Bay Area, and the intangible (e.g., Cantonese opera) cultural heritage trail is one of them. *Wanfutai*, as a key link in the location of the trail, carries the rise and fall of Cantonese opera in the past hundred years. Designers need to build a virtual space bearing the spiritual connotation of intangible cultural heritage through media technology to convey abstract ideas to the visitors. The information space theory provides a feasible design strategy for intangible cultural heritage, and conducts design research around the three dimensions of "encoding", "abstraction" and "diffusion". Therefore, this study examines Cantonese opera, the representative of Lingnan intangible cultural heritage, as the research case to better understand the development and utilization of digital technology in the field of intangible cultural heritage.

## 2    Literature Review

Max．H．Boisotz creates the concept of information space (i. e. "I-space"), which is more utilized in the relationship between physical assets and intellectual assets [2], integrating the three dimensions of encoding, abstraction, and diffusion. Among them, encoding dimension is the process of giving form to things, phenomena and experiences, describing data, and making data attributes change from fuzzy to clear [3]. The abstraction dimension is the process of simplifying, categorizing, and reassembling the data collected by the code [4]. The diffusion dimension is the process of disseminating information that has been encoded and abstracted to a specific audience [5]. Therefore, information space is a model that expresses the above three dimensions. In different positions of information space, there are four typical areas: fief, clan, bureaucracy and market. In these areas, information has different forms and properties. Its spatial dimension is shown in Figure 1.
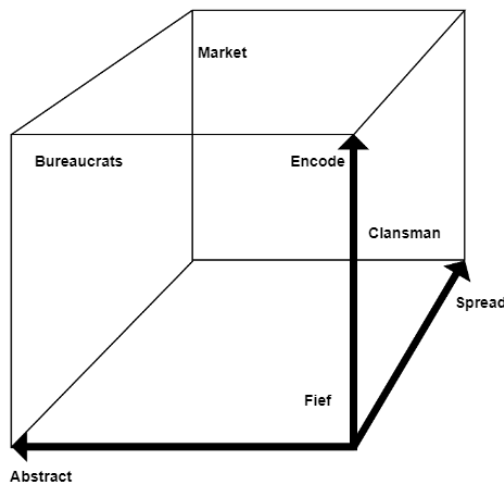


**Fig. 1.** Information space model

At present, based on the theory of information space, the development and utilization of digital technology in the field of intangible cultural heritage in China is limited to some areas and fields, and the coverage is not rich enough and the mining degree is not deep enough. For example, Tan takes the information space theory as the framework, integrates different dimensions of abstraction, coding and diffusion to standardize Tujia intangible cultural heritage, and discusses its mode of dissemination, realizing the dynamic circulation and innovation of intangible cultural heritage in the information space [8]. Taking Maba Batik as a representative case, Song et al. interpret the information characteristics of Batik from three dimensions of information space theory, analyze the opportunity points of its development by using the social learning cycle, and propose protection and communication strategies [6]. Wang utilizes the three-dimensional information space composed of encoding, abstraction and diffusion to analyze the information of bamboo weaving process, analyzes the effectiveness of digitalization on traditional cultural inheritance, and points out that digital technology, which can effectively improve the encoding degree of traditional bamboo weaving [7]. Wang et al. classify and stratify the contents of porcelain bamboo plaiting based on its information attributes, and explore the digital path of porcelain bamboo plaiting according to different needs of audiences [8]. There is still a certain gap in domestic research on the field of Cantonese opera. Although relevant departments have compiled and organized traditional operas including Cantonese opera, and established corresponding all-media information resources, web pages and digital audio and video, there is a lack of virtual experience design for Cantonese opera.

Nowadays, digital imaging, 3D modeling, behavior capture and other technologies have been widely used in the field of intangible cultural heritage, which has brought new possibilities to the digitization of intangible cultural heritage. The digitalization of traditional Cantonese opera should also adapt to The Times and try more possibilities.

## 3     Research Method and Process

At present, the interactive products of Cantonese opera generally have problems such as single interaction, too long item description, boredom, lack of emotional feedback from users and so on [9]. Therefore, by means of interactive design and digital virtual technology, this study focuses on the digital reconstruction of the performance venue "Wanfutai", which carries the feelings and thoughts of Cantonese opera culture, and creates virtual characters and objects of Cantonese opera, and immerses users in it by means of emerging narrative.

As a designer, the first thing need to be paid attention to is the user experience, which determines users' satisfaction and loyalty to the product or service. The same is true of the digital products of Cantonese opera here. Good user experience determines the effect of Cantonese opera culture communication. The second is to focus on the platform of product realization, and consider the economic feasibility and technical feasibility of the bearing platform.

In terms of user experience, in order to establish a good user experience, a survey was conducted in this study between August and September 2023. By interviewing and

analyzing the results of the questionnaire, the survey summarizes users' acceptance and potential points of interest in Cantonese opera culture. According to the survey results, Cantonese opera is very strange to most people. If it is combined with digital education, users are more inclined to have excellent guidance and services, hoping to experience the shock and surprise brought by Cantonese opera culture. In terms of scene restoration, users tend to be highly realistic scenes and want to interact with the items in the scene. As for the related elements of Cantonese opera, the top three most popular among users are Musical Instruments, costumes and drama performances. They prefer to gain more knowledge of Cantonese opera through voice explanation. Secondly, users are eager to see more stories in them and improve their emotional experience.

In terms of technology development, game engine technology has unique advantages. Current mainstream game engines include the Unity and Unreal Engine 5. Here is a comparison of the two engines, as shown in Table 1.

**Table 1.** Comparing the Unity and Unreal Engine

| Factors | Learning difficulty | Visualize the script | Rendering and graphics quality | Platform support | Communities and resources |
|---|---|---|---|---|---|
| Unity | Easy to learn | Visualization scripting tool and the C# programming language | Poor rendering ability and visual effect | Support for cross-platform development | With an active community and a rich resource pool |
| Unreal Engine 5 | It's harder to get started | The Blueprint system and the C++ programming language | Realistic, high-quality visual effects | Focus on high-end console and PC game development | Community is strong providing case tutorials |

Unity and Unreal Engine are well-known game engines, and they have their own pros and cons in many ways. For the construction of digital products of Cantonese opera intangible cultural heritage, users pay more attention to the restoration of realistic scenes. Therefore, Unreal Engine 5 is selected for development in this research. The following is the development flow chart of the core technology used in the institute, as shown in Figure 2, including the formation of the preliminary design scheme, the design of the character scene, model planning, material mapping, UI interface and interactive program design. The used technologies include Houdini programmatic modeling technology, large world generation technology, cutscene production technology and virtual interaction technology.
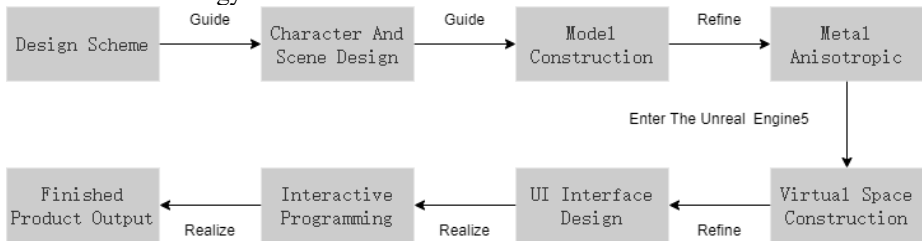


**Fig. 2.** Flowchart of core technology development

# 4     The Application of Literature Review

## 4.1     Encoding Dimension: to Construct the Extraction and Coding Mode of Cantonese Opera Information

Cantonese opera is a traditional kind of opera performing art in Lingnan region, known as the "southern red beans" reputation. During the Ming and Qing Dynasties, Cantonese opera was already popular, and the local people hoped to pray for their peace and prosperity in the coming year through opera performances [10], which not only reflects the local people's love and respect for drama culture, but also carries a folk belief and the significance of traditional sacrifice. In the long river of history, opera covers almost all human joys and sorrows, and carries many emotions and thoughts. The digital coding of Cantonese opera is the basis of abstraction and diffusion, which requires a comprehensive and authentic recording and collection of Cantonese opera information [11]. The richer the coding information, the deeper the information mining, the more inspiration the designer gets. Therefore, in the process of design, designers should code knowledge as much as possible. The following are the coding contents: (1) the origin, development and historical evolution of drama; (2) drama performance, stage art and music performance; (3) representative plays and historical materials; (4) representative figures and non-genetic inheritors; (5) the space and geographical location related to drama [12].

## 4.2     Abstraction Dimension: to Analyze the Composition Logic of Cantonese Opera Culture and Reconstruct the Information Environment of Cantonese Opera

Abstraction is to extract and simplify the information on the basis of the coding process, and then present it in the way of information visualization [13]. The CIDOC CRM conceptual model referred to in this study is the common semantic framework in the field of cultural heritage [14]. Designers can build the "conceptual reference model" of Cantonese opera to establish the connection between entities, so as to improve their abstraction degree. The following is the semantic network architecture constructed by the study, as shown in Figure 3.
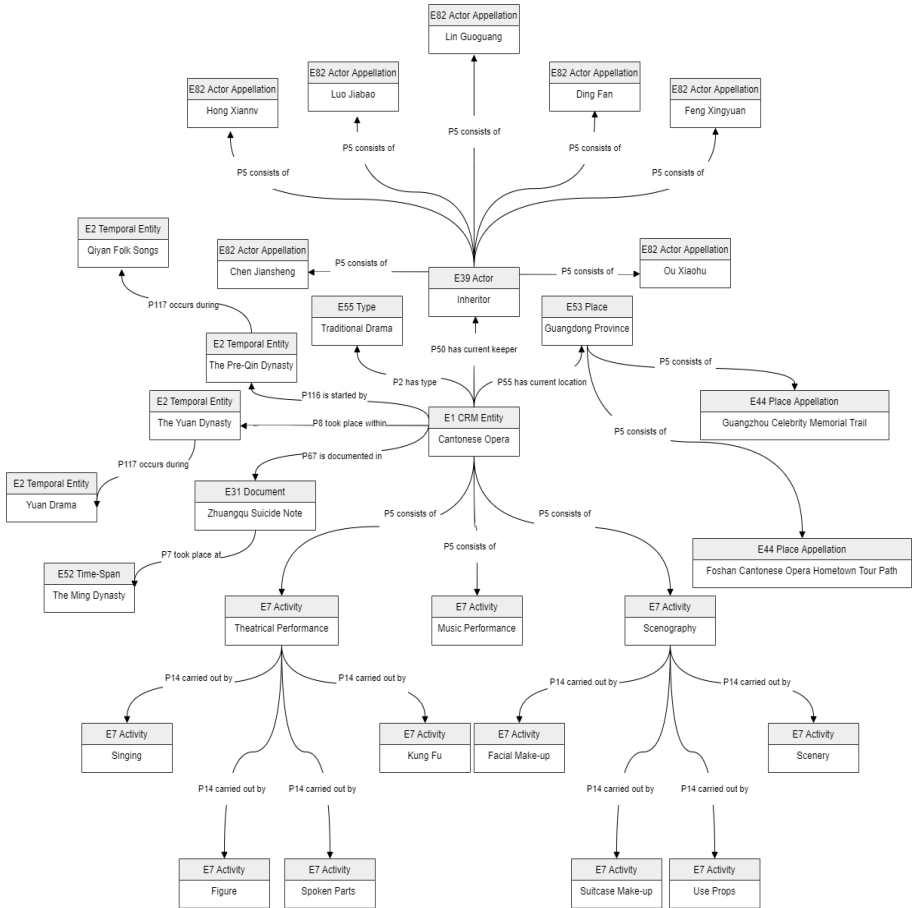
**Fig. 3.** Semantic network architecture of Cantonese opera information

The architecture demonstrates the entities and attributes associated to Cantonese opera, For example, Cantonese opera (E1 CRM Entity) is a (P2 has type) traditional drama (E55 Type), originated in the pre-Qin period (E2 Temporal Entity), by the Yuan Dynasty, has developed into a miscellaneous drama (E2 Temporal Entity). The written record of Cantonese opera (P67 is documented in) first appeared in the book of the Ming Dynasty (E52 Time-Span) (E31 Document), Cantonese opera includes (P5 consists of) Drama performance (E7 Activity), music performance (E7 Activity), stage art (E7 Activity) and other activities, with (P5 consists of) Red Line female (E82 Actor Appellation), Luo Jiabao (E82 Actor Appellation) and other 7 national intangible cultural heritage representative inheritors (E39 Actor). At present, the main audience is distributed in (P55 has current location) Guangdong region (E53 Place). At the same time, it has (P5 consists of) Guangzhou Famous Actor Memorial Trail (E44 Place Appellation) and Foshan Cantonese Opera Hometown Trail (E44 Place Appellation) two cultural heritage trails for tourists to visit.

After constructing the "conceptual reference model", the designer can digitize the design of Cantonese opera with the help of its framework convey the design concept of non-genetic inheritance and protection through different forms of expression. Such as designers can use virtual reality, augmented reality, the Cantonese opera performances, clothing, stage and props elements presented in digital way, with simple interaction, the audience can through the computer, mobile devices or virtual equipment applications, in a more intuitive way to experience and appreciate the Cantonese opera, and works and space in-depth emotional interaction. Therefore, for a more realistic user experience, this application uses unreal Unreal Engine 5 to rebuild the Wanfutai site on the intangible (Cantonese opera) cultural heritage trail in Guangdong Province to realize the original ecological reproduction of Cantonese opera performance art, music performance and stage place, At the same time, in the form of website-based interactive information visualization, The paper shows the history of Cantonese opera, the genre of plays, the anecdotes of the troupe, and the information of the representative tour path. With the voice explanation, users feel the strong cultural value of Cantonese opera in the interactive scene, thus helping the protection and dissemination of Cantonese opera culture. The specific design is as shown in the Figure 4.
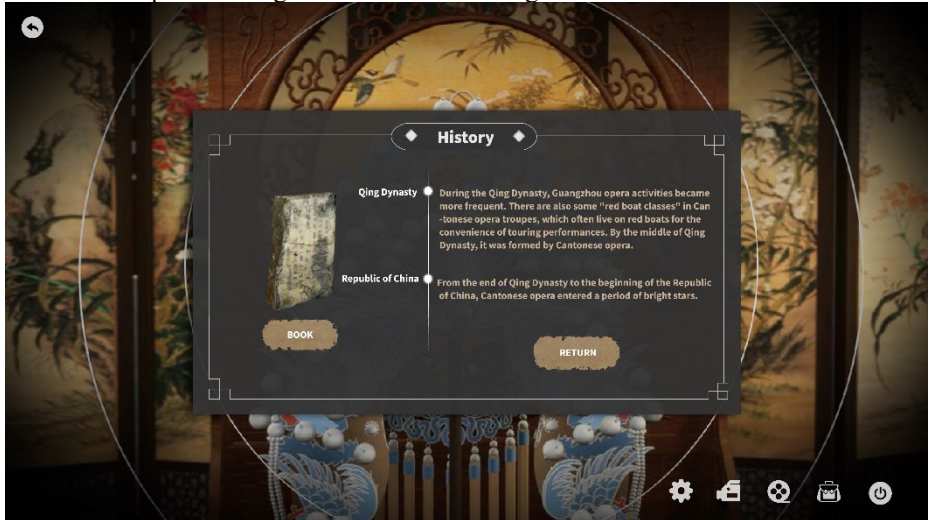


**Fig. 4.** Part of the interactive scene interface

## 4.3 Diffusion Dimension: Promoting the Education Popularization and Dissemination of Cantonese Opera Culture

For designers, intangible Cantonese opera encoding and abstract process has completed the design of the early research, the formation of the theme of the design concept and design practice output the three parts, in the process, the designer need to consider retaining the core of the Cantonese opera characteristics and style, at the same time using digital technology to increase performance and interactivity, in order to improve the diffusion effect. Overall, coding and abstracting process for intangible Cantonese opera

digital design produces the diffusion dimension, which spreads through digital chan-
nels, including the Internet, the social media, mobile applications. At the same time the
spread across geographical and time limits, global sharing and inheritance help in pro-
moting the cultural innovation and integration，  converting the intangible Cantonese
opera traditional art into modern society, and attracting more young generations' atten-
tion and participation. Therefore, this part is mainly spread and promoted through dig-
ital channels, and its audience is mainly distributed in the Pearl River Delta region,
including university students, teachers, administrators of intangible cultural heritage
centers and museums, and young groups who love Cantonese opera culture.

At the same time, in order to continuously optimize the product experience, the SUS
scale was selected for usability testing, assessing the user experience from three dimen-
sions: learnability, usability, and user satisfaction. The study conducted two rounds of
usability testing. After the first round of usability testing, the product was iterated based
on user interview feedback and usability scores. In the second round of usability testing,
an overall average score of 76.8 was obtained, higher than the first round's average
score of 65.9. The test results indicate that the product has good learnability and usa-
bility, and users have a high level of satisfaction. The analysis of the results of the
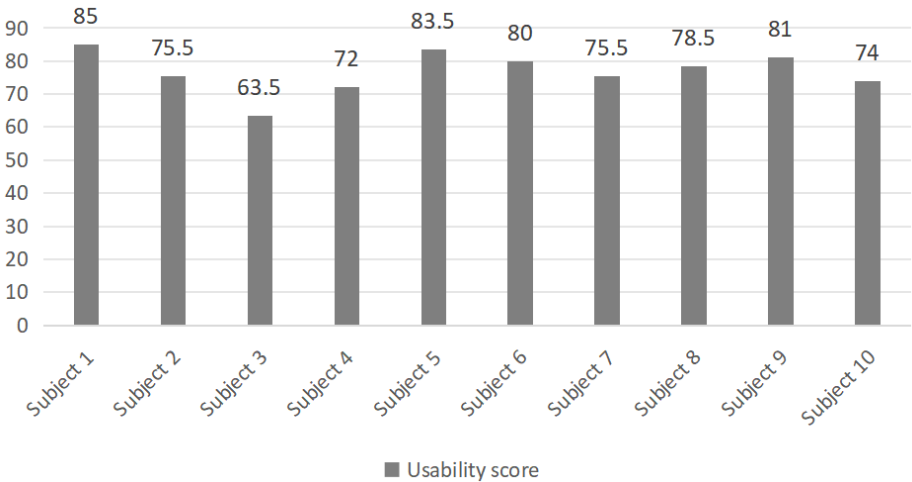second usability test based on SUS scale is shown in Figure 5:



**Fig. 5.** Score results of SUS scale

Finally, the study utilized the revised Virtual Experience Scale by Kabassi et al.
(2019) [15] to specifically evaluate the cultural education and learning aspects. A total
of 198 valid questionnaires were collected. From the perspective of the scale's dimen-
sions, the score for the educational learning aspect (4.05) indicates that the product
possesses excellent learnability, the test results are shown in Table 2.

**Table 2.** Test results of virtual experience learning scale

| Dimensions | Factors | Definitions | Item | score |
|---|---|---|---|---|
| **Learning** | Information availability | The audience gets the information they want. | Q1: I can get the information I want. | 4.12 |
| | Information abundance | The system can provide enough information. | Q2: I get enough information from the exhibition. | 3.94 |
| | Enjoyable presentation of information | The information provided by the system can arouse the attention and interest of the audience. | Q3: The information I get is interesting to me. | 4.21 |
| | Connectivity of information | The audience is willing to share their information with others. | Q4: I will discuss the information with others. | 3.93 |

# 5    Suggestions

So far, the popularization and dissemination of education on intangible cultural heritage has not been limited to the research of static literature, but should regard these cultures as a renewable and alternative resource [16]. Digital design of intangible cultural heritage based on Information Space Theory has been proven to effectively promote the education of intangible cultural heritage. With Cantonese Opera culture as the focus, the author analyzes the core design elements in digital Cantonese Opera products as follows.

First, in the coding dimension, designers should collect as much information related to Cantonese opera as possible, use the literature research method to analyze the collected data and build a knowledge map. At the same time, form a research basis for the digitalization of Cantonese opera based on the analysis and research results of the digitalization of Cantonese opera at home and abroad. Although the information cannot be fully displayed in the design practice, the designers can use this information to expand and supplement the key content of the design practice. Secondly, through field investigation, we can obtain the graphic materials of the local Cantonese opera museum, and record important information to capture dynamic scenes. At the same time, during the visit, we will observe the local architectural structure, appearance, local customs and social features, which plays a vital role in the digital construction of virtual scenes. For example, in the virtual Wanfu Platform scene, designers can integrate Lingnan cultural elements to enhance users' environmental immersion.

Secondly, in the abstract dimension, the process of refining and simplification of Cantonese opera information follows an effective semantic organization, so as to build a reliable semantic network architecture, so that the digital products of Cantonese opera can be better recognized by the public [17]. In concrete design, establishing a digital experience with strong interactivity and high openness is the key for transmitting cultural heritage [18], which can generate the desire to participate in the learning of intangible cultural heritage knowledge for a long time. Therefore, interactive experience is the core element of design. Designers enhance users' immersion in the virtual space through the combination of audio-visual experience, which is the premise that users are willing

to open the interaction. In Cantonese opera digital design, for example, the interaction can be divided into environmental interaction and character interaction, environmental interaction including user and scene props, Cantonese opera costumes, instruments, the main purpose is to let the user in the process of interactive learning intangible related knowledge, at the same time, the user can also dialogue with these items and characters, the whole work in the form of gaming narrative, bring the user more immersive experience.

Third, in the dimension of diffusion, considering the particularity of Cantonese opera culture, designers need to position the audience group. Traditional Internet, social media, mobile applications and other platforms are the main communication channels to attract young users, and designers can use them for dissemination and promotion.

Finally, in the process of the user use the product, the designer can by observing the user's reaction, get the behavioral experimental data, and after the completion of the user experience, the user in-depth interview, questionnaire survey, verify the user of Cantonese opera information accepted, to improve digital products of Cantonese opera area, help the transformation from the market area [12].

# 6     Conclusions

## 6.1     Promote the Digital Education of Cantonese Opera Culture Industry

The research method based on information space theory provides a feasible design scheme for the digital education communication of intangible cultural heritage. Encoding and abstracting dimensions can make designers a comprehensive understanding of Cantonese opera culture. Form semantic structure and design framework, diffusion dimension utilizes the modern technology in spreading intangible knowledge to the mass community, to break the old performance form, making the Cantonese opera cultural industry convert into digital development, adapting to the change of modern society.

## 6.2     Use Emerging Technologies to Help the Technological Innovation of Cantonese Opera Culture Industry

The game engine is a tool to create an interactive game experience. Through the game engine, developers can easily create game worlds, characters, items and other content, and define the interaction rules between them. By using it in the digitalization of Cantonese opera, users can have a richer audio-visual experience, and various interactive behaviors and narratives can mobilize users' emotions and immerse them in it. Nowadays, many emerging technologies such as 3D modeling, multimedia interaction, and VR/AR have enabled the traditional intangible cultural heritage to break through the formal restrictions and find new opportunity opportunities for innovation.

### 6.3 To Improve the User Experience and Promote the Sustainable Development of the Cantonese Opera Culture Industry

User experience is a core element that designers need to consider when designing products. In order to let users have a more good user experience, designers need to grasp the use of the virtual product process, for example, the clarity of the navigation system, interactive experience immersion, at the same time, the designer can redesign of Cantonese opera, on the basis of the core characteristics of traditional culture and style, combining the traditional intangible elements and modern ideas, create a new form of artistic expression, for example, the Cantonese opera clothing, makeup, props tide design, modern aesthetic fusion, create unique works, so as to promote the sustainable development of Cantonese opera cultural industry.

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