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The Exploration of Visualization Technology in Sichuan Opera

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Abstract: Visualization techniques can visually present and analyze data. This paper explores the visual field in the culture of Sichuan opera. Firstly, it summarizes the data of Sichuan opera and analyzes the characteristics of the data. Then, it introduces five kinds of visualization techniques: text visualization, hierarchical data visualization, network data visualization, spatio-temporal data visualization and multidimensional data visualization, and analyzes their application in the cultural visualization design of Sichuan Opera. Finally, the paper summarizes and puts forward the prospect.

Keywords: Sichuan opera, Cultural visualization, Text visualization, Data visualization.

1. Introduction

Sichuan opera is the most influential local opera in southwest China[1]. It has a history of about 300 years and has the research and cognitive value of culture, art, history and folk custom[2], which embodied rich historical spirit and cultural deposits, and was once a necessary entertainment program for people in Southwest China for dinner, festival and marriage. However, with the rapid development of science and technology, the once brilliant Sichuan opera has gradually lost its market in the change of entertainment and marketization. Sichuan opera needs to follow the trend of The Times and adopt the methods and contents in line with the knowledge acquisition of modern people to present and spread. Visualization is an interactive visual interface that can transform data into visual expressions that are easy to understand and explain, and it is an effective means to assist human to acquire knowledge from data[3]. For the purpose of disseminating traditional Chinese culture, visualization technology is combined with traditional culture to change the traditional way of presenting culture, so as to provide a new perspective for the audience to experience Sichuan opera culture and provide certain reference for the communication mode of traditional culture.

2. Overview of Data

The data of Sichuan opera are mainly obtained from ancient books, historical sites, cultural relics, modern records and Internet media. In this paper, the data of Sichuan opera are divided into three aspects: the historical origin, artistic characteristics and inheritance and development of Sichuan opera, as shown in Table 1. The data of Sichuan opera mainly has the following characteristics:

Table 1. Data classification

Historical Origin	Art Characteristics	Inheritance and Development
Formation process	Plays	Performing artist
Immigrant culture	Type of role	Actors
River school	Opera tune	Theatre
	Theatrics	Old-type opera school
	Acting technique	Opera Academy

(1) Large amount of data

In the 300-year history of Sichuan opera, a large number of data have been accumulated. According to incomplete statistics, more than 1000 books and 3000 related books have been published in Sichuan Opera, and more than 6000 newspapers and periodicals have been published. Moreover, in the book the Dictionary of Sichuan Opera Repertory [4], there are about 6,000 Sichuan opera repertory.

(2) Many kinds of data

The data of Sichuan opera can be divided into books, pictures, audio, video, text and so on. According to the elements, sichuan opera contains nine elements of full-scale Chinese opera : story, poetry, music, dance, acrobatics, singing, performance of artists in a pantomime, speaking-for-others and narrow theater[5];

(3) Obvious data fragmentation characteristics

The resource digitization of Sichuan opera is not perfect, the data is stored separately and lacks the integrity of the data. Therefore, it is necessary to collect data through multiple channels.

(4) Strong data composite characteristics

As the carrier of Sichuan opera culture, data has certain relationships among its attributes, structure, function and relevance.

(5) The data are mainly spatio-temporal data and content data

In the overall sense, culture extends along the two dimensions of time and space. Time and space is the basic attribute of any specific culture, and Sichuan opera culture is no exception. At the same time, Sichuan opera culture contains a large number of content data bearing cultural connotation and cultural representation.

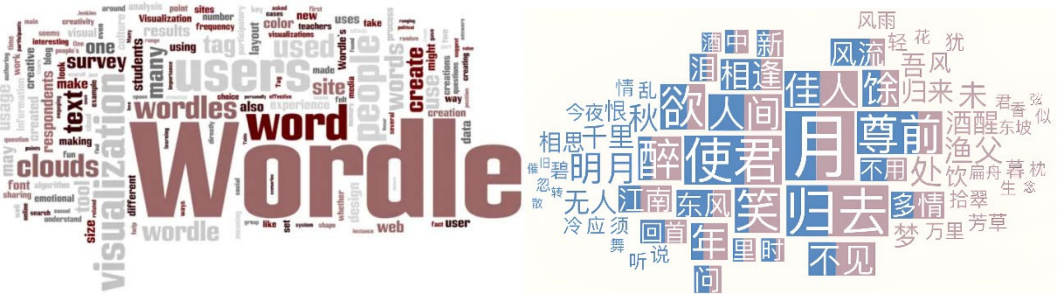
3. Visualization Technology and Application in Sichuan Opera

Reasonable selection and effective presentation of visualization technology are crucial. This paper introduces visualization technology from five categories: text visualization, hierarchical data visualization, network data visualization, spatio-temporal data visualization and multidimensional data visualization, and explores its application in Sichuan opera culture.

3.1. Text Visualization

Text visualization is to present the complicated content in text data that is difficult to be expressed in words in the form of visual symbols, so that simple data and text can be easily read, understood and accepted by human beings, so as to discover the rules and values hidden in the data[6], and it is an effective means to deal with massive and complex text information. Text data visualization mainly includes visualization based on text content, visualization based on text relationship, and visualization based on multi-level information[7]. Among them, text visualization based on word frequency is the most commonly used, which is also known as "word cloud". It arranges keywords in a certain order and law, and the size represents the importance of words. Figure 1.a is a very classic word cloud arrangement style[8], and Figure 1.b Presenting the works of Song Ci poets in the form of word cloud is conducive to the analysis of Song Ci poets[9].

The data of Sichuan opera culture usually contains a large number of semi-structured and unstructured text data, which provides data sources for the text visualization of Sichuan opera culture. Therefore, text visualization is the overall design of the visualization research of Sichuan Opera culture. For example, text visualization based on word frequency can be applied to Sichuan opera repertoire, which can effectively carry out word frequency statistics on a large number of plays in Sichuan opera culture, so that people can quickly browse the main content of each play or the whole play, so as to better analyze the content of Sichuan opera repertoire.



(a) Classic word cloud (b) Word cloud about Ci writers' works

Figure 1. Text visualization based on word frequency

3.2. Hierarchical Data Visualization

Hierarchical data is usually used to show the hierarchical relationship and subordination relationship between individuals[10], which is the most common data format. It can present the inclusion and subordination relationship in the natural world and social relations, and can also be used to show how things are constructed. Hierarchical data visualization mainly includes two visualization methods: one is space filling, such as tree graph, circular nesting, radial filling; The other is node connection, such as space tree, hyperbolic tree and radial tree[11]. In radial tree, nodes of different levels are configured on concentric circles of different radii, and the root node is drawn at the center of the circle, which makes efficient use of display space and expresses hierarchy at the same time. Figure 2 takes computer language as one node and puts it on the level representing different time, showing the development history of computer language from 1957 to 2006[12].

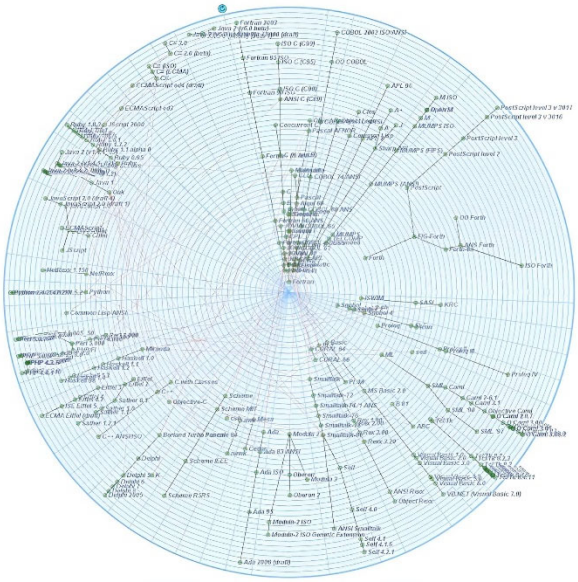


Figure 2. Treemap of the history of computer languages

The cultural data of Sichuan opera contains a lot of hierarchical data, among which the data on artistic characteristics are basically hierarchical data. For example, the role types of Sichuan opera are divided into the male role, the female role, the painted-face role, the old and the comic role, then there are further classifications. The hierarchical data visualization can directly reflect the hierarchical data of Sichuan opera cultural data, so that users can quickly and accurately understand the knowledge points contained in Sichuan Opera culture.

3.3. Network Data Visualization

Network data visualization is the visualization of large-scale networks with a large number of nodes and edges in limited space[13]. It is usually composed of nodes and edges, nodes represent objects, and lines represent the relationship between objects. It is used to analyze the relationship between things and reveal the law of data change, and is commonly used in force guide graph and relationship graph. The difference between network data and hierarchical data is that hierarchical data has a one-to-many relationship, while network data has a many-to-many relationship. Figure 3 uses the force-directed graph to connect historical celebrities, forming a figure relationship network diagram[14].

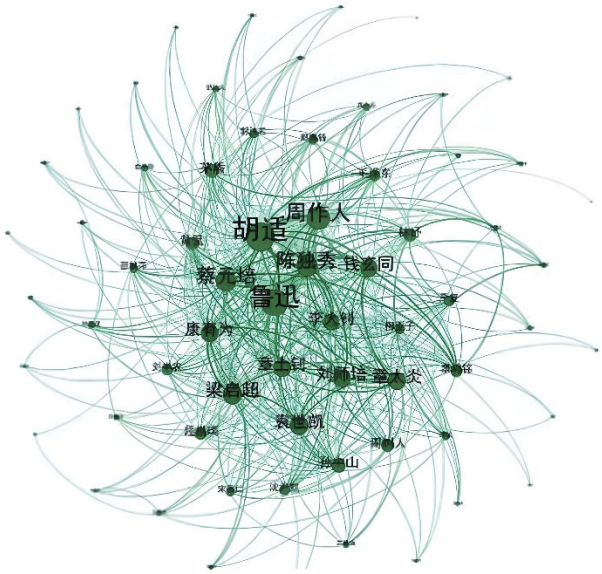


Figure 3. Force-directed graph of historical celebrities

The data on the inheritance and development of Sichuan opera culture contains many characters and teaching places related to Sichuan opera, which can be used as nodes in network data visualization to analyze the inheritance and family relationship between characters, study the development law of Sichuan opera teaching places, and construct the inheritance and development relationship graph of Sichuan opera culture, which is helpful to promote the inheritance and development of Sichuan opera culture.

3.4. Spatio-temporal Data Visualization

Spatio-temporal data refers to the data with geographical and temporal attributes, which usually needs to show the distribution of geographic information and the change of time, etc., and often superimposes the elements describing the change of time on the basis of maps, which can intuitively describe the change process of things in time and spatial information. Streaming map[15] is a typical method that combines the flow of time events with the map. Figure 4 shows the situation of French wine exported to different parts of the world in 1864 using streaming map[16].

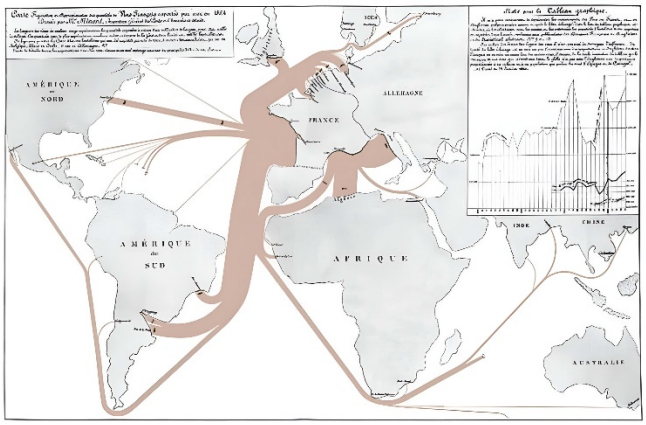


Figure 4. French wine exports

In the data about the historical origin of Sichuan opera culture, time and space data are indispensable, because the time data affects the origin and development of Sichuan opera in history, and the spatial data contains the unique regional characteristics of Sichuan opera. When visualizing the historical origin of Sichuan opera culture, the visualization of spatio-temporal data is crucial, which is an important method to deeply understand the historical development of Sichuan opera culture.

3.5. Multidimensional Data Visualization

Multi-dimensional data visualization is to transform multi-dimensional or high-dimensional data into easy-to-understand graphs[17], so as to better reflect the multi-dimensional information and the relationship between the attributes, which is an effective means of dealing with high-dimensional data sets. In order to present multi-dimensional data, multi-dimensional data visualization can be divided into geometry-based techniques, pixel-based techniques, icon-based techniques, layer-based techniques, graph-based techniques and techniques based on dimension reduction mapping, etc[18]. Figure 5 analyzes the distribution trend of words in each period of the Song Dynasty by analyzing the text data of ancient books, taking the time axis as the main line, showing the word frequency information with scatter plots in the micro level, and showing the trend with broken lines in the macro level[19].

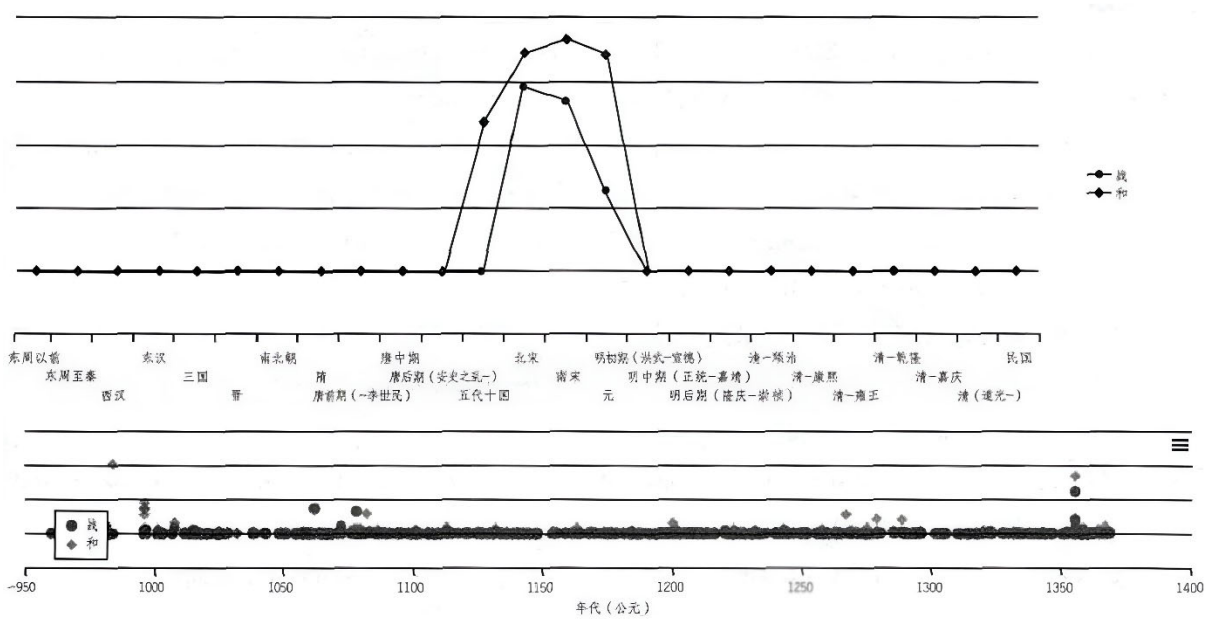


Figure 5. The distribution trend of words in the Song Dynasty

The data of Sichuan opera culture is complex, and it is difficult to comprehensively present the characteristics of the data by using ordinary one-dimensional or two-dimensional visualization methods to achieve the purpose of visual analysis. By using multi-dimensional data visualization, the three aspects of historical origin, artistic characteristics, inheritance and development of Sichuan opera culture can be combined with each other. At the same time, operations such as color coding, interactive technology, chart combination and view association can be added, which can carry out more valuable and meaningful exploration and analysis of Sichuan opera culture.

4. Conclusion

This paper focuses on the combination of data visualization technology and Sichuan opera culture, presents Sichuan opera culture in a new way, facilitates users to quickly understand and master Sichuan opera culture, and achieves good science popularization and communication effects, which is an innovative way for the communication and development of Sichuan opera culture. This paper makes a preliminary exploration on how to choose appropriate visualization techniques and visualization methods according to the data types of Sichuan opera culture. In the future, more researchers are still needed to participate in the visualization work of Sichuan opera culture.

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