# Design Strategy and Application of Headwear with National Characteristics Based on Information Visualization Technology

Ting Zhang

School of Design and Art, Henan University of Technology
Zhengzhou Henan, 450000, China

*Abstract*—With the rapid development of big data technology, information technology and visualization technology, traditional national headdress design has gradually been combined with it. The strategies and applications related to national headdress design also fully reflect the beauty of modern science and technology, which is a model of the combination of national classics and modern technology. Based on this, this paper will deeply analyze the various links and processes of the design based on the data based on the specific information of Yao ethnic headwear. At the same time, based on the existing visual design, this paper will take spring, hibernate and other systems as the basic software architecture of the design system and deeply study the visualization principles and data information visualization methods of spring, hibernate and other software, and carry out data information visualization processing on the relevant design of national headwear, to build the corresponding digital material library with national characteristics and the digital design process of national headwear. Through the digital processing and matching of the whole design, the current design of national headwear can be simplified and optimized, and the design efficiency can be improved to provide reference samples for the design of other national characteristics. In the specific design part, this paper will carry out design verification based on Yao nationality's corresponding characteristic headdress design and evaluate the corresponding design from the perspective of artistry, practicality and nationality of headdress design. The practice results show that the information visualization design of national headwear proposed in this paper has obvious advantages over the traditional design, which greatly improves the design efficiency and simplifies the design process.

*Keywords—Information visualization; headwear national characteristics; digital material library; yao nationality characteristic headdress design*

## I. INTRODUCTION

With the rapid iterative development of information technology, visualization technology, as a new technology, is developed and integrated with a large number of disciplines and projects. Traditional information visualization technology processes the data, things, information, models and corresponding knowledge in the design process. It converts them into visual images and videos so that humans can understand through computers [1]. The corresponding data information visualization decision mainly uses visualization technology to transform the important data, decisions, judgments, predictions and corresponding models in the design process so that they can be seen and understood by humans to provide clear, simple and scientific decision-making reference for decision-makers and designers [2], [3]. Conventional data information visualization technology imports the corresponding data into the preprocessing and processing data module [4], [5]. Then the data module analyzes and models it based on the corresponding data [6], carries out a large number of analogue-to-digital conversions, and carries out visual displays based on this digital information [7], [8] When this kind of software is actually running, it first carries out digital modelling processing for the corresponding processes that need modelling, which mainly includes digital conversion and mathematical statistics of the corresponding data, and then filters the corresponding data based on the statistical results, Through the corresponding query method, we can filter the data that need a visual operation, and finally create the corresponding visual interactive design chart. In the actual design and application, some data may also need the software to carry out the necessary data format conversion, to meet the specific conditions of data visualization [9], [10]. In a word, the development of data information visualization technology is of great significance to realize the scientific, convenient and scientific design process. At the same time, it is also of great significance to promote the corresponding culture and make people better understand the corresponding concepts [11].

Headwear with national characteristics is an important factor in reflecting the national characteristics, culture and customs [12], and it is also an important element to further distinguish this nation from other nations [13], [14]. The headdress with national characteristics reflects the unique aesthetic habits, religious customs and characteristic culture of the nation to a certain extent [15], which is the most distinctive embodiment of the nation. Ethnic minorities pay special attention to the design and dressing of headwear, so headwear also contains a lot of national stories, national changes and development, which itself has very important cultural significance, and it also has important value for the research and promotion of ethnic culture [16], [17]. However, the design of traditional national headwear is often limited to the representative endorsement and teaching of the traditional craftsman of the nation. Its way is too traditional, which makes a large number of craftsmanship techniques and headwear elements gradually lost in historical development, and even some headwear elements lost. Therefore, the design process, design elements and historical changes contained in the

corresponding national headwear Digital preservation of cultural elements are of great significance [18], [19]. Similarly, the personalized design of national headwear based on the national characteristic headwear data information database after complete digital processing is of great significance for the scientific, reasonable and efficient design of national cultural headwear, the inheritance of national cultural development, and the giving of new meaning and new life to national culture [20]. The deep combination of the national headdress design process and information data visualization technology is a model of efficient integration of classic and modern technology.

Visualizations of data that itself can have two-dimensional or three-dimensional semantics have been used for years before computers were used for visualization. Since the computer began to be used in visualization technology, many novel visualization techniques have been discovered and the existing ones have been improved. And the application field extends to large-scale data set visualization and dynamic interactive display. However, for most data stored in databases, there is no standard way to map data to a Cartesian coordinate system because the data has no fixed two-dimensional or three-dimensional semantic properties. In general, a relational database is viewed as a collection of multidimensional attribute data, with each dimensional attribute corresponding to the dimension of the coordinate. If three-dimensional orthogonal coordinates are used to represent visual data, visualization technology, distortion and interaction technology, then all data visualization technology can be considered as a combination of the above three. In this paper, the abstract information in the data table is transformed by visualization technology, that is, the data is stored in the form of visual structure, and the data is represented by multi-dimensional variable values. Different visualization methods will have different visualization structures. Finally, after mapping transformation, the graphical image of the composition is displayed, which also the final result is observed by the user. Each state of the data can be manipulated by the user through human-computer interaction, but the user's action does not change the fundamental structure of each data state.

Based on the above analysis and research, this paper will deeply analyze the various links and processes of the design based on the data and on the specific information of the headwear with Yao characteristics. At the same time, on the basis of the existing visual design, it will take spring, hibernate and other systems as the basic software architecture of the design system and deeply study the visualization principles and data information visualization methods of spring, hibernate and other software, and carry out data information visualization processing on the relevant design of national headwear, to build the corresponding digital material library with national characteristics and the digital design process of national headwear. Through the digital processing and matching of the whole design, the current design of national headwear can be simplified and optimized, and the design efficiency can be improved to provide reference samples for the design of other national characteristics. In the specific design part, this paper will carry out design verification based on Yao nationality's corresponding characteristic headdress design and evaluate the

corresponding design from the perspective of artistry, practicality and nationality of headdress design. The practice results shows that the information visualization design of national headwear proposed in this paper has obvious advantages over the traditional design, which greatly improves the design efficiency and simplifies the design process.

The structure of this article is arranged as follows: the second section of the article will mainly analyze and study the current research status of information visualization technology, national headdress design and other related concepts; The third section of the article will mainly analyze and study the national headdress design based on information visualization technology, focusing on the application of visualization technology and the digital process of national headdress design; The fourth section of the article will take the Yao characteristic headdress design as the object to practice, and compare it with the traditional design; Finally in fifth section the article will be summarized and prospected.

## II. RELATED WORKS

With regard to the current situation of data information visualization technology and the design of headwear with national characteristics, the current main research focuses more on the research of isolated data information visualization technology and headwear with national characteristics, while the corresponding fusion research is relatively few. The research on information visualization technology is a hot research topic at present. A large number of scientific research institutions, scholars and universities have conducted a lot of discussion and Analysis on its integration with other disciplines [21]. The current visualization technology is mainly divided into scientific computing visualization technology, data information visualization technology, information visualization technology and scientific knowledge visualization technology, Relevant researchers at Stanford University in the United States have proposed traffic information data visualization technology for the corresponding traffic information technology, established a digital information database based on the corresponding traffic information data, and built a large number of data information models [22], [23]; Relevant travel companies in the United States have established corresponding traffic data information into visual dynamic data charts, realized the analysis and research of travel big data, and carried out research on transportation travel planning based on this analysis [24]; Relevant European researchers have combined visualization technology with medical imaging technology, which realizes three-dimensional imaging of medical images through visualization technology, and has been widely used in diagnosis and treatment planning [25]; Based on this, relevant research institutions in the United States have applied the corresponding visualization technology to the field of communication with medical patients and patients' families. They have built a visualization communication platform based on data visualization technology, which further solves the communication problems of medical problems and further alleviates the problems of doctors and patients [26], [27]. At the corresponding level of national headwear design, there are many relevant studies in this part of the Chinese Mainland. Still, the main research focuses on excavating and protecting the cultural meaning of headwear, and there is little literature to

discuss and analyze its design process. At the same time, the corresponding national headwear design and research are mostly focused on the research and analysis of traditional design methods. At the level of headwear research, Relevant scholars in the Chinese Mainland have analyzed and studied the specific national headdress design, mainly discussing the differences in headdress design behind different ethnic branches and its cultural connotation [28], [29]; Relevant scholars have studied the process and protective significance of headdress design for specific ethnic groups, but have not conducted in-depth research on its combination with modern technology [30]. Therefore, there is relatively little research on integrating information visualization technology and traditional ethnic headdress design, and in-depth research is of great value.

## III. RESEARCH METHODOLOGY

This section mainly analyzes and studies the design process of the integration of information visualization technology and national headdress design, including the principle and application of information visualization technology and the national headdress design process based on the Yao nationality. Based on this, the corresponding research principal framework is shown in Fig. 1. It can be seen from the figure that the information visualization technology mainly includes data sorting and analysis, process data statistical analysis, data model establishment, digital data conversion, digital information screening, visual operation and processing, visual presentation and design evaluation. In the corresponding information visualization process, the processes that need to be modelled are first digitally modelled, mainly including the digital transformation and mathematical statistics of the corresponding data. The corresponding data are filtered based on the statistical results, and the data that need to be visually operated are filtered through the corresponding query methods. Finally, the corresponding visual interactive design charts are created. In the actual design and application, some data may also need software to perform necessary data format conversion to meet the specific conditions of data visualization. In the corresponding part of headwear design with national characteristics, it is mainly necessary to carry out data statistics on the relevant element information of headwear, digitally present the corresponding abstract and specific design elements and the corresponding design process, and transform the important data of national headwear, the decision-making of designers, the judgment of designers, the prediction of designers and the corresponding models in the whole design process, so that they can be seen and understood by human beings, To provide clear, simple and scientific decision-making reference for national headdress designers. From the corresponding principal block diagram in Fig. 1, it can be further seen that the design verification analysis in this paper is mainly based on the characteristic headwear of the Yao Minority in the Chinese Mainland. It mainly compares the corresponding design process and design results, design evaluation and traditional design process, and design results and design evaluation proposed in this paper. The main analysis indicators include design efficiency and scientificity [31]. The design method proposed in this paper has obvious advantages from the corresponding design results. In addition,

it can be further seen from Fig. 1 that the visualization software used in this paper is Spring and Hibernate, and its integration application in information visualization technologies and other fields has been widely verified [32].

### A. Application Analysis of Information Visualization Technology

Based on the analysis of national headwear and on the information visualization technology proposed in this paper, the corresponding information visualization technology is defined as information visualization interactive design [33]. It is combined with the corresponding characteristics of national headwear design and the corresponding design factors, the corresponding information visualization interactive design technology is divided into five levels, corresponding to the strategic demand level of headwear design, the demand range level of national headwear design, the structure level of national headwear design, the frame layer of national headdress design and the expression layer of national headdress design [34]. Based on this, the information visualization technology flow chart of the corresponding national headdress design is shown in Fig. 2.

In the corresponding strategic demand level of national headwear design, the corresponding needs is to analyze the specific design elements of national headwear in detail, including the cultural heritage, cultural stories, national customs, etc. the corresponding part of the national headwear design is the ultimate goal of this part of the design [35]. For national headwear designers, they can get the corresponding design goals through this part, get the corresponding other design goals based on this design goal, and extend and analyze the economic benefits on the basis of the design goals expected by the designers to make the national headwear design finally have a focus at the beginning of the design.

The range of national headwear design needs level, which is mainly the analysis of national headwear design needs [36]. The corresponding demand objects are different, and the design concepts they face are also different. For the people of this nationality, the corresponding headdress needs to maintain the original flavour, fully reflect the specific cultural characteristics of this nationality, and reflect the cultural connotation and cultural story behind this nationality; For other nationalities, it is necessary to fully meet the curiosity of such people about the national characteristics, meets the combination of national characteristics like aesthetics and modern art, and reflect the artistic beauty of the combination of classics and modernity, to give new historical significance and cultural inheritance to national headwear, and reflect the aesthetic vitality of National headwear in the new era.

The corresponding national headdress design structure layer mainly includes the interaction structure and information structure of the national headdress design. The corresponding national headdress information architecture not only includes the interface display of the front-end design but also includes the information exchange, information storage and display of the background of the design system. In this part, the design system needs to fully respond to the designer's design needs and meet the designer's convenient, fast and scientific concept for national headwear design.
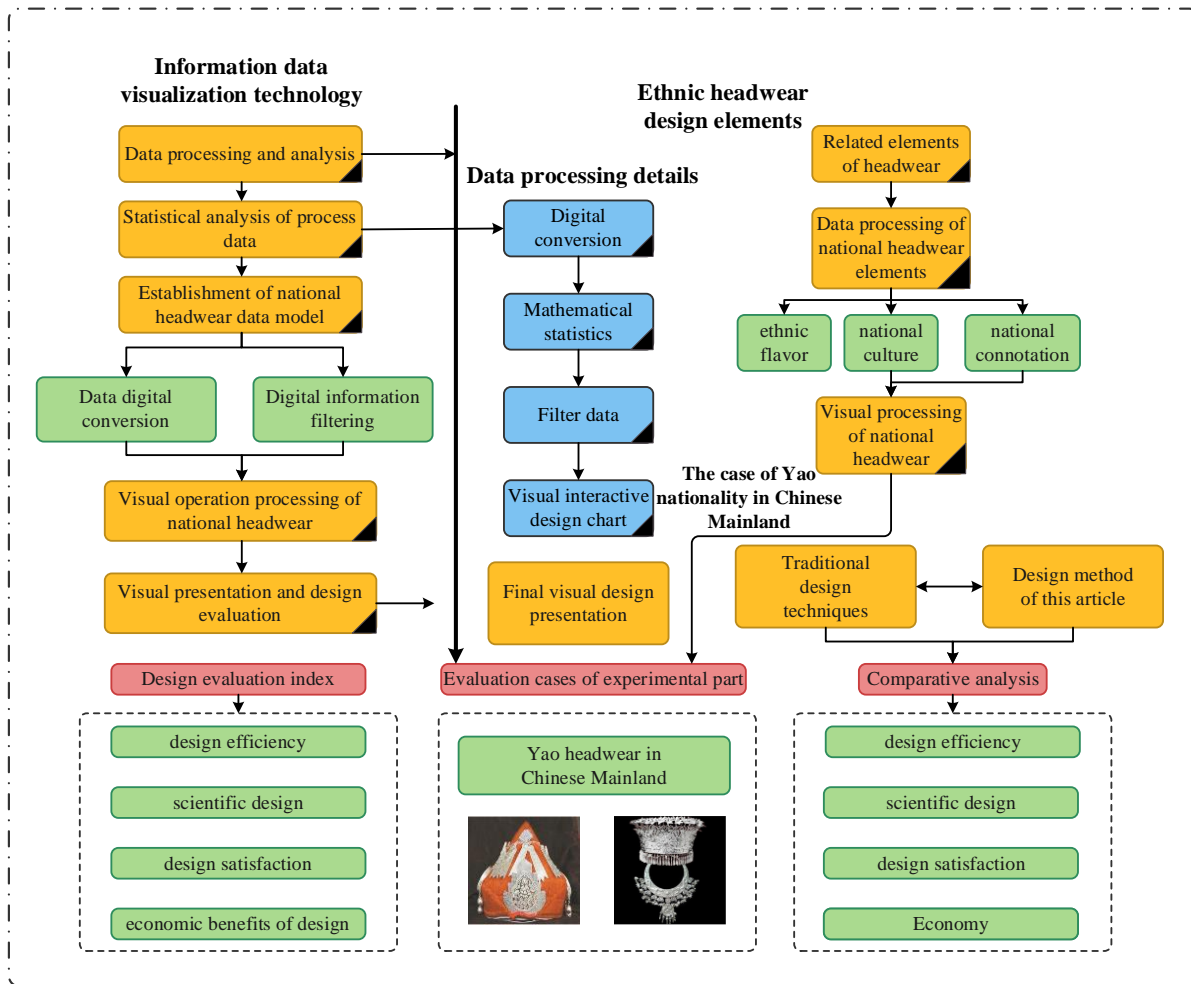
Fig. 1. Principal block diagram of the integration of information visualization technology and national headdress design.
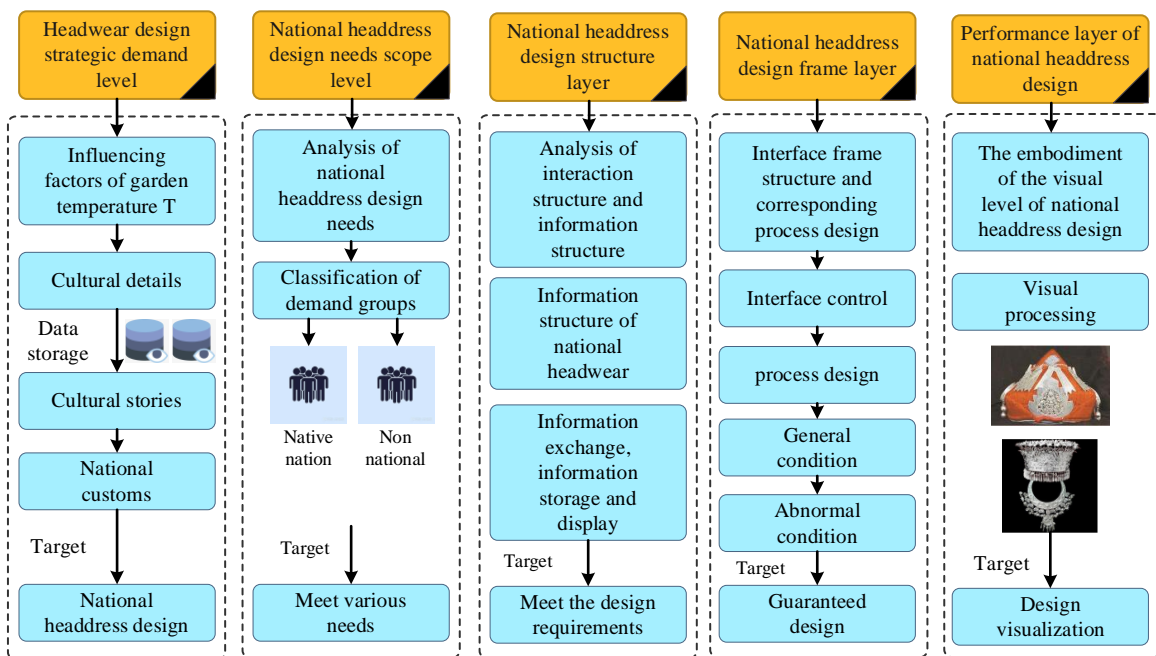


Fig. 2. Design flow chart of information visualization technology for national headdress design.
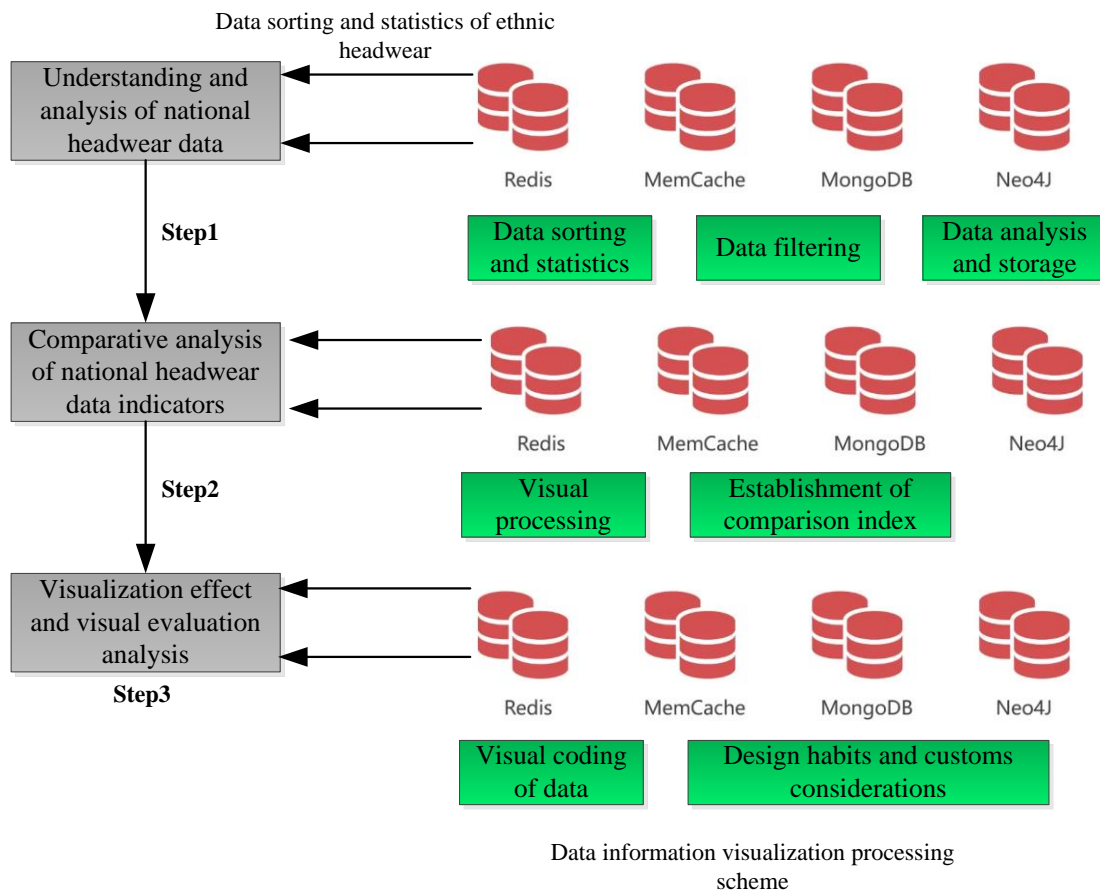
Fig. 3. Design flow chart of data visualization technology for national headdress design.

The corresponding national headwear design framework level mainly includes the interface framework structure of national headwear design and the corresponding process design, including determining various interface control forms, process design, routine condition process and abnormal condition process.

The corresponding performance level of national headdress design, this level mainly focuses on the embodiment of the visual level of national headdress design, that is, the visual presentation of the final headdress design effect [37]. At this level, the designer needs to adjust, analyze and deal with the relevant needs of the demander.

In order to further optimize its visualization processing of national headwear-related data, this paper not only uses information visualization processing but also adopts data visualization technology analysis. The corresponding analysis process is shown in Fig. 3. From the figure, it can be seen that the actual process of national headwear data visualization analysis is mainly divided into national headwear data understanding and analysis, Comparative analysis of national headwear data indicators, as well as visualization effect and visualization evaluation analysis. At the level of understanding and analyzing the corresponding national headwear data, it is mainly to screen, analyze and store a large number of collected data, correctly sort out the relationship between relevant data, and analyze the correctness and scientificity of relevant data;

At the level of comparative analysis of corresponding national headwear data indicators, visualization tools are mainly used to process the corresponding data visually. In this process, appropriate comparative indicators need to be established as a reference; In the corresponding visual data level, it is mainly to encode different data of national headwear visually. In this process, it is necessary to strictly follow the designer's design habits and customs of national headwear.

Based on the above analysis, the relevant data information on national headdress design can realize visualization technology to better provide design services for designers and make the national headdress design process simpler and more scientific.

### B. Construction of National Headdress Design System based on Information Visualization Technology

This section mainly realizes the construction of the national headdress design system based on the information data visualization technology, and the corresponding system operation framework is shown in Fig. 4. The corresponding whole system integrates information visualization technology and data visualization technology. It mainly includes a national headdress design performance layer, national headdress design control layer, national headdress design service layer, national headdress design data access object layer and national headdress design database layer. In the corresponding performance layer of national headwear design, it is mainly the

top layer of the system, which is mainly used to collect, sort out and count all kinds of data information and cultural information about national headwear. At the same time, it also needs to interact with other layers to realize the visual processing of national headwear data information, and its corresponding display form is mainly based on visual charts; The corresponding national headdress design control layer is mainly used to process designer design requests and corresponding design process business management [38]. At the same time, data access is realized by accessing the database layer. In this paper, the IOC container in spring is mainly used to manage Dao components and corresponding business logic components; In the corresponding ethnic headwear design service layer, which is mainly located below the control layer, it mainly provides the corresponding design interface for the control layer to call and process, so as to complete the functional design of the ethnic headwear design application module and realize the processing and analysis of the actual design business operation; The corresponding national headwear design data access object layer is mainly used to realize the persistent processing of national headwear data, so that the corresponding design data can be independent of the application program or the business logic of the system design, so that the system data can be easily expanded and run independently; The corresponding national headdress design database layer mainly stores the data in the relational database, which mainly adopts hibernate as the corresponding persistence processing framework.

In addition to the overall design of the system, the database design of the system is equally important. The database data corresponding to the system proposed in this paper comes from the collation and statistics of a large number of design details,

constituent elements, cultural stories and cultural connotations of national headwear. The interface between the corresponding design elements and the design system is processed by web service in this paper. After the actual data sorting and statistics, it is necessary to preprocess and analyze the corresponding headwear information data to obtain the potentially important factors of headwear design in advance. The corresponding data processing process includes the cleaning, screening, selection and corresponding transformation of the original data to ensure the accuracy of the data as much as possible and reduce the time for the designer to query the element data in the actual design. Improve the efficiency of national headdress design. The corresponding data management module mainly includes the system data management module, system data statistics module, system data monitoring module and system data comparison module. The corresponding system data management module mainly realizes the sorting, statistics and distribution of national headwear related data; The corresponding system data statistics module mainly realizes the classification and storage of national headwear related design elements, as well as the storage and memory of corresponding design preferences; The corresponding system data monitoring module is mainly to realize the online monitoring of the use of the corresponding design process data information, so as to avoid some low-level errors and cultural errors at the design level; The corresponding system data comparison module is mainly to compare the final designed finished product with the classic national headdress design, the needs of the demander and other relevant data, so as to assist the designer to complete the design evaluation of the final work, so as to ensure that the designed national headdress not only conforms to the national characteristics of the nation, but also meets the needs of the demander, and improve the satisfaction of the design.
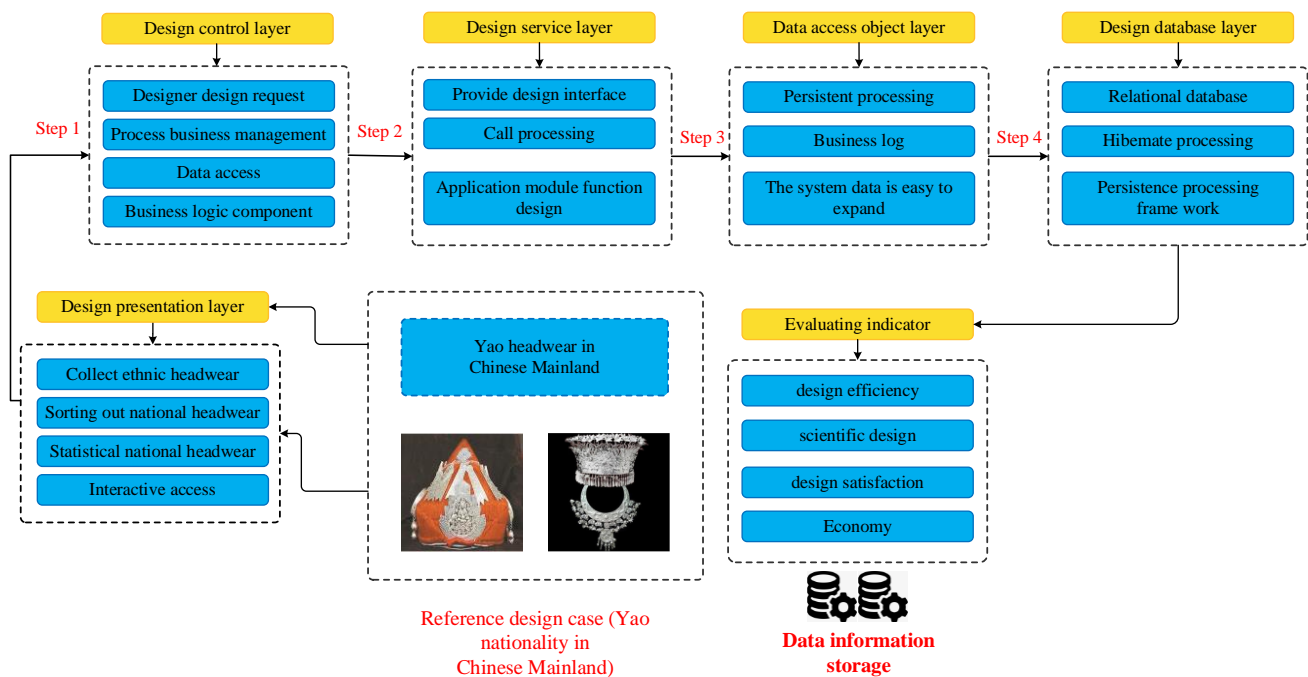


Fig. 4. Frame diagram of national headdress design system based on information data visualization technology.

## IV. RESULTS AND DISCUSSION

### A. Evaluation Results

To further verify the design advantages of ethnic headwear based on information visualization technology proposed in this paper, this paper selects Yao nationality as a sample for design comparison. The Yao nationality has a long history of national culture, and its headdress design is unique and has rich cultural connotations and aesthetic characteristics. Before the comparative analysis of the actual design, this paper fully collates the pattern, texture, colour, shape and corresponding structural design of the headdress with Yao national characteristics. It makes a statistical analysis of its important elements. Based on the comparative analysis of one of the headwear of the Yao nationality, the e-crown hat, the design process of this paper is compared with the traditional manual design process. The main comparison indicators include the nationality score of the design works, the artistic score of the design works, the practical score of the design works, and the economic score of the design work.

In terms of the nationality of the corresponding design works, questionnaires, visits and other methods are mainly used to show the works under the two design methods, invite the corresponding ethnic and non-ethnic people to score, and take the corresponding average score for evaluation. Based on this, the corresponding evaluation results are shown in Fig. 5. From the figure, it can be seen that the products designed by the design process proposed in this paper have slight advantages in nationality compared with the traditional design

process. The reason is analyzed. It mainly reproduces some complex design patterns lost in the early years.

In terms of the artistry of the corresponding design works, questionnaires, visits and other methods are mainly used to actually display the works under the two design methods, invite the corresponding ethnic, non-ethnic and professional people to score, and take the corresponding average score for evaluation. Based on this, the corresponding evaluation results are shown in Fig. 6. From the figure, it can be seen that the products designed by the design process proposed in this paper have obvious advantages in artistry compared with the traditional design process. Analyze the reasons. The design process proposed in this paper combines aesthetics under modern technology, and its psychological positioning for the demander is more accurate.

In terms of the practicality of the corresponding design works, questionnaires, visits and other methods are mainly used to actually display the works under the two design methods, invite the corresponding ethnic, non-ethnic and professional people to score, and take the corresponding average score for evaluation. Based on this, the corresponding evaluation results are shown in Fig. 7. From the figure, it can be seen that the products designed by the design process proposed in this paper have obvious practical advantages compared with the traditional design process. The reason is analyzed. The design process proposed in this paper combines data visualization technology and information visualization technology, which is more accurate for the demand positioning and processing of the demander.
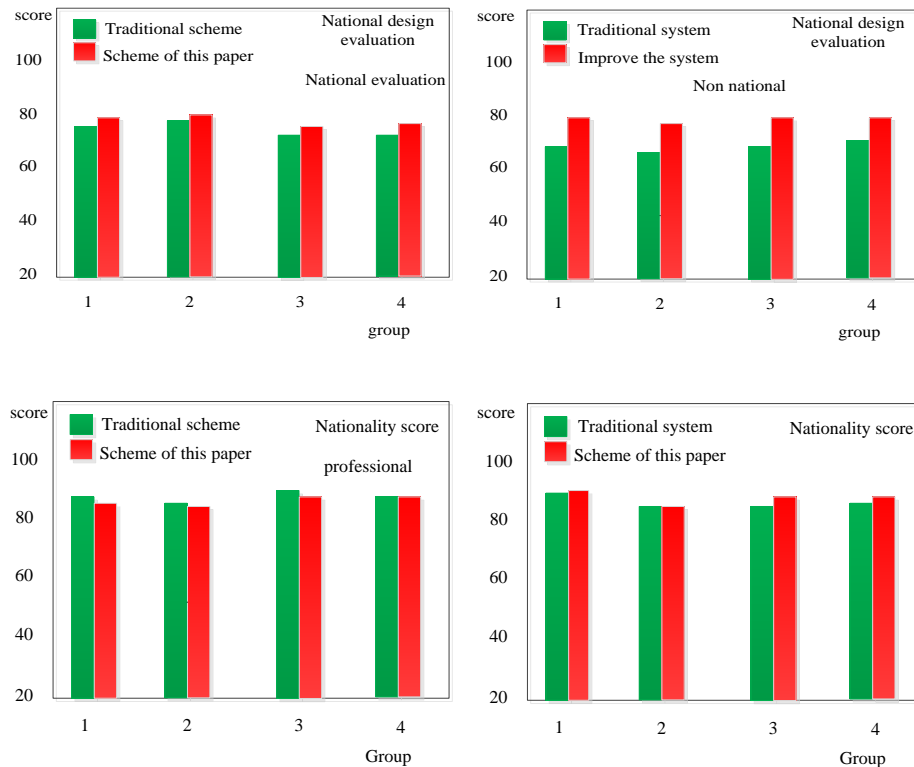


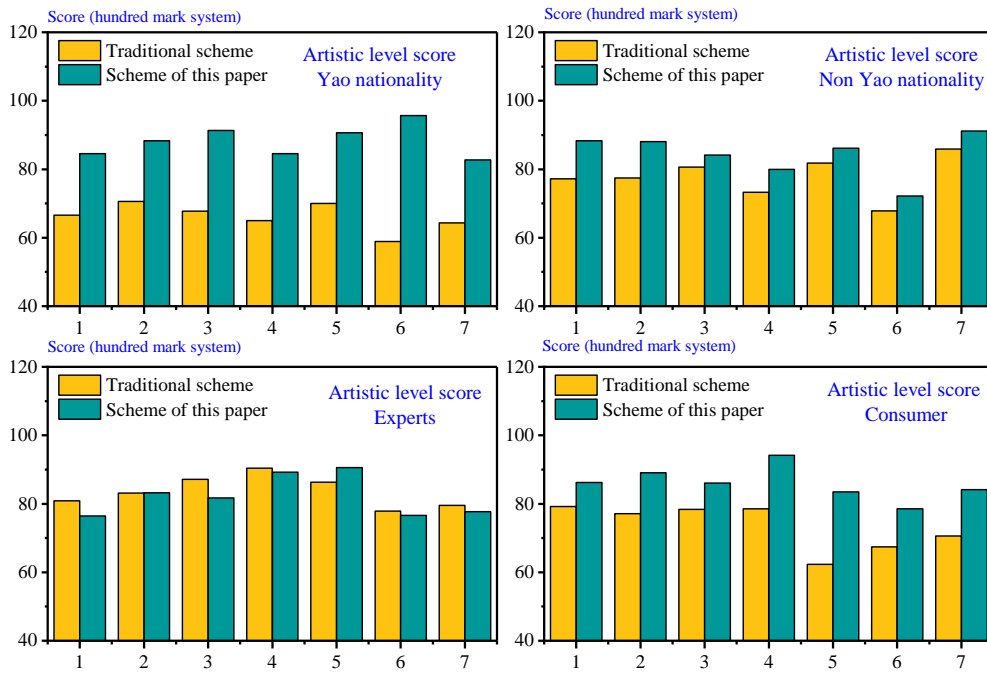Fig. 5. Comparative analysis of the nationality of design works.

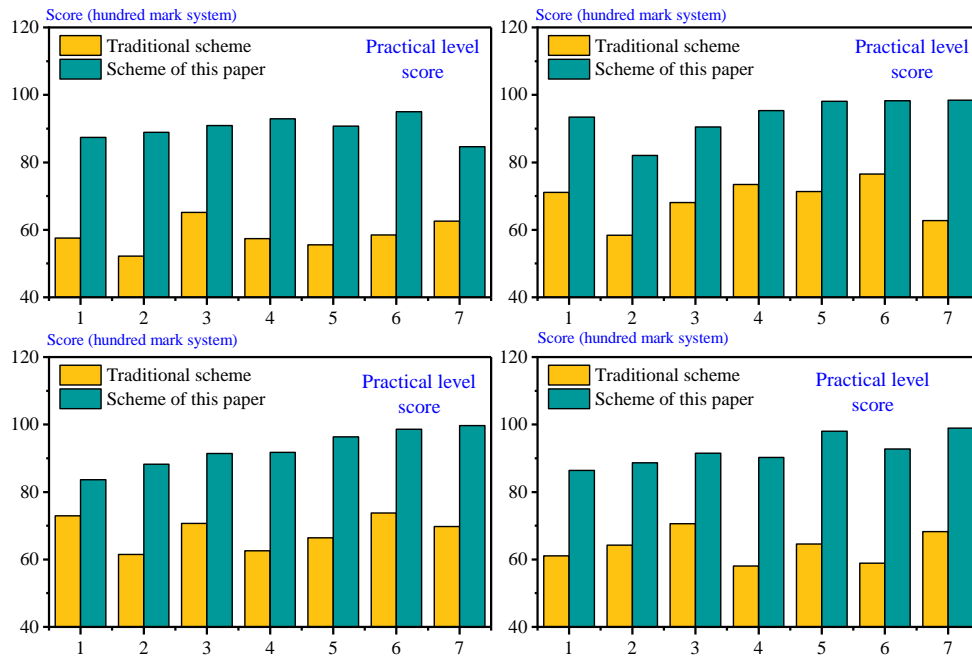Fig. 6. Comparative analysis of artistic aspects of design works.



Fig. 7. Comparative analysis of practical aspects of design works.

In terms of the economy of the corresponding design works, questionnaires, visits and other methods are mainly used to actually display the works under the two design methods, invite the corresponding ethnic, non-ethnic and professional people to score, and take the corresponding average score for evaluation. Based on this, the corresponding evaluation results are shown in Fig. 8. From the figure, it can be seen that the products designed by the design process proposed in this paper have obvious advantages in the economy compared with the traditional design process. The reason is analyzed. The design process proposed in this paper realizes the batch design and production of national headwear design, which greatly saves human design costs and reflects the advantages of modern technology at the design level.
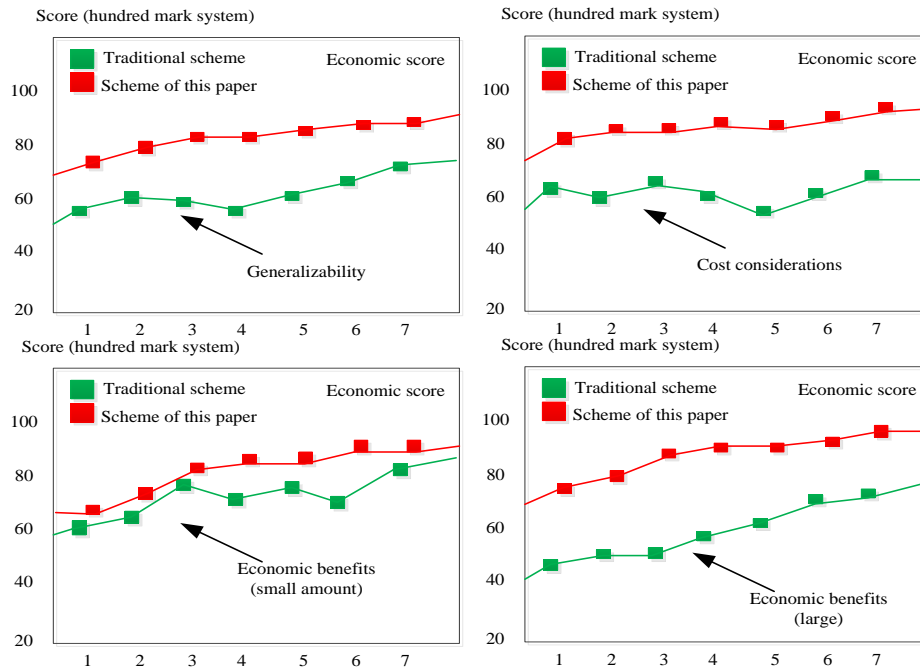
Fig. 8. Comparative analysis of economic aspects of design works.

Based on the above experimental results, it can be found that the national headdress design idea based on information visualization technology proposed in this paper has obvious advantages over traditional design methods, and it is of great significance for further promotion and inheritance of national culture.

*B. Discussion*

Visualization originates from the promotion and development of computer graphics, user interface and other research fields. Visualization technology refers to the use of computer technology to transform data into graphic form, and to transform abstract things or processes into graphics or images. With the support of computer, information visualization can express abstract data in an interactive visual way, so that people can deepen the cognitive process of data. Visualization technology is widely used in various fields. It presents data in a multidimensional form, which is more conducive to discovering the characteristics of data distribution and its potential semantic relations. Therefore, how to visualize data reasonably in the data space so that users can browse and explore these data conveniently and quickly has become a research hotspot in recent years.

In a computer, information is expressed in a certain structure to facilitate people to store, modify, query, add or delete information and other operations. As a widely used data structure, graph can be used to represent a variety of complex system models. It is basically composed of nodes and edges, where nodes are used to represent the abstraction of entities, and edges connecting nodes are used to represent the relationship between corresponding entities. Uniform, beautiful graphics are very important for understanding and analyzing data. Graph layout algorithm is the basis of graph visualization, and its performance is very important to the effect of data display. At present, most of the algorithms used in graph

visualization draw graphs simply based on the structure of the graph, that is, the connectivity between points. In the personal dataspace system, there are not only structural relations between entities, but also attribute relations determined by their own attributes, so it can also be considered to draw graphs through attribute relations.

National culture is a splendid treasure of China. Each nation has its own unique beauty, which brings us rich and different feelings. The Yao nationality has also shown us its unique national charm, carrying its material and spiritual civilization on its traditional headwear and expressing it with its unique artistic form language. From the shape features of the headwear to the decorative art, all reflect the Yao people's pursuit of beautiful things and longing for the future life. Yao traditional headwear is a very valuable intangible cultural heritage of the motherland. Their wealth is turned into silver ornaments decorated on the headwear. The art of headwear not only has practical application functions, but also is the carrier of Yao civilization. The perfect combination of its function and art is reflected incisively and vividly in the shape and decoration of the headdress.

## V. CONCLUSION

Based on the existing visual design, taking spring, hibernate and other systems as the basic software architecture of the design system, this paper deeply studied the visualization principle and data information visualization method of spring, hibernate, and other software and the relevant design of national headwear is visually processed with data information, to build the corresponding digital material library with national characteristics and the digital design process of national headwear. Through the digital processing and matching of the whole design, the current design of national headwear is simplified and optimized, and the design efficiency is

improved to provide reference samples for other national designs. In the specific design part, this paper mainly carries out the design verification based on the corresponding characteristic headdress design of the Yao nationality. It evaluates the corresponding design from the perspective of artistry, practicality and nationality of headdress design. The practice results show that the information visualization design of national headwear proposed in this paper has obvious advantages over the traditional design, which greatly improves the design efficiency and simplifies the design process. In the follow-up research, this paper will pay attention to more national headwear and conduct practical analysis and research based on the design process proposed in this paper. At the same time, this paper will also pay attention to the design process of national clothing and try to combine it with information data visualization technology. In the follow-up research, this paper will also focus on the protection of national culture, design thinking at the level of national culture mining, and realize the processing of corresponding cultural protection and cultural inheritance by collecting more specific data so that the design process proposed in this paper becomes the development of traditional design ideas.

When the amount of data increases, the number of layers increases, resulting in too long edges, which not only makes the drawing space not fully utilized, but also makes the whole graph relatively chaotic. In the future work, we can consider the clustering of nodes and then stratification to reduce the amount of data displayed. In addition, this paper only completed the graph drawing in two-dimensional space. In order to display the graph more aesthetically, the algorithm can be extended to three-dimensional space, and the parameters used in the algorithm can be further optimized to improve the overall efficiency of the algorithm.

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