Visual application of Tengwang Pavilion architecture from the perspective of information design

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Abstract. Today, with the rapid development of digital technology, it has also brought about the problems of data explosion and information overload. Information design, as a means of efficient dissemination of information to the public, can promote more effective dissemination of Chinese culture, but it also has the problem of complex information visualization data and ineffective data dissemination. How to more efficiently create visual designs suitable for cultural communication has become an important research direction in information visualization. As one of the four famous buildings in China, the Tengwang Pavilion's architectural style and construction technology reveal the high level of ancient Chinese architectural skills and is a cultural symbol with rich humanistic spirit. In this context, the author takes "Tengwang Pavilion Architecture" as the research object, and constructs corresponding design strategies for the data complexity and ineffectiveness of data dissemination faced by information visualization. It is intended to demonstrate the accuracy of the visual expression of Tengwang Pavilion's architectural culture and the effectiveness of communication from the perspective of information design, spread the unique architectural culture of Tengwang Pavilion, and inherit its rich history and traditional Chinese cultural connotations. I hope that in the author's information visualization design, this cultural heritage will be presented to the broad audience in a clear and easy-to-understand way, so as to provide certain reference for the development of visualization.

Keywords: Information Design; Cultural Communication; visualization; Tengwang Pavilion Architecture; Design Strategy.

1   Preface

As one of the masterpieces of ancient Chinese architecture, the architectural style of Tengwang Pavilion embodies the characteristics of ancient Chinese architectural art. The pavilion-style architectural structure demonstrates excellent wood craftsmanship and engineering technology. Its architectural beauty and sense of proportion are the embodiment of the artistic value of Tengwang Pavilion. Later generations of artists and architects provided valuable inspiration and reference. At the same time,

Tengwang Pavilion, as a witness of Chinese history and culture, has become an important landmark for future generations to review history[1]. Its thousands of years of historical heritage and literary achievements have created the rich enriching value of Tengwang Pavilion. Its existence is to demonstrate the world a magnificent picture of Chinese history and inject new vitality into the inheritance and promotion of Chinese culture.

In this era of rapid changes in digital technology, the amount of information people receive at the same time is further increased. This has improved the audience's perception of information to a certain extent, and has also resulted in an increase in the audience's anxiety about processing massive amounts of information. Information visualization, as a means of efficient dissemination of information to the public, can more intuitively help people witness and identify the complex relationships, intrinsic information and potential patterns between original data[2-3]. Establish relevant connections with the culture of "Tengwang Pavilion Architecture" through visualization, build relevant information structures and levels, and visually transform abstract and complex information, so as to display the value and connotation of Tengwang Pavilion architecture in a beautiful and interesting form to facilitate the audience. Better acceptance and understanding will help extend the breadth and depth of its inherent cultural communication.

2   User experience requirements from the perspective of information design

2.1   Construction of information hierarchy

When users receive information, salient information will stand out in the user's perception and attract their attention. A clear title, concise image, or short narrative is also more likely to grab a user's attention. Because the brain will produce a series of reactions when receiving information. The first step of the reaction is to notice the salient information, and then generate certain memories and behavioral intentions[4]. In addition, different users and different situations may have altered attention and attraction factors for information. Therefore, when designing information, the extracted useful information should be hierarchically constructed, prioritized, and highlighted with a clear and concise design to draw the attention of the audience. This will help users automatically filter and extract useful information.

2.2   Intuitive and clear expression of visual design language

Data explosion and information overload are characteristics of digital city construction. How to express information effectively and accurately has become the key. When performing visual design, one of its principal purposes is the accuracy of information transmission, and converting cumbersome information into clear and intuitive graphics and charts[5]. The visual design language solves some obstacles in interpreting information to a certain extent, but it can also easily lead to a weakening of

information accuracy. Therefore, this also requires that when performing visual design, the data conversion needs to be clear to ensure that the information in the visual design is transmitted efficiently and accurately.

2.3   Three elements of information design

Psychologist George A. Miller's cognitive psychology research shows that people's cognitive resources are limited[6]. When the brain generates high cognitive load, people have a tendency to feel fatigue, anxiety and discomfort, so the processing, screening and transformation of complex information have become crucial steps in information visualization design. First, the clarity and simplicity of information hierarchy construction in information visualization design. Only by ensuring that the information content and chart form are not confusing and weakening non-key information can the audience be given a more intuitive display of information. Second, guarantee the authenticity of the information content. Before conducting information visualization design, the sorted data needs to be cleaned and processed again, and the accuracy of the data must be ensured through repeated verification, and errors, duplications or incomplete information must be eliminated. Information data, perform necessary data transformation and summary. This helps to choose a more suitable chart type that can accurately convey data, ensure that charts can accurately reflect data information in visual design, and avoid misleading visual design language. Third, the expression of emotions in design can more easily bring the user closer to the user, attract the user's attention, and increase the user's interest[7]. Psychological theoretical research mentions that different colors can trigger different emotional reactions in users under specific circumstances. For example, red may be associated with passion and tension, and blue may be associated with calmness and trust. In the design process, incorporating appropriate colors into the information visualization design can better stimulate users' emotional resonance with the information, which is conducive to shortening the distance between the "Tengwang Pavilion Architecture" culture and the users during the dissemination process, achieving Maximize the information dissemination effect[8]; it helps to increase the user's perception and experience, convey the culture of "Tengwang Pavilion Architecture" to users more concisely and directly, improve the cultural dissemination effect while reducing the user's cognitive load.

3   Bottlenecks of visual communication from the perspective of information design

3.1   Data complexity

Information visualization design aims at how to accurately express effective information. Before information design, the original data sets are often large in number, intricate in structure, and multi-source[9]. Only by effectively handling this complex information and choosing appropriate visualization methods and color schemes can

we ensure a clear understanding of the data. Then analyze the information to obtain more valuable information and formulate feasible visual design plans.

The effective processing, selection and presentation of information are are at the heart elements of information visualization and data communication. How to effectively process, select and present information in information design[10]; how to avoid information confusion and lack of focus during the information sorting process. These issues are the focus of this study. Based on the above issues, the author proposed a data set information level construction strategy model as illustrated in Figure 1. Use the "DIKW model" to sort out the information level construction strategy of the data set. The strategic model divides information sorting into four levels and twelve levels of content, namely "requirements - data selection - data classification - data input - original database - data testing - data extraction - data cleaning - data verification - data analysis - data transformation -Strategy Output". The construction of the design data set information level strategy model can be dynamically adjusted at each stage based on data verification feedback. The four levels of this model are mainly divided into: data-original data, information-data extraction, knowledge-data analysis, and wisdom-data transformation.
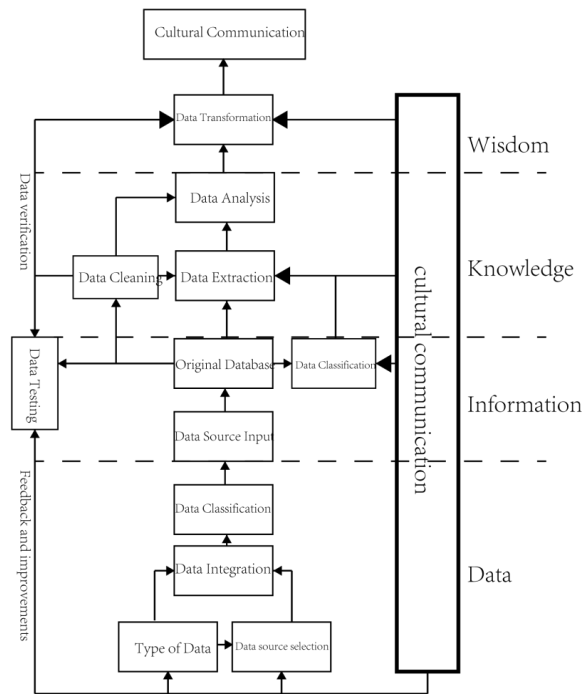
Fig. 1. Data set information level strategy model

3.2   Data dissemination effectiveness

In information design, the effectiveness of data dissemination usually refers to the successful communication of data information to the target audience to achieve preset goals or results[11-12]. Setting up a communication effectiveness evaluation model helps to effectively select information and conduct specific analysis of the audience during visual design, as illustrated in Figure 2. The communication effectiveness evaluation model takes the communication goals and objectives as the starting point, conducts purposeful audience analysis and screening of information data, and proposes corresponding communication strategies to ensure that the communication strategies match the audience. At the same time, the communication effect evaluation, audience number, communication scope, feedback response monitoring, etc. will be carried out. Make corresponding rectifications to the communication strategy based on the feedback results and information, optimize the visual design language, and establish a feedback loop mechanism during visual design to maintain the effectiveness and sustainability of data communication.
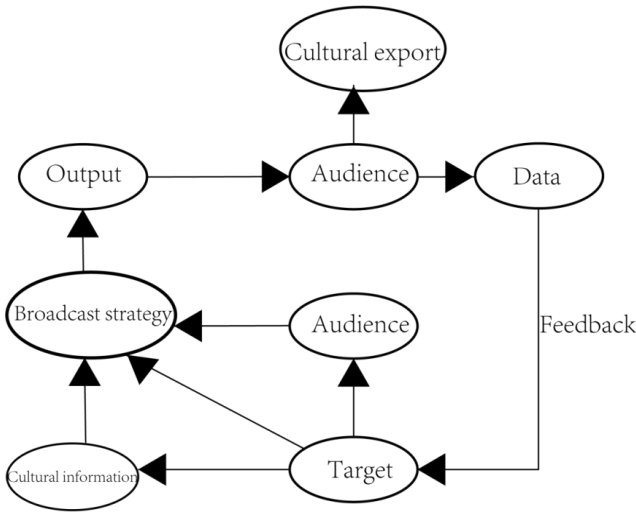
Fig. 2. Communication effectiveness evaluation model

4   Visual design strategy of Tengwang Pavilion architecture from the perspective of information

4.1   Information processing of Tengwang Pavilion architecture from the perspective of information

The culture of "Tengwang Pavilion" was gradually formed after more than a thousand years of accumulation of connotations. Since Wang Bo's "Tengwang Pavilion Preface" spread to the world, it has become an object of profound feeling and being en-

trusted by scholars and writers in the past generations. Whether it is from the architectural structure of Tengwang Pavilion, exquisite wood craftsmanship, or gorgeous paintings, it is full of meticulous artistic expressions, fully demonstrating the excellent craftsmanship and exquisite skills of ancient Chinese architecture[13]. They are a display of the rich visual texture of Tengwang Pavilion architecture, a reflection of the cultural history and aesthetic taste of the time, and a reflection of the rich literary and artistic value of Tengwang Pavilion architecture.

The cultural connotation, construction technology and historical background of "Tengwang Pavilion Architecture" are all the pinnacle works that reflect the traditional craftsmanship of ancient Chinese architecture. The author mainly analyzes the construction technology, architectural layout, architectural painting, historical changes and other aspects of "Tengwang Pavilion Architecture", as illustrated. Information is transformed into graphics using the means of information visualization combined with three-dimensional forms.

4.2   Visual design and transformation of Tengwang Pavilion architecture from the perspective of information

Tengwang Pavilion is part of the masterpieces of ancient Chinese architecture. Its construction history can be traced back to the Tang Dynasty. The modern Tengwang Pavilion was rebuilt in 1989 and was designed by the ancient Chinese architect Liang Sicheng. The architectural style is based on the Song Dynasty's "Building French Style" and is a typical wooden structure building in China. The main pavilion of the building adopts the "three bright and seven dark" format. It is a three-story corridor imitating the Song Dynasty style building. It is 57.5 meters high and has a total of seven floors inside. It is divided into three bright floors, three dark floors and a loft style[14].

4.2.1 Construction structure process

With the help of 3D visualization perspective, create a sense of space and three-dimensionality in a two-dimensional plane. This allows the building to be presented from multiple perspectives, helping the audience better understand the building's architectural structure and spatial layout. The three-dimensional model is used to transform the architectural information of Tengwang Pavilion into graphics to reflect the foundation construction, wooden structure construction, roof and colored tiles, doors, windows and decorations in the construction process of Tengwang Pavilion, as illustrated in Figure 3. It allows the audience to get a clearer visual interpretation of the internal structure of Tengwang Pavilion, a more realistic experience from a perceptual perspective, and a more effective resonance emotionally.
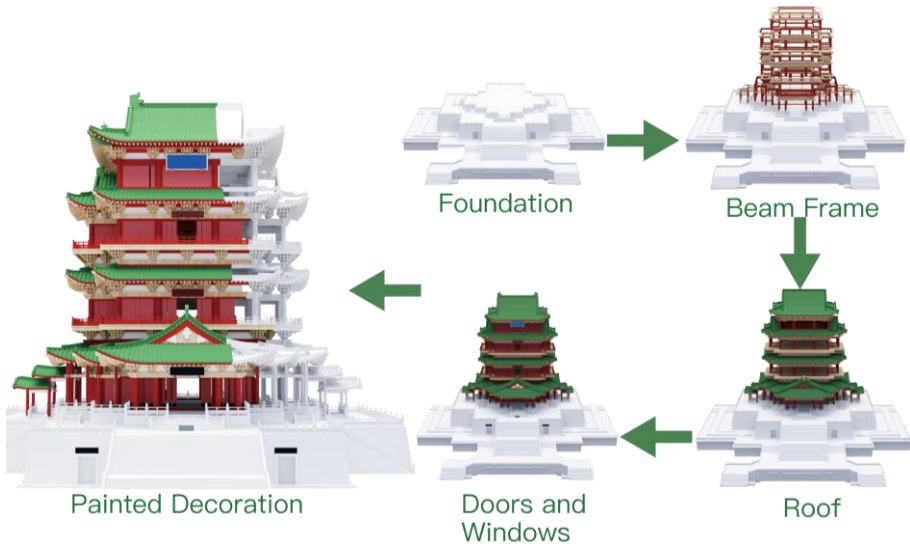
Fig. 3. Basic flow chart of the construction of "Tengwang Pavilion Building"

4.2.2 Disassembly of structural components

The bracket craftsmanship has a long history in Chinese architecture. It carries the essence of Chinese cultural tradition and plays an important role in the architectural structure. These exquisite brackets are not only structural elements of the building, but also functions of art. They represent the excellent craftsmanship and wisdom of ancient Chinese carpenters. In the building of Tengwang Pavilion, the brackets can be divided into three major categories from a functional perspective: flat body family, stigma family, and horn family[14]. Among them, the caisson on the top of Tengwang Pavilion is a very representative Dougong. It is composed of 288 small Dougongs, with a total of 12 floors and 24 small arches on each floor. It is derived from the ancient Chinese saying of 12 months and 24 solar terms. Each layer is superimposed on each other and continues to rise in a spiral, giving a sense of continuous climbing and also symbolizing the infinity of the universe.

The 3D model is used to deconstruct and analyze the brackets and cornices of the Tengwang Pavilion building, as shown in Figures 4 and 5. The visual expression of information allows the construction technology, structural core, and assembly process of the Tengwang Pavilion building to be more intuitively displayed, the cognitive burden of the audience is reduced, and the craftsmanship value of traditional Chinese architecture is more effectively conveyed.
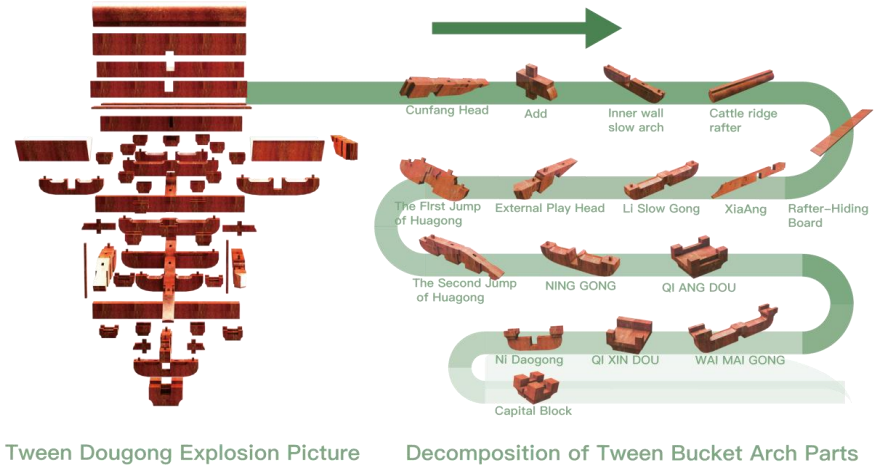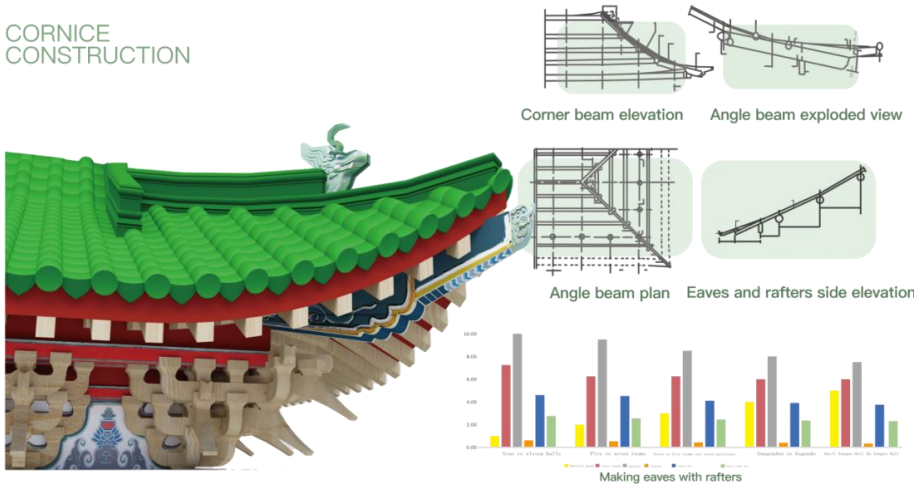
Cunfang Head

Add

Inner wall slow arch

Cattle ridge rafter

The First Jump of Huagong

External Play Head

Li Slow Gong

XiaAng

Rafter–Hiding Board

The Second Jump of Huagong

NING GONG

QI ANG DOU

Ni Daogong

QI XIN DOU

WAI MAI GONG

Capital Block

Tween Dougong Explosion Picture   Decomposition of Tween Bucket Arch Parts

Fig. 4. Exploded view of bracket parts of "Tengwang Pavilion Building"

CORNICE CONSTRUCTION

Corner beam elevation   Angle beam exploded view

Angle beam plan   Eaves and rafters side elevation

Making eaves with rafters

Tengwang Pavilion cornice structure

Fig. 5. "Tengwang Pavilion Building" cornice structure information diagram

4.2.3 Architectural painting

The origin of Chinese architectural painting can be traced back to the early history of ancient China. As early as the Shang Dynasty and Western Zhou Dynasty around 2,000 BC, murals and painted decorations began to appear on Chinese buildings. This kind of painting was first used on the walls of palaces, temples and tombs, and China's mural and painting art reached its peak in the Tang Dynasty. Such as the murals

in Buddhist cave temples such as Mogao Grottoes, Dunhuang, Longmen Grottoes, etc. During the Song, Yuan, Ming and Qing dynasties, many temples, palaces, temples and official buildings began to be decorated with exquisite murals and paintings. The Chinese painting tradition has been passed down to this day and   continues to be widely used. In fact, architectural painting is not only an art form, but also a concentrated expression of rich cultural, historical and religious connotations. It is a part of traditional Chinese culture and a witness to the development of ancient Chinese history, philosophy, culture and values. The architectural paintings of Tengwang Pavilion are also diverse in patterns, such as the circle head and zizi pattern, the multicolored forehead pillar stacked halo pattern, the shuttle body halo pattern, the partial halo pattern, the multicolored forehead pillar tooth foot and other patterns are all very representative, as shown in Figure 6. These paintings are essential for increasing the beauty and visual appeal of the building. They are also the embodiment and inheritance of Chinese traditional culture, religion, history, unique artistic value and cultural connotation.


Colorful forehead pillar stacked halo

Shalo Pattern on Body

partial halo decoration

Colorful forehead pillar tooth foot

Tengwang Pavilion architectural painting
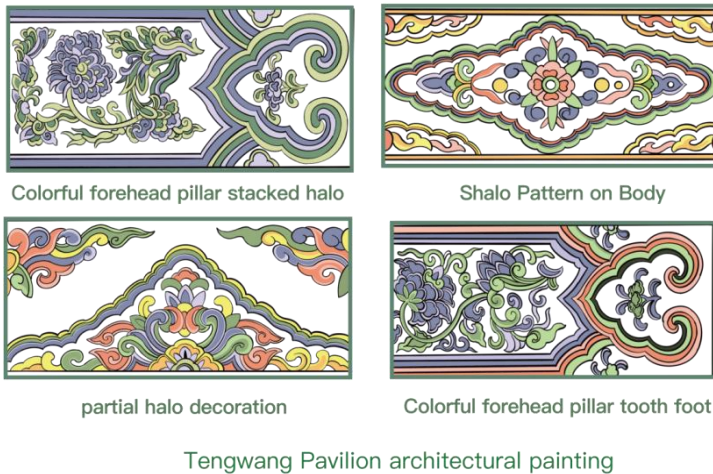
Fig. 6. Architectural Painting of "Tengwang Pavilion Building"

### 4.2.4 Historical development and literati of past dynasties

Tengwang Pavilion carries profound historical and cultural heritage and records the vicissitudes of thousands of years. Since it was first built in the Tang Dynasty in 653, Tengwang Pavilion has been destroyed by wars and flames several times, but it has also regained its splendor many times. In the sound of Wang Bo's powerful and bold poem "Preface to Prince Teng's Pavilion", it has become a resort for literati and refined scholars, reflecting the glory of ancient Chinese culture. As shown in Figure 7, during the 29 historical waves of repeated destruction and construction between 653 AD and 1985 AD, it became the most representative witness of the development of Chinese history and culture. It was also mentioned by many literati such as Wang Bo, Bai Juyi, Han Yu, and Wang Zhongshu. The writing becomes an elegant cultural

palace[15]. The author uses the visual form of timeline and context diagram to reorganize the complicated and confusing time nodes and events, as shown in Figure 8. It is desirable for the historical changes and cultural context of Tengwang Pavilion architecture can be presented more clearly and effectively. It aims to accurately describe the information while vividly restoring the data, delivering interesting and logical information to the audience, so that the audience can gain both knowledge and cultural and emotional value.
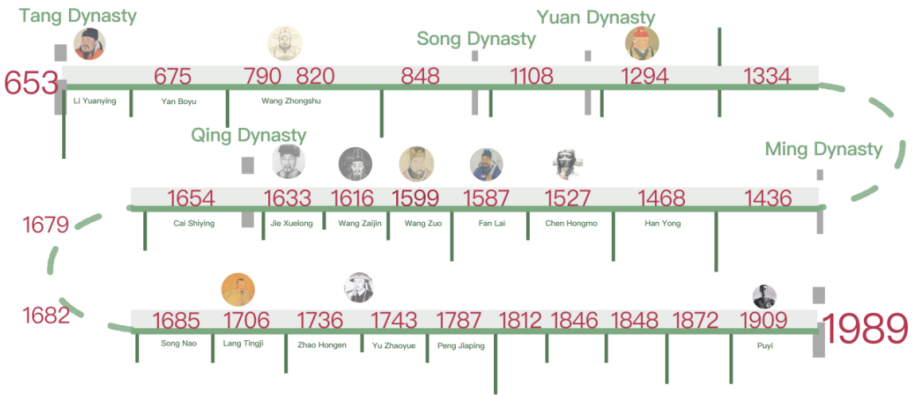
Fig. 7. Axis diagram of the 29 reconstructions of "Tengwang Pavilion Building" in the past dynasties
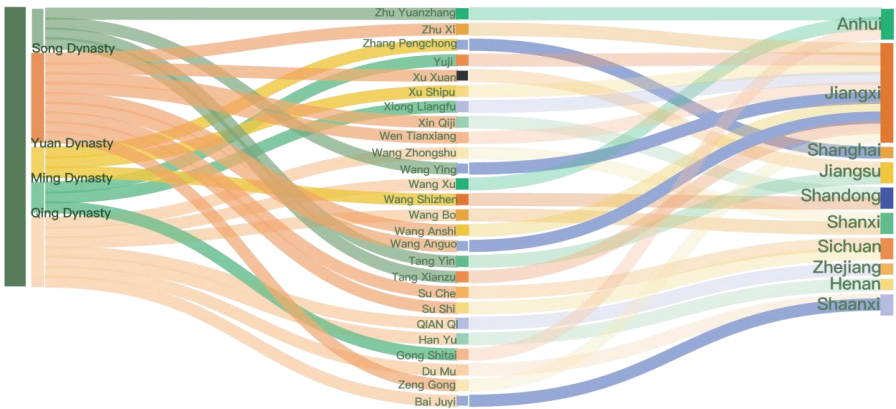
Fig. 8. Diagram of the relationship between historical literati in "Tengwang Pavilion Architecture"

4.3   Visual presentation of Tengwang Pavilion architectural information

The extraction of the architectural information of Tengwang Pavilion is roughly based on the cultural value and architectural value, including the changes in the architectural history of Tengwang Pavilion, the deconstruction analysis of the architectural structure, the development research of architectural painting, and the analysis of the reconstruction of the building through the ages. After using the visual design language to convert the above information, we began to sort out the framework of partial information display, hierarchically constructing the information and highlighting important information. Finally, the text, graphics, charts, colors and other contents that need to be conveyed above are effectively designed in the layout space, hoping to build an information visualization design that can be conveyed efficiently, as illustrated in Figure 9.
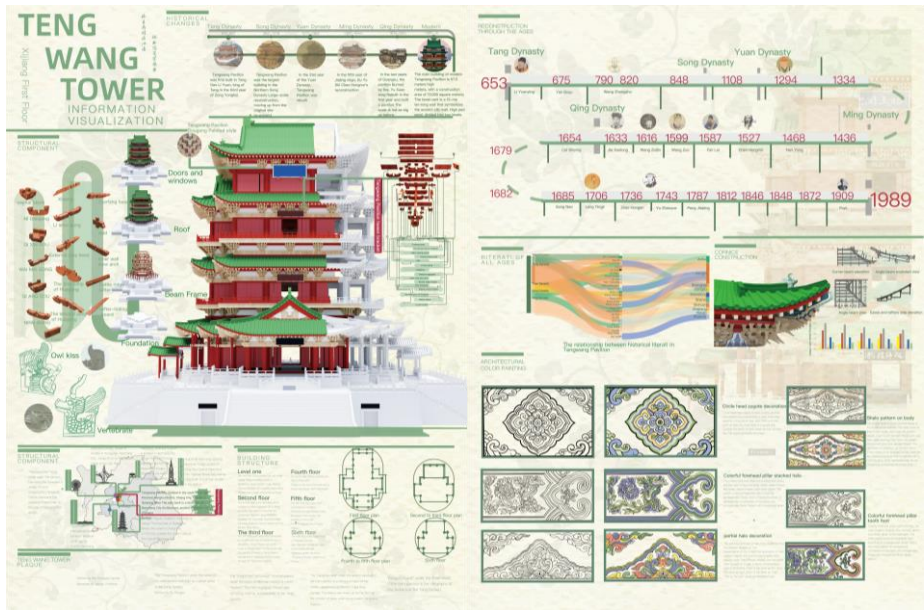

Fig. 9. Information visualization design of "Tengwang Pavilion Building"

5   Conclusion

This article explores the bottleneck of visual communication, proposes concepts such as "data set information hierarchical strategy model", and completes the architectural visualization design practice of Tengwang Pavilion based on the model and design strategy. When processing information data during visual design, point out the hierarchical division and establish a sustainable "communication strategy evaluation model" to verify the communication effectiveness of information visualization and audience satisfaction. It is hoped that in the process of visual communication, while

simply graphical processing of the architectural information of Tengwang Pavilion, the culture of Tengwang Pavilion can be effectively and intuitively conveyed to the audience, and the effectiveness of the communication of the cultural value of Tengwang Pavilion can be improved. I hope that in this era of rapid progress of digital technology, it will bring more possibilities to the inheritance and development of Tengwang Pavilion's architectural culture.

Funding

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