

Digital Reconstruction of Dunhuang Caisson Patterns Incorporated into Interface Design Driven by Innovation

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Abstract

Information visualization design is an emerging communication style in the field of media communication, this paper analyzes the elements, symbols and colors of Huangmei Opera from the perspective of visualization design, and explores the design process, content and methodology of the "Picture Description of Huangmei Opera" series of posters and derivatives design practice as an example. We also take the "Huangmei Opera" series poster design and derivative design practice as an example to explore the design process, design content and design method of information visualization design, to present the art form of Huangmei Opera to the audience in a more intuitive and attractive way, and to provide feasible solutions for the inheritance and innovation of excellent traditional culture. As a treasure of Dunhuang culture and art, the Dunhuang algal well pattern contains rich historical and cultural connotations and exquisite artistic skills, and has immeasurable artistic aesthetic value and diversified application value. In the context of innovation-driven, the integration of Dunhuang zaojing pattern into interface design and digital reconstruction can not only inherit and carry forward Dunhuang culture, but also inject new vitality into the interface design. The article introduces the content and characteristics of Dunhuang zaojing pattern, analyzes the feasibility and value of its integration into interface design, discusses the methods and paths of digital reconstruction, and analyzes it through actual cases, aiming to provide theoretical support and practical reference for promoting the deep integration of Dunhuang culture and modern interface design.

Keywords

Dunhuang Caisson Patterns; Interface Design; Digital Reconstruction; Innovation-driven

1. Overview of Dunhuang Algal Well Patterns

As an important part of the art of the Dunhuang Mogao Grottoes, the Dunhuang algal well pattern spans multiple historical periods, with rich and distinctive content, like a living art history book. Algal well pattern of the center of the square well is its visual focus, often through the geometric division method of construction, such as

equilateral triangles, squares, rhombuses, etc., these geometric shapes to give the pattern of the regularity, stability of the visual experience, reflecting the ancient craftsmen on the deep understanding of mathematics and aesthetics. For example, in the Tang Dynasty algal well pattern, the square center square well creates a solemn and atmospheric visual effect through the symmetrical layout. And the decorative elements such as *Lonicera japonica* show a unique development trajectory in the evolution of the algal well pattern. Early patterns influenced by Buddhist culture, abstract symbols to convey religious teachings; later with the changes of the times, into the natural world of flowers and plants, birds, animals, people and other elements, so that the pattern is more life atmosphere and artistic infectivity, such as the Song Dynasty algal well pattern, *Lonicera japonica* and other elements intertwined to form a vivid picture.

Dunhuang Algae Well Patterns are of great artistic and aesthetic value, and are considered a classic of ancient art. The use of color is subtle, bright and harmonious. Algae well pattern in different historical periods in the color selection has its own characteristics, the Tang Dynasty to red, yellow, green and other bright colors, creating a warm, gorgeous atmosphere, showing the prosperity and openness of the Tang Dynasty; the Song Dynasty tends to be light, fresh colors, such as blue, white, gray, etc., to give a person a sense of serenity, elegance, reflecting the literati class of the time the pursuit of aesthetics. Algae well pattern lines are smooth and natural, full of rhythm and rhythm, whether it is curly grass lines or geometric contour lines, reflecting the artist's exquisite skills and a deep grasp of the expressive power of lines. Through combining and arranging, these lines outline the shape of the pattern and give it a sense of vitality and dynamism. In terms of styling, the algal well pattern is unique and novel, with each element containing a profound symbolism, such as the lotus flower symbolizing purity and sanctity, and the flying sky showing freedom and romance, reflecting the rich imagination and creativity of ancient artists.

2. The feasibility and value of integrating Dunhuang algal well patterns into interface design

2.1. Feasibility

From the professional point of view of design science, the typical features of the Dunhuang mojing pattern can be analyzed in depth and extracted precisely by modern advanced design methods. Shape grammar, as an effective design analysis tool, can systematically deconstruct and reconstruct the basic graphic units of the mojing pattern. With the help of Shape Grammar, designers can break down the complex Mogai pattern into simple basic graphic elements, and then recombine and reconstruct these basic graphic units according to the needs and styles of the interface design, so as to generate a series of innovative derivative programs suitable for modern interface design. For example, by deforming and repeating the diamond-shaped

geometric units in the mojing pattern, a unique visual effect of the interface background pattern can be designed.

The rapid development of digital technology provides strong technical support for the application of Dunhuang zaojing patterns in interface design. Computer graphics processing technology can carry out high-precision digital processing of algae well pattern, including pattern scanning, vectorization, color correction, etc., to ensure that the pattern in the digitization process to ensure that the quality and details of the complete retention. Advanced software development technology enables designers to conveniently incorporate the processed elements of mojing patterns into various interface design projects, and flexibly edit and adjust them to meet different interface design needs.

2.2. Value

(1) Cultural heritage. The integration of Dunhuang algal well pattern into the interface design opens up a new way for the inheritance and promotion of Dunhuang culture with more mass communication. In the digital age, the products and services involved in interface design are widely used in daily life, and have a large user base and a wide range of dissemination. By skillfully integrating Dunhuang algal well patterns into various interface designs, more people can subconsciously come into contact with and learn about Dunhuang culture when they use electronic devices in their daily lives, enhancing people's knowledge of and identification with traditional culture and effectively promoting the inheritance and development of Dunhuang culture.

(2) Enhance the cultural connotation of interface design. Incorporating Dunhuang algal well patterns into the interface design can inject a deep historical and cultural heritage into the interface. Compared with the traditional interface design, the interface that incorporates Dunhuang cultural elements has more personality and unique charm, and can stand out in many interface designs, attracting users' attention. This cultural connotation not only enhances the user's aesthetic experience of the interface design, but also strengthens the emotional connection between the user and the interface, so that the user can get a richer and more meaningful emotional experience in the process of using the interface.

(3) Innovative design style. Traditional interface design in the long-term development process, gradually formed some fixed patterns and styles, to a certain extent, limit the design innovation. The Dunhuang well pattern, with its unique artistic style and rich cultural elements, brings new creativity and inspiration to the interface design. The integration of the pattern into the interface design can break the limitations of the traditional interface design, create a unique style of interface works, to meet the needs of users for diversified and personalized design. For example, applying the dynamic elements and color combinations of mojing patterns to interface design can create a dynamic and artistic interface style, bringing users a new visual experience.

3. Digital Reconstruction Methods for the Integration of Dunhuang Algae Well Patterns into Interface Designs

3.1 Deconstruction and dynamic adaptation of core elements

(1) Huangmei Opera is the crystallization of Anhui history and culture, through the systematic analysis and organization of Anhui Huangmei Opera, it provides valuable information for the author to deeply excavate the cultural connotation of Anhui Huangmei Opera. The combination of Anhui Huangmei Opera and information visualization design provides theoretical references for seeking effective ways of Anhui Huangmei Opera dissemination and cultural inheritance. It has certain reference value for exploring the expression of traditional culture and promoting multi-dimensional information visualization design. Layered topological analysis. Dunhuang algal well pattern has a typical "square well - side ornaments - hanging mantle" three-level structure, based on this structural feature, the use of shape grammar on the typical pattern of layered topological analysis. Taking the core decorative elements such as lotus petals and lonicera as the research objects, we analyze their morphological features and compositional laws in depth, and extract the most representative initial graphic units. For example, the geometric shape of the center square well can be abstracted into simple geometric shapes, and its ratio, angle and other parameters can be accurately measured and analyzed, so that they can be flexibly applied according to different needs in the interface design. In the process of deconstruction, the cultural connotation and symbolic meaning of each element can be deeply understood by combining historical documents and art research results, which will provide rich inspiration for the subsequent design and reconstruction.

(2) Adaptation. Considering the dynamic interactive characteristics of modern interface design, dynamic processing of the deconstructed algae well pattern elements is the key to realizing innovative design. Using CSS3 animation, JavaScript animation and other advanced animation production techniques, give dynamic change effects to the algae well pattern elements. For example, the vines of Lonicera show the effect of fluttering with the wind, or the lotus petals produce the animation of blooming or closing when the user operates, so as to enhance the interactivity and interest of the interface through these dynamic effects, so that the user can have a more vivid and interesting experience in the process of interacting with the interface. At the same time, according to the function of the interface and the use of the scene, the design of different animation rhythms and effects, to better meet the needs of the user and the use of habits.

3.2 Digital conversion of color systems

(1) Color extraction and analysis. The systematic extraction and in-depth analysis of the colors of Dunhuang algal well patterns is the basis for the digital conversion of the color system. With the help of professional color extraction software and tools,

accurately extract the colors of different historical periods and different styles of algal well patterns, and use color theory knowledge to analyze and summarize. For example, through the color analysis of a large number of Tang Dynasty algal well patterns found that the color combination of red, yellow, green as the main hue, and there is a certain proportion of the relationship between the colors and the pattern of changes in brightness and saturation. Combined with the historical and cultural background and artistic aesthetic concepts at that time, in-depth understanding of the cultural meaning and symbolism behind these color choices and combinations, to provide a theoretical basis for subsequent color adaptation and innovation.

(2) Color adaptation and innovation. On the basis of extracting and analyzing the colors of Dunhuang algal well patterns, according to the theme, style and use of the interface design scene, the extracted colors are adapted and innovative design. Under the premise of retaining the traditional color flavor and cultural connotations, the brightness, saturation, contrast and other parameters of the color are appropriately adjusted to make it more in line with modern aesthetic concepts and interface display requirements. For example, for science and technology application interface design, can reduce the saturation on the basis of the traditional algal well pattern color, increase the gray tone, to create a simple, modern sense of science and technology; for cultural exhibitions virtual tour interface, it is appropriate to enhance the color vibrancy and contrast, highlighting the richness of the culture and history of the sense of gravity. In addition, try to combine the traditional algal well pattern colors with modern popular colors to create a new and unique color scheme, adding more creativity and personality to the interface design.

3.3 Immersive experience design based on virtual reality and augmented reality technologies

(1) Virtual reality scene construction. The use of virtual reality (VR) technology to build a realistic Dunhuang algal well virtual scene, providing users with an immersive immersive experience. When building the virtual scene, first of all, the Dunhuang Mogao Grottoes actual caves and well patterns for high-precision three-dimensional modeling, through laser scanning, photogrammetry and other technologies to obtain the exact geometry of the caves and wells and texture information. Then using professional 3D modeling software and rendering engine, the model is processed with fine texture mapping and light and shadow effects to restore the real details and historical atmosphere of Dunhuang wells. In the interface design set up a special virtual tour entrance, users wearing VR helmets, handles and other virtual reality equipment, you can enter the virtual Dunhuang caves, free to browse the details of the pattern of the wells, to feel its exquisite craftsmanship and unique artistic charm. At the same time, in the virtual scene set up voice explanation, virtual tour guide and other interactive links to help users deeply understand the historical and cultural background and artistic value of Dunhuang wells.

(2) Augmented reality interactive experience. With the help of augmented reality

(AR) technology, the Dunhuang algal well pattern is organically integrated with the real scene to realize a rich and varied interactive experience. Users scan specific areas or markers on the interface through the cameras of smart devices such as cell phones and tablet computers, triggering the augmented reality effect, so that the Dunhuang zaojing pattern is presented in the real environment in the form of virtual images. For example, in the museum exhibition, users scan the specific QR code or logo next to the exhibits, you can see the dynamic display of Dunhuang zaojing pattern related to the exhibits on the cell phone screen, and can touch the screen, gestures, and other ways to interact with the zaojing pattern, such as rotating, zooming in, zooming out, checking out the details of the pattern and the cultural introduction, etc. This augmented reality interactive experience not only adds to the exhibition, but also enhances the user's experience. This augmented reality interactive experience not only increases the interest and attractiveness of the exhibition, but also allows users to intuitively feel the close connection between Dunhuang culture and real life, and enhances users' understanding and cognition of culture.

4. Practical case studies

4.1 A cultural APP interface design

The APP takes Dunhuang culture as its theme and incorporates the elements of Dunhuang algae well pattern in the interface design. By deconstructing and reconstructing the core elements of the algae well pattern, geometric shapes and scrolling patterns are applied to the navigation bar, buttons and other components of the interface, so that the interface has obvious Dunhuang cultural characteristics. Meanwhile, the dynamic light and shadow simulation scheme is used to add light and shadow effects to the interface, creating a mysterious and solemn atmosphere. In terms of color, the color system of the Tang Dynasty algal well pattern is extracted, with red, yellow and blue as the main colors, together with fresh green, making the interface rich in history and culture without losing the sense of modernity.

4.2 Virtual tour interface for an exhibition

In order to enhance the visiting experience of the exhibition, a virtual tour interface was designed, incorporating the Dunhuang algal well pattern. Using virtual reality technology, a virtual exhibition scene is constructed, in which the dome part adopts the design elements of Dunhuang wells. Users can freely browse the exhibition content through the navigation interface, and at the same time feel the charm of Dunhuang wells. In the interactive design of the interface, augmented reality technology is utilized, when the user clicks on a specific exhibit, the introduction and dynamic display related to the algae well pattern will pop up, which enhances the user's sense of participation and experience.

5. Conclusion

In the context of innovation-driven development, the integration of the Dunhuang algal well pattern into the interface design and digital reconstruction is an important initiative to inherit and carry forward Dunhuang culture and promote the innovative development of interface design, which is of great practical significance and has a broad development prospect. Through the deconstruction of the core elements of Dunhuang zaojing pattern, the conversion of color system and the use of virtual reality and augmented reality and other technologies, we can create interface design works with unique cultural connotations and innovative styles. However, in future research and practice, it is necessary to continue to explore and improve the methods and techniques of digital reconstruction, to further promote the deep integration of Dunhuang culture and modern interface design, and to bring users a more high-quality and rich experience.

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