





Digital Model of Computer-Aided Art Design: From Plane to Space

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Abstract. Art design includes a wide range of fields including industrial design, environment design, advertising design, web design, fashion design and animation design, etc.; the digital model of art design also faces the transition from plane to space and differential analyses. With the continuous update and development of computer technology, the role of computer-aided design in the field of art has become more and more obvious, and its position has become more and more important. Based on the summary and analysis of previous research results, this paper expounded the current status and significance of the digital model of art design, elaborated the development background, current status and future challenges of computer-aided technology, proposed the digital model of computer-aided graphic art design including art design strategy and digital model structure, analyzed the digital model of computer-aided spatial art design including art design system and digital model optimization, and discussed the interactive range interaction between design and calculation and the association between the graphic and spatial digital model. The analytical results show that, in the process of introducing computer applications, the digital model of computer-aided art design can also introduce the professional knowledge of art design in more detail, so that designers can understand the principles and patterns of art design and can apply them to computer-aided designs, having greatly improved the efficiency and quality of art design, extended designers' thinking, and then developed a digital model from plane to space. The study results of this paper provided a reference for further research on the digital model of computer-aided art design.

Keywords: Art design; Digital Model; Computer Aided

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1 INTRODUCTION

Art design is a broad field, which includes industrial design, architectural environment design, advertising design, web design, fashion design, animation design and many other aspects. With the continuous update and development of computer technology, the role of computer-aided

design in the field of art has become more and more obvious, and its position has become more and more important [1]. The application of computers in the field of art design has included all art design content, from graphic art design to spatial art design to animation art design and all of these design activities are inseparable from the assistance of computers. Mayvan et al. [2] pointed out that two-dimensional accurate drawing, three-dimensional modeling, virtual reality experience, geographic information system support and other computer-aided technologies represented by computer-aided art design. Especially in recent years, new computer-aided design technologies such as virtual reality technology and geographic information system technology have been combined with planning and design more and more in-depth, making the integration of science and aesthetics in the application of art design. Zhao et al. [3] suggested that in-depth study of the application and development status of computer-aided art design is of great significance for expanding the application field of computer-aided design, shortening the time of art design and improving the quality of art design.

The purpose of computer-aided art design is to better serve the needs of human art design and the humanization and intelligence of the digital model of art design is the most ideal embodiment of service quality. At present, computer-aided art design simply combines the existing intelligent technology with related software technology, and combines computer technology with artificial intelligence to improve the auxiliary function of computer technology to art design is the inevitable development of computer-aided art design in the future trend [4]. Liu et al. [5] suggested that the communication between customers and designers will be more convenient and faster. Designers can establish initial digital models according to customer needs in the early stage, and then modify and adjust according to customer needs, which greatly save design time shorten the design process. Designers can use their imagination to the fullest according to their own needs, and directly generate various highly creative visual images in font design or graphic processing. Qin et al. [6] concluded that the digital model can also record the drawn graphics into the computer through various technologies, and then apply a variety of methods to perform various special processing, so as to produce unique creative and breathtaking picture effect.

Based on the summary and analysis of previous research results, this paper expounded the current status and significance of the digital model of art design, elaborated the development background, current status and future challenges of computer-aided technology, proposed the digital model of computer-aided graphic art design including art design strategy and digital model structure, analyzed the digital model of computer-aided spatial art design including art design system and digital model optimization, and discussed the interactive range interaction between design and calculation and the association between the graphic and spatial digital model. The study results of this paper provided a reference for further research on the digital model of computer-aided art design. The detailed chapters are arranged as follows: Section 2 proposes the digital model of computer-aided graphic art design including art design strategy and digital model structure; Section 3 analyzes the digital model of computer-aided spatial art design including art design system and digital model optimization; Section 4 discusses the interactive range interaction between design and calculation and the association between the graphic and spatial digital model; Section 5 is conclusion.

2 DIGITAL MODEL OF COMPUTER-AIDED GRAPHIC ART DESIGN

2.1 Graphic Art Design Strategy

The application of computers in the field of art design has included all art design content, from graphic art design to spatial art design to animation art design; all design activities are inseparable from the assistance of computers. In the process of introducing computer applications, the digital model of art design also introduces the professional knowledge of art design in more detail, so that designers can understand the principles of art design and the laws of design art, and apply them to computer-aided design (Figure 1). It not only can computer applications be applied, but also is important is the application of artistic design and production. The digital model of artistic design

pays attention to readability, practicality and maneuverability and most of the content is written based on the designer's own design experience. The purpose is to enable the designer to apply the most practical computer-aided graphic design method. Oladumiye [7] suggested that the digital model involves the case is more practical and representative art design and production, and it is more about the experience of actual art design work. The content of the art design digital model is comprehensive and accurate, the case is rich and diverse, the operation is explained in detail, the steps are complete, and the key points are highlighted.

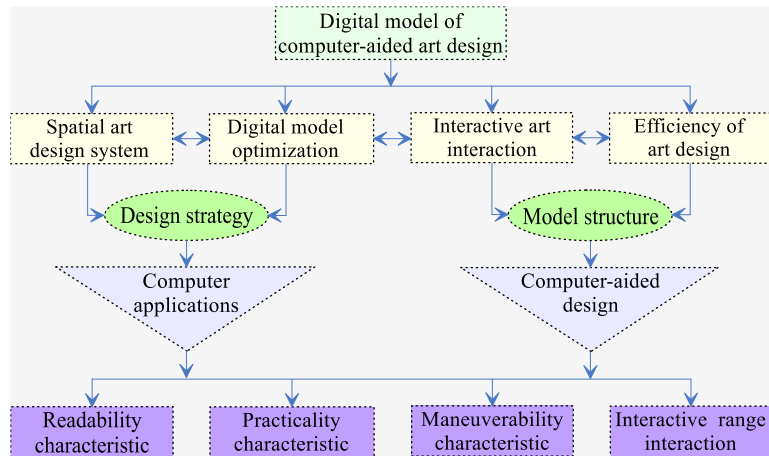


Figure 1: Digital model framework of computer-aided graphic and spatial art design.

After the art design digital model plan is completed, it is necessary to think in detail how to better express the functional relationship between the various parts of the design plan, how to make the designer's design concept and design idea better show to the audience, and can be understood and understood by the audience. This requires detailed analysis of the plane structure in the model, such as functional structure analysis, traffic structure analysis, landscape structure analysis, etc. The purpose of computer-assisted analysis is to make overall planning of the model road, whether the artistic design plan is reasonable, solve whether there are problems, and make backup solutions for this. Specifically, the computer-aided design software used in the art design digital model can be divided into two types: vector software and bitmap software. The advantage of vector graphics is that it can be infinitely enlarged or reduced without affecting the image quality. The disadvantage is that the color level is not rich enough, and the overall look and feel is worse than that of bitmaps. Graphic analysis plays a very important role in planning and design and it is an important embodiment of designers expressing their thoughts and ideas.

The digital model of artistic design is a mathematical model created based on the principle of binocular stereo vision. Different scenes need to choose different binocular stereo vision models to achieve the expected stereo effect. The parallel binocular model simulates the situation where the eyes of the two eyes observe the object in parallel, and the convergent binocular model simulates the situation of viewing the object when the eyes of the two eyes intersect [8]. The object coordinate system is also called the model coordinate system, which is a coordinate system for computer-aided description of the basic shape of the space model. The projection plane coordinate system is a plane coordinate system, which refers to the coordinates on a projection plane, that is, when viewing the space model. The digital model of art design is projected to the projection plane to generate a plane image, which describes the coordinate system of the image. When performing computer-aided art design, the most critical step is to obtain a flat image, and the objects that can be displayed by the left and right eye images must be consistent in the corresponding positions, which require consistent image design. Based on this problem, an auxiliary viewpoint is set in the

space scene, and the viewpoint design space model obtains an image that includes the binocular field of view, which lays the foundation for subsequent stereoscopic display.

2.2 Plane Digital Model Structure

The purpose of computer-aided art design is to better serve the needs of human art design and the humanization and intelligence of the digital model of art design is the most ideal embodiment of service quality. At present, computer-aided art design simply combines the existing intelligent technology with related software technology, and combines computer technology with artificial intelligence to improve the auxiliary function of computer technology to art design is the inevitable development of computer-aided art design in the future trend. Art design is the intersection of disciplines and aesthetics in various fields. In the future, the areas covered by digital models of art design will become wider and wider with the continuous improvement of the level of science and technology (Figure 2). This requires designers not only to be professional artistic skills, as well as knowledge of more disciplines, such as ecology, materials science, architecture, psychology, etc. For example, if designers need to use computer-aided software to create a virtual ecosystem, designers must understand the science of mutual concern between organisms and the surrounding environment, that is, ecology. Therefore, the integration of multidisciplinary knowledge from plane to space is one of the future development trends of computer-aided art design digital models.

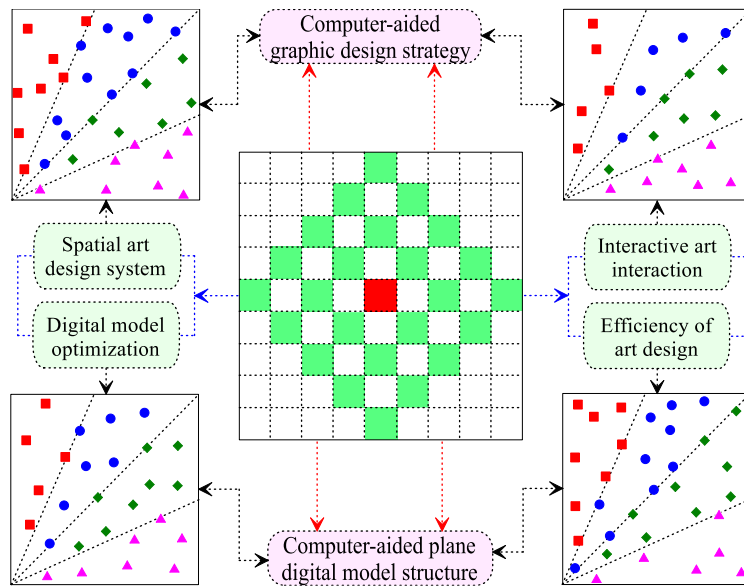


Figure 2: Plane digital model structure of computer-aided graphic art design.

Compared with traditional art design, computer-aided designers can directly see the design effect model at the beginning of the design, so that multiple design schemes can be selected, the selectivity is greatly increased, and the design scheme can be edited again at any time. Designers can establish initial digital models according to customer needs in the early stage, and then modify and adjust according to customer needs, which greatly save design time shorten the design process. Comparing with the plane digital model of the photo, the computer-aided design technology can show the objects that can be directly observed more realistically, and can also reflect the digital model imagined by the designer to the greatest extent. Computer-aided design can be created in both plane and space at the same time, more vividly and vividly beyond the

objects that people have ever imagined. Designers can use their imagination to the fullest according to their own needs, and directly generate various highly creative visual images in font design or graphic processing. The digital model can also record the drawn graphics into the computer through various technologies, and then apply a variety of methods to perform various special processing, so as to produce unique creative and breathtaking picture effects.

Computer-aided design also provides a wealth of expression techniques in drawing graphics. It can imitate the effects of oil painting, watercolor painting, mural painting, and it can also imitate other painting techniques that cannot express and cannot exist in the real world. The manifestation creates a mythical realm that combines reality and fantasy, which often creates effects that photography cannot achieve. In art design, text is an important carrier of transmitting information and the most basic medium of art design. The designer often spent a lot of time on the training of writing fonts, and ultimately often failed to express the creative content of the design work. The application of computer-aided design in art design in terms of text, graphic objects, painting, color, etc., has broken through the limitations of previous art design techniques, design methods, design methods and design thinking, especially the high speed of computer hardware in recent years. The development and the continuous development of related software have provided designers with unprecedented convenience and speed. Coupled with the popularization and development of supporting equipment such as laser scanning, color printing and digital imaging, computer-aided design has become more widely used in art design.

3 DIGITAL MODEL OF COMPUTER-AIDED SPATIAL ART DESIGN

3.1 Spatial Art Design System

The real space digital model of artistic design is to construct a real digital model of artistic design space according to the actual spatial geographic coordinates of the object. The real-space digital model of artistic design can accurately measure the spatial and spatial coordinates of the structure according to the large-scale computer-aided digital method. The structure model of the object is automatically generated by the software and the corresponding texture is attached to it. Then the result is converted to the next level of computer-assisted matching, until the original computer-assisted, and centered on the matched point pair, the points in its neighborhood are matched (Figure 3). Computer-assisted ascent to the first layer, select another point in the neighborhood of the matched point in this layer, perform matching, convert the result to the original computer-assisted, and repeat the process of the previous point until the first matching point of the first layer after processing the points in the neighborhood. From the point of view of computer assistance without affecting the visual effect, only considering that the light emitted by the light source is white light and the object is an opaque body, the designer proposes an illumination model, and the color meter of the object surface is determined by the reflected light.

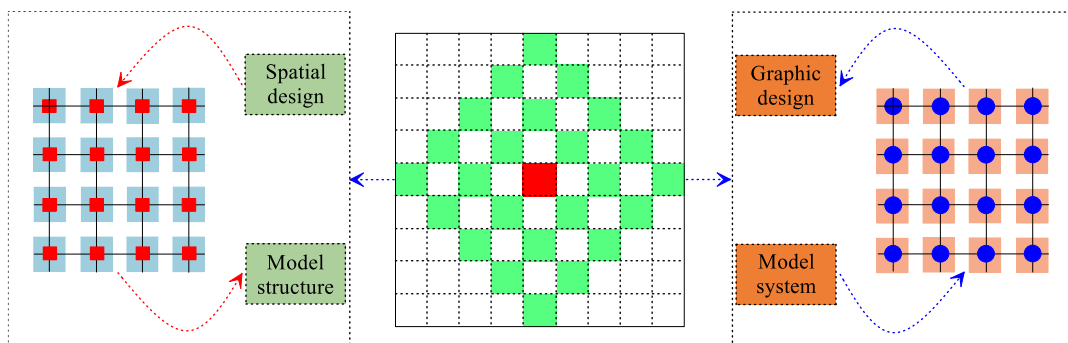


Figure 3: Spatial art design system of computer-aided spatial art design.

The existing digital model of space is mainly obtained through scanning of space scanning equipment and artistic design of spatial art design software. Scanning the digital model of space in reality through space scanning equipment has complicated operations and low precision; in addition, the spatial art design software is huge, the functions are complex, and professional knowledge is often needed to get a better model. These two reasons make it difficult to obtain computer-assisted digital models, and the number is limited, resulting in a lack of diversity in digital models generated based on spatial digital models (Figure 4). However, despite the development of computer aids, both spaces scanning equipment can be used to scan real sculptures to obtain space data, and modeling software can also be used to build space models. However, the model obtained by the hardware device is often not accurate enough, and when the model is large, it is difficult to use the hardware device; the modeling software has complex functions, and it is often necessary for professionals to operate to obtain a better spatial model. Therefore, the digital model generation based on the space model is susceptible to the limitations of the space model and cannot meet the individual requirements of users, and the operation of the space model is often more complicated and time-consuming than the plane operation.

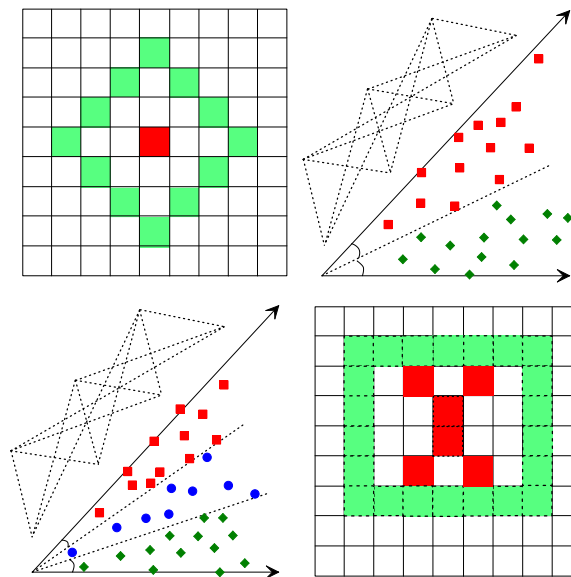


Figure 4: Spatial art design calculation of computer-aided spatial art design.

According to people's visual perception tendency, when there are multiple types of objects within the scope of vision, people will regard the same type of things as a whole. The computer-aided art design digital model divides the visual art design elements contained in the research object into six categories of sky, plants, ground and grass, water, architecture, and rockery, and the resulting space slices are abstracted into visual icons according to the types of artistic design elements. According to computer-aided art design, the digital model selects multiple spatial nodes, and intercepts the visual art design at the nodes in a three-dimensional space to convert the visual scene into a visual image [9]. From the perspective of the satiability of the space, the relatively open space and the more hydrophilic places are more attractive to stay. Second, from the perspective of the layout of the art design screen and the composition of the art design elements, the art design screen in the garden has a better visual experience and is roughly a three-stage layout. There are about three types of main art design elements and the visual richness is high, and the proportions of the main art design elements are relatively balanced. Third, from the spatial

scale, the more suitable art design has a small visual distance for larger spaces, and the division of space elements can be used to create a good viewing distance range.

3.2 Spatial Digital Model Optimization

From a computer-aided point of view, establish the application of digital models for studying art design in visual communication design, that is, step out of the pure plane form of art design, and study a space form with multiple perspectives, rich connotations, and diverse presentation methods, so as to make art design the spatial form of is widely used in visual communication design. The application of the spatial form of art design in visual communication design will better promote the perceptual image form of art design, enhance the visual impact, convey new visual impact to the audience, and enrich the visual communication methods of art design. Due to the rapid development of art design, designers have largely ignored the development and use of digital models of art design, one-sided only the plane form, and neglected its three-dimensional space form, especially the development and use of image space form. Computer-assisted use can be made rationally in the design, to excavate the beauty of the positive and negative space, and create a profound visual communication effect between the positive and the negative. The wide application in visual communication design has enabled this important element of art design to be applied in all directions, and truly went out of the narrow scope of planarization.

As the basis of artistic design, computer-aided composition design plays a pivotal role. On this basis, designers add their own creativity, inject the essence of culture, and then use some technical means to enrich the content of the design, and then they can design unique artworks. The development trend of cultural and creative industries has made artworks closer to people's daily lives and the fusion of art and model, the two complements each other. In the context of cultural and creative industries, the composition design concept and constructivist artistic style are integrated into the creative product design with cultural characteristics has become a fashion and trend, and its development space is huge (Figure 5). In the design practice, the theme of regional cultural characteristics, through the extraction, decomposition, reorganization, and construction of new visual images of abstract elements, based on traditional culture and the characteristics of the times, to enhance the cultural connotation of creative products with novel and vivid art forms and aesthetic value. Color cannot exist independently, and needs to rely on shape, space, location, texture, etc.; digital models integrate color composition into various designs, which can make the designed products more discernible.

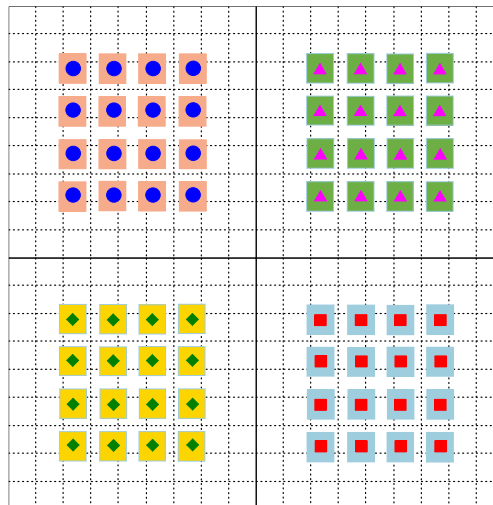


Figure 5: Spatial digital model optimization of computer-aided spatial art design.

Words, graphics, and colors are indispensable elements in graphic art design properly processed words can interact with graphics and complement each other. Graphic and image software can effectively fill the required text in the picture and perform artistic processing on the text, greatly enhancing the visual effect of the text, even if the print advertisement cannot stimulate the reader on the image, it can also attract the reader in the excellent text design, plus the application of the appropriate color tone is a successful design work [10]. Since the axonometric drawing is a kind of affine projection line drawing, it is feasible to use the definition of the digital model under the affine projection to classify and identify the axonometric projection line drawing. Computer-aided uses faces as matching primitives, and classifies faces in art design according to the definition of digital models, and the matching of faces is limited to digital models. Once the circuit in the line drawing and a certain surface of the art design are regarded as a digital model, designers can immediately determine whether the circuit and the surface intersecting with it are digital models. If two figures are axonometric projections of the same object, then their corresponding loops and surfaces should be digital models of artistic design from plane to space.

4 DISCUSSIONS

4.1 Interactive Range Interaction Between Design and Calculation

Since art design is a graphic design process, designers only rely on the horizontal, vertical, and horizontal design data of the digital model to evaluate the rationality of the model, which is not intuitive to achieve rapid comparison of different digital model design plans. From the cross-section data, the horizontal distance and height difference of each feature point on the cross-section relative to the midpoint of the model are calculated. After the coordinates and elevation of the center point of the model are calculated, they form the feature point data of the section of the road models. When a structure needs to be added to the computer-aided space scene, the system will directly load the corresponding model from the model library, and set the model position, zoom ratio and other attributes according to the parameters in the design data to realize the structure model integrated (Figure 6). The visualization of spatial model data is the key to practical applications. In the visualized environment, the environment around the digital model can be understood from the whole and the part, so that the designer can better grasp the quality of model design and improve model operation ability. After the design and digital model are processed by simplification, scheduling data, perspective transformation, blanking processing, lighting simulation and texture mapping, the space visualization scene of the artistic design digital model is built.

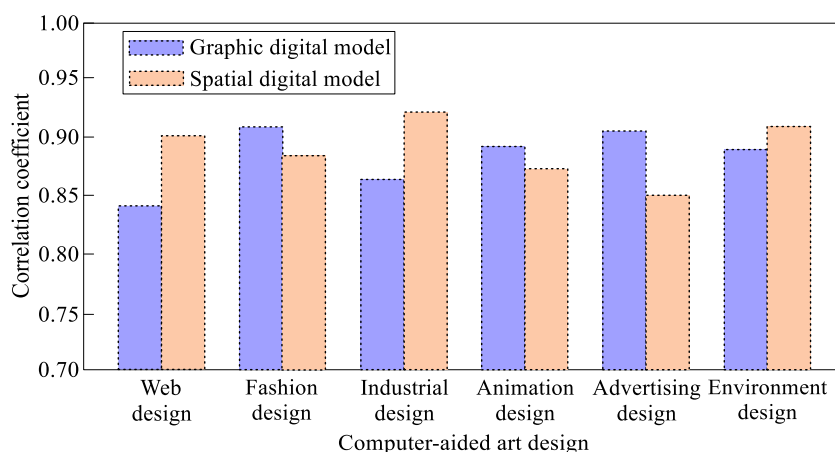


Figure 6: Interactive range interaction between design and calculation in six typical art design fields.

Computer-aided design is the process of applying computer software to draw and simulate physical objects to design, and to show the shape, structure and color of the design object. The use of computer-aided design in art design can improve the efficiency and accuracy, fault tolerance, richness and extensibility of the digital model of art design. Computer-aided design and drawing can store the design drafts and samples in the design at any time, which can be easily recalled at any time, and can be copied, pasted and modified at any time. For example, advertising and other art designs are not formed at one time, and often require repeated revisions and continuous improvement. Traditional hand-drawn works can only be rebuilt from scratch if there are drawing errors during the drawing process, which is time-consuming and labor-intensive. Computer-aided design software is fault-tolerant, which can restore the previous steps, such as the color and contrast of the drawn graphics, and can be modified and repeatedly adjusted at any time for the drawing errors, modification errors, and accidental deletions generated in the artistic design. Computer-aided design provides designers with unlimited imagination and can realize their creativity and expressiveness. Designers can use the graphic information database to obtain the required materials, and create new graphics through the processing of computer-aided design.

The application of computer in art design mainly uses computer-aided design software as a tool, and network materials and art materials as resources for artistic design creation. The practicability of its digital model is mainly reflected in the following aspects: first, compared with traditional design methods, computer art design is more suitable for the needs of modern society. It has sound and pictures, large amount of information, convenient and quick display, vivid images, and forms. Strong sense and some effects of artistic design using computers cannot be accomplished manually. Second, computer-aided design can effectively reduce the transmission deviation and loss of design effects in manual design to the minimum, and can further extend and expand the designer's creative consciousness on the basis of the previous. The third is to use computer-aided design to make physical modeling, allowing designers to modify and edit virtual objects arbitrarily, to maximize the realization of design and design intent, simple and convenient in operation, and unprecedented ease of use. The fourth is the use of computer-aided design, injustice can improve efficiency and accuracy, and graphics processing software can also be used to plan and organize the design plan, and directly present it with intuitive theological effects, better adapt to market competition, and more fully meet customer needs.

4.2 Association Between the Graphic and Spatial Digital Model

When a designer completes a behavior that requires computer assistance, the completion of the task and the time to complete the task are important criteria that affect the experience of computer-aided art design software. In order to better complete the task, the functions of the software will become more and more powerful, and the tools and parameters will become more controllable. Therefore, the development trend of design software tends to find a balance between learning ability and functional use, and learning ability experience is mainly reflected in the learning cost, that is, the time required to learn to complete the corresponding task under the same conditions. The practicability of its digital model is mainly reflected in the following aspects: first, compared with traditional design methods, computer art design is more suitable for the needs of modern society. Digital model function use experience digital model is mainly reflected in the complexity of the operations required to complete the task [11]. This complexity includes not only the number of operations required to complete the task, but also the number of operations during use and the fluency of user operation aspects. Studies have found that the complexity of functions will inevitably lead to an increase in the learning cost of fully mastering computer-aided software, which is inevitable (Figure 7). There are two ways to control the digital model from the plane to the space to a certain extent. One is to solve the problem through the design method centered on the user's task, which is to reduce the learning by understanding the task that the user wants to complete. Traditional hand-drawn works can only be rebuilt from scratch if there are drawing errors during the drawing process, which is time-consuming and labor-intensive.

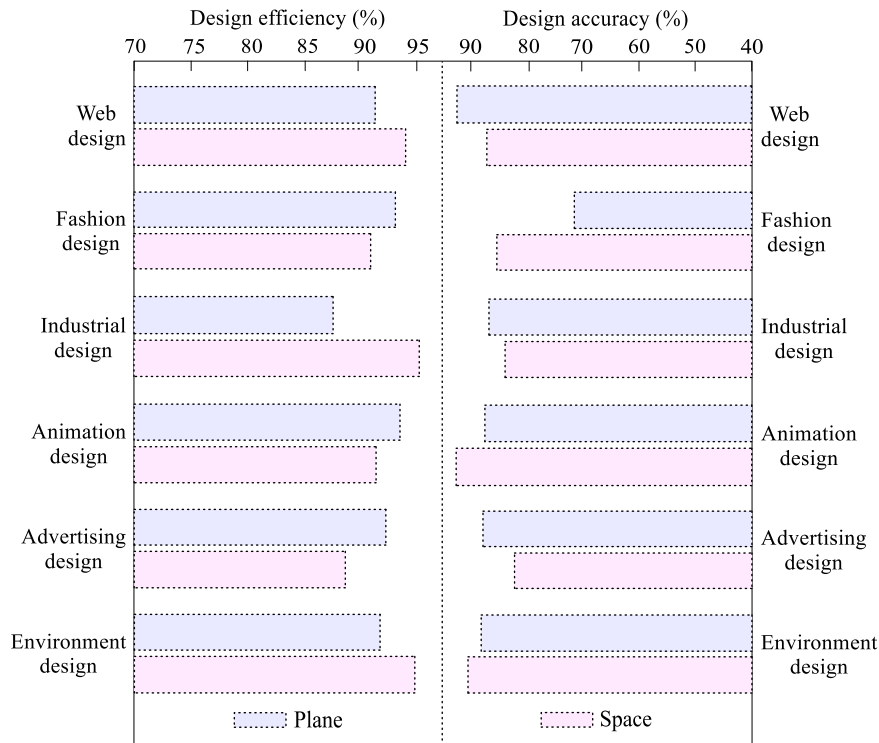


Figure 7: Association between the graphic and spatial digital model in six typical art design fields.

The continuous development of computer technology and digital models has brought a huge impact on the field of art design. Compared with the traditional hand-painted design, the computer has the advantages of fast, convenient, and realistic, providing designers with sufficient means of expression. Freed from the complicated work in the past, it has more energy, more accurate and effective processing of design performance icons, and realizes the creativity that was difficult to achieve before. In fact, a computer is just a design tool; it will make the digital model play to the fullest effect, but cannot rely on it too much, thinking that with a computer, no human brain is needed. In fact, when using computer-aided design, designers need to have the necessary design foundation and aesthetic skills such as creativity, aesthetics, composition, color, etc., instead of just learning two or three design applications and collecting picture data simply put together, or even abuse various computer special effects, play with production skills. Computer-aided art design has incomparable advantages over traditional design methods, which can improve the overall quality of the design and shorten the design cycle. With the help of computer-aided design software, designers can focus on creative design instead of mechanical repetitive work, so as to achieve high-quality and high-efficiency design.

The space model made with computer-aided design tools breaks through the space limitation of traditional art design. It is made on actual scale, what designers see is what designers get; at the same time, the model making process is the process of designer thinking and the model's reproducibility is extremely prominent. With the help of the network, it can basically achieve multi-party intuitive real-time communication. At the same time, the production of the digital model of computer-aided art design is synchronized with the thinking of the designer. The two promote each other, which can reflect the thinking of the designer to the greatest extent and the thinking of the designer at all stages can be easily reflected in the model. The communication time difference between designers in traditional design is completely avoided. The related software of computer-aided space design has some functions to simulate the real environment, such as the

performance of light and shadow effects. Through the simulation and display of light and shadow, the designer can more accurately grasp the scale of each part of the model, and control the light and shadow relationship between modeling and shape. When planning group objects, it is more convenient to display the sunshine conditions at a specific time and in a specific area, so that the layout of the objects can be adjusted at any time. One of the most significant advantages that computer-aided space design brings to design is that designers no longer have to rely entirely on personal experience and imagination to describe the space.

5 CONCLUSIONS

This paper proposed the digital model of computer-aided graphic art design including art design strategy and digital model structure, analyzed the digital model of computer-aided spatial art design including art design system and digital model optimization, and discussed the interactive range interaction between design and calculation and the association between the graphic and spatial digital model. The real-space digital model of artistic design can accurately measure the spatial and spatial coordinates of the structure according to the large-scale computer-aided digital method. The structure model of the object is automatically generated by the software and the corresponding texture is attached to it. Since art design is a graphic design process, designers only rely on the horizontal, vertical, and horizontal design data of the digital model to evaluate the rationality of the model, which is not intuitive to achieve rapid comparison of different digital model design plans. In the process of introducing computer applications, the digital model of art design also introduces the professional knowledge of art design in more detail, so that designers can understand the principles of art design and the laws of design art, and apply them to computer-aided design. The analytical results show that, in the process of introducing computer applications, the digital model of computer-aided art design can also introduce the professional knowledge of art design in more detail, so that designers can understand the principles and patterns of art design and can apply them to computer-aided designs, having greatly improved the efficiency and quality of art design, extended designers' thinking, and then developed a digital model from plane to space. The study results of this paper provided a reference for further research on the digital model of computer-aided art design.

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REFERENCES

- [1] Li, B.; Lou, R.; Segonds, F.; Merienne, F.: Multi-user interface for co-located real-time work with digital mock-up: a way to foster collaboration? *International Journal on Interactive Design and Manufacturing*, 11(3), 2017, 609–621. <https://doi.org/10.1007/S12008-016-0335-2>
- [2] Mayvan, B.-B.; Rasoolzadegan, A.; Yazdi, Z.-G.: The state of the art on design patterns, *Journal of Systems and Software*, 125, 2017, 93–118. <https://doi.org/10.1016/J.JSS.2016.11.030>
- [3] Zhao, Y.; Dai, F.; Gupta, M.-M.; Zhang, W.: Ontology modeling for intelligent computer-aided design of apparel products, *International Journal of Automation Technology*, 10(2), 2016, 144–152. <https://doi.org/10.20965/IJAT.2016.P0144>
- [4] Tang, Q.: Quantitative analysis of design ability of culture and creative designers under ethical vision, *Art and Design Review*, 7(4), 2019, 237–252. <https://doi.org/10.4236/adr.2019.74019>
- [5] Liu, H.; Zhang, X.-T.; Fu, X.-M.; Dong, Z.-C.; Liu, L.: Computational peeling art design, *ACM Transactions on Graphics*, 38(4), 2019, 64. <https://doi.org/10.1145/3306346.3323000>

- [6] Qin, Y.; Lu, W.; Qi, Q.; Liu, X.; Zhong, Y.; Scott, P.-J.; Jiang, X.: Status, comparison, and issues of computer-aided design model data exchange methods based on standardized neutral files and web ontology language file, *Journal of Computing and Information Science in Engineering*, 17(1), 2017, 10801. <https://doi.org/10.1115/1.4034325>
- [7] Oladumiye, E.-B.: Graphic design theory research and application in packaging technology. *Art and Design Review*, 6(1), 2018, 29–42. <https://doi.org/10.4236/ADR.2018.61003>
- [8] Zhu, Q.: Interior design and pattern innovation design study based on generic algorithm logistics information, *Cluster Computing*, 22(6), 2019, 13745–13751. <https://doi.org/10.1007/S10586-018-2080-8>
- [9] Williams, W.-R.: Attending to the “visual” aspects of visual storytelling: Using art and design concepts to interpret and compose narratives with images, *Journal of Visual Literacy*, 38, 2019, 66–82. <https://doi.org/10.1080/1051144X.2019.1569832>
- [10] Murphy, J.; Biemer, P.; Berry, C.: Transitioning a survey to self-administration using adaptive, responsive, and tailored (ART) design principles and data visualization. *Journal of Official Statistics*, 34(3), 2018, 625–648. <https://doi.org/10.2478/JOS-2018-0030>
- [11] Balint, T.-S.; Pangaro, P.: Design space for space design: Dialogs through boundary objects at the intersections of art, design, science, and engineering, *Acta Astronautica*, 134, 2017, 41–53. <https://doi.org/10.1016/J.ACTAASTRO.2017.01.029>