Research on Visual Communication Graphic Design
Information System Based on Computer Simulation

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Abstract. The article is based on the basic theories of computer graphic image design and visual communication design, combined with the historical background, tasks, creative rules, educational methods, involved fields and thinking styles of computer visual communication design. Combining the needs of visual communication graphic design, the paper designs a graphic design visual aesthetics computer-aided analysis system based on design geometry, which realizes the import of graphic design works, the interactive segmentation and acquisition of design elements, and the analysis and judgment of the relationship between proportion and composition. And other basic functions. The system can be used to judge the visual aesthetics of design works and can also provide design support related to geometric aesthetic principles to users engaged in graphic design.

Keywords: Computer simulation, visual communication, graphic design, information system.

1. Introduction
Computer graphics design and visual communication design have certain similarities in some respects. When designing, different software designs can bring different effects. In the process of product design, graphic design can bring viewers a completely different feeling from manual drawing, so as to better resonate with viewers. This feature of design software is widely used in more fields, such as product design and sales. In actual design, computer graphics design and visual communication design have their own focus. Therefore, when using different software for design work, they must be able to clarify their ideas and designers need to clearly determine their goals.

Although the current graphic design system can provide users with a platform for design works, it cannot provide users with a basis for design geometric theory. When designing, users only improve their works based on their own artistic qualities, without geometric knowledge assistance, and the design works are messy. Harmonious [1]. To this end, this paper designs a new computer-aided graphic design system, completes the aesthetic analysis of the proportions of geometric elements in graphic design, helps users realize visual aesthetic judgments, and can also provide users with design support related to geometric aesthetic principles.
2. Concept elaboration

2.1. Computer graphics design
With the continuous development of computer technology, more and more industries have begun to apply computer technology, and computer technology is also constantly broadening the development path. When using computer software for work, it can also provide users with effective help, thereby improving overall work efficiency. For the graphic image design, the computer can bring more convenience to the designer, and the designer’s exquisite creativity can be displayed more intuitively through the computer graphic image design. In the context of the information age, design methods are constantly innovating [2]. Different designers have different ideas for product design creativity, which can all be demonstrated through the use of computer graphics and image design software. The comprehensiveness of design software directly breaks the limitations of traditional manual design, and more diverse designs are of great help to the development and promotion of some products; effective computer graphics and image design can make more products have better decorative effects to show.

2.2. Visual communication design
The visual communication design contains the designer's design ideas, they visually convey the design content, and the main content involves some information. On the one hand, visual communication design is transmitted through people's sense organs, and on the other hand, it also has a specific psychological effect. Visual communication design first designs related content through designers, and then achieves the effect of communication through individuals-groups or groups-groups. Designers use traditional media such as newspapers or other media to communicate to express certain ideas and goals. Visual communication design is widely used in various fields, such as similar to commercial design and print art design, as well as various political propaganda, display design, clothing design and other fields.

3. Comparison of computer graphic image design and visual communication

3.1. Comparison of historical background
The historical background of visual communication design: Visual communication design was formed after the Second World War, and the combination of painting and advertising caused changes in the communication system of the goods circulation system. The historical background of computer graphics design: computer graphics design as a first Door technology was formed at the end of the 20th century [3]. With the improvement of computer structure, storage, speed, network and other technologies, brand new tools have been configured for computer graphics and image design, and the combination of printers, scanners, plotters, and multimedia has been expanded. The scope of design. The development of computer software technology has enabled the design of computer graphics and images to move from the two-dimensional field to the three-dimensional field.

3.2. Task comparison
The task of visual communication design: persuade the audience; establish an image; achieve dynamic and beauty; master media dynamics; modeling generation, etc. The task of computer graphic image design: the creation of two-dimensional and three-dimensional spaces; the establishment of static images and dynamic images; modeling, etc.

3.3. Comparison of Creative Rules
The creative rules of visual communication design: conversion from intention to form; combination of meaning; combination of form and colour; combination of image and symbolic meaning, and these laws are based on abstract points, lines, surfaces, bodies, colours, light, texture, etc. Above. The creative rules of computer graphic image design: the combination of shape and colour; the combination of three-dimensional and space; decoration and visual beauty; the combination of static and dynamic. These rules
3.4. Comparison of Educational Methods

The educational method of visual communication design: In addition to the training of various design skills (advertising design, product packaging, book binding, etc.), the core curriculum of its education system also teaches related theoretical knowledge (the history of arts and crafts, the history of design, the general theory of advertising, Advertising psychology, communication, etc.). Computer graphics and image design education methods: In addition to the training of related design courses, the main training content of the computer graphics image design education system is computer graphic software, computer three-dimensional software, video editing, and phototypesetting. Printing etc.

4. Image design and visual communication computer-aided system

4.1. The overall structure of the system

Graphic design needs to follow geometric principles to a certain extent, so that graphic design works have a sense of cohesion. These geometric aesthetic principles are not only the key to understanding many graphic design works, but also the aesthetic rules for the analysis of graphic design works [4]. This paper designs a computer-aided graphic design system based on the aesthetic principles of the golden section. The overall framework of the design system is described in Figure 1.

![Figure 1. The overall framework of the system](image)

4.2. Key technology

4.2.1 Golden section function. The paper divides a line segment into two parts. The ratio of the whole line segment to the longer part AC is the same as the ratio of the longer part AC to the shorter part BC. The ratio obtained by this line division is approximately 1.618:1 (can also be expressed as \(\frac{1 + \sqrt{5}}{2}\)), and this ratio is the golden ratio. The golden section has perfect proportions. Under such a ratio, different golden section rectangles, golden section triangles, golden section ellipses and golden section spirals can be obtained. These shapes with similar aesthetic properties can maintain their original characteristics. Blended into a larger overall pattern, so that the overall picture is coordinated and natural.

Take AB as the side to make the figure ABCD in Figure 2, take the midpoint E of AD, extend DA to F, make EF equal to EB, and make AFGP, then point P is the sub-point of the wonderful division.
4.2.2 Dynamic rectangle. Because the fixed rectangle is predictable and basically unchanged again, the fixed rectangle cannot be divided again to form a satisfactory plane ratio, but the dynamic rectangle can be realized. This is mainly composed of the dynamic rectangle ratio through irrational numbers. Therefore, when the dynamic rectangle is divided again, a large number of visually satisfactory and harmonious division ratios can be formed [5]. The following gives an example of the golden section dynamic rectangle harmonious division, as shown in Figure 3.

![Dynamic Rectangle Diagram](image)

**Figure 3.** An example of dynamic rectangular and harmonious division of the golden section

4.2.3 Determination of dividing line. When realizing graphic design through computer-aided systems, based on the golden section theory, the dividing line is drawn through human-computer interaction, and the proportional relationship between the dividing line and the whole picture, the dividing line and the dividing line can be calculated, which can make the design work more in line with geometry, and visually more harmonious. In this section, based on the golden section theory, the image is segmented through the between-class variance. According to data theory, the greater the variance between different categories, the better the separation between categories and the smaller the error rate.
Using the spatial information of the relative position of the pixels in the image, the regional Gray-level co-occurrence matrix can be established, that is, the matrix that represents the spatial correlation of the image gray level. Because the joint frequency distribution of a certain Gray-level combination of a group of pixel pairs separated from (Δx, Δy) in the image can be represented by a gray-level co-occurrence matrix, it is an effective method to extract texture features with the help of the co-occurrence matrix. If the Gray level of the image is set to N level, then the co-occurrence matrix is a NN matrix, which can be expressed as $M(Δx, Δy)(h,k)$, where the value of the element $m_{hk}$ located in $(h,k)$ indicates that one gray level is h and the other gray level is k. The number of occurrences of two pixel pairs separated by (Δx, Δy). Let $U_s$ be the set of pixel pairs with a specific spatial connection in the target area R, then the co-occurrence matrix P can be defined as:

$$P(g_1, g_2) = \# \left\{ (x_1, y_1), (x_2, y_2) \in S \mid f(x_1, y_1) = g_1 \& f(x_2, y_2) = g_2 \right\} / \# S$$

The numerator on the right side of the equal sign in the above equation is the number of pixel pairs that have a certain spatial relationship and gray values are $g_1$ and $g_2$ respectively, and the denominator is the total number of pixel pairs (# represents the number). The P thus obtained is normalized. Due to the different texture scales of different images, the gray-level co-occurrence matrix can be very different. Because for coarse textures, the values of elements near the main diagonal of the gray-level co-occurrence matrix will be larger and more concentrated [6]. For fine-textured areas, the values of most elements in the gray-level co-occurrence matrix are relatively similar. It can be seen that various statistics of the gray level co-occurrence matrix can be used as a measure of texture characteristics. Image retrieval based on texture features often uses the following four statistics of the gray-level co-occurrence matrix as a measure of texture features.

1. **Contrast** (or called the moment of inertia of the main diagonal):
   $$CON = \sum_h \sum_k (h - k)^2 m_{hk}$$

$m_{hk}$ is the element in the gray-level co-occurrence matrix that represents the texture feature. For coarse texture, since the value of $m_{hk}$ is more concentrated near the main diagonal, the value of (h-k) is smaller at this time, so the corresponding CON value is also smaller. On the contrary, for fine texture, the corresponding ECON value is larger. If the gray level of the image is set to N, then the co-occurrence matrix is a NN matrix, which can be expressed as $M(Δx, Δy)(h,k)$, where the value of the element $m_{hk}$ located at $(h,k)$ indicates that one gray level is h and the other gray level is k. The number of occurrences of two pixel pairs separated by (Δx, Δy).

2. **Energy** (or called angular second moment):
   $$ASM = \sum_h \sum_k (m_{hk})^2$$

5. **Conclusion**

This paper proposes a computer-aided graphic design system. The overall framework of the design system is given through the principle of golden section aesthetics. The golden section ratio is introduced, the analysis results of different types of dynamic rectangles and map frames of the golden section are given, the dividing line is determined, and the standard auxiliary line template is designed. The experimental results show that the system design works designed in the thesis conform to geometry. The system is visually harmonious, and the evaluation result is good.
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