Design and Realization of Remote Graphic Design System Based on Computer Aid

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Abstract. The traditional remote graphic design system cannot provide users with the basis of design geometry theory, which leads to the disharmony of the design works. For this reason, a computer-aided remote graphic design system is proposed. Determine the image import direction, obtain the contour ratio, compare it with different dynamic rectangle ratios, and give the difference between the image and the standard value and the recommended adjustment value. The experimental results show that the works designed by the design system conform to geometry, are visually harmonious, and the evaluation results are good.

Keywords: Computer-aided, Remote Graphic Design, System Analysis, Golden Section, Geometric Knowledge, Image Addition

1. Introduction

With the rapid development of science and technology and the gradual improvement of the market economy system, the competition in the survey and design market of railways and urban roads has become increasingly fierce, with minimal human resources to complete larger design projects, with minimal material input Obtaining more economic and social benefits has been the goal pursued by the managers of every enterprise [1-2]. For this reason, only by continuous improvement of survey and design techniques and methods can they adapt to the development of society and enable survey and design enterprises to gain a foothold [3-4]. In an invincible place[5-6]. In order to adapt to the needs of the development of the times, it is necessary to eliminate those ancient rulers, protractors, curve boards and drawing boards and other design tools to achieve paperless office and improve design efficiency. It frees the majority of engineering designers from heavy manual labor [7-8]. At the same time, the emergence of high-tech resources and products has provided resources for greatly improving the survey and design level of railways, highways and urban roads, such as digital maps and digital ground [9-10]. The model (referred to as DTM) has created great convenience for survey and design; the rapid development and upgrade of computers, graphics input and output devices, and graphics processing software have provided engineering designers with a hardware and software environment. In the past, a single person Computer interactive drawing can no longer meet the requirements of designers. For this reason, on the existing drawing software platform, the use of high-level languages and development tools to develop automatic design software that can truly realize various traffic routing functions has important practical significance and applications [11].
Although the current remote graphic design system can provide users with a platform for design works, it cannot provide users with the basis for design geometric theory. When designing, users only improve their works based on their own artistic quality, without geometric knowledge assistance, and the design works are messy Discord. To this end, this paper designs a new computer-aided remote graphic design system to complete the aesthetic analysis of the proportions of geometric elements in remote graphic design, to help users realize visual aesthetic judgments, and to provide users with relevant geometric aesthetic principles of design.

2. Computer-aided remote graphic design system

2.1. The overall structure of the system
To a certain extent, remote graphic design needs to follow geometric principles to make remote graphic design works have a sense of cohesion. These geometric aesthetic principles are not only the key to understanding many remote graphic design works, but also the aesthetic rules for the analysis of remote graphic design works. This paper designs a computer-aided remote graphic design system based on the principle of golden section aesthetics [5]. The overall framework of the design system is described in Figure 1.

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

2.2. Key technology
The design system is mainly based on the golden section principle, the ratio chart of the golden section. 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.
In Figure 2, assuming $AB=k$, $AP=b$, then $PB=k-b$. Because of $\frac{AB}{AP} = \frac{AP}{PB}$, $k = \frac{b}{k-b}$, $b_2 + bk - 2(k-b) = 0$, and finally:

$$b = \frac{\sqrt{5} - 1}{2} k.$$  

It can be seen that the golden ratio, $\frac{\sqrt{5} - 1}{2}$, is the approximate value of the golden section number $\frac{\sqrt{5} - 1}{2}$.

There are many types of dynamic rectangles in the golden section, which can be divided into two categories: one of which is a fixed rectangle containing the fractional ratio of rational numbers composed of irrational numbers, such as $1/2$, $2/3$, $3/3$, $3/4$; One type is a dynamic rectangle containing irrational fraction ratios composed of irrational numbers such as $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$ and the golden ratio. Because the fixed rectangle's re-segmentation is predictable and basically unchanged, the fixed rectangle's re-segmentation cannot form a satisfactory plane ratio, but the dynamic rectangle can be realized. This is mainly composed of the dynamic rectangle ratio through irrational numbers, so the dynamic rectangle is again In the case of segmentation, a large number of visually satisfactory and harmonious segmentation ratios can be formed. The following gives an example of the golden section dynamic rectangle harmonious division, as shown in Figure 3. Figure 3a) describes the composition of the golden section rectangle, Figure 3b) describes the golden section rectangle formed by the solid line for harmonious division, and Figure 3c) describes the harmonious division part.
Figure 3. An example of dynamic rectangular and harmonious division of the golden section
2.3. Map frame analysis
After the image is added to the designed system, first place the image at the bottom of the system layer and lock it so that it cannot be adjusted at will, ensuring that the auxiliary lines and templates used in the computer-aided process cannot be superimposed on the upper layer of the image. Obscured. After completing the above operations, use the obtained image attributes to realize the image frame analysis. First determine whether the image is imported horizontally or vertically, and then obtain the image insertion point and the length and width values to obtain the contour ratio. After obtaining the contour ratio, compare it with different dynamic rectangle ratios. The degree of satisfaction is determined within the allowable accuracy interval. When the error value is within a certain interval, it is regarded as the standard value. Otherwise, the relationship between the contour ratio and the standard value is given through computer assistance. If the calculated contour ratio is not much different from the standard value, the length and width value of the standard value is calculated, and the adjustment plan is given at the same time, and the difference between the image and the standard value and the recommended adjustment value are given.

2.4. Determining the dividing line
When implementing remote graphic design through a computer-aided system, 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 entire picture, the dividing line and the dividing line can be calculated, which can make the design work more in line with the geometry Learn more visually. 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. Assuming that the proportion of pixels in the image \( i(i \in \{0,D-1\}) \) is described by \( P_i \), the image is divided into \( k+1 \) categories (\( E_0, E_1, E_2,...,E_k \)), where \( E_0=\{0,…,s_1\} \), \( E_i=\{si+1,…,si+1\} \), \( E_k+1=\{sk+1,…,D-1\} \), then the average gray value of the image can be described as:

\[
\sigma_i = \sum_{j=0}^{D-1} jP_j
\]  

(1)

The probability \( \lambda_i \) and the mean gray value \( \vartheta_i \) of various types of appearance can be described as:

\[
\lambda_i = \sum_{j=a_i}^{b_i} P_j
\]  

(2)

\[
\vartheta_i = \sum_{j=a_i}^{b_i} jP_j/\lambda_i
\]  

(3)

Then the variance between classes can be described as:

\[
\omega_h^2 = \sum_{i=0}^{k} \lambda_i (\vartheta_i - \vartheta_h)^2 = \sum_{i=a_i}^{b_i} \lambda_i (\vartheta_i - \vartheta_h)^2 = \sum \lambda_i (\vartheta_i - \vartheta_h)^2
\]  

(4)

Regarding the maximum between-cluster variance as a segmentation rule, the golden ratio corresponding to the maximum between-cluster variance is the optimal golden ratio for image segmentation, which can be described as:

\[
[t_1, t_2, \cdots, t_k] = \arg\max_{0 \leq d_1, d_2, \cdots, d_k \leq D-1} \omega_h^2(t_1, t_2, \cdots, t_k)
\]  

(5)
Different types of statistical parameters are the accumulation of gray level parameters of this type. If the image is regarded as a continuous function of gray level, the summation problem will be converted into an integral problem, and the probability, mean and variance between classes of different classes will be converted into integrals. function.

The discrete probability distribution of the k-1 type can be described by a continuous probability density function:

\[
\delta_{k-1}(s_{k-1}, s_i) = \int_{s_{k-1}}^{s_i} P(g) \, dg
\]

If the variance between classes is large, it is considered that the coupling between different classes is small, different degrees are large, and the division is reasonable. Therefore, the gray value corresponding to the maximum inter-class variance in the gray domain is the optimal golden ratio, and the image segmentation line can be obtained according to the optimal golden ratio.

2.5. Standard auxiliary line template
If there is no dividing line in the image, or further research is needed after the dividing line is determined, the standard auxiliary line template is used to complete the analysis of the image. Because the dynamic rectangle segmentation is very complicated, the effective use of the dynamic rectangle cannot be realized by manual judgment, and the role of the dynamic rectangle in the remote graphic design cannot be played. The standard auxiliary line template can explore the deep-level proportional relationship in the design work. The designed system provides a total of 90 standard auxiliary lines including dynamic rectangles and network auxiliary lines of the golden ratio \(\sqrt{2}, \sqrt{3}, \sqrt{5}\), etc., which can be used reasonably according to the results of map analysis.

3. Analysis of experimental results
The system processing results of this article.

Experiments design a side butterfly based on the computer-aided remote graphic design system designed in this paper. First draw an ordinary side butterfly, described with Figure 4.

![Figure 4. Side butterfly drawn](image)

In order to more objectively verify the aesthetic attainments of the system design works of this paper, remote graphic design professionals are invited to evaluate 85 works with the same source drawing images designed by this system, ASP system and SSH system. The invited evaluators are masters, doctoral students and teachers, professional designers and users in remote graphic design of a 211 college. The detailed information of evaluators is described in Table 1. The evaluation score is 1-10 points, the higher the score, the higher the evaluation of the design work by the evaluator.
Table 1. Details of evaluator objects

| Feature               | Classification         | Percentage/% |
|-----------------------|------------------------|--------------|
| Gender                | Male                   | 41.72        |
|                       | Female                 | 58.28        |
|                       | Professional teacher   | 18.31        |
|                       | User                   | 22.52        |
| Personnel background  | Master's degree        | 18.85        |
|                       | PhD                    | 21.77        |
|                       | Professional designer  | 18.55        |

In the following, for the product appearance designed by the method, knowledge reuse method and Java method in this article, the evaluator's evaluation results of the design works of this system, ASP system and SSH system are described in Table 2.

Table 2. The evaluation results of the evaluators on the three system design works (points)

| Evaluation index                      | Text system | ASP system | SSH system |
|---------------------------------------|-------------|------------|------------|
| Innovation                            | 8.31        | 7.21       | 6.57       |
| Color coordination                    | 9.22        | 6.86       | 6.12       |
| Visibility                            | 9.53        | 8.12       | 7.35       |
| Harmony                               | 9.61        | 7.33       | 8.17       |
| Satisfy the degree of geometric       | 9.66        | 7.91       | 5.82       |
| aesthetics                            |             |            |            |
| Composition                           | 9.35        | 6.35       | 7.35       |
| format                                | 8.71        | 7.27       | 6.91       |
| symmetry                              | 8.26        | 6.18       | 5.88       |
| Continuity                            | 9.15        | 5.92       | 6.22       |
| Unity                                 | 9.25        | 6.89       | 5.52       |
| Total average score                   | 9.105       | 7.004      | 6.591      |

Analysis of Table 2 shows that the evaluators have high average scores for the innovation, color coordination, visibility, harmony, geometric aesthetics, composition, format, symmetry, continuity, and unity of the system design works in this article. For ASP system and SSH system, the total average score is as high as 9.105, while the total average score of ASP system and SSH system is only 7.004 and 6.591, indicating that the system design works in this article are more in line with the requirements of professional knowledge.

4. Conclusion

This paper proposes a computer-aided remote 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 designed system design works conform to geometry, are visually harmonious, and the evaluation results are good.

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