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Graphic Art Design of Guangfu Intangible Cultural Heritage Based on Fractal Theory

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Abstract: Fractal theory is a new discipline that has only emerged and developed in recent decades. It belongs to the category of nonlinear science and is still under continuous development and improvement. Taking the design of Cantonese intangible cultural heritage graphic art as an example, this paper uses MyEclipse software as the design platform and Java as the programming language to realize the programming of classical fractal graphics and the boundary class design of fractal drawing software. The preservation of Cantonese intangible cultural heritage fractal graphics has deepened the intangible cultural heritage publicity and protection work, and continued the inheritance of intangible cultural heritage national treasures.

1. Introduction

Now the combination of fractal theory and graphics in computer science has aroused people's most urgent and enthusiastic attention to fractal graphics. While content with watching colorful fractal graphics, people are eager to understand the generation principle of how fractal graphics are dynamically generated, and are eager to draw and design various styles of fractal graphics; eager to realize a real-time, interactive interface after some simple parameter settings and modifications, fractal graphics with a certain artistic beauty are generated. All of these have opened up a broader and long-term development direction for the application of fractal graphics.

Scholars at home and abroad have conducted in-depth research on intangible cultural heritage graphic art design based on fractal theory, and have achieved extraordinary results. For example, in order to realize the non-legacy fractal graphics, a scholar first proposed a mathematical algorithm for fractal graphics, which combined the rational thinking of mathematics with the perceptual thinking of artistic design, and then transformed the mathematical algorithm into computer language, that is, computer program coding. In order to make the obtained intangible cultural

heritage graphics more realistic, parameters are set for the graphics, and the shape, position and color of the graphics are changed by modifying some attribute parameters to reflect the unique properties of fractal graphics [1]. Some researchers have discussed the conception method and expression method of fractal pattern design, and the drawing of irregular lines such as pollen movement trajectories and curved mountains can be realized through GUI elements in the computer. The research has great inspirational value in the design thinking of fractal pattern modeling [2]. Although there has been great progress in the research of intangible cultural heritage graphic art design based on fractal theory, how to display the attribute characteristics of intangible cultural heritage graphic design still needs to be solved.

This paper first expounds the self-similarity, self-affineness and dimension characteristics of fractal set graphics, then introduces several fractal design software, and uses MyEclipse software as the design platform to design a fractal graphics design program based on Java language, and finally realize the program's design of Cantonese intangible cultural heritage graphic art. Fractal Related Theory and Algorithm

1.1 Basic Properties of Fractal Geometry

(1) Self-similarity

The so-called self-similarity refers to the similar characteristics of the geometric object under study in the shape of the part and the whole. No matter what size of measurement scale is used for measurement, the shape of the obtained object remains unchanged, or it can be the part is regarded as a microcosm of the whole [3]. Based on the elements in the original graph, a new graph is generated by invoking the same segmentation method with different times. The basic elements and constitution rules of these graphs are the same, and they are all generated by the same elements with the same iterative rule [4]. Approximate self-similarity, as the name suggests, is imprecise similarity. Statistical self-similarity is the same as approximate self-similarity. The difference is that statistical self-similarity does not necessarily have obvious self-similarity visually, but its statistical parameters are consistent, which is a kind of self-similarity in statistical significance. Self-similarity not only includes geometric similarity in the standard sense, but also includes in the statistical sense, the self-similarity presented by the fractal graph in the statistical sense only exists in the area where the scale is invariant, such as in the service Fractal self-similar elements are integrated into the construction of sexual government [5].

(2) Self-affineness

The difference between self-affineness and self-similarity transformation is that in terms of partial and whole transformation of fractal graphics, the former has different fractal graphics transformation ratios in all directions, while the latter is the same [6]. In fact, self-similarity is contained in self-affineness. To a certain extent, self-affineness actually refers to an extension based on the self-similarity characteristics of fractals. Intuitively comparing similarity and affineness, they are fundamentally and most similar to each other in the transformation of proportions in parts and in the whole. Self-similarity can actually be classified as a special case of self-affineness, that is, the transformation in all directions is proportional, such transformations include shifting, rotating, scaling, and so on. From this, we can conclude that self-radioactivity is also one of the important binding features of fractals [7-8]. The movement of stock prices and the application of fractals in garden design are the most widely used fractal self-affine studies.

(3) Dimensional characteristics

Dimension is used to measure geometric figures. For most art pattern designers, due to

differences in disciplines and because dimension is a relatively abstract concept, they have a certain degree of understanding and understanding of fractal dimension. It will have an important impact on their knowledge, understanding, and mastery of fractal art pattern design. Therefore, to learn fractal art pattern modeling design, we must first have some knowledge and understanding of fractal dimension [9-10].

1.2 Fractal Design Related Software

There are dozens of software for fractal pattern modeling design and generation, among which the most popular and widely used software are Apophysis, MyEclipse and Context free.

(1) Apophysis

Apophysis is developed based on the theory of iterative function system (IFS) generation method. The main features of the software are: the software has many built-in function plug-ins, and there are also many function plug-in resources on the Internet. These function plug-ins can be used to achieve countless wonderful graphic transformations make the pattern produce dazzling and shocking light and shadow effects. While infinitely possible artistic patterns can be designed, the requirements for designers in mathematics are not high [11].

(2) MyEclipse

JAVA is an object-oriented, distributed, portable and dynamic programming language for computer development. Its excellent performance enables it to be widely used in many disciplines. MyEclipse is an improvement and upgrade of Eclipse. They both provide an enterprise-level integrated development environment, which is more powerful in function than Eclipse. Therefore, MyEclipse can be used as a platform for fractal graphics program development to develop Java.

(3) Context free

Context free structure context connection is loose, so it is more suitable for the statement of creating iterative structure, which provides an excellent place for us to use the idea of IFS to create fractal images, because in its statement, we can unlimitedly define graph generation rules, implement iterations, control variables and constants, control parameters, and author. When creating in Context free, a file called CFDG document should be generated first, which contains the program logic structure information edited with the context loose structure grammar, that is, the program language in our usual sense [12]. A CFDG file consists of several rules to define the various shapes of the graphics, as well as some other optional components and a mandatory component, that is, the mandatory start shape directive, which tells CFDG what shape to start generating the image in. There must be at least a start shape. If there are multiple initial shapes, they are used in sequence; the RGB value of the background can be set with the background command, the default is white; the optional grid command tells CFDG to draw a grid design using the grid design specified by the tile grid command. Paved version; optional size directive, limited to a specific drawing canvas size and position, used to clip the outline shape; there can be more than one include directive and header files can include other files; one or more shape rules, telling how CFDG draws shapes uses the rules of other shapes and primitive shapes. There is no limit to the number of rules. A given shape can also have many rules or just one rule.

2.3 Fractal Iterative Function System Algorithm

The basic idea of the iterative function system (IFS) algorithm is to use the self-similar structure between the whole and part of the object during the transformation process to transform and

compress through functions. Let T_0 be the starting image, there are a_1, a_2, ..., a_N compression transformations acting on T_0 at the same time, generating $a_1(T_0)$, $a_2(T_0)$, ..., $a_N(T_0)$. Let these N output graphs be T_1, expressed as:

$$T_1 = A(T_0) = a_1(T_0) Y a_2(T_0) Y ... Y a_N(T_0) \quad (1)$$

In the next iteration, T_1 is the input graph, and the N transformations of a_1, a_2, ..., a_N are applied to T_1 at the same time, and T_2 is obtained, that is:

$$T_2 = A(T_1) = a_1(T_1) Y a_2(T_1) Y ... Y a_N(T_1) \quad (2)$$

By repeating the above process in this way until convergence, the relationship between the input and output graphs of each iteration can be expressed as:

$$T_{k+1} = A(T_k), k = 0,1,2,... \quad (3)$$

Among them, T_k is the input image and T_{k+1} is the output image.

2. Software Design Based on Fractal Theory

2.1 The Program Design of Fractal Graphics Generation

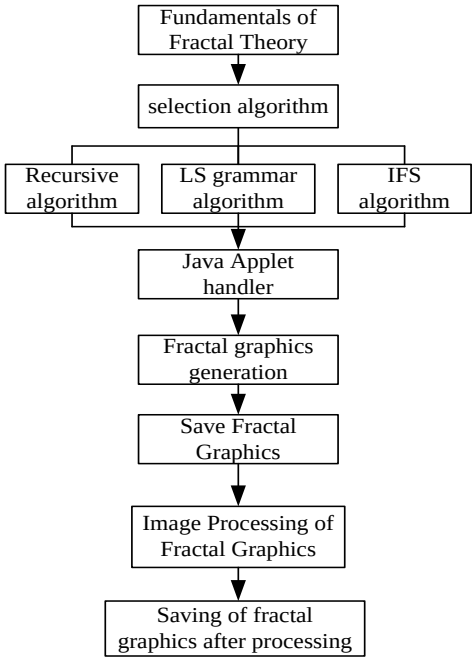

Figure 1: Fractal graphic design program framework

This system is a software for generating fractal graphs based on Java technology. By combining the basic knowledge of fractal theory and the fractal graph recursive algorithm, LS grammar algorithm, and IFS iterative system function algorithm included in the fractal theory, it uses the Java Applet applet to process fractals. The algorithm in the theory can realize the generation of fractal

images, the generated fractal graphics or the selection of fractal graphics existing in the system for learning, research, etc. After understanding the basic knowledge of the fractal profit, select the fractal design algorithm and add it to the Java Applet processing program, generate the fractal graph and save the graph, and finally process the saved fractal graph for further processing (see figure 1).

2.2 Design of Boundary Classes

In the software design stage, it is very important to use the static mechanism of the UML language to design classes. UML modeling tools mainly generate codes according to the classes designed by the software. The detailed design of this system is mainly designed by writing programs to generate boundary classes. The boundary class is the class that establishes the model for the interaction between all the business protagonists (inside and outside the system) involved in the development project. The main function of the boundary class is to provide a human-computer interaction graphical interface design for the operation of the business protagonist, or an interface for interaction between the inside of the system and the outside of the system, so when the external human-computer interaction graphical interface occurs When changing, you don't need to do anything, just modify the boundary class. Generally speaking, the design of the boundary class is mainly to realize some pages and page jumping functions in the front interface. The fractal graphics design and learning research system mainly designs the boundary classes from the three generation interfaces of fractal learning, fractal research and fractal design. As shown in Table 1 is the boundary attribute. The boundary class includes three categories, namely brush class, tool class, and drawing class. The brush class includes brush size and brush color, the tool class includes tool type and tool size, and the drawing class includes straight lines, curves and Self-drawn line. As shown in Table 1 is the attribute description table of boundary design.

Table 1: Boundary property descriptions

Boundary class name	Property type	Attribute field length
Brushes	Brush size	20
	Brush color	100
Tools	Tool type	75
	Tool size	30
Drawing class	straight line	10
	Curve	10
	Self-drawn line	25

3. Application of Fractal Design Program in Cantonese Intangible Cultural Heritage Graphic Design

3.1 Aesthetic Characteristics Reflected by Cantonese Intangible Cultural Heritage Fractal Graphics

The Cantonese intangible cultural heritage graphics have the characteristics of rotational symmetry in shape, and in terms of color, it has the characteristics of light to dark, which makes the whole image have a sense of dynamism and balance at the same time. The basic elements of the Cantonese intangible cultural heritage graphics designed this time are the most simple lines. The color, curvature, position, thickness of the lines are changed through functional transformation,

presenting a form that seems to be free and impossible, but also contains certain rules.

3.2 The Degree of Restoration of Cantonese Intangible Cultural Heritage Graphics

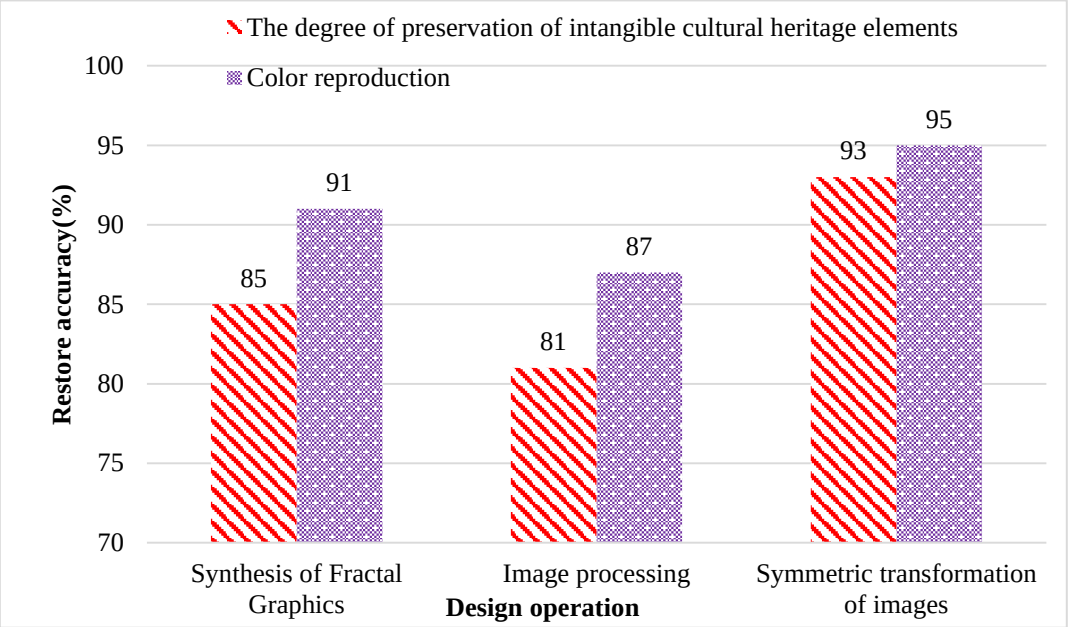

Figure 2: Intangible cultural heritage image restoration degree

As shown in Figure 2, when using fractal graphic design software to design Cantonese intangible cultural heritage graphics, the graphics need to be synthesized, processed with special effects, and symmetrically transformed. The image form is presented without destroying the sense of inheritance of intangible cultural heritage. Therefore, the design and synthesis process of the test design software is the degree of restoration of the intangible cultural heritage objects, including the degree of preservation of intangible cultural heritage elements and the degree of color restoration. It can be seen from the test results that the graphics designed by symmetrically transforming the intangible cultural heritage images have the highest intangible cultural heritage elements and color restoration, reaching 93% and 95% respectively. The color accuracy is the lowest, at 76% and 87%, respectively. This is because the difficulty coefficient of special effects processing is relatively large, and some characteristics of Cantonese intangible cultural heritage will be ignored. However, in this way, it is still possible to design intangible cultural heritage graphics with a high degree of restoration to inherit intangible cultural heritage culture.

4. Conclusion

The Cantonese intangible cultural heritage represents the profound cultural connotation of our country, and its inheritance and protection are particularly important. In this paper, the fractal graphics design program software is developed by using Java language, and the Cantonese intangible cultural heritage graphics are designed on the software. In the synthesis of intangible cultural heritage graphics, special effects processing and symmetry transformation, the graphics restoration accuracy reaches 80%-95%%, and the inheritance of intangible cultural heritage culture is realized.

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