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STUDY ON COMBINATION BETWEEN FRACTAL GEOMETRY IN NATURE AND MODERN VISUAL ART

ИССЛЕДОВАНИЕ СОЧЕТАНИЯ ФРАКТАЛЬНОЙ ГЕОМЕТРИИ В ПРИРОДЕ И СОВРЕМЕННОМ ВИЗУАЛЬНОМ ИСКУССТВЕ

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Аннотация. Фрактальная геометрия пронизывает нашу современную науку и природу. Это не только общественные науки, но также гуманитарные науки и искусство. Фрактальная геометрия, как мост и соединение науки и искусства, стала горячей точкой для многих предметных исследований. формы и пропорции узоров соответствуют правилу фрактальной геометрии. Многие работы в современном художественном дизайне были созданы, заимствуя фрактальное правило в природе. Сама природа - чисто естественный дизайнер, и все - его работа. Каждое естественное творение имеет изящную изящность. смысл дизайна, за исключением его функциональности, точно так же, как мы используем

современные технологии для создания части работы (продукта), мы должны учитывать не только функциональность, но также ее конфигурационную эстетику и смысл дизайна. геометрии, а также исследовать и анализировать сочетание и сходство фрактальной геометрии в зрелом и современном визуальном искусстве.

Abstract. Fractal Geometry goes through our modern science and nature. It is not only social studies, but also humanities and art. Fractal Geometry, as the bridge and linkage of science and art, has been the hotspot for many subject researches now. Many patterns' shapes and proportions conform to the rule of fractal geometry. Many works in modern art design were created by borrowing the fractal rule in nature. The nature itself is a purely natural designer, and everything is his work. Every natural creation has a graceful sense of design except for its functionality, just as we use modern technology to create a piece of work (product), not only should we consider functionality, but also we consider for its configural aesthetics and design sense. This paper explains the concept of fractal geometry and explore and analysis the combination and similarity between fractal geometry in mature and modern visual art.

Ключевые слова: фрактальная геометрия; визуальное искусство; искусство природы.

Key words: Fractal Geometry; Visual Art; Nature Art.

I.Art Form Originated from Nature

The famous French sculptor Rodin said:"The world is not lack of beauty, but lack of eyes to find beauty." Especially the beauty of fractal disappears in a second. When these arts are discovered by some scientists or artists, they will be utilized again and presented in front of us in another form of visual feast. So there comes the art works one after another.

1.Relationship Between Art and Nature

In fact, nature and art has been complementary and inseparable since ancient times. They won't restrict but make each other. People often can transfer nature to the so-called second art, even sometimes, some nature is taken as the first art without any modification. Therefore to some extent, they are equal. Almost all the artists and scientists are filled with reverence to nature.

From the various art works in ancient China to the works in different times in foreign countries, we can see the aesthetic ideas of the artists from different times and regions. But what the same is, they all agree that only when the created works are truly integrated with the nature, that is the real art.

2. How Nature Conveys Feelings to the Outside World Through Art

It is quite important to make the audience accurately understand. Because art and design are existed to solve problems. It is intentional and purposive. Suppose that it is not for the problem-solving and goal achieving, what do we design and plan for? Why do we have the behavior of design? In essence, art and design are the interaction between artists and scientists. If there is only one's expression, without audiences, it is only a piece of work of oneself. Only when the art works can be accurately understand by its audiences, truly solve the problem of the audiences, achieve goals, can they be called art works. And art in nature is such a work that can communicate with people. It seems that they can always grasp what people want, and then present it as it should be.

3.Distinction Between Art and Nature

Art is an extension of nature, it is a part of nature. How can nature imitate nature? So it must be the beauty of nature holding the hand of man to show nature. However, when we deduce in opposite that the nature is infinite and man is limited, art is of course even more limited. So people turn art into tools with their hands, without doubt, it is an imitation of nature. It is said that Tao operates naturally, it is also said that the divine law (or truth) can be known, but it may be not the law well-known to you.If we are obsessed with the semantic precision, we will inevitably fall into the trap of logic. But art, or nature, is just the thing

that needs the least precision and logic. The law is intangible and the semantic meaning is controversial. No matter it is imitation or presentation, art and nature are just right there, right there in your heart.

II.Overview of Fractal Geometry

1. Concept of Fractal Geometry

Many sceneries in nature have one thing in common, that is the more carefully you look with a magnifying glass or microscope to study, the more you discover their deeper secrets. Things in nature, when observed at large, do not seem boring, but even more interesting and attractive. Just think about how amazing and visually striking it will be if something remains the same all the time under constant magnification. And actually that's the concept of fractal.

To see in our real life, the coastline of our country, the tangle of tree roots, or the blood vessels in our bodies, even though they appear to be irregular, but no matter how much they are magnified, they seem to be the same. This similarity is the self-similarity in mathematics. In order not to describe the concepts of fractal geometry and fractal art so awkwardly and smoothly, I will summarize them in a short sentence: fractal geometry is the quantitative and visual description of irregular forms like lines, planes, and solids.

2. Application of Fractal Geometry

Actually we have mentioned some applications of fractal geometry in life before. The 3D processing technology in our modern life is just the application of fractal. Simply speaking, it draws from the rough appearance at first, gradually narrowing and become similar. If it draws or designs continuously like this, it will present a perfect 3D picture. This kind of method has been maturely applied in science fiction movies and games.

In the respect of wireless telecommunication, you can also see the fractal and self-similarity lime this. In a very small and confined space, designers will place entangled wires in such small space by a great amount of zoom, and it won't affect its utility. By doing this it can not only save the volume and floor space,

but it can show the beauty of art behind the rigorous science. It is no doubt the application of fractal geometry that has transformed our communication devices from last century's cellular phones to today's smart phones.

Of course, in addition to the above scientific applications, fractal geometry also applies to the humanities, such as philosophy. What fractal geometry shows is the synthesis of unity and dispersion, whole and part. Just as mentioned before, fractal comes from nature, so it must have some characteristics of nature. That is, order can be seen from chaos and whole can be seen from part. In fact, many complex things can be solved by the concept and idea of fractal, which is exactly what our ancients said: "Turn big things into small and then turn small things into nothing". Fractals naturally reflect the relationship and characteristics of dialectical materialism in this way. They are simple and not complicated, and we can get a lot from simplicity.

III. Combination of Fractal Geometry in Nature and Modern Visual Art

The art of fractal not only reserves in standard and traditional art, but also innovates with the support of modern science. Its whole and part, internal and external, all give people surprising strike to different degrees. Just as there is order in chaos and dispersion in unity. The works of fractal art are all like this, giving people a strong sense of visual strike in endless inlays. In the following, there are several examples of visual art to be analyzed.

1.Visual Presentation of Chinese Traditional Paper Cuttings in Fractal

In the Spring Festival Gala in 2013, there was such a children's dance performance, which was completely composed of children, presenting various beautiful shapes similar to paper cuttings in a way of dancing. And the shapes created by these children were inspired by the shape of natural snowflakes.

We can easily see from the traditional Chinese paper cutting and flower cutting art that it is a multi-dimensional art form. These forms are just like snowflakes with repeated standard beauty and exquisite beauty after decomposition. Creators pay attention to the display of stereo feeling in the

process of paper cutting, using the decomposition and reconstruction (actually, that is magnify and zoom in the fractal geometry) to edit around the lines in paper cutting. We can find that no matter how large it magnifies or how small it zooms, we all feel like seeing the same form of paper cutting, butthe feelings it gives a person are so different, as if even though it uses the same side of the gong, but you can tell which is which. In fact, this fixed change is exactly in line with fractal geometry and fractal art, which gives people a strong visual striking. In terms of composition, it also strictly follows the form and style of snowflakes in nature, and attach great importance to the perfection of paper-cutting, which can make people feel that this is a complete work, rather than a simple piece of paper. The most important part of paper cutting is the overall adaptability of paper cutting. As mentioned above, paper cutting is actually infinite repetition and infinite superposition like snowflakes. It is not only visual effect, but also reflected in the process of paper cutting. A piece of paper is repeatedly superimposed and then "cut", and finally the perfect pattern is obtained. These paper cutting skills together, can make a perfect paper cutting, and these skills after being broken down seem so easy to operate.

2. Visual Presentation of Chinese Ancient Gardens in Fractal

In fact, at this point, I have to talk about the series of discussions about fractal geometry in coastlines at the beginning. Here, I will use a small story to illustrate: long time ago in Australia, an elephant wanted to measure the coastline of the Australian continent with his feet, so he walked along the coastline until he returned to the original starting point, covering a total of more than 30,000 kilometers. At the same time, the ant also wanted to measure the coastline of such a large area with its feet, so it set out too, but when it finally returned to its starting point, it had covered more than fifty thousand kilometers! Why are there different numbers by walking along the same coastline? Is it to say that continent can change its coastline in a short period of time? Actually it's not about the rising of the sea level or the moving of continent, but the

unremarkable coastline itself. The reason is that elephants can cover parts of the bay in one step, while ants can only follow the road around smaller rivers or bays. This is self-similarity in mathematics. If we magnify the coastline of the Australian continent, we can find that the overall structure is not so much different, and this is actually the embryonic form of fractal.

The shadow of fractal can be seen in the overall design of ancient Chinese traditional gardens, such as The Master of Nets Garden, Lion Forest and Lingering Garden. These gardens first set the boundary line of the overall layout, and then designed a path around the garden inside of the line, and set the water pool for viewing in the path, and finally formed the complete garden we see. And every step of internal expansion is the application of fractals.

When designing the garden landscape, we should consider not only the comfort of the people inside, but also take into account the visual effect of the people watching and appreciating outside. And gardens bring more aesthetic feeling and visual enjoyment to people in the process of constantly narrowing, which is the application of fractal in the visual aspect of garden art. In modern society, in addition to garden landscape, all urban landscape design should also consider the visual effect, and fractal art can be completely used in it. These visually striking fractal art can be presented to people from point to line, and then from line to plane, both as a whole and in parts, so as to not only meet its applicability, but also increase its beauty. When people are living in or around such a city, a beautiful state of mind will form naturally.

3.Brief Analysis of Modern Fractal Visual Art Modeling -- Taking Sydney Opera House as an example

I don't have to tell you many things about the Sydney Opera House. We are all familiar with it. It has appeared in our textbooks since our childhood, and its symbolic appearance like orange segments impresses us most. We also know that it is an art center where various operas and plays can be staged. In these years after it was built up, it has gradually become a symbol of Sydney and even

Australia. Its shape is designed based on fractal geometry. So where is visually beautiful about this application?

What people talk most delightfully about Sydney Opera House is its appearance, each flap like a sail is about to go to sea, like a dolphin jumping out of water, and complement with the sea on its side. This kind of its external structure is a typical fractal art. Besides, its internal structure also makes deep use of the art of fractal geometry. That is why it is so impressive and even become a national landmark. Look around again, it is surrounded by sea on three sides. By such a beautiful coastline building such a building of strong contemporary feeling, as if to tell people that we got fractal inspiration from the coastline, now return to it again, hoping the coastline can all see the building on every moment, from the building to see human's understanding and application of fractal, also hoping the coastline to be able to respond, to answer us, whether art in nature should return to people's life in such a manner.

We can see the shadow of science from most of the art, such as the Mona Lisa, human art or architecture as mentioned above. To some extent, fractal art will continue to go beyond the normal human imagination thinking, giving people a sense of refreshing and surprising, it is not only reflected on the vision, but also in the mental feeling and thinking. As mentioned in this paper, no matter the coastline or the garden design, the visual embodiment of fractal in art is to magnify or zoom, a whole design with the design of similar but smaller, to form the perfect structure of the infinite. So whether from the depth and width, they give a person infinite daydream. What they present is random and accidental, varied and peculiar. In these mysteries, we can see the beauty of science behind fractal art. Such art is more needed in modern life.

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