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Digital Bionic Design in Sustainable Interior Spaces

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Abstract. With the development of society, people's concern for the environment is increasing, and sustainable design permeates every aspect of life. The combination of science and technology, and the intersection of technology and nature have promoted the development of digital bionic technology as an important means of sustainable development. This paper explores the emerging concept of digital bionic design and its potential application in the field of sustainable interior space design, and introduces the theory of digital bionic design by collecting literature and inquiring about cases, and the specific application of combining it with interior design, so as to achieve the creation of a space that is optimized for functionality, aesthetics, and ecology, and to satisfy the natural emotional needs of the user's outputs with the beautiful visions of environmental protection and resource sustainability.

Keywords. Bionic design, digitalization, interior space, sustainable design

1. Introduction

Since the 1980s, with the increasingly severe global resource and energy consumption and environmental damage, it has aroused the attention of the world. 1995, a new concept - "sustainable development", was officially proposed by the Central Committee of the Communist Party of China as an important national development strategy. In 1995, a new concept - "sustainable development" - was officially proposed by the Central Committee of the Communist Party of China as an important strategy for national development. "Man, and nature is a community of life." "There are no substitutes for the ecological environment, and it is difficult to use them without realizing that they are lost." This is a design concept compatible with the sustainable development strategy, based on the premise that man and nature live in Digital bionic Design in Sustainable Interior Spaces harmony, both to meet the needs of the current generation's life, but also to ensure the continuation of the development of future generations and its impact on them. With the development of science and technology, the intersection of technology and nature has led to the emergence of digital bionics, which combines the strengths of digital systems and biological processes. This concept has caught the attention of various industries, including interior design, as a means of addressing the pressing need for sustainable practices. In today's interior design, people are no longer looking for a simple functional indoor environment, but need to produce an emotional demand and follow a pleasant, healthy and peaceful indoor environment.

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The integration of natural elements and indoor environment can precisely meet the needs of individuals, not only the integration of image, but also the integration of technology, and digital bionic design as a new technical means, the harmonious integration of technology and natural elements, can create a space that optimizes the functionality, aesthetics, and ecology, so as to achieve the purpose of environmental protection and resource sustainability. Therefore, this study aims to enable its users to also experience the natural feeling of the outdoors by incorporating digital bionic design techniques in indoor spaces.

2. Digital bionic design

2.1. Bionics

Bionics is a multidisciplinary interdisciplinary field and the foundation of digital bionics. Bionics draws inspiration from natural organisms, mimicking their form, sound, texture, function, and other characteristics, and building adaptive technological systems by mimicking biological systems [1]. Bionics aims to create more efficient, effective, and adaptive technologies in a variety of fields, including medicine, engineering, and design. The ultimate goal of bionics is to bridge the gap between biology and technology in order to develop advanced and breakthrough science and technology that can improve human life and solve complex challenges.

2.2. Bionic Design

Bionic design is a new interdisciplinary subject based on bionics and design. To some extent, it can be understood as the application of bionics in design [2]. Bionic design is mainly through the imitation of biological morphology, color, texture, structure and so on. In nature, biological elements are refined and imaged, innovated according to needs and functions, and applied to design in the most perfect form.

2.3. Digital Bionic Design

Forging the structure of creatures in nature and applying it to digital design is called digital bionic design [1]. Relying heavily on the integration of digital technologies, designers use computer-aided design (CAD), 3D modeling, complex algorithms, and parametric modeling to replicate structures and behaviors found in the natural world. These digital tools enable designers to analyze, simulate, and optimize their bionic designs to ensure that they meet specific goals, such as increased strength, energy efficiency, or aesthetic appeal.

The dialectical materialist view of nature writes that ' nature is a pre-existing and historical nature, a nature that exists before human beings, and a nature generated during the formation of human society Human beings are the sons of nature, and people will feel comfortable and healthy in nature. In interior design, designers will give the ecological materials of natural elements such as stone, wood and bamboo, energy-saving lamps and lanterns that simulate sunlight and moonlight, and the placement of green plants, etc., through digital software. In the space, the final visual design effect is displayed in front of the customer.

3. Strengths and limitations of digital bionic design in sustainable design

3.1. Advantages of digital bionic design

Throughout the interior design process, it generally involves the owners, designers and builders. On the basis of fully understanding the spatial characteristics and individual needs, designers need to use digital tools such as Sketch Up and 3D Max to visualize the overall effect to the individual, and then guide the construction. But in today 's era of man and nature as a community of life, designers should add a factor-the social environment. Interior space is one of the subsets of the social environment. For the long-term survival and development of human beings, first of all, designers themselves need to have a sense of green environmental protection, choose ecological materials in building materials, and pay attention to the comfort and safety of individuals in the indoor environment. Secondly, interior design generally takes ten years as a cycle. Designers should take into account the impact of renovation after ten years, reduce the generation of construction waste during construction, and take into account the sustainable recycling of resources to protect the environment and resources [3]. Specifically, the integration of digital bionics into interior design can not only provide solutions to the above problems, but also have the following advantages :

- Improving energy efficiency Item

Digital bionic design uses computer tools to carry out digital commands for complex operations, so as to monitor and optimize the use of energy, water and other resource in real time, so as to avoid extravagance and waste during construction, so as to allocate resources more effectively, minimize waste and reduce the repetition of indoor space.

- Adaptability

Digital bionic design can be combined with data collection. After calculation, it can optimize the interior design layout according to the user 's hobbies, prejudices and habits. While enhancing user comfort, it can also adjust lighting, temperature and other parameters to optimize energy use as needed.

- Aesthetics

Digital bionic design can create a realistic visual enjoyment, and will achieve harmony in terms of image, color, structure and design of bionic objects, which is in line with people 's visual experience. Coupled with the operation of the computer, the dynamic interior created by digital bionics can enhance the overall user experience. Transformable space and dynamic elements also contribute to the emergence of creative and customizable interior design solutions.

- Naturality

Digital bionic design comes from nature. By simulating natural elements, it is placed in indoor space to improve happiness. Digital bionics can simulate natural lighting patterns, virtual green spaces, water features and other elements, and promote closer links between man and nature.

- Easily changeable

Digital bionic design can enhance the natural experience in indoor space. Users can be immersive and interact with the virtual environment. If the customer does not

meet the layout and the use of elements, it can be changed in time to avoid rework after completion and improve customer satisfaction [1].

3.2. Limitations of digital bionic design in interior spaces

- Data privacy and security

The integration of digital bionic design into interior space design can undoubtedly bring resource conservation and protect the environment for human survival. However, digital technology and indoor intelligent embodiment also need users ' personal information and preferences to cooperate with each other. The integration of sensors and data analysis has attracted attention to user privacy and data protection,which also has certain security risks for users ' personal privacy.

- Maintenance and longevity

The complexity of the system and intelligence created by digital technology cannot be solved by ordinary users, especially in the later maintenance. For example, intelligent furniture and traditional furniture, intelligent furniture needs regular maintenance and renewal to ensure the life of digital bionic system, while the later investment of traditional furniture is only simple cleaning and stable service life.

- High cost

The cost of consumption brought by the investment of digital bionic design to users is undoubtedly not low. The purchase and maintenance of internal functions of the system are a lot of income for users, and the potential change problem also proves this.

4. Case study - Sustainable design with digital biomimetic design

4.1. "Dolphin House" digital bionic training room

The "Dolphin House" (Figure 1) is used in the indoor space of a children's rehabilitation center, mainly for the rehabilitation training of children with autism and Asperger's syndrome; attention deficit hyperactivity disorder (ADHD); and speech and language delay (SLD).

The core technology of "Dolphin House" is the AR body interactive system, through the body Kinect recognition portrait technology to let the children be in the scene, combined with the system prompts or self-selected walking, jumping, rotating and other sports training, to achieve the relief of muscle tension, enhance muscle strength, enhance the balance of the coordination of the purpose.AR interactive digital bionic training system is Comprehensive dolphins and other human and animal in different physiological states issued by the human body, especially the central nervous system has a co-training and promote the function of the acoustic signals, through the dolphin bionics effective rate conversion technology, combined with multimedia digital projection, digital modulation of the light composed of visual, auditory, tactile and other multi-sensory perceptual system, supplemented by modern design concepts of visual, auditory and other multi-sensory spatial structure, so that the trainee The trainees can be "immersed" in the environment to achieve the effects of tranquility, comfort, adjustment, integration and overall state enhancement.

The "Dolphin House" digital release training room shows dolphins and other creatures as well as bionic-shaped equipment to pediatric patients through technology, eliminating the need to move real animals into the indoor space, reducing unnecessary harm to the animals, and promoting social and environmental protection, while also helping children to address mental illnesses.

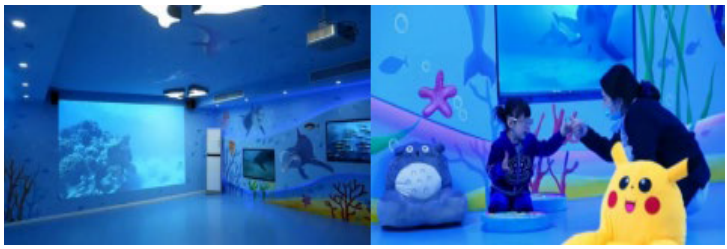

Figure 1. "Dolphin House" digital bionic training room.

4.2. Simulation of electronic fireplace

In today's home space, interior decorations bear not only aesthetics but also functionality. Simulated electronic fireplace can not only decorate the space to bring natural vitality, but also can be used as a heater to warm the space. Traditional fireplaces (Figure 2) are prone to odor and smoke, and even have a risk factor, which will cause some harm to the environment. Simulation of the electronic fireplace through virtual technology, virtual surreal flickering flames and three-dimensional simulation of wood carbon pile of the fireplace, it is the principle of heating in the fake fire fireplace on the basis of an increase in the heating components. Electric fireplace as a household electric heating appliances, with clean and sanitary, safe and reliable, convenient loading and unloading, combustion utilization rate is high. Compared to wood-burning, gas fireplaces in comparison, electric fireplaces will not have soot, strange odor, not only can save heating costs, but also can bring elegant ornamental effect.

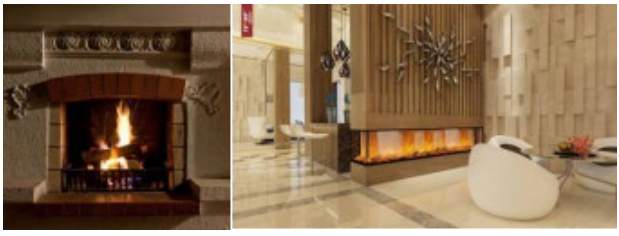

Figure 2. Simulation of electronic fireplace.

5. Digital Bionic Design Practice - An Example of Domestic Space

Taking ordinary home space as an example, starting from the three aspects of color, material and furniture, the elements are extracted and condensed by imitating the color and form in the natural ecology and applied to the home space, so that the occupants can also feel the sense of nature's oxygen indoors.

5.1. Bio-inspired color palette

The color of everything in the world comes from nature, color is also a space that can directly influence the user's feelings of visual expression, for example (Figure 3), extracted from the cloudy world of trees, mountains, the sky and the color of running water, forming a group of brown and green color scheme, brown and green tones as the main color scheme into the home space, brown to create a dignified living space, while the green can bring the feeling of freshness and naturalness, the combination of the two is the perfect combination of stability and vitality.

Figure 3. Color cards extracted from nature.

5.2. Selection of space materials

Materials are essential to the construction of a space, and it is essential for users to not only have mental enjoyment in the environment, but also to ensure their physical health. Choosing the right eco-friendly materials can also contribute to the space's ability to reduce waste materials in the future. Create a sustainable home space by using reclaimed wood, bamboo or recycled glass that mimics natural textures and patterns.

Figure 4. Recycled wood, bamboo and recycled glass.

5.3. Bionic Furniture

Furniture is the blood and flesh in space, and it is also the link between people and space. Furniture that imitates the form and flexibility of natural elements can add more functionality to the space and make the space more complete. For example, snake-shaped sofas and flower-like tea tables and so on.

Figure 5. Serpentine Sofa and Flower Bloom Coffee Table.

5.4. Demonstration of effects with the help of digital technology tools

Based on the above three aspects of color, material and furniture bionic choice, is an essential factor in the creation of a natural atmosphere in the home space. First through midjourney using the keywords needed, (such as brown and green color scheme, snake sofa, recycled wood, natural forms and other keywords), roughly generate the desired space effect diagrams, the user through the program selection, the designer can be based on the user's program, coupled with the subsequent needs to build the model drawings and construction drawings, not only able to jump out of the common template for interior design, but also reduce the process of The user can not only get out of the common template of interior design, but also reduce the waste of resources in the process.

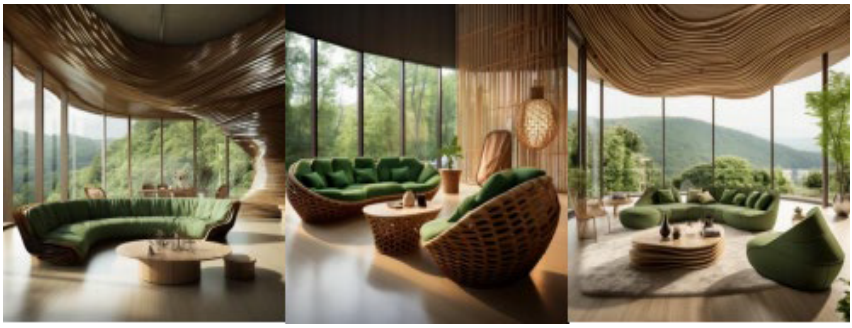

Figure 6. Effect generated using midjourney.

6. Conclusions

In conclusion, as society becomes increasingly aware of environmental sustainability and the preciousness of resources, the interior design industry must embrace innovative approaches like digital bionic design. This concept provides the platform to incorporate the potential for creation and nature to harmonize with each other, enhancing the user experience and enabling a significant reduction in resource consumption. By considering the principles and benefits associated with digital bionics, interior designers can pave the way for a more sustainable and eco-friendly future in their designs, but the limitations of digital bionics need to be addressed head-on to make digital bionic design a more technologically sound experience for the interior design industry.

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