Research on the Function of Digital Technology in Modern Ceramic Art Creation

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Abstract. This paper first analyzes the concept of digital technology and its development process, and then deeply analyzes the development of the combination of digital technology and artistic creation. Finally, it expounds the application and advantages of digital technology in modern ceramic art creation, including the application of renderings in ceramic art, the application of digital software in modern ceramic art decoration and the application of digital equipment in modern ceramic art modeling. Through the research and application of digital technology, it promotes the development and application of ceramic art in today's society, and makes ceramics with digital technology more attractive.

Keywords: digital technology, modern ceramics, art creation, role research, discussion

1 Introduction

With the rapid development and progress of information technology in China, a series of network technologies, such as digital technology, big data and Internet, have begun to appear in people's field of vision and are widely used in people's daily life and work. The wide application of digital technology has brought convenience to people's lives. Especially in modern ceramic art, it not only brings a brand-new creative concept to the creation of ceramic art, but also greatly influences and impacts the design of ceramic art. The application of digital technology in modern ceramic art creation can also broaden the creative thinking of ceramic designers. Due to the rapid development of network technology, traditional ceramic art creation can no longer meet people's needs, and ceramic art creation based on digital technology is bound to become the development trend in the field of ceramic art in the future.

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2 The concept of digital technology and its development process

2.1 The concept of digital technology

Digital technology is a kind of science and technology accompanied by electronic computer. It refers to the technology of converting all kinds of information, including pictures, texts, sounds and images, into binary digits "0" and "1" which can be recognized by electronic computer, and then calculating, processing, storing, transmitting, spreading and restoring them. Digital technology includes digital signal, computer science, communication technology and signal processing. Digital technology generally uses binary to process information in the application process, so all the two stable States of components can be used to represent binary. Digital technology has strong anti-interference ability, good confidentiality and versatility, and digital signals can be stored for a long time, so that a large number of valuable information resources can be preserved. Digital signal, mixed signal and analog signal are the three major signals that are transmitted, processed and processed in electronic technology, among which mixed signal refers to the signal that contains both analog signal and digital signal. This signal can be processed by digital signal processing technology, such as the image of a digital camera. Their sensors collect analog signals, but these signals are digitized by a digital signal processor and output digital image signals. Analog signal is a kind of continuous signal, and its magnitude changes continuously in time. It is expressed by the amplitude or voltage of the signal in electronic circuits. For example, traditional telephone audio is an analog signal, which will be transmitted to telephone lines. Digital signal is a kind of discrete signal, which can only take some specific values, and its processing space is determined by the smaller values. [1] It is represented by a series of binary digits (0 and 1) in electronic circuits. For example, all data processed in computers are digital signals, and digital signals are often used in high-speed data communication (such as network communication and mobile phone communication) and digital audio processing, which is the process of collecting, transmitting and processing information. Figure 1 shows the schematic diagram of the digital technology framework.

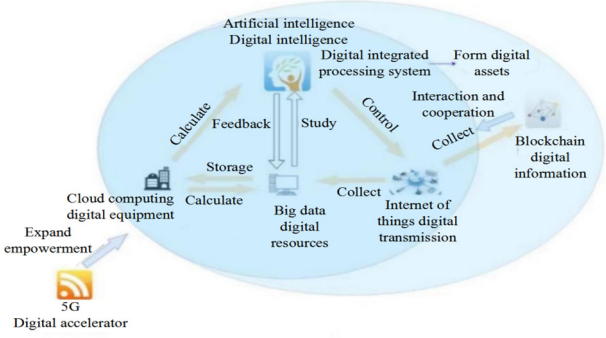

Fig. 1. A Schematic diagram of the digital technology framework

2.2 The development process of digital technology

The development of digital technology can be traced back to decades ago in the last century. In the 17th century, G.W. Leibniz invented the binary algorithm, which converted integers into 0 and 1 sequences. The birth of the binary algorithm laid the foundation for the later invention and application of computers. The birth of ENIAC, the first electron tube computer in the 1940s, enabled the machine to start digital operation, and the birth of this invention marked the beginning of digital technology. By the 1960s, with the continuous miniaturization of electronic components and the improvement of integration, the first integrated circuit was born, which greatly improved the production efficiency and cost benefit of digital circuits. The first microprocessor invented by Intel in 1971 marked that digital technology began to enter various electronic products from the computer field, and was widely used in various household appliances and consumer electronic products such as mobile phones and calculators. [2] The rise of digital signal processing technology in 1970s promoted the rapid development of digital technology, which made the acquisition, processing, transmission and storage of digital signals more accurate and efficient (Figure 2 is the basic process diagram of digital signal processing). From the 1990s to the present, with the rapid development and popularization of Internet technology and digital communication technology, digital technology has become one of the most important information industries in today's society, and various digital devices and technologies have emerged in people's lives and work. The popularization and application of internet technology in today's society has promoted the development of digital technology. However, due to the late start of China's economic and social construction compared with other fields, there is little research on related technologies in the field of digital technology. Although digital technology has been applied to ceramic art creation, there is little research on core technologies. Many ceramic creators still use traditional ceramic creation methods in ceramic creation, and few applications are made to digital technology. Digital technology has not yet achieved a major position in ceramic art creation, but with the continuous development of network technology, digital technology is constantly being improved, and its application in ceramic art creation will become an important research topic in the future development of ceramic field. [3]

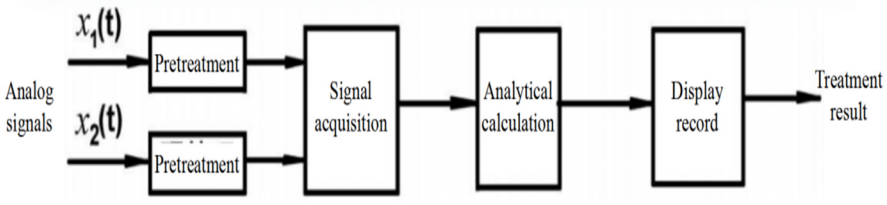

Fig. 2. Basic process diagram of digital signal processing

3 The application advantage of digital technology in the creation of modern ceramic art

3.1 Realize the customization of ceramic design and manufacture.

Digital technology plays an important role in the field of ceramic art creation, providing more solutions for the design and manufacture of ceramics, breaking the obsolescence of traditional ceramic design and manufacture, and realizing the customization of ceramic design and manufacture. Through digital technology, unique ceramic products can be customized according to customers' requirements and needs, and ceramic products have the charm of modern ceramic art. For example, the application of CAD software and the CAD software of digital technology provide the basis and conditions for the customization of ceramic design and manufacturing. Using CAD software, designers can create 3D models on computers, which can be directly exported to ceramic manufacturing machines, and can complete tasks by themselves according to the instructions in the computer during the manufacturing process, thus reducing the utilization of human resources in the ceramic manufacturing process and improving the efficiency of ceramic production. In addition to the application of CAD software technology, 3D printing technology also provides a brand-new idea for the formulation of ceramic manufacturing. The creator can make a customized ceramic product based on CAD model through 3D printing technology, including various complex ceramic shapes and patterns. [4] The application of 3D printing technology in ceramic art creation not only greatly improves the production efficiency of ceramics, but also can make fine adjustments and modifications according to the needs of customers. The application of CNC machine tools in ceramic creation has also made an important contribution to the customization of ceramics, because CNC technology can process ceramics and other materials and equipment according to pre-designed CAD models and programs, and can quickly make any shapes and patterns needed in the production process of ceramic products, thus realizing the customization of ceramic products. Digital technology provides a variety of modern scientific and technological production methods for modern ceramic production, making the produced ceramics more modern. Digital technology can also ensure the accuracy and stability of ceramic works, simplify the ceramic production process, and use computer visualization to predict the changes of important parameters, such as ceramic temperature and furnace pressure, so as to make the produced ceramic works more accurate. [5]

3.2 Realize the virtualization of ceramic modeling

Digital technology contains a lot of computer technology and computer software, such as three-dimensional modeling technology and computer-aided technology, so it plays an important role in the application of ceramic art creation. 3DMAX is a three-dimensional modeling software, and its functionality is similar to Maya. According to the survey, the traditional ceramic modeling method is mainly polygon, which also determines that the traditional ceramic modeling method can not accurately control the surface radian of ceramic model to a certain extent. The application of 3DMAX in ceramic

creation solves this problem. The modeling methods of 3DMAX include patch modeling, polygon modeling and NURBS modeling, in which NURBS modeling method is generally completed by plug-ins to make curved objects, which can ensure the accuracy of surface parameters in the process of ceramic creation and provide corresponding modules for ceramic rendering. NURBS can simulate the relatively complex ceramic curve shape through fewer points, which greatly improves the manufacturing accuracy of ceramic modeling. In addition, NURBS can obtain the parameter values and parameter types of various angles of ceramic modeling, so that the manufactured virtual ceramic modeling can have certain surface shape and curve parameters with the real ceramic modeling. 3DMAX can generate high-quality 3D rendered images (Figure 3 shows the 3D model of curved surface constructed by NURBS modeling). With 3DMAX technology, accurate 3D models of ceramic objects can be created, and artistic adjustments and parameter adjustments can be made to them. [6] Finally, a rendered image with lubricating aesthetic feeling can be produced, which provides visual representation for product demonstration and prototyping, and realizes the virtualization of ceramic modeling. Virtual modeling of ceramics can be obtained at the early stage of ceramic creation by using virtual technology, and the modeling has strong authenticity. If customers have different needs or requirements for ceramic modeling design, the creator can directly adjust and modify the ceramic modeling on the renderings, which simplifies the time and process of ceramic modeling modification. [7]

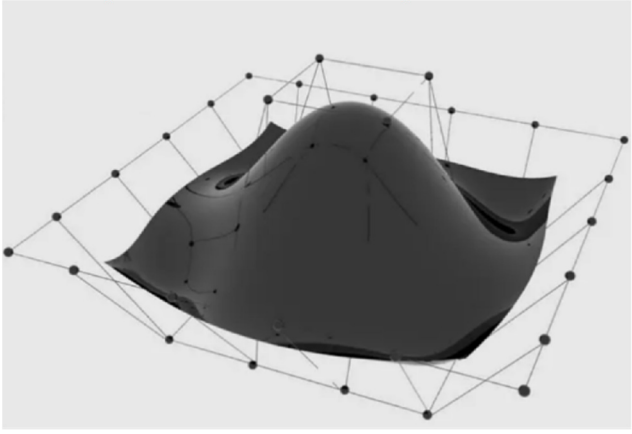

Fig. 3. 3D model of NURBS surface

4 The concrete application analysis of digital technology in the creation of modern ceramic art

4.1 The application of high-pressure CNC water jet and 3D printing technology in modern ceramic art modeling design

High-pressure numerical control water jet and 3D printing technology have been widely used in the design of ceramic modeling in recent years. High-pressure CNC water jet is a common cutting tool, which can cut various shapes of materials into required shapes

in a non-contact way. Wu Jiangzhong's "icing on the cake carving cylinder" was applied to the high-pressure CNC water jet in the process of pattern carving and creation. Figure 4 shows the high-pressure CNC water jet drawing ceramic patterns, and Figure 5 shows Wu Jiangzhong's "icing on the cake carving cylinder". From Figure 5, it can be seen that the ceramic pattern modeling is complex, the creativity is unique, the overall ceramic looks full of national charm, and the application of modern ceramic creation techniques can be seen in the modeling design, which is impossible for traditional ceramic modeling design. High-pressure CNC water jet adopts the cutting method of high-pressure water flow and abrasive, which makes the cutting precision higher, the cutting surface smoother, and will not produce too many scratches and burrs. It can also meet the design requirements of various complex shapes in ceramic modeling design, which is one of the reasons why modern ceramic modeling looks more exquisite. [8] High-pressure CNC water jet has a wide range of cutting materials, wide flexibility and applicability, and its application in ceramic modeling design has greatly improved the quality and production efficiency of ceramic products. High-pressure CNC water jet adopts the cutting method of high-pressure water flow and abrasive, which has higher cutting accuracy and smoother cutting surface, and will not produce too many burrs and scratches. For example, in the production of Ru Kiln ceramics in Jingdezhen, CN water jet technology has realized complex ceramic design and patterns, and met the design requirements of various complex shapes in ceramic modeling design. In addition, 3D digital printing technology has also been widely used in ceramic modeling design. Using 3D digital printing technology, designers can transform ideas in their minds into objects. The traditional ceramic modeling process is complicated, and it takes many times of molding and firing to form the ceramic object. This traditional ceramic modeling is not only time-consuming and laborious, but also has various inevitable factors, which will affect the design of ceramic modeling. In the 3D digital printing technology, designers use AutoCAD, SolidWorks and other software to design according to the ceramic modeling required by customers, and then import the designed model into a 3D printer to print out the actual ceramic model. When using the 3D digital printing technology, we must pay attention to selecting appropriate parameters and materials, so as to avoid the phenomenon of repairing the ceramic after molding. 3D digital printing technology can create complex shapes and internal structures, such as complex geometric patterns and curved shapes, vases and bowls with hollow structures. Figure 6 shows a ceramic model made by 3D digital printing technology. [9]

Fig. 4. High-pressure CNC water jet drawing ceramic patterns.

Fig. 5. Wu Jiangzhong "Icing on the cake carving cylinder"

Fig. 6. Ceramic model made by 3D digital printing technology

4.2 Application analysis of digital technology in ceramic processing

The application of digital technology in ceramic processing plays an important role, which can provide more environmentally friendly, efficient and precise processing methods for ceramic designers and creators, thus making the field of ceramic processing technology develop and progress. The traditional ceramic forming methods are mainly hand-drawing and slow-turning, which consumes too much time and produces a lot of residual materials in the processing of ceramics. On the contrary, the laser scanning molding technology using digital technology can save the molding time of ceramics and effectively reduce the waste produced in the ceramic production process. Using digital technology can also realize more refined and natural ceramic products. In addi-

tion, the application of digital virtual molding technology in modern ceramic art creation can form a ceramic virtual model with the help of computer-aided tools, which breaks the limitation of ceramic display time and space, and customers can watch the virtual ceramic modeling. [10] If customers have different needs for ceramic modeling, they can tell designers about their needs. Designers can directly modify and adjust the renderings of ceramic factor works through computer-aided tools. By using the computer-aided function of digital technology, the technical content of ceramic processing is improved, and the creation time of ceramic art is greatly shortened, which promotes the integration and development of ceramic creation and modern science and technology.

5 Conclusion

In recent years, with the continuous development and maturity of Internet technology, digital technology based on computer network technology has become more and more mature. Due to the increasing demand for ceramic modeling, traditional ceramic modeling design methods can no longer meet people's demand for ceramics. The application of digital technology in modern ceramic art creation can not only create more beautiful and complex ceramic works, but also improve the production efficiency of ceramic products. Digital technology plays an important role in the development of modern ceramic art.

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