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Research Article

Design and Research of Digital Media Art Display Based on Virtual Reality and Augmented Reality

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Purpose. To serve as a reference for the evolution of the online digital art display industry, as well as to conduct further studies in the field of digital entertainment art in the showcase design business in order to give solid evidentiary assurances, this article presents a virtual reality which is a technology reality-based digital media art exhibition design with the goal of examining the new construction trend of online media art with in context of existing period and the use of sophisticated technology. *Implications*. This paper enriches the theory, skills, and means of digital cultural communication, opens up a broader space and vision for digital media art communication, enriches the communication skills and means of digital media, and provides flexible and efficient ideas and methods for the dissemination of digital media art, which is of practical significance for realizing the active and effective dissemination of digital media art. *Methodology*. The method of this paper is to use the digital three-dimensional panorama technology of virtual reality to explore the digital media art display and digital media art expression form of augmented reality. The role of these methods is to solve the problem of spatial positioning of virtual 3D objects in real scenes and to judge the final detection model, the problem of model making to satisfy AR computing power, and the problem of scene interaction. *Research Findings*. Through a mix of digital content artwork and virtual reality and augmented reality technologies, this research examines the impact of AR and VR in digital art and analyzes and summarizes a series of design strategies for digital media art display projects. The results show that people are 33.6% more satisfied with VR and AR displays than traditional displays.

1. Introduction

The advance of technology has made a significant change in people's lives, as well as a new level of information distribution and media trends. When technology and online content art are merged, virtual reality technology becomes a medium of art transmission and a form of expression, as well as a media design with an interactive aspect. Digital media art is an art form that enables participants to complete this interactive experience through virtual reality technology.

This article examines and categorizes the current state of digital entertainment art and exhibition design in the United States and internationally, as well as offering some suggestions for future development and use of local digital entertainment art in notch display. This is encouraging news for the study of China's digital entertainment art business. The growth of digital media art will reach a new stage with the use of virtual reality technology as a carrier and will be more closely tied to people's lives, which will definitely has a strong push for the development of genuine art. Multimedia art seems to be in the process of continual development and change as a result of a turning point in the history of human creative development. It always bursts through conventional art's restrictions and swiftly extends the art kingdom's area, yet it has grown omnipotent in many respects. The consequences of this study are significant for redefining and controlling the idea of digital publishing art. This article investigates the many types of digital new media and sheds light on the link between contemporary art's digitalization and digital entertainment art.

This paper enables digital media to innovate and develop display art from different perspectives, jointly improve the level of China's display industry, make the application of art display design innovative and develop, and make the specific practice research of art display design rise to comprehensive theoretical research. The growth of digital media art will, in the end, encourage the business applications of the display sector and other industries. This article discusses the influence and value of digital media art on cultural communication from the perspectives of communication and art. At the same time, it analyzes the design language, aesthetic characteristics, and manifestations of culture in digital media art from the perspectives of art, aesthetic psychology, and cognitive psychology. To summarize, the paradigmatic induction, characteristic induction, and communication impact of the change of digital media art production are the primary innovations of this study.

2. Related Work

Digital media art is an emerging art form. Virtual reality and augmented reality technology are emerging technologies, and the combination of the two can have unexpected effects. In the realm of laparoscopic surgery, Bastug investigated the use of virtual reality technology. He tested the degree of surgical coordination of the test doctors using virtual reality technology and compared the performance of different doctors. His experimental results show that the assessment of laparoscopic skills is based on parameters measured by the simulator [1]. Kihonge describes a synthesis process for designing 4C space mechanisms in a virtual environment, and he develops software that also allows multiple users to network and share the designed mechanisms. Compared to using a traditional human-machine interface (HCI), virtual reality allows users to view and interact with digital models in a more intuitive way [2]. Freeman researches the use of virtual reality in the management of depression, schizophrenia, substance abuse, and eating disorders. Using virtual reality and computer-generated interactive environments, he repeatedly experiences the problem situations of people with different mental illnesses and learns how to overcome them through evidence-based psychotherapy. His research methods have important implications for mental health treatment [3]. Sucipto creates learning material using an immersive boxing movement guide. The approach is preferable to old manual methods since the learning medium is an Android-based animation video visualization that provides direction for basic boxing moves. The 3D AR boxing action training application can effectively help boxers to memorize actions during practice [4]. Ayu's research is aimed at improving primary school students' knowledge of artistic literacy, and he adopts the ADDIE-type R&D method to carry out the experimental steps of analysis, design, development, implementation, and evaluation. He surveyed users online to establish the usefulness of this learning medium, and he came to conclusion that enhanced reality-based applied media may successfully increase students' creative literacy [5]. Moreno proposed that the use of new media by human beings can create a barrier-free communication space, where the role of the artist is diluted and the public becomes the main user of the art space. He also proposed that the only effective way to protect art is to achieve permanent preservation of art through digital technology [6].

3. Virtual Reality and Augmented Reality

3.1. Digital 3D Panoramic Technology of Virtual Reality. It is vital to have a theoretical understanding of the camera imaging computational domain and the consequent image transformation model before exploring panorama creation strategies. It is the basis for generating panoramic images. In short, the image transformation model is intrinsically related to the camera imaging geometry, and they are different external representations of the same type of concept. The camera imaging architecture may be used to determine the new methodology between the collected pictures. Similarly, the geometric posture of the sensor during imaging may be reversibly deduced using the information from the model developed between pictures. They serve as the mathematical foundation for picture registration and stitching. Prior to picture stitching, a suitable image conversion relationship model must be chosen based on the geometric connection of camera imaging. The ability to master the sensor imaging geometric is also a prerequisite for picture stitching. As a result, before discussing panorama production technology, a theory of the transformation link between camera scanning geometry and picture is presented [7, 8].

A simplified camera imaging model usually adopts the principle of pinhole imaging. It is also known as perspective projection. This section will simply deduce the complete form of the perspective projection formula, which describes the mapping of three-dimensional space points to two-dimensional plane pixels, as well as introduce the world Cartesian coordinates, camera coordinate system, and image plane coordinate that are all involved.

The universe everlastingly and the camera coordinate system are shown schematically in Figure 1. In photogrammetry, the impact of intersystem is also known as the surface photogrammetry coordinate system, and it is represented by (X_w, Y_w, Z_w). The origin is located at a certain point on the ground of the shooting scene, the X axis is consistent with the horizontal direction of the heading, the Y axis is opposite to the X axis, the Z axis is vertically upward, and the X, Y, and Z axes make up a right-hand continental coordinate system. The reasonable adjustment system is represented as (X_c, Y_c, Z_c), with the origin being the optical point of the camera, the optical axis being the Z_c axis, and indeed the plane defined by the X_c and Y_c axes being parallel to the field of view. The camera is positioned in a certain position in the subjective three-dimensional environment. The world synchronize system and the photo coordinate system do not always agree, and there are translation and rotation relationships between them. A 44 matrix can be used to illustrate these connections in secondary coordinates. Formula (1) depicts the link here between camera coordinate as well as

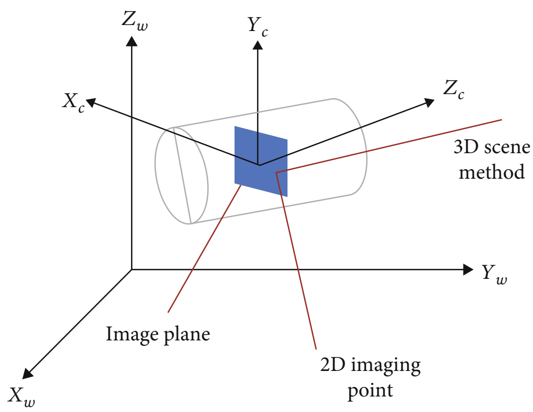


Figure 1: The world data processing systems and the camera coordinate system are two different systems.

the world coordinates:

$$\begin{pmatrix} X_c \\ Y_c \\ Z_c \\ 1 \end{pmatrix} = \begin{pmatrix} R & T \\ 0 & 1 \end{pmatrix} \begin{pmatrix} X_w \\ Y_w \\ Z_w \\ 1 \end{pmatrix} = M \begin{pmatrix} X_w \\ Y_w \\ Z_w \\ 1 \end{pmatrix}. \quad (1)$$

The subscript c denotes the camera coordinate system, the colon w denotes the world reference frame, T denotes a 31 translation vector, R denotes a 33 rotation tensor, and 0 denotes a 13 element vector with all 0 elements.

The image plane coordinates indicate the projection locations of the three-dimensional scene points on the imaging plane, and the image plane coordinates describe the connection between the camera coordinate system and the image plane coordinate system, as shown in Figure 2. The image plane coordinate system takes the optical axis of the camera and the vertical foot of the image plane (represented by point P in the figure) as the origin, and the X and Y axes are parallel to the X and Y axes of the camera coordinate system, respectively. The focal length f is the distance between the camera coordinate system's optical center O and the picture plane. The perspective projection formula of equation can be used to express the relationship between the camera coordinate system and the image plane coordinate system in homogeneous coordinates (2).

$$Z_c \begin{pmatrix} X_c \\ Y_c \\ 1 \end{pmatrix} = \begin{pmatrix} f & 0 & 0 \\ 0 & f & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} X_c \\ Y_c \\ Z_c \\ 1 \end{pmatrix}. \quad (2)$$

In order to facilitate computer processing, it is necessary to convert the image plane coordinates in units of physical dimensions to a representation in units of pixels. The conversion of the two representations can be represented by equation (3), where (u_0, v_0) are the coordinates of point O in the coordinate system $o-uv$ and d_x and d_y represent the width and height of each pixel (in units of physical size).

It is important to transform the picture plane coordinates in physical size to representations in pixels in order to enable computer processing. Equation can be used to express the transition of the two images (3). The parameters of 0° in the coordinate system $o-uv$ are (u_0, v_0), and the length and width of each pixel are d_x, d_y (in units of physical size).

$$\begin{pmatrix} u \\ v \\ 1 \end{pmatrix} = \begin{pmatrix} \frac{1}{d_x} & 0 & u_0 \\ 0 & \frac{1}{d_y} & v_0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} X_c \\ Y_c \\ 1 \end{pmatrix}. \quad (3)$$

The partnership here between plane coordinate and the world coordinates can be obtained by combining the three equations above, which is shown in

$$Z_c \begin{pmatrix} X_c \\ Y_c \\ 1 \end{pmatrix} = \begin{pmatrix} \frac{1}{d_x} & 0 & u_0 \\ 0 & \frac{1}{d_y} & v_0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} f & 0 & 0 \\ 0 & f & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} R & T \\ 0 & 1 \end{pmatrix} \begin{pmatrix} X_w \\ Y_w \\ Z_w \\ 1 \end{pmatrix} = P \begin{pmatrix} X_w \\ Y_w \\ Z_w \\ 1 \end{pmatrix}. \quad (4)$$

The matrix P is referred to as the projection matrix in the formula. Out-of-camera parameters are the vectors T and R that are determined by the camera's position and orientation in relation to the global coordinate system. Assume that a pixel $p(x, y)$ on the final photo is transformed to point $p' = (x', y')$ using an image enhancement model M, and the relationship between them is indicated in

$$\begin{pmatrix} x' \\ y' \\ 1 \end{pmatrix} = M \begin{pmatrix} X \\ Y \\ 1 \end{pmatrix} = \begin{pmatrix} R & T \\ 0 & 1 \end{pmatrix} \begin{pmatrix} X \\ Y \\ 1 \end{pmatrix}. \quad (5)$$

Translation, rotation, stiff adjustment, similarity modification, affine transformation, and perspective transformation are some of the most often used image transformation models. Rigid transformations do not resize objects, similarity transformations do not change the angle between lines, and affine transformations maintain the parallel relationship between parallel lines. The display platform for digital material is split into a multiple

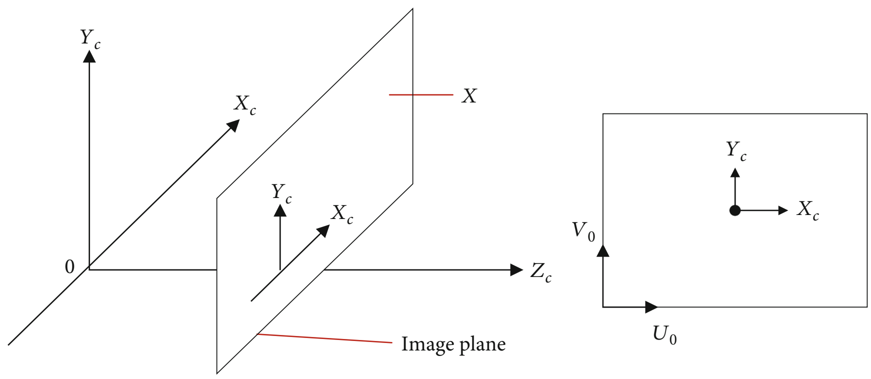


FIGURE 2: The camera coordination system and the picture plane coordinate system are depicted in this graphic.

matrix with a frequency of $M \times N$ in real display. Obviously, the pixel (i, j) coordinates on the platform may be represented as $(0 \leq i \leq M-1, 0 \leq j \leq N-1)$. The exhibit's height on the pixel may thus be represented as h_{ij}. The formula shows how an image of height h_{ij} may be reproduced on the pixel (i, j).

$$h_{ij} = k \times \frac{I_{\max} - I_{ij}}{I_{ij}}. \tag{6}$$

When I_{ij} is the illumination at pixel (i, j) and k denotes a user-defined constant for adjusting the height value, the height I_{ij} should be limited to the range $I_{\min} \leq I_{ij} \leq I_{\max}$, where $I_{\min}$ and $I_{\max}$ are the minimum and maximum highlight values that can be displayed in the platform. When there are no shows on the platforms, the size input image will be the highest and almost equal to the starting brightness I_0. For ease of understanding, the formula can be rewritten as formula (7) by substituting I_0 for $I_{\max}$.

$$h_{ij} \approx k \times \frac{I_o - I_{ij}}{I_{ij}}. \tag{7}$$

The direction vector at pixel (i, j) is denoted as $d(i, j)$. Its corresponding weight can be calculated based on its occupancy, each small arc relative to the area cleared around the entire arc. Supposing the weight value of directions $d(i, j)$ is P_m, where m is the index of the direction and n is the number of discrete directions discussed above. Then, P_m should satisfy formula (8).

$d(i, j)$ stands for the space vector at pixel (i, j). Its weight may be estimated by comparing the surface cleared around the total arc to the occupancy of each little arc. Assume that the value of direction $d(i, j)$ is P_m, where m is the direction's index and n is the total number of separate directions stated before. Then, P_m should be able to meet

$$\sum_{m=1}^{n} P_m = 1. \tag{8}$$

Following the research, n is set to 4 in the actual system implementation, and the strength value P_m can be calculated using formula (9), where $d_m(i, j)$ denotes the direction vector $d(i, j)$ subdirection vector of m_{th}.

$$P_m = \frac{|d_m(i, j)|}{\sum_{(i,j)\in m} |d_m(i, j)|}. \tag{9}$$

The altitude of the shows varies depending on which direction they are distributed. Assume the exhibit has a density of p, a mass of M, a size alter $\Delta h(i, j)$ in the m_{th} direction, a coverage area in the show bottom ΔS, and the size change does not take the path field $\Delta h1(i, j)$ into account. As a result, the formula may be used to compute the exhibit mass M.

$$M = \sum_{(i,j)\in m} p \times \Delta S \times \Delta h(i, j). \tag{10}$$

3.2. Augmented Reality Digital Media Art Display. A major feature of the AR system is to provide real-time spatial poses for virtual objects that need to be superimposed. Combined with real scenes and human-computer interaction, it can interact and perceive objects in virtual scenes [9]. This section mainly solves the following problems: the spatial positioning of virtual 3D objects in the real scene and the problem of judging the final detection model, the problem of model making to meet the AR computing power, and the problem of scene interaction. The quality of feature detection directly affects the accuracy of subsequent positioning and construction, which mainly includes global and local features. Global functions are functions that interpret the image from the whole image, such as image texture and image color. The local feature is a point or area in the image that is different from the surrounding area. The feature point is the regional expression of the image and can express the local characteristics of the image. After feature points and their feature descriptors are extracted, features need to be compared to analyze the similarity between images and the relationship between feature points [10]. The connection here between feature points is usually determined using the registration technique, which includes Euclidean, Hamming, and Mahalanobis distances. Figure 3 depicts a schematic design of nearby picture feature matching.

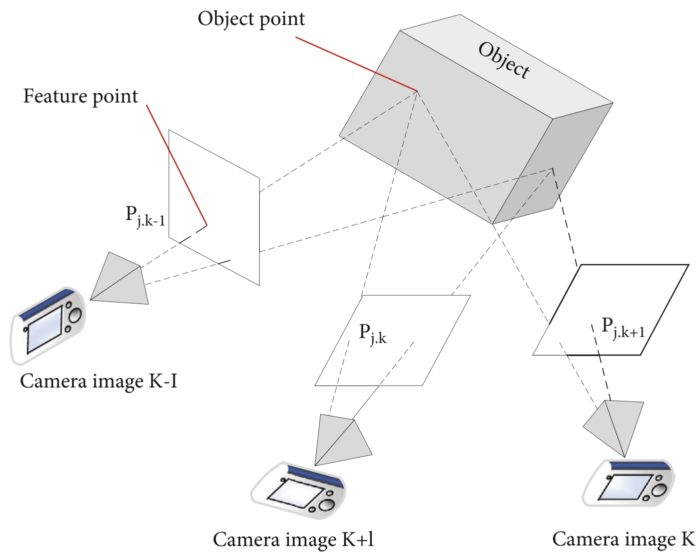


Figure 3: Adjacent image feature matching.

For two arbitrary images, two sets of feature descriptors D_1 and D_2 are obtained in the previous feature extraction part:

$$\begin{aligned} D_1 &= (x_0, x_1 \cdots x_n), \\ D_2 &= (y_0, y_1 \cdots y_n). \end{aligned} \tag{11}$$

The Euclidean distance calculates the actual distance between two points in the n-dimensional space, as in

$$d(D_1, D_2) = \sqrt{\sum_{i=1}^{N} (x_i - y_i)^2}. \tag{12}$$

Hamming distance calculates the number of different corresponding elements between two vectors with the same dimension, such as

$$d(D_1, D_2) = \sum_{i=1}^{N} (x_i + y_i). \tag{13}$$

In Mahalanobis distance, the variance is normalized so that the distance has nothing to do with the scale dimension, and the distance between the covariances between different vectors is calculated. It is mainly used in probability statistics and is calculated by

$$d(D_1, D_2) = \sqrt{(D_1 - D_2)^T S^{-1} (D_1 - D_2)}. \tag{14}$$

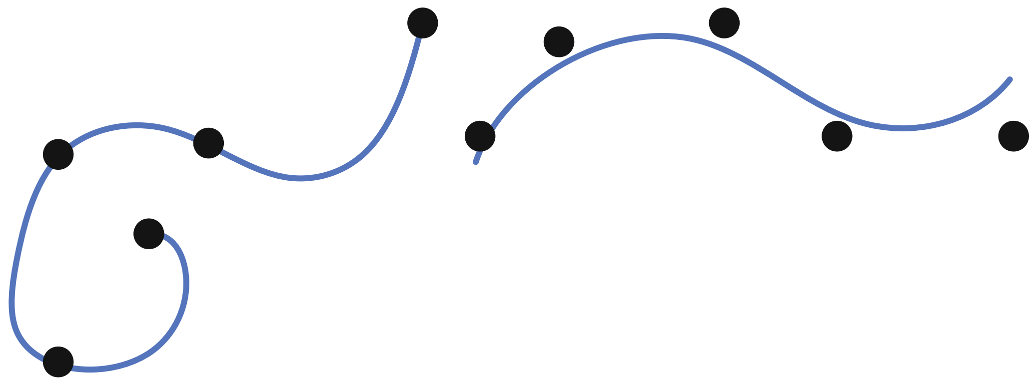
In monocular vision-based methods, brute force matching is usually adopted. That is, assuming two images image 1 and image 2, for a feature descriptor in any one of them, it is necessary to calculate the distance from all descriptors of the other one; finally, the feature descriptor with the smallest distance is selected as the registration object so that the optimal matching result can be obtained. According to whether all control points are on the generated spline, the spline can be divided into interpolation spline and approximate spline [11]. As shown in Figure 4(a), the interpolation spline curve passes through each of its control points, and this spline curve is suitable for the situation where the coordinate information of the data points is relatively accurate. Therefore, such splines are mainly used for digital drawing and animation path specification. Common interpolation splines are natural cubic splines, Hermite splines, and cardinal splines. As shown in Figure 4(b), the fitted spline curve does not pass through all or part of the control points, because this spline curve is suitable for the case where there are many data points and the coordinate information of the data points is noisy, so the approximate splines commonly used to create the surface of objects are B-spline (B-spline) curves and Bezier splines.

By adapting a given set of predetermined points to a piecewise second-order polynomial curve, the spline method can generate a sparse representation cubic polynomial curve and thereafter obtain a cubic spline curve over each command center [12]. The linear interpolation fitting of these chokepoints is displayed in Figure 5 if there are $n+1$ security measures where dimensions are $P_k = (X_k, Y_k, Z_k)$, where $k = 0, 1, \cdots, n$.

The system of equation (15) describes the parametric cubic polynomial fitting each pair of control points (as the parameter u varies from 0 to 1 (the point represented by $x(u)$, $y(u)$, and $z(u)$) will change from the earlier control point to the later control point along the spline):

$$\begin{aligned} x(u) &= a_x u^3 + b_x u^2 + c_x u + d_x, \\ y(u) &= a_y u^3 + b_y u^2 + c_y u + d_y, \\ z(u) &= a_z u^3 + b_z u^2 + c_z u + d_z. \end{aligned} \tag{15}$$

For each equation in the equation set (15), the values of the four coefficients a, b, c, and d need to be determined, and



(a) Interpolating spline

(b) Approximate spline

FIGURE 4: Classification of splines.

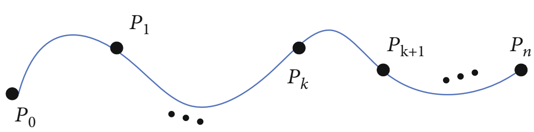


FIGURE 5: Piecewise continuous cubic spline interpolation.

$n + 1$ control points generate a total of n curve segments; the coefficients for each curve segment need to be decided by the user in advance. All coefficient values can be obtained by setting sufficient boundary conditions at the intersection of two spline segments [13].

3.3. Digital Media Art Expressions. Digital art graphics have the characteristics of artistic abstraction, which are produced by the expression of human subjective comfort and desire. It is not only a cultural phenomenon but also an important way for people to achieve emotional communication. The main and fundamental feature that distinguishes art from other idealisms is its aesthetic value. Art comes from life, but it is higher than life. It is closely related to social harmony and human activities [14]. Art and beauty exist in human activities, and the most important thing is to study and appreciate.

Aesthetics is the harmony and unity of the entirety of color, composition, and texture in the image content and the human spiritual world. People show the science of nature and self-cognition through various artistic behaviors such as photography, painting, and design creation. The well-known aesthetic metric formula is shown in

$$\mathrm{AM} = \frac{O_o}{O_c}, \tag{16}$$

where O_o represents the internal order of things and O_c represents the internal complexity of things. The measure of beauty is related to inner order and complexity. For example, for polygonal graphics, O_o includes intersection and symmetry, and O_c represents the number of edges. This formula is regarded as the initial model of aesthetic digitization.

This paper proposes a new aesthetic formula on the bases of traditional aesthetics and concretizes the calculation of variables in it [15]. The "beauty" of a picture is inverse to PC complex and proportionate to IC complexity, according to this article, which splits image complex into PC and IC complexity. The following is the new aesthetic formula:

$$M = \frac{\mathrm{IC}}{\mathrm{PC}}. \tag{17}$$

Images with high inherent repeatability, like digital art graphics, are rich in content and fine in structure, so they have a high IC value. However, people's understanding of these complex contents is relatively simple, that is, the PC value is low, so they feel relaxed and pleasant to appreciate, and they will feel "beautiful." IC is calculated by dividing the JPEG image compression error rate by the compression rate, while PC is calculated by dividing the fractal wavelet transform rate by the compression rate.

Color reflects the overall characteristics of the image. In this paper, general methods such as color histogram, color moment, and color correlation diagram are usually used to describe the image, and high-level statistical methods such as color distribution and chromaticity can also be used. The HSV color model has two distinct advantages: the luma and chrominance components are independent of each other and are incoherent with hue information. Hue and chroma components are highly correlated with the visual thinking of human perception of color [16]. Alternative color space theories are different representations of the physical amount of color, and mathematical formulae may be used to map them to each other. The *RGB* space's three components all have values of 0255. The three components' values are normalized in this study, while maximal and min are the highest and minimum numbers of B, G, and R, accordingly. The S

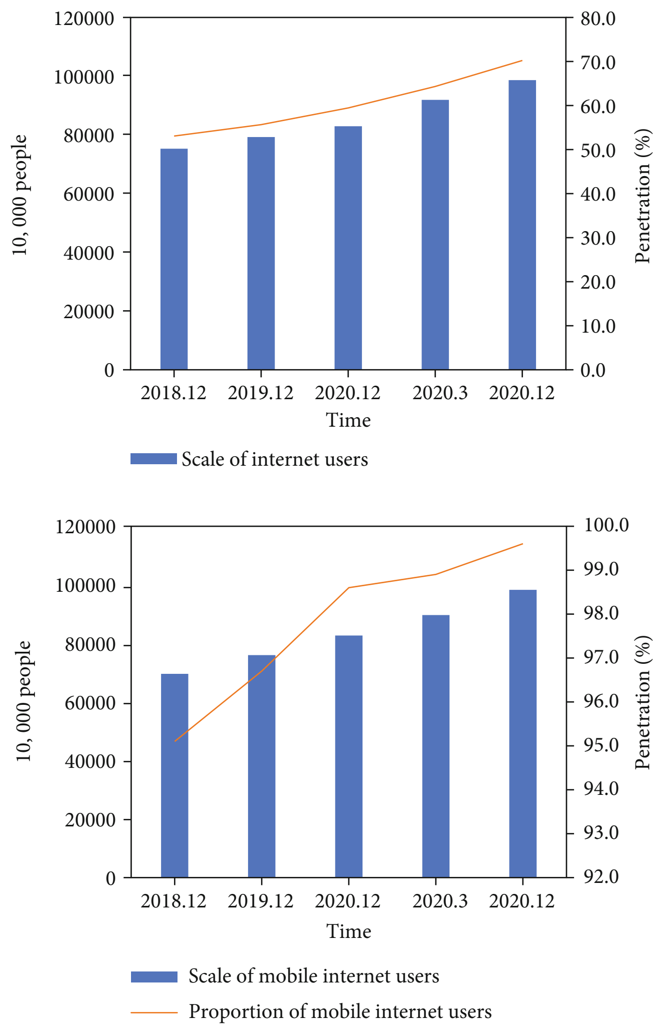


FIGURE 6: Changes in the scale and penetration rate of Chinese netizens.

and V values are calculated as follows:

$$H = \begin{cases} \dfrac{G - B}{\max - \min} \times 60^{\circ}, \\ \left(2 + \dfrac{B - R}{\max - \min}\right) \times 60^{\circ}, \\ \left(4 + \dfrac{R - G}{\max - \min}\right) \times 60^{\circ}, \end{cases}$$
$$S = \max - \min,$$
$$V = \max. \quad (18)$$

4. Digital Media Art Display Design and Analysis

4.1. Virtual Reality Technology and Digital Media Art. Virtual reality technology allows participants to interact and engage with appliances, which is a computational system, in a virtual environment. It makes use of a computer to create a virtual environment that is a dynamic muitistereoscopic view that interacts with the phone based on the user's physical actions. It can create a simulation model virtual reality environment, allowing users to fully immerse themselves in the simulated space [17].

As a design method of digital media art, immersive scene design is diffused in various fields of the latter. As a result, in order to discuss the categorization of immersed scene design in digital media art, the numerous application domains and classification of online media art must first be sorted out. According to the classification of media products, digital media art includes four professional application areas: time media design, interactive product design, visual communication design, and interactive entertainment design. Figure 6 depicts the current size and coverage of Chinese Internet users.

It can be seen that the way people surf the Internet has changed. Mobile Internet access has brought a devastating impact on the PC side. Mobile Internet access is gradually replacing the computer Internet access, which has basically achieved comprehensive coverage. The vigorous development of Internet technology and the continuous innovation and change have gradually shifted the way of people's

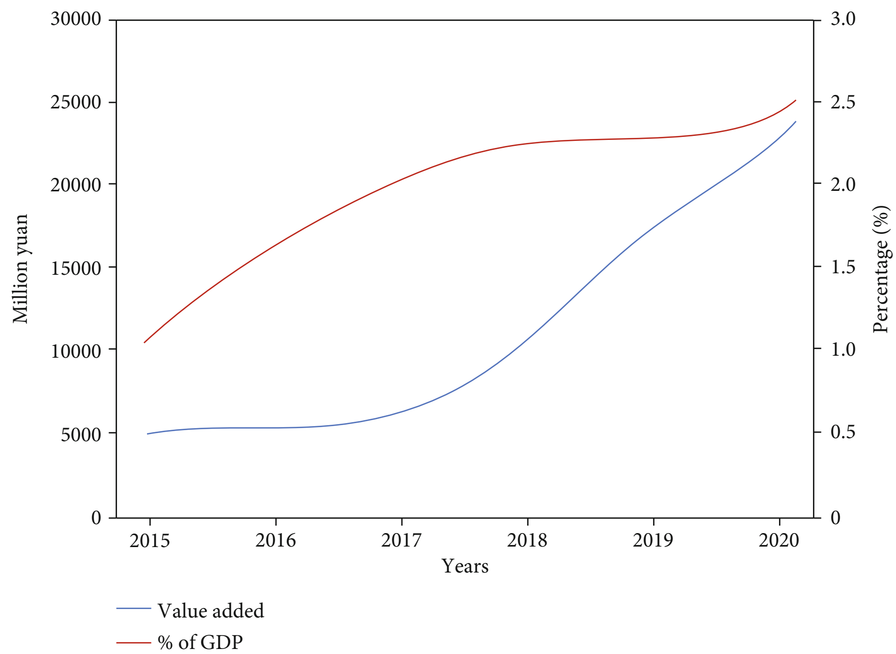


Figure 7: Added value of Chinese culture-related industries.

information exchange from the computer side to the mobile side, and people have entered the self-media era unknowingly. The self-media era requires digital media art, which represents a new momentum for the continuous expansion of information media into the field of art and culture [18]. With the characteristics of interactivity, cross-time and space and integration, digital media art is widely and deeply applied to film and television advertising, relying on network media as the carrier in the self-media era with the popularization of 4G and the development of 5G, network art and interactive installations, and other fields [19]. At this time, the commercial value of digital media art is not limited to "buying" and "selling" itself, but needs to form a consumer industry chain. The new commercial value lies in the huge additional products and added value behind it. The output value of China's cultural industry is shown in Figure 7.

The extensive and distinctive methods of expression of digital entertainment art suit the demands of young people's spiritual entertainment consuming and respond to the interests of today's young consumer groups, which are primarily reflected in the economic value of digital media art. Second, the "people-oriented" concept and the "consumption upgrade" triggered by the development of digital technology may become the next breakthrough point for the digital cultural industry.

4.2. Offers Unique Innovation and Digital Media Art. AR technology is indeed a private label new technology that simulates physical quantities such as vision, listening, taste, touch, and some other physical details that people in life cannot easily obtain into virtual world information via pcs and then "flawlessly" links the with real world. AR technology highly simulates the real world and then restores the information of the virtual world to the real world to satisfy the information that people cannot feel in the real world. The ultimate goal is to satisfy the human sensory experience beyond reality. On the basis of expressing the real world, AR technology will also simulate the virtual world, and the two worlds overlap and improve each other. The user superimposes the virtual world and the real world environment into one space through the helmet simulation display. In this process, the virtual helmet will use a variety of new augmented reality technologies. The technology covers real-time tracking, scene fusion 3D modeling, multisensor fusion, multimedia, real-time video reality and control, and other new technologies and tools [20]. Virtual reality technology contains four main hardware indications, as illustrated in Table 1. The high refresh rate, resolution, latency, and computational power of the device are all indications of 3D visualization, and increasing these indicators helps to increase the immersion of the experience material.

Visual interaction is a process in which visitors observe the exhibits through their eyes and produce corresponding sensations and reactions [21]. Visual interaction technology is also one of the first technologies to be developed. The audience obtains information through vision and generates corresponding behaviors to complete the interaction. For example, according to people's common sense of thinking, some color pictures, abstract icons, and multimedia information interfaces that can convey certain meanings are presented in the exhibition, as well as augmented reality AR and naked-eye 3D, which are becoming more and more common in multimedia applications. In addition, in some new media exhibition works, the audience can also visually interact with the exhibits through the movement of their eyeballs. Eyeball technology is an emerging technology, including "eyeball

Table 1: Key metrics for augmented reality hardware.

Name	Minimum standards	Mature standard	Current level
Screen refresh rate	90 Hz	100-120 Hz	90 Hz
Resolution	2K	4K	1080P
Delay	<19.3 ms	Continue to decrease	19 ms
Calculate ability	Qualcomm 820	Continuous improvement	CORE-i7

Table 2: Audience initial ability questionnaire.

Problem	Result			
Knowledge of VR	Know it well	Generally	Heard about it	Do not understand
	0.01	0.15	0.22	0.62
Knowledge of VR games	Involved in the design	Played	Heard about it	Have no idea
	0	0.41	0.23	0.36
Have you ever been in contact with VR equipment?	Been touched	Heard about it	Have no idea	
	0.02	0.23	0.75	
Have you ever touched VR teaching?	Frequently	Occasionally	No	
	0	0.02	0.98	
Willingness to apply VR to teaching	Powerful	Generally	It does not matter	
	0.67	0.21	0.12	
Advantages of VR	Intuitive	Interesting	Interactivity	
	0.2	0.45	0.35	

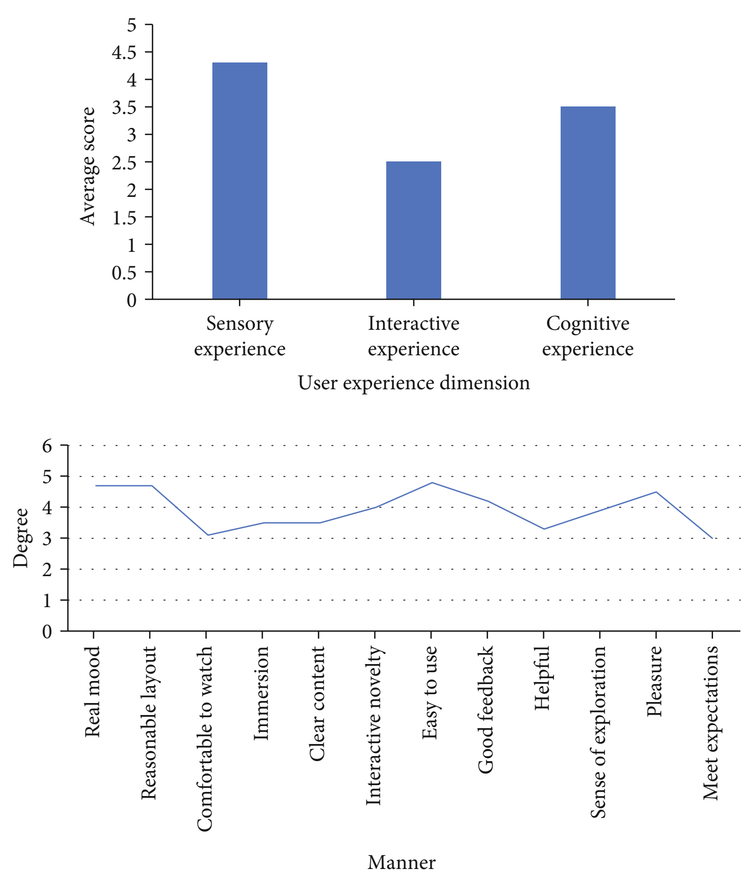


Figure 8: Questionnaire statistical results.

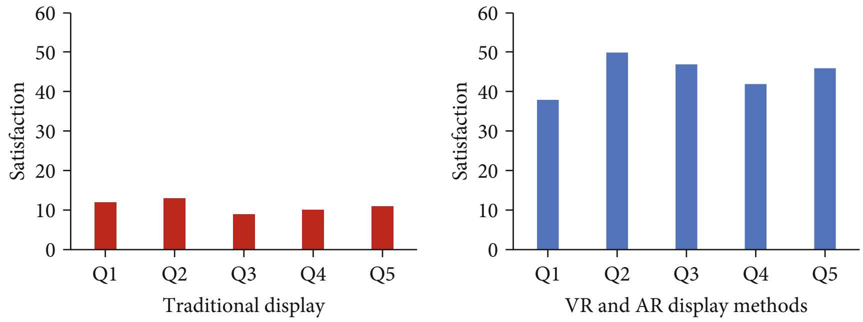


Figure 9: Audience satisfaction with traditional exhibitions and VR and AR exhibitions.

recognition" and "eyetracking." It mainly relies on computer vision, infrared detection, or wireless sensing to control interactive devices with eyes and uses eye movements to realize interactive forms such as page turning, shooting, and moving objects.

Digital media technology is the bedrock of the growth of digital media art [22]. Online media product is no longer merely a tool in the sphere of artistic creativity. Technology's aesthetic, creative, or conception has merged talents into an essentially indistinguishable blend. Digital entertainment art has spawned a slew of new digital art genres, including flux art, nouvelle film, video art, graphic imaging, and network art. Its progress is heavily reliant on improved technologies.

This study examines the changes and growth of visual language as the medium of multimedia environments and globalization, starting with idea, thinking, and invention, and investigates ways to make graphics more effectively influence physical conduct. Visual communication (producer and consumer) seeks aesthetic modernity with a creative mindset [23]. Interaction design research in new media display design is a relatively short-lived field of study. Domestic research and practice are still in their infancy and are not competitive to a certain extent, but the number of exhibitions continues to grow, the level of exhibitions rises rapidly, and grows from related issues. From the perspective of venue construction and website construction, China's new media display design is off to a good start.

4.3. Application Effects of AR and VR in Digital Art. In this exhibition research, according to the results of the "Audience Initial Ability Questionnaire," it can be seen that the audience has little knowledge in the field of VR and AR, and even some audiences have not been exposed to such content at all. This survey delivered 100 questionnaires, 100 of which were really retrieved, 100 of which were legitimate questionnaire survey, and the cure rate and effective rate have both been 100%. The first question is a study of industrial audience of digital media art's basic capabilities. Table 2 shows the statistical results.

When arranging and analyzing the data, the average of the three dimensions is divided into reference values, and the results are shown in Figure 8.

Among the twelve indicators in Figure 8, the highest average score is that the VR video interaction method is novel, followed by the audience's strong sense of immersion in the process of using VR video for learning. This also shows the immersive nature of VR video itself [24]. However, there is still room for improvement in terms of feedback effect and user experience, mainly because the VR equipment that can be provided under objective conditions is really limited, and secondly, the network speed and hardware facilities of the environment are also a major factor limiting interactivity.

It can be found that most audiences still agree that, through use of VR and AR, they can intuitively experience the true artistic beauty of digital media art. In this regard, the expressive power of digital art surpasses that of traditional teaching methods by means of pictures, videos, or language descriptions. The specific data is shown in Figure 9.

It can be seen that people's average satisfaction with traditional exhibitions is 11%, while the satisfaction with VR and AR exhibitions is 44.6%, with a difference of 33.6%. Through the survey data, we can sort out the public's attention to the creative subject and style of VR painting display, as shown in Table 3. The science fiction-themed VR painting

Table 3: The choice of the digital media art style of the research population.

Type	Proportion (%)
Sci-fi	66.1
Martial arts cultivator	57
Cartoon	46.3
Chinese painting	52.9
Other	4.1

Table 4: How audiences browse and share digital media art.

Manner	Way	Proportion (%)
Expect	QR code	31
	Content platform	29.7
	Album	39.4
No interest	QR code	37.5
	Content platform	27.5
	Album	25
Wait and see	QR code	34.5
	Content platform	32.8
	Album	35.6

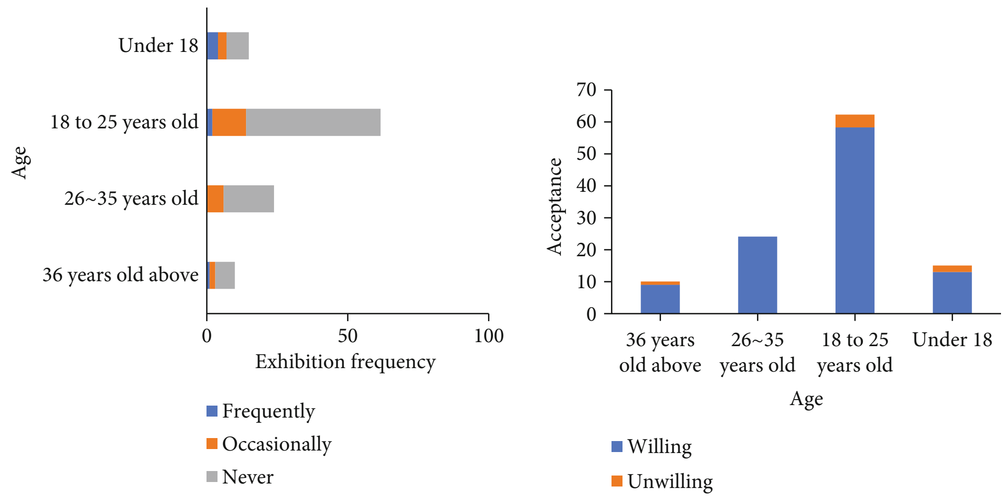


Figure 10: Graph of the acceptance of VR painting and the frequency of participation in art exhibitions among the surveyed population at different ages.

display content currently attracts the most interest of the public, because the public has the inherent technological positioning of VR products, as well as the visual stimulation and game experience that VR brings to people.

The questionnaire also investigated the respondents' views on the relationship between virtual reality painting and traditional painting, so as to obtain the most intuitive view of the current level and stage of VR painting development. The survey results are shown in Table 4.

Through the summary and analysis of the data in this survey activity, it is concluded that the VR technology in VR painting has been popularized in the daily life of the public, and the immersion brought by the VR technology provides people with a fresh gaming experience. Through the setting of the question of whether the respondents will participate in the VR art exhibition, the cross-analysis with the age stage of the survey population can be obtained: the 18- to 25-year-old group has a higher degree of participation and enthusiasm for the VR art exhibition, followed by the 26- to 35-year-old group, as shown in Figure 10.

Using VR technology to mimic the creation of virtual venues and modern media to scan paintings into the online environment to produce an interactive panoramic virtual exhibition is a very prevalent kind of VR+ art exhibition at moment, both at home and abroad. The VR virtual art online gallery is a true "VR painting" exhibition. The exhibition works are all created using VR technology and software. In addition to the VR immersive experience, works can be uploaded to the 3D website platform for dynamic display and interaction and shared on more social platforms. The means and methods include scanning QR codes with mobile phones to watch. This type of painting exhibition has the advantages of convenience, speed, and fun, and it can try it out.

5. Discussion

In the future work, research and experiments will be carried out on more aesthetic features that can describe image information, focusing on inconspicuous texture and shape features and looking for more targeted calculation methods. Digital works produced from emerging technologies such as wearable technology, mixed reality, machine learning, and intelligent systems that have surfaced in past years still have not been addressed, and additional study is required. The use of digital media art with virtual reality technology in combination can enhance the audience's ability to sense the creative environment. People appreciate art, but a shift in experience mode will have a greater influence on society. People will establish a new type of creative language if they mix the aesthetic speech of online media art with power of 3D visualization. Digital art graphics are images created by people using computers through numerical calculation methods. They often have the characteristics of partial and complete self-similarity, dynamic balance, symmetry, and fine structure. They have rich connotations, unique styles, and dual value of science and art. The following aspects need to be focused on in the follow-up of this subject: further research on image features based on aesthetics and analysis of people's psychological reactions and emotional laws caused by various image features. Studying the proper way to describe and extract these features is the key work of image aesthetic research.

6. Conclusions

Digital media art, which matured in the 1960s, entered a new "digital" phase in the late 1990s. The progress in social productivity and the digital transformation of art media have promoted the emergence and development of digital media art. Technological progress and artistic innovation always go hand in hand. Digital media art has great value in cultural communication activities, as well as very large development space and prospects. Text messaging not only alters the way information is disseminated, but it also has a significant impact on people's lives, work, and entertainment, as well as the way they receive information and think. People have higher expectations when it comes to information. As a result, online media art transmission should evolve in tandem with the growth of material on one hand and continually adapt its own means of speech and communications to satisfy the demands of the audience on the other. This study presents a design approach for a virtual world display project based on the examination of these design aspects. The exhibit of online media art has its own individuality, according to the examination of display design challenges, and the habit of mindlessly following trends and disregarding oneself should be abandoned. Combining with the relevant theories of user experience, the author proposes four levels of design strategies: unifying the whole and individual, adapting to the psychological needs of the audience, creating a realistic space situation, and attaching importance to the display content planning.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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