Based on 3D Virtual Reconstruction of Modern City Landscape Sculpture Planning Design

Xin Xu[1,*]

[1]Faculty of Design and Architecture University Putra Malaysia, Serdang Selangor 43400, Kuala Lumpur, Malaysia

Abstract

INTRODUCTION: with the continuous advancement of urbanization, urban landscape sculpture plays an increasingly important role in modern urban planning. Traditional planning and design methods make it challenging to demonstrate the three-dimensional sense and artistry of sculpture fully; therefore, this study explores a new method of planning and designing modern urban landscape sculpture based on three-dimensional virtual reconstruction.

OBJECTIVES: This study aims to enhance the three-dimensional sense and artistry of urban landscape sculpture planning and design through three-dimensional virtual reconstruction technology to meet the needs of modern urban development better. By using advanced technical means, the planning and design can be made more intuitive and specific and provide urban residents with a more artistic public space.

METHODS: The study adopts advanced three-dimensional virtual reconstruction technology, combined with urban planning and design theory, to plan and design modern urban landscape sculpture. Firstly, relevant literature on urban planning and sculpture design is collected to understand the existing design concepts and technical means. Secondly, a detailed virtual reconstruction of the sculpture is carried out by using three-dimensional modeling software to show the three-dimensional effect of the sculpture. Finally, the design scheme is optimized and improved through fieldwork and expert review.

RESULTS: Through three-dimensional virtual reconstruction technology, this study successfully shows the whole picture of modern urban landscape sculpture. The design scheme not only has a three-dimensional sense but it has also been improved in artistry. The results of fieldwork and expert evaluation show that the new design scheme is more in line with the needs of urban development and adds a unique artistic atmosphere to the urban space.

CONCLUSION: This study has achieved positive results in the field of modern urban landscape sculpture planning and design through 3D virtual reconstruction technology. The new design method not only provides a more specific tool for urban planners but also creates a more creative and artistic public space for urban residents. In the future, the application of this method in different urban contexts can be further explored and expanded to inject more innovation and vitality into urban planning and sculpture design.

*Corresponding author. Email: XuXinUPM@gmail.com

1. Introduction

The diversity of three-dimensional materials is one of the most essential characteristics of sculpture. In a variety of historical contexts, increasing technology and efficiency have led to changes in materials and techniques, from clay to marble to metal, from the production process of hand metalworking, and finally to modern 3D printing technology (Larue et al., 2023). The different social characteristics indicate the different sculptural forms that have witnessed these changes over the centuries. The emergence of digital technology is an inevitable part of the evolution of the times, and sculpture has changed over time (Madrid et al., 2023). The quality of a digital sculpture is closely related to the choice of tools used by the artist to

create it. The presentation of the finished product, if the virtual hardware of the rendering software is able to convey the artistic concept of the sculpture accurately into the mind of the artist, is an essential factor that the sculptor must consider.

With the rapid development of computer hardware technology, more advanced and comprehensive software technology has also entered the vision of digital artists (Liao, 2021). As an essential environment for digital art creation, the continuous development of art forms is a mysterious field that every digital artist wants to explore. Sculpture, as a category of three-dimensional art, aims to develop a holistic and integral presentation method that enables users to express design concepts accurately (Cho et al., 2021). Currently, the expression of digital sculpture can be divided into two categories: one is the traditional expression of digital sculpture, which can only be viewed through images and videos but cannot be passively received. The other type is interactive digital sculpture, which opens up a "green bridge" for users of experience and creativity (Li et al., 2023). Through the talent of the artist, the user can choose the artistic design that best suits their inner beauty, thus realizing the goal of virtual reality in the interaction with the artwork (Ztürk et al., 2022). Through the interactive features of this platform, artists and users create a two-way communication platform where users are no longer passive recipients of the dynamic fusion of sculpture and digital technology.

First, research on this topic has had a positive impact on the popularization of interdisciplinary technological research and arts professionals, providing artists with a broader perspective and more comprehensive professional capacity development. Second, by supporting digital technologies, the diversification of traditional art disciplines can be realized. Finally, it follows the trend of the digital art era and promotes the organic integration of the art and technology fields.

2. Background of the study

With time, public sculpture can express the human spirit in different forms, convey the language of the soul, and reflect the history and future of the city (Eriksson et al., 2022). Using virtual 3D reconstruction technology to study the interaction between public sculpture and urban space enables society to recognize and be satisfied with the interaction between them. It can also improve the environment, give new meaning and atmosphere to urban public sculpture, and better reflect the human spirit (Nozawa et al., 2021). The interaction between the public urban sculpture space and the 3D virtual reconstruction technology makes human life in the city come to life. By studying the interaction of urban public sculpture space based on virtual three-dimensional reconstruction technology, the natural connection between urban public sculpture space based on virtual three-dimensional reconstruction is revealed (Liu et al., 2021). Reasonable suggestions and practical methods are proposed for the

construction of urban public sculpture facilities. This enables artists to take into account social behavior and psychological needs in planning, programming and consulting. It is essential to improve the urban landscape.

As society develops, the demand for urban public art increases. Not only from an aesthetic point of view, more and more works should bring emotional therapy and behavioral experience to the public (Barnett et al., 2022). From emphasizing the traditional meaning of static public sculpture, combining dynamic three-dimensional public sculpture with movement and time, to two-way interactive public Sculpture, Public Sculpture is gradually shifting from shelf art to public life. Art has indeed achieved its goal. Interactive public urban sculpture came into being through the development of technology and systems (Huang et al., 2021). In urban public sculpture facilities, interactive works based on 3D virtual reconstruction technology can not only ease the general tension but also appreciate and participate in the artworks. Interactive public urban sculptures based on 3D virtual reconstruction technology can not only provide a social experience but also help society interpret urban culture.

The spatial interaction of urban public sculpture based on three-dimensional virtual reconstruction technology usually adopts the form and effect of traditional multidimensional sculpture, emphasizes the static and dynamic expression of sculpture, and responds to the everyday needs of aesthetic and spiritual education (Ji et al., 2022). With the development of society, people's needs are growing. Traditional static and dynamic sculptures no longer meet human needs. Public urban sculpture must provide a new way of adapting to the changing times. The use of virtual 3D reconstruction technology brings more vitality to public sculpture and interactive urban space, paving the way for unlimited creativity.

On the one hand, the interaction of public urban sculpture space is stimulated by the public's visual and sensory perception, as well as by multidimensional participation and experience. On the other hand, the audience is the main element of the interaction of public urban sculpture space, both as a viewer and as a creator (Sun et al., 2021). The development of the times has given society more rights to participate in the creation of urban public sculpture, promoted the multi-functional development of urban public sculpture, and strengthened the connection between urban public art and the public's daily life.

An interactive public sculpture space based on 3D virtual reconstruction technology brings new vitality to knowledge and creativity. The interactive study of urban public sculpture based on three-dimensional virtual reconstruction technology not only meets the needs of society but also guides and even educates society, brings it closer to social life, and increases its interest and participation. It makes the audience feel that art has transcended ordinary people's lives and become happy, intimate and approachable (Tan, 2021). At the same time, it brings many new ways of thinking. The spatial interaction

of urban public sculpture based on 3D virtual reconstruction technology is a very complex art, so the research should cover aesthetic aspects as well as communication and behavioral psychology. The introduction of 3D virtual reconstruction technology not only follows the design principle of "public foundation" in the interactive creation of urban public sculpture space but also reduces the distance between public sculpture and urban public sculpture, thus creating an excellent interactive effect.

Based on virtual 3D reconstruction technology, the interaction of public urban sculpture space is investigated to enable the public to participate uniquely in the creative process and influence the final impact of public urban sculpture. Based on virtual 3D reconstruction technology, public urban sculpture is an interactive spatial art that guides and shapes social, psychological, and behavioral models. In contrast, the social, psychological and behavioral modeling of public urban sculpture installations based on virtual 3D reconstruction technology can also stimulate the creation of interactive studies (Webb et al., 2023). Interactive spatial studies of urban sculpture based on virtual 3D reconstruction technology are issues that artists must consider in their creations. The research on interactive urban sculpture is based on three-dimensional virtual reconstruction technology, which analyzes the interaction and relationship of different urban public spaces based on the psychological and behavioral characteristics and patterns of public activities(Hu et al., 2021). At the same time, it provides valuable references for the creative practice and interactive research of urban public sculpture space so that public sculptures can better reflect their social identity and enrich and expand the vitality of urban public space. They will become a platform for communication and socialization.

It will be helpful to study the interaction of urban public sculpture space based on virtual 3D reconstruction technology from the perspective of virtual 3D reconstruction. The interaction of urban sculpture space based on virtual 3D reconstruction technology focuses on the dissemination of human values and social participation (Zhang et al., 2021). In integrating virtual 3D reconstruction into the interactive study of public urban sculpture space, artists can perfectly combine science and art, rationality and emotion (Yu, 2023). On the other hand, it also helps the public understand the public sculpture of the city. The audience can not only better understand the interaction with urban public sculpture from the perspective of aesthetic observation but also deepen the artist's performance through the participation process (He, 2022). Therefore, there is an interaction between the public space of the sculpture and the audience's emotions and behavior. Based on three-dimensional virtual reconstruction technology, an interactive study integrating psychological, social and behavioral characteristics into the public sculpture space has been carried out to promote creative exploration of the public sculpture space (Yun, 2021). The attraction of the interactive study of public urban sculpture space based on three-dimensional virtual reconstruction technology lies not only in the sense of social well-being and fun but also in the fact that people can feel the meaning of life and cultural attraction behind the work. Based on 3D virtual reconstruction technology, the spatial interactive research of public urban sculpture has been integrated into the urban environment and social groups to stimulate, guide and even change social behavior(Song & Zhong, 2021). In the creation of urban public sculpture, artists emphasize the integration of urban public sculpture into urban public space and the realization of benign interaction between sculpture and urban public space as a way to meet the requirements of humanization and humane design (Yao et al., 2023). It not only combines the psychological and behavioral characteristics of the audience with interactive research in public urban sculpture space but also allows artists to focus on applying rational and emotional thinking to make the work more in line with the social psychology and mode of operation.

3. Research methodology

3.1 Three-dimensional virtual reconstruction

Virtual 3D reconstruction technology refers to the use of computer technology to draw the overall shape of a computer graphic, which is divided into two categories: two-dimensional animation (2D) and three-dimensional animation (3D). With the popularization of computers, many computer design tools have appeared in people's lives, and works of artists known as 3D virtual reconstruction techniques have been published. Due to its digital capabilities, games use virtually reconstructed 3D artwork. For example, many works have appeared in the movie and animation industries. Due to the continuous development of 3D virtual reconstruction technology, many great movies, games and special effects screens are seen today that are faked using technologies such as 2D and 3D modes. Virtual computers and motors are the primary means of production. The concept of 3D virtual reconstruction is expanding as the application areas continue to expand. Virtual 3D reconstruction technology is present in almost all computer arts, from graphic design to web design, from game models to visual effects, and from architectural design to industrial design. The content is a purely artistic advertising design creation that can be 2D, 3D, static or animated. In the information age, almost all computerized visual arts contain both artistic and technical elements, often referred to as virtual 3D reconstruction techniques. Virtual 3D reconstruction technology has become an objective technology engine for visual games and the creative economy. It was developed in the 1990s to help game developers make game plans. With the development of electronic information technology and the improvement of people's quality of life, virtual video games have become one of the most essential entertainment activities. The development of the game market has provided solid financial support for game development, and the

technological upgrading of game engines has been continuously improved. Urban landscape sculpture planning and design research, as shown in Figure 1.
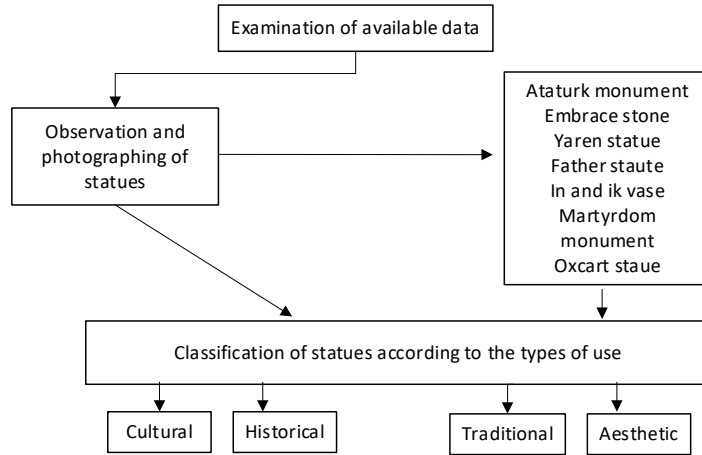

Figure 1 Urban landscape sculpture planning and design study

3.2 Scene construction for 3D virtual reconstruction

The World Creator software allows people to customize the terrain change management details, create terrain based on user requirements, and create terrain-style models using the software's filtering feature. According to the requirements of the research project, the sculpture only needed a relatively small area as a display environment, so the size of the terrain was set to 512 x 512 m, and the filtering mode of the terrain was selected. In the landscape design, the authors used four different textures in the natural environment: mountains, flat grass, deep grass and stone, and modified the characteristics of the texture distribution in the creator's world to make the material distribution more natural and realistic. The principle of urban landscape design is shown in Figure 2.
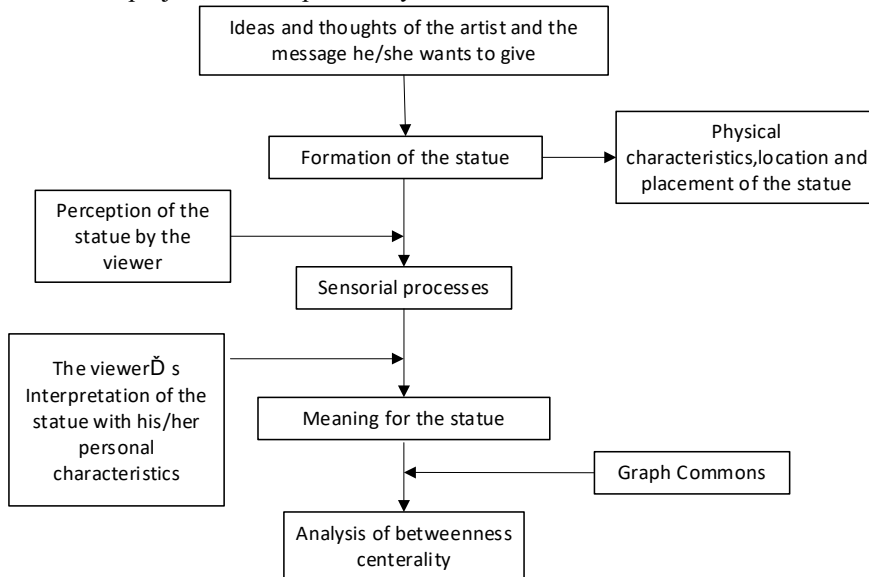

Figure 2 Principles of Urban Landscape Design

Thermal mapping allows the structure of the engine terrain to be changed by importing four selected terrain surfaces into the engine and marking them as usual, creating a new structure, and adding a horizontal layer connection node to combine all four surfaces into one texture. Since the researcher has already selected four textures, a blended horizontal layer needs to be added from the four properties panels, and each layer needs to be renamed, e.g., Grass 1, Grass 2, etc. Combine the four textures with a horizontal layer and a horizontal layer with the primary outline color. Copy the horizontal blend node and paste it into the four standard cards. Finally, connect the horizontal blend nodes

to the normal nodes of the texture outlines and define the structure of the terrain. After changing the four textures horizontally, add a control channel to the panel that controls the distribution of the four textures using the exported in-field heat map. Currently, the computation of the area still needs to be completed. A node needs to be added to control the size and structure of the patterned terrain map, and a patterned node to control the size of the map.

As a designer, it needs to be that adding sky is not available by default. First of all, the reflection of the lens in the scene will only be complete by adding the Skybox HDRI setting. For example, if people place a stainless steel ball in the scene like a mirror, people will see that part of it is black at the intersection of the earth and sky. In the Content Pack, click on the Draw column. In the red area of the image, there is a driver called BP, which allows adjusting the shooting mode and lighting of the HDRI monitor to achieve a perfect visual design. The problem of imperfect material reflections has been solved by using the on-set BP control to reflect the terrain and content of the HDRI Sky Box into the stainless steel mirror material. The requirements for the scene configuration have now been met: first, create a digitally sculpted model using 3D Max software to more smoothly perform the digital UV sculpting, zero coordinates, and reset functions imported by 3D Max virtual motors; create terrain map heights using the WorldCreator plug-in, import the terrain maps into the virtual engine to create the terrain model, and address the HDRI Sky Map lighting environment and customizable switches. Customizable switches. Add bootable content to the Virtual Engine to control BP in the package; download five textures from the QuixelBridge plug-in and import them into the Virtual Engine to create textures. Drag the sculpture onto the stage and set the coordinates of each component to zero.

A complete interactive digital sculpture platform must contain elements such as a digital sculpture theme, a user interface and a stage environment. The next step is to improve and optimize the stage environment with the Open World Demo, a free open resource package for the Virtual Mall. Import the Open World Demo portfolio into the interactive design of the digital sculpture platform, search for template resources in the content panel, and then enter terrain editing mode. This is a virtual engine that adds templates to brushes to remove environments. Thus, the researcher only needs to add templates, use them to remove brushes, and then use the brushes to remove terrain. Plants, rocks, objects, etc., should be removed. To create nature, the researcher used grass, flowers, trees, and rocks from the Open World series. For installation, the researcher used red brick panels and standard seat models. A layer of grass was first covered on the surface of the field using the brushing method. Then, a small red brick square was placed, and the sculpture was placed in the center of the square. In the environmental modeling, trees were placed in the middle of the plaza and placed freely to create a woodsy atmosphere outside the plaza. Finally, the parameters of the sky map, lighting intensity, lighting color and dense fog should be

adjusted according to the requirements of the scene atmosphere.

The 3D virtual reconstruction of the model is shown below:

$$\lg uana^G : 1guana_i^G = lb_j + r(ub_j - lb_j), j = 1, 2 \ldots\ldots m \ (1)$$

In Equation (1), $1guana^g$ is the expectation function chosen, and its specific calculation method is shown in Equation (1).

$$for - i = \left|\frac{N}{2}\right| + 1, \left|\frac{N}{2}\right| + 2, \ldots, Nandj = 1, 2, \ldots, m \ (2)$$

Equation (2) is a loop with I for Python's function pair.

$$X_i = \begin{cases} X_1^{p_1}, F_i^{p_j} < F_i \\ X_i, eles \end{cases} \quad (3)$$

Equation (3) utilizes Fi to segment the function X_i.

$$lb_j^{local} = \frac{lb_j}{t}, ub_j^{local} = \frac{ub_j}{t}, where\_t = 1, 2, \ldots, T \ (4)$$

Equation (4) is obtained as a result of the derivative function by using the local subdivision of the labor function for t.

$$y = X_{sbest} + F \times (X_{r1} - X_{r2}) \quad (5)$$

Equation (5) is the result after the highest order differencing of the X-function.

4. Results and discussion

4.1 Sculpture planning for virtual reconstruction

The purpose of this article is to change the material of the digital sculpture at any time during the real-time presentation in order to change the material layout of the second phase based on the first phase. Select the material from the first ribbon and place it in the "Project Content" column. When people double-click on a material to enter material processing mode, the primary color settings for the material specified in the material profile change. Create a new Hardware Settings folder on the Project Contents line, and then create a new Collection folder in the Hardware Settings folder. In this vector setup, people can set the default color, return to the Drag Material page, use the color picker to absorb the material's default color, and then copy it to the material setup. The default color of the material setup is now the same as the color of the digital tape material. Drag and drop the material parameter specified on the Material Processing page into the Actions box, replace the Base Color node with the material boundary, and then select the parameter name "Stream Color." Currently, the

tape material on the stage is unchanged. Still, suppose the researcher clicks on the Material Settings parameter and adjusts the color via the Color Palette. In that case, the researcher can conclude that the tape material on the stage is changing in real time. The next step is to replace the material in the Material Change area of the Material Processing window and create a new parameter node called "Material Color." The material change stage has been completed, and the change of material parameters of these two materials can be adjusted through the pallet. The comparison of the performance of Vise and 3D materials, the principal part of Landscaping, and the change in the material temperature of the sculpture are shown in Figures 3, 4, and 5.
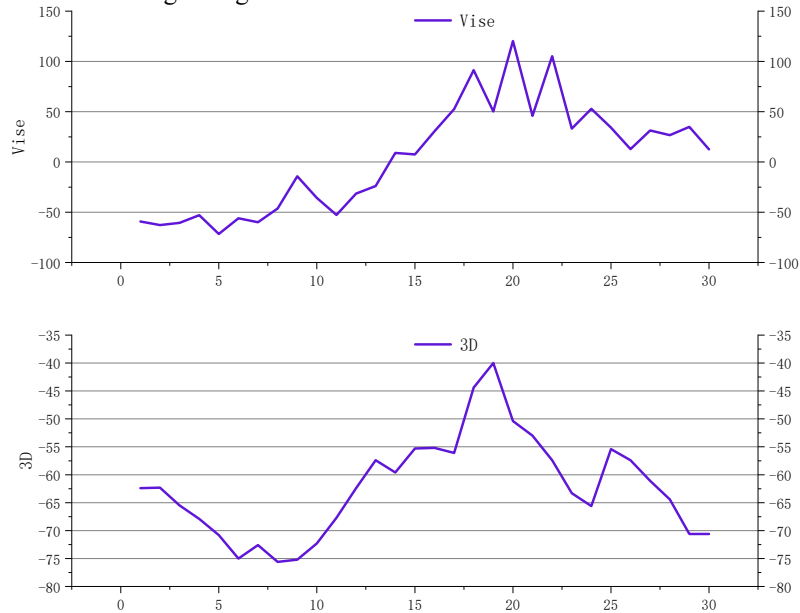
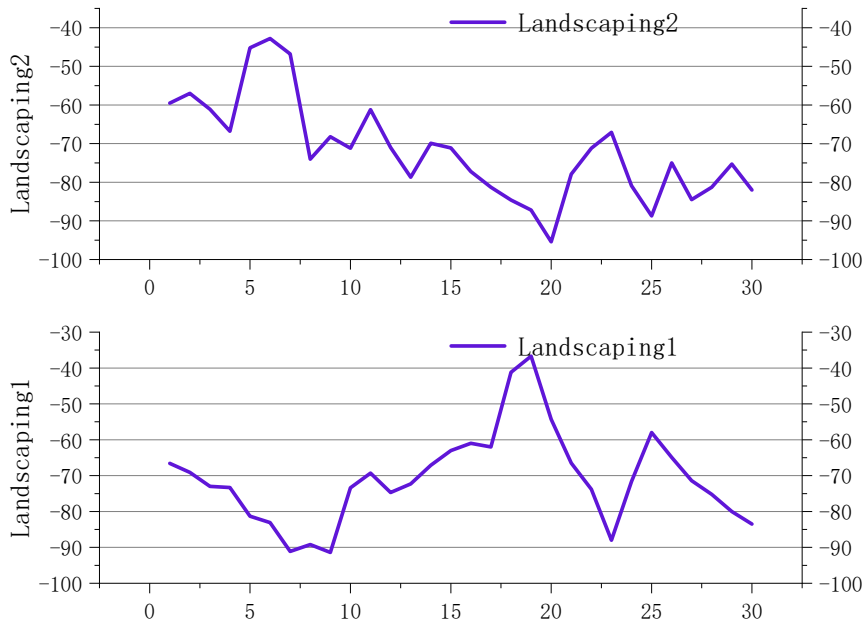**Figure 3** Comparison of Vise and 3D material properties

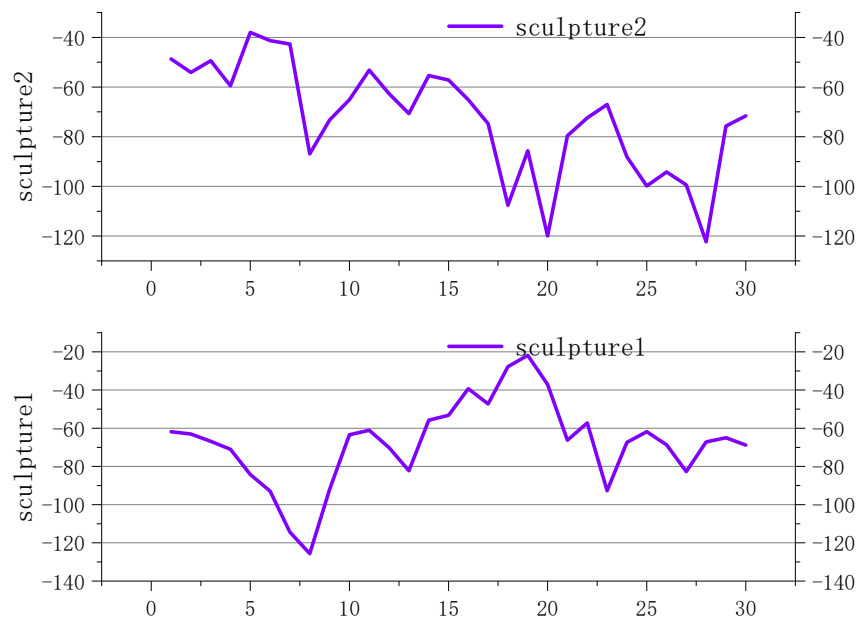**Figure 4** Principle part of Landscaping

Figure 5 Material temperature variation of sculpture

After installing the X-axis and Y-axis rotation, people need to use the mouse wheel to control the distance and viewing angle distance. Users can not only rotate the mouse wheel 360 degrees but also view the digital sculpture up close. Add two input commands to the project settings. These two commands are called mouseup or Amouseup due to the Virtual Engine variable naming protocol. Try simulating pressure by holding and dragging the mouse wheel and then going to the camera. Drag and drop the MouseUp and MouseDown nodes onto the machine and add a timeline node to simulate the trajectory of the remote camera and the large camera. Set the Time Interval to Max 1800 and at least 400, Max 1800 to maximum distance from the Digital Camera and at least 400 to minimum distance from the Digital Camera, and set this distance to the spring arm.

Please create a user interface folder in the content pane, right-click to create a new GUI control, double-click to open the Control Architecture Editor, drag and drop the button onto the project line and place it at the bottom of the project line. The researcher changes the material by calling and pressing the button. The researcher adds a button below the vertical square of the panel to maintain vertical order when placing items above the button. The "Add Text" command changes the text in the material switch controller. The researcher also needs a horizontal frame to hold the text content for the two materials. Repeat and name the new text: Sculpture Body Material. Connect the Create widget node, select "MyWidget" from the Create widget drop-down menu and add it to the existing UI widget. Add it to the existing UI widget. Connect Create Widget to Add to View and move the UI to the screen. When the configuration is

complete, click start, and the user interface will be displayed.

The user can change the material settings by clicking the UI button and changing the digital material. Double-click on the UI Management Plan Editor and enter Graphic Mode. Under the variable bar on the left, press, press, slow down, scroll and stop to save all existing buttons. Click, select "Material Band 1", create an event "Click," drag the event node to create "Vector Set Material Parameter Set Set Set," then select the set of material parameters created under the "MTC" node, specify the color "Parameter Name" from the streamer color ribbon, and set the parameter value to "Parameter Name." "and elevate the parameter value to a variable. Name the variable "streamer color" and set the default variable to the material of the first set of functional areas. Then, define another set of functional areas, name them StreamerColorB, and click the Tail 2 button below to create an event, just like Texture 1. Run the above test setup. By clicking on the interface controls "Texture 1" and "Texture 2", the researcher can change the tape material without restoring the lighting and save the light card material after changing it. Ambient light and reflected light vary depending on the material. To use this procedure for Sculpted Body Material 1 and Sculpted Body Material 2, select the Sculpted Body Material 2 button and create an event in the "Click on "section to create an event. Drag the Event node to create a set of parameter vector material parameters. In this node, select all the parameters of the "mtc" material created by the researcher, find the ribbon color under the parameter name, and add the value parameter to the variable. Name the variable "bodycolor" and set it as the first default material of the sculpture. Use

the same "Cut main material 2" button for the above setup, backup and test.

4.2 Model creation and realization

Traditional digital sculpture displays use only 3D software to display images and videos and transmit them exclusively to users and the public with little interaction. In this study, the creation of digital sculpture models was only part of the project. 3ds Max is 3D modeling, rendering and animation software developed by Discreet. Standard polygonal modeling models are widely used in a variety of industries, as well as many model file formats such as OBJ and FBX. This is one of the main reasons why the authors chose 3D Max to build their model.

When creating a digital sculpture model, the artist only creates a model without specifying the materials, so the interactive landscape of the exhibition has yet to be created. The digital sculpture model is an essential virtual resource added to the materials that are imported into the virtual engine. Three factors must be considered when importing a virtual engine into a 3D software model: in order to obtain high-quality materials and a more realistic reflective

environment in the 3D software, this process must be followed to generate an image of the 3D UV model. The UV map can be understood as the 3D model on the outside of the surface, whereas the texture map provides a 3D model on top of the UV map. Select a 3D model into the Editor list, select UV coordinates from the UVW Chart Editor list, select the corresponding 3D shape, and then right-click on the selected 3D model to convert it into a multi-threaded editable model, completing the addition of the UV-3D model. Select the "3D Move Tool" switch on the model. Select the Horizontal panel on the right side. It only affects the three coordinates of the XYZ axis. Thus, the sculpture model imported by the researcher is transferred from the 3D Max software to the virtual engine, and the zero coordinates of the model are displayed on the engine. The model can be rendered in a completely virtual engine. To perform the reset, select the 3D model, click "Resume Conversion" on the right side of the application pane, and then right-click "Convert to Editable Strategy. Urban landscape comparison, two vs. three-dimensional comparison, and Space virtualization research progress are shown in Figures 6, 7 and 8.
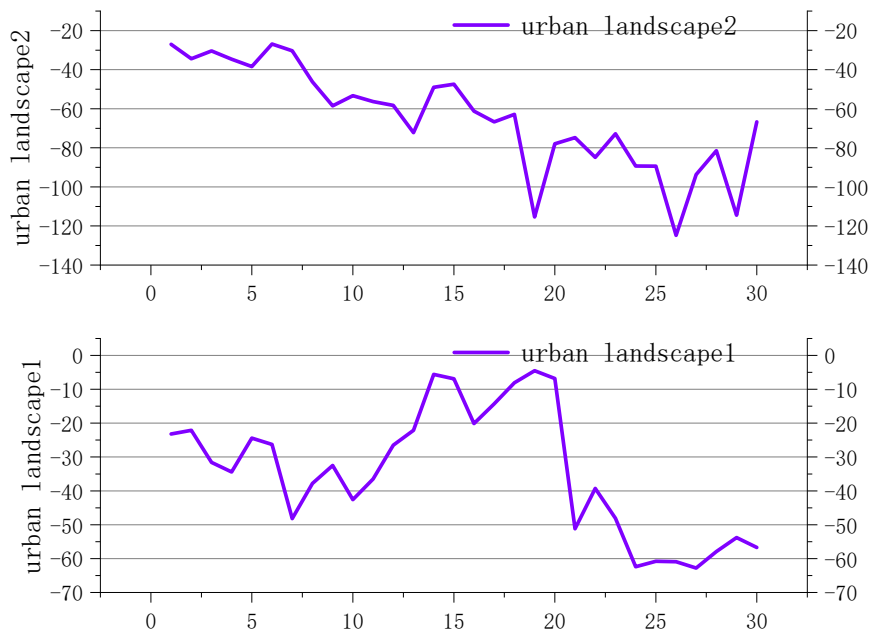

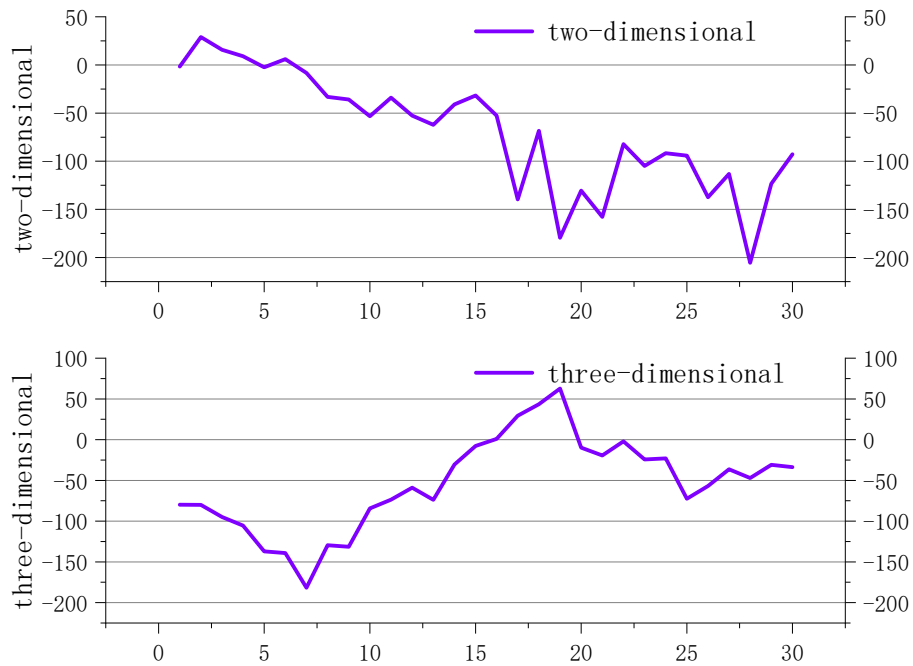**Figure 6** Comparison of Urban landscape

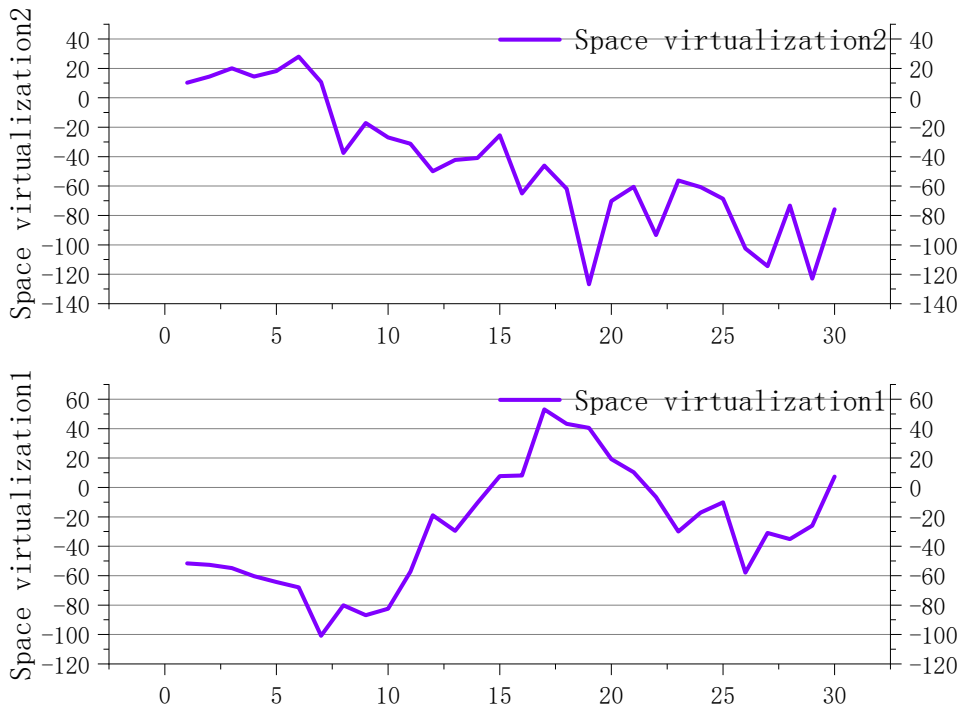**Figure 7** Comparison of two versus three-dimensional

Figure 8 Research progress of Space virtualization

The purpose of this study is to encourage users to apply digital sculpture actively and to realize interactive effects by changing the combination of digital sculpture materials. This digital sculpture was created on the basis of

3D Max, and two materials were produced for the sculpture band and the central sculpture, both of which have alternative materials. In addition, the base of the sculpture is made of marble. This is why there are five sets of hardware

cards. The analysis of the cell technology references four forms of textures used to create the base: reflective color cards, metallic cards, roughness and normal. Researchers can derive the rules for creating the different types of cards from the table above, where the primary color card shows the hue and content of the surface material. The metal density map is shown in black, white and gray. Metal and digital sculptures are made of stainless steel, so metal cards look white. The roughness map is different from the rich metal map. Thanks to the smooth material used in the digital sculpture, the card has a very low roughness and is almost black.

Standard graphics attached to the surface of a 3D model represent the shape of the UV light folded into the elevation to show details of the model's surface material. Regular lines give a quiver from the texture of the pattern. The standard line content is displayed according to the orientation of the model surface. If the researcher looks at the model from a uniform angle, the normals do not have a "concave" structure. There are two ways to create a regular chart that stores the surface data of a 3D model. The first method is to use a high screen, called "visual fraud." As mentioned above, the height does not change when the researcher views the surface from the side. The normal map follows only the average direction of the predicted curve. Conventional normal mapping, also known as normal mapping, requires high accuracy and is more challenging to create than a high-quality mapping model.

Click to create a new material in the material folder of the sculpture. Creating a new material opens the material editor page and automatically displays the material specification file. Drag and drop different types of cards directly into the Material Editor to attach the appropriate nodes, attach the Reflective card to the Primary Color node of the Material Profile, and attach the Metal card to the Material Profile. The metal card is attached to the primary color node of the material outline. The roughness map is attached to the roughness node of the outline, and the normal map is attached to the standard node of the outline. Bringing 3D Max to the Virtual Engine. Due to the Virtual Engine configuration, after importing a model into the Virtual Engine, the model will appear as a template element in the project package. Drag and drop all components of the Virtual Engine onto the stage and set the coordinates of all components to zero to create the complete digital sculpture model.

4.3 Interaction design of digital cityscape sculpture

The most crucial feature of interactive expression in digital art is interactivity. If interactive expression in digital art loses interactivity, then it loses its fundamental value and cannot be called interactive expression in digital art. The interactivity of art communication must follow the principle of equality of all people; the artist is not the absolute dominator, and the public cannot passively accept art communication. In the interactive experience of digital art, the team in the hands of the artist has the right to participate in the creation of the artwork and experience the art with their own aesthetic experience and interest. Interaction should emphasize the direct interaction between the participants and the artwork. The actions of the participants change the meaning of images, shapes, colors, textures and even graphics. Digital artworks are presented through psychological and physiological interactions, where the art viewer interacts with the artwork in different ways, such as physical contact, body movement, and singing. This interaction also produces various interactive responses in the artwork according to the different behavioral habits of each individual. On the other hand, different art receivers interact with the artwork through different emotions and experiences, creating different aesthetic meanings for the artwork. In this new concept, the artist is the designer and initiator of artistic activities and experiences.

Interactive artists must consider the experience of the art viewer when producing an interactive artwork. When a work is categorized as an interactive artwork, its interactivity is not limited to the final stage of completion. For example, in an interactive digital sculpture demonstration, when the artist completes the development of the interactive digital sculpture platform, the user must make the final design of the digital sculpture based on their aesthetic preferences. This means that the interactive nature of interactive art can also be expressed in the creative process. With user participation, the work experience can be considered unique. Secondly, user participation in the art experience is a cyclical process that culminates in the culmination of the experience by exploring and reinforcing the individuality of different user forms. As virtual channels communicate with each other, users change their relative positions to create different video and audio frequencies. These components do not allow the user to touch the actual ropes but rather interact with the virtual ropes, which can affect movement like waves in water.

The creation of virtual digital spaces for near-reality computer platforms can be experienced using virtual reality glasses, virtual processors for external hardware devices, and interaction with the virtual world. Virtual reality, a media technology of the information age, extends people's senses of sight, sound, and touch through the creation of virtual models, the development of radiation monitoring techniques, and the creation of simulated sound effects. It is not only influencing researchers' understanding and experience of the global environment, but it is constantly changing it and advancing society and development. Caslur is the world's first interactive art museum. These museums are dedicated to creating a world of experimental art that combines traditional art with modern technology. The opening of the museum has sparked a new visual movement that has attracted the attention of many artists. Cave Training is a type of interactive artwork that combines images, sound effects, and the language of art. It consists of virtual reality using real-time computing technology, with interactive features derived from large virtual dolls in an enclosed space and changing images around them.

Although these works are created in a closed, fixed space, the viewer can enter this space and experience a new, ever-changing world. The virtual plays a central role in digital art and new media installations, and traditional art often ignores the "infinite" conditions of virtual creation. In the virtual space, artists can participate in many creative activities that cannot be realized due to the limitations of objective reality.

A fixed expression is a number that is set as an output value in the editor or at the start of the game, and the program does not change it. Standard expressions generate only one value or input only one value and can be attached to each node for output or input. For example, if a constant is combined with an input that requires three vectors, it will be applied to all three elements. If individual values are specified, the node can be turned off using the small triangle icon in the Description pane. For example, to change the Contour Roughness node, add a constant, right-click on the Convert option, and then paste it into the Contour Roughness node to specify the roughness by changing the settings. The Vector Parameters node provides four identical channels (red, blue, green, alpha) of the RGB expression standard 4vector (standard vector 4). Not only does the vector expression provide the researcher with four access points to change the material parameters, but it also uses a color absorption function to adjust the natural color of the material. For example, a researcher needs to change the primary color node within a texture boundary. Add a vector and paste it into the base color node of the texture outline so the researcher can change the base color by changing the settings. There are four basic structural modes: primary color, standard color, roughness, and metallic intensity. The researcher needs to select the four types of texture files and then go directly to the virtual engine. The researcher needs to create a new structure that combines four different texture nodes with similar texture nodes.

5. Conclusion

This research has achieved remarkable results in the planning and design of modern urban landscape sculpture based on three-dimensional virtual reconstruction technology, which brings new ideas and methods to the field of urban planning and sculpture design. By summarizing and analyzing the whole study, the following conclusions are drawn. Firstly, three-dimensional virtual reconstruction technology provides strong tool support for modern urban landscape sculpture planning and design. The traditional design method makes it difficult to fully show the sculpture's three-dimensional sense and artistry in the plan. In contrast, three-dimensional virtual reconstruction technology enables the designer to perceive the appearance and spatial relationship of the sculpture more intuitively by simulating the actual space，which provides more accurate and specific information for planning and design, helping optimize the design scheme. Secondly, the new design method has achieved good results in enhancing the three-dimensional sense and artistry of urban landscape sculpture.

Through the use of three-dimensional modeling software, the designer is able to express the details of the sculpture more meticulously, making it more ornamental and artistic. This enhanced sense of three-dimensionality provides city residents with a richer visual experience, making the public space more attractive and dynamic. In addition, the results of the fieldwork and expert review validated the feasibility and superiority of the new design solution. The design scheme is not only technically validated but also better able to meet the needs of urban development in practical application. The participation of expert evaluation increases the objectivity and scientificity of the design, providing a more reliable basis for planning and design. Comprehensively speaking, the planning and design of modern urban landscape sculpture based on three-dimensional virtual reconstruction has injected new vitality and creativity into urban space. The successful application of this method provides a powerful tool for urban planners and sculpture designers and promotes the integration of urban planning and sculpture art. In the future, the research on 3D virtual reconstruction technology can be further deepened, and its application in different urban environments and cultural contexts can be expanded to promote the continuous innovation and progress of urban landscape sculpture planning and design.

Reference

[1] Barnett, M., Keating, T., Barab, S., & Hay, K. (2022). *Conceptual change through building three-dimensional virtual models. 123*, 78–101.

[2] Cho, J. W., Cho, W. T., Sakong, S., Lim, E. J., & Oh, J. K. (2021). Mapping of acetabular posterior wall fractures using a three-dimensional virtual reconstruction software. *Injury*, *56*, 1–34.

[3] Eriksson, M. E., De, L. G. R., Horn, E., & Lindgren, J. (2022). A review of ichthyosaur (Reptilia, Ichthyopterygia) soft tissues with implications for life reconstructions. *Earth-Science Reviews: The International Geological Journal Bridging the Gap between Research Articles and Textbooks*, 226.

[4] He, C. (2022). *The Design ofUrban Sculpture SpacewithUserBehaviorBased on Internet of Things and Edge Computing. 36*, 45–88.

[5] Hu, W., Li, Y., & Wang, X. (2021). Research on the Current Situation of 3D face reconstruction based on 3D Morphable Models. *Journal of Physics: Conference Series*, *1966*(1), 012017 (4pp). https://doi.org/10.1088/1742-6596/1966/1/012017

[6] Huang, T. Y., Fang, C. Y., Lin, K. C., & Ashikaga, Y. (2021). Utilizing virtual surgical planning and three-dimensional-printed osteotomy guides in fibular free flap reconstruction can achieve a better result in mandibular osteoradionecrosis patients. *Journal of Dental Sciences*, *141*, 47–69.

[7] Ji, T., Ren, B., & Huang, S. (2022). *Hydraulic and Pneumatic Transmission Three-Dimensional Virtual Training System Research. 46*, 77–94. https://doi.org/10.1088/1742-6596/2219/1/012064

[8] Larue, E. A., Fahey, R. T., Alveshere, B. C., Atkins, J. W., Bhatt, P., Buma, B., Chen, A., Cousins, S., Elliott, J. M., &

Elmore, A. J. (2023). A theoretical framework for the ecological role of three-dimensional structural diversity. *Frontiers in Ecology and the Environment*, *98*, 271–299. https://doi.org/10.1002/fee.2587

[9] Li, F., Villa, U., Duric, N., & Anastasio, M. (2023). Three-dimensional time-domain full-waveform inversion for ring-array-based ultrasound computed tomography. *The Journal of the Acoustical Society of America*, *34*, 73–94.

[10] Liao, M. (2021). *Current Status and Application Analysis of Computer Software Development Technology. 12*, 121–156. https://doi.org/10.1007/978-3-030-70042-3_32

[11] Liu, K., Xu, Y., Abdelrehem, A., Jiang, T., & Wang, X. (2021). Application of Virtual Planning for Three-Dimensional Guided Maxillofacial Reconstruction of Pruzansky-Kaban III Hemifacial Microsomia Using Custom Made Fixation Plate. *Journal of Craniofacial Surgery*, *published ahead of print*, 78–90.

[12] Madrid, J. A., Ortega, G. S., Carabao, J. G., Olsson, N., & Ríos, J. A. T. (2023). 3D Claying: 3D Printing and Recycling Clay. *Crystals*, *111*, 27–41.

[13] Nozawa, S., Iwai, C., Yamada, K., Fushimi, K., & Akiyama, H. (2021). Preoperative Three-Dimensional, Multiplanar Reconstruction Simulation and Virtual Laminectomy Using VINCENT Software. *Journal of Spine Research*, *12*(9), 1110–1116.

[14] Song, S., & Zhong, Y. (2021). *Exploration of Interactive Urban Sculpture Based on Augmented Reality. 35*, 1–78. https://doi.org/10.1007/978-3-030-51431-0_63

[15] Sun, W., Li, H. G., & Xu, X. (2021). Research on Key Technologies of Three-dimensional Digital Reconstruction of Cultural Heritage in Historical and Cultural Blocks. *IEEE*,

46, 55–82.

[16] Tan, J. (2021). Research on 3D to 2D atlas of tujiayang opera mask characters based on fuzzy image reconstruction. *Microprocessors and Microsystems*, *81*(81), 103666. https://doi.org/10.1016/j.micpro.2020.103666

[17] Webb, E. K., Robson, S., Evans, R., & Oconnor, A. (2023). Wavelength Selection Using a Modified Camera to Improve Image-Based 3D Reconstruction of Heritage Objects. *Journal of the American Institute for Conservation*, *62*(2), 111–128.

[18] Yao, J. C., Zhu, J., Jiang, H., & Xiang, L. I. (2023). Research on the path of urban-rural integration in ecological areas based on the realization of the value of ecological products. Journal of Natural Resources, *38*(8), 2169–2183. https://doi.org/10.31497/zrzyxb.20230815

[19] Yu, Y. (2023). Design of Urban Sculpture Artwork Pattern on Account of Smart Sensor Network from the Artistic Perspective. *Journal of Internet Technology*, *47*, 77–110.

[20] Yun, B. (2021). Design and Reconstruction of Visual Art Based on Virtual Reality. *Security and Communication Networks*, *2021*(8), 1–9. https://doi.org/10.1155/2021/1014017

[21] Zhang, W., Fu, X., & Li, W. (2021). Point cloud computing algorithm on object surface based on virtual reality technology. *Computational Intelligence*, *79*, 131–178.

[22] Ztürk, M., Paulin, E., Charbonnier, C., Dupuis-Lozeron, E., & Holzer, N. (2022). Three-dimensional reconstruction and virtual reposition of fragments compared to two-dimensional measurements of midshaft clavicle fracture shortening. *BMC Musculoskeletal Disorders*, *23*(1), 1–8.