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FEATURES OF THE DEVELOPMENT OF MODERN SCIENCE IN THE PANDEMIC'S ERA

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SECTION 22.
CULTURE AND ART

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ART OF CREATING A REALISTIC 3D PORTRAIT

In today's digital age, creating a lifelike 3D portrait has become a highly sought-after skill. With the rapid advancement of technology, it is now possible to create stunningly realistic representations of human beings that were once thought impossible. This has opened up exciting possibilities for various fields, including gaming, film, and advertising, as well as for artists seeking to express themselves through this unique medium [1]. Creating a realistic 3D portrait is a creative process that requires the artist to not only have the skill to work with software but also a deep understanding of proportions, light and shadow, anatomy, and the essence of the human face. When creating a 3D portrait, the artist must depict every detail with maximum accuracy and realism on the digital canvas in order to embody the image of a living person with their unique facial expression and features.

The paper presents issues related to the development of approaches to creating a realistic 3D portrait, discusses the choice of software, modeling methods, texturing, and rendering, as well as best practices for achieving maximum liveliness and expressiveness of the image.

Reproducing a living image on a digital canvas is not just a process of technical calculations, but also an art that requires the master's creativity and skill to convey the mood and emotions of a person through a realistic model [2]. The process of modeling a 3D portrait requires significant experience, knowledge of drawing, sculpture, anatomy, composition, color recognition, attention to detail, and expertise in computer modeling.

At the beginning of the portrait work, it is necessary to develop a concept art, a drawing of what the character should look like. To prepare for creating the image, it is necessary to gather sufficient additional material, such as anatomical illustrations and portrait photographs. Based on this material, an illustration can be created that will help in further work on the project.

To achieve a realistic image of the character, it is necessary to pay attention to every detail of the image, from the texture of the skin to the direction of the hair movement. It is important not just to reproduce the physical features of the face, but also to convey the emotional state and characteristic features of the character. Figure 1 shows an illustrated concept that will be used as a reference for further 3D modeling.

Fig. 1. **Character concept art**

With the rapid advancement of technology and software, 3D artists have been given unprecedented opportunities to realize their creative projects. Popular graphic programs like Maya, 3Ds Max, Blender, Zbrush, and Houdini [3] have become widely used for their robust features. After careful consideration, Blender was chosen for its exceptional modeling and rendering tools, as well as its extensive visualization options.

At the initial stage of 3D portrait design, sculpting is the key process for creating a highly detailed 3D model. The first step of this process is called "blocking out", which involves creating a basic, simple shape of the character without any details. This stage starts with adding a sphere to serve as the foundation for the character's head. The most fundamental sculpting tools, such as move tools, clay buildup, standard brush, and inflate, are used during the blocking out stage. Additionally, masking and polygroup functions are used to separate different areas and elements of the model. When sculpting, it is important to focus on finding proper proportions and balancing the form. Understanding the basic structure of the face, including muscles and bones, is crucial to ensure that the proportions are accurate and the model looks natural.

Paying attention to details is another critical factor in achieving realism. For instance, wrinkles and fine lines on the skin can greatly enhance the model's realism. The use of alpha maps, applied to the model's surface to add details such as pores and wrinkles, can also help create a more realistic appearance.

The subsequent phase involves adding color information to the portrait, known as texturing. Among the most prevalent and extensively utilized software applications for texturing is Substance Painter. This 3D painting program allows artists to paint and texture 3D models in real-time, making it a potent tool for producing 3D characters. Working with textures in Substance Painter encompasses various stages, such as importing the 3D model, unwrapping UV coordinates, developing and implementing materials, and painting textures onto the model. Subsequently, the artist can generate new materials or choose from pre-existing ones. Substance Painter offers a vast library of pre-made textures, including metals, fabrics, and plastics.

Creating realistic hair is an important part of 3D portrait creation. One of the most common techniques used to create realistic hair is particle systems. Particle systems allow for the creation of thousands of individual hairs that can be styled and manipulated in various ways. Blender offers several tools for hair styling, including combing, cutting, and clumping. The combing tool allows for shaping and styling individual hairs, while the cutting tool can be used to trim hair. The clumping tool allows for grouping hair together to create a more natural look.

Another important aspect of creating realistic hair is the use of textures. Textures can be used to create the appearance of different types of hair, such as curly or straight. Figure 2 demonstrates different variations of hair textures.

Fig. 2. **Different options for character hair textures**

The lighting plays a crucial role in creating a realistic three-dimensional portrait. It helps to emphasize the facial features and add depth to the image. The first step in lighting a 3D portrait is

choosing the appropriate light sources. Blender offers various types of light sources such as point, area, and spotlights, each of which affects the portrait differently. For portrait photography, it is recommended to use a combination of these light sources to achieve a realistic result.

The next step is placing the lights in the right position. For example, if it is necessary to emphasize the facial features, it is recommended to place the lights at a 45-degree angle to the object's face. This will create shadows that highlight the contours of the face. The third step is adjusting the intensity of the light. The intensity of the light affects the brightness of the image. It is important to find the right balance between the brightness of the light and the shadows. A common mistake is overexposing the image by setting the intensity too high, which can result in a blurry image without depth.

The fourth step is adding additional lighting effects, such as rim lighting. Rim lights are used to create reflections around the hair or shoulders of the object, which can add depth to the image and separate the object from the background. Fill lights are used to balance the shadows created by the main light. After adjusting the lighting, the next step is setting up the camera. Figure 3 demonstrates the finished rendering of the 3D model.
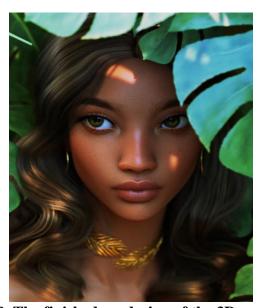

Fig. 3. **The finished rendering of the 3D portrait**

In conclusion, this work proposes recommendations for creating a realistic 3D portrait, including sequential steps for its development, selecting software, and requirements for the projected object. Special attention is paid to recommendations for finding the conceptual idea of the 3D portrait, which includes searching for an image that corresponds to the technical requirements of the project, working on realism, finding the uniqueness of the external image, creating schemes for constructing the character, and so on.

References:
1. Oliver Villar. (2014). Learning Blender: A Hands-On Guide to Creating 3D Animated Characters. 312 p. [in English]
2. Daniel Pedersen. (2017). Create a character with Blender 2.78. 3DArtist. №107. 48-54. [in English]
3. James Hyun., Creating a Stylized Viking Warrior in ZBrush and Substance Painter. URL: https://80.lv/articles/creating-a-stylized-viking-warrior-in-zbrush-and-substance-painter/ [in English]