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USING 3D ANIMATION TO CREATE A SENSE OF TIME

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Abstract. *This article discusses the importance of 3D animation in virtual reality. Explores methods for creating a sense of time passage in virtual reality. It mentions techniques such as adding adaptive 3D models, dynamic lighting, and texture mapping.*

Keywords: *3D ANIMATION, VIRTUAL REALITY, LIGHT, ADAPTIVE 3D MODELS, IMMERSION.*

3D-animation has become an integral part of our life, being successfully integrated into education, advertising, entertainment, etc. The visualization of information, from instructional videos to computer games, is being qualitatively transformed. The continuous improvement of this technology opens up new opportunities for innovation and applications in various fields. In particular, this technology plays a key role in the formation of virtual reality is an integral part of the development of virtual reality, which is gaining momentum among users and becoming more accessible every day. According to statistics, in 2025, the estimated revenue from sales of VR video games will reach $6.9 billion [1].

Virtual worlds are becoming dynamic and more realistic, which greatly enhances the immersive effect. Using 3d animation forms the basic principles of human interaction and virtual space. One of the most important aspects in creating the complete illusion of presence and immersion in virtual reality is the ability to transmit and control the perception of time. Research shows that users of virtual reality may experience a more rapid time flow during games. For example, in an experiment, participants playing the same game in virtual space and on a normal monitor spent 72.6 seconds longer in virtual reality to feel that five minutes had passed [2].

VR technology creates an immersive environment that affects the experiencer's perception, making them react to the virtual environment as if it were real. The effect of time passage can be captured in various ways, such as texture changeability, dynamic light manipulation, variability and adaptivity of models. These techniques are used both separately and together to create global environmental transformations. An example of using a set of such methods is the creation of seasonal variations.

To accurately reflect seasonal changes in nature, techniques are used: creating seasonal texture maps, performing dynamic color settings to simulate changing pigments, adjusting the reflection of light, creating separate shaders for realistic light, creating photorealistic textures and create a smooth transition between textures in real time [3]. These techniques improve the visual space of the project, creating an environment that attracts users and allows them to be comfortable there. This approach not only ensures the realism and dynamics of the project, but also allows to create unique and memorable visual worlds, which come alive and change with seasons. This method is especially noticeable when integrating various libraries of 3D models of plants. 3D animation allows you to display

changes that occur over time, such as the gradual change of color of leaves or the accumulation of snow on plants and objects. Adaptive 3D objects that vary with context and time in virtual space play a significant role in creating the effect of time transformations. The surrounding objects change, and «time traces» appear on them due to our influence and environment. It may be some kind of deformation or transformation, growth or decay. To create this effect, special collections are created with elements that display incremental changes. For example, it may be a stone monument that is destroyed or a tree that spreads from a small seedling (pic. 1).

Picture 1 – Collection for tree growth animation

The light effect in virtual reality is crucial for creating a sense of presence, which is the psychological experience of being in a simulated world [4]. Dynamic lighting best demonstrates the passage of time, as in reality we focus on the level of light. Therefore, in VR you also need to add animation of change of light during the day, its intensity and angle of fall. It is also important to consider the color of the lighting: morning time is characterized by light shades of blue and pink, and evening time corresponds to orange and purple shades3D-animation has changed data presentation, enhancing immersion in virtual reality. Techniques like dynamic light manipulation, seasonal variations, and adaptive 3D objects create immersive environments that reflect time passage. Continuous evolution of 3D animation technology offers endless opportunities for innovation and applications across different fields, shaping the future of virtual reality experiences.

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