3D DESIGN VISUALISATION USING TECHOLOGY OF PHYSICALLY-BASED RENDEING

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Project visualization has always been an integral part of design process. It helps not only to present project to an audience or client, but also appears to be a part of thinking and error resolving process on different design stages. Raw renders help more fully understand the designed object from both aesthetical and structural points of view.

Lately concept modelling and visualization became one of the beloved designers' tools, giving even-more rapid and descriptive results than hand-drawing or sketching. For presentation purposes, designers began to use powerful real-time visualization systems that can handle free movement of the viewer's position and the interaction with objects and data.

The goal of the article is to analyze rendering systems features and 3D content rendering services, find the most successful solutions for use by designers in their workflow. The application of modern visualization systems in design process today is of a great importance. Therefore, the right choice of service can make a huge increment in design workflow optimization.

Material and methods. The article draws upon Technical specifications of visualization services, statistical research of design market published online by various professional design networks in the 2017th and personal experience of the author in the industry. The following methods were used in research: method of synthesis and generalizations, method of deduction, historical method.

Results and their discussion. Not much time ago the only way to produce artistic, product and environmental visualization in 3D was non real-time photo-realistic rendering. Photo-realistic rendering places emphasis on the appearance of its output rather than the techniques used to derive it. There is no attempt to use physically realistic values for the light sources or the surface reflectances. In fact, the light sources themselves often have physically impossible values [1].

In the last decade of the XXth century an alternative solution came to the market of visual technologies: physically-based rendering. "Physically based rendering or PBR is a model in computer graphics that seeks to render graphics in a way that more accurately represents the flow of light in the real world" [2]. PBR engine generates physically accurate, high-definition, photographic output with control of all light and camera settings (focal length, aperture, depth of field, ISO setting, exposure, etc.) in real-time. But much of what makes a physically-based shading system different from its predecessors is a more detailed reasoning about the behavior of light

and surfaces. Shading capabilities have advanced enough that some of the old approximations can now be safely discarded, and with them the old means of producing art and design visualizations.

Physically based rendering was born, in part, out of the requirements of the US Department of Energy, which provided funding in the early 80's to the Lawrence Berkeley National Laboratory (LBNL) for research into new ways to use computers to simulate the transport of energy within complex spaces.

PBR has become increasingly popular over the past few years. With the development of OpenGL technology and rapid growth of graphical hardware (GPU) production real-time 3D rendering began to actively spread in our life [3]. Special popularity PBR technology gained in game development; Unity, Unreal Engine, CryEngine, Frostbite, Fox Engine, and many more game engines use it. These engines include not only visualization functionality, but also offer physics, sound, network, and interactive user input and output [4]. A big improvement to the realism of virtual environments is the inclusion of vegetation. Tree libraries are now available that are successfully used in commercial game products, architecture, landscape visualization.

In addition to game engines there is also an increasing number of asset-authoring, modelling and texturing software tools on the market like: Marmoset Toolbag, Substance Painter, Coat3d, Quixel. Game designers have already beloved Toolbag for the ease of operation, quick and high-quality PBR engine (one of CryEngine's variations) and a relatively low price tag. For the late 2 years it's gaining popularity among industrial and interior designers for presentation purposes. That is the way to generate images of the highest quality and realism, long before the products themselves have been manufactured. Later the necessary 3D model detail can easily be derived from prototyping and production tooling files. Unfortunately, the rapid development in computer game technology is almost unnoticed by the users of professional CAD software and engeneers [5].

The trend is also expanding to the web area; most of modern browsers support WebGL technology that can perform 2D and 3D rendering in an HTML canvas and therefore can handle PBR. The result is growing number of web services that use PBR in real-time to showcase 3D objects online. Sketchfab tends to be the most popular social platform today for sharing and rating one's 3D scenes in world wide web. It also became a source of inspiration to 3D artists, industrial designers and animators. Another option is to use sketchfab as an online portfolio presenting work to public and clients. One of the most vivid and remarkable features that makes sketchfab unique, and helps it to stand out from the majority of similar online services is virtual reality implementation.

PBR technology aims mostly for PC environments, so that the visualization of photo-realistic, textured landscapes and objects is now

available for almost everyone. Such applications are far more desirable then pre- generated movies that are still commonly used for presentation purposes and the demand for real-time systems steadily increases. Especially in application areas like product design, architecture, urban and landscape planning the freedom of movement that game engines offer are of great interest [6].

Conclusion. Thanks to the wide dissemination of 3D technologies and means of physical world simulation with a fairly high degree of accuracy, people engaged in designing of real life objects have received an excellent tool for virtual prototyping and visualization of their designs. In turn, the development of technologies in this area leads to an ever-increasing working process optimization and, consequently, to the improvement of final product's quality in shorter periods of time.

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