A Review on 3D Modeling

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Abstract: Making 3D models with polygon modeling is the most common technique used for a 3D animated movie production, but there are also other good modeling techniques to work with. The results showed that the model's geometry and how smooth it is to work with the modeling technique matter most for judging which technique is the most appropriate. In addition, the results show that how the light falls and reflects the surface depends on how the geometry was placed on the model rather than which of the other modeling techniques that was used.

I. INTRODUCTION

3D Modeling is the steps of taking a shape and decorates it into a completed 3D mesh. The most common factor of building a 3D model is to take a smooth body, called a primitive, and widens it into a shape that can be refined and precise. Primitives can be anything from an individual point (called a vertex), a two-dimensional line (an edge), a curve (a spline), to three-dimensional objects (faces or polygons).

It is equal parts math, geometry, and design. Using Particular software, 3D modeling brings about files that are instructions for 3D printers. Like a sculptor, architect, or builder, modeling indicates how an object or building will be established. If a blueprint is a 2D image of a building, a model is its 3D image, giving a mathematical explanation of the surface of that object.

It produces a digital object accomplished of being fully animated, making it a crucial technique for character animation and special effects.

These 3D objects can be developed automatically or build manually by deforming the mesh or otherwise manipulating vertices.

There is a need for you to know that there are 4 types of 3D models out there. Each one of them have their own editing techniques and creation, so you better be aware of it.

II. APPLICATION AREAS

3D modeling is used in different industries like film, animation and gaming, interior design and architecture. They are also used in the medical industry to create interactive defining of anatomy.

3D modeling is also used in the field of Industrial Design, wherein products are 3D modeled before describing them to the clients.

2.1 Interior Design
2.2 Film and television industry
2.3 Architecture
2.4 Medical Industry
2.5 Gaming Industry

III. METHODOLOGIES

3.1 3D geological Model

Many spatial objects in the 3D scene contain much information in order to represent different types of objects, such as vertices of the mesh, texture coordinates, and colors. The vertex and texture coordinates belong to geometric information, and the colors and textures belong to image information. One important point is the connectivity among the vertices [14].

3.2 Geometric visualization models

3.2.1 Data structure of the models

Borehole data are the main data source of 3D geological objects. They often irregularly distributed. One borehole contains several height information of strata level.

3.2.2 Subdivision of the tri-prism

The tri-prism becomes two new geometric objects after being cut, whose shape is decided by the way of cutting. To guarantee the data structure consistency during the whole process of drawing geological object, we must do the further division if the new geometric object is not tri-prism. Using the same tri-prism structure is to ensure the geological object being cut many times accurately. According to the data structure of tri-prism advanced in this paper, we categorize subdivision into complete subdivision, special subdivision, and pseudo subdivision. Each of them contains several subdivision types which are introduced as followed [12].

3.3 Self-adaptive visualization

With the development of data acquisition techniques, it is difficult to implement real-time transmission and visualization of large 3D geological models in the networking environments with the limited bandwidth. To realize that and meet the demand of data sharing and spatial analysis service, we advanced visualization of 3D geological objects with the technique of progressive transmission.

IV. TECHNIQUES

4.1 Box modeling

This is a type of polygonal modeling, where the artist uses a geometric shape, like a cube, cylinder or sphere and shapes it until the intended appearance is achieved. Box modelers carry out the process in different stages. They start with a low-resolution mesh and then refines the shape. Then they sub-divides the mesh, ensuring that the hard edges are smoothened out and add the necessary detail. They repeat the process of refining and subdividing, till enough polygonal detail is present in the mesh, that can convey the desired concept. Box modeling is one of the most common polygonal modeling techniques and is used in combination with edge modeling techniques [16].

4.2 Edge modeling

Edge modeling is another type of polygonal modeling technique, although it is different from box modeling. In this process, the modelers develop the model piece by piece, instead of refining a primitive shape. This is done by placing the loops of polygons along the outlines and filling the gaps that lie between them. This process is applied, as it is difficult to complete certain meshes through box modeling. For instance, the human face cannot be completed only through box modeling. You can collaborate with one of the reputed modeling companies to get these models designed. The experts carry out the 3D modeling process with dexterity and develop the desired models [16].

4.3 NURBS modeling

This type of modeling is extensively used in the industrial and automotive modeling processes. A NURBS mesh does not have any edge, face or vertices. These models come with surfaces that can be interpreted smoothly. The modelers can develop the concept by lofting a mesh between the splines. NURBS curves are developed using a tool, similar to the pen tool used in Adobe Photoshop or MS Paint. The modelers draw the curve in the 3D space and edit them my moving the control vertices, which is a series of handles. The curves are to be placed along prominent contours and the space between them is automatically interpolated by the software. Alternatively, you can also create a NURBS curve using a profile curve, revolving it around a central axis. This is one of the most extensively used 3D model design techniques used to design objects like vases, wine glasses and plates, that are radical in nature [16].

4.4 Sub-division modeling

Sub-division modeling is created by mixing polygonal modeling and NURBS modeling techniques. In this hybrid process, the 3D models are created through a polygon model and then it is converted into sub-division model. The artist enjoys the control over the refinement of the 3D model in certain areas. Besides, they can easily transfer these models between various software. The polygon needs to be subdivided and refined, until the details are clear enough to display the desired model. With greater subdivision, the surface becomes smoother [16].

4.5 Digital sculpting

The tech industry has integrated various 3D modeling processes, that they call disruptive technologies. The experts use advanced 3D modeling software to develop these models. The automobile industry has also evolved, with these technologies making their way into the product development and marketing strategies. Digital sculpting is a type of disruptive technology, and it has leveraged the 3D modeling process to a great extent. The modelers now need not carry out the painstaking constraints of edge flow and topography. This enables them to design the 3D models, in a way similar to the process of sculpting digital clay [16].

4.6 Procedural modeling

Procedural modeling refers to the designs that are generated algorithmically, and are not created by the artist manually. Here, the objects and scenes are developed on the basis of user defined parameters or rules. In various environment modeling packages, the modelers can create entire landscapes by modifying the parameters like elevation range and foliage density [16].

They can also choose from landscapes like coastal areas, desert or alpine. Various modeling techniques for games are used for developing 3D designs.

4.7 Image-based modeling

In image-based modeling, 3D objects are derived algorithmically from a set of 2D images, that are static in nature. This type of modeling is used in cases, where the modeler faces budgetary or time restrictions, and are not able to develop fully realized 3D images. This is one of the most common type of 3D modeling in the film industry. Over the years, image- based modeling is increasingly being used in the entertainment industry [16].

V. INTRO TO 3D MODELING TOOLS

There's no shortage of 3D modeling programs to choose from.

Whether you're looking to make animated characters, game models, or design a house, there's a program out there to fit any budget.

5.1 Maya by Autodesk is the industry standard in 3D modeling and animation.

If you were to take a 3D modeling course at a university this is probably the software you'd use. Most professional studios look for experience with Maya when hiring new talent, so any artist looking to break into the industry should seriously consider learning Maya [15].

5.2 Cinema4D

It is another very popular choice.

The learning curve isn't as steep as with Maya and it supports a more streamlined integration with tools like Adobe After Effects, making it an excellent choice for those interested in motion graphics [15].

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Blender's learning curve is quite steep, however, and the software is considered non- standard in the industry [15].

5.4 Sketch Up

It is a tool popular among architects and landscape designers.

It boasts an easy-to-use interface that makes it perfect for beginners looking to get started with 3D modeling for architectural work [15].

VI. LATEST R&D

6.1 3D modeling and rendering:

Graphics-based modeling and rendering (GBMR) is a traditional method. 3D modeling software, such as AutoCAD and Maya, can help modeling by interaction. But it is time- consuming and demands many skills for users, especially to model scenes with complicated and irregular structures [17].

6.2 Model of satellite development:

For the characteristic of satellite production primarily comes about small scale production or single-piece production. Even if custom orders two satellites belonged to the same load platform, each satellite is manufactured in its unique way according to specific requirements. In other words, satellite is essentially produced in single piece way. Usually, Satellite product organizations consist of three departments: design department, manufacturing department and AIT department. AIT department dedicates to assembly and integrated test including final assembly process design, assembly implementation, test and so on [1].

VII. REFERENCES

[1] https://www.matec-conferences.org/articles/matecconf/pdf/2016/07/ matecconf_iceice 2016_02043.pdf
[2] http://paper.ijcsns.org/07_book/200801/20080108.pdf
[3] Carlos Hernández Esteban, Francis Schmitt. Silhouette and stereo fusion for 3D object modeling. Computer Vision and Image Understanding, 2004, 96: 367～392
[4] Carlos Hernández Esteban, Francis Schmitt. Silhouette and stereo fusion for 3D object modeling. Computer Vision and Image Understanding, 2004, 96: 367～392
[5] Miguel Sainz, Renato Pajarola, Albert Mercade. A Simple Approach for Point-Based Object Capturing and Rendering. IEEE Computer Graphics and Applications, 2004, July/August: 24～33
[6] Liu Gang, Wang Zhangye, Peng Quensheng. Generating Visual Hulls from Freely Moving Camera. Journal of Computer-Aided Design & Computer Graphics, 2004,16(11),1501～1505 (in Chinese)
[7] Yoo-Kil Yang, Jung Lee, Soo-Kyun Kim, Chang-Hun Kim.Adaptive Space Carving with Texture Mapping. LNCS 3482, 2005, 1129～1138
[8] Toshihiro ASAI, Masayuki KANBARA, Naokazu YOKOYA. 3D Modeling of Outdoor Environments by Integrating Omnidirectional Range and Color Images. Proceedings of the Fifth International Conference on 3-D Digital Imaging and Modeling(3DIM'05)
[9] Livio De Luca, Philippe Veron, Michel Florenzano. Reverse engineering of architectural buildings based on a hybrid modeling approach. Computers & Graphics, 2006, 30:160～176
[10] Matthew Brand, Kongbin Kang, David B. Cooper. Algebraic solution for the visual hull. Proceedings of the 2004 IEEE Computer Society Conference on Computer Vision and Pattern Recognition, CVPR 2004, I33 ~ I35
[11] Matthew Brand, Kongbin Kang, David B. Cooper. Algebraic solution for the visual hull. Proceedings of the 2004 IEEE Computer Society Conference on Computer Vision and Pattern Recognition, CVPR 2004, I33 ~ I35
[12] Zhang L Q, Tan Y M, Kang Z Z, et al. A methodology for 3D modeling and visualization of geological objects. Sci China Ser D-Earth Sci, 2009, 52(7): 1022-1029, doi: 10.1007/s11430-009-0105-0
[13] Wu L X. Topological relations embodied in a generalized tri-prism (GTP) model for a 3D geoscience modeling system. Comput Geosci, 2004, 30(4): 405—418
[14] Wu L X. Topological relations embodied in a generalized tri-prism (GTP) model for a 3D geoscience modeling system. Comput Geosci, 2004, 30(4): 405—418[doi]
[15] https://conceptartempire.com/what-is-3d-modeling/
[16] https://3d-ace.com/press-room/articles/3d-modeling-techniques-games
[17] IJCSNS International Journal of Computer Science and Network Security, VOL.8 No.1, January 2008