Using 3Ds Max Application Create an Eyeball

Jian Gao

This paper represents an experiment report of VR (Virtual Reality) and AR (Augmented Reality) for medical learners. Four main purposes of this experiment through 3Ds Max application create an eyeball. The environment of experiment also be discussed. As well as the studies of organ in medical points of view. Two parts, two objects and three modifications as core activities for representing anatomical studies. More details about creation in experiment essential features demonstrated consequently. Thirty steps in experiment, descriptions show with screenshots. Output of this experiments would be able to understand medical learner's anatomical perspective studies, as well as medical educators introduce organ and medical knowledge to no-medical learners. Combining VR and AR to medical learning activities, as well as clinical presentations. This paper no only practices the application 3Ds Max create organ models, but also medical learning perspective discussion.

Keywords: *3Ds Max, Eyeball, Organ Model, VR and AR.*

I. INTRODUCTION

This article introduces the experimental assignment for computer course, first year medical undergraduate. 3Ds Max applications is widely used to different perspective project works [1-24]. This paper is part of the computing laboratory studies in VR (Virtual Reality) and AR (Augmented Reality). There is a theoretical learning session before as well as practice. It is combinational studies with Unity 3D software which will introduce to the learners later. However, this paper only focuses on the 3Ds Max studies.

The name of the experiment is: "You are my eyes". Experiment type is: undergraduate level of VR and AR fundamental laboratory plus application 3Ds Max modelling medical organ. Eight students each group.

II. FOUR MAIN PURPOSES

There are four main purposes of this experiment assignment:
1) Understand 3Ds Max application fundamental user frame and geometric modelling: application begin-end; file open-save; working frame allocations and installation; view windows manipulate; main tool bar common tools handling; internal geometric modelling regular methods.
2) Appling common basic modelling: familiar with fundamental modeling in 2D graph; understand structural level of objects in 2D graph; important properties; capable editing modifier of 2D graph; understand how to transmit from 2D to 3D; understand

complex modeling, Boolean operation, setting-out, graph merging.
3) Basic operation of Material and Mapping: familiar material editor, common tool, parameters, standard structure of material; understand categories and coordinates of common mapping.

Videos camera and lighting, animation generation: understand different types of videos cameras, main parameters; common type of lighting, main parameters; operational method in animation control panel, timing slider and trajectory bar, basic procedure of animation generation.

III. EXPERIMENT CONTENTS

A. Experiment environment

There are two pieces of software have been used, window 10 operation system and Autodesk 3Ds Max Simplified Chinese 64bit. Hardware requirement is must for highly graph display.

B. Anatomical studies

Experiment aims to apply fundamental modeling and complex modeling knowledge and technique, modeling built 3Ds Max operation platform, objects is human eyeball. Following is the eyeball anatomical analysis.

According to anatomical point of view, there are four main parts of eyeball need to be built geometrically, cornea, pupil, lens and vitreous body respectively. Anterior chamber, iris, ciliary body and posterior chamber also need to be considered in front of eyeball. Sclera, choroid, retina will be representing by two spheres, superior rectus muscle and inferior rectus muscle will not be considered.

Base on anatomical graph of eyeball, we divided experiment into two parts, two objects, three modifications.

Two parts:
[1] The basic sphere sharp establishing of eyeball.
[2] The material mapping of eyeball.

Two objects:
[1] Sphere, use as entire body of eyeball.
[2] Smaller sphere compares to first object, it is used for retina and choroid, as well as back sclera.

There modifications:
[1] Cornea
[2] Lens
[3] Pupil

IV. EXPERIMENT PROCEDURES

Thirty steps were planned to complete the whole experiment.
1. Open Autodesk 3ds Max application, create object;
2. Click material editor, click first sample in sample window, change name to "EYE";

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1

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3. Modify material of "EYE", click select multidimension/sub-object, change old material to sub-material;
4. Setting up "3" in multidimension/sub objects basic parameters as number of materials;
5. Change name, ID 1 for "EYEBALL", ID 2 for "PUPIL", ID 3 for "LENS";
6. We only used three material, for different objects such as eyeball, pupil, lens. The experiment proved would be able to apply various material in order to realistic and high-quality of objects. Only three because time limited;
7. Return to main operation window, click and create object Sphere (name is "EYE"), at front window view, move mouse, create a sphere;
8. Under the main operation window, input value of X, Y, Z, give allocation for objects, input (0, 0, 0) respectively, leave object at centre position;
9. Narrow down front window, press key "shift", drag sphere to right, copy and create another same size sphere, then clone optional window, select object as copy, name is "EYEBALL";
10. Right Click Mouse, select freeze current choice;
11. Select first sphere, click modifying window, under the modifier list, right click inside view window, click select editing polygon;
12. Select three level on right in left view window, please see screenshot (picture 1) below;

Picture 1

13. Then select left view window, maximum it, click and select average scaling or press hot key "R" on keyboard, move it on X axis to right, click and select move to left, sharp it like pupil, please see screenshot (picture 2) below;

Picture 2

14. Change material ID to 3, LENS;
15. Change "EYEBALL" X position to 0, "EYE" and "EYEBALL" overlap;
16. Change "EYEBALL" parameter, smaller than "EYE" slightly, radius 835;
17. We found the original colour of sphere is too shining so that visual fatigue occurred, therefore, we dark it a little bit colour of objects;
18. Use same methodology of "EYE" change "EYEBALL" in order to it has capabilities of edit polygon, select first three levels, remove "delete" key on peak, then select hidden unselected object, please see screenshot (picture 3) below;
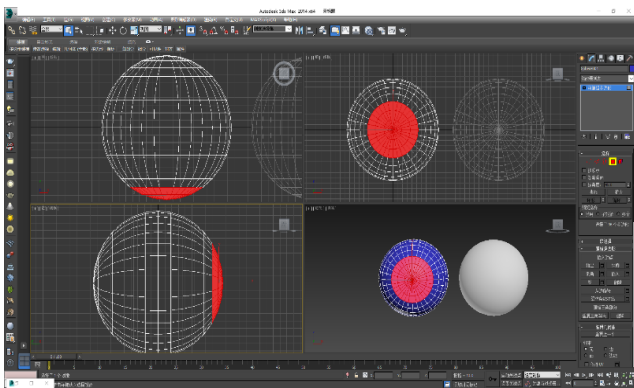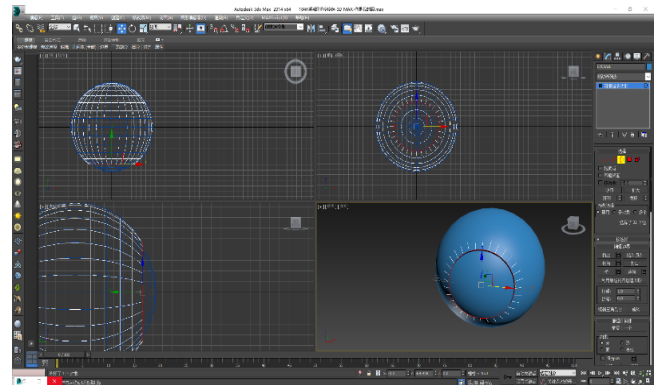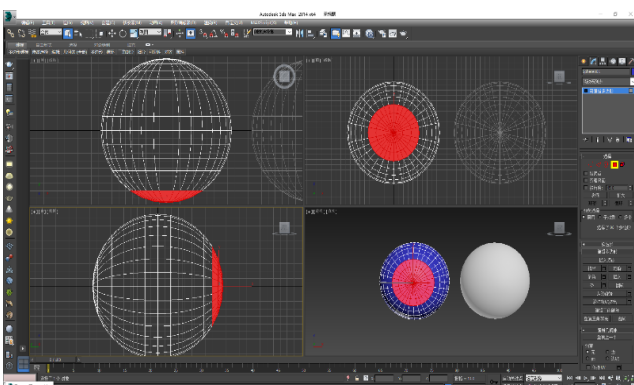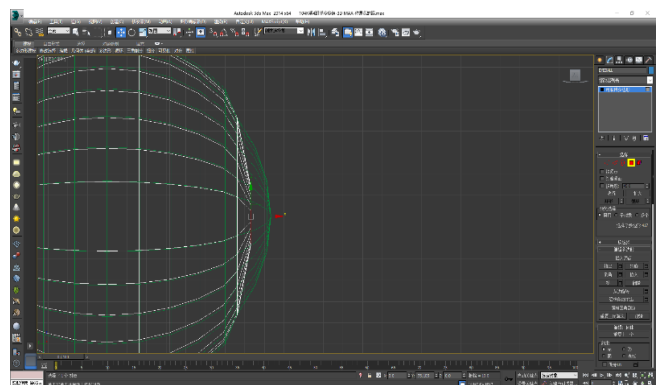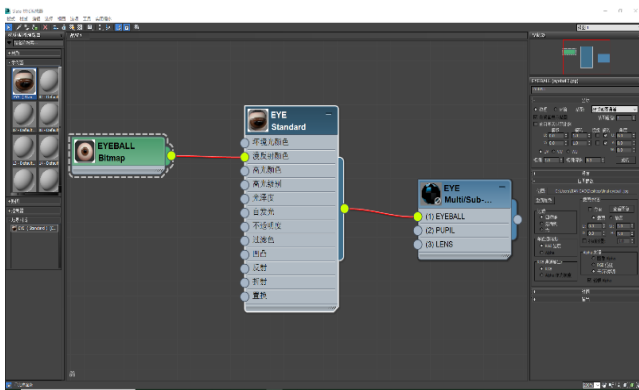

Picture 3

19. Select boundary, click seal option in windows of editing boundary;
20. Return to the option polygon, insect in editing polygon, setting up number of insects to 33, select certain;
21. Setting polygon smoothing group to 1, then select "EYEBALL" peak;
22. Select first level on right vertically, move left and right, overlap arc of "EYE";
23. Return to fourth selection in polygon option, move to right, highlights it part of it, please see screenshot (picture 4) below;
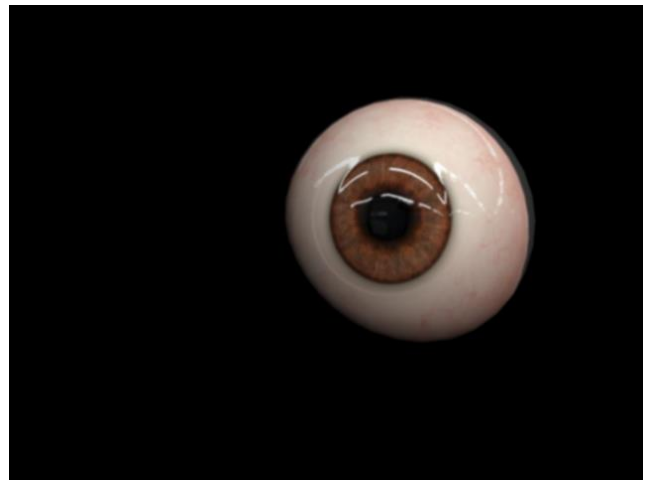

Picture 4

24. Select "EYEBALL" as polygon material ID1;
25. Hidden unselected objects;
26. Select UVW mapping in modifying list;
27. In material editing window, select material/mapping browser behind diffuse reflection of Blinn basic paraments. Select bitmap, cover the download picture on object.
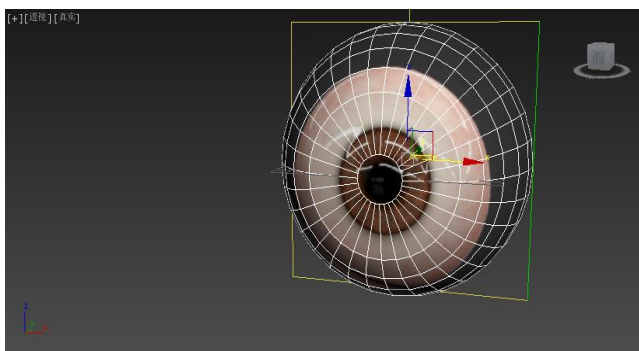
2

Click material to indicated object at first, then click shading material in window, please see screenshot (picture 5, 6) below;
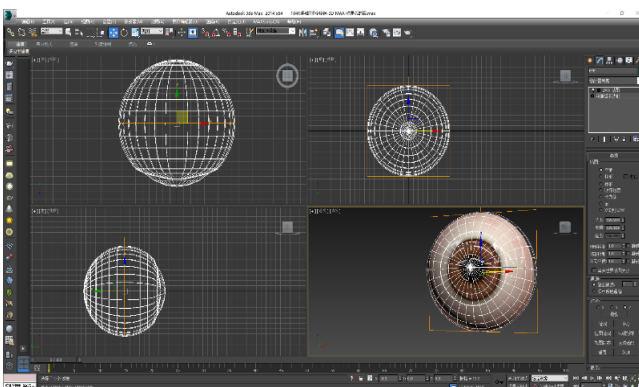

Picture 5

Picture 6

28. At axis window of bitmap, select ceramic tile value of both U and V to 0.84, pupil and corneal will see it bigger and clearer;
29. Improve quality of graph in pupil and corneal, change the size of them slightly through changing value of U and V;
30. Cancel all hidden selection, click editing polygon in "EYE", then click attached, please see screenshot (picture 7) below;

Picture 7

V. DISCUSSION AND RESULT

The final work output see screenshot (picture 8) below:

Picture 8

It is understandable we purpose to build a 3-dimension graph rather than a 2-dimension on front view. Much detail we have been ignoring such as anterior chamber, posterior chamber, ciliary process, iris, zonula, ciliary body and optic disk etc.

VI. CONCLUSION

There are many perspectives projects would be able to apply 3Ds Max application for different purpose, combining Adobe Photoshop and any other graph editing software [1-24]. This paper only represents using 3Ds Max create organ, it is part of the undergraduate course for practicing medical students combining using Unity 3D application. This studies no only shows an experiment, but also give benefit introduction to medical learners about VR and AR.

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REFERENCES

1. Coelho, G., et al. (2019). "Development and evaluation of a new pediatric mixed-reality model for neurosurgical training." Journal of neurosurgery. Pediatrics: 1-10.
2. Chung, J., et al. (2019). "Layout placement optimization methods using repeated user interface sequence patterns for client applications." Information Visualization **18**(3): 357-370.
3. Si, L., et al. (2019). "Assessment of rib spalling hazard degree in mining face based on background subtraction algorithm and support vector machine." Current Science **116**(12): 2001-2012.
4. Szelag, K., et al. (2019). "Real-time camera pose estimation based on volleyball court view." Opto-Electronics Review **27**(2): 202-212.
5. Kurbak, A. (2019). "Models for basic warp knitted fabrics Part I: Chain stitches and their applications on marquisette and weft-inserted warp-knitted fabrics." Textile Research Journal **89**(10): 1863-1885.
6. Kurbak, A. (2019). "Models for basic warp knitted fabrics Part II: single guide bar fabrics (closed-lap and open-lap)." Textile Research Journal **89**(10): 1886-1916.
7. Kurbak, A. (2019). "Models for basic warp knitted fabrics Part III: the two guide bar fabrics (Double Tricot, Locknit, Reverse Locknit, Satin, Sharkskin)." Textile Research Journal **89**(10): 1917-1937.
8. Kumar, D., et al. (2019). "A novel real-time DIC-FPGA-based measurement method for dynamic testing of light and flexible structures." Measurement Science and Technology **30**(4): 15.

9. Xiao, N., et al. (2019). "A method to evaluate the trueness of reconstructed dental models made with photo-curing 3D printing technologies." Beijing da xue xue bao. Yi xue ban = Journal of Peking University. Health sciences **51**(1): 120-130.

10. Chen, R. T., et al. (2019). "Optical Modeling and Physical Experiments on Ocular UV Manikins Exposure." Ieee Access **7**: 478-486.

11. Hu, N. T., et al. (2018). "The environmental navigation using geometric virtual reality." Advances in Mechanical Engineering **10**(6): 13.

12. Kurbak, A. (2018). "Load-extension properties of glass plain knitted technical fabrics - Part II: extensions in the course-wise and wale-wise directions." Textile Research Journal **88**(6): 667-695.

13. Sugden, A., et al. (2019). "Interactive 3D Visualisation of the Mammalian Circadian System." Advances in experimental medicine and biology **1156**: 13-39.

14. Kivrak, S. and F. R. Kia (2018). "A virtual blind spot identification system for construction projects." Scientia Iranica **25**(1): 109-117.

15. Abu-Nabah, B. A., et al. (2018). "Virtual laser vision sensor environment assessment for surface profiling applications." Measurement **113**: 148-160.

16. Liu, Y. J., et al. (2017). "Automatic Design Method and Application in Complex Ship Block Lifting." Journal of Ship Production and Design **33**(4): 283-290.

17. Leipner, A., et al. (2017). "Simulation of mirror surfaces for virtual estimation of visibility lines for 3D motor vehicle collision reconstruction." Forensic Science International **279**: 106-111.

18. Passos, C., et al. (2017). "Design of a collaborative virtual environment for training security agents in big events." Cognition Technology & Work **19**(2-3): 315-328.

19. Villa, C., et al. (2017). "Virtual animation of victim-specific 3D models obtained from CT scans for forensic reconstructions: Living and dead subjects." Forensic Science International **278**: E27-E33.

20. Zheng, Z. J., et al. (2017). "The impact of rhythm-based visual reference system in long highway tunnels." Safety Science **95**: 75-82.

21. Kurbak, A. (2017). "Geometrical and mechanical modelings of dry relaxed slack plain-knitted fabrics for the benefit of technical textile applications Part I: A geometrical model." Textile Research Journal **87**(7): 838-852.

22. Zhang, W. J. and A. J. Xu (2017). "Study on 3D simulation of toxic gas leakage in virtual subway space." Agro Food Industry Hi-Tech **28**(3): 1228-1232.

23. Im, J., et al. (2017). "Visual simulation of rapidly freezing water based on crystallization." Computer Animation and Virtual Worlds **28**(3-4): 10.

24. da Silvaa, M. L., et al. (2017). "Computer tool to evaluate the cue reactivity of chemically dependent individuals." Computer Methods and Programs in Biomedicine **140**: 139-149.

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