

# Study on development of three-dimensional contents for Education and Research in the Immersive Virtual Reality Environment

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**Abstract**—The immersive virtual reality environment (IVE) such as CAVE or Holostage etc has been applied in the education for both the undergraduate students and high school students, and in the scientific studies in the fields of the three-dimensional configuration and motion. It has been used also in the three-dimensional computer graphics (CG). The 3D objects allpied for IVE will be shown in this presentation. The tools used in the development are (1)three-dimensional visualization tool AVS, and (2) three-dimensional CG tools such as Shade, 3d max etc. The 3D contents have been visualized in the relating 3D environment (3D-PC, 3D projection etc). The application for education of these 3D contents will be discussed.

**Keywords**—3D visualization, 3D data development in the education, 3D CG objects, 3D animation

## 1 Introduction

The immersive virtual reality environment (IVE) such as CAVE, or Holostage has been used in the universities for education and research. The applications using IVE are scientific visualization and entertainment of 3D scientific configuration and 3D CG. In the present paper the development and applications using 3D visualization tools AVS and CG tools will be shown and discussed in the fields of education and research.

## 2 3D environment

Two types of development tools have been used in the present studies. The one is the 3D visualization tool AVS. The other type of tools is 3D CG software such as Shade, 3d max. Some CG tools have been developed to include the stereographic rendering. The contents developed by using AVS and the stereographic CG features have been shown in 3D environment of 3D PCs and 3D projection. They are well visualized and give the intensive impression in IVE.

## 3 Results and Discussion

### 3.1 The development of 3D configuration

The author has got the occasion to give the education extended to the high school students, organized by JST (Japan Science and Technology Agency). The attendees came from the high schools, encouraged by the JST and teachers all over Japan

In the exercise of scientific visualization by using 3D configuration, the high school students developed 3D scientific model by themselves as shown below Figure 1 shows the 3D molecular model. They are shown in IVE as shown in Fig.2.

In the other case, the cross-section of fruits are photographed (Fig.3). The cross-section images in the taken photos are processed, and then piled into the 3D configuration model as shown in Fig.4. The 3D model visualized by AVS is shown and examined in IVE as shown in Fig.5.

In this education course, the students have learned about the 3D features of scientific matters and got the experiences to

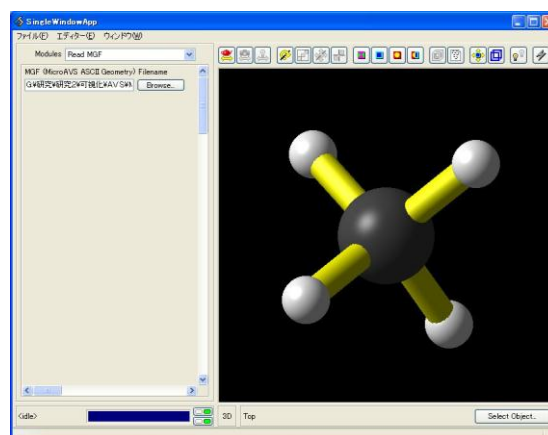


Fig. 1 Visualization by AVS of a 3D molecular model

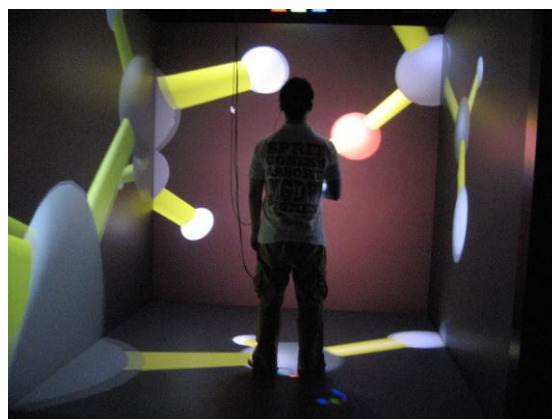


Fig. 2 Visualization by AVS in IVE



Fig. 3 Photographing of a cross-section of a fruit



Fig.6 3D visualization of mathematical surface model

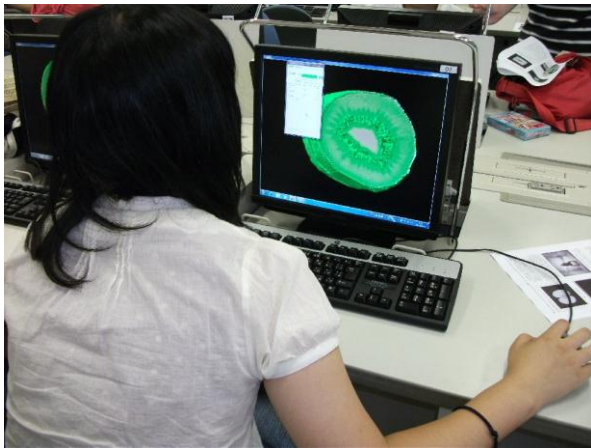


Fig. 4 3D model piled from the cross-section images



Fig.7 IVE visualization of mathematical surface model



Fig.5 Visualization of a 3D model of a fruit in IVE

observe the 3D configuration of the model that they made by themselves.

### 3.2 The development of 3D scientific model

In the research and education, 3D scientific model are examined by the AVS visualization tool. Figure 6 shows the 3D visualization of mathematical surface model shown on PC. The same 3D model is shown in IVE as shown in Fig.7.

### 3.2 The development of 3D CG model

3D CG models are now developed by using 3D CG tools that are well prepared. Those 3D models are shown in IVE through some processing and/or software tools. Figure 8 shows some sample of a 3D CG model in IVE.



Fig.8 IVE visualization of 3D CG model

## 4 Conclusion

The IVE visualization is well applied in the fields of education and research. The development and application are shown in the present paper.