Integrating Modeling and Animation Tools into an Introductory Computer Science Graphics Course

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Abstract

We report our experience of integrating a free modeling and animation tool into an introductory computer graphics class. The goal is to help students better understand the computer graphics development process and therefore inspire their long term interest in this field. We also present the feedback from our students.

1   Introduction

Animation and modeling are essential parts of computer graphics. But current introductory computer graphics courses generally do not provide students with sufficient training on those subjects. Most of these courses are designed around OpenGL based programming. However, it is difficult to create sophisticated animation and 3D models with the typical OpenGL/GLUT combination.

Advanced computer graphics tools have been used extensively in games and animated feature films. As a result, long before they take their first computer graphics course, most college students have experienced high quality computer animation and modeling created by those tools.

Because of this, the level of students' expectations about computer graphics has significantly increased. They expect to be able to create something close to what they have seen in movies and games but doing that with OpenGL requires skills and experience that they have yet to possess. In our classes, many students expressed disappointment with OpenGL's seemingly limited capabilities.

In past graphics courses we have had the students either create simple models, using 3D Studio MAX, or else download them from the web. These models were then imported into their OpenGL programs. However, all animation was done using OpenGL which limited the complexity. In the latest course we have taken a slightly different approach. Specifically, we have used a combination of OpenGL programming and free graphics tools to teach our class.

We choose to use free graphics tools because most of our students use their own computers for homework and project development. We also want students to continue using this software after they complete this course.

Recently the major modeling and animation tool vendors released free versions of their flagship products, namely *gmax* from Discreet, *Maya PLE* from Alias, and *SOFTIMAGE XSI EXP* from Avid. All three software packages are mature and have similar feature sets. All the free tools do come with various restrictions. For example, Maya PLE has a water mark imposed over shaded images. In addition, the model files created in the free tools can not be used in the commercial versions. The open source graphics tool *Blender* does not have such restrictions. However, Blender has an unintuitive user interface that is very different from other mainstream modeling and animation tools. Its documentation is also not as well developed as the commercial tools.

We decided to use Maya PLE because of its quality and reputation. Another reason is that Maya has been used in the production of many feature films and therefore students can easily relate to it. More importantly, there are large numbers of online Maya tutorials and how-to guides that can help students learn. In future courses we will continue to evaluate the options and might switch tools.

Here we report our experience of integrating Maya PLE into an introductory computer graphics class. Our motivation is to use this type of modeling and animation tool to address the limitations of OpenGL and scene graph based programming. The goal is to help students better understand the 3D graphics development process and therefore stimulate their interests in computer graphics. We will also report students' feedback to this experiment.

2   Course project design

One of the authors taught an undergraduate computer graphics course at Georgia State University in the fall 2003 semester. The class had 18 computer science major students who had no prior experience with 3D graphics programming or Maya. Only one student had used 3DS Max before.

The course required students to complete four projects and several homework assignments. The project design generally follows the guidelines described in Cunningham [2000].

- Project 1: Write an OpenGL/GLUT program that creates and transforms two 3D geometric objects – a teapot and a cube. Add an ambient light source and a diffuse light source to light the scene. Allow the user to rotate each or all of the objects.

- Project 2: Based on the result of project 1, write an OpenGL/GLUT program that applies 2D texture images to the teapot and cube models. The program shall allow users to manipulate the light source.

- Project 3: Write an OpenGL/GLUT program that displays a textured polygon mesh surface along with several 3D objects with different surface material properties. Add a spotlight source and fog. The program shall allow users to manipulate camera, spotlight, texture attributes, fog attributes, anti-aliasing, and depth test.

- Project 4: Use a modeling and animation tool to create a "Hollywood style" car-chase scene. Create a textured NURBS surface to simulate an uneven terrain. Create textured car and helicopter models. Spotlights shall be

attached to cars and helicopters to simulate headlights and search lights. Cameras shall be attached to cars and helicopters so that users can switch among the perspective view, car driver's view, and helicopter pilot's view. Create a 30-second animation in which the car moves around on the terrain model and the helicopter follows the car with its search light turned on.

The students were required to complete project 4 in four weeks. They were allowed to use 3DS Max on the lab computers or Maya PLE. All but one student chose Maya PLE.

We asked students to report their experience with project 4, which is summarized in the next section.

3   Student feedback

Sixteen of the eighteen students finished project 4 on time. Overall the feedbacks from our students were positive. They were very impressed with Maya's capabilities and regarded it as a powerful graphics tool.

In general, students found it challenging to learn Maya PLE at the beginning due to the difficulty of navigating through its many functions, features, and menu items. It took some time for some students to get familiar with multiple perspective and orthographic views. They reported that the help files and many online tutorials were helpful in getting them through the initial difficulties and the software became fun to use when they got more experienced.

The tedious and time consuming process of modeling and animation came as a surprise to many of the students. This led them to a much better understanding of the efforts behind the games and animated feature films they enjoy. The experience of this project also convinced some students that they are better at programming than using a graphics tool and therefore reinforced their interest in programming.

Most students reported that they learned a lot from this project. Many felt that this project allowed them to use what they had learned in this class in a real world setting. Most importantly, many students reported that this project inspired their interest in computer graphics and expressed their intention to continue learning it in the future.

The following comments are quoted from students' feedback.

- "I had no clue how to do anything at first. But when I started reading the tutorials, watching the tutorial movies and getting help from people, I became familiar to the basic concepts of Maya. I actually enjoyed working on the project. Now I know a lot more about animation and I wished we had done more projects using Maya."

- "When I began the computer science program, my goal was to be an animator. I wanted to one day make a feature film. However, after doing this project, I have reassessed my ambitions. The first lesson I learned was that I am a better programmer than a modeler."

- "Maya software is very interesting. I enjoyed working with the modeling tool and hope to have more time in the future to work with it more."

- "One of the lessons I learned from this project is that one can learn how to use a certain program by exploration and patience, which is mostly how I learned to use Maya. Another is that school can be a lot of fun, especially with projects like this."

- "Maya can create many fantastic animation and graphics that is unbelievable and I'm glad I know how to do little bit of that. I learned great deal about how today computer animation is done, and animators deserve great deal of respect."

- "Most of the concepts I learn in the Graphics Algorithm class was reinforce by working on this project. With this project, I have a chance to learn the basics of mainstream 3D modeling and animation tools. It gains my interest in computer graphics."

- "After this project, I feel like I have a much better understanding of 3D animation. I now have a new appreciation for computer graphics."

4   Summary

We have reported our experience of integrating free graphics tools in teaching an introductory computer graphics course. Students studied rendering topics through OpenGL programming and animation and modeling topics through graphics tools. This gives them a more balanced view of computer graphics. Our students reported that using graphics tools reinforced what they had learned in the class.

Most students prefer to use the free graphics tools such as Maya PLE despite its restrictions. They can install free graphics tools on their own computers and continue to learn after they finish the class.

One of the most important goals of an introductory computer graphics class is to inspire students' interest in the field. Our experience has shown that graphics tools like Maya PLE can help stimulate students' long term interest in learning computer graphics.

Finally, this experiment once again demonstrates the need for adapting the computer graphics curriculum to technology advances as well as the ever-changing student expectations. A future development might be to allow the students to create the models and animations in the tools and then export them into an OpenGL program, as is done in game development.

References

CUNNINGHAM, S. 2000. Projects for a Computer Graphics Programming Course, In *ACM SIGGRAPH 2000 Conference Abstracts and Applications*, 56-59.