

# Deepening assignments in computer graphics courses

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## Abstract

We discuss deepening assignments as part of a graphics course where students are allowed to choose their assignments according to their own interest. This gives the students the possibility to adjust the course in the diversified and growing field of computer graphics.

## 1. Motivation and general ideas

Computer graphics is a diversified and growing field. Students typically attend the graphics courses with different interests and motivation. It is usually within the limited time available not possible to cover all the topics that some students may want to hear about.

A possible option that we use to satisfy the wishes from students is to let them have a deepening assignment with a topic of their own choice.

## 2. Courses at our school

The deepening assignment is usually done as part of the second computer graphics course. Short descriptions of our first and second courses are given below.

### 2.1 Computer Graphics and Interaction

A course that gives a broad introduction to computer graphics and human-computer interaction, ECTS Credits: 6, course book: Angel 2003.

Content include: Applications, standards, raster graphics, fundamental algorithms, 2D- and 3D-transformations, projections, viewing, hierarchical graphics structures. Overview of hidden surface removal, lighting models, modelling, antialiasing, fractals, color, multimedia, visualization, and animation. Human-computer interaction: Fundamental principles, language, models and metaphors, human capacity, graphical user interfaces (GUIs).

### 2.2 Advanced Graphics and Interaction

A course focusing on computer graphics and interaction, ECTS Credits: 9, course book: Watt 1999.

Content include:

Animation: Different methods to describe animation, object orientation and constraints for animation, tools to build animation, morphing.

Rendering: mapping techniques, photorealistic rendering, radiosity, fractal methods.

Virtual environments (VR) and 3D interaction: different models for 3D interaction, hardware for 3D and VR, possibilities and limitations for VR, methods, tools. Multimodal interfaces: several modes in interaction, sound interfaces, haptics.

Perception: the human visual system, colour, perceptual graphics.

The second course includes the 3-credit assignment discussed in this paper.

## 3. Character of deepening assignments

The assignments may be more implementation oriented or more paper oriented.

The students usually make one assignment of each character or they may combine the two into one assignment where they write about a problem with references to literature and then make an implementation in relation to the problem.

## 4. Examples of assignments

Below we give a list of examples of topics that have been used in the assignments done by students.

- ray tracing
- radiosity
- photon mapping
- continuation of modelling assignment (usually in Maya)
- continuation of graphics programming assignment (usually OpenGL)
- particle systems, including smoke animation, fire animation, fire works etc
- flock behaviour etc
- perceptual aspects, design guidelines, color use/advice
- fractals, such as Mandelbrot, Julia curves, L-systems
- image based rendering
- non photo realistic rendering, including cel shading etc
- animation
- comparison of graphics system such as OpenGL and Direct3D
- multimodal interaction (sound, haptics,...)
- shader languages
- algorithms, such as collision detection, shadows, antialiasing etc
- applications, such as games, landscape generation, plant generation, chemistry, GIS

One general experience is the importance to find a good specification of the assignment so that it matches the 80h of work that is expected.

The result of the assignments are presented at small seminars with 5-10 students.

## 5. Experiences at Nada

Often students who can choose an assignment using their own interest spend much time with these assignments. There are examples of students who have used the assignments as an introduction to their master thesis work. One group used it to implement a computer game that they brought to a game competition which they won.

For some students we have observed the need for extra guidance although they are usually expected to manage on their own.

We have also seen that many students do these assignments late in the course.

## 6. Problems

One crucial issue is the exact choice and specification of assignment. Usually specification should be taken care of by the student, who sends the specification to the course leader asking for comments and acceptance. This should of course be done in advance before the work starts. One problem may be that the student starts without having a final acceptance from the course leader.

Usually the students are expected to work on their own without very much guidances (except in the beginning when specification is done). If they face problems, it may not always be straightforward to help them with a good turn-around time. The

problems may be programming problems of various kinds. There may also be problems with for instance finding relevant literature.

Another problem with these assignment has been that the students usually do the work at the end of the course or even after the course which means a delay with passing the course. Explanations to this is that the students try to take too many courses and finally realize that they have to postpone some part of the courses. We have met the problem with bonus points for the grade in the course when the assignment is finished before a given date. We also keep reminding them with emails.

## **7. Conclusions**

We have found that students appreciate the possibility of choosing part of the course content themselves. They can adjust the course according to their own interest. Trends and the latest developments in the area can also be included easier.

One drawback that we have found is that students often don't finish the deeping assignments in time. Due to their interest in the topic of their own choice they may also spend more time than expected with their assignment.

We also sometimes realize that we need to allocate more time for guidance of these assignments.

In summary we think that the deepening assignments represent a valuable part of our graphics courses.

## **8. References**

Angel, E, Interactive Computer Graphics, Addison-Wesley, third edition, 2003

Watt, A, 3D Computer Graphics, Addison-Wesley, third edition, 1999

Web pages for the courses (mainly in Swedish):

<http://www.nada.kth.se/kurser/kth/2D1413/>

<http://www.nada.kth.se/kurser/kth/2D1323/>