Powers of 10: The Case for Changing the First Course in Computer Graphics

Steve Cunningham
California State University Stanislaus

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Computer graphics has not been seen as an essential topic in the small college curriculum for many reasons.
Conventional wisdom says

- Computer graphics is a difficult subject that requires a lot of mathematics and mastering highly technical algorithms
- Computer graphics is only about synthesizing realistic images
- All the computer graphics students need to know is how to run the right tools and applications
But I believe that...

- Computer graphics does **do not need** to be an especially difficult subject
- Computer graphics courses **does not need** to require a focus on technical algorithms
- Computer graphics courses **can** focus on visual communication instead of realism
- Students **should** know the basis for graphics just as they should know the basis of calculus
My goal: to create a computer graphics course that serves a broad student audience and is still a sound computer science course
Whom does the course serve?

- Shift the emphasis from developing graphics specialists to developing a broad group of students with graphics skills.
- Students can come from mathematics and science or from many other fields, depending on the focus of the institution and department, and student breadth improves the course.
- Computational science is a natural!
The computer graphics course creates many opportunities for collaboration between fields and is a natural bridge between computer science and other areas of campus.
The revised course focuses on the top of the pyramid instead of the bottom.

Diagram:
- High-Level Graphics
- Users
- App & Tool Developers
- Sys Dev
What is the revised course like?

• The focus is on graphics programming and sound graphics concepts and principles instead of graphics theory, algorithms, and techniques

• The course uses a standard programming API, such as OpenGL, for its work

• The course lectures discuss graphics concepts, while the course projects allow the students to work in their individual specialty areas
What are the prerequisites?

• Sound programming skills, and an ability to see the geometry in the world around them
  – Programming skills means roughly B or better in two programming courses
  – Seeing geometry requires simple spatial abilities that don’t come from coursework but may be picked up from the students’ work in their fields, especially science/math
Course projects

• Projects are based on a sequence of topics:
  – Simple geometry and color
  – Lighting/shading, transformations, callbacks
  – Event-driven programming, user control, interface
  – Clipping, transparency, texture maps, splines, ...
  – Object selection and interaction with image

• Project include problem statement and summary of project results
The traditional computer graphics course is

Geometry → Rendering → Display
while we want the more complete
Some possible student projects
Who wins with this approach?

• Computer Science wins because we serve our colleagues and our universities better (and we get a broader student base),
• Students across campus win because they get a good background in the computer graphics they need in their professional work
• Computer science students win because they get useful professional skills and a good start in graphics
What’s the follow-on course?

- A second graphics course presents the traditional graphics algorithms and techniques. The new introductory graphics course allows this second course to move very quickly, and at its end students are as far along as with a traditional sequence.
- Other courses could build on the intro course to serve other groups of students
Contact information:

• Email address is rsc@cs.csustan.edu or cunningham@siggraph.org

• Draft materials are online at http://www.cs.csustan.edu/~rsc/NSF/

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