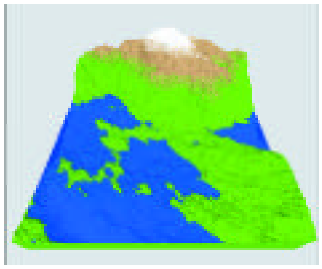
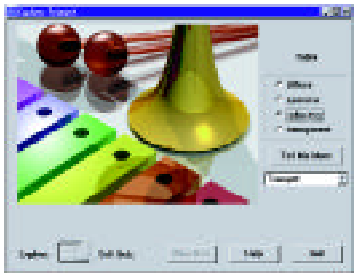
GVE ’99
Eurographics/SIGGRAPH Workshop on Graphics and Visualization Education

The Graphics and Visualization Education Workshop (GVE ’99), held in July in Coimbra, Portugal, was a joint Eurographics/ SIGGRAPH event and was partially supported by the National Science Foundation. It assembled 44 colleagues from 12 countries to consider the future in computer graphics education. Among the workshop themes were curriculum for computer graphics in computer science and in art, development of computer graphics for teaching, interaction, and collaborations between disciplines and institutions. These will be followed up by more detailed publications in *Computer Graphics* and *Computer Graphics Forum* and by presentations at several conferences. This paper summarizes the workshop themes, and complete information is at `www.eg.org/WorkingGroups/GVE/GVE99` and `www.education.siggraph.org/conferences/GVE99/`.

Computer Science





The discussion of computer graphics in the computer science curriculum began by considering introductory computer graphics courses for computer science majors. This working group considered the job market, prerequisite knowledge, and skills students should acquire in this introductory course.

In spite of many changes in the way computer graphics is done in the computer science world, the rendering pipeline continues to be of enduring importance. Its treatment will, however, vary depending on the course goals. If a student is taking only one graphics course, the concensus is that a top-down approach using a high-level API is appropriate, and instructors should examine selected aspects of the pipeline (modeling, viewing, rasterization, display) in detail.

The working group agreed that computer graphics is fundamentally interactive. Event-driven programming is an essential component in any introductory course. Similarly, the working group agreed that computer graphics is fundamentally visual. Unlike most of computer science, algorithm analysis in computer graphics must not only consider space and time aspects, but also a user’s perception of the output in the context of the user’s goals. Students should learn to consider an image’s appearance when choosing such things as shaders, color, and level of detail in modeling.

There is also a need for a two-semester undergraduate sequence for students wanting a career in graphics, and this group will explore topics and approaches for this format. There seems to be a trend to begin with an overview and then treat topics in more depth in the second semester, often using pre-defined modules. In this context, computer graphics has a rich potential as a capstone course. It can draw together work from a variety of disciplines including computer science, mathematics, physics, psychology, and software engineering.

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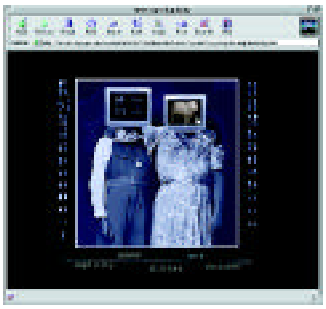
Arts



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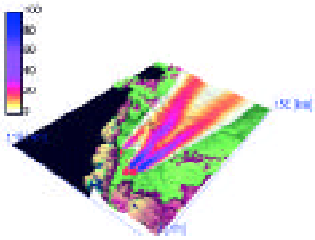
The defining nature of technology in the arts is constant change, and arts curricula should be flexible enough to adapt to new developments. Computer arts allow a diversity of expression and educators are encouraged to determine whether a general or a specialized focus is appropriate within their courses and curricula. These curricula may encompass diverse topics that span various disciplines including computer science, film, music, and psychology. Educators are urged to build their curricula on several principles:

- focus on creative and technical concepts rather than just hardware and software,
- provide a historical and theoretical context for the development of computer arts and digital technology,
- provide an environment that stresses problem solving skills and learning resourcefulness,
- encourage students to develop both individual and group communication skills,
- emphasize the fundamentals of visual language important to all artistic disciplines, including those that use the computer, and
- include digital concepts as well as an overview of the variety of expression possible with the computer in introductory computer art classes.

Educators are particularly urged to encourage the introduction of digital visual concepts within art foundation education.

Other issues that continue to be very important include limited equipment and faculty resources, questions of basic competency of incoming students, and objective assessment of student work.

Computer Graphics for Teaching



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This working group, with participants from many disciplines who teach at different levels, discussed challenges in using computer graphics for teaching. These included problems in finding existing high-quality resources and connecting with others doing similar work. There is also typically less reward and recognition for creating and using computer graphics in teaching than for research, and it is very difficult to measure those methods' effectiveness.

To help educators find resources, SIGGRAPH and Eurographics should jointly support a portal for reviewed or refereed modules and other teaching materials, a collection of best practices in using computer graphics to teach in all disciplines, and a searchable, annotated, moderated list of URLs containing additional graphics-based teaching materials. There is an immediate need for a multi-national review committee to assure that materials on the portal are of high quality.

In the long term, a refereed journal for articles on computer graphics and teaching is needed to put the credibility of teaching on the same level as research. A first step will be to compile a list of current journals having educational sections. Next, in order to show that there is both a supply of good material in the area and a demand for such a publication, a book will be developed, *Computer Graphics: Tools and Techniques for Teaching*, similar to the very popular series of *Graphics Gems* books.

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Interaction

The question of interaction ran throughout the topics above. Current graphics APIs and tools open opportunities for education in interaction. 3D navigation and selection enable understanding of complex visual data and are essential for multidimensional explorations.

There is no short answer to the question of where students should learn about interaction. It has components in a number of disciplines and involves many modalities, so designing interaction requires knowledge of computer science, communication, design, psychology, and ethics. Furthermore, research is needed in interaction techniques and technologies, and the working groups encourage such research to open new doors for our users to interact in visual settings.

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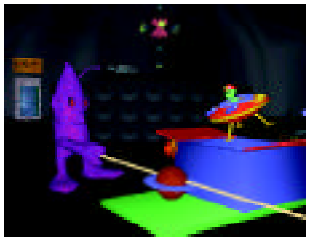
Collaboration



Another consistent theme in the workshop was collaborations in education. These can be simple collaborations between students in group projects, collaborations between disciplines at the same institution, collaborations between individuals or groups at different institutions, or collaborations between institutions and industry. Such collaborations raise a number of issues in supporting technology, in working across disciplinary cultures, in managing language, cultural, and time differences, but are seen as powerful tools to expand the breadth of a student's experience. The unique role of computer graphics in such collaborations is in either content or supporting technology, with important needs for development of networked graphics to take advantage of the possibility of shared environments.

Collaborations (multi-disciplinary, multi-cultural, or industrial) can lead to more effective international communication. These collaborations may include students working together, or teachers collaborating on a course, although they are geographically separated. Such a course may be interdisciplinary, or it may be within the same discipline with students in different locations. High-performance networks are essential in classes where students are interacting globally. Students may communicate through simple tele-conferencing, sharing animations or complex graphical objects, or entering a "shared reality" to explore together in a networked, tele-immersive environment. The appropriate hardware and software are important, as are the local, national and international networks.

Credits

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