Campfire Stories: Production Process of 3D Computer Graphics Applications – Structures, Roles and Tools

Why would a group of 34 computer graphics experts meet in June 2002 way up in the Rocky Mountains? Why would they isolate themselves far away from any town in Snowbird, Utah? Why were these people not arrested for making a campfire in an area where campfires are usually prohibited? Well, because these people participated in an ACM SIGGRAPH and Eurographics Campfire. Spending four days together, being away from any distraction and having time for highly interactive discussions about an important topic that is interesting to both industry and academia are all major characteristics of an ACM SIGGRAPH and Eurographics Campfire event. One of the two campfires this year, the June event was entitled "Production Process of 3D Computer Graphics Applications – Structures, Roles and Tools." Below is information on the outcome and background of the campfire – and some campfire stories.

While nearly all computer graphics conferences and workshops focus on the underlying algorithms, methodologies, techniques and hardware, we wanted to focus on the process of how 3D computer graphics applications are actually produced. What does the current production process of computer games look like, for instance? How are they designed and implemented? What roles are involved? Does the process look the same in all companies? And how does it differ from an "academic" production process? What is the difference between producing a virtual reality application, a mixed reality application, a visualization and a computer game? What are current problems of the production process? What is missing? What are the economic constraints? What technological developments do we foresee impacting the way 3D computer graphics applications will be made? What conceptual levels are there (e.g. for defining the behavior of a human figure) anyway?

...except for ACM SIGGRAPH.

June 2002 Campfire participants.

An outdoor Campfire demonstration.

The participants of the campfire came from academic institutions all over the world (from Austria to Australia) as well as from different companies. Since many disciplines are involved in the questions raised, the participants of the campfire had various backgrounds: artists, storytellers (very valuable for a campfire!), designers, animators, modelers, game developers, teachers and computer scientists (computer graphics, human-computer interaction, artificial intelligence, software engineering) were present. Interestingly, the variety of backgrounds itself became a topic of the campfire. How do these people cooperate and how do they communicate in the current production process? What has to be improved? How should people with different backgrounds communicate in order to produce something together? Is there a chasm between artists/designers on the one hand and engineers/technicians on the other?

And if so, how can we overcome it? Is there also a chasm between researchers and practitioners? How can the research community contribute to solving the problems of people in the field? Conversely, what can researchers learn from them?

Fortunately, the people affected by the problems mentioned above also potentially have the power to solve them. So, while the first part of the Campfire was used to identify the state-of-the-art, the third day was spent discussing ideas, improvements and solutions. The last day was about visions and future work. Three working groups were formed to deal with the following topics: the usage of new technology for authoring purposes, innovative authoring tools and organization of the authoring process. In addition, position statements, paper presentations, demonstrations, panels and roundtable discussions were good opportunities to tell campfire stories. Here are some of those stories.

A Campfire working group session.

Some Campfire Stories

Michael Wahrman told several stories about the traditional production process in Hollywood, like a story about very talented animators who are forced to use mostly off-the-shelf packages and processes chosen by their facilities for their creative work. Especially for technicians, his talk was helpful in providing a non-technical perspective on computer graphics. Based on a primary characterization of production in Hollywood, a lively discussion ensued on how the culture of traditional production has evolved since its early days.

In contrast to this traditional production process, Adrian Cheok presented a possible production process for mixed reality (MR) entertainment applications. He illustrated its usage with three examples where users apply tangible computing techniques to interact in a virtual space. For his production, he used a video capture system for MR applications, where an arbitrary subject is captured from several angles by 15 video cameras.

"10 Myths of interdisciplinary work" was the title of Ulrike Spierling´s talk about the chasms separating the fields of science/engineering and the arts/humanities. Her pointed statements about prejudices in interdisciplinary work like "Myth #3: Tools for designers have to be usable in a way that they do not need explanation," or "Myth #8: Algorithms for interaction have to be created by programming people" were controversially discussed. She tried to convince the audience that people should have more confidence in the artist and should give them more control, even concerning the technical layers of a production.

Randy Pausch demonstrated a production process with his 3D interactive graphics programming environment Alice, a scripting and prototyping environment for 3D object behavior. He reported that his system is used successfully in interdisciplinary courses, where students from arts, design, drama and computer science have to develop games within a two-week (!) time frame.

Maic Masuch and Stephane Natkin reported about graduate and postgraduate courses on video game design and production that also have significant practical segments, allowing hands-on experience similar to commercial projects. They told stories about students who underestimated the amount of work necessary for the creation of their games. These practical segments are important for the students to learn to cope with restricted resources. One goal for artists and computer scientists is to learn from one other in combined courses about software engineering, computer graphics, psychology, design and artificial intelligence.

Ken Perlin demonstrated what a high-level control tool for a very specific domain (interactive virtual actors) could look like. Basic techniques for character animation, like inverse kinematics, are used to build an articulated figure. An abstraction allows the author to direct a character in specific positions and poses. The system includes higher level controls like "slump shoulders" as a single degree of freedom parameter. Another level of abstraction is provided by Perlin's "body language shaders" that easily allow a virtual character to convey emotions like sadness, anger, etc. A domain expert can easily experiment with the control parameters using the tool and get responses in real time.

David Ebert also showed a gain of parametric control using procedural techniques. In a procedural approach, rather than explicitly specifying and storing all the complex details of a scene or sequence, he abstracts them into a function or an algorithm (i.e. a procedure) and evaluates that procedure when and where needed. His talk raised an interesting discussion about the influence of new graphics hardware on the production process in general and how new features like vertex and pixel shading can be integrated using abstraction layers.

Don Brutzman demonstrated x3D-Edit as an authoring tool for Extensible 3D (X3D), an XML-based specification to express geometry and behavior capabilities of the Virtual Reality Modeling Language (VRML). This editor was built to enable simple error-free editing, authoring and validation of 3D scenes. It is an example of what tools for the production process of 3D applications can look like and how a production process can be unified by a standardization of the underlying technologies.

In addition to the work mentioned above, many other interesting campfire stories were presented. In particular, working in groups fostered discussions about new paradigms and open issues like the question of how technology might look like if its development would be driven by the goal to improve and

simplify the authoring process in contrast to the main technology development, which is driven by the question of what can be achieved and how it can be achieved with better performance. A highlight of the coffee breaks was to take Bruce Thomas' backpack to play ARQuake, an outdoor augmented reality version of the game Quake.

Wrapping Up

During the four days, three main areas of interest were identified: design issues, technology and applications. Rather than collecting solutions, the campfire identified a number of issues and raised important new questions. Some of them are presented in the following paragraphs.

The question of whether there is a process model available for 3D application design was hard to answer. Due to the variety of 3D applications, no general process model exists so far but specific approaches for selected domains were discussed. The VR Juggler approach, for example, uses different prototypes (research prototype, application prototype) that are iteratively tested, refined and combined with content elements that are developed separately. Process models for 3D applications in the production industry mainly focus on clearly defined steps that can be automated (e.g. object reduction, model conversion, data handling). The approach presented at the campfire combines iterative prototyping and storyboarding with a suitable process model for training purposes. The resulting discussions raised the question of how a process model for specific 3D application domains can be developed. It still remains unclear how solutions from other 3D domains can be adapted and what is needed to establish such models for commercial purposes.

One result of the discussions about tools was the agreement that many authors would make use of interactive 3D content if it was easy to produce. This would allow, for example, domain experts to enhance their presentations with 3D. Many domains, e.g. in medicine, production and marketing, could benefit from this. These users are mainly domain experts and not experienced 3D programmers, and they need appropriate tools to use 3D as a creative medium. Unfortunately, current 3D tools (with few exceptions) are not usable by laypersons, because they still focus on controlling low-level parameters. Ken Perlin's and Randy Pausch's systems were a convincing demonstration of what high-level control for interactive virtual actors could look like. The question was raised of how we can build general tools that use an approach similar to these systems. Is it possible to develop complex interactive 3D applications with visual tools - completely without programming?

One central aspect of the campfire was the application of software engineering principles to the design of interactive 3D applications. A number of presentations concentrated on questions like "What should VR middleware look like?," "What is required for a suitable 3D component system?" or "Is it possible to define visual design patterns?" The idea of reusable 3D elements is not new, but to date, most approaches are of an academic nature and focus on isolated aspects. Game design seemed to be an exception, as the campfire discussions showed. Computer game development has a long tradition and has significant resources available. Many designs for game engines are very innovative and the participants agreed that it is important to consider whether such concepts can be applied to other domains in 3D authoring.

It was interesting that many participants—programmers, as well as designers—mentioned scripting as a very important issue for 3D production. This raised the question of why scripting is only provided in a few approaches and how it is possible to combine scripting, programming and visual tools in a unified approach for 3D authoring.

In summary, it became very apparent that authoring is a complex topic in and of itself and many facets could only be discussed briefly. The questions raised show the importance of further workshops, conferences and discussions in this field to find suitable answers. The participants agreed that the campfire's topic is important and that there is no regular event that addresses these issues.

More information about this campfire, links to the participants' talks and to the workshop proceedings can be found at **http://www.agc.fhg.de/campfire.**

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Christian Geiger

Paul Grimm

Michael Haller

they showed the simple skinned version as he swung through a city street lined by skyscrapers, followed by the grid underlying the same scene. Next was a strange version of sparkly colored lights without an under skin. Finally they showed the final version from the movie.

It Begins with Drawing

I found myself standing by the Pixar booth staring at a huge monitor with a scene from *Monsters Inc*. Each hair on the character was a long thin cone rendered with light and dark value to give it volume. Then there were tiny highlights, which caught on the edges of the hairs. There appeared to be thousands of hairs and they all were rendered and caught incidental light and they all moved with the character's motion. It was fantastic. I could not imagine drawing and describing the form and incidental lights in a single position, let alone in motion. A person in the booth asked me if I had questions. I was confounded for a moment because I know so little. I asked him how something like *Monsters Inc*. is started. He replied, "By drawing." He said all characters are drawn for initial concept and then sculpted before they are digitally modeled.

I stopped at the DreamWorks booth and focused on a poster of a movie scheduled to come out in a couple of years. The poster featured a turtle on a rock in a sunny landscape. What caught my attention in this poster was that it looked like a pastel drawing, not a computer rendering. One of the DreamWorks' representatives also asked if I had questions. So I asked him if it was a drawing. He replied that it was and that all of DreamWorks' concepts are done initially in traditional mediums. The characters are drawn or painted and storyboards are drawn first before the piece is produced by the computer modelers and animators. The character and look of the original art is maintained throughout production. He said that in hiring, DreamWorks prefers people with training in drawing even if they are looking for a 3D modeler. He said that they are better at modeling if they are able to draw.

This conversation was making me feel much more comfortable. Here at SIGGRAPH I was surrounded by this world of hardware and software and the fantastic images, which imitate visual reality so believably, and all I do is draw. I could not model a cylinder on a computer. It is not my medium. But computer animations and the reality of form, space light and motion created by them fascinate me. It all just seemed so far away from my skills until I talked to Pixar and DreamWorks.

I love drawing. I have come to realize that a person learning to draw is really learning how the human brain sees and understands visual reality. As I looked at the images playing from monitor to monitor, I could see the drawing basics in every image. I could observe the use of light and dark, perspective and ellipses to create the illusion of form, and the use of overlap, linear perspective, change in size or relative scale, focus and atmospheric perspective to show space. I was aware of the manipulation of color to create mood or emphasis. Color is the most emotional of the visual elements and the producers of animations use it as effectively as the film industry does.

The Lessons Learned

The opportunity to experience SIGGRAPH was wonderful. I have taught for a long time–30 years. There are times that I wonder if what I do has any meaning. I teach the basics. I do not even work with students near their graduation. Seeing the incredible products of the digital art world gave me great feedback. I am able to see the art lessons we have all learned applied and developed to the highest level of production.

The work that is being done all over the globe in animation is tremendously creative. This will be one of the art mediums that will be remembered for our time in the future art history books. My thanks to all of those people who have developed this industry and the opportunity to experience this convention. It was unbelievable.

Helen Webster is a drawing instructor at The Art Institute of Pittsburgh in Pennsylvania and has been teaching there for the past 30 years.

The Art of Process | The Process of Art

Each year, the ACM SIGGRAPH Art Gallery selects an evocative theme as a focus for the fine art exhibition. The theme is meant to elicit a forum for discussion of the nuances and trends in the arenas of fine and digital art. Each year, ACM SIGGRAPH attempts to convey what is relevant to the current atmosphere in the art community and, more importantly, to investigate the larger scope and direction of work being produced.

This year's Art Gallery Chair, Karen Sullivan, chose to engage the idea of 'process.' Describing a desire to "look behind the scenes to see how art is being produced" in the 21st century, she is interested in how the digital artist creates. What is the spirit that inspires the artist? For many artists, the process of creating often involves deliberative iterations, where the resulting artwork is imbued with the contemplative processes that have produced it.

Another important question raised in this year's Art Gallery was how will the expression of process affect the perception of the audience towards work? The ACM SIGGRAPH Art Gallery featured more than 60 works that included 2D and 3D interactive installations, sculptures, 2D artwork, animations and art papers addressing the creative process. All the pieces traced the conceptual, creative and technical processes involved in creating the artwork with a display of artists' notes and process drawings adjoining the exhibits.

Among the work featured were seven 'working artists' who produced their pieces inside the exhibit as part of the exhibit. While fairly unconventional, these artists and their creative processes made for a very active and vibrant Art Gallery. The process that brings life to these works reveals not just a vision, but at times the turbulence, the trials and the, sometimes fortuitous, errors that all contribute to the process of art.

What follows are excerpts from three of the 'working artists' own descriptions of their work detailing their process and how they planned to produce work - while being viewed at the SIGGRAPH 2002 Art Gallery exhibit.

Lily Shirvanee
Media Arts and Sciences Program
MIT
Web: **http://web.media.mit.edu/~lilys/**

The Choreography of Everyday Movement

By Teri Rueb

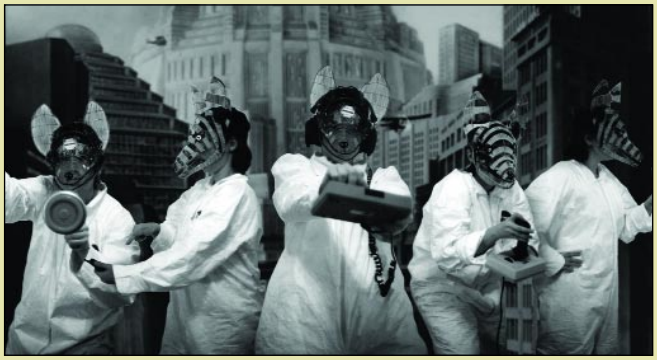
Teri Rueb's work, *The Choreography of Everyday Movement*, tracks participants movements via a global positioning satellite and transposes the "trail of movement" visually as a dynamically evolving drawing generated in real time. The drawings are recorded onto transparency films and stacked between plates of glass. Rueb describes her process as a performance that is "articulated as live and archived elements in the exhibition."

TextArc

By W. Bradford Paley

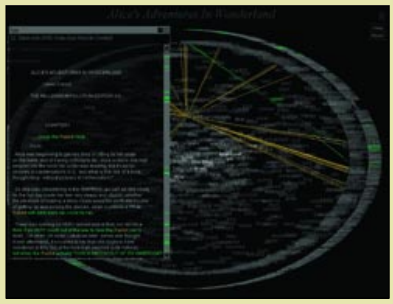
W. Bradford Paley's work, *TextArc*, represents a visual index of text in the form of two overlapping, dynamically adjusting ellipses. He describes *TextArc* as an organizing structure that "spatially reveals any text by letting its key concepts float to the surface." A designer in the fields of interface design and information presentation, Paley would like his work to interpret and "filter to see some of the most beautiful phenomena" like "the fluid arabesques created in the air by any simple gesture—invisible until we add tiny particles of smoke."

The Jackals



By TangentLab: Ben Chang, Mary Lucking, Silvia Ruzanka, Andrew Sempere, Dmitry Strakovsky

The TangentLab collective created one of the liveliest performances about process in the Art Gallery. Their performance of *The Jackals* was concerned with the scavenging of everyday objects to create a bricolage of recycled technology. They described themselves as "opportunistic omnivores who are unavoidably circling your city!…the ones who put your tech to use, the ones who recycle the glut and make it useful in aesthetic glory." *The Jackals* invited conference attendees to participate in their constructions and included participants in their creative process.



ANNOUNCEMENTS

Calendar

November 5-6, 2002
Manuals for Global Use
Eskilstuna, Sweden
See *Computer Graphics* 36(4)
November 2002, this issue

December 16-18, 2002
ISA 2002
Shanghai, China
See *Computer Graphics* 35(1)
February 2001, p 44

April 27-30, 2003
ACM SIGGRAPH 2003 Symposium on Interactive 3D Graphics
Monterey, CA, U.S.A.
See *Computer Graphics* 36(4)
November 2002, this issue

July 16-18, 2003
7th International Conference on Information Visualization
London, England
See *Computer Graphics* 36(4)
November 2002, this issue

July 27-August 1, 2003
SIGGRAPH 2003
San Diego, CA, U.S.A.
http://www.siggraph.org/s2003/

August 8-12, 2004
SIGGRAPH 2004
Los Angeles, CA, U.S.A.
http://www.siggraph.org/s2004/

Details on many of these announcements are available on siggraph.org at http://www.siggraph. org/calendar.

Export Forum Manual Design 2002

November 5-6, 2002
Eskilstuna, Sweden

The International Institute for Information Design and the Department of Innovation, Design and Product Development presents the 2 IIID Expert Forum Manual Design on "Manuals for Global Use" at Maelardalen University, Eskilstuna, Sweden, November 5-6, 2002.

The forum focuses on the development and usage of visual instructions (manuals, operating instructions) for technical products with regard to the effective use of images, their interaction with universally understood keywords, requirements of multi-language applications and issues of related terminology and standardization. Topics include design concepts of user manuals for global use; theories of manual design for global use; how to integrate illustration and text to support global use; animated illustrations and text instructions to support global use; influence of style on effectiveness in multicultural environments; integration of manuals into global products; web delivery based on single sourcing (accessing content from XML or SGML databases); multiple media solutions on a global scale to accommodate Web delivery, help systems and paper documentation; historical aspects; and user reactions to manuals for global use.

More information is available at **http://www.iiid.net** or by contacting the Department of Innovation, Design and Product Development, Maelardalen University, P.O. Box 325, S-63105 Eskilstuna, Sweden; tel: +46-16-153699; fax: +46-16-153650; email: **rune.pettersson@mdh.se.**

ACM SIGGRAPH 2003 Symposium on Interactive 3D Graphics

April 27-30, 2003
Monterey, CA, U.S.A.

The 2003 Symposium on Interactive 3D Graphics, sponsored by ACM SIGGRAPH, is set for April 27-30, 2003 at the Monterey Marriott, Monterey, CA.

The Symposium on Interactive 3D Graphics focuses on research and applications for the real-time, interactive 3D domain including interactive 3D visual display; networked interactive systems; human computer interaction; technologies for immersion; and computer-generated autonomy. It consists of formal paper sessions, panels and hands-on demonstrations where research groups and vendors will show the state-of-the-art in the field.

Program chairs are Randy Pausch (**Pausch@cmu.edu**) and Gary Bishop (**GB@cs.unc.edu**).

For more information, visit **http://www.siggraph.org/i3d/** or contact General Conference Co-chairs Michael Zyda (**zyda@movesinstitute.org**) and Michael Capps (**capps@armygame.com**).

7th International Conference on Information Visualization - IV03

July 16-18, 2003
London, England

The 7th International Conference on Information Visualization (IV03) is set for July 16-18, 2003 in London, England.

The conference provides the latest on information visualization theory and practice; design visualization; knowledge domain visualization; collaborative information visualization environments; semantic web visualization; visualization and data mining; web graphics and visualization; spatial/geographic data visu-

alization; visualizing databases; cooperative design visualization; information visualization in medical and biological sciences; visualization in built environment; symposium of digital art and gallery; fundamentals of visualization and graphics; multimedia-theory and practice; education and industrial perspective; augmented and virtual reality; computer animation and visual effects; computer visualization and graphics rendering; and data real-time visualization of simulation.

Conference sponsors include Information Visualization Society GraphicsLink; VGRU, SCISM, South Bank University, U.K.; Department of Computer Graphics Technology, Purdue University, U.S.A.; Department of Visual Art, University of Northern Colorado, U.S.A.; Computer Graphics & Modeling Group - DMU Milton Keynes, U.K.; National Centre for Computer Animation, Bournemouth University, U.K.; School of Library and Information Science, Indiana University, U.S.A.; Motorola U.K. Research Lab; Information and Computer Science Department, KFUPM, SA; Mixed Reality Ltd., U.K.; Department of Electronic Imaging and Media Communications, University of Bradford, U.K.; University of Balearic Islands, Spain; University of Kent at Canterbury, U.K.; Technical University Graz, Austria.

For more information, go to **http://www.graphicslink.demon.co.uk/IV03/** or contact Ebad Banissi, IV03, Visualization & Graphics Research Unit, South Bank University, 103 Borough Road, London SE1 0AA, U.K.; tel: +44-171-815-7476; fax: +44-171-815-7499; email: **banisse@sbu.ac.uk.**

ACM Launches Educational Program to Address Members' Career Needs

ACM has inaugurated an educational program to help members keep up with the latest information technology developments. The new benefit, available through the newly created Professional Development Centre (PD Centre), offers professional members unlimited access to nearly 200 web-based technology training courses at no charge. ACM is partnering with Sun Educational Services for this program, which also offers more than 500 additional courses to professional members at a discount. The program is designed to help members advance their technical knowledge in their current specialties, learn new skills in related fields and improve their prospects for a satisfying career in the IT field. When offered on a retail basis without an ACM professional membership, these courses average about $200 each, with some costing up to $600.

These web-based courses, accessible from a desktop computer 24/7, offer individualized instruction, allowing participants to learn at their convenience and at their own pace. Many courses feature state-of-the-art audio and animation as well as interactive tools to enliven the learning process, including progress maps, glossaries, discussion and chat rooms, quizzes, messaging capabilities and mentoring. The PD Centre also offers ACM student members a limited number of courses at no charge, as well as access to all of the discounted courses.

"We've selected course topics that members have told us in surveys and focus groups are of significant value to their professional development, ranging from basic levels to cutting edge content," said ACM Associate Director Fred Aronson, who oversees the Professional Development Centre program. Among the topics to be offered are Java, C and C++ Programming, Object-Oriented Programming and Web Publishing as well as Telecommunications, e-Business Applications, Networking and Security and Project Management.

These courses will enable ACM professional members to manage their career development with an exciting array of choices," said Lillian Israel, Director of Membership. "For example, if you want to pursue programming, you can choose from courses on the basics of Java technology to advanced courses for designing graphical user interfaces in Java," she said.

To launch its Professional Development Centre, ACM is partnering with Sun Educational Services (SES), a recognized leader in technical education programs, as well as other course providers who offer the caliber of courses that are consistent with the high quality members expect from ACM programs. To help maintain these quality standards, participants will be asked for feedback on particular courses they have taken, as well as other topics of interest. As part of ACM's partnership with SES, the PD Centre offering includes courses provided by DigitalThink and Telecommunications Research Associates. Both of these companies are experienced purveyors of e-learning and greatly expand the range of free courses available to professional members.

For more information, go to **http://www.acm.org** or contact Virginia Gold at **v_gold@acm.org** or at +1-212-626-0505.

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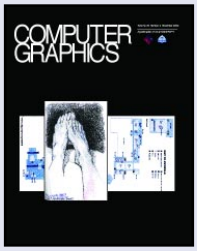

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ACM SIGGRAPH members can access the proceedings of the SIGGRAPH Annual Conference online through the ACM Digital Library (for information on the full ACM Digital Library, see http://www.acm.org/dl). To show their affiliation with the SIGGRAPH community, members are welcome to set up an email forwarding address at acm.org or siggraph.org.

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If you would like expedited air delivery of the quarterly, please add the air option below (other publications have an air option available as well; the costs varies as shown. This is recommended for international members).

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For ACM SIGGRAPH members who are unable to attend the Annual Conference each year, you may purchase the Annual Conference publications at the following discounted prices. ACM SIGGRAPH members may also place advance orders for the proceedings of the ACM SIGGRAPH-sponsored conferences listed below at significant discounts (note that not every conference occurs in every calendar year).

SIGGRAPH Annual Conference Publications	Member Price	Air
Full Package (all three publications listed below)	❑ $40	❑ $12
Conference Proceedings + videotape + CD-ROM	❑ $25	❑ $7
Electronic Art & Animation Catalog + CD-ROM	❑ $25	❑ $6
Conference Abstracts & Applications + CD-ROM	❑ $25	❑ $6

Member Plus Proceedings	Member Price	Air
Computational Geometry (June)	❑ $22	❑ $8
Multimedia (November)	❑ $28	❑ $8
UIST (November)	❑ $15	❑ $5
Graphics Interface (May)	❑ $20	❑ $8
Volume Visualization (October '00, biennial)	❑ $12	❑ $4
IEEE Visualization (October)	❑ $25	❑ $9
Interactive 3D Graphics (April '01, biennial)	❑ $15	❑ $5
Solid Modeling (May)	❑ $25	❑ $8
Eurographics Rendering Workshop (June)	❑ $40	❑ $7
VRML (February)	❑ $12	❑ $5
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ACM Membership Category	Dues	Air
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ACM Optional Publications	ACM Member Price	Air
Transactions on Graphics (Professional Members)	❑ $44	❑ $13
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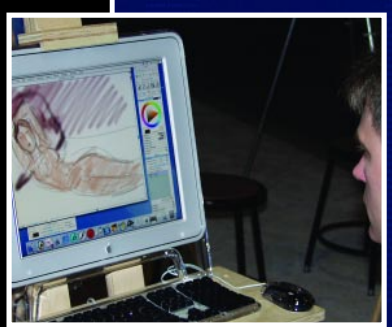

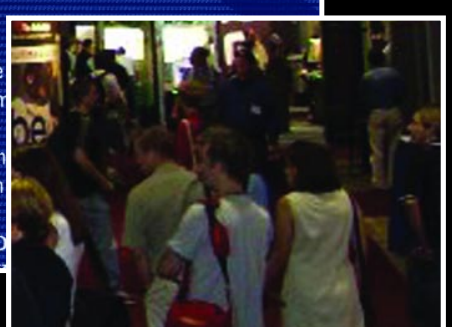

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