The Pioneers Return To Dallas
SIGGRAPH 1990

Advance Program

17th International Conference
On Computer Graphics And Interactive Techniques
August 6-10

JOIN IN SIGGRAPH '90

Each year the Association for Computing Machinery's Special Interest Group on Computer Graphics (ACM SIGGRAPH) holds an international conference. It draws as many as 30,000 people to see the presentation of

courses,
technical papers,
panels,
developer exhibits,
manufacturer exhibits,
an art show,
and a film and video theater.

Along with the traditional events, SIGGRAPH '90 offers new ones including workshops and an exhibit of hypermedia.

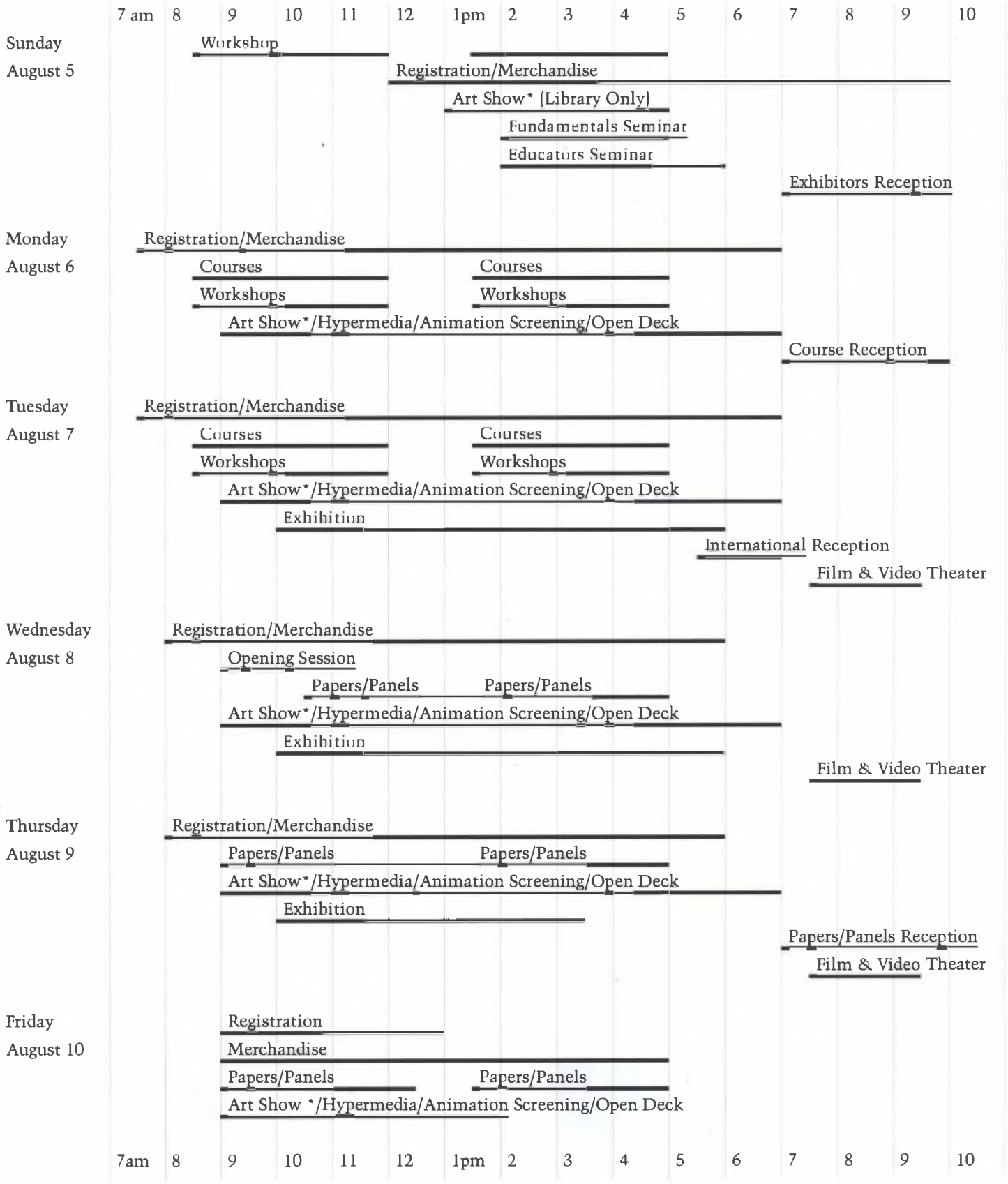
The SIGGRAPH conference is the place to see what's new in computer graphics. Developers announce new products, animators work all year long to debut new films, experts prepare technical papers on new techniques and theories.

The SIGGRAPH conference attracts engineers, scientists, and artists—just about everyone who has anything to do with computer graphics. Whether they do automobile design, medical imaging, scientific visualization, or animation. Whether they're a novice or an expert.

Dallas will host the SIGGRAPH '90 conference August 6 through August 10. This booklet provides an overview of the conference including registration and hotel forms. The conference organizers invite you to fill out these forms and join us in Dallas.

Contents

SIGGRAPH '90 AT A GLANCE



*A portion of the SIGGRAPH '90 art show will be exhibited at the J. Erik Jonsson Central Library Gallery from July 26-September 30. Gallery hours are: Mon.-Fri., 9 am-9 pm, Saturday, 9 am -5 pm and Sunday, 1-5 pm

SIGGRAPH '90 OVERVIEW

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This section describes the major events at SIGGRAPH '90. A complete description of each workshop, course, paper, and panel appears later in this program.

A schedule of all the courses appears at the beginning of the course descriptions. A schedule of all the papers and panels appears at the beginning of the papers and panels descriptions.

Fundamentals Seminar

Terminology and First Principles of Computer Graphics
Sunday, August 5,
2-5 p.m.

Again in 1990, SIGGRAPH is hosting a seminar for those who wish to learn about the basic terminology of computer graphics, the salient features of graphics hardware and the software needed to control the hardware.

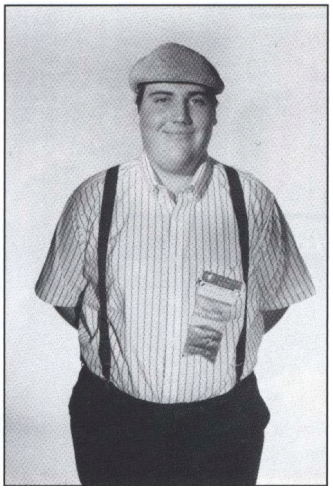
Graphics hardware is presented in terms of its relation to application needs. Graphics software is discussed from a conceptual viewpoint, rather than in terms of implementation. Generic operations, such as line-drawing, text display, area filling, and geometric transformations, are described without using programming. Particular emphasis is placed on the relationship between software techniques and applications such as engineering design, presentation graphics, CAD, graphic design, fine arts, business, statistics, simulation, and data visualization.

All attendees will be admitted; there is no additional charge.

Seminar Chair
R. Daniel Bergeron,
University of New Hampshire

Seminar Lecturer
R. Daniel Bergeron,
University of New Hampshire

Chair Biography
Dan Bergeron has been on the faculty of the Computer Science Department at the University of New Hampshire since 1974 and served as the department's first chairman from 1980 to 1986. He was the technical program chairman for SIGGRAPH '82 and served as editor-in-chief of *Transactions on Graphics* from 1982-1987. His principal research interests include multi-dimensional scientific data visualization, user interfaces, and the design and evaluation of parallel graphics algorithms.



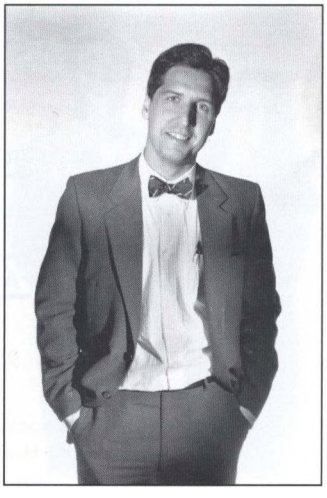
Educators Seminar

Education for Visualization
Sunday, August 5,
2-6 p.m.

Visualization in science and mathematics is an increasingly important application which requires techniques and skills beyond those normally taught in computer graphics courses. It is a method of enhancing the communication of information, particularly multi-dimensional information, using visual techniques. It entails image synthesis and image understanding, and encompasses techniques in computer graphics, art, design, and the particular data domain. This seminar discusses the techniques, skills and methods necessary for teaching them to students and professionals.

Educators from a range of fields present their experiences in educating undergraduates and research professionals.

Registration is open to anyone with an interest in visualization education. Be sure to register for the educators seminar on the advance registration form.



Educators Seminar Continued

Co-Chairs
Stephen Cunningham
California State University, Stanislaus
G. Scott Owen
Georgia State University

Lecturers
Brian Cabral
Lawrence Livermore National Laboratories
Thomas A. DeFanti
University of Illinois at Chicago
Sylvie Rueff
California Institute of Technology
Nan Schaller
Rochester Institute of Technology

Chair Biographies
G. Scott Owen is a professor of mathematics and computer science at Georgia State University in Atlanta, Ga. He has been using computer graphics in scientific research and education for over 20 years, and is the current chair of the SIGGRAPH education committee. He received his Ph.D. from the University of Washington and his B.S. from Harvey Mudd College.

Steve Cunningham is professor of computer science at California State University, Stanislaus and is former chair of ACM SIGGRAPH's Education Committee. He has written widely on computer graphics education and on visualization in science and mathematics education. He is particularly interested in how scientific visualization can change undergraduate computer graphics courses.

Art Show

The SIGGRAPH '90 art show is an international exhibition of computer art which features works created by using the computer in a variety of ways. A jury selects works from thousands of submissions received from artists worldwide and looks for those which demonstrate aesthetic quality and a significant use of the computer. Special attention is given to works which could only have been created on a computer.

The exhibition includes two-dimensional works, sculptures, and computer installations. In some cases, the computer is used in the dynamic generation of the work. In other cases, the computer involves the viewer in interaction with the work or contributes to the presentation environment. Animations and other works on videotapes are selected for the art show in collaboration with the film and video theater jury.

The SIGGRAPH '90 art show will be held Monday-Thursday, August 6-9 from 9 a.m.-7 p.m. and Friday, August 10 from 9 a.m.-2 p.m. in the Dallas Convention Center.

In addition, a free SIGGRAPH-sponsored exhibition entitled *Digital Image-Digital Cinema* will be open to the public at the nearby J. Erik Jonsson Central Library Gallery in Dallas from July 26-September 30. Gallery hours are: Monday-Friday, 9 a.m.-9 p.m., Saturday, 9 a.m.-5 p.m., and Sunday, 1-5 p.m. The exhibition, curated by Susan Kirchman, features examples of digital imagery which use photographs as the original source material.

Admission to the art show and one copy of the art show catalog—entitled *Digital Image-Digital Cinema*—are included with courses and papers/panels registration. This year's catalog is once again co-published with *Leonardo*, the journal of the International Society for the Arts, Sciences and Technology. It features juried essays on computer art, as well as high-quality reproductions of select work from the exhibition.

Exhibits registrants will be admitted to the art show, but will not receive a catalog. Art show catalogs will be available for purchase on-site.

Art Show Chair
Thomas Linehan
Texas A&M University

Art Show Committee
Paul Brown
Royal Melbourne Institute of Technology, Australia
Michael Ester
J. Paul Getty Trust
Isaac Kerlow
Pratt Institute
Susan Kirchman
Texas A&M University
Randolph McAusland
National Endowment for the Arts
Patric Prince
SIGGRAPH Traveling Art Show Chair
Mark Resch
Computer Curriculum Corporation
Chris Wedge
Blue Sky Productions

Art Show Jury
Paul Brown
Royal Melbourne Institute of Technology, Australia
Michael Ester
J. Paul Getty Trust
Patric Prince
SIGGRAPH Traveling Art Show Chair
Mark Resch
Computer Curriculum Corporation
Chris Wedge
Blue Sky Productions

Film and Video Theater
The film and video theater is a highlight of any SIGGRAPH conference, it's the culmination of the year's work in animation. For everyone it's a chance to see the debut of the world's most stunning and sophisticated computer graphics animation. This internationally acclaimed event showcases the year's best work in art, education, science and industry, broadcast, motion pictures, corporate communications, and research. Material for this prestigious event is selected by a jury of experts based on innovation, technical excellence, and audience impact.

There will be three showings of the film and video theater in the Dallas Convention Center arena:

Tuesday, August 7
7:30 to 9:30 p.m.

Wednesday, August 8
7:30 to 9:30 p.m.

Thursday, August 9
7:30 to 9:30 p.m.

Admission to one performance of the film and video theater is included with both courses and papers/panels registration (but not with exhibits registration); only one ticket will be issued per registrant. Additional tickets for all performances will be available beginning Tuesday morning at 10 a.m., subject to availability. All performances contain the same material.

Animation Screenings
Also judged by jury, the programs in the animation screening areas allow for longer and more specialized selections. Programs will be presented Monday through Friday during conference hours. They will run in two locations and feature art, entertainment, and scientific visualization. This is an ideal opportunity to review the best of computer graphics in a relaxed atmosphere. You will receive a schedule of these programs in your registration packet.

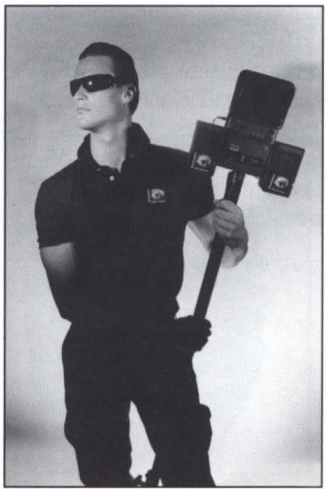
The "Open Deck"
Video playback systems will be made available adjacent to the balcony area to provide a place where individuals can share their material with others. Access will be on a first-come, first-serve basis.

Film and Video Theater Chair
Dave Inglish
Walt Disney Pictures

Film and Video Creative Director
John Grower
Santa Barbara Studios

Film and Video Theater Jury
Wayne Carlson
Ohio State University
Rob Cook
Light Source Computer Images, Inc.
Doris Kochanek
National Film Board of Canada
John Lasseter
Pixar
Frank Thomas
Disney Animator
Chris Wedge
Blue Sky Productions

Film and Video Theater Committee
Janet Doran-Veevers
Santa Barbara International Film Festival
Scott Johnston
Walt Disney Pictures
Richard Weinberg
University of Southern California
Dave Wolf
Walt Disney Pictures



Workshops

Four workshop topics have been selected for one- and two-day small, working group meetings during SIGGRAPH '90. Each workshop is organized around a timely topic and is a discussion of work in progress by people actively pursuing the topic at their jobs or institutions.

To protect the working group flavor, attendance is limited and will be closed by June 1990. To be accepted for participation submit a position statement to the workshop organizer by June 15. See pages 11 to 12 for complete information on how to apply for workshops.

To provide other members of the SIGGRAPH community with the workshop results:

- A special interest group meeting will be open to all conference attendees August 8, 9, 10 to provide the earliest information about each workshop topic.
- A written report on each workshop will be included in a 1991 issue of *Computer Graphics*.
- The SIGGRAPH Video Review will contain video sequences from each workshop.

Workshops Chair
Christine Barton
Morgan Guaranty Trust Co.
212-648-2355

Workshops Committee
Rob Pike
AT&T Bell Labs
Tim Binkley
School of the Visual Arts

Special Interest Groups

Special interest group meetings are user and attendee groups organized around a particular product, topic, or problem. These meetings provide an excellent way for attendees, who share a common interest to identify each other and exchange ideas on the topic freely. The meetings are informal, open to all attendees, and do not require any followup reports.

At SIGGRAPH '90, anyone can schedule such a meeting by contacting the special interest groups coordinator either before or during the conference. All meeting topics, times, and locations will be posted in the registration area at the conference.

To schedule a SIGGRAPH '90 special interest group, contact:

Special Interest Groups Coordinator
John French Jr.
GeoQuest Systems, Inc.
713-622-8065

Special Interest Groups Chair
Christine Barton
Morgan Guaranty Trust Co.
212-648-2355

T-shirt Contest
The second annual SIGGRAPH T-shirt contest will take place at SIGGRAPH '90. Prizes will be awarded during the paper/panel reception. For further information see the next issue of *Computer Graphics* or contact Jock Mackinlay at Xerox PARC. 415-494-4335 Mackinlay.pa@Xeroc.com

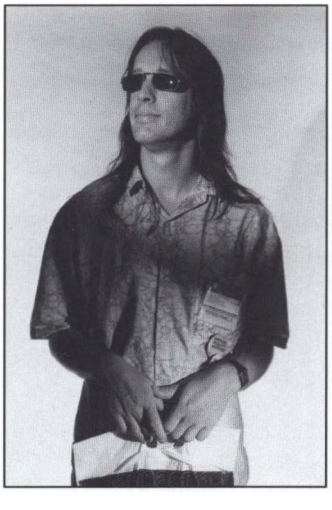
Technical Slides

Each year the SIGGRAPH conference committee requests new computer-generated images for the 35mm technical slide sets and a 3D stereoscopic slide set. These images demonstrate techniques, algorithms, and procedures which are new or improved over previously published works. More than anything, the SIGGRAPH '90 technical slide sets reflect the latest, most state of the art in computer graphics technology and is part of the technical archiving of the conference.

To ensure the highest quality and most state-of-the-art submissions, a jury selected this year's technical slides. SIGGRAPH will sell the slide sets at the conference and afterward as a documentation of computer graphics for the year.

Slides Chair
Diana Tuggle
Los Alamos National Lab

Slides Jury
Andy Martinez
Los Alamos National Lab
Patric Prince
SIGGRAPH Traveling Art Show Chair
Pete Watterberg
Sandia National Lab



Hypermedia

SIGGRAPH '90 offers something new to attendees—hypermedia. Hypermedia is a new and important technology that organizes and links computer graphics and desktop publishing with interactive video and sound recordings. This creates an exciting environment that entertains, engages, and educates.

Unlike reading a novel from front to back, in hypermedia you can explore a nonsequential collection of ideas by stepping back and getting an overview, diving in for details, experiencing the sound and images of the real thing on video and replaying the same thing over and over again at your own pace and in your own style.

The SIGGRAPH '90 hypermedia jury selected the best literature, interactive art pieces, entertainment, educational material, museum installations, and historical retrospectives for display at the conference. At designated locations in the Dallas Convention Center, attendees can explore the hypermedia documents by observing, interacting with real examples of this new technology, and experiencing the joy of learning this exciting medium.

Hypermedia Chair
Richard J. Beach
Xerox PARC

Hypermedia Jury
Bill Buxton
University of Toronto
Sally Rosenthal
Digital Equipment Corporation

Courses

SIGGRAPH '90 courses offer an intensive day of instruction by industry experts presenting up-to-date material on a wide variety of topics in computer graphics and interactive techniques. Course attendees not only hear about but see graphics used in creative ways, as course speakers use multi-media presentations to help accomplish the educational goals of the course.

Each course is categorized as to the level of material, to best meet student needs and interests:

Introductory
Introductory courses require no prerequisites. However, overall interest, general background (computing, graphics, math applications), and, possibly, a prior short course or "survey" may be beneficial.

Intermediate
For intermediate courses, students should have a significant working knowledge of the area, attained through introductory courses, reading, and practical experience. These courses often organize existing knowledge into a coherent whole, to supply a model or other structure for the discipline and supply substantial technical content and depth. Most courses cover many specific topics in detail, such as algorithms, techniques, and architectures.

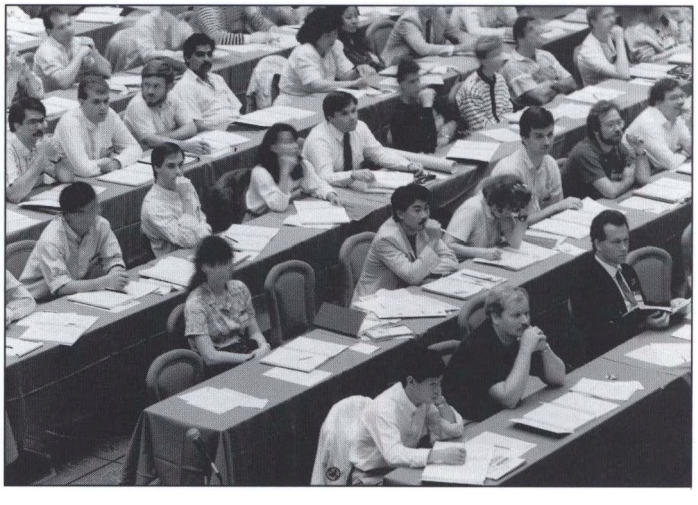
Advanced
An advanced course covers a narrow topic in substantial technical depth. Presentations will often include challenging mathematical concepts and programming examples. Students in these courses are well-informed in the general topic of the course and are ready to consider advanced material. They have gained their knowledge through intermediate courses, reading, and significant years of experience.

Courses will be held in the Dallas Convention Center and the Hyatt Regency from 8:30 a.m.-5 p.m. on Monday, August 6 and Tuesday, August 7. Room assignment information will be available on-site. Lunch is provided.

Course descriptions are provided on pages 13 to 27. To register, indicate your first two course choices on the registration form. Course seating is limited and some will fill up quickly. You will receive notification by mail of the course(s) in which you have been enrolled.

Courses Chair
Patricia Wenner
Bucknell University

Courses Committee
Teresa Bleser
The George Washington University
Frank Bliss
Electronic Data Systems
Janet Chin
Chin Associates
Rich Ehlers
Evans and Sutherland
Mark Henderson
Arizona State University
Nan Schaller
Rochester Institute of Technology
Dino Schweitzer
United States Air Force Academy



Papers

SIGGRAPH is widely regarded as the preeminent forum for scholarly papers on computer graphics. Each year, papers presented at SIGGRAPH serve to keep members of the industry informed about the state of the art in computer graphics, including developments in hardware, software, and theory. The wide variety of papers presented offer techniques and tools for attendees in all areas of computer graphics.

SIGGRAPH '90 received a record number of paper submissions. From those entries, the papers jury assembled an exciting docket of current industry topics, including rendering algorithms, computer animation, geometric modeling, and the computational complexity of graphics algorithms. Three to four papers will be presented during each paper session, focusing on one particular aspect of the topic offering a well-rounded, wide range of perspectives for participants. Papers selected for presentation are published in the conference proceedings, as an issue of *Computer Graphics*.

Paper sessions are offered in parallel with panel sessions Wednesday through Friday, August 8-10, in the Dallas Convention Center. A list of the paper presentations can be found on pages 29 to 37.

Papers Chair
Forest Baskett
Silicon Graphics Computer Systems

Papers Committee
Alan H. Barr
California Institute of Technology
Richard J. Beach
Xerox PARC
Jim Blinn
California Institute of Technology
Ingrid Carlbom
Digital Equipment Corporation, Cambridge
Loren Carpenter
Pixar
Edwin E. Catmull
Pixar
Elaine Cohen
University of Utah
Robert L. Cook
Light Source Computer Images, Inc.
Nick England
Sun Microsystems, Inc.
A. Robin Forrest
University of East Anglia, U.K.
Henry Fuchs
University of North Carolina, Chapel Hill
Donald P. Greenberg
Cornell University
Leo Guibas
MIT, Cambridge
Digital Equipment Corporation
Satish Gupta
IBM, Yorktown Heights
Pat Hanrahan
Princeton University
Paul Heckbert
University of California, Berkeley
Jeffrey Lane
Digital Equipment Corporation, Palo Alto
Jock Mackinlay
Xerox PARC
Tom Sederberg
Brigham Young University
Robert Sproull
Sutherland, Sproull and Associates
Turner Whitted
Numerical Design, Ltd.
Jane Wilhelms
University of California, Santa Cruz
Jim Winget
Silicon Graphics Computer Systems

Panels

Panel sessions—held concurrently with paper sessions—offer attendees an alternative format for exchanging ideas on timely topics in an informal atmosphere. Panelists share their opinions on techniques and applications in a lively forum, enabling the audience to gain new insights and contrasting viewpoints. Topics include current controversies in computer graphics, multi-media, interactive techniques, emerging concepts in hardware and software, and new applications in science, industry, and the arts. All ses-sions are recorded and transcribed for distribution to at-tendees after the conference.

As with paper presentations, SIGGRAPH '90 panels will be held Wednesday through Friday, August 8-10, at the Dallas Convention Center.

Details on the panels may be found on page 29 to 37.

Panels Chair
Alyce Kaprow
The New Studio

Panels Committee
David S. Backer
Fluent Machines, Inc.
Alka Badshah
Open Software Foundation
Thomas A. DeFanti
University of Illinois at Chicago
Masa Inakage
Media Studio
Delle Maxwell
Consultant
Vibeke Sorensen
California Institute of the Arts

Exhibition

The SIGGRAPH exhibition—a principal attraction at the conference—enjoys the enviable reputation as the preeminent world showcase for new product introductions. It is also the industry's most comprehensive showplace for computer graphics hardware, software, applications, and systems—where the cutting edge of development meets qualified buyers.

SIGGRAPH '90 is proud to announce that the U.S. Department of Commerce has selected the conference and exhibition to be one of a select few participants in its Foreign Buyer Program.

The number of exhibitors at the SIGGRAPH '90 exhibition has increased threefold since it first met in Dallas in 1981. Over 225 leading designers and manufacturers of the most advance computer graphics products will occupy 110,000 net square feet in the Dallas Convention Center and demonstrate their products to an international audience of over 25,000 people from industry, business, science, and the arts.

Following are some application categories, products, and services that will be on display at SIGGRAPH '90:

Animation

Architecture, engineering, and construction

Artificial intelligence

Biomedical

Business graphics software

Communications

Computer-integrated manufacturing

Computers and special processors

Data analysis (seismic, etc.)

Desktop publishing

Digitizers, light pens, mice, and other input devices

Digitizing cameras and scanners

Display generators

Electrical CAD/CAM/CAE

Electronic publishing

Engineering workstations

Film or video recorders

Graphics arts systems

Graphics standards packages

Image processing

Mapping and cartography

Mechanical CAD/CAM/CAE

OEM components

Pattern recognition

PC add-on products

PC-based systems

Printers, plotters, and other hardcopy devices

Publications

Robotics

Scientific research

Scientific visualization

Software

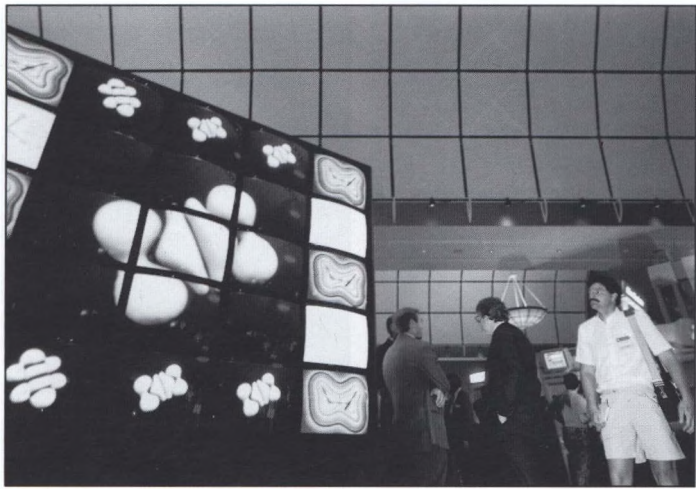
Support Services

Terminals, monitors, and displays

Turnkey systems

Video technology

Visual arts and graphic design



The SIGGRAPH '90 exhibition runs Tuesday through Thursday, August 7-9 in the Dallas Convention Center. Registration for courses and papers/panels includes admission to the exhibition. If you choose to attend the exhibition only, you must register on-site. Registration for exhibits also includes entrance to the art show.

SIGGRAPH presents an unparalleled opportunity to reach the leaders of the computer graphics profession.

To reserve exhibit space
Call or write the exhibition management office to request an exhibitor prospectus.

SIGGRAPH '90 Exhibition Management
Robert T. Kenworthy, Inc.
866 United Nations Plaza
New York, NY 10017
212-752-0911
212-223-3034 FAX

SIGGRAPH '90 exhibition dates and hours are:

Tuesday, August 7
10 a.m. - 6 p.m.

Wednesday, August 8
10 a.m. - 6 p.m.

Thursday, August 9
10 a.m. - 3:30 p.m.

Children under 16 are not permitted to attend the exhibition.

SIGGRAPH '90 EXHIBITORS

Exhibitors as of February 23, 1990

Abekas Video Systems, Inc.
Academic Press
Addison-Wesley Publishing Company
Advanced Graphics Engineering (AGE)
Advanced Imaging
Advanced Micro Devices (AMD)
Advanced Technology Center
Alias Research, Inc.
Alliant Computer Systems Corporation
American Power Conversion Corporation
Amtronics Inc.
Analog Devices, Inc.
Analogic Corporation
Androx Corporation
Apollo Computer, A subsidiary of Hewlett-Packard Co.
Apple Computer, Inc.
Applied Visual Technologies Ltd.
Association for Computing Machinery
AT&T Graphics Software Labs
AT&T Pixel Machines
Autodesk
AV Video
Aztek, Inc.
Barco, Inc.
Brooktree Corporation
BTS Broadcast Television Systems, Inc.
Cahners Publishing Company
Calzone Case Company
Canada, External Affairs and International Trade
Canon USA, Inc.
CELCO
CIS Graphics, Inc.
CMP Publications, Inc.
Commodore Business Machines, Inc.
Computer Graphics Review
Computer Graphics World
Computer Pictures Magazine
Convex Computer Corporation
Covid, Inc.
Cubicomp Corporation
Dainippon Screen
Data General Corporation
Digital Arts
Digital Equipment Corporation
Dimension Technologies, Inc.
Display Automation Group, Inc.
Division Limited
Du Pont Company
Dubner Computer Systems, Inc.
Dynair Electronics, Inc.
Eastman Kodak Company
Electrohome Display Systems
Electrohome Projection Systems
Electronic Engineering Times
ETAX, Inc.
Evans and Sutherland
Expert Graphics Systems
Extron Electronics
Folsom Research
French Expositions in the US, Inc.
Gammadata Computer, Inc.
General Electric Company, PDPO
Gretag Image Systems
GTCO Corporation
Helios System
Herstal Automation, Ltd.
Hewlett-Packard Company
High Performance Systems
Howtek, Inc.
IBM Corporation
IEEE Computer Society
Ikegami Electronics (USA), Inc.
Ilford Photo Corporation
IMAgraph Corporation
Intel Corporation
Intelligent Light, Inc.
Intelligent Resources
Intergraph Corporation
IRIS Graphics, Inc.
Ithaca Software
JVC Professional Products Company
LAZERUS
Levco Sales
Litton Systems Canada Limited
Lyon Lamb VAS
Macro Data, Inc.
Magni Systems, Inc.
Management Graphics, Inc.
Matrox Electronic Systems, Ltd.
Maximum Strategy Inc.
McGraw-Hill Publishing Company
Measurement Systems, Inc.
Media Cybernetics
Megatek Corporation
Meiko Scientific Corporation
Mercury Computer Systems, Inc.
Meret, Inc.
Metheus Corporation
Microfield Graphics, Inc.
Mirografx, Inc.
Microtime, Inc.
Midwest Communications Corporation
Minolta Corporation
Mitsubishi Electric Sales America
Mitsubishi Electronics America, Inc.
Mitsubishi International Corporation
Montage Publishing Inc.
Morgan Kaufmann Publisher, Inc.
Motorola Semiconductor Products
NCGA (National Computer Graphics Association)
NEC Technologies, Inc.
Nikon Inc.
Nissei Sangyo America, Ltd.
Nth Graphics, Ltd.
Number Nine Computer Corporation
Numonics Corporation
Ohio Supercomputer Graphics Project
Omnicomp Graphics Corporation
Oxberry
Panasonic Communications & Systems Company, Computer Products Division
Panasonic Industrial Company, Display Components Division
Pansophic Systems, Inc.
Paragon Imaging, Inc.
Parallax Graphics
Peritek Corporation
Philips Components-Signetics
Photron Limited
Pixar
PIXEL Magazine
Pixelworks, Inc.
Polhemus Limited
Presentation Products Magazine
PRIOR Data Sciences
PTN Publishing Co.
QMS, Inc.
Quantum Data, Inc.
Radius Inc.
Rainbow Technologies
Ramtek Corporation
Raytheon Company, Submarine Signal Division
RGB Spectrum
Sampo Corporation of America
Ron Scott, Inc.
Seiko Instruments USA, Inc.
Seiko Mead Company
SGS-Thompson/INMOS Corporation
Sharp Electronics Corporation
Shima Seiki USA, Inc.
SIGGRAPH '91
Sigma Electronic Inc.
Sigma Soft and Systems
Silicon Graphics
Softimage, Inc.
Software Security
SONY Corporation of America
Spaceward Video Systems, Ltd.
Springer-Verlag NY, Inc.
Stardent Computer Inc.
Star Technologies, Inc., Graphicon Product Division
StereoGraphics Corporation
Summagraphics Corporation
Sun Microsystems, Inc.
Supercomputing Review
SuperMac Technology
Symbolics, Inc.
TDI-America
TEAC America, Inc.
Team Systems
Tech-Source, Inc.
Techexport, Inc.
Tektronix, Inc.
Template Graphics Software, Inc.
Texas Instruments
Texas Memory Systems, Inc.
Texnai, Inc.
Time Arts, Inc.
Toshiba America Electronic Components, Inc.
Truevision, Inc.
University of Lowell
Univision Technologies Inc.
UnixWorld Magazine
Van Nostrand Reinhold
Vicom Systems Inc.
Video Manager
Videomedia SED, Inc.
Video Systems
Videotex Systems Inc.
Viewpoint Technologies
Visual Information Technologies, Inc.
VT Inc.
Wacom Inc.
Waldmann Lighting Company
Wasatch Computer Technology, Inc.
Wavefront Technologies
WaveTracer, Inc.
John Wiley & Sons, Inc.
Winsted Corporation
Yamashita Engineering Manufacture, Inc.

WORKSHOPS

1 Software Architectures and Metaphors for Non-WIMP User Interfaces

Sunday, August 5
8:30 a.m.- 5 p.m.

Monday, August 6
8:30 a.m.- 5 p.m.

Many new input and output devices have become readily available, including 3D digitizers, datagloves, stereo and head-mounted displays, sound synthesizers, eye trackers, and speech production and recognition devices. However, software technology has not evolved to handle these new hardware technologies. Current software tools address WIMP—windows, icons, mice, and pointing—user interfaces and assume there is one display (with multiple windows) and one active input device (mouse or keyboard).

This two-day workshop identifies key research topics in this area and addresses software tools needed to support the new technologies and user interfaces not fitting the WIMP model. Participants discuss metaphors to guide the design of new user interfaces and high-level tools to assist the designer in producing these interfaces. The workshop's resulting report will serve as a stimulus for future research.

Interested practitioners, researchers and developers should direct their written position papers on the above or related issues by June 15 to:

Mark Green
University of Alberta
Department of Computing Science
Edmonton, Alberta, T6G 2H1
Canada
403-492-5198
mark@cs.UAlberta.CA

2 Computer Graphics Research Topics for Industry/ University/Non-Profit Collaboration

Monday, August 6
8:30 a.m.-5 p.m.

Industry/university/non-profit collaborations are becoming increasingly important as industry faces growing competitive pressures and universities/non-profit organizations rely more on industry for a share of their research support. By definition, collaborative research is iterative and interactive. It requires that groups work together to develop research programs with mutually agreeable outcomes and results. This contrasts with the typical technology exchange where the university/ non-profit group proposes research and, if the industry group perceives it valuable, funds the research.

The primary result of this one-day workshop is compiling a list of computer graphics research topics which participants feel are appropriate for collaborative research.

Prospective workshop attendees should submit written position papers which describe their experiences with collaborative research by June 15 to:

Robert Ellis
Sun Microsystems, Inc.
Collaborative Research
Mailstop 23-41
2550 Garcia Ave.
Mountain View, CA 94043
Fax: 415-965-4903
rellis@sun.com

3 Data Structures and Access Software for Scientific Visualization

Monday, August 6
8:30 a.m.-5 p.m.

Tuesday, August 7
8:30 a.m.-5 p.m.

Despite the advancement of scientific visualization techniques over the last several years, there are still problems in bringing today's hardware/software technology into the hands of typical scientists for developing extensible visualization systems.

There are needs for developing a data (base) model which possesses elements of a modern database management system but is geared toward scientific data sets and applications; replacing traditional, incompatible, flat-file mechanisms with uniform access methods for visualization software; and addressing issues of uniform data transport among heterogeneous machines.

This two-day workshop establishes an interdisciplinary focus among government, academia and industry attendees, and addresses scientific data models and structures, software implementations, and data access methods.

Interested participants should submit a written position statement by June 15 to:

Lloyd Treinish
IBM T.J. Watson
Research Center
P.O. Box 704
Yorktown Heights, NY 10598
914-784-5077 (FAX)

4 Teaching Computer Graphics in an Art Design Environment

Tuesday, August 7
8:30 a.m.-5 p.m.

An increasing number of students and professionals without traditional backgrounds in engineering or computer science are seeking educational programs to help them understand, control, develop, and create with computer graphics technology. Also, those with engineering/computer science backgrounds—but without artistic and design training—want educational programs allowing them to apply their programming skills to create effective visual messages.

This one-day workshop compares educational strategies and produces a report offering very specific guidelines for future educational efforts. Topics discussed include: program scope, general areas of interest, curriculum structure (ie. balance between art and technology, which courses to teach), educational approach (ie. how to teach this new discipline, model assignments), textbooks, and system requirements.

Interested participants should submit a written position paper on this topic and similar issues by June 15 to:

Isaac Kerlow
Pratt Institute
Computer Science
Department
200 Willoughby Avenue,
PS 24
Brooklyn, NY 11205
718-636-3489

COURSES-AT-A-GLANCE

Introductory -	Monday	1	Fundamentals and Overview of Computer Graphics
		2	Color and Computer Graphics
		3	Introduction to Hypertext and Hypermedia
		4	An Artistic Introduction to Computer Animation
	Tuesday	5	Generation of Three-Dimensional Data for Computer Image Synthesis
		6	Stereographics
		7	Emerging User-Interface Media: Potentials and Challenges
Intermediate -	Monday	8	Human Figure Animation: Approaches and Applications
		9	PHIGS PLUS: Advanced Three-Dimensional Graphics with a Standard Application Programmer Interface
		10	Character Animation by Computer
		11	Volume Visualization Algorithms and Architectures
		12	Solid Modeling: Architectures, Mathematics, and Algorithms
		13	Curve and Surface Design: From Geometry to Applications
		14	The Computer Graphics Interface (CGI)—The Next International Graphics Standard
		15	Fractals: Analysis and Modeling
		16	Introduction to Window Management
	Tuesday	17	Computer Graphics in Visual Effects
		18	The RenderMan Interface and Shading Language
		19	X3D-PEX (PEX): Three-Dimensional Graphics in a Distributed Window System
		20	The PostScript Page Description Language
		21	Radiosity
		22	Video Technology for Computer Graphics
		23	Modeling and Animating with Implicit Surfaces
Advanced -	Monday	24	Advanced Topics in Ray Tracing
	Tuesday	25	Unifying Parametric and Implict Surface Representations for Computer Graphics
		26	State of the Art in Facial Animation
		27	State of the Art in Data Visualization
		28	Parallel Algorithms and Architectures for 3D Image Generation

INTRODUCTORY COURSES

1 Fundamentals and Overview of Computer Graphics

When - Monday

Who Should Attend
Technical professionals and managers who are unfamiliar with computer graphics, desiring general knowledge. Also, those who have heard terms like "pixel," "CSG," "Z buffer," and "trackball," and would like a more global context for understanding their relationship. Not for those who want to learn specifics, such as how a Bresenham vector algorithm works or how to best code a 3D transform.

Course Description
This course starts with a historical perspective of computer graphics and an introduction to the fundamental concepts. The current state of the industry and important trends are discussed, followed by a topics survey. Emphasis is on breadth of coverage rather than on teaching technical details. The guiding principle gives attendees an intuitive understanding of many concepts instead of detailing introductory issues.

Recommended Background/Difficulty
No background in computer graphics or mathematics required. Some exposure to computers and programming helpful.

Chair
Olin Lathrop
Cognivision, Inc.

Lecturers
Norman Badler
University of Pennsylvania
Richard M. Fichera
Independent Consultant
Olin Lathrop
Cognivision, Inc.
Carl Machover
Machover Associates

Chair Biography
Olin Lathrop is co-founder and vice president of research at Cognivision, Inc., specializing in data visualization software and services. He is currently interested in visualization algorithms, techniques, and how to best present information for human understanding. He previously worked at Apollo Computer, designing the high-end graphics system for the DN10000/VS and the model One/25-S. He received his bachelor's and master's degrees in electrical engineering from Rensselaer Polytechnic Institute in 1978 and 1980, respectively.

2 Color and Computer Graphics

When - Monday

Who Should Attend
Programmers and managers who need to understand the properties of color as they relate to humans. Professionals developing user interfaces and presentation systems for a wide variety of applications, including process control, scientific visualization, and computer-aided design. Also, training specialists, technical editors, graphic designers, and human factors specialists.

Course Description
This course introduces terminology, principles, guidelines, and heuristics for using color in user interfaces, screen presentations, and hardcopy graphics. The course covers physiological, perceptual, cognitive, and communication issues, such as how human beings see color, what colors to select, how to select them, how to display and communicate color effectively, and how to design with color.

Recommended Background/Difficulty
Assumes some familiarity with color terminology, color appearance, and interaction issues in current computer graphics systems.

Chair
Aaron Marcus
Aaron Marcus and Associates

Lecturers
Aaron Marcus
Aaron Marcus and Associates
Gerald Murch
Tektronix, Inc.
Wanda J. Smith
Hewlett-Packard Laboratories

Chair Biography
Aaron Marcus is an internationally recognized authority on graphic design for computer graphics, especially chart, form, document, icon, and screen design. He has given screen design, information graphics, and electronic publishing tutorials at SIGCHI, SIGGRAPH, NCGA, Nicograph (Tokyo), and several U.S. and international firms. He and his staff have designed and critiqued computer graphics presentations, user interfaces, templates, and documentation for many companies including Apple, Eastman Kodak, DuPont, General Motors, and Symbolics. Marcus holds a bachelor's degree in physics from Princeton University and a bachelor's and master's in graphic design from Yale University Art School. He has taught computer graphics since 1970.

3 Introduction to Hypertext and Hypermedia

When - Monday

Who Should Attend
Programmers, managers, technical writers, and educators interested in designing hypermedia systems or including hypertext features in other systems.

Course Description
This course gives attendees an introduction to the concepts of hypertext (non-sequential writing) and hypermedia (multimedia hypertext), the background for evaluating hypertext applications, and the ability to structure and design hypertext document systems with good human factors characteristics. Lecturers cover: the definition of hypertext and hypermedia, a survey of applications, an existing hypertext system with demonstration, user interface issues and problems, empirical testing, navigating large information spaces, automatic transformation of linear text files, and future developments.

Recommended Background/Difficulty
No previous hypertext knowledge or experience required.

Chair
Jakob Nielsen
Technical University of Denmark

Lecturers
Jakob Nielsen
Technical University of Denmark
John Leggett
Texas A&M University
Hannah Kain
Baltica Finance

Chair Biography
Jakob Nielsen is assistant professor of user interface design at the Technical University of Denmark, responsible for the human factors/user interface program and the user interface subproject of the European Community DELTA SAFE project. A user interface consultant for several Danish and international companies, his research interests include usability engineering and hypertext. Previously he was affiliated with the IBM User Interface Institute in Yorktown Heights, N.Y., and Aarhus University, Denmark. He has authored *Hypertext and Hypermedia* and serves on the editorial board of the *Hypermedia* Journal.

4 An Artistic Introduction to Computer Animation

When - Monday

Who Should Attend
Artists, designers, students, and educators wishing to understand the principles of computer graphics animation and the application of these techniques. Provides information for those who work with computer animation and who interact with computer graphics procedures.

Course Description
Covers ideation to execution of a design through the use of computer animation. Speakers introduce the fundamentals of storyboarding, 2D and 3D graphics, animation, image processing, character animation, and the integration of technology into traditional methods. Actual techniques and concepts are demonstrated with in-class hardware and software, slides, video, and film.

Recommended Background/Difficulty
Material is straightforward consisting of introductory technical descriptions and art concepts.

Chair
Maria Palazzi
Rutgers University

Lecturers
John Donkin
The Ohio State University
Maria Palazzi
Rutgers University
Anne Seidman
Moore College of Art

Chair Biography
Maria Palazzi is both an assistant professor of art and coordinator of the Computer Graphics Lab at Rutgers-Camden. She has worked as a technical director/animator at Cranston/Csuri Productions and is currently a member of The Group in New York City. Palazzi received her B.S. degree in industrial design and her M.A. degree in computer graphics from The Ohio State University, Columbus.

5 Generation of Three-Dimensional Data for Computer Image Synthesis

When - Tuesday

Who Should Attend
Those with a limited knowledge of computer graphics techniques, but with the desire to learn how 3D models are defined and how environments are described for image creation.

Course Description
This course gives an understanding of the issues and techniques involved in basic data generation for computer graphics and user interface issues. It covers application-independent data generation techniques, with various easy-to-understand/implement procedures. Presenters share effective techniques and procedures, program samples, and interactive real-time demonstrations of various techniques. This course differs from the traditional courses in CAD, geometry and free-form surface design as it concentrates on the basic techniques which underlie the more sophisticated approaches.

Recommended Background/Difficulty
A familiarization with computer graphics fundamentals and equipment. Some knowledge of linear algebra and trigonometry recommended.

Co-Chairs
Wayne E. Carlson
The Ohio State University
Richard E. Parent
The Ohio State University

Lecturers
Wayne E. Carlson
The Ohio State University
Richard Parent
The Ohio State University
Turner Whitted
Numerical Design, Ltd.
Kevin Weiler
Stardent Computer

Chair Biographies
Wayne E. Carlson is an assistant professor at The Ohio State University's department of computer and information science. He was formerly with Cranston/Csuri Productions as vice president of research and development. Carlson received his B.S. and M.A. degrees in mathematics from Idaho State University and a Ph.D. in computer graphics from The Ohio State University.

Richard E. Parent is an assistant professor at The Ohio State University's department of computer and information science. He was formerly an associate director of the Computer Graphics Research Group (CGRG) at Ohio State and a consultant with the Computer Animation Company. He received a B.S. degree in computer science at the University of Dayton and a Ph.D. in computer graphics at The Ohio State University.

6 Stereographics

When - Tuesday

Who Should Attend
Computer graphics users, programmers, and hardware designers who need a "true" 3D representation in order to disambiguate depth information and detail in complex models. Those interested in medical imaging, robot control systems, terrain modeling, cartography, CAE/CAD, molecular modeling, and meteorology applications.

Course Description
Although 3D graphics creates and interacts with data in 3D, the majority of display devices allow only perspective rendering of images in 2D. This course provides a detailed introduction to the rapidly growing area of stereographics and other 3D display techniques. Topics include: perceptual issues, an overview of 3D display technologies, stereoscopic perspective transformations, in-depth material on the design and display characteristics of time-interlaced stereoscopic display systems, 3D hardcopy techniques, and stereo animation issues. Both commercial 3D display systems and prototype systems are demonstrated.

Recommended Background/Difficulty
Familiarity with basic computer graphics.

Chair
David F. McAllister
North Carolina State University

Lecturers
Robert J. Beaton
Virginia Tech
Larry F. Hodges
Georgia Institute of Technology
Phil Johnson
Tektronix, Inc.
David F. McAllister
North Carolina State University
Rodney Don Williams
Texas Instruments

Chair Biography
David F. McAllister received his bachelor's degree in mathematics from the University of North Carolina, Chapel Hill, a master's in mathematics from Purdue University, and a doctorate in computer science from North Carolina State University. He has published many papers in the area of 3D technology and has given several courses in this area for SIGGRAPH, SPIE, and SPSE.

7 Emerging User-Interface Media: Potentials and Challenges

When - Tuesday

Who Should Attend
Anyone interested in the potential application of "fringe" user-interface technologies, either immediately or as potential components of future systems.

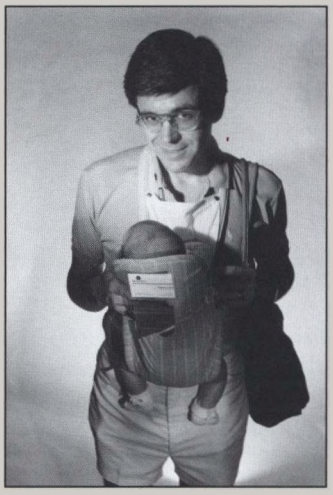
Course Description
This course surveys emerging user-interface media: display technology, stereoscopic graphics, eye-tracking, speech, and spatial input. For each, the underlying theories of device operation are explored, detailing examples of current "products." It discusses the current status and future potential of these interfaces, including merits, limitations, and range of suitable applications. Instructors offer practical advice toward using these technologies at the interface, and present demonstration systems built by themselves and others.

Recommended Background/Difficulty
Assumes a basic understanding of computer technology, but no experience in the media discussed. Cursory understanding of user-interface design issues helpful. No mathematics beyond algebra required.

Chair
Chris Schmandt
MIT Media Lab

Lecturers
Walter Bender
MIT Media Lab
Scott Fisher
NASA Ames Research Center
Robert J.K. Jacob
Naval Research Laboratory
Chris Schmandt
MIT Media Lab

Chair Biography
Chris Schmandt holds an M.S. from MIT and has been active at the Media Lab and its predecessors for 10 years. During that time, he has participated in research programs employing all the media included in this course. His work currently focuses on speech, both as a user-interface channel as well as a data type, and integration of voice technologies with workstation window systems. He is the director of the Media Lab's Speech Research Group and teaches a graduate course in conversational computer systems.



INTERMEDIATE COURSES

8 Human Figure Animation: Approaches and Applications

When - Monday

Who Should Attend
Those with some background in animation, wishing to understand the challenges involved in human animation. Also, those with particular applications in mind—particularly ergonomic evaluation of environments, simulation of micro-worlds and animation production for film and video.

Course Description
This course poses the challenge of human figure animation with major approaches adopted to address the problems (kinematics, dynamics and artificial intelligence). It examines three application areas—ergonomic evaluation of environments, simulation of micro-worlds, and human figure animation for film and video production.

Recommended Background/Difficulty
Some background in animation and basic computer graphics. Full appreciation of particular topics (e.g. physically-based models) requires more mathematical background, but not essential.

Chair
Tom Calvert
Simon Fraser University

Lecturers
Norman I. Badler
University of Pennsylvania
Armin Bruderlin
Simon Fraser University
Tom Calvert
Simon Fraser University
Thecla Schiphorst
Simon Fraser University
Jane Wilhelms
University of California, Santa Cruz
David Zeltzer
MIT

Chair Biography
Tom Calvert is a professor of computing science and engineering science at Simon Fraser University in British Columbia, Canada. He has a bachelor's degree from University College London, a master's in electrical engineering from Wayne State University and a Ph.D. from Carnegie-Mellon University. Following industrial appointments with ICI Ltd. and Canadair Ltd. he held faculty appointments at Carnegie-Mellon University and Simon Fraser University. His research interests include human figure animation, intelligent CAD, and computer vision.

9 PHIGS PLUS: Advanced Three-Dimensional Graphics with a Standard Application Programmer Interface

When - Monday

Who Should Attend
Application or graphics-system developers, who are well-versed in a programming language. (The C-language will be used.)

Course Description
PHIGS PLUS is the ANSI/ISO proposed extension to the PHIGS standard and is supported by multiple vendors as the API for providing advanced rendering and advanced primitive geometries within the PHIGS enviroment. This course covers the evolution, architecture, and algorithms of PHIGS PLUS. It explores the impact of PHIGS PLUS on an application environment and investigates necessary considerations for application and graphics-system implementers.

Recommended Background/Difficulty
Assumes minimum familiarity with 3D graphics fundamentals and the PHIGS graphics standard. Serves as background for courses on PEX, the PHIGS Extension to X.

Chair
Edy Henderson
Sun Microsystems, Inc.

Lecturers
Henri Gouraud
Digital P.R.L.
Griff Hamlin
McDonnell Douglas
Edy Henderson
Sun Microsystems, Inc.
Eileen McGinnis
Sun Microsystems, Inc.
Mike Stapleton
System Simulation Ltd.
Spencer Thomas
University of Michigan

Chair Biography
Edy Henderson has been involved in computer graphics for 12 years in the areas of ECAD, MCAD, scientific applications and graphics standards. Most recently, she has been a member of Sun's graphics standards department since January 1988. She is the engineering project manager of SunPHIGS, Sun Microsystems' product implementation of PHIGS with PHIGS PLUS Extensions. Henderson holds a bachelor's degree in mathematics from the University of Redlands.

10 Character Animation by Computer

When -Monday

Who Should Attend
Animators, art directors, designers, technical directors; those with an interest in the art, technology, or creation of sophisticated motion choreography using computer graphics.

Course Description
Speakers will show computer-animated films and discuss how each work was created.

Recommended Background/Difficulty
Familiarity with basic terminology of computer graphics.

Chair
Bill Kroyer
Kroyer Films, Inc.

Lecturers
John Chadwick
Ohio State Computer Graphics Group, Columbus
Matt Elson
Symbolics, Inc.
Bill Kroyer
Kroyer Films, Inc.
Henry Selick
Colossal Pictures

Chair Biography
Bill Kroyer is a Disney-trained character animator who became involved in computer graphics on the feature film TRON. In addition, he previously animated and directed projects at Digital Productions in Los Angeles. He currently heads Kroyer Films, Inc. and produces animated films using a unique blend of classic hand and computer animation. His short film, *Technological Threat*, opened the SIGGRAPH '88 film and video show and was nominated for the 1988 Academy Award for Best Animated Short Film.

11 Volume Visualization Algorithms and Architectures

When - Monday

Who Should Attend
Computer scientists and professionals who develop visualization techniques for volume data. Professionals in scientific, engineering, and medical disciplines who use these techniques and want to learn how they work.

Course Description
The last three years have seen a revolution in techniques for visualizing 3D sampled data. This course provides a technical overview and comparison of these new techniques, emphasizing algorithms and architectures, not applications. Algorithms presented include marching cubes, dividing cubes, gray-level gradient shading, and volume rendering. Architectures presented include CUBE, the Pixar Image Computer, GE's dividing cubes, and the University of North Carolina's Pixel-Planes-based systems. The course includes a "render-off," featuring images prduced by each algorithm from common datasets and a panel discussion focusing on unsolved technical issues in volume visualization.

Recommended Background/Difficulty
Assumes basic understanding of hidden-surface methods, shading models, sampling theory, and computer organization.

Chair
Marc Levoy
University of North Carolina

Lecturers
Pat Hanrahan
Princeton University
Karl-Heinz Hoehne
University Hospital Eppendorf
Arie Kaufman
SUNY at Stony Brook
Marc Levoy
University of North Carolina
William Lorensen
General Electric Corporation

Chair Biography
Marc Levoy is a research assistant professor of computer science at the University of North Carolina at Chapel Hill. He holds an M.S. degree in computer graphics from Cornell University and a Ph.D. in computer science from the University of North Carolina. Levoy headed the Hanna-Barbera Studios Computer Animation project for several years and has chaired two courses at SIGGRAPH on computer animation. His current research interests include scientific visualization, volume rendering, medical imaging, and molecular graphics.

12 Solid Modeling: Architectures, Mathematics, and Algorithms

When - Monday

Who Should Attend
System developers, although material may interest users and potential users. Anyone with a basic understanding of solid modeling and a desire to understand fundamental architectures, data structures, and the mathematics of common algorithms.

Course Description
Following a brief review of pertinent background concepts and an overview of the assumed modeling environment, lecturers present basic, contemporary solid modeling architectures. They introduce the importance of a boundary evaluation algorithm in such environments and describe an approach to such algorithms. Common curve and surface representation schemes and intersection algorithms are then discussed; basic issues and contemporary approaches for boundary representations presented. Finally, it examines features in modeling systems, feature recognition and design.

Recommended Background/Difficulty
Basic understanding of modeling, obtained from a previous solid modeling course or practical experience. Basic knowledge of vector geometry and geometric analysis (vector arithmetic, cross products, dot products, lengths of vectors) useful. Some knowledge of calculus helpful, although less critical.

Chair
James R. Miller
The University of Kansas

Lecturers
George Allen
McDonnell Douglas
James R. Miller
The University of Kansas
Kevin J. Weiler
Stardent Computer
Peter R. Wilson
Rensselaer Polytechnic Institute

Chair Biography
James R. Miller has been involved in research and development activities in the general area of graphics for design since 1976—specifically in the area of solid modeling for mechanical CAD/CAM since 1980. He is currently an associate professor in the department of computer science at the University of Kansas, where he teaches courses in computer graphics and geometric modeling. Prior to that, he spent eight years at Control Data Corporation working on a production solid modeler and developing long-term strategic directions. His current research interests include architectural issues in modeling systems and expanding the geometric coverage of solid modelers.

13 Curve and Surface Design: From Geometry to Applications

When - Monday

Who Should Attend
CAD developers, programmers/analysts, researchers, and educators wanting to learn the geometric foundations of curve and surface modeling.

Course Descriptions
Through live, interactive demonstrations, this course presents geometric foundations for curve and surface design, including: Bézier curves and curve interpolation, B-spline and NURBS curves, geometric continuity and parameterizations, tensor product surfaces, Coons and Gordon surfaces, Bézier triangles, trimmed NURBS surfaces, and surface interrogation. The presentation relies on intuitive geometric concepts, with applications to practical design problems.

Recommended Background/Difficulty
Calculus, basic linear algebra and basic computer graphics recommended. Basic numerical analysis helpful, as mathematical equations and interactive graphics techniques are used.

Chair
Gregory M. Nielson
Arizona State University

Lecturers
Thomas A. Foley
Arizona State University
Gregory M. Nielson
Arizona State University
Alyn P. Rockwood
Silicon Graphics Computer Systems

Chair Biography
Gregory M. Nielson is a professor of computer science at Arizona State University where he teaches and does research in the areas of computer graphics, computer-aided geometric design and scientific visualization. He has published and lectured widely on curve and surface design and scattered data fitting, and has collaborated on curve and surface problems with scientists and engineers at Xerox, NASA, General Motors, Barrows Neurological Institute and Lawrence Livermore National Lab.

Nielson is on the editorial board of a variety of CAGD, computer graphics and scientific visualization journals and currently chairs the IEEE Computer Society Technical Committee on Computer Graphics.

14 The Computer Graphics Interface (CGI)—The Next International Graphics Standard

When - Monday

Who Should Attend
Those designing or developing 2D graphics packages, systems, or applications where device-independence, portability, and efficiency are important.

Course Description
The Computer Graphics Interface (CGI) provides a 2D, device-independent foundation level standard for designing graphics devices and interfacing them with other graphics standards such as GKS, PHIGS and CGM. Lecturers present CGI procedural bindings and data encodings, a reference model showing various configurations in which the CGI can occur, and the use of the CGI as a system level interface. They emphasize the graphic object pipeline, compound primitives, segments, input functions, and raster functions.

Recommended Background/Difficulty
Previous experience with and exposure to computer graphics. Prior knowledge of related graphics standards desirable, but not necessary.

Chair
Theodore N. Reed
Los Alamos National Laboratory

Lecturers
Janet S. Chin
Chin Associates
Theodore N. Reed
Los Alamos National Laboratory
Karla Steinbrugge Chauveau
Metheus Corporation

Chair Biography
Theodore N. Reed is responsible for computer graphics planning and advanced development activities at Los Alamos National Laboratory. His software engineering/design background has particular emphasis on computer graphics. Reed was chairman of the ASC task group responsible for the CGM and CGI standards from their 1979 inception through 1984. An active participant in the ISO and ANSI groups developing the CGI, he teaches C-programming language short courses and has worked for the British Home Office.

15 Fractals: Analysis and Modeling

When - Monday

Who Should Attend
All students and professionals from universities, industry and art intending to learn the governing principles and state of the art of fractals.

Course Description
Covers basic principles and applications of fractals, supported by video animations and live demonstrations. Its goal is to present the theoretical foundations of fractals from the computer graphics point of view, their algorithmic generation and their uses in modeling, including many new state-of-the-art algorithms. Topics include random fractals, dynamical systems and fractals, and modeling.

Recommended Background/Difficulty
Assumes a working knowledge of fundamental computer graphics and a solid mathematical background including calculus, complex numbers and probabilities. Some reading and practical experience with fractals.

Chair
Dietmar Saupe
Universität Bremen

Lecturers
Heinz-Otto Peitgen
Universität Bremen
Przemyslaw Prusinkiewicz
University of Regina
Dietmar Saupe
Universität Bremen

Chair Biography
Dietmar Saupe is a researcher and graduate of the mathematics doctoral program at the Universität of Bremen, West Germany. His current research interests include mathematical computer graphics and experimental mathematics in dynamical systems. Saupe has been a speaker and course organizer for three previous SIGGRAPH fractals courses.

16 Introduction to Window Management

When - Monday

Who Should Attend
Implementers of graphics systems desiring an introduction to the complementary field of window management. Users writing applications for window system products requiring a background in the field.

Course Description
This course is intended to provide a basis for the understanding of window management systems and uses this basis to illustrate the tradeoffs and solutions in implementing currently available systems.

The course begins with the presentation of a general model for window management systems, grouping various window management systems components into kernel and user components. Both the kernel and the user components are discussed, using examples from current industry practice. It covers component selection, design, and implementation.

Recommended Background/Difficulty
A familiarity with computer graphics, especially raster graphics. Some knowledge of current common window-managed systems helpful. Knowledge of operating system fundamentals recommended.

Chair
Jonathan E. Steinhart
Independent Consultant

Lecturers
Richard J. Greco
Intel Scientific Computers
Jonathan E. Steinhart
Independent Consultant

Chair Biography
Jonathan E. Steinhart is an independent consultant specializing in graphics system architectures, hardware and software design for graphics, and windowing systems. He has served on the ANSI computer graphics committee, authoring the C binding of GKS and the window manager drafts. He has worked on graphics hardware and software design for 18 years.

17 Computer Graphics in Visual Effects

When - Tuesday

Who Should Attend
Anyone interested in the application of computer graphics in visual effects. Those with a greater understanding of the fundamentals of computer graphics will best appreciate course material.

Course Description
The presence of computer graphics in visual effects has increased dramatically. This course's goal is to introduce the audience to the experience of using computer graphics in filmmaking. It introduces the visual effects process, discusses problems involved in dealing with film, and discusses computer graphics applications in feature films. While speakers cover the technical details of their work, they also explain production concerns which guide the decision-making process. Speakers use examples from *The Abyss, Back to the Future II, The Hunt for Red October* and *Indiana Jones and the Last Crusade.*

Recommended Background/Difficulty
A general knowledge of advanced graphics and animation techniques recommended.

Co-Chairs
Scott E. Anderson
Industrial Light & Magic
Jonathan P. Luskin
Industrial Light & Magic

Lecturers
Scott E. Anderson
Industrial Light & Magic
Lincoln Hu
Industrial Light & Magic
Douglas S. Kay
Industrial Light & Magic
Jonathan P. Luskin
Industrial Light & Magic
Dennis Muren
Industrial Light & Magic

Chair Biographies
Scott Anderson, computer graphics animator, has worked on a number of theatric projects at ILM including *The Abyss* and *The Hunt for Red October*. He has also worked on a variety of television projects including a Star Tours commercial and an upcoming PBS series segment. Anderson graduated from Brown University with an A.B. in semiotics and a Sc.B. in computer science.

Jonathan Luskin is a computer graphics animator. He has worked on a number of motion picture projects including *Star Trek IV, Willow, The Abyss* and *Back to the Future II* as well as the *Body Wars* simulator ride at Disney's Epcot Center. He graduated from Cornell University with degrees in political science and electrical engineering.

18 The RenderMan Interface and Shading Language

When -Tuesday

Who Should Attend
Anyone who wants to learn RenderMan for producing beautiful images. Graphics programmers who wish to generate images from their modeling programs and graphics users wishing to make images from their CAD databases.

Course Description
The RenderMan Interface is a 3D scene description interface for realistic image synthesis. This course explores both the geometric modeling interface, for describing the shapes and positions of objects in a scene, and the Shading Language, for describing appearance characteristics of those objects. Rendering algorithms and renderer implementations are not discussed; rather, the use of interface features is described. Many useful Shading Language techniques are demonstrated, examining several examples of successful images and animations which made extensive use of RenderMan and the Shading Language.

Recommended Background/Difficulty
A basic knowledge of raster computer graphics and buzzwords useful. Some programming skill—C or Pascal-like language—required.

Chair
Tony Apodaca
Pixar

Lecturers
Tony Apodaca
Pixar
Phil Beffrey
Digital Arts
Mark Dippe
Industrial Light & Magic
Pat Hanrahan
Princeton University
Darwyn Peachey
Pixar
Steve Upstill
Pixar

Chair Biography
Tony Apodaca is a graphics software engineer in the RenderMan Division of Pixar. Tony is a co-developer of the RenderMan Interface Specification and is one of the unknown implementers of both of Pixar's image synthesis products. He received his master's degree in computer and systems engineering from Rensselaer Polytechnic Institute. His screen credits include *Red's Dream* and *Tin Toy*.

19 X3D-PEX (PEX): Three-Dimensional Graphics in a Distributed Window System

When - Tuesday

Who Should Attend
Technical professionals who are either applications or graphics-system designers or developers. Attendees should be familiar with X Window System concepts, the existing PHIGS graphics standard fundamentals, and the proposed PHIGS standard extensions (PHIGS-PLUS or its equivalent).

Course Description
X3D-PEX (PEX) is an emerging multi-vendor supported protocol extension to the X Window System for the rendering of PHIGS and PHIGS-PLUS 3D graphics within windows in a distributed environment. PEX also allows developers to take advantage of advanced graphics by using a standard application programming interface such as PHIGS. This course covers the evolution and architecture of PEX, explores the impact PEX use might have on application environments, and investigates important considerations for application and graphics-system implementers.

Recommended Background/Difficulty
Assumes fluency in a programming language and familiarity with PHIGS programming. (Simple C-language and PHIGS program examples will be used.)

Chair
Marty Hess
Sun Microsystems, Inc.

Lecturers
Marty Hess
Sun Microsystems, Inc.
Dave Plunkett
Solbourne Computer, Inc.
Randi Rost
Digital Equipment Corp.
Jeff Stevenson
Hewlett-Packard Co.

Chair Biography
Marty Hess has been a member of Sun's Graphics Standards Department since early 1987. He is a member of the original multi-vendor architecture team that designed PEX and is responsible for the design and development of the PEX Sample Implementation (PEX-SI) to be distributed to the public through the X Consortium at MIT. Hess has been involved in computer graphics for 10 years in the areas of MCAD, ECAD, business graphics, and graphics standards. He holds a bachelor's degree in computer engineering from the University of Michigan.

20 The PostScript Page Description Language

When -Tuesday

Who Should Attend
Programmers, computer artists, system designers, or others who wish to learn a language for page description. Those who have some programming background, but not necessarily an introduction to specific page description languages.

Course Description
Introduces the PostScript page description language—a powerful, programmable interface to imaging systems used for both printer and screen graphics. Begins with defining the role PostScript plays in an imaging system, and then explains the PostScript imaging model used by PostScript and language features. Covers uses of the PostScript language as a graphics exchange format, and newer developments such as Display PostScript and color extensions. Allows the attendee with a programming background to leave with a working knowledge of PostScript.

Recommended Background/Difficulty
Some programming and graphics background required, as detailed material includes PostScript language, syntax, semantics, and examples.

Chair
Leo Hourvitz
NeXT, Inc.

Lecturers
Ken Anderson
Adobe Systems Inc.
Linda Gass
Adobe Systems Inc.
Leo Hourvitz
NeXT, Inc.
John F. Sherman
University of Notre Dame

Chair Biography
Leo Hourvitz is the manager of graphics software at NeXT, Inc., where he has been involved in the design of Display PostScript and the NeXT Computer System since 1985. Previously, he worked in the Macintosh software group at Apple Computer. He is a graduate of the MIT Architecture Machine Group and the University of Michigan.

21 Radiosity

When - Tuesday

Who Should Attend
Anyone interested in realistic image synthesis.

Course Description
Describes radiosity algorithms and how they have evolved in computer graphics. The radiosity method, based on thermal engineering principles, simulates global illumination phenomena, such as indirect lighting, shadows, color-bleeding, and surface interreflections. This view-independent approach is particularly applicable to diffuse environments, but has recently been extended to incorporate specular surfaces and scattering. Due to new progressive refinement approaches, the technique is now practical for the rapid generation of high-quality images of complex environments. Descriptions of all pertinent algorithms and their limitations are presented.

Recommended Background/Difficulty
General knowledge of computer graphics display algorithms helpful. Course is understandable to those with knowledge of graphics display pipeline and rendering algorithms.

Chair
Donald P. Greenberg
Cornell University

Lecturers
Michael F. Cohen
University of Utah
Donald P. Greenberg
Cornell University
Roy A. Hall
Cornell University
Holly E. Rushmeier
Georgia Institute of Technology
John R. Wallace
3D/EYE Inc.

Chair Biography
Donald P. Greenberg is the Jacob Gould Schurman Professor of Computer Graphics at Cornell University. He teaches computer science, architecture, and engineering and is director of the interdisciplinary program of computer graphics at Cornell. He has worked in computer graphics for more than 20 years, specializing in realistic image synthesis, scientific visualization, and the uses of computer graphics in a wide variety of applications. He was presented the SIGGRAPH Coons Award in 1987 and has educated hundreds of students actively involved in computer graphics.

22 Video Technology for Computer Graphics

When - Tuesday

Who Should Attend
Computer graphics professionals who anticipate using video technology, or those who use video and wish to have a stronger technical background and better understanding of current techniques.

Course Description
This course gives computer graphics professionals a thorough understanding of the practical applications and theory of video technology. It begins with scanning theory, describing the monochrome video signal, the NTSC color video signal, color encoding techniques, and signal measurement. It reviews all current video formats including D-1/D-2 digital video and HDTV. It continues with contemporary video production and post-production techniques, including video special effects hardware, combining CGI with live action. Lecturers present criteria for evaluating 3D graphics systems and a quantitative approach to analyzing 3D animation systems.

Recommended Background/Difficulty
Assumes some familiarity with computer animation techniques.

Chair
Dean Winkler
Post Perfect Inc.

Lecturer
Dean Winkler
Post Perfect Inc.

Chair Biography
Dean Winkler holds a bachelor of science and master's degrees from Rensselaer Polytechnic Institute. He is currently vice president, director of creative services at Post Perfect Inc., a $15 million electronic special effects facility located in New York City. Winkler is also a computer/video artist, and has created over 5 1/2 hours of video art which have been shown internationally. Winkler's interests span art and engineering. He is holder of a U.S. patent, has been recipient of numerous awards in the television industry, and lectures frequently in the United States and abroad.

23 Modeling and Animating with Implicit Surfaces

When - Tuesday

Who Should Attend
Computer-aided design engineers, animators, programmers, or managers who use or build computer animation or modeling tools and wish to know more about an underutilized area in computer graphics.

Course Description
This course introduces designers and computer graphics system builders to implicit surfaces, showing advantages and disadvantages relative to more conventional modeling techniques. Researchers from academia and industry introduce the basic concepts of implicit surfaces, discuss how such surfaces are useful, present techniques for the building, animating and realizing of these surfaces, and discuss their current research results.

Recommended Background/Difficulty
Knowledge of interactive computer graphics techniques and elementary algebra.

Co-Chairs
Brian Wyvill
University of Calgary
Jules Bloomenthal
Xerox PARC

Lecturers
Thad Beier
Pacific Data Images
Jim Blinn
California Institute of Technology
Jules Bloomenthal
Xerox PARC
Alyn Rockwood
Silicon Graphics Computer Systems
Brian Wyvill
University of Calgary
Geoff Wyvill
University of Otago

Chair Biographies
Brian Wyvill is a professor at the University of Calgary, where he heads the Graphicsland animation research group. Besides publishing a number of papers on modeling and animation, Wyvill has directed several animations—two have been shown at SIGGRAPH—that demonstrate the use of implicit surfaces.

Jules Bloomenthal is currently at Xerox PARC working on modeling techniques. Bloomenthal has made a number of contributions to computer graphics literature over the years. He attended the University of Utah and has conducted research at the New York Institute of Technology.

ADVANCED COURSES

24 Advanced Topics in Ray Tracing

When - Monday

Who Should Attend
Those interested in obtaining more detail and background on topics which provide the theoretical basis of ray tracing.

Course Description
This course details color phenomena and photometry, offering a more complete understanding of the basic ray tracing algorithm and its limitations. It provides attendees an understanding of ray tracing assumptions and allows attendees to appropriately apply ray tracing and understand its theoretical limits.

Lecturers bring attendees up to date on the frontiers of ray tracing research, discussing the combination of ray tracing and radiosity. They show the power and use of ray tracing for purposes other than direct image synthesis, and discuss modeling and animation techniques that use ray tracing mechanisms in non-obvious ways to achieve surprising results.

Recommended Background/Difficulty
A basic knowledge of ray tracing through a previous course or programming experience.

Chair
Andrew Glassner
Xerox PARC

Lecturers
Jim Arvo
Hewlett-Packard/Apollo Computer
Andrew Glassner
Xerox PARC
Roy Hall
Cornell University
Jim Kajiya
California Institute of Technology
Don Mitchell
AT&T Bell Laboratories
John Wallace
Cornell University

Chair Biography
Andrew S. Glassner has been working in computer graphics as a researcher, writer, and lecturer for 10 years. He has worked on graphics at Case Western Reserve University, New York Institute of Technology Computer Graphics Lab, IBM T.J. Watson Research Center, Bell Communications Research, and Delft University of Technology, Netherlands. He is currently a member of the research staff at Xerox PARC. Glassner's work has focused on methods for efficiently creating imaginative and realistic 3D computer graphics and animation. His publications include research papers on texture mapping, ray tracing, and digital sound editing.

25 Unifying Parametric and Implicit Surface Representations for Computer Graphics

When - Tuesday

Who Should Attend
Those interested in state-of-the-art techniques in computer-aided geometric design and modeling. Typical participants: researchers and practitioners in geometric design and modeling or software engineers developing 3D modeling systems.

Course Description
One effective way to represent or render a complex surface is by using polynomials or ratios of polynomials. Two approaches for incorporating this idea are parametric and implicit surface representations, each suited to certain types of problems. This course compares, contrasts, and unifies these approaches with an emphasis on the Bernstein/Bézier representation. The course begins with a brief description of both representations and applies material to three fundamental problems. Presenters cover piecewise surface generation and rendering and conversion methods.

Recommended Background/Difficulty
Assumes basic familiarity with Bernstein/Bézier curves.

Chair
Brian A. Barsky
University of California, Berkeley

Lecturers
Chanderjit Bajaj
Purdue University
Brian A. Barsky
University of California, Berkeley
Tony DeRose
University of Washington
Chris Hoffmann
Purdue University
Joe Warren
Rice University

Chair Biography
Brian A. Barsky is associate professor of computer science at the University of California, Berkeley and adjunct associate professor of computer science at the University of Waterloo. He holds a D.C.S. in engineering and a bachelor's degree in mathematics and computer science from McGill University, an M.S. degree in computer graphics and computer science from Cornell University, and a Ph.D. in computer science from the University of Utah. Barsky is author of Computer Graphics and Geometric Modeling Using Betasplines and co-author of An Introduction to Splines for Use in Computer Graphics and Geometric Modeling. He is an area editor for the new journal *CVGIP: Graphical Image Processing*. He was the technical program chair for SIGGRAPH '85.

26 State of the Art in Facial Animation

When -Tuesday

Who Should Attend
Persons desiring a better understanding of the currently used techniques and research directions in facial animation.

Course Description
Offers a state-of-the-art course on facial modeling and animation which includes data sources, modeling techniques, animation approaches, parameterized expression models, dynamic physical simulation, speech synchronization, and interactive real-time "performance" systems. This is an updated version of the course offered at SIGGRAPH '89.

Recommended Background/Difficulty
A good understanding of fundamental 3D computer graphics and basic computer animation concepts. Material is straightforward for those with solid computer graphics background.

Chair
Frederic I. Parke
NYIT Computer Graphics Laboratory

Lecturers
Brad deGraf
deGraf/Wahrman
Matt Elson
Symbolics
Frederic I. Parke
NYIT Computer Graphics Laboratory
Jeff Kleiser
Kleiser-Walczak Construction Co.
Bill Reeves
Pixar
Keith Waters
Schlumberger Laboratory of Computer Science
Brian Wyvill
University of Calgary

Chair Biography
Frederic I. Parke has been a professor and director of the NYIT Computer Graphics Laboratory since 1981. He has been involved in the development of facial animation since 1971 and received his doctorate degree in 1974 from the University of Utah. He chaired SIGGRAPH courses in 1983, 1984, 1985, and 1989.

27 State of the Art in Data Visualization

When - Tuesday

Who Should Attend
Technical individuals, with a strong interest and some acquaintance with data visualization, wanting to learn about the work of active researchers in the field. Useful for those looking to solve a particular data visualization problem.

Course Description
Active participants in data visualization relay the latest research, ideas, and experiences. Each speaker appears more briefly in favor of providing exposure to a larger number of different views, keeping the discussion focused on the truly latest and state-of-the-art work. Course also discusses the latest technical details of visualization research in-depth. A unique opportunity to hear ideas and experiences that are not ready for, or are usually omitted from, formal publication. No representation of earlier papers or 1989 technical session topic repeats.

Recommended Background/Difficulty
A good grasp of computer graphics recommended. A strong interest or experience with data visualization helpful.

Chair
Mark Smith
Cognivisions, Inc.

Lecturers
Matthew Arrott
University of Illinois, Urbana-Champaign
Todd Elvins
San Diego Supercomputer Center
Larry Gelberg
Stardent Computer, Inc.
George Grinstein
University of Lowell
Arie Kaufman
S.U.N.Y. Stony Brook
Rainald Loehner
The George Washington University
Mark Smith
Cognivisions, Inc.
Hikmet Senay
The George Washington University

Chair Biography
Mark E. Smith is vice president and co-founder of Cognivision, Inc. While under the employment of Conoco Inc., a subsidiary of Du Pont, he designed and was the principal author of a computer program for multidimensional visualization of numerical simulations and experimental data.

Smith is interested in the advancement of new visualization techniques, the rapid manipulation of large data sets, and the user/computer interface. A 1982 graduate of Purdue University with master's and bachelor's degrees in civil engineering, he was with Conoco from 1982 to 1988 until co-founding Cognivision.

28 Parallel Algorithms and Architectures for 3D Image Generation

When - Tuesday

Who Should Attend
Those interested in parallel methods for displaying computer graphics imagery. Software and hardware designers interested in parallel processing, VLSI, graphics workstation architecture, or graphics display algorithms.

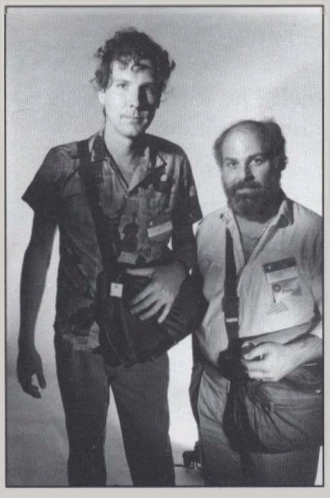
Course Description
This course highlights several ongoing research areas within parallel graphics display algorithms and elaborates on the radiosity approach and polygon rendering algorithms. It discusses parallel programming techniques as related to graphics algorithms to provide knowledge of the various issues involved. Principal designers of several graphics workstation architectures present their design philosophy, discuss the field in general, and expand upon future architectures. They discuss how these techniques are used in commercial products and determine the feasibility of true real-time 3D graphics at the workstation level.

Recommended Background/Difficulty
Familiarity with computer graphics display algorithms and processing or hardware architecture helpful. Should have attended previous course or possess sufficient technical knowledge to understand topics.

Chair
Scott Whitman
The Ohio State University

Lecturers
Kurt Akeley
Silicon Graphics Computer Systems
Dan Baum
Silicon Graphics, Inc.
Wm. Leler
Cogent Research
Doug Voorhies
Apollo/HP
Scott Whitman
The Ohio State University

Chair Biography
Scott Whitman is a doctoral candidate in the computer and information science department at The Ohio State University, Columbus. He received his master's degree from Ohio State in computer science and his bachelor's degree in mathematics from Carnegie-Mellon University. Previously, Whitman worked at Cranston/Csuri Productions as a computer graphics researcher and at Evans & Sutherland as an applications engineer. His research interests include image synthesis, advanced computer architectures, and parallel programming.



Papers and Panels-At-A-Glance

Wednesday	9:00-10:30	Opening Session		
	10:45-12:30	Papers: Dynamics	Panel: Grand Challenges of Computational Science	
	1:45-3:15	Papers: Rendering	Panel: Using Photographic Quality Images In Desktop Applications	Panel: Interface and New Interactive Systems
	3:30-5:00	Papers: Object Space Methods	Special Session: SIGGRAPH College Bowl	Panel: Multimedia Document Architecture
Thursday	9:00-10:30	Papers: Radiosity	Panel: Beyond Scientific Visualization: Mapping Information	Panel: Interactive Art and Artificial Reality
	10:45-12:30	Papers: Interaction	Panel: New Methods, New Art Forms: 3D Applications in Sculpture	Panel: Hand Tools or Head Tools?
	1:45-3:15	Papers: Non Photo Realistic Rendering	Special Sessions: "Hip, Hype, and Hope—The Three Faces of Virtual Worlds"	
	3:30-5:00	Papers: Animation	Special Sessions: "Hip, Hype, and Hope—The Three Faces of Virtual Worlds" (continued)	
Friday	9:00-10:30	Papers: Lighting and Shading	Panel: What is Happening on The Hill?	Panel: Getting it Off the Screen and Onto Paper: Current Accomplishments and Future Goals
	10:45-12:30	Papers: Hardware	Panel: Visualization Technologies as a Tool for Science Education	Panel: The State of the Animation Industry
	1:45-3:15	Papers: Surfaces and Volumes	Panel: Color Portability—Reality in the '90s	
	3:30-5:00	Papers: Pools, Puddles, Stones, Waterfalls, and Fire	Panel: Digital Publication: Status, Opportunities, and Problems	

Papers And Panels

Wednesday
9:00-10:30 a.m.

Opening Session

SIGGRAPH '90 Welcome

David D. Loendorf
Jacqueline M. Wollner
SIGGRAPH '90 Co-Chairs

SIGGRAPH Report
James J. Thomas
SIGGRAPH Chair

1990 SIGGRAPH Award
Presented by Bertram Herzog

Computer Graphics Achievement Award

Wednesday
10:45 a.m.-12:30 p.m.

Papers: Dynamics

Curved Surfaces and Coherence for Non-penetrating Rigid Body Simulation
David Baraff
Cornell University

Dynamic Simulation of Autonomous Legged Locomotion
Michael A. McKenna
and David Zeltzer
MIT

Geometric Collisions for Time-Dependent Parametric Surfaces
Brian Von Herzen, Alan H. Barr and Harold R. Zatz
California Institute of Technology

Rapid, Stable Fluid Dynamics for Computer Graphics
Michael Kass
and Gavin Miller
Apple Computer, Inc.

Panel: Grand Challenges of Computational Science

There has been a massive expansion in the computational infrastructure supporting scientific research in the last five years. Today tens of thousands of researchers have access from their desktop computers to supercomputer centers over the national network. Scientific visualization has arisen as a critical tool of discovery; or scientific impact are being addressed.

Leading researchers discuss how advanced computing and visualization resources are used to advance knowledge on these problems in university, industrial, and governmental research centers. They explain the White House's High Performance Computing Program, a $500 million annual program for computer and technology research and development.

Chair
Larry Smarr
NCSA

Panelists
Gregory McRae
Carnegie Mellon University
Arthur Freeman
Northwestern University
David Dixon
E. I. Du Pont De Nemours & Co.
Eric Lander
MIT

Wednesday
1:45-3:15 p.m.

Papers: Rendering

Cone-Spheres
Nelson Max
and Hikari Kinema
Lawrence Livermore National Laboratory

Particle Transport and Image Synthesis
James Arvo
Apollo Systems Division of Hewlett-Packard
David Kirk
California Institute of Technology

Rendering CSG Models with ZZ-Buffer
David Salesin
Stanford University
Jorge Stolfi
DEC Systems Research Center

Antialiasing of Interlaced Video Animation
John Amanatides
and Don P. Mitchell
AT&T Bell Laboratories

Panel: Using Photographic-Quality Images in Desktop Applications

PC technology and applications have advanced significantly, but they are still primitive compared to professional publishing. Ordinary desktop computers cannot use photographic-quality images due to bandwidth constraints; quality is sacrificed because the computer cannot process and manipulate complex images. Today, new technology eliminates these barriers and enables desktop computers to use high-quality, true-color images.

Making photographic-quality images part of ordinary computers enhances and creates a new class of applications. This panel addresses hardware and software advances that remove the tech-nical barriers to 24-bit color images, including compression, printer and board technologies. It discusses new ways to integrate photographic-quality color images into desktop applications.

Chair
Jim Rafferty,
C-Cube MicroSystems

Panelists
John Warnock,
Adobe Software
Mike Templeman,
Aldus Corporation
Steve Edleman,
SuperMac Technologies

Panel: Interface and New Interactive Systems

Developments in theory, technology, the marketplace, and business suggest that we are entering a period of accelerating growth in the variety and pervasiveness of interactive products. Integrated medium technology platforms are emerging in entertainment, design, engineering, manufacturing, and education. Delivery systems range from television screens to bodysuits.

In the world of "traditional" computers, user-interface design has become a discipline with established, sometimes contradictory, theory and design principles. These new interactive technologies underline the need to develop and extend the domain of user-interface design. Panelists identify and discuss key interface issues for new media and technologies.

Chair
Brenda Laurel
Interactivist

Panelists
David Nagel
Apple Computer, Inc.
Chris Schmandt
MIT Media Lab
Michael Naimark
Independent Media Artist and Researcher
Douglas Crockford
Lucasfilm Games, a Division of LucasArts Entertainment

Wednesday
3:30-5:00

Papers: Object Space Methods

Parallel Object-Space Hidden Surface Removal
Wm. Randolph Franklin
and Mohan S. Kankanhall
Rensselaer Polytechnic Institute

Hidden Curve Removal for Free Form Surfaces
Gershon Elber
and Elaine Cohen
University of Utah

A Polyhedral Solid Modeler that Always Works
Mark Segal
Silicon Graphics Computer Systems

Merging BSP Trees Yields Polyhedral Set Operations
Bruce Naylor
AT& T Bell Laboratories
John Amanatides
York University
William Thibault
California State University at Hayward

Special Session: SIGGRAPH College Bowl

Test your knowledge about the history of computer graphics research and the SIGGRAPH conference by participating as a member of the "SIGGRAPH College Bowl!"

A spinoff of the famous televised College Bowl, invited teams representing leading universities and graphics companies will test their knowledge of SIGGRAPH history.

Participants identify quotes from important SIGGRAPH papers, recognize rendered images and film show animations of past years, and answer trivia questions about events, trends, and personalities of past SIGGRAPH conferences.

Co-Chairs
Tomas Porter,
Pixar
Pat Hanrahan,
Princeton University

Masters of Ceremony
Jim Blinn,
California Institute of Technology
Nick England,
Sun Microsystems
Rob Pike,
AT&T Bell Labs

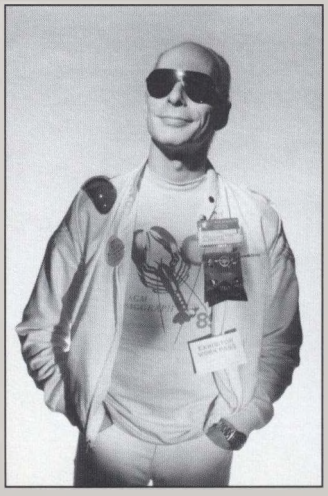
Panel: Multimedia Document Architecture

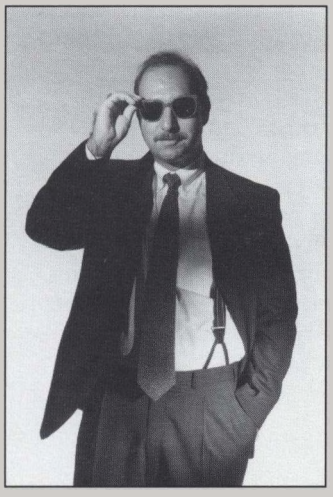
Multimedia information systems capable of managing combined text, graphics, still images, audio, and video are leaving the laboratory to enter the mainstream of information technology. An important level of organization for information handled by such systems is the multimedia document, which provides a means for packaging and coordinating related objects of different media types. Furthermore, multimedia document architecture is a fundamental model for representing the structure, content, and presentation characteristics of multimedia documents.

However, most existing architectures are unique—designed specifically for the systems that use them and do not permit easily exchanged information. This panel addresses some of the current problems associated with multimedia document architectures and important issues of the future.

Chair
Stephen Bulick,
U.S. West Advanced Technologies

Panelists
Terry Crowley,
Bolt, Berenek, and Newman
Lester Ludwig,
Bell Communications Research
Jonathan Rosenberg,
Carnegie-Mellon University





Thursday
9:00-10:30 a.m.

Papers: Radiosity

An Efficient Radiosity Solution for Bump Texture Generation
Chen Hong and Wu Enhua
Institute of Software, Academia Sinica

Incremental Radiosity: An Extension of Progressive Radiosity to an Interactive Image Synthesis System
Shenchang Eric Chen
Apple Computer Inc.

Adaptive Radiosity Textures for Bidirectional Ray Tracing
Paul Heckbert
University of California at Berkeley

Adaptive Mesh Generation for Global Diffuse Illumination
Donald Fussell and
A.T. Campbell
University of Texas at Austin

Panel: Beyond Scientific Visualization: Mapping Information

The term "scientific visualization" conjures up mental images of molecules reacting or velocity vectors whizzing around. Yet, visualization is migrating beyond the scientific domain because it maps not only numerical, but all data into visual representations.

This panel compares several visualization methodologies and how they have employed advanced computer graphics to map abstract information into meaningful animations and interactive software. Panelists demonstrate how they have organized abstract data or concepts using spatial, quantitative, dynamic, and symbolic techniques to visually communicate maximum information. Examples from linguistics, humanities, education, statistics, engineering, and science are presented.

Chair
Donna J. Cox
NCSA

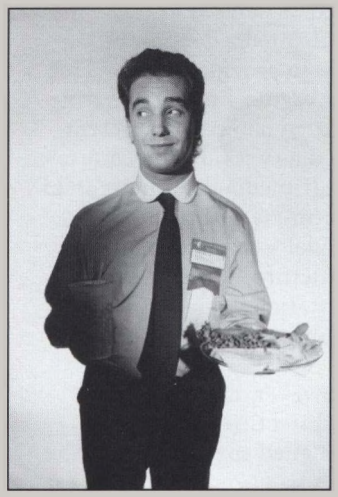
Panelists
Jim Blinn
California Institute of Technology
Richard Ellson
Eastman Kodak Company
Helga M. Leonardt Hendriks
The Leonhardt Language System

Panel: Interactive Art and Artificial Reality

This panel focuses on and addresses the distinctions made between computer art, interactive art, artificial, and virtual realities. Panelists consider how the computer, as a symbol-manipulating, all-purpose machine, is a tool that changes the way art is created and experienced. Panelists argue that this view implies interactivity and possibly trivializes static paintbox computer art by changing the viewer's role from passive observer to active participant. Interactivity is discussed as a step toward artificial or virtual realities and a means to define new possibilities in real-time performance.

Chair
Gregory P. Garvey
The New England School of Art and Design/Northeastern University

Panelists
Myron Krueger
Independent Consultant
Ed Tannenbaum
Independent Artist
Don Ritter
Concordia University
Lillian Schwartz
AT&T Labs



Thursday
10:45 a.m. -12:30 p.m.

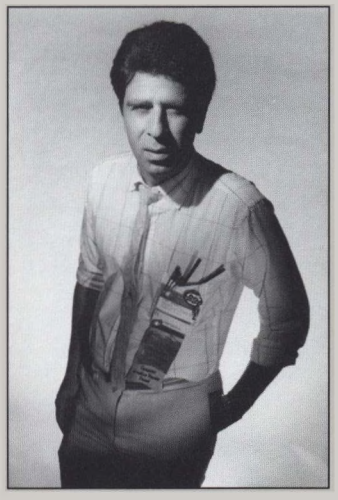
Papers: Interaction

Artificial Reality with Force-feedback: Development of Desktop Virtual Space with Compact Master Manipulator
Hiroo Iwata
The University of Tsukuba

Rapid Controlled Movement Through a Virtual 3D Workspace
Jock D. Mackinlay,
Stuart K. Card,
and George G. Robertson
Xerox PARC

Project Grope-Haptic Displays for Scientific Visualization
Fred Brooks, Ming Ouh-Young, and James Batter
University of North Carolina at Chapel Hill
P. Jerome Kilpatrick
IBM Corporation

Extended Free-Form Deformation: A New Sculpturing Tool for 3D Geometric Modeling
Sabine Coquillart and Inria Rocquencourt
Institut National de Recherche en Informatique et en Automatique



Panel: New Methods, New Artforms: 3D Applications in Sculpture

Many artists use computer modeling and animation tools for creating, editing, and presenting sculptural works. Some artists design for the 3D virtual space—others use computers to control 3D output devices to create holograms and other illusory 3D environmental works. Stereolithography and other new technologies offer artists output devices to enhance, extend and enrich 3D visual communication.

Panelists discuss the effect computers have in the developments of new artforms as a result of available new technologies and present their views on potential direction, including collaborative works, interdisciplinary and cross-disciplinary projects, and curriculum revisions in sculpture education.

Chair
Barbara Mones-Hattal
George Mason University

Panelists
Ken Snelson
Independent Sculptor
Rita Starpattern
Art in Public Places, City of Austin
Sally Weber
Independent Artist
Charles Csuri
The Ohio State University
Tony Longson
California State University, Los Angeles

Panel: Hand Tools or Head Tools?

Large-firm designers use computers in fields like architecture, where the production aspects of design and working drawings are an important part of the budget. In comparison, small firms in fields like graphic design—where design, typesetting or artwork has traditionally been done outside the firm—computer tools are less widely used.

In effect, designers have been offered tools for production—"tools for the hand"—whereas "tools for head" would enable them to design better, rather than simply allowing them to produce work faster. This panel discusses the effects of the present generation of computer tools, the organization's approach to working, and the design process. It considers how universities, design firms and hardware and software manufacturers might work together to develop design tools of the future which enable designers to use computers at their full potential.

Chair
Robin Baker
Royal College of Art

Panelists
Alison Black
Reading University
Gillain Crampton Smith
Royal College of Art

Thursday
1:45-3:15 p.m.

Papers: Non Photo Realistic Rendering

Comprehensible Rendering of 3D Shapes
Takafumi Saito and
Tokiichiro Takahashi
NTT Human Interface Laboratories

Paint By Numbers: Abstract Image Representations
Paul Haeberli
Silicon Graphics Computer Systems

Direct WYSIWYG Painting and Texturing on 3D Shapes
Pat Hanrahan
Princeton University
Paul Haeberli
Silicon Graphics Computer Systems

Special Session: "Hip, Hype and Hope—The Three Faces of Virtual Worlds"

By now, almost everyone in computer graphics has read, seen, or experienced virtual worlds—"artificial realities" generated by computers which surround the user. Virtual-world systems are the focus of the media, grist for the TV mill, and everyone's pick as "The Big Idea of the 90s." But what does it all mean? Is virtual-worlds technology really that important? Panelists address the artificial reality controversy and suggest the future of professional and personal computer use.

Chair
Bob Jacobson
University of Washington

Panelists
John Barlow
Author and Songwriter
Nolan Bushnell
Aaps, Inc.
Esther Dyson
Editor, Release 1.0, Analyst
Timothy Leary
University of Pittsburgh
Tom Furness
Human Interface Technology Lab
Warren Robinette
University of North Carolina
Randall Walser
Autodesk

Thursday
3:30-5:00 p.m.

Papers: Animation

Reusable Motion Synthesis Using State-Space Controllers
Michael van de Panne,
Eugene Fiume,
and Zvonko Vranesic
University of Toronto

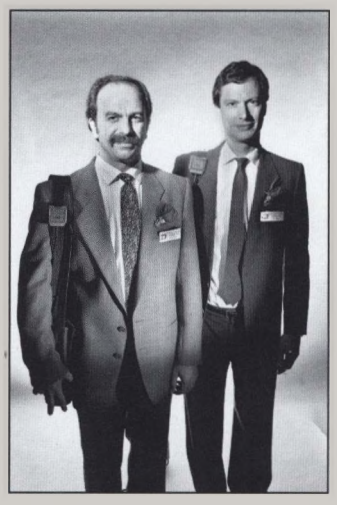
Electronic Mask Technology
Lance Williams
Apple Computer, Inc.

Fast Animation and Control of Nonrigid Structures
Andrew Witkin
and William Welch
Carnegie Mellon University

Strength Guided Motion
Norman Badler,
Philip Lee,
Susanna Wei,
and Jianmin Zhao
University of Pennsylvania

Special Session: "Hip, Hype and Hope—The Three Faces of Virtual Worlds"

Continued



Friday
9:00-10:30 a.m.

Papers: Lighting and Shading

A Super Photorealistic Rendering Technique
Atsushi Takagi, Hitoshi Takaoka, Teisuya Ohshima and Yoshinorl Ogata
Toyota Motor Corporation

A Model for Anisotropic Reflection
Alain Fournier
and Pierre Poulin
University of British Columbia

Building Block Shaders
Gregory Abram
and Turner Whitted
Numerical Design Ltd.

A Language for Shading and Lighting Calculations
Pat Hanrahan
Princeton University
Jim Lawson
Pixar

Panel: What is Happening on the Hill?

This panel provides important information on public policies affecting computer graphics research grants and helps prepare for future directions. Panelists present public policies having both beneficial and not-so-beneficial ramifications. For example, the "High Performance Computing Initiative," concerning technology industrial incentives trends, the objectives and priorities of funding agencies such as the National Science Foundation and National Endowment for the Arts, as well as trends in technology grants and incentives from the private sector. The primary goal of this panel is to increase SIGGRAPH awareness about decisions being made on Capitol Hill that directly affect future research funds.

Chair
Donna J. Cox
NCSA

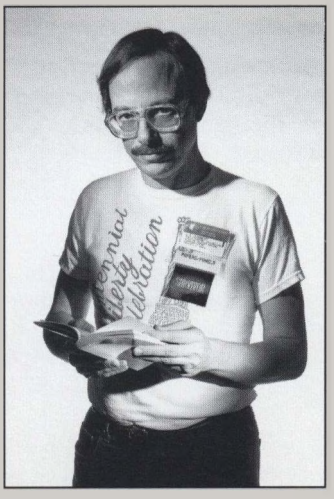
Panelists
Larry Smarr
NCSA
Jacob Maizel Jr.
National Institute of Health
Rich Hirsh
National Science Foundation

Panel: Getting it Off the Screen and Onto Paper: Current Accomplishments and Future Goals

Obtaining satisfactory hardcopy of an image displayed on a color monitor has been the elusive holy grail of computer graphic color reproduction work. Progress has been made in applying the color science principles to this problem, with products now available to provide a colorimetric match between the CRT image and the reflection print produced by the hardcopy device. Further improvement of such equipment will require that designs consider additional aspects of human color perception, such as color adaptation and color contrast. This panel reviews the current state of research and development, discusses problems, and shows how this work is important to other areas of computer graphics.

Chair
Gary W. Meyer
University of Oregon

Panelists
Ricardo J. Motta
Hewlett-Packard Laboratories
Gerald M. Murch
Tektronix Laboratories
Maureen C. Stone
Xerox PARC



Friday
10:45 a.m.-12:30 p.m.

Papers: Hardware

The Rendering Architecture of the DN10000VS
Douglas Voorhies
and David Kirk
Apollo Systems
Division of Hewlett-Packard

The Accumulation Buffer: Hardware Support for High-Quality Rendering
Paul Haeberli and Kurt Akeley
Silicon Graphics Computer Systems

High Speed High Quality Antialiased Vector Generation
Anthony Barkans
Hewlett-Packard Company

Real-Time Robot Motion Planning Using Rasterizing Computer Graphics Hardware
Jed Lengyel, Mark Reichert,
Bruce R. Donald, and
Donald P. Greenberg
Cornell University

Panel: Visualization Technologies as a Tool for Science Education

Most U. S. high school graduates are technologically illiterate, whether the subject be genetic engineering, computing technology or the large-scale structure of the universe. But the problem is less technological than societal. We conjecture that if teenagers are bright enough to use the technology of arcade games, VCRs, electronic music and laser disks, they can simulate and visualize physical phenomena with the proper tools.

Panelists explore this problem from technological and implementation perspectives: What visualization are technologies available to teachers and students? How can we incorporate visualization technologies into base science and math curricula?

Chair
Robert Sherman Wolff
Apple Computer, Inc.

Panelists
Thomas A. DeFanti
University of Illinois at Chicago
H. Eugene Stanley
Boston University
Larry Yaeger
Apple Computer, Inc.
Paul Hickman
Belmont High School

Panel: The State of the Animation Industry

A few years have passed since the great depression of computer graphics animation companies. New companies formed, a few survived, and the industry seems to be back on its feet. What have we learned from our experience? What will the future bring?

Panelists discuss their company's direction, current projects, their goals and views of the future.

Chair
Carl Rosendahl
Pacific Data Images, Inc.

Panelists
Kathryn Riccio
Rhythm & Hues
Michael Wahrman
deGraf/Wahrman, Inc.
Ralph Guggenheim
Pixar
Xavier Nicolas
Exmachina

Friday
1:45-3:15 p.m.

Paper: Surfaces and Volumes

Ray Tracing Trimmed Rational Surface Patches
Thomas W. Sederberg
and Masanoil Kakimoto
Brigham Young University
Tomoyuki Nishita
Fukuyama University

Generalized B-spline Surfaces of Arbitrary Topology
Charles Loop
and Tony DeRose
University of Washington

Rendering and Animation of Gaseous Phenomena by Combining Fast Volume and Scanline A-buffer Techniques
David S. Ebert
and Richard S. Parent
Ohio State University

Footprint Evaluation for Volume Rendering
Lee Westover
Numerical Design Ltd.

Panel: Color Portability—Reality in the '90s

Will the high-quality color found in commercial prepress systems be available at the desktop publishing level? Some say it's impossible; others say it isn't. Panelists address issues such as coordinating the wide range of input, output, and display devices for color computing; bringing high-quality color to the desktop with minimal memory; accommodating the variability of input/output; and using multi-vendor systems. They discuss issues regarding printers and processing, and calibrating hardware devices, and color in relation to printing and imaging.

Chair
Efraim Arazi
Electronics for Imaging

Panelists
John D. Meyer
Hewlett-Packard Lab
James A. Kasson
IBM Almaden Research Center

Friday
3:30-5:00 p.m.

Papers: Pools, Puddles, Stones, Waterfalls and Fire

Light-Water Interaction using Backward Beam Tracing
Mark Watt
Digital Pictures

A Method of Generating Stone Wall Patterns
Kazunori Miyata
IBM Research, Tokyo
Research Laboratory

A Lighting Model Aiming at Drive Simulators
Eihachiro Nakamae
Kazufumi Kaneda
and Takashi Okamoto
Hiroshima University

Particle Animation and Rendering Using Data Parallel Computation
Karl Sims
Optomystic

Panel: Digital Publication: Status, Opportunities and Problems

Digital publications are a reality. High-resolution workstation displays and low-cost mass storage systems create an electronic reading environment that exceeds the capabilities of traditional printed publications. Digital publications include text, line art, still images, and also include sound, video sequences and animations.

However, while the opportunities for digital publication are great, there are many associated problems. This panel addresses the current status of digital publications, its opportunities, problems (such as lack of standards), centralized document database development, documents to workstation distribution, and appropriate user interfaces.

Chair
Dick Phillips
Los Alamos National Laboratory

Panelists
Michael Lesk
Bellcore
Michael Hawley
MIT Media Laboratory
Andries van Dam
Brown University
Richard J. Beach
Xerox PARC

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SIGGRAPH '90 General Information

If you register for the Educators Seminar	you may attend	and you'll receive
	Seminar	Notes for your seminar
	Exhibition	
	Art show	
	Hypermedia	
	Fundamentals seminar	
	Animation screenings	
	Open deck	

If you register for Courses	you may attend	and you'll receive
	Your confirmed course(s)	Notes for your course(s)
	Lunch on your course day(s)	Art show catalog*
	Course reception	Film and video theater catalog*
	Exhibition	
	Art show	
	Film and video theater*	
	Hypermedia	
	Fundamentals seminar	
	Animation screenings	
	Open deck	

If you register for Paper/Panel Sessions	you may attend	and you'll receive
	All paper/panel sessions	Conference proceedings
	Papers/panels reception	Art show catalog*
	Exhibition	Film and video theater catalog*
	Art show	
	Film and video theater*	
	Hypermedia	
	Fundamentals seminar	
	Animation screenings	
	Open deck	

Registration to both courses and papers/panels entitles a registrant to only one film and video theater ticket, one film and video theater catalog and one art show catalog. Badged attendees may purchase additional tickets to the film and video theater at the on-site registration counter beginning Tuesday, August 7 at 10 a. m., subject to availability. All performances will contain the same material.

Dates to Remember

Early registration discount deadline:
Postmarked by June 29

Advance registration deadline:
Received by July 18

Refund deadline:
Postmarked by July 18

Discounts

Members. To qualify for member discounts, you must be a current ACM, IEEE, or SIGGRAPH, member. Your membership number must appear on the registration form.

Students. To qualify for student discounts, you must attach either a copy of your current ACM student membership card or a copy of your student identification card to the registration form. Without this information, you will be charged non-member rates.

How to Pre-Register

1. Activity selection. Read pages 13 through 37. Determine if you will attend courses, paper/panel sessions, or the educators seminar.

2. Registration information. Read the "SIGGRAPH '90 General Information" section to determine registration deadlines, payment procedures and what your fee(s) include(s).

3. Registration form. Complete the registration form located on page 47 to register in advance for SIGGRAPH '90. Complete all sections of the form including personal data, membership status, courses and papers/panels selection, educators seminar, film and video theater showing, merchandise purchases, and payment.

For courses:
You may register for at most two one-day courses, one on Monday and one on Tuesday. Seating is limited in all courses. Please indicate your first two choices, in order of preference.

For paper/panel sessions:
You may attend all paper/panel sessions Wednesday through Friday for one registration fee. Enter the appropriate papers/panels registration fee on the form.

Indicate the date and time of the showing you prefer for the film and video theater. Every attempt will be made to accommodate your requests.

4. Payment. A check, money order in U.S. funds, made payable to SIGGRAPH '90, or credit card information must be included with the advance registration form. Advance registration forms will not be processed without full payment. Purchase orders will not be accepted.

5. Mailing instructions.
Regular mail. Place your registration form, check, money order (made payable to SIGGRAPH '90), or credit card information in an enve-lope and return to:

SIGGRAPH '90
P.O. Box 95316
Chicago, IL 60694-5316
USA

Overnight mail. Overnight courier services such as Federal Express, United Parcel Service, or other couriers cannot deliver to a post office box number. If you must use such a service, the bank has agreed to accept overnight packages directly if you follow this procedure:

A. Place your registration form and payment in an envelope addressed to the post office box indicated above.

B. Next, place this envelope in an overnight courier package addressed to:

Remittance Processing
Harris Bank
311 W. Monroe
Chicago, IL 60606 USA

Fax. If you register by credit card, you may fax your advance registration form to SIGGRAPH '90 at 312-938-1232 until July 18 at 5 p.m. Central Standard Time. Both sides of your completed registration form must be faxed for your form to be processed.

It is strongly recommended that you fax your forms long before the June 29 early registration and July 18 advance registration deadlines as heavy volume is expected at these times. SIGGRAPH '90 cannot be responsible for faxes not received by June 29 or July 18 due to busy or unavailable phone lines.

6. Deadlines. Forms received after July 18 will not be processed before the conference. If your form and payment is not received by this date, full payment of fees will be required on-site and your advance payment will be refunded after the conference.

7. Registration verification. You will receive written acknowledgement of your registration from the conference management office if your form and payment are received before July 18 Attendees who pre-register must pick up their conference credentials at the Dallas Convention Center during registration hours. You must present your registration receipt to receive your credentials.

8. Refunds. All refunds must be made in writing and postmarked or faxed on or before July 18 to:

SIGGRAPH '90
Conference Management
111 E. Wacker Drive
Suite 600
Chicago, IL 60601 USA
Fax: 312-938-1232

Allow eight to 10 weeks for processing refunds. No refund requests will be honored after July 18.

How to Register On-Site

On-site registration for SIGGRAPH '90 will take place in the Dallas Convention Center during the following times:

Sunday, August 5
Noon - 10 p.m.

Monday, August 6
7:30 a.m. - 7 p.m.

Tuesday, August 7
7:30 a.m. - 7 p.m.

Wednesday, August 8
8 a.m. - 6 p.m.

Thursday, August 9
8 a.m. - 6 p.m.

Friday, August 10
9 a.m. - 1 p.m.

Upon arriving at the convention center, proceed to the area marked "On-Site Registration."

How to Find a Hotel

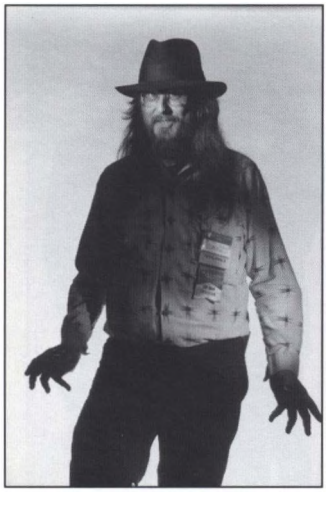
Hotel reservations are handled separately from conference registration. To obtain housing in Dallas, follow this procedure:

A. Complete the hotel form located on page 46.

B. Mail the completed hotel form to:

SIGGRAPH '90
Housing Bureau
1201 Elm Street Suite 2000
Dallas, TX 75270 USA
1-800-972-1029 (U.S. only)
Fax: 214-746-6799

C. A hotel reservation acknowledgement will be mailed to you showing the assigned hotel. The assigned hotel will then send a confirmation directly. Review the confirmation carefully for any deposit requirements. Any cancellations or changes on your reservations must be made in writing by July 9 and mailed to the SIGGRAPH '90 Housing Bureau.



How to Make Airline Reservations

Several airlines are offering special discounts for travel to SIGGRAPH '90 in Dallas. Full coach and first class have no minimum stay or advance booking requirements, and no penalty for itinerary changes or cancellations. Limited special excursion fares and restrictions do apply to those fares.

We recommend that you make your travel arrangements as early as possible. When making reservations with the designated airlines, please identify yourself as a SIGGRAPH '90 participant by providing the particular airline file number. Seating will be limited in some discount categories. Tickets will be mailed to you by the official SIGGRAPH '90 travel agency, Arta Travel.

American Airlines
File Number: S0170PM
Hours: 7 a.m. - 1 a.m.
Monday through Sunday, EST
Valid Dates of Travel:
July 31 - August 13, 1990

Continental U.S.:
800-433-1790
5% discount on excursion fares
5% discount on first-class fares
45% discount on full-coach fares
7 day advance purchase required

Canada: Call your local reservation office meeting services department.
35% discount on full coach fares
7 day advance purchase required

Delta Airlines
File Number: F0936
Hours: 7:30 a.m. - 8:30 p.m.
Monday through Friday, EST
8:30 a.m. - 8:30 p.m.
Saturday through Sunday, EST
Valid Dates of Travel:
July 31 - August 13, 1990

Continental U.S.:
800-672-2782 (8:30 a.m. - 5:30 p.m. CST) 800-241-6760
5% discount on excursion fares
5% discount on first-class fares
45% discount on full-coach fares
7 day advance purchase required

Southwest Airlines
Reservations to be made through Arta Travel.
Hours: 8:30 a.m. - 5:30 p.m., CST
Monday through Friday
Valid Dates of Travel:
July 31 - August 13, 1990
Intra Texas and connecting five states 800-678-2782
The first 50 ticketed fares will receive an additional $10/25 discount.

As an added incentive for all SIGGRAPH '90 participants, eight roundtrip tickets will be raffled:

- American—two tickets domestic only fares
- American—two tickets anywhere on the American System
- Delta—two tickets domestic only fares
- Southwest—two tickets intra Texas and five connecting states.

To qualify for the drawing, book your tickets through the SIGGRAPH '90 air program or mail a 3x5 card with your name, address, and phone number by August 1 to:
Arta Travel
P.O. Box 1485
Plano, TX 75074

Local Transportation

Transportation is available to downtown Dallas from the two airports serving metropolitan Dallas via taxi, rental car or Super Shuttle.

Special discounts on rental cars have been arranged for SIGGRAPH '90 attendees. These discounts can be arranged when booking your air travel or for additional information call:

Avis, 800-331-1600, and ask for convention rate B136000 or National, 800-328-7949, and ask for Recap #6302778.

Discount coupons for Super Shuttle will be available for attendees with their advance registration acknowledgement. For service information call toll-free 800-648-7051. Super Shuttle will cost approximately $8 - $12. Taxis will cost approximately $25.

How to Purchase Technical Materials and Souvenirs

As always, SIGGRAPH merchandise is available in limited quantities. Some merchandise may be purchased in advance; while other merchandise will be available only on-site.

Pre-Conference

1. Mugs, t-shirts and other memorabilia. Refer to the registration form to select the merchandise you would like to purchase in advance. Be sure to include the cost of your purchases with your advance registration payment. You must pick up these purchases at the merchandise desk on-site in the Dallas Convention Center.

2. Full sets of course notes. New in 1990, a complete set of notes for all SIGGRAPH '90 courses may be ordered in advance and shipped directly to attendees in the continental United States. If you would like to have your full set of course notes shipped, be sure to select the appropriate option on the registration form. Full sets will be shipped on August 10. Course notes are not available for purchase after the conference. Individual course notes cannot be ordered in advance.

3. Technical, art show and stereoscopic 3D slide sets. Slide sets may be ordered in advance and picked up at the merchandise desk on-site. The technical slide set depicts the current state of the art in computer graphics research; the art show slide set provides a visual record of the SIGGRAPH '90 art show; and the stereoscopic 3D slide set provides an exciting new way to view the latest developments.

At the Conference

1. Course notes. Each course registration entitles you to one copy of notes for that course. Individual and full sets of course notes may be purchased on-site, subject to availability. Shipping services will be available for your convenience. Course notes are not available for purchase after the conference.

2. Additional copies. Additional copies of the following merchandise may be purchased on-site:

Proceedings,
Art Show Catalog,
Film and Video Theater Catalog,
Technical, Art Show, and Stereoscopic 3D Slide Sets,
and various memorabilia.

After the Conference

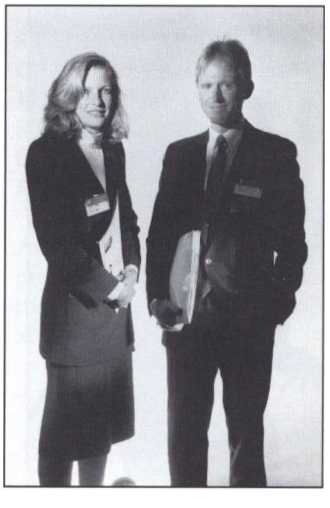
Proceedings, slide sets, and video reviews are available for purchase after the conference. For proceedings and slide sets phone the ACM Order Department 301-528-4261 or write ACM Order Department, P.O. Box 64145 Baltimore, MD 21264 USA.

To order video reviews the toll-free number is 800-223-5503.

For International Attendees

Foreign Buyer Program
SIGGRAPH '90 is proud to represent the computer graphics industry in the 1990 Foreign Buyer Program sponsored by the U. S. Department of Commerce. The purpose of this program is to bring international visitors to the conference and to promote business with U. S. companies who want to create or expand overseas markets.

To join a group coming to SIGGRAPH '90 from your country, contact the commercial section of your nearest U.S. embassy or consulate.



International Registration
In order to simplify the registration process for international attendees, it is strongly recommended that the following guidelines be followed:

When transferring funds by wire, a copy of the bank draft should be attached to the registration form.

You must make sure the bank transmits your name with your funds.

The July 18, deadline for advance registration processing will be observed. In order to meet the deadline, we recommend that you send your payments no later than June 29.

If the deadline is missed, full payment of fees will be required on-site and your advance payment will be refunded after the conference.

International Business Center
As an international visitor, you are encouraged to make the International Business Center, located in the registration area, your "home away from home." You should register there for all portions of the conference and relax in the lounge area with friends and business associates.

Interpreters, as well as staff members from the Department of Commerce, will offer assistance on international business matters. In addition, a directory will be available listing U.S. based SIGGRAPH '90 exhibiting companies who are participating in the program.

The International Business Center will be open during all registration hours Sunday - Thursday.

For Your Convenience

Conference Transportation
Frequent shuttle bus service is provided for all conference activities between SIGGRAPH '90 hotels and the Dallas Convention Center.

Shipping Desk
A shipping desk will be located in the registration area of the Dallas Convention Center and will be open the same hours as the merchandise desk. This desk will provide next-day air and second-day air service to the United States, Canada, and overseas as well as regular ground service.

Special Needs
We will attempt to accommodate attendees who have special needs whenever possible. Please contact the conference management office in advance at 312-644-6610 with your specific needs.

Special Policies
Children under 16 will not be permitted to attend the exhibition.

No cameras or recording devices are permitted in the SIGGRAPH '90 courses, paper/panels, art show, exhibition or film and video theater.

Required Press Credentials

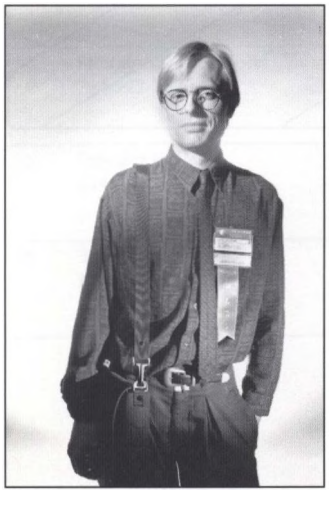
Credentials required for complimentary press registration are as follows:

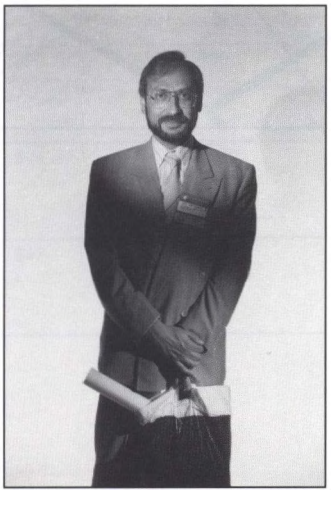
Full-time staff must have an editorial business card or letter from an editor requesting press credentials. These titles are accepted:

Editor,
Photographer/Cameraperson,
Reporter,
Writer,
and Analyst.

Freelance writers must have a letter from a computer graphics-related magazine stating that they have been assigned to cover SIGGRAPH; or bring a copy of their bi-lined article which has been printed in a technology magazine/newspaper within the past two years.

Consultants with industry newsletters must have a business card with the name of the newsletter and a copy of the publication.





Map of Dallas

Hotel Information

Map	Hotel	Single	Twin/Double	Hotel Parking Facilities
1	Adolphus 214-742-8200	$115 Jr. ste. single: $140	$130 Jr. ste. double: $155	Valet $10 per day in/out privileges
2	The Aristocrat Hotel 214-741-7700	$70 Sgl./dbl. deluxe	$80 Sgl./dbl. jr. ste. $90 Sgl./dbl. 1 bdrm ste.	No charge
3	Crescent Court 214-761-9090	$105	$125	$8.50 overnight
4	Dallas Park Plaza 214-747-7000	$50	$58	$5 per day in/out privileges
5	Days Hotel 214-421-1083	$60	$68	No charge
6	Embassy Suites 214-630-5332	$85	$95	No charge
7	Fairmont 214-720-2020	$105	$120	$11 per day in/out privileges
8	Holiday Inn Brook Hollow 214-630-8500	$64	$74	No charge
9	Holiday Inn Downtown 214-748-9951	$60	$60	$5.40 per day in/out privileges
10	Holiday Inn Market Center 214-747-9551	$50	$60	No charge
11	Hyatt Regency Dallas 214-651-1234 **Headquarters Hotel**	$97	$112	Valet $8 per day in/out privileges
12	Plaza of the Americas 214-979-9000	$105	$120	Self: $7.75 per day Valet: $10 per day Both with in/out privileges
13	Quality Hotel 214-741-7481	$60	$65	No charge
14	Sheraton Dallas Hotel 214-922-8000	$80	$90	Valet $11 per day in/out privileges
15	Stouffer Dallas 214-631-2222	$95	$110	No charge
16	Travelodge Hotel Market Center 214-522-6650	$47	$51	No charge

SIGGRAPH '90 has selected these hotels to provide accommodations for conference participants. In addition to being easily accessible to the Dallas Convention Center, these hotels offer attendees special rates.

Note: A 13% tax per night will be added to all hotel bills in Dallas.

Non-smoking rooms are available at most SIGGRAPH hotels. Requests for non-smoking rooms will be entered and rooms will be assigned on a first come, first served basis. Hotels **cannot guarantee** assignment of non-smoking rooms.

SIGGRAPH '90 HOTEL FORM

Hotel preference

First choice

Second choice

Third choice

Fourth choice

Important: If my choice of hotels is not available, please select another hotel giving priority to: ☐ Location ☐ Rate

Please supply names of all persons to occupy room(s) and type of room. Attach a list of additional names, if necessary.

Name of Occupant(s)	Single/Twin/Double Room	Rate	Non-Smoking	Arrival Date/Time	Departure Date

To confirm a room please include: Credit Card Type Card Number Expiration Date

Send confirmation to:

First name, middle initial, last name

Home phone (including area code) Work phone (including area code)

Organization

Address

City State/Province

Postal Code Country

Mail the completed housing form to:

SIGGRAPH '90
Housing Bureau
1201 Elm Street, Suite 2000
Dallas, TX 75270

New this year,
fax your form: 214-746-6799

Reservations must be made using this official SIGGRAPH '90 hotel form. It may be photocopied. Reservations must be received by the housing bureau no later than **July 9.** You may direct housing inquiries to the Dallas Convention Bureau's toll free number, 800-972-1029, and fax forms to the convention bureau at 214-746-6799.

The housing bureau will send an acknowledgement showing the assigned hotel. A confirmation will then be sent directly by the assigned hotel. Review the confirmation carefully for any deposit requirements.

Any cancellations or changes on your reservations must be made by calling 800-972-1029 or **in writing** directly to the housing bureau prior to **July 9.** After that, cancellations and changes should be made directly with the hotel.

Conference rates are available only through the use of this form.

SIGGRAPH '90 REGISTRATION FORM

Registration Badge

Please note: Your badge will read exactly as indicated on this form.

First Name, Middle Initial, Last Name

Job Title

Area Code/Telephone Number

Organization

Street Address

City/State/Province/ Postal Code/Country

Membership

☐ ACM or SIGGRAPH Member (AM) Membership #

☐ IEEE Member (IM) Membership #

☐ Non-Member (NM)

☐ Student (SM): You **must** provide a copy of your current ACM student membership card or your valid student identification card.

Registration Information

Use the back of this form to select options, order merchandise, and calculate costs.

Payment

Make your check or money order (U. S. funds only) payable to **ACM SIGGRAPH '90.**
No forms will be processed without accompanying payment.

Registration forms received after **July 18** cannot be processed in time for the conference. If your registration form is received after **July 18**, you will be required to pay your registration fees on-site and apply for a refund of the original payment.

International attendees are strongly urged to airmail their registration form and payment by **June 29** in order to be received by the **July 18** deadline.

Refund requests must be made in writing and postmarked on or before **July 18.**

Check the following if appropriate:

☐ Send me information on ACM SIGGRAPH membership. (IL)
☐ Do not include my name, address, or telephone number on a published list of attendees. (NL)
☐ Do not include my telephone number on a published list of attendees. (PL)

For office use only:

Mon: ___
Tue: ___
Crse: CR CC
Tech: TR TC
F+V: TT WW RR
Educ: WR WC
Mem: AM IM SM NM
Time: PR LR
Misc: IL NL PL

Inq: 1 2 3 4 5
6 7 8 9 10
11 12 13 14 15
16 17 18 19 20
21 22 23 24 25

Signature

Date

Send your registration form and payment to:
SIGGRAPH '90
P. O. Box 95316
Chicago, IL 60694-5316

Or fax it with Credit Card information to:
312-938-1232

For further information call:
SIGGRAPH '90
Conference Management
312-644-6610

Please complete the back of this form.

SIGGRAPH '90 REGISTRATION FORM CONTINUED

Course Selection
Monday and Tuesday

Circle first choice	Monday	1	2	3	4	8	9	10	11	12	13	14	15	16	24
	Tuesday	5	6	7	17	18	19	20	21	22	23	25	26	27	28
Circle second choice	Monday	1	2	3	4	8	9	10	11	12	13	14	15	16	24
	Tuesday	5	6	7	17	18	19	20	21	22	23	25	26	27	28

Course Registration Fee

Includes notes for course(s), admission to assigned course(s), lunch(es), course reception, exhibit, art show, hypermedia, animation screenings, film and video theater, and one catalog for the art show and film and video theater.

		Member	Non-member	Student
If you attend **two days** of courses, the fee is as follows:	Postmarked on or before June 29	$365	$420	$180
	Postmarked after June 29	$455	$525	$230
If you attend **only one day** of courses, the fee is as follows:	Postmarked on or before June 29	$245	$280	$120
	Postmarked after June 29	$305	$350	$150

Enter the appropriate course fee $ _____

Educators Seminar

Fee: $50 (#150)

Enter the appropriate educators seminar fee $ _____

Papers/Panels Registration Fee
Wednesday through Friday

Includes a copy of the conference proceedings, admission to the paper/panel sessions, papers/panels reception, exhibit, art show, hypermedia, animation screenings, film and video theater, and one catalog for the art show and film and video theater.

	Member	Non-member	Student
Postmarked on or before June 29	$245	$375	$120
Postmarked after June 29	$405	$465	$205

Enter the appropriate papers/panels fee $ _____

Film and Video Theater
Please check one time.

Tickets included with courses and papers/panels registration. Limit one per person.
☐ Tuesday, 7:30 pm ☐ Wednesday, 7:30 pm ☐ Thursday, 7:30 pm

Merchandise
May be ordered with registration or purchased on-site.

	quantity		costs		
Full set of course notes (#170)	_____	x	$500	=	$ _____
Full set of course notes (#180) (Shipped in continental U. S. only)	_____	x	$530	=	$ _____
Technical Slide Set (#320)	_____	x	$30	=	$ _____
Art Show Slide Set (#340)	_____	x	$30	=	$ _____
Stereoscopic 3D Slide Set (Includes viewer) (#360)	_____	x	$40	=	$ _____
T-shirt (100% cotton) (#600)	_____	x	$12	=	$ _____
Polo shirt (100% cotton) (#610)	_____	x	$25	=	$ _____
Denim shirt (100% cotton) (#620)	_____	x	$30	=	$ _____
Bolo tie (#630)	_____	x	$15	=	$ _____
Mug (#640)	_____	x	$7	=	$ _____
Collector series of four mugs (#650)	_____	x	$30	=	$ _____
3.5 inch diskette holder (#660)	_____	x	$12	=	$ _____
Mouse pad (#670)	_____	x	$10	=	$ _____

Enter merchandise fee $ _____

Payment

Enclose a check or money order or pay by credit card.
Signature Card # Expires

The above card holder hereby authorizes this transaction.
☐ American Express ☐ MasterCard ☐ Visa

Total Payment (U. S. funds only) $ _____

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Future Conference Dates

SIGGRAPH '91
July 29 - August 2, 1991
Las Vegas, NV

Co-Chairs
Michael J. Bailey
San Diego Supercomputer Center
Carol Byram
Sony Microsystems Company

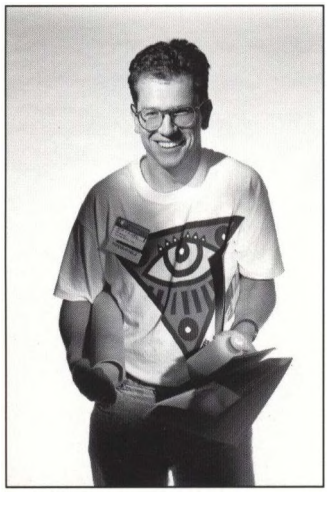
SIGGRAPH '92
July 27-31, 1992
Chicago, IL

Co-Chairs
Maxine Brown
University of Illinois at Chicago
Robert E. Holzman
Jet Propulsion Laboratory

SIGGRAPH '93
August 2-6, 1993
Anaheim, CA

For additional information regarding future conferences, contact:

SIGGRAPH Conference
Management Office
111 E. Wacker Drive
Suite 600
Chicago, IL 60601
312-644-6610



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