

Springing into the Fifth Decade of Computer Graphics – Where We’ve Been and Where We’re Going!

Organizer:

Carl Machover, Machover Associates Corp.

Panelists:

Dr. Frederick P. “Fred” Brooks, Jr., University of North Carolina

Dr. Edwin E. “Ed” Catmull, Pixar

Sylvan “Chase” Chasen, Investment Advisor

Robert M. “Bob” Dunn, Enterprise Solutions International

Dr. Bertram “Bert” Herzog, University of Michigan

Dr. Andries “Andy” van Dam, Brown University,
and NSF Science and Technology Center for Graphics and Visualization

It’s been a helluva ride for the past 40 years!

In the 50s... computer graphics was a cure for no known disease... a solution in search of a problem. Now, computer graphics has become a cure for EVERY known disease.

How did this happen, and where is it going? A “blue-ribbon” panel of computer graphics pioneers/innovators/practitioners will discuss their successes and foibles of the past and their vision for the future with each making a brief statement about their CG recollections and anecdotes, and making succinct comments about what they see coming up. The following are brief comments that each of the panelists prepared about their expected presentation.

Carl Machover

Machover has been involved in computer graphics for almost four decades as a consultant, entrepreneur, academic, author, and marketeer and was the first SIGGRAPH panels chair. He will discuss the evolution of computer graphics from being a “cure for no know disease” to being a “cure for every known disease.”

Early users were “risk takers” since there was little available application software and the user, without really having ROI experience, elected to make significant hardware investments in the hope that the investment would pay off by saving time, saving money, improving decision making, or doing something that couldn’t be done any other way. By the early 70s, users in such applications as process control and CAD were reporting ROIs that were attractive to industrial companies in spite of the substantial capital investments required. And by the late 80s and 90s, cost of entry became low enough that the technology took its place beside telephones, typewriters, answering machines, copiers, faxes, and other common office machines, and were acquired just to stay competitive.

Dr. Frederick P. “Fred” Brooks, Jr.

Dr. Brooks is an ACM Newell Award winner, widely read and respected author, and computer graphics pioneer and innovator with particular interest in man-machine interfaces. He will talk about the future of synthetic environments, sometimes called “artificial reality.”

Faster graphics engines promise to be able to render 10-20 million polygons/second. This allows a great increase in the complexity of the world models we can move about in real time. John Poulton points out that with screen resolution of about a million pixels and frame update rates on the order of 20 frames/second average, polygon size becomes the scene depth complexity, approaching a few pixels/polygon. The whole purpose of polygons in the first place was to save computation by allowing full computation on vertices and interpolation between. As polygon size becomes less than three, there is no saving. We might as well compute pixels directly.

The first such approach to be explored is image-based rendering, with 2-D image warping interpolating between frames of full 3-D rendering. Just as frame buffers decoupled frame update from image refresh, so this technique promises to decouple world-model change from viewpoint change, to the great relaxing of urgency for 3-D rendering.

Dr. Edwin E. “Ed” Catmull

SIGGRAPH Coons Award recipient Dr. Catmull has led pioneering efforts in animation and rendering for the last twenty years. As a student at the University of Utah he developed texture mapping, Z-buffers, and techniques for displaying curved surfaces. These techniques have become standard in the industry. While a graduate student, he also created one of the first computer-generated effects for films – a computer generated animation of a hand, which was used in the movie “Futureworld.” He was the first Director of the Computer Graphics Laboratory at the New York Institute of Technology in 1974. In 1979, Dr. Catmull joined Lucasfilm, managing the Computer Division with the charter to bring high technology into the film industry. In early 1986, when the Computer Division split off from Lucasfilm, he became president of the newly formed company, Pixar.

Between 1986 and 1989, Pixar produced a series of short films, two of which were nominated for Academy Awards, and one, “Tin Toy,” received an Oscar in 1987. Dr. Catmull recently was executive producer of the wildly successful “Toy Story,” the first full-length computer graphics film.

He will discuss the pursuit of illusions.

Sylvan “Chase” Chasen

“Chase” Chasen pioneered in the use of computer graphics for design and manufacture. Chase was responsible for some of the first production CAD/CAM applications in engineering and design. He was an active contributor to CAD/CAM education and received an SME “Distinguished Contributor” award.

In 1963, officials of Lockheed-Georgia Aircraft Company’s newly formed Research Lab, the chief engineer, and other members of management visited MIT to witness and to evaluate Ivan Sutherland’s PhD project, “Sketchpad.” It was clear that picture-based man-computer communications would give the computer field an added dimension, but would be moderately expensive with little or no apparent short term benefit. A leap of faith was required.

To document our justification, I wrote over 50 pages entitled “Prospectus on Computer Aided Design.”

Early in 1964, we formed a dedicated team of people with complementary technical expertise. In early January 1965, we asked management for permission to establish a team of potential CAD/CAM users to study alternative application possibilities, and to select one that would demonstrate cost-benefit potential by the end of the year. By mid-November, we had demonstrated both the creation of a 3D (actually 2 1/2 D) prototype part and the path, converted to a machine-driven tape, for the numerically controlled milling machine to manufacture the part.

This is believed to be the first production-oriented CAD/CAM application of any kind – not just N/C. By the spring of 1966, this led to a fully operational three station time-shared CAD/CAM computer graphic N/C system. Concurrent with the General Motors DAC-1 system (Design Augmented by computers directed by Don Hart), this is believed to be the first multi-station computer graphics system for production usage.

During 1965, Lockheed-California began full scale development of CADAM, and at the 1995 Fall Joint Computer conference, we presented a paper entitled "The Introduction of Man-Computer Graphics into the Aerospace Industry." This was done to document Lockheed's role in the historical beginnings of CAD/CAM and interactive computer graphics.

It is usually easier to start something than to finish it. Therefore, the challenge of today is greater than for the pioneers. Today we have to determine how we can most efficiently link the "islands of automation," make relevant data easy to locate, store and retrieve myriad documents electronically, and standardize the many interfaces among many concerns. Most importantly, how do we train both computer professionals and the lay public to know what question to ask, and to seek answers without intimidation of hosts of complex, bewildering alternatives?

Robert M. "Bob" Dunn

About 20 years ago, Bob Dunn, together with Bert Herzog and under the auspices of SIGGRAPH, chaired the committee that produced one of the first device-independent computer graphic standards, CORE. Bob was SIGGRAPH chair 1973-1975, and together with Jon Meads and Jim Foley, launched the SIGGRAPH Conferences and Exhibitions in the early 70s. After promoting the use of computer graphics in the Army, Bob moved into several responsible industrial positions. Today, he is focused on IT Industry international corporate development.

My Occam's Razor for technology is the position taken by Lord Alfred North Whitehead about 100 years ago, which is "Civilization advances by virtue of the number of operations it can do without thinking about them."

Each time the technology of computing has entered a new setting in which to be of value, the technologies of depiction, representation, portrayal, and illusion (i.e. ?computer graphics?) have faced new challenges. Thinkers, users, and producers face new challenges.

My Occam's Razor for the use of technology are the personal judgements each user makes about whether the cost and effort to adopt and deploy a technology is offset by the gains/pleasure/?pain? from its use. For the researcher, to have devised the more elegant/correct/robust theory/technology/design is the impetus to inquiry and the pursuit of research grants. For the early adopter, to have made it work first and gain bragging rights is justification enough. For those embroiled in hard, real-world problems, getting a solution where one was not possible before is to remove a barrier to success. And for the rest of us mainstream users of technology, if it shows up naturally, installs easily, and can be used directly through our GUI controls, we are willing to be amazed and grateful to the gods of technology for having made the world wonderful.

For Computer Graphics, it still takes too long to do some things that we wish to be ordinary.

Dr. Bertram "Bert" Herzog

As both an academic and an industrialist, Bert Herzog has contributed to, and maintained close contacts with, both worlds. Initially, he was a structural engineer who got interested in analog computers at Case Institute of Technology, and subsequently worked with digital computers while teaching at the University of Michigan. In 1963 he joined Ford Motor Company, where he became involved in modern computer graphics. He returned to the University of Michigan (where he originated some of the first CG short courses), then to the University of Colorado, back to industry, and then back to the University of Michigan. Herzog is EIC of the IEEE publication, Computer Graphics and Applications, co-chair of ACM's 50th Anniversary Celebration, as well as SIGGRAPH Awards chair.

He will ask: How long does it take a vision to reach fruition? There is evidence obtained from now-older but early visionaries that the answer is: Twenty years or more! On the other hand, recent events associated with the Internet and World Wide Web would lead us to believe that instant gratification is, at last, possible. What is wrong with this picture? Does memory play tricks? Can the visionary's optimistic expectations be realized now?

Dr. Andries "Andy" van Dam

Andy was a founder of SIGGRAPH 30 years ago, and has remained a computer graphics innovator and educator. With Dr. Jim Foley, he authored "Fundamentals of Computer Graphics," and with Foley, Feiner, and Hughes, the expanded version "Computer Graphics Principles and Practice." Both are *the* standard references in the field. Dr. van Dam was a recipient of the SIGGRAPH Coons award, and is a member of the National Academy of Engineering. He will discuss pre-WIMP, WIMP, and post-WIMP user interfaces, the impact that next-generation graphics and multimedia hardware and software will have on the evolution of user interfaces, and why the user interface is increasingly important in society's use of computers.

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