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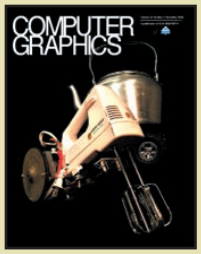

Stirring It Up

Karen Sullivan
***Computer Graphics* Cover Editor**

Each year, the SIGGRAPH Fine Art Exhibition organizers work harder and harder to explain to the rest of the SIGGRAPH constituency how to read the artwork, how the computer was used in the creation of the work and why the computer was used as a medium.

At SIGGRAPH 2000, docents were hired. Artists gave gallery talks and panel presentations. Conceptual links and physical proximity were developed with The Studio, the Creative Applications Lab and Emerging Technologies. But the boundaries between art, animation, interactivity and visualization continue to blur. Why?

First, we confuse innovation and creativity with the purpose of art. And at SIGGRAPH, this is a significant point. The entire conference is based on a "what's new" mentality and a demonstration of that which is innovative and creative in every field. Jack Ricchiuto, creative consultant, defines creativity as being both innovative and useful. At SIGGRAPH, innovative is also utilitarian, or useful – as in practical. Art is useful too. But its usefulness is usually more philosophical.

Second, the differences between the Art Exhibition and the other SIGGRAPH venues are not so much in how they look, what materials are used and how they work, as in what they *do* and how we receive (or read) them.

This is inherently the root of the confusion. Audiences see computation and want to read "visualization"; see 3D characters in a linear narrative and want to read "entertainment"; see frames, tables and mouse clicks and want to read "information."

Most of the applications that use images, use them in terms of design. In design, the information being communicated must be immediately available to the audience. The design *should* grab the attention of the viewer and *might* engage him emotionally, but at some point, the viewer must be able to get the message rather than be preoccupied by the layout. Information is king.

In this way, visualization, entertainment and interactivity are designed. They are utilitarian in a way that art is not. They have a mass audience and the purpose is to accurately describe the "how" of things – how they work or how they are ordered. This is true whether that how is computational information, comparative datasets, scripts, narratives, pipelines or the new e-commerce. And, images concerned with utilitarian purposes have preconditions to inform, persuade or educate. They start with prescribed information and must end with immediate communication of that information to the audience.

Art, on the other hand, doesn't concern itself with a mass utilitarian purpose. Art is an end in itself. Often that end is simply an emotional or aesthetic experience. Sometimes, the end is commentary or critique of people, culture and technology. In art, the audience is *required* to look, contemplate and reflect. Art is meant, not to be looked *at,* but to be looked *into.* In a culture used to immediate information, art requires time. This makes understanding art more difficult.

Milton Glaser (big famous guy in graphic design) has explained a major difference between art and design. Designs must convey a given body of information. However, the "essential function" of art is "to intensify one's perception of reality."

When one enters the SIGGRAPH Fine Art Exhibition, this is what they should be looking for – an experience that changes how we see our world - if only for a moment.

Below are the artists' statements from two of the pieces from this year's Art Exhibition. Read them and see if you can imagine the world differently.

Front Cover

Free Range Appliances in a Light Dill Sauce
By Rania Ho

This piece aims to highlight the relationship between cause and effect in electronic mediums. As machines become more and more reliant on electronics and computer chips to drive their functionality, the relationship between user input and machine output becomes increasingly disjointed.

Free Range Appliances in a Light Dill Sauce is an exploration of anthropomorphic qualities inherent in household gadgets and an irreverent look at the meaning of "smart" appliances. Kitchen appliances are liberated from their mundane existence and taught motor skills; enabling them to fully realize their suppressed ambulatory desires.

Each of the appliances have been retrofitted with "state of the art" mechanics and sensors. Each machine has been carefully and lovingly enhanced in accordance with its individual personality. The work is done the old-fashioned way; hand crafted by skilled artisans living in the depths of the remote island Manhattan. This time-worn process is the key to our success. Most of our products are photo sensitive and react to the bright lights. Of course, all of them are friendly and enjoy the company of humans. Shining an ordinary household flashlight directly on the body of any one of the appliances will cause it to move towards the light. Removing the flashlight will cause it to seek light and heat elsewhere. Some days, if the machines are in a good mood, they may break out in a celebratory dance. We hope you enjoy our *Free Range Appliances in a Light Dill Sauce*. If you're happy, they're happy.

Basic Care and Feeding: Battery replacement and periodic battery charging is needed.

Rania Ho
Interactive Telecommunications Program
New York University
Email: **r.ho.1@alumni.nyu.edu**
http://itp.nyu.edu/ho

Back Cover

Final Spin
By Jen Zen

The red and metallic figures are "cyber-touch shells" created in virtual reality by petting actual human beings, head to toe, with a cyberglove. The figures dance on the Devil's Racetrack in Death Valley, an elementally awesome place. Flattened views of the originally animated, life-sized, three-dimensional forms are curious images of limbic kinesthetic experiences, recording paradoxical aspects of that which cannot be held.

Jen Zen (Jennifer Jen Grey)
Professor
Drawing & Painting Program
Art Department
CSULB
Email: **jgrey@csulb.edu**
http://www.art.csulb.edu/academics/faculty/Grey_Jen/bio.html
www.geocities.com/~vjeran/mural.html

Collaborator:
Sheriann Ki Sun Burnham

About the Columnist

Karen Sullivan is a faculty member at Ringling School of Art and Design in the Department of Computer Animation and Foundation Studies. Her major focus of research is in concept, narrative and literacy for media and animation. Her video installations and single channel pieces have been shown nationwide. Karen received her M.F.A. from the University of Massachusetts, Amherst, and her B.F.A. from Indiana University, Bloomington.

Karen Sullivan
12417 Riverglen Dr.
Riverview, FL 33569
Tel: +1-813-677-4553
Email: **karen_sullivan@siggraph.org**

Computer Games, Not Computer Movies

Richard Rouse III
Paranoid Productions

In an essay I read from the defunct *Journal of Computer Game Design*, game designer Chris Crawford referred to computer game developers as having "movie envy." What he meant by this was that many computer game designers often secretly (and sometimes overtly) wish they were making movies instead of games, and as a result try to get their computer games to emulate films. One of his most salient examples was that of scrolling credits in computer games, where the names of the designers, programmers, artists and so forth scroll by the player much as they would at the end of a movie. His conclusion was that "movie envy" has resulted in particularly poor computer games, and that we'd all be better off if game designers concentrated on making games instead of making half-baked movies.

And Crawford is by and large correct: the computer gaming industry is infected with a pretty bad case of movie envy, and it's really not doing any of us any good. *Next Generation* magazine is a perfect example. Generally speaking, the magazine is well written, interesting and informative. It makes the effort to go beyond endless previews of games, often devoting column inches to the people behind the games and what makes the industry tick. Despite its strengths, *Next Generation* almost never gets through an issue without making some reference to how the development of computer games as an art form somehow parallels the artistic development of movies over the course of the twentieth century. And as game developers, we see the fame, widespread appeal and cultural validation that movies have received and, curse it all, we want some of that for ourselves. Many find it tough to work in an industry that so much of the public sees as being without any redeeming artistic value. So we say, "Yeah, we're just like movies, right now is like 1910, and just in a couple of weeks society's gonna come knockin' at our door offering us fame beyond our wildest dreams and more money than we'll know what to do with. And they'll agree we're art, while they're at it." But this is more wishful thinking than anything else; the similarities between computer games and movies are truly far fewer than the number of differences. As game developers, we need to realize that as of now we're still a fringe art form with little mainstream appeal, and it's really too early to tell whether or not computer games will ever evolve to become the mass media phenomena movies are. And if computer games are destined for cultural dominance, the best way to get there is certainly not by attempting to be second-rate movies.

Similarities

That's not to say that computer games and movies aren't similar in some ways. Most any reasonable person will agree that both are forms of art, since calling something "art" cannot be a quality-based definition if the term is to have any useful meaning. Certainly no one will dispute that both are entertainment. Both films and games are art forms that communicate to the audience using a combination of constantly changing audio and visual information. Both can, but by no means have to, tell stories; just as there's really no story behind games like *Pac-Man*, *Tetris* or even *Doom*, movies don't have to tell stories, as can be witnessed in the work of many experimental filmmakers, such as Bruce Connor. Certainly anyone who has sat through one of Andrei Tarkovsky's more ponderous films will agree there isn't much story to be found in there. Both computer games and film are largely collaborative mediums, where it is extremely difficult - though not impossible - to create a work in the form without the assistance of others. And both are dependent on technology to communicate to their audience, albeit computer games more so than films.

Most interesting to me is that both arise out of other art forms, yet use a means of communication which is significantly different enough from their stylistic ancestor to cause them to be perceived as a discreet form. Movies arose out of stage plays, and in fact many early films were merely filmed versions of plays, where the camera never moved, there was no editing and the audience's experience was in many ways the same as going to the theater, except with inferior picture quality and no sound. These early films are very far removed from what we think of as movies today, and one could argue that they weren't a separate art form (from stage plays) at all.

Computer games can trace their roots back to games played between multiple humans, whether these are in the form of board games such as *Risk*, *Monopoly* or *Diplomacy*, role-playing games such as *Dungeons & Dragons* or the games of "war" that children (and sometimes adults) play with each other. There are some "solitaire" non-computer games, such as the card game of the same name, though solitaire games are the exception to the rule in traditional games. (One may also be able to trace the development of computer games back to the likes of pinball and other coin-operated "amusements." But I think these by and large have little relationship to the games which are being created today, and comparisons with such early forms are more appropriate in the way in which games are sold to the public through arcades than to the actual content and form of computer games.) Similar to movies, many early games, some of which are still very popular today, are little more than straight adaptations of established non-computer game forms. For instance, often when I talk to a non-computer game player and mention that I design computer games for a living, they're bound to say: "Oh, computer games! Those are great! I've got solitaire for my computer and I just play it for hours!" I'm often tempted to answer "That's not really a computer game," conceding that though it is a game and one can play it on one's computer, it's not significantly different from the gaming experience one has if one uses a

deck of cards. In the same way that a static filmed stage play is not really a film - or at least is not different enough to be considered a unique art form - strict adaptations of board or other traditional games to the computer cannot be considered a distinct medium. In order for a game to truly be considered a computer game, for me, it must present a gaming experience which would be impossible without the computer.

It is important to note that computer games did not arise out of movies. Sure, lots of people (many of them "new media" company executives bereft of a clue) have tried to substitute elements of films in place of well conceived game design mechanics and have called the results "interactive movies." Fans have called these products "terrible" and avoided them like the plague. When one gets down to the core of all computer games, when one searches for and locates its archetypal form, one will find that it's based on a game, not a movie. In the case of really bad "interactive movies" it may be based on a ludicrously simple, unfair and 'unfun' game, but it's a game nonetheless. In the final analysis, computer games are as fun and stimulating as their base games are, regardless of what pyrotechnics may be layered on top.

Irreconcilable Differences

So I've listed the similarities between computer games and films that spring to mind. What's different about them, then, you may ask? Everything else, which is quite a lot. The biggest, of course, is interactivity. In films one watches and experiences the art form. In games one acts, watches and experiences the art form. For a film, everyone in the movie theater has the same experience of watching the film: they may enjoy it more or less, some may understand some sections better than others and some may react differently to different stimuli than others. But they've all seen the same thing. In computer games (or well designed ones, at least) nearly every player has a unique experience, which was generated as the result of the actions they chose. In movies the filmmaker only has to worry about one-way communication: how is he going to deliver his message to the audience? In computer games, designers must be concerned with both how information is communicated to the player, as well as how the player communicates back to them via their surrogate, the computer. A computer game that cannot do both output and input well is a failure.

The above observation that the core difference between movies and computer games is interactivity may seem like an obvious statement and, indeed, it is. But enough so-called game designers have missed this obvious-as-the-nose-on-your-face difference in their attempts to design computer games that it bears repeating. Although Chris Crawford's mention of scrolling credits as a good example of movie envy may have seemed like sarcastic nit-picking, it's actually a pretty good example of how game designers can lose sight of what medium they're working in, as a result of their secret or at least subconscious desire to be making movies. In a film the audience is unable to interact with the projector, and so in order to communicate a long series of names, the filmmaker is reduced to having them scroll slowly in front of the audience. Sure, audience member Joe Bloggs only wants to know who the Best Boy Grip is, but he has to wait for all of the other credits to scroll by to get to his item of interest, due to the limitations of the medium. He has no way of controlling the information presented to him. But in a computer game, the player has control of the game, at least in theory. In a properly designed computer game credits sequence, then, he should be able to scroll or flip through the credits at any speed he wants. When Joe's done reading the first set of credits or if he's only looking for who was the Quality Assurance Lead on the project, he can just flip onto the next screen by pressing a key. Making him sit through scrolling credits in a computer game is absurd, when the very nature of the medium allows him to go looking for exactly the credit he wants to see.

Who Cares About Scrolling Credits?

Of course, scrolling credits can hardly be considered the ruination of a computer game, but what about when the designers put movie-copying elements into other points of the game, where instead of interacting the player spends most of his or her time just watching? Then we end up with bad games, as we've seen time and time again as poorly made movies have been sold to us as hot new games. Still more important is that we must realize that making broad-based comparisons between computer games and movies are hardly useful, and may in many ways be damaging to our understanding of where our art form is and how it should develop. So when someone says that computer games right now are at the same technological level as films were in 1910, careful thought will reveal that this is a ludicrous, absurd and useless statement. How can one compare something so different as movies and computer games in such a manner? It's just about as useful as comparing pulp fiction novels and pop songs: sure there are some similarities, but the two forms are more different than they are similar, and broad-based analogies drawn between them are likely to be useless. At worst such analogies will lead designers down the wrong paths entirely, serving to hinder the development of games as an art form.

Of course, that's not to say that computer games cannot learn valuable lessons from film, especially in terms of storytelling. When I interviewed game designer Jordan Mechner (most famous for the *Prince of Persia* games) some years ago and asked what he thought of the potential use of film techniques in computer games, he answered: "Film has an incredibly rich vocabulary of tricks, conventions and styles which have evolved over the last hundred years of film making. Some of which have been used in computer games and really work well, others which are waiting for someone to figure out how to use them, and others which don't work very well, and which kill the games they get imported into." Mechner was not talking about merely slamming full motion video sequences into games that don't need them, but rather examining film techniques such as cross-cutting and changing perspective and determining how best these can function in a computer game, if they can function at all.

Abdicating Authorship

Aside from the potential fame and acceptance that designers believe making games more like movies will bring them, I think another force at work here is the game developer's desire for control. In designing a really good computer game which allows the player to explore the gameworld in her own way, the game's designer is giving up some degree of control over how that story will transpire. Whereas an author in a non-interactive medium such as literature or film has total control of the work while the audience is left merely to watch, the audience of computer games is invited to participate in the shape and form of the art they are experiencing. Indeed, the games which provide the most freedom and empowerment for the player, titles such as *The Sims* and *Civilization*, are the games which turn out to have the most lasting appeal for players. The designers of these games, Will Wright and Sid Meier respectively, both understood that they were providing merely a framework on which players could build their own stories. Games that try to force the player to experience only one particular story, as told through long movie-like cut-scenes, tend to have very little appeal at all. As game designer Doug Church put it at a Game Developer's Conference talk, the game designer must abdicate a large part of the game's authorship to the player if he hopes to create the most compelling gaming experience possible. And everyone knows that artists are often the most obsessive control-freaks imagin-

able. No wonder game developers so often tend to drift toward a medium, film, in which they would have total control over the work being created.

A lot of game designers are big fans of movies (as is a very large portion of the population) and I must admit that I'm one of them. Probably I'm a bit more of a fanatical movie buff than most. And I'd be lying if I said that, if someone up and offered me the chance to write and/or direct a film, I wouldn't give the offer serious thought. But right now I've decided to devote my creative energies to the creation of computer games, and I must not try to pursue my potential movie career through the games I design. Because if I did I'd have neither a good computer game nor a good movie, and what good would that be to anyone? Sure computer games and movies have similarities as art forms. But as game developers we must realize what medium we're working in, and understand that designing a good game has very little to do with directing a good movie.

About the Columnist

Richard Rouse III is a computer game designer, programmer and writer at Surreal Software, where his current project seems to be in a state of constant flux. His past design credits include *Centipede 3D*, *Odyssey - The Legend of Nemesis* and *Damage Incorporated.* At long last, he recently submitted the manuscript for his book, *Game Design: Theory & Practice,* for publication in the first quarter of 2001 by WordWare Publishing, **www.wordware.com.**

This article was originally published in an earlier form in *Inside Mac Games* magazine, **www.imgmagazine.com.** Thanks to Tuncer Deniz for allowing me to reprint it here. Interested readers can find Chris Crawford's article on movie envy on his website, **www.erasmatazz.com.** Crawford is an extremely prolific author, and on the site one will find all that he ever wrote for *The Journal of Computer Game Design,* along with a link to an HTML version of his indispensable book, *The Art of Computer Game Design.* Feedback on this column is encouraged at **rr3@paranoidproductions.com.**

Richard Rouse III
716 11th Ave E.
Seattle, WA 98102
Email: **rr3@paranoidproductions.com**
Web: **www.paranoidproductions.com**

Visualization Spaces

The National Center for Supercomputing Applications (NCSA) has a long history of excellent visualization work. Polly Baker has been part of the NCSA visualization effort from the beginning and now leads it, so I asked her to describe some of their recent work.

— Bill Hibbard

Polly Baker
NCSA
University of Illinois

Organizations around the world are installing virtual reality labs and experimenting with their use as display spaces for exploring and analyzing the output of science and engineering simulations. Academic labs, government labs and various industries have invested substantial sums of money in virtual reality facilities such as the CAVE™, large-format tiled walls and ImmersaDesks™.

Experimenting with new hardware is appealing to many of us in the graphics community, but several people do, in turn, question the return on the investment being made in virtual reality equipment. For example, Bill Hibbard (this column's resident skeptic) recently pointed out some limitations of virtual reality that inhibit acceptance among the scientists in his user community [1]. Hibbard notes three things that must change before virtual reality can be widely accepted by scientists for visualization. Costs must drop so that equipment can be put in every researcher's office. Tracking latency must be reduced. And dependency on helmets and glasses must be reduced or eliminated.

At NCSA, we've been experimenting with and using VR for scientific visualization for almost a decade. Over the years, we've found some applications that work especially well in large-scale virtual reality installations such as the CAVE. We are encouraged by that experience, yet we also agree with Hibbard that advances are needed before virtual environments can be more widely adopted for scientific visualization. In this column, I'll characterize some of the applications that have been successful in the NCSA CAVE. I'll also describe my group's Visual Spaces project – an effort to assemble display and interaction environments that are affordable and easy to use.

Successful VR Applications

Measuring the success of a virtual reality application is difficult. Formal studies are few in number, and simpler metrics such as numbers of downloads don't apply since installations are few in number. For our purposes here, we'll define success to mean that someone other than the developer is able to use the application to do work and is willing to go out of their way to use the application. We briefly describe a few successful applications, and take a look at what features have contributed to their success.

The CRUMBS application is a particularly successful virtual reality visualization tool. CRUMBS supports visual exploration of biomedical data, such as MRI scans, through direct volume rendering. The motivating problem for the application was to understand the convoluted structure of twisted chromatin fibers in DNA. Using CRUMBS, the researcher steps into the data and can place a marker at a place where a fiber is clearly present. From inside the data, taking advantage of a local viewpoint, it is possible to examine the local space and determine the next step in the path of the fiber. The CRUMBS application uses audio cues to assist the user in following the path of a fiber. Different instruments, each repeating a pleasantly subdued melody, reinforce the visual image of the underlying data values. Several groups beyond the original circle have used CRUMBS – users travel regularly from the distant edges of campus and from out of town to use this tool in the CAVE.

Virtual Director is a tool for choreography and animation, useful in visualization as a way to define camera paths. Using the gesture and speech commands available in Virtual Director, the user specifies keyframe parameters for the visualization, which are then interpolated for rendering and playback of the animation sequence. Virtual Director is particularly useful for constructing sophisticated camera movements for flying through the data. That kind of operation is very difficult, and tedious, to do in most desktop animation software packages, but it is very easy to do in the physical interaction space provided by the CAVE.

The Virtual Prototyping System is an engineering design application that we do in collaboration with Caterpillar. A physical platform that replicates the operator's seat of a front-loader or backhoe, complete with steering wheel, pedals and levers, is put into the center of the CAVE. As the user interacts with the steering wheel, pedals and levers, activity is fed to a vehicle dynamics simulator that computes in real time the behavior of the piece of equipment. The graphic display recreates the operator's view out the windows of the cab, including the visible parts of the equipment as well as the overall landscape. Engineers traveled regularly from Caterpillar to NCSA to use this application. Caterpillar subsequently built a CAVE-like installation at their site.

What Determines Success?

This sampling includes three different kinds of applications – visualization, choreography and engineering design. Each one is a successful CAVE application, in that it is used regularly for production work. Can we identify what contributed to their usability and success as virtual reality applications? Our evidence is mostly anecdotal, since we have not formally studied this. Our observations

Figure 1: *The SMARTBoard is mounted horizontally on a frame.*

suggest that three things characterize successful CAVE applications.

First, successful applications were developed, from the beginning, in collaboration with the intended target audience. This shouldn't be surprising. Conversation with your target user community allows you to build a more informed solution, and you have buy-in from your intended users from the beginning.

Second, these applications have well-developed user interfaces. The big issue here is *time*. For any platform, it takes a lot of time to build a good interface. It's especially hard for VR applications, since the range of choices is quite broad. There is no standard metaphor. Not surprisingly there isn't much supporting software either.

Finally, each of the successful CAVE applications that I've cited makes use of some feature that is a special characteristic of a CAVE-like environment – a feature that is not available on the standard desktop. Another way to say this is that the virtual reality setup has to add value. There has to be a reason to do an application in the CAVE.

In the case of the applications cited here, there is no one feature that explains collective success. CRUMBS and the Virtual Prototyping System make use of high-performance computer and graphics capabilities that have been unavailable at the desktop until just recently. More importantly, CRUMBS' usability relies on the ability to reach in and, with 6-DOF movement, physically place markers in the data. Positioning the Virtual Director camera also relies on the ability to physically manipulate a virtual object in 3-space. For both applications, stereoscopic viewing assists in the object placement. The Virtual Prototyping System uses a full-size mock vehicle platform – the fact that the CAVE is built on a human scale contributes to this application's success. Also, the wide field of view provided by the CAVE suits the display of the surrounding VPS landscape.

Our experience with successful CAVE applications reinforces the notion that "virtual reality" is a collection of features, each one more or less important for a particular application [2]. Perspective views, egocentric views, physical immersion, scale factors and multimodal, human-in-the-loop interaction are component virtual reality features. In designing visualization applications, we must find a match between the tasks involved in the application and the characteristics of various kinds of display and interaction environments.

Although the CAVE has been host to a number of successful applications, Hibbard's skepticism about widespread and speedy migration to virtual reality as a platform for visual analysis of scientific data is well founded. The component technologies, especially for stereoscopic views and tracking, must evolve and mature into more usable form. Costs must drop so that equipment can be more plentiful. And it's our belief that the form factor of these virtual environments must be such that they can be embedded into the scientist's work environment.

At NCSA

In NCSA's Visual Spaces project, we are experimenting with various display and interaction configurations. We want to capture those features of large-scale virtual environments that have contributed to successful applications, and recreate them in environments that can be embedded more easily in our scientists' workspaces. We are designing towards a small footprint that can be used in normal office lighting. We are experimenting with commodity components for affordability, and aiming towards a wire-free user interface.

For example, large-format plasma panels provide a wide field of view, although with limited resolution. Adding a touch-sensitive overlay provides a simple wire-free user interface, useful for locating in the plane or for manipulating the buttons and sliders of an interface written as the familiar desktop-style GUI. Figure 1 shows a variation. A SMARTBoard is more commonly mounted on the wall, but we built this frame to hold it horizontally. The SMARTBoard is rear-projected and touch-sensitive. This sort of configuration might be good for small groups working on problems that have a 2D aspect, such as GIS problems.

Optical tracking offers a nice solution for wire-free tracking of the user's head and hand in 3-space. We've experimented with various approaches. We've pointed a camera to capture the imagery on a projection screen and used a standard laser pointer to point at and select objects. Software is used to detect the laser dot from the camera signal and map that screen position against objects in the scene. We've also put a camera atop the ImmersaDesk to capture hand movements in the area in front of the display screen.

In Figure 2, we've mounted the camera atop a plasma panel, capturing activity in front of the panel. The black-and-white card is used as an input prop to interact with and manipulate the application. In this picture, we are running the Virtual Director application, one of our CAVE success stories. Initial feedback from Virtual Director users is good, suggesting that this arrangement duplicates some of the advantages of having a physical space in which to move and manipulate objects. Although we have sacrificed resolution and stereoscopic viewing, we gain in terms of cost, comfort and the ability to work in a bright environment.

Figure 2: *The Virtual Director application, with camera mounted atop a plasma panel.*

Summary

We see our Visual Spaces work as filling in the gaps between standard desktop displays and expensive, large-format facilities. As such, it blurs the (already cloudy) distinction between VR and not-VR. Over the next year, we'll continue to draw from our CAVE experiences and assemble a collection of environments that are cost-effective, easy to use and suitable for an office environment in terms of size and lighting conditions.

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About the Columnist

Bill Hibbard's research interests are interaction techniques, data models and distributed architecutures for numerical visualization. He leads the SSEC Visualization Project and is primary author of the Vis5D and VisAD systems. He has degrees in mathematics and computer science from the University of Wisconsin - Madison.

Bill Hibbard
Space Science and Engineering Center
1225 W. Dayton Street
Madison, WI 53706
Tel: +1-608-253-4427
Fax: +1-608-263-6738
Email: **hibbard@facstaff.wisc.edu**
Web: **http://www.ssec.wisc.edu/~billh/vis.html**

When the World Plague was Stopped by a Digital Artist

"The future of humanity and microbes likely will unfold as episodes of a suspense thriller that could be titled Our Wits versus Their Genes." [1]

— Dr. Joshua Lederberg

"Our initial hope was to find some weakness in [the] Mao [plague virus] that we could exploit. But what we found scared the living daylights out of us. . . . What we discovered [was that] . . . in hours, it converted the entire immune system into an ally. We were devastated. [But in time we realized that] we had the human genome nailed, and we had the Mao genome nailed. And we had that marvelous [broadband Internet VR] system for communicating among scientific minds. We used the system to design a new human killer T-cell — the Mao [plague virus] Killer T. . . ."

"How did you do that?"

"Actually, it wasn't me; that was Javier's idea."

"But I thought Javier was a graphic designer, not a scientist."

"Which is probably why he cracked it, and we didn't. He worked out the simulation routines that showed how [the] Mao [virus] did the cell intrusion and subversion. And he became fascinated with membrane geometry, not knowing anything about protein electrochemistry or synthesis. For him it was just a graphics puzzle, and he played around with the simulations until he found a surface that would turn the probe back on itself. All we'd asked him to do was modify the program. . . . We thought . . . he would just create a simple command. Instead, he solved the problem of armoring, because if you can simulate it, you can order it up in wetware. When we saw the demo, the [lab] went silent. Absolute silence for perhaps 30 seconds. Then everybody started talking frantically." [3]

— Interview from the story "Savior of the Plague Years 1996-2020," Wired Scenarios

Thomas G. West

Our Wits versus Their Genes

It is our wits against their genes — and their fast evolution. And it will always be so. We now understand that we can never live without the microbes and that they are essential to our lives and our world. In addition, latterly we have learned to think more in terms of ecology than warfare. Yet we now also know that we can never stop finding new ways to protect ourselves from their occasional pathological outbreaks (and our own stupidity). We can never adapt through our own genes as quickly as they can – so we must find other ways. We must use our wits…and we can never stop.

When I read Joshua Lederberg's wonderful short essay in *Science* on how we have come to understand the fundamental nature of infectious disease, I was immediately reminded of the *Wired* story excerpted here. This story has stayed with me, returning to my mind from time to time, since I first read it years ago (a good test of a good piece). I thought there might be a special connection between the two that would be of interest to SIGGRAPH members and readers of *Computer Graphics*.

On the surface, the story seems to revolve around a bold, and almost comical, idea – that of the world being saved by a digital artist during a time of global plague, where small surviving colonies are linked by a diminished yet functional Internet. Yet the idea gains credibility, as behind the story lies a greater issue – one which we've been dealing with for some time in this column and elsewhere. That is, of course, do the skills, the technologies, the kinds of mind and the special experience of the digital artist lend themselves distinctly to solving certain kinds of problems better than others? And might these solutions (one day) have unexpectedly broad impact? Perhaps we have a short story here that could be making a statement with greater weight than many volumes of factual material. Considering the enduring importance of the topic, it would appear that it could be of interest to many beyond the comparatively small world of computer graphics.

Just a Graphics Puzzle

I had long admired the *Wired* Scenarios' story because it seemed to capture in a few words (and provocatively doctored photographs), my own long-term belief — that the visual approach has a special power for seeing patterns and solving problems which is not properly or fully appreciated. Too often, it is assumed that what is required is knowledge of a lot of *facts,* and the ability to recall them quickly and accurately on demand. The training and selection for most of our professions, from law to medicine, is based mainly on this idea.

However, the literature on creativity has long observed that the most important thing is seeing the big patterns and seeing the novel and unexpected solutions. For this, it is often the outsider who has the advantage of seeing what the well-trained professionals within the field somehow miss.

The story of the less than fully trained and less than fully informed outsider making the big discovery is in fact relatively commonplace. Albert Einstein relied more on his mental images than the kinds of mathematics used by his associates. (Indeed, as he became a better mathematician, some argue that his creativity became considerably diminished, as his approach became more mathematical and less visual.) One mathematician of the period, David Hilbert, a great admirer of Einstein's work, came close to some of the early basic insights involved in general relativity. Hilbert did not claim any share of Einstein's major accomplishment. However, he did make clear, with no small amount of exaggeration, that Einstein's ideas came from other places than his mathematical skill. "Every boy on the streets of Göttingen," he said, "understands more about four-dimensional geometry than Einstein. Yet, in spite of that, Einstein did the work and not the mathematicians." [2] (Quoted in West, *In the Mind's Eye*, 1997, p. 122)

I was pleased to see the authors of the *Wired* story acknowledge these observations. But I was even more pleased to see them focus on the skills and approach of a computer graphics artist — one who saw

the solution to the disease process as "just a graphics puzzle" involving "membrane geometry." Since (in the story) they were all using VR simulations of the microbes, the artist could visualize directly the various structures, without having to rely on years of training to build a crude mental image of what was going on.

It is quite easy to imagine that discoveries such as this may be routinely expected once high-quality VR and high bandwidth Internet connections become widely and inexpensively available. A lot of unrecognized talent could come quickly and unexpectedly into play. Of course, in the end, you need the experts and the outsiders along with a large and varied team with many kinds of training and native talents in order to find solutions as well as implement remediation programs. In the near future, with the widespread use of new visualization technologies, perhaps we will all grow to have a greater appreciation of what each person, and each kind of brain, can bring to such a problem, whether in medicine or other areas.

Around the World in 80 Hours

In his *Science* essay, Dr. Lederberg points out that in our competition with microbes, many of our recent technical and economic advances play right into the strengths of the fast-adapting, tiny creatures. We live longer and world population grows, doubling twice in the last century, fostering "new vulnerabilities." There is greater crowding making disease transmission between individuals easier. Continued destruction of forests brings greater contact with disease-carrying animals and insects. Increased freedom in travel and trade further compound these problems. "Travel around the world," he says, "can be completed in less than 80 hours (compared to the 80 days of Jules Verne's 19th-century fantasy), constituting a historic new experience."

Everywhere this long-distance travel has become frequent and routine: "Well over a million passengers, each one a potential carrier of pathogens, travel daily by aircraft to international destinations. International commerce, especially in foodstuffs, only adds to the global traffic of potential pathogens and vectors. Because the transit times of people and goods are now so short compared to the incubation times of disease, carriers of disease can arrive at their destination before the danger they harbor is detectable, reducing health quarantine to a near absurdity."

Dr. Lederberg also points out that when it comes to the pathological development of microbes, we may be our own worst enemies. He observes that "the darker corner of microbiological research is the abyss of maliciously designed biological warfare (BW) agents and systems to deliver them. What a nightmare for the next millennium! What's worse, for the near future, technology is likely to favor offensive BW weaponry. . . ."

Brilliant Flashes

Consequently, we can see that it is indeed our wits against their genes. And it will always be so. Mostly, as Dr. Lederberg explains, we now see that microbes are essential supports for our lives and our world. They are everywhere — and mostly they are on our side, more or less. However, we do need to be aware that in spite of medical successes and a wiser understanding of ecological perspectives, that serious problems most probably lie ahead. We know more, but our economic and political successes may create enormous future problems. But we may take some heart in expecting that the spread of new visualization technologies may promote a more comprehensive view of our whole situation — promoting strong visual thinkers to make wiser decisions about the future for us all. And, with some luck, we may learn to explicitly appreciate the full value of digital artists — and their potential to be true global heroes if the worst were to happen.

Accordingly, we have learned to think more in terms of ecology than warfare. We all now know that we can never stop searching for new ways to protect ourselves. We can never adapt through our own genes as quickly as the microbes can. We must find other ways. We have to use our wits, and learn to bring to bear all the forms of intelligence and inventiveness we can muster— especially those of us in the visualization field who might be best suited to seeing patterns and structures that might be missed by the experts. We need to search a broader field with greater success — because we can never stop.

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About the Columnist

Thomas G. West is author of *In the Mind's Eye*, now in its eleventh printing. He believes that computer graphics together with visualization and simulation technologies will be major tools in our endless task — especially when used by innovative digital artists and other strong visual thinkers. In November, he will participate in a conference at Green College, Oxford University, which will focus on families where several generations have manifested very strong visual and spatial abilities in art, science and technology. His co-presenter will discuss her own family of artists and filmmakers, scientists and mathematicians — where most are hands-on and visual, and a great many have been dyslexic. It is perhaps of no small significance that within this visually-oriented family of Braggs and Thomsons, no less than four have been awarded Nobel prizes.

Thomas G. West
Visualization Research
National Dyslexia Research Foundation
Tel: +1-301-654-5828
Fax: +1-301-654-0987
Email: **tom.west@siggraph.org**

Student Chapters

Full Sail

Michael Thompkins, chair
3300 University Avenue
Winter Park, FL 32792
Sponsor: Happy Aziz
full_sail_schapter@siggraph.org

Northern Arizona University

Montrose F. Edmonds, chair
Box 5619
School of Communication
Flagstaff, AZ 86011
Sponsor: Chris Johnson
northern_arizona_university_schapter@siggraph.org

Purdue University

Nathan Martz, chair
Dept. of Technical Graphics
1419 Knoy Hall, Rm 363
W. Lafayette IN 47907-1419
Sponsor: Dr. Mark Bannatyne
purdue_university_schapter@siggraph.org

Seminole County High School

Nathan Selikoff, chair
601 King Street
Dept. Chair Arts & Communications
Oveido High School
Oveido, FL 32765
Sponsor: Pamela Coffman
seminole_county_hs_schapter@siggraph.org

University of Pennsylvania

Michael Pan, chair
University of Pennsylvania
Computer & Information Science
Philadelphia, PA 19104-6389
Sponsor: Norman I. Badler
university_pennsylvania_schapter@siggraph.org

Chapters

U.S.A

California

Los Angeles
Genny Yee, chair
P. O. Box 9399
Marina del Rey, CA 90295
Tel: +1-310-450-9991
los_angeles_chapter@siggraph.org
http://www.siggraph.org/chapters/la

San Diego
Alan Scrivener, chair
10150 Waynecrest Lane
Santee, CA 92701
Tel: +1-619-596-5434
san_diego_chapter@siggraph.org
http://www.siggraph.org/chapters/sd

San Francisco
Walter Beer, chair
2211 18th Street #10
San Francisco, CA 94107
Tel: +1-415-550-7558
san_francisco_chapter@siggraph.org
http://www.siggraph.org/chapters/sf

Silicon Valley
Jenny Dana, chair
215 Mountain View Ave.
Mountain View, CA 94041
silicon_valley_chapter@siggraph.org
http://www.siggraph.org/chapters/silicon_valley

Florida

Ft. Lauderdale
Francis X. McAfee, Chair
c/o Florida Center for Electronic Communication
220 Southeast Second Avenue
Ft. Lauderdale, FL 33301
Tel: +1-954-762-5618
fort lauderdale chapter@ siggraph.org
http://www.siggraph.org/chapters/ftlsig/

Orlando
Betsy Walton, acting chair
1012 Vernon Loop
Oviedo, FL 32765
Tel: +1-407-366-2126
orlando_chapter@siggraph.org
http://www.siggraph.org/chapters/orlando/

Tampa Bay
Blake Barr, acting chair
12001 Ninth Street N. #2901
St. Petersburg, FL 33716
Tel: +1-727-578-4572
tampa_bay_chapter@siggraph.org
http://www.siggraph.org/chapters/tampa_bay

Massachusetts

Boston
Brent Coullard, chair
boston_chapter@siggraph.org
http://www.siggraph.org/chapters/boston

Michigan

Motown
Ed McDonald, chair
Center for Creative Studies
College of Art and Design
201 East Kirby
Detroit, MI 48202-4034
motown_chapter@siggraph.org

Minnesota

Minneapolis/St. Paul
Stan Bissinger, chair
5401 Elliot
Minneapolis, MN 55417
Tel: +1-612-332-3361 ext. 131
minneapolis-stpaul_chapter@siggraph.org
http://www.siggraph.org/chapters/minneapolis-stpaul

Mississippi

Oktibbeha
Paras Kaul, acting chair
P.O. Box 5275
Mississippi State, MS 39762
Tel: +1-601-325-6676
oktibbeha_chapter@siggraph.org
http://www.siggraph.org/chapters/oktibbeha

New Jersey

Princeton
Douglas Dixon, chair
P.O. Box 1324
Princeton, NJ 08542
Tel: +1-609-734-3176
Fax: +1-609-734-2259
princeton_chapter@siggraph.org
http://www.siggraph.org/chapters/princeton/

New York

Long Island
Paul Lipsky, chair
8 Arthur Court
Plainview, NY 11803
Tel: +1-201-343-6000, ext. 3380
long_island_chapter@siggraph.org
http://www.siggraph.org/long_island

New York City
Scott Lang, chair
ACM/Local Activities
1515 Broadway
New York, NY 10036
Tel: +1-201-343-6000, ext. 3380
new_york_city_chapter@siggraph.org
http://www.siggraph.org/chapters/nyc

Rochester
Marla Schweppe, chair
70 Lomb Memorial Drive
Rochester, NY 14608
rochester_chapter@siggraph.org

North Carolina

NC Research Triangle
Carl Schmidt, chair
624 Ashe Ave.
Cary, NC 27511
Tel: +1-919-677-8000
research_triangle_chapter@siggraph.org
http://www.siggraph.org/chapters/research_triangle/index.htm

Tennessee

East Tennessee
George W. Brumbaugh, chair
11316 Twinview Drive
Knoxville, TN 37932
east_tennessee_chapter@siggraph.org

Texas

Dallas/Fort Worth
G. Michael Youngblood, acting chair
P.O. Box 191064
Arlington, TX 76019
dallas_fort-worth_chapter@siggraph.org
http://www.siggraph.org/chapters/dallas_fort-worth/

Houston
Scott Senften, acting chair
houston_chapter@siggraph.org
http://www.siggraph.org/chapters/houston/

San Antonio
Nancy Wood, chair
San Antonio College
1300 San Pedro
San Antonio, TX 78212
san_antonio_chapter@siggraph.org

Utah

Wasatch Front
Richard Coffey, chair
50 South Central Campus Drive, Room 3190
Merrill Engineering Building
Salt Lake City, UT
Tel: +1-801-581-7977
wasatch_front_chapter@siggraph.org
http://www.siggraph.org/chapters/wasatch_front

Washington

Seattle
Ken Greenebaum chair
seattle_chapter@siggraph.org
http://www.siggraph.org/chapters/seattle

Washington, D.C.

Washington, D.C. Metro Area
Mary Higgins, chair
c/o SMS Interactive
85 South Bragg Street, Suite 500
Alexandria, VA 22312
Tel: +1-703-914-4933
washington_dc_area_chapter@siggraph.org
http://www.siggraph.org/chapters/washington_dc

Argentina

Buenos Aires (In Formation)
Alejandro Beviglia, chair
TucumBn 1625 PB "B"
1050 Buenos Aires, Argentina
Tel: +541-375-5500
Fax: +541-375-5400
buenos_aires_chapter@siggraph.org
http://www.siggraph.org/chapters/buenos_aires

Bulgaria

Sofia
Gospodin Jelev, chair
Technical University of Sofia
1756 Sofia
Bulgaria
Tel: +359-2-962-4037
Fax: +359-2-683-104
sofia_chapter@siggraph.org

Canada

Toronto
Adele Newton, chair
Newton Associates
6338 Snowflake Lane
Mississauga, Ontario L5N 6G9
Canada
Tel: +1-905-824-6793
toronto_chapter@siggraph.org
http://www.siggraph.org/chapters/toronto

Vancouver B.C.
Graeme Gish, chair
Vancouver Film School
420 Homer Street
Vancouver, B.C. V6B 2V5
Canada
vancouver_bc_chapter@siggraph.org
http://www.siggraph.org/chapters/vancouver_bc

France

Paris
Thierry Frey, chair
c/o SUPINFOCOMM
Tertia 3000
#2 Rue Henre Matisse
59300 Aulnoy-les-Valenciennes
France
Tel: +33-27-28-42-42
paris_chapter@siggraph.org
http://www.siggraph.org/chapters/paris

Germany

Southern Germany (In Formation)
southern_germany_chapter@siggraph.org
http://www.siggraph.org/chapters/southern_germany

India

Chennai (In Formation)
K. Seshasai, acting chair
Digital Media Interactive
#1C 1st Floor JP Towers
Nungambakkam High Road
Chennai 600 034
India
chennai_chapter@siggraph.org

Israel

Central Israel
Ayellet Tal, chair
Dept. of Electrical Engineering
Technion – Israel Institute of Technology
Haifa, Israel, 32000
Tel: +972-4-8294651
central_israel_chapter@siggraph.org
http://www.siggraph.org/chapters/central_israel

Italy

Milan
Maria Grazia Mattei, acting chair
MGM Digital Communication s.r.l.
via Vivaio 23
20122 Milano Italia
Tel: +39 2 798760
Fax: +39 2 798701
milan_chapter@siggraph.org

Japan

Tokyo
Masa Inakage, chair
c/o Yukiko Ozaki
Image Systems Engineering Division
IMAGICA Corporation
2-14-1, Higashi-Gotanda, Shinagawa-ku
Tokyo, 141
Japan
Tel: +81-3-3280-1110
Fax: +81-3-3280-7527
tokyo_chapter@siggraph.org
http://www.siggraph.org/chapters/tokyo

Mexico

Mexico City
Gonzalo Leon, chair
Calzada de las Aguilas #1124-E-202
Col. San Clemente
Mexico City 01740 D.F.
Mexico
mexico_city_chapter@siggraph.org
http://www.siggraph.org/chapters/mexico

The Netherlands

Rotterdam (In Formation)
Richard E. Ouwerkerk, acting chair
Willem de Kooning Academy
Hogeschool Rotterdam & Omstreken
Blaak 10
P.O. Box 1272
3000 BG Rotterdam
The Netherlands
rotterdam_chapter@siggraph.org

Singapore

Singapore
Hock Soon Seah, chair
Nanyang Technological University
Nanyang Avenue
Singapore 639798
Singapore
singapore_chapter@siggraph.org
http://www.siggraph.org/chapters/singapore

Taiwan

Taipei
Michael Huang, chair
4F. 495 Kuang Fu S. Rd.
Taipei, Taiwan 110
taipei_chapter@siggraph.org

Venezuela

Caracas (In Formation)
Arturo Puente, acting chair
caracas_chapter@siggraph.org

Rendering + Modeling + Animation + Postprocessing = Computer Graphics

John L. Lowther and
Ching-Kuang Shene
Michigan Technological University

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Introduction

Nowadays, students coming into a computer graphics course have seen movies that have fantastic graphics effects (e.g., *Toy Story*, *A Bug's Life* and the *Star War* series). These students have also acquired a certain level of graphics knowledge by playing games and reading popular magazines. Their expectations are certainly high for their first graphics course. Moreover, many deep and powerful theories were developed during the past decade. Either because these topics are too new or because they are too difficult to teach, they are frequently only sketched or even skipped in favor of a "programming" approach. Hence, what a student learns in an introductory course might only be some programming skills using a graphics API, usually OpenGL, along with some fundamental computer graphics knowledge. Students are only exposed a little to modern developments which are frequently used by the graphics industry for creating fantastic special effects or realistic images.

At Michigan Technological University, we have three computer graphics related courses: an introduction to graphics course, a computing with geometry course for junior and senior students and an advanced graphics course for graduate students. We also have graduate courses on geometric modeling and visualization. The minimum prerequisite of the introductory graphics course is only a sophomore software development course which is usually taken after a data structure course. This introductory course covers essentially all traditional topics with the help of publicly available tools (e.g., GLUT and GLUI) and other tools developed by the instructor of this course. We believe that our current approach is a successful combination of theory and the current popular programming approach using tools. However, we still feel that we need to do more to introduce students to modern theories and developments. While many educators have already observed the need of a new graphics course and proposed some approaches [1], our approach is more ambitious and non-traditional.

We believe that graphics consists of four major components: rendering, modeling, animation and postprocessing. The rendering part has become the major topic in typical graphics textbooks and the main thrust of a programming approach. There is nothing wrong with a focus on rendering methods. The problem is that the programming approach cannot cover global illumination models (e.g., ray tracing and radiosity) and volume rendering, because most popular APIs only implement local illumination models. Every scene contains some objects and object building requires the knowledge of modeling. However, building a good and realistic model is not part of any API. Animation is the skill for creating animation sequences and simulating physical events. Finally, postprocessing makes created scenes satisfy additional requirements and requires a special set of 2D operations. Obvious topics should include, but not be limited to, filters, morphing, dithering and other current techniques. Since the programming approach usually cannot go this far to cover all four components, additional course materials and working environments are required. This has become the main thrust of our project.

To address this need, our goal is to design a comprehensive introductory computer graphics course that covers all four major components to some depth with a breath-first and learning-by-doing approach. To support this goal, a pedagogical environment is required for students to experiment and visualize important concepts, and to perform a semester-long project of implementing various components. In the following, we discuss a number of problems that prompted us to initiate this project, present a description of our proposed course and its software tools, address the software modules that are currently under development and, finally, make our conclusions.

Current Problems

After teaching a computer graphics course for several years, we have found four major problems: course materials are inadequate, "programming" alone is not sufficient, the "design" component is missing and graphics educational research is almost non-existent in spite of the recent and rapid advance of graphics technology. The following sections discuss each of these problems in some detail.

Course Materials Are Inadequate

Comparing the content of popular graphics textbooks [2] with features available in low-end graphics systems shows that some topics in our textbooks are a little out-of-date. A survey conducted by Wolfe [3] clearly shows that most syllabi did not cover all four important components of graphics. Topics frequently covered (e.g., viewing transformations, lighting models and 3D transformations) are now part of typical graphics programming APIs or even have been incorporated into graphics hardware. Other important and frequently used features (e.g., global illumination models - ray tracing and radiosity, animation, texture mapping, surface materials, design and modeling and postprocessing) are less frequently covered. These topics cannot be presented thoroughly without good pedagogical tools. A panel led by L. Hitchner [4] at the Thirtieth SIGCSE Conference also discussed this problem and made some suggestions. While the panelists correctly pointed out a right direction, their suggestions are still not enough to catch the trend. Recently, Cunningham proposed an API-based geometric problem-solving approach. His proposed outline of an introductory course [5] is basically the programming approach with some extensions. This

approach has been used by the authors as well as many other graphics educators for years. Moreover, the meaning of "geometric problem-solving" is not clearly stated and the rendering techniques covered center around only local illumination models. Thus, ray tracing, radiosity, volume rendering, 2D image manipulation and other modern developments are excluded. In contrast with Cunningham's point of view, our approach is to look into the future by incorporating modern as well as traditional topics into a comprehensive introductory course.

"Programming" Alone Is Not Sufficient

The current trend in teaching graphics courses is the programming approach typified by Angel [6]. There are three popular approaches: algorithmic, survey and programming. The algorithmic approach teaches everything about what makes a graphics system work. As Lao-Tzu, a great Chinese philosopher (604-531 BC), observed [7], students will hear about the theory and forget it quickly. The survey approach will certainly make students feel good; but, they will remember many things without acquiring the skills for their career. The programming approach teaches students how to do things. This seems to fit the "I do and I understand" theory. Unfortunately, the coverage of the programming approach is quite limited compared with those theoretical and survey textbooks. Many topics (e.g., shadows generation, radiosity and curve/surface modeling) could be too difficult for students to implement from scratch. Moreover, without seeing the effect, it is even more difficult for them to program. Also, the programming approach often is constrained by the length of a course. There is not enough time to develop and implement every topic. As a result, pedagogical tools are required for students to practice before they implement [8].

The "Design" Component May Be Missing

Another major problem is that the design and modeling component may be totally missing. We probably concentrate too much on rendering. While textbooks discuss curve and surface representations (e.g., Bézier, B-spline and NURBS), students usually learn a set of cold formulas. They have little chance to learn the proper use and impact on design of these curves and surfaces. Design techniques are vital in graphics because they are required for putting objects into a scene. Many design tools are now available in most popular graphics systems (e.g., trueSpace, LightWave 3D and 3D Studio Max) and used in all typical graphics related productions. If we expect our students to take jobs in the graphics industry, these design and modeling related topics must be covered.

Incorporating design techniques into a graphics course is not a very difficult task, although striking a balance between design/modeling and programming is. In our Introduction to Computing with Geometry course, which does not focus on graphics but uses graphics as a vehicle for learning modeling and geometry related computation [9], with a minimal introduction of design principles and modeling techniques, students were able to develop very creative and imaginative designs of good quality. What we educators need to do is provide students with an environment for them to develop their creativity and imagination. If only programming is taught, students' creativity and imagination will be severely limited by the difficulty of implementing some challenging features (e.g., designing a scene which is rendered with radiosity is easier than implementing a good radiosity system).

Are We Ignoring Graphics Education Research?

The answer seems a "yes." Graphics technology has had an explosive development in recent years, programming APIs have reduced to just a few standard ones and good graphics systems for PCs cost as little as $200. But, compared with other topics, graphics education research seems missing in major education conferences and journals. There are three papers published in the 1995 SIGCSE Conference [10], one in 1996 [11], none in 1997, one in 1998 [12], one in 1999 [13] and one in 2000 [14]. SIGGRAPH's *Computer Graphics* also publish graphics education related articles. Professional journals such as *Computers & Graphics* also occasionally publish education research articles. This shows that the computer science education community has not yet done enough for computer graphics courses. While graphics may not be the main stream of computer science education research, we should not ignore the current trend and should provide our students with up-to-date and comprehensive training to enhance their understanding and capability for their future careers.

Proposed Course and Tools

To go one step beyond the API programming approach and to promote the "I hear, I see and I do" scheme, our proposed course is different from a traditional one. It is unique because all important components of graphics are covered in a coherent way with an environment for students to easily develop a comprehensive understanding, and to perform a semester-long programming project. The design of this course has the following purposes in mind:

- Free students from spending a tremendous amount of time in doing non-essential programming just to get a simple implementation working.
- Help students quickly appreciate each concept and algorithm. Some concepts and algorithms are easy to understand but difficult to implement (e.g., ray tracing and radiosity).
- Provide an environment for students to practice basic design and modeling skills, and to visualize the inner working of various algorithms, special effects and other concepts.
- Provide a system for students to perform semester-long programming projects. This approach has been very popular in other courses (e.g., Nachos for operating systems). However, no similar system exists for graphics.

Our proposed course consists of five units: basic understanding, global illumination, object modeling, animation and postprocessing. The basic understanding unit has five subunits: camera and viewing, textures, material and surface, lighting and local illumination models. Color models and transformations are parts of the illumination models and camera and viewing units, and event-driven programming is an integral part of the programming projects using GLUT and GLUI. The following sections present some details of each unit.

The Camera and Viewing Unit

This unit covers camera, viewing and geometric transformations. Software for this component serves as the foundation of the whole system. Topics covered in this unit are usually scattered throughout a traditional graphics course. In fact, these materials can be grouped together in a coherent way and covered quickly for students to understand the entire nature of a graphics system and to permit them to produce good-looking images. Details can be discussed later after students have acquired sufficient experience. In this way, they will have enough incentive to learn some theory. The following discusses the software designed for the five subunits.

Camera: This component utilizes four split windows for top/bottom, left/right, front/end and camera views. The World View Window provides the position of the camera, view volume, front and back clipping plans, view plan and up, right and viewing direction vectors. All viewing transformation matrices and their meaning are shown in separate windows, and are updated on-the-fly when the characteristics of the camera change. Hence, students can have a complete view and understanding of the inner working of viewing transformations. They can also control the focal length and depth-of-field of the camera.

Lights: A number of light sources are placed at default locations. The World View

Window will show the location, direction, type (e.g., spotlight), color, intensity and other characteristics of each light source. Since all objects, including light sources, can be transformed, it is easy for students to see and learn the effect of all involved characteristics such as positions of light sources, attenuation factors, specular highlights, textures and materials of objects, characteristics of the camera and related topics.

Object Primitives: A number of primitives (i.e., blocks, spheres, cylinders, cones, tori and various regular polyhedra) are available. Students can select and drop objects into a scene. Once an object is in the scene, it can be seen in all four split viewing windows and in the World View Window, and displayed in wireframe or rendered mode.

Geometric Transformations: Students can translate and rotate the camera, all light sources and all objects in the World View Window. They can also turn on/off and change the characteristics of any light source. Translations, rotations, scalings and shears can be applied to objects. In this way, students will be able to create a scene and setup the camera and light sources easily and quickly. The background theory will be discussed later in this course.

Texture Mappings and Surface Materials: Some predefined texture maps (e.g., wood, marble, bump and checker) and surface materials are available in the Texture Window and Material Window. Students can select color, texture and material for any object. Fundamental concepts and programming skills of texture and material mapping will be discussed. The basics of texture mapping will also be covered.

Local Illumination and Shading: This part supports ambient and diffuse reflection, attenuation and specular reflection. The Illumination Model Window can be used for modifying the parameters of the illumination equation. The Shading Window allows students to visualize the effect of these factors, and the rendering procedure of Gouraud shading and Phong shading.

The Global Illumination Unit

This unit includes ray tracing and radiosity. Students will learn reflection, transparency and refraction with recursive ray tracing. The radiosity component will implement some popular form factor computation methods, with and without progressive refinement. Software for this unit is not designed to compete with the existing ray tracing (e.g., POV-Ray [15] and Radiance [16]) and radiosity systems (e.g., Lightscape and Radiance). Instead, its purpose is to provide students with an easily accessible, unified and simple environment for them to see the internal working, be familiar with their effects, and have a chance to practice these features.

The Object Modeling Unit

This unit provides students with an environment to learn modeling and design techniques. In addition to the primitives described in the Camera and Viewing unit, this unit will initially support the following modeling activities: polyhedral objects, hierarchy of objects, extruding and sweeping, surfaces of revolution, cubic NURBS curves and bicubic NURBS patches and constructive solid geometry. Polyhedra editing will also be supported to some extent so that students can practice a clay-modeling type shape editing operation. Constructive solid geometry objects can either be triangulated or exact (for ray tracing). All other objects, including surfaces of revolution and objects generated with extruding and sweeping, will be triangulated. This will simplify the implementation and achieve a faster speed but have the disadvantage that polyhedron models are not very accurate. This is what most inexpensive modeling systems do and should not affect our introductory graphics course.

The Animation Unit

This unit provides students with an environment to practice important animation skills. They can set up animation paths for camera, light sources and objects using cubic B-spline curves. They can also specify keyframes and perform forward and inverse kinematics and add transformations to each component of an object for character animation. A bone-based animation subsystem is planned. Other interesting animation options (e.g., particle systems, walking and deformation of soft objects) will be added if time permits.

The Postprocessing Unit

This module will provide students with some limited postprocessing capabilities. Planned features include image enhancement, dithering, sharpening, blurring, warping, morphing, compositing and other frequently used filters and their implementations.

Programming Support

This system will be used not only in classroom as a tool for enhancing teaching, but also provide a platform for programming projects. In other courses, there are many tools for students to implement a significant portion of a working system. For example, Nachos and Minix have been very popular in operating systems courses, and Lex and Yacc in compiler design courses. Unfortunately, no similar system exists for graphics courses, although almost every instructor has tried his/her best to provide students with some modules for programming project use. Thus, a system that is similar to Nachos is urgently needed.

A library for creating buttons, slides, trackball and Gimbal lock has been developed and used in previous NSF projects. The GUI of this system will use this library with extensions. Once this GUI library becomes available, students can use it to create their own or improve the existing system. An instructor can replace one or more components with templates for students to develop their own versions, perhaps with extensions. For example, an instructor can replace the form factor computation module with a template and ask students to implement a modified or simpler algorithm. In this way, an instructor will be able to teach this course using this system for students to gain hands-on experience and deeper understanding, to learn the effect of each taught topic and to do their programming projects.

Past Success and Progress

The method used for developing this course has been very successful in a previous NSF supported course, Introduction to Computing with Geometry. We have shown that, with properly designed tools, one can teach juniors about Bézier, B-spline and NURBS curve and surface design, and many important algorithms (e.g., de Casteljau's, de Boor's, knot insertion, subdivision and degree elevation) in an intuitive and non-mathematical way. These topics are frequently skipped in a graphics course due to their mathematical content and time constraints. The above mentioned course and DesignMentor, the accompanying software tool, have made all topics down-to-earth so that juniors can understand fundamentals, program algorithms and carry out elementary design tasks. DesignMentor was announced in March 1999 and since then has had more than 900 downloads from all over the world. Approximately 32 percent are from computer science and related departments. The course electronic book has 13 hits daily on average, most from off-campus. Hence, we believe that it is a success and anticipate that the same development process applied to this project will also be successful.

Currently, we are developing two of the most difficult and most needed modules. The first one is for radiosity. In this module, a user supplies a scene to the form factor computation subsystem, which, in turn, pipes the computed form factors to the radiosity rendering subsystem. This rendering system supports Gauss-Seidel (e.g., gathering) iteration with and without subdivision, and progressive refinement (e.g., shooting). A user can step through iterations to see an intermediate result, turn on the visualization component to see the computation process (e.g., gathering and shooting radiosity and subdivision) and perform a walkthrough. Each of the submodules is replaceable for students to implement their own version and/or improvement. The second module is about

volume rendering. Volume rendering has been very popular in medical imaging and visualization, but does not catch much attention in the graphics education community. This module can read in a MRI scan, reconstruct the object, perform slicing operations and help visualize the marching cube algorithm. We anticipate completion of these prototypes and the course units/modules mentioned in previous sections in about a year.

Conclusions

In previous sections, we have presented the problems leading to a new design of an introductory computer graphics course and its accompanying pedagogical software tools. Under NSF support, we have started the development of software tools. We believe our course will cover more modern topics without sacrificing the traditional and programming elements. The anticipated outcome of this project will include an electronic book, a set of programming notes and a number of accompanying software tools and their user guides. All materials will be made available to educators on the Internet.

Acknowledgments

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Footnotes

1. See, for example, Steve Cunningham, Powers of 10: The Case of Changing the First Course in Computer Graphics, *Thirty-first SIGCSE Technical Symposium on Computer Science Education*, March 8 to March 12, 2000, Austin, TX, pp. 46-49, and Rosalee J. Wolfe, *3D Graphics: A Visual Approach*, Oxford University Press, 2000.
2. Edward Angel, *Interactive Computer Graphics*, 2nd edition, Addison-Wesley, 1999; James D. Foley, Andries van Dam, Steven K. Feiner, John F. Hughes and Richard L. Phillips, *Introduction to Computer Graphics*, Addison-Wesley, 1993; and Donald Hearn and M. Pauline Baker, *Computer Graphics*, 3rd edition, Prentice Hall, 2000.
3. Rosalee Wolfe, A Syllabus Survey: Examining the State of Current Practice in Introductory Computer Science Courses, *Computer Graphics*, Vol. 33 (1999), No. 1 (February), pp. 32-33.
4. Lew Hitchner, Steve Cunningham, Scott Grissom and Rosalee Wolfe, Computer Graphics: The Introductory Grows Up, *Thirtieth SIGCSE Technical Symposium on Computer Science Education*, New Orleans, March 24-28, 1999, pp. 341-342.
5. See footnote 1 above.
6. Edward Angel, *Interactive Computer Graphics: A Top Down Approach with OpenGL*, second edition, Addison-Wesley, 2000, and Teaching a Three-Dimensional Computer Graphics Class Using OpenGL, *Computer Graphics*, Vol. 31 (1997), No. 3 (August), pp. 54-55.
7. *I hear and I forget. I see and I remember. I do and I understand*. See Lao-Tzu, *Tao Te Ching*, translated by D. C. Lau, Knopf, 1994.
8. C. A. R. Hoare said *You can't teach beginning programmers top-down design because they don't know which way is up*. If students do not know the effect of radiosity, they will not be able to recognize if their implementations are correct and of good quality. Thus, knowing the effects must be the first step.
9. Note that the meaning of "geometry" here is very different from and has a much wider coverage than that of Cunningham's. We emphasize the development of understanding and skills of converting a geometric object into various representations, implementation of algorithms for each representation, and design activities. The interested readers may find the following URL helpful **http://www.cs.mtu.edu/~shene/NSF-2/index.html**.
10. Dino Schweitzer and Tom Appolloni, Integrating Introductory Courses in Computer Graphics and Animation, *Twenty-Sixth SIGCSE Technical Symposium on Computer Science Education*, Nashville, TN, March 2-4, 1995, pp. 186-190; Andrew Sears and Rosalee Wolfe, Visual Analysis: Adding Breath to a Computer Graphics Course, pp. 195-198; and Lee H. Tichenor, Inexpensive Advanced Graphics Applications for the CS Majors Graphic Class, Integrating Introductory Courses in Computer Graphics and Animation, pp. 191-194.
11. David Goldman, Richard E. Eckert, and Maxine S. Cohen, Three-Dimensional Computation Visualization for Computer Graphics Rendering Algorithm, *Twenty-Seventh SIGCSE Technical Symposium on Computer Science Education*, Philadelphia, PA, February 15-18, 1996, pp. 358-362.
12. Yuan Zhao, John L. Lowther and Ching-Kuang Shene, A Tools for Teaching Curve Design, *Twenty-ninth SIGCSE Technical Symposium on Computer Science Education*, February 25-March 1, Atlanta, GA, 1998, pp. 97-101.
13. Yan Zhou, Yuan Zhao, John L. Lowther and Ching-Kuang Shene, Teaching Surface Design Made Easy, *Thirtieth SIGCSE Technical Symposium on Computer Science Education*, March 24 - 28, New Orleans, LA, 1999, pp. 222-226.
14. Steve Cunningham, Powers of 10: The Case of Changing the First Course in Computer Graphics, *Thirty-first SIGCSE Technical Symposium on Computer Science Education*, March 8 to March 12, 2000, Austin, TX, pp. 46-49.
15. Chris Young and Drew Wells, *Ray Tracing Creations*, 2nd edition, Waite Group Press, 1994.
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About the Guest Columnists

John L. Lowther and Ching-Kuang Shene
Department of Computer Science
Michigan Technological University
1400 Townsend Drive
Houghton, MI 49931
Email: **{john|shene}@mtu.edu**

About the Columnist

Rosalee Wolfe obtained a masters of music from Indiana University before changing majors to earn a Ph.D. in computer science. She is a NASA Fellow, was SIGGRAPH Technical Slides Editor in 1993 and 1995-97 and edited *Seminal Graphics* for SIGGRAPH 98. She also authored the 1997 education slide set on mapping techniques, co-created the first B.S. in human-computer interaction (at DePaul University) and is currently Director of the Division of Graphics and Human-Computer Interaction in the School of Computer Science, Telecommunications and Information Systems at DePaul University.

Rosalee J. Wolfe
School of Computer Science
DePaul University
Chicago, IL 60604
Email: **wolfe@cs.depaul.edu**

Opportunities and Remembrances

This issue's column includes several items I think will be of interest: new computer graphics stamps, *The Story of Computer Graphics* video available from SIGGRAPH as SVR #137 and some short remembrances from a few computer graphics Pioneers.

— Carl Machover

Carl Machover
Machover Associates Corporation

Computer Graphics Stamps

The 1990s "Celebrate the Century" United States postage stamps include a computer graphics and art, a virtual reality and a World Wide Web stamp. I understand you'll need to buy the sheet of 15 stamps for $4.95, but it's worth it, I think!!

The Story of Computer Graphics Available!

SIGGRAPH Video Review Issue 137, *The Story of Computer Graphics*, is now available in NTSC VHS format for $60 each and PAL VHS format for $75 each, plus shipping and handling. If renewing or signing up for a new ACM SIGGRAPH membership, this SVR is available to you under the Member Value Program for a discounted price of $45 each (NTSC VHS) or $56 each (PAL VHS). A DVD version is currently not available, but if the situation changes we will announce it on the movie web page, **http://www.siggraph.org/movie/.**

Orders can be placed by mail, fax or phone to:

SIGGRAPH Video Review
c/o ACM
P.O. Box 11414
New York NY 10286-1414
USA/Canada: 1-800-342-6626
Overseas: 1-212-626-0500
Fax: 1-212-944-1318
Email: **svrorders@siggraph.org**

Pioneer Remembrances

It occurred to me that members of the Computer Graphics Pioneers would have a number of fascinating stories to tell about their early days in computer graphics. In August, I emailed the following note to the Pioneers for whom we had addresses, and at time of writing in September, had received around a dozen responses.

"Fellow CG Pioneer....hope you've had a chance to read (and perhaps enjoy) the Computer Graphics Pioneer column several others and I have been writing for the quarterly SIGGRAPH *Computer Graphics* publication. I'm sure each of you have some fascinating recollections and anecdotes about your early days in computer graphics and I want to encourage you to share them with the graphics community. The columns usually run between 1,000 and 2,000 words. Please send columns, anecdotes or other material to me...ideally by email...and we'll try hard to publish the material in the column...with full credit to you, of course... For the last couple of years, we've been on a history "roll'....let's keep the pot boiling!! Look forward to hearing from you."

(Incidentally, the criteria for membership in the CG Pioneers is at least 20 years in computer graphics - the magic qualification year is now 1980. If you qualify, please contact Sherry Keowen, Executive Director, 20961 Bandera Street, Woodland Hills, CA 91364-4504, phone/fax 818-347-2210 or 818-347-2210, email: **sherry@westworld. com**).

Here are three of the short remembrances I've received so far. We hope to print others in subsequent columns, and look forward to perhaps hearing from you too !

"The Spring semester 1959 was my final one at Harvard's Graduate School of Design, where I received my masters in city and regional planning. Our final project concerned the redevelopment of the Park Square section of downtown Boston. I personally did not like to slave over hand copying maps and coloring them.

"Then came an aha! My husband, Gordon, was working on the TX-0 at MIT. It had a small, built in, graphics scope. To get the output from the scope, a Polaroid camera could be screwed unto it at the appropriate distance and the image recorded. Further the image could be changed using a light pen. So that it was interactive.

"At the time the computer generated images were all produced by printers on long sheets of paper with no possibility of interaction. I was not in graphics at the time. I was just trying to get a job done without ridiculous hand labor...."

Dr. Gwen Bell
The Computer Museum History Center
Building T12-A
NASA Ames Research Center
Mountain View, CA 94035
Tel: 650-604-2571
Email: **bell@comupterhistory.org**
Web: **www.computerhistory.org**

"Regarding early graphics activity, while at RCA in the very early 1960s, we were developing a high voltage switching power supply to drive the beam penetration phosphors that became available. RCA had these operating in the Sarnoff Lab but wouldn't tell anybody due to their strong position in shadow mask CRTs. We wanted to use the technology in the new FAA ATC programs. I set up teaming with Tasker (Homer) to propose monochrome and also the possibility of color. We went pretty far with the FAA. When I was asked to present the team approach to the RCA lawyers in Princeton they said RCA would not do business with the FAA because of patent rights. In the '70s while at Kratos, we became the largest supplier worldwide of beam penetration monitors, primarily for pilot training in aircraft simulators."

Tom Curran
Mgr. Advanced Programs
Planar Advance, Inc.
13950 SW Karl Braun Drive
P.O. Box 4001
Beaverton, OR 97076
Tel: 503-614-4138
Fax: 503-614-4101
Email: **tom_curran@planar.com**

"One of my memories from 1974 is my wife and new daughter sleeping on the floor at MAGI in the room with a certain film recorder [1], reason being that if I left the premises the night computer operator would dump my job and go back to unduplicating mailing lists - no sympathy for the True Path, he just wanted the company to make money or something...

"A further jog on the story is that I was probably doing film for either the Julie Christie film *Demon Seed* or Spielberg's *Close Encounters.* Steve Spielberg was quite interested in Synthavision. We had a terminal set up in his office at Universal and did tests for the landing-field sequence at the end of the film. But when Doug Trumbull took over effects for the picture, SV was dropped."

Bo Gehring
Focal Point 3D Audio
179 Webster St.
East Boston, MA 02128
Email: **bgehring@fp3d.com**
Web: **www.fp3d.co**

[1] Note from the columnist: Bo graciously doesn't mention it in his recollection, but I think the film recorder is one my old company, Information Displays, sold to MAGI - a custom built unit, never again duplicated!! Carl

About the Columnist

Carl Machover is President of Machover Associates Corporation, a consultancy providing services to computer graphics users, suppliers and investors. He has been interested and involved in the field of CG for many years, written numerous articles and conducted a number of seminars. Machover is Editor of the *CAD/CAM Handbook* (McGraw Hill, 1996) and serves on the editorial board of several publications.

Carl Machover
President
Machover Associates
152A Longview Avenue
White Plains, NY 10605
Tel: +1-914-949-3777
Fax: +1-914-949-3851
Email: **machover@siggraph.org**

Photo credit: Louis Fabian Bachrach

Public Policy Update

We begin this column with a review of public policy activities at SIGGRAPH 2000, which was held in New Orleans, July 23-28, 2000. Next, guest columnist Myles Losch reports on the expected availability of broadband services that may be installed by the customer instead of requiring a service call by a technician, thereby potentially lowering the installation cost. We then look at the issue of consumer acceptance of new technology based on a recent *CACM* column by ACM Past President Barbara Simons. We close by reprinting a short piece by Eugene Spafford, Co-Chair of USACM on the Uniform Computer Information Transactions Act and its implications for personal and professional software purchases.

— Bob Ellis

Public Policy Activities at SIGGRAPH 2000

Policy Maker Interaction

Attending our committee meeting was Jason Hutter, a staffer in the local office of Congressman Billy Tauzin. Congressman Tauzin is the Chair of the House Sub-Committee on Telecommunications. Because Hutter is not an expert on telecommunications policy, the session consisted primarily of our giving him our thoughts on the importance of broadband telecommunications to computer graphics and the impediments we see to the wide adoption of broadband. Because of the next item (see below), we also spent time discussing the issue of U.S. government support for computing and computer graphics research. Hutter was very interested in what we had to say.

An email from Hutter after the conference indicated that he had transmitted the information to Congressman Tauzin and appropriate staffers in the Washington office. It was also obvious to us that ACM has very little visibility in Washington making meetings like this an important part of our activities. I will try to get some policy maker participation in all our future committee meetings.

Prospective NRC/SIGGRAPH Study on Computer Graphics Research

In conjunction with National Research Council's (NRC) Computer Science and Telecommunications Board (CSTB), we have defined a study project entitled "Research Challenges in Computer Graphics." The SIGGRAPH Executive Committee has approved $50,000 as seed funding for this study pending a favorable review by the computer graphics research community.

Although small in number, we've had some thoughtful responses to our initial solicitation for comments. The most important critical comments centered on the difficulty of getting adequate representation for all aspects of computer graphics, the almost insurmountable problem of getting computer graphics recognized as a research discipline in its own right separate from applications, the difficulty of having such studies make an impact and the overwhelming presence of the game and entertainment markets. None of the reviews said not to do the study.

Our discussion of the comments led us to the conclusion that the study should be done and the NRC is the right organization to do it. The project description will be revised to ensure that the points raised in the reviews are highlighted.

Public Policy at SIGGRAPH Conferences

I observed that a number of points made in the courses and panels have strong policy side issues and that we should work at getting more visibility at future SIGGRAPH conferences. There are a number of possibilities, including having policy issues awareness added to several courses and panels, offering our own course and organizing a panel. All of these should avoid the descriptive term "public policy" because most people don't see this as a very exciting issue, particularly compared to the other content of the conference.

We decided that a course should focus on awareness and a panel should have a single topic rather than overview several issues. Subsequent discussion and thought has led me to consider proposing a two-hour course and a panel on copyrights for digital material for SIGGRAPH 2001. The course would be a two-hour course to increase the probability of acceptance of this decidedly non-mainstream topic with options to expand the course to a half or full day. The panel would consist of speakers representing the academic community, a practicing intellectual property attorney, creators of copyrighted digital material and users of copyrighted digital material representing a diverse array of positions on the relative rights of copyright holders and fair use by users of copyrighted material. One idea for a panel was to have a placeholder called something like "Hot Topics" so we could discuss last minute issues that were not active at the time the panel was accepted, but this seems unlikely to win acceptance by the conference committee.

If the proposals are going to happen, I will need considerable help. While I welcome your suggestions for content and speakers, what I really need are co-organizers for both, who can contribute to the development of the proposals. The deadline for early feedback on course proposals was October 25, 2000 with final proposals due November 29, 2000. Panel proposals are due January 17, 2001.

Third On-Line Survey

We have some initial results from the survey. Although there have been only 23 responses to date, some early trends are emerging. Over 80 percent of the respondents are U.S. residents, with four other countries having one respondent each. Surprisingly, freedom of speech has emerged as the respondents' top policy issue facing computer graphics. Also of interest is the fact that there is considerable support for all aspects of SIGGRAPH and ACM work in policy, ranging from providing information to the computer

graphics community and policy makers to taking positions on issues. The only caution comes on financing these activities with an extremely strong response that funding not be diverted from other activities such as publications and conference support.

We discussed the value of doing these surveys because the respondents are self-selected and not representative of any community except that of respondents to our surveys. Some concern was expressed that these surveys are not particularly exciting, but the majority of the committee favored continuing them because they do represent the opinion of those who care enough about the issues we raise to take to time to respond.

Public Policy BOF

As usual the BOF was not particularly well attended, but one university affiliated attendee presented a situation where one of their new research grants requires a public policy component. We had a long and interesting discussion about how we could help them by being an information resource.

Self-Installation of (Wired) Residential Broadband Internet Access

Myles Losch

Among the obstacles to widespread home adoption of both DSL and cable modem services has been the typical need for expert on-site technical skills furnished by service providers' field crews. Past attempts to let consumers self-install [in industry jargon, "self-provision"] such broadband links (as they would a dial-up telephone modem) fared poorly, due to technical and standardization problems.

But better technology, combined with quickly growing demand, have prompted new efforts to cut labor costs and delays by offering the customer an "out-of-box experience." Broadband access providers, with equipment makers and retailers, have developed (and cautiously begun to deploy) a new generation of streamlined industry standards for self-installation.

The research consortium Cable Television Laboratories (**www.cablelabs.org**) developed, and tests hardware compliance with, the DOCSIS (Data Over Cable Service Interface Specification) standard for cable modems. Phone companies' corresponding initiative for ADSL service, once called "G.lite," was standardized by the International Telecommunication Union (**www.itu.int**) as Recommendation G.992.2. This standard is being overseen by a new deployment consortium, OpenDSL (**www.opendsl.org**).

Retail packaging of both types of broadband access device is expected to take two forms: kits for use with separately purchased computers, and inboard versions pre-installed in both computers and fixed function "Internet appliances" such as Microsoft's Web TV terminals.

Industry analysts expect that such products, if successful, will do much to speed public acceptance of broadband Internet access. In future columns, we hope to assess the results.

Consumer Acceptance as an Aspect of Policy Issues

In the "From the President" column in the May 1999 issue of *Communications of the ACM* ("To DVD or Not to DVD," *CACM*, Vol. 42, No. 5) then President Barbara Simons discusses the issue of digital copy protection for DVD movies. The column was prompted by the publication of (and subsequent legal battles over) the code to decrypt the Content Scrambling System (DeCSS). In the column, Simons discusses some of the policy issues surrounding this action. For more information on the DeCSS trial see **http://eon.law.harvard.edu/openlaw/DVD/.** For a copy of Simons' deposition for the DeCSS trial see **http://www.eff.org/IP/Video/MPAA_DVD_cases/20000708_ny_simons_dep.html**.

I believe the real answer to the question asked in the title depends on whether consumers will accept the first consumer device for the playback of pre-recorded content that from its introduction did not permit full-quality copying. CDs aren't copy protected - copying just had to wait for popularly priced CD writers. Digital Audio Tape (DAT) failed at least in part because of the lack of ability to make multiple generations of digital copies. DiVX failed not so much for lack of copy capability but because of the control exercised over consumers' playback options. And VCR copy protection came after the devices were widely deployed. By the way, it will be interesting to see what happens as consumers begin to realize this. Public demand has led, in large areas of Europe, East Asia and elsewhere, to the commercial availability of DVD players that, contrary to the industry's technology licenses, allow playback of discs from multiple movie-distribution regions of the world.

For example, DVD movie players are down to around $150. If you buy one of these and don't buy, but rent, DVD titles, what do you care about whether or not you can copy a DVD and the potential loss of your capital investment? If it is useful for five years, the DVD player has only cost you $30 per year. Of course this argument does not take into account what is called "fair use" copying.

The same argument applies to UCITA (see below). People buy and install software all the time without reading the End User License Agreements. And they give it to their kids, etc., without bothering to get the publishers permission. If restrictions become really onerous and enforced, consumers just won't buy the products. This strategy has obvious limitations; you can't really not buy certain software where the vendor has a monopoly in the market. But you can search for alternatives and delay upgrading as long as possible in the hopes that the worst features of the license agreements will go away before you need to move to the new versions of the software. Even in these situations, the effects of an informal boycott could work wonders.

An Illustration of Why Security is More Than Technology

Eugene H. Spafford
Purdue University CERIAS

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The biggest threats in the next decade to information security may not be malicious hackers and viruses. They are going to be bad law, passed by ill-informed legislators, and pushed by greedy and unscrupulous commercial interests with lots of money with which to lobby. Those companies are going to seek to further expand (bad) law protecting intellectual property, curtailing consumer rights, and further protecting them from consequence for their production of bad software.

You don't believe it? If you live in the U.S., consider the following scenario: You buy some shrink-wrapped software for use in your business or at home. As part of that purchase:

- You are bound by a license inside the box that you cannot read until you make the purchase.
- The license can be changed by the vendor simply by posting an update at the vendor's WWW site or sending you email, and you are legally bound by the changes.
- You are required to open your firewall to allow the vendor access to a "backdoor" in the software to allow the vendor to monitor license compliance and remotely disable the software at the vendor's option.
- The vendor can sue you if you reverse-engineer the code or protocol to find out exactly what information the software is collecting and sending out.
- If the software fails catastrophically because of clear and obvious negligence, you can't sue the vendor.

- If you decide to publish a review of the software noting your bad experiences, you can be sued by the vendor for not obtaining prior review and permission by the vendor.

Sounds absurd, doesn't it? Impossible, perhaps? Unfortunately not — it is currently embodied in state law in both Maryland and Virginia, and will soon be considered by the state legislatures in the other 48 states. If a vendor chooses to write any of the above-mentioned provisions into a software license, state contract law will allow and support it.

The vehicle for this travesty is UCITA — the Uniform Computer Information Transactions Act. Ostensibly an update of the Uniform Commercial Code in each state, the process of drafting the act was co-opted by some of the largest entertainment and software firms. The result is something that is opposed by a Who's Who of the computing and consumer-rights milieu — including the IEEE, ACM, MPAA, ALA, Consumers Union and the FTC. *[Note also that about half of all the U.S. state attorneys general are formally opposed - Ellis]* (**See http://www.badsoftware.com/oppose.htm** for an incomplete list of opponents.)

Why is UCITA such a threat when it is so obviously bad for consumers and the IT industry (and security people in particular)? Mainly because of the complexity of the issue and the money involved. The draft act is several hundred pages of dense legalese that is beyond the ability of most state legislators to analyze. So, they are depending on the word of knowledgeable experts to understand the impact. Unfortunately, the companies that stand to gain the most are also lobbying the most strongly on this issue. The mantra heard in Maryland and Virginia from these lobbyists was that if the states didn't pass UCITA then they would not be able to complete for high-tech jobs and dollars. This is persuasive to legislators who don't otherwise understand the issues. How would it play in the halls of your state capitol?

So, what can *you* do? Well, first of all, educate yourself about the issues. Start with Barbara Simons' editorial "Shrink-Wrapping Our Rights" in the Inside Risks column of *CACM* (Vol. 8, August 2000); also available at **http://www.csl.sri.com/neumann/insiderisks.html**. You can also find articles about UCITA and its impact at **http://www.ucita.org/.**

Then, you need to communicate with your state legislators about the problems this law would bring to your state if passed, and your opinion thereto.

Remember — the insider threat is not simply from employees. The software you use may well be the biggest threat, along with its vendor. What good is security technology when the law doesn't let you protect yourself?

About the Columnist

Bob Ellis is Chair of SIGGRAPH's Public Policy Committee. When last gainfully employed (1993), he was Sun Microsystems' representative on the Computer Systems Policy Project's (CSPP) Technology Committee and also co-managed Sun's external research program. Before that, Ellis held computer graphics software development and management positions with Sun, GE-Calma, Atari, Boeing and Washington University (St. Louis).

Bob Ellis
Email: **bob_ellis@siggraph.org**

ACM SIGGRAPH 2001 Elections: Nominating Committee Report

This year ACM SIGGRAPH members will elect the ACM SIGGRAPH officers for a term beginning July 1, 2001. The Nominating Committee sought colleagues whom we believe can successfully lead ACM SIGGRAPH in the changing and exciting world of computer graphics and interactive techniques. We are pleased to present you with a group of persons with experience within ACM SIGGRAPH and with solid achievements in industry, in academia and as volunteers.

The Nominating Committee has selected two nominees for each position. The statements from the candidates will appear in the February issue of *Computer Graphics* and in the ballot materials. Other names may be added to the ballot by the petition process described below. Any questions about nominations, petitions or elections can be directed to Steve Cunningham, **cunningham@siggraph.org**.

Ballots, including copies of the candidate statements, will be mailed to ACM SIGGRAPH members in a first class mailing in the spring of 2001, and we hope you will make the effort to read the candidates' statements and vote carefully. Ballots are NOT included in this issue of the newsletter.

The Nominating Committee
Steve Cunningham, Chair
Alain Chesnais
Nan Schaller

Slate for 2001 ACM SIGGRAPH Elections

Chair

David Arnold, University of East Anglia, Norwich, UK

Judith R. Brown, author and consultant, Iowa City, IA USA

Vice Chair

Alan Chalmers, University of Bristol, Bristol, UK

Barb Helfer, The Ohio State University, Columbus, OH, USA

Treasurer

Omar Ahmad, Logictier, San Mateo, CA, USA

Garry M. Paxinos, Metro Link, Inc., Ft. Lauderdale, FL, USA

Call for Petition Candidates

ACM and SIGGRAPH bylaws allow candidates to be added to the slate of nominees upon receipt of a petition signed by 1 percent of the voting members of ACM SIGGRAPH. In 2001, a petition candidate for any of the offices being contested must submit 65 signatures. Each signature must be accompanied by member name, address and membership number. Notice of intent to submit a petition should be sent to the address below by **January 31, 2001**, and completed petition should be sent to the same address and must be received by **March 2, 2001**.

Pat Ryan
ACM Headquarters
One Astor Plaza, 17th floor
1515 Broadway
New York, NY 10036 USA

A copy of the completed petition must also be sent to the address below and received by **March 2, 2001**.

Steve Cunningham
ACM SIGGRAPH Past Chair
Computer Science Department
California State University Stanislaus
801 W. Monte Vista Avenue
Turlock, CA 95382 USA

SIGGRAPH Executive Committee Minutes

Meeting
July 29, 2000
New Orleans, LA

Attending
Judy Brown, Alan Chalmers, Colleen Cleary, Steve Cunningham, David Ebert, Leo Hourvitz, Erica Johnson, Scott Owen, Garry Paxinos, Dino Schweitzer, Stephen Spencer.

Absent
Gudrun Enger, Mike McGrath.

Guests
David Arnold, Tom Appolloni, Bob Ellis, Dieter Fellner, John Fujii, Scott Lang, Mike Pique, Lynn Pocock, Theresa-Marie Rhyne, Larry Vliet, Warren Waggenspack, Jackie White.

The meeting was called to order at 9 a.m. by Judy Brown, and there was a brief introduction of guests.

Presentation of Appreciation
ACM Certificates of Recognition of Service were given to Scott Lang, Theresa-Marie Rhyne, John Fujii and Steve Cunningham for their service on the Executive Committee and Conference Advisory Group.

Plaques were given to outgoing Executive Committee members John Fujii, Scott Lang and Theresa-Marie Rhyne.

The Executive Committee meeting schedule was set for the upcoming year, as follows:

The November meeting will be the weekend of November 10-12 preferably in Europe. Location suggestions: Dublin, Paris, Barcelona, Rome. Erica Johnson will look into airfares to determine if these are feasible.

The budget meeting will be held in late January, preferably in Colorado Springs. EC members should keep the last two weekends open, January 19-21 and 26-28, until we hear about availability from those who were absent.

The May meeting will be held May 4-6. Location suggestions: Boston, Atlanta, San Francisco, Vancouver. Erica will look into airfares to determine which of these are feasible.

The August conference call is tentatively scheduled to be held on August 30 at a time to be determined later.

Approval of EC Minutes
Motion: To approve the minutes of the May EC meeting.
Hourvitz, Ebert (8, 0, 0)

Motion: To approve the minutes of the two conference calls (May 25 and June 14)
Chalmers, Hourvitz (8, 0, 0)

Conference Status Reports
Scott Owen reported that the SIGGRAPH 2000 conference was very successful and turned the discussion over to the Conference Chair Jackie White. Jackie reported that they sold 145,000 square feet of exhibit space, and that the attendance was 25,986. Full Conference registration was 8,300. This high number of full conference attendees caused some of the overcrowding at the Monday reception. Conference Select registration was 1,860. There were no major issues other than overflows for AV setup.

Motion: That EC commend the S2000 chair and committee for putting on a wonderful conference.
Owen, Cunningham (By acclamation)

Lynn Pocock reported that the SIGGRAPH 2001 exhibit pre-sale numbers look great, with approximately 128,700 square feet sold. The SIGGRAPH 2001 committee will meet in September to prepare the budget and review space sales.

Tom Appolloni reported that the SIGGRAPH 2002 committee building is progressing, and both program plans and business plans look good.

Scott reported that a summary of the strategic planning he has been doing this week will be written and given to EC for use prior to the September strategic planning meeting.

Leo Hourvitz reported that the ACM SIGGRAPH booth was very busy all week and that we signed up 430 members through on-line registration at the booth.

Status on Digital Media News
Warren Waggenspack reported that the appearance of the Digital Media News website (**www.siggraphnews.com**) has changed. It now looks like any other media site for news and doesn't look like it's coming from ACM SIGGRAPH. There has not been any direct follow up with this company since our conference call in June. The subcommittee will have email contact after this week to discuss it.

Awards Issues
There are three separate, but related, issues:

1) Do any of the selections that we have, such as the Computer Animation Festival (CAF) Best of Show and Jury Honors selections need to be approved as part of the ACM Awards Program?

2) Do we want to restrict units of ACM SIGGRAPH from giving prizes, "awards," or otherwise selecting "winners?"

3) Should the term "award" be reserved for the official ACM SIGGRAPH Awards Program (Coons, Achievement, Significant New Researcher, and Outstanding Service Awards)?

On the first issue, the ACM award policy is to get external recognition of work being done by SIGs. The discussion did not indicate any interest in having the CAF selections or any other selections outside the ACM SIGGRAPH Awards Program becoming an ACM award.

With regard to the second issue, the Education Committee has given prizes in poster and animation competition; the conference has had t-shirt prizes; and some chapters have given significant monetary prizes. There are other examples, as well. Some think this is a decision that each committee should make, while others feel that acceptance should be the only recognition needed. Still others feel that there should be some guidelines, but each committee should make its own decisions within the guidelines.

The chair will appoint a task force to discuss these issues before the next conference call. There was a brief discussion of the use of the word "award." The above task force will also include this topic in its discussion.

The discussion about the CAF awards raised the question about press releases and where they are recorded. We were told that they are documented online on the Conference Advisory Group website. Scott Owen will inform us as to the location of the press releases.

Eurographics
ACM SIGGRAPH and Eurographics signed an affiliation agreement this week, by which joint members receive a discount on membership dues. We will continue to work closely together and seek new opportunities for the common goal of furthering the field of computer graphics and interactive techniques. Eurographics also had a very good number of new memberships at their booth.

ACM Student Research Contest

For eight years, ACM has sponsored a student research contest at the SIGCSE Technical Symposium on Computer Science Education. In order to get a broader student involvement, there are plans to have some SIGs host discipline-focused contests to bring research students to an event with maximum interest in them. If SIGGRAPH were to sponsor a competition for student research in computer graphics, the winners at the SIGGRAPH competition would compete with winners from other SIG-sponsored events, with the winners being presented at the ACM awards banquet in May. This is likely to begin with May 2002 or 2003. Steve Cunningham will look into this at the undergraduate level, and David Ebert will look into it for the graduate level. Both the Education Committee and chair of the educators' program have shown interest. There is a need to define what "research" is in the SIGGRAPH community. Steve and David will focus on computer science, but other areas may also be involved.

Bylaws for Terms of Office

Steve Cunningham, Nominations Committee Chair, presented some proposed changes to Article 4 of the bylaws, defining the ACM SIGGRAPH Officers and Executive Committee and terms of office. The intent is to phase in a non-renewable three year term of office and to change the titles of several of the Executive Committee members. The rest of the recommended bylaw changes will be brought forward at the November EC meeting, but EC approval of this section was needed for the Nominations Committee to continue. Bylaws changes approved by EC posted on the **siggraph.org** website and will be voted on by ACM SIGGRAPH membership in the next ballot.

Motion: To approve the changes in Article 4 of the bylaws with the changes presented to EC and to replace the title of Chair, Vice Chair, and Past Chair w/President, Vice President and Past President. Cunningham, Chalmers

Friendly amendment: To also change Director for Professional Chapters to Director for Chapters because we now also have student chapters.

Colleen Cleary (Friendly amendment accepted)

Amendment: To delete the recommended statement under (d) iii "No person may be selected as CAG Chair while serving in that position, unless that service shall have had a duration of no more than one year at the time the selection is made by the Executive Committee."

Owen, Chalmers (7,1,0, Against – Cunningham)

Vote passed on the motion as amended (8,0,0)

Public Policy

Bob Ellis discussed the public policy activities: informing policy makers about issues, the on-line surveys and results, public policy and visibility, and the National Research Council study. We have not done much to inform policy makers. Bob participated in a congressional briefing and invited a staff member from the committee on telecommunications to the Public Policy Committee meeting this week. The on-line surveys have low participation, only 26 on the most recent one. Bob discussed ways to raise public policy visibility at the annual conference.

The comments received back from researchers on the National Research Council study on computer graphics applications and research will be reflected in the revised project description. Other researchers will be contacted to request their comments.

Strategic Planning

A two-hour scenario-based strategic planning session was held.

Outstanding Service Award

We need to have policies and procedures for this award, including whether it is to be an annual or bi-annual award. It is felt that it should be a life-time service kind of award.

Motion: The charter of the ACM SIGGRAPH Outstanding Service Award shall be changed to be as follows:

The ACM SIGGRAPH Outstanding Service Award is given in even-numbered years to recognize a career of outstanding service to ACM SIGGRAPH by a volunteer. It recognizes an individual who has given extraordinary service to ACM SIGGRAPH, both in the trenches and in positions of more responsibility or visibility, over a significant period of time. This award shall be administered by a designated Service Awards Chair who will create an appropriate committee, and shall be based upon nominations to the Service Awards Chair. The award shall consist of a plaque and full travel expenses and registration to the SIGGRAPH annual conference at which the award shall be given.

Hourvitz, Cunningham

Motion passed (7,0,1,Abstain - Chalmers)

Motion: To adjourn at 3:30 p.m. Cunningham, Hourvitz (By acclamation)

ANNOUNCEMENTS

Calendar

November 11-12, 2000
Game-On 2000 Simulation and AI in Computer Games
London, England
See *Computer Graphics* 34(3) August 2000, p 48

November 16-17, 2000
Future Directions in Virtual Environments III
Umeå, Sweden
See *Computer Graphics* 34(3) August 2000, p 48

December 12-15, 2000
ISA'2000
Near Sydney, Australia
See *Computer Graphics* 34(1) February 2000, p 97

January 24-27, 2001
The Ninth Annual Medicine Meets Virtual Reality Conference
Newport Beach, CA, U.S.A.
See *Computer Graphics* 34(3) August 2000, p 49

February 5-9, 2001
WSCG '2001
Plzen, Czech Republic
See *Computer Graphics* 34(4) November 2000, this issue

February 14, 2001: papers due
Eurographics 2001
Manchester, United Kingdom
See *Computer Graphics* 34(4) November 2000, this issue

February 19-22, 2001
2001 ACM Web3D Symposium
Paderborn, Germany
See *Computer Graphics* 34(4) November 2000, this issue

March 13-17, 2001
IEEE Virtual Reality 2001
Yokohama, Japan
See *Computer Graphics* 34(3) August 2000, p 49

March 19-21, 2001
2001 Symposium on Interactive 3D Graphics
Research Triangle Park, NC, U.S.A.
See *Computer Graphics* 34(3) August 2000, p 48

March 20-23, 2001
ISI'2001
Dubai, U.A.E.
See *Computer Graphics* 34(1) February 2000, p 98

May 28-June 1, 2001
The Fifth International Conference on Autonomous Agents 2001
Montreal, Canada
See *Computer Graphics* 34(4) November 2000, this issue

July 25-27, 2001
IV2001
London, England
See *Computer Graphics* 34(4) November 2000, this issue

August 12-17, 2001
SIGGRAPH 2001
Los Angeles, CA, U.S.A.
See **http://www.siggraph.org/s2001/**

September 3-7, 2001
Eurographics 2001
Manchester, United Kingdom
See *Computer Graphics* 34(4) November 2000, this issue

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

Call for Participation

Eurographics 2001

September 3-7, 2001
Manchester, United Kingdom

A call for contributions has been issued for Eurographics 2001, to be held September 3-7, 2001 at the Manchester Conference Centre, Manchester, United Kingdom. The organizers seek paper, presentation, state of the art reports and tutorials in line with the theme, "Challenges in Computer Graphics for the 2lst Century." Sub-themes include visualization, virtual reality and computer games.

Authors are invited to submit original papers reporting research contributions, practice and experience or novel applications by **February 14, 2001**. Proposals for short presentations of late results, work-in progress and new ideas are due **April 13, 2001**. State of the Art Reports (STARs) cover topics in research, practice and applications and are due **February 14, 2001**. Tutorials on computer graphics topics, especially the sub-themes, are due **January 15, 2001**.

For details on the electronic submission procedure, check **http://www.eg.org/eg2001/** or contact the Conference Secretariat at tel: +44-161-200-4068; fax: +44-161-200-4070; email: **eg2001-info@eg.org**.

Awards to be presented at Eurographics 2001 include:

- *The John Lansdown Award*: John Lansdown was an inspirational figure in European computer graphics. Following his death in 1999, Eurographics established this award which judges multimedia products and projects submitted on CD-ROM for their originality and flair in the use of graphics, sound and interaction.
- *The Guenther Enderle Award*: This award is given to the best conference paper and carries a cash prize of 1,000 CHF.
- *The Best Student Paper Award*: This award is given to the best paper authored and presented at the conference by a full-time student.

Eurographics 2001 Conference Co-chairs

are Terry Hewitt (UK), Nigel John (UK) and Ivan Herman (NL). International Programme Committee Co-chairs are Alan Chalmers (UK) and Theresa-Marie Rhyne (US).

The 9th International Conference in Central Europe on Computer Graphics, Visualization and Computer Vision 2001 (WSCG '2001)

February 5-9, 2001
Plzen, Czech Republic

The 9th International Conference in Central Europe on Computer Graphics, Visualization and Computer Vision 2001, WSCG '2001, is to be held February 5-9, 2001 in Plzen, Czech Republic. The conference is being held in cooperation with Eurographics, IFIP WG 5.10 & Computer Graphics Society.

Topics include fundamental algorithms, rendering and visualization, computer vision, pattern recognition and image processing, virtual reality, medical imaging, geometric modeling and fractals, parallel and distributed graphics, computational geometry, graphical interaction and standards, object-oriented graphics, WWW technologies, animation and multimedia, computer aided geometric design, CAD/CAM, DTP and GIS systems, educational aspects of related fields and usage of graphics within mathematical software (Maple, Mathematica, MathCAD etc.) in education.

Honorary Chair is Jarek Rossignac, GVU Center, Georgia Institute of Technology, U.S. Conference Chairs are Nadia Magnenat Thalmann, MIRALab-CUI, Univ. of Geneva, Switzerland and Vaclav Skala, Univ. of West Bohemia, Czech Republic.

For more information, visit **http://wscg.zcu.cz** or contact Organizer and Conference Secretariat Prof. Ing. Vaclav Skala, CSc c/o Computer Science Dept., Univ. of West Bohemia, Univerzitni 8, Box 314, 306 14 Plzen, Czech Republic; tel: +420-19-7491-188; fax: +420-19-7822-578, 799; email: **skala@kiv.zcu.cz**.

2001 ACM Web3D Symposium

February 19-22, 2001
Paderborn, Germany

The annual Web3D Symposium is a major event in the Web3D community. The 2001 ACM Web3D Symposium, formerly the ACM VRML Symposium, is slated for February 19-22, 2001 in Paderborn, Germany. This conference unites researchers, developers, experimenters, content creators and others in a dynamic learning environment. Attendees share and explore methods of using, enhancing or creating new 3D web technology such as VRML, X3D, Java3D and MPEG-4.

Papers are presented on applications, research and systems with content innovative and meaningful to the advancement of 3D technologies on the web. Short videos complimenting the papers are run in the Web3D 2001 lobby. Panels address current issues in the Web3D community with opinionated, controversial speakers and focused, structured discussions. Workshops and courses provide instruction exposure to techniques and uses of Web3D technologies.

No true Web3D event is complete without the legendary Web3D RoundUp! Each presenter gives their demonstration within a five-minute period. The audience has the ability to judge the presentation and control its duration.

The Web3D/VRML event series is sponsored by ACM SIGGRAPH and the Web3D Consortium. For more information, please see **http://www.c-lab.de/web3d2001** or contact General Chair Dr. Stephan Diehl, University of Saarland, Germany, at **diehl@cs.uni-sb.de**. The Program Chair is Dr. Michael Capps, Naval Postgraduate School, USA, and the Local Chair is Dr. Frank Freykamp, C-LAB, Germany.

The Fifth International Conference on Autonomous Agents 2001

May 28-June 1, 2001
Montreal, Canada

The Fifth International Conference on Autonomous Agents 2001 is set for May 28-June 1, 2001 in Montreal, Canada. The conference brings together researchers and developers from industry and academia to report on the latest scientific and technical advances and to discuss and debate the major issues and showcase the latest systems.

Autonomous agents are software and robotic entities that are capable of independent action in unpredictable environments. Agents are currently being applied in domains as diverse as computer games and interactive cinema, information retrieval and filtering, user interface design, electronic commerce, autonomous vehicles and spacecraft and industrial process control.

General Chair is Jörg P. Müller, Siemens, Germany. Technical Program Co-chairs are Elizabeth Andre, DFKI, Germany, and Sandip Sen, University of Tulsa, U.S.A.

The conference is co-sponsored by ACM SIGART, SIGCHI and SIGGRAPH. For more information, see **http://www.csc.liv.ac.uk/~agents2001/.**

International Conference on Information Visualisation (IV2001)

July 25-27, 2001
London, England

The International Conference on Information Visualisation (IV2001) is set for July 25-27, 2001 in London, England. Topics to be covered include information visualisation theory and practice, design visualisation, digital libraries, mobile communications, environments, symposium and gallery of digital art, augmented and virtual reality, Web graphics and visualisation, visualisation in built environment, visualisation in medical and biological sciences, computer-aided geometrical design, cooperative design and visualisation, education and industry partnerships in visualization, multimedia, computer visualisation and graphics rendering, real-time visualisation of simulation data and computer animation.

For more information, check **http://www.graphicslink.demon.co.uk/IV2001/** or contact Ebad Banissi, Visualisation & Graphics Research Unit, South Bank University, 103 Borough Road, London SE1 0AA. UK; tel: +44-171-815-7476; fax: +44-171-815-7499; email: **banisse@sbu.ac.uk**.

ACM SIGGRAPH Membership Application

If you have any questions about ACM SIGGRAPH membership, contact the ACM Member Services Department at acmhelp@acm.org
Tel +1-212-626-0500
FAX +1-212-944-1318

Please support the computer graphics community worldwide and year-round by joining ACM SIGGRAPH today.

ACM SIGGRAPH Membership

Please choose one of the following three membership options (all prices are in U.S. dollars)

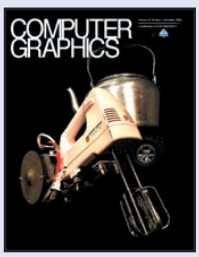
ACM SIGGRAPH Membership	❑ $27
ACM SIGGRAPH Student Membership	❑ $20
ACM SIGGRAPH Membership for current Eurographics members (for more information on Eurographics, see www.eg.org)	❑ $20

In recognition of your support, members receive the following.

ACM SIGGRAPH Quarterly
Computer Graphics

This quarterly publication includes...

Columns on:	Plus:
Art and CG	Current topics in CG
International CG	Conference Reports
Chapter activities	Calls for Participation
Education	Events Calendar
Pioneers	SIGGRAPH News
Standards	More cool stuff



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

Discount on the SIGGRAPH Annual Conference
ACM SIGGRAPH members receive a significant discount on registration for the annual conference. Even for members who can't attend the annual conference every year, the membership discount more than offsets the cost of membership. In addition, members receive a discount on all other ACM SIGGRAPH supported conferences, symposia and workshops.

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

Air Option for Computer Graphics Quarterly ❑ $8

If you would prefer to read the Computer Graphics Quarterly online at http://www.siggraph.org/publications/newsletter and not receive a printed copy, please check the box below.

Electronic-only Option ❑

Optional Publications and Memberships

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

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

Member Plus Proceedings	Member Price	Air
Computational Geometry (June)	❑ $22	❑ $8
Multimedia (November)	❑ $28	❑ $8
UIST (November)	❑ $15	❑ $5
Graphics Interface (May)	❑ $20	❑ $8
Volume Visualization (October '00, biennial)	❑ $12	❑ $4
IEEE Visualization (October)	❑ $25	❑ $9
Interactive 3D Graphics (April '01, biennial)	❑ $15	❑ $5
Solid Modeling (May)	❑ $25	❑ $8
Eurographics Rendering Workshop (June)	❑ $40	❑ $7
VRML (February)	❑ $12	❑ $5
Workshop on Implicit Surfaces (October)	❑ $30	❑ $4

You may also join ACM SIGGRAPH's parent organization, the Association for Computing Machinery. Membership in the ACM includes a subscription to the *Communications of the ACM* (for more information about ACM membership, see http://www.acm.org/membership). If you join ACM, you are also eligible to subscribe to *ACM Transactions on Graphics* and the *Journal of Graphics Tools* at the following discounted rates.

ACM Membership Category	Dues	Air
Professional Member	❑ $95	❑ $37
Student Member	❑ $38	❑ $37

ACM Optional Publications	ACM Member Price	Air
Transactions on Graphics (Professional Members)	❑ $42	❑ $13
Transactions on Graphics (Student Members)	❑ $37	❑ $13
Journal of Graphics Tools	❑ $35	❑ $13

Please total your membership option from the top left, air option (if applicable) from bottom left, and all optional selections and air options from this column.

Total for all dues, air, and publications: _____

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If you are already a member using this form to renew or alter your membership, enter your ACM member number: _____

Eurographics membership number or student ID number (if applicable): _____

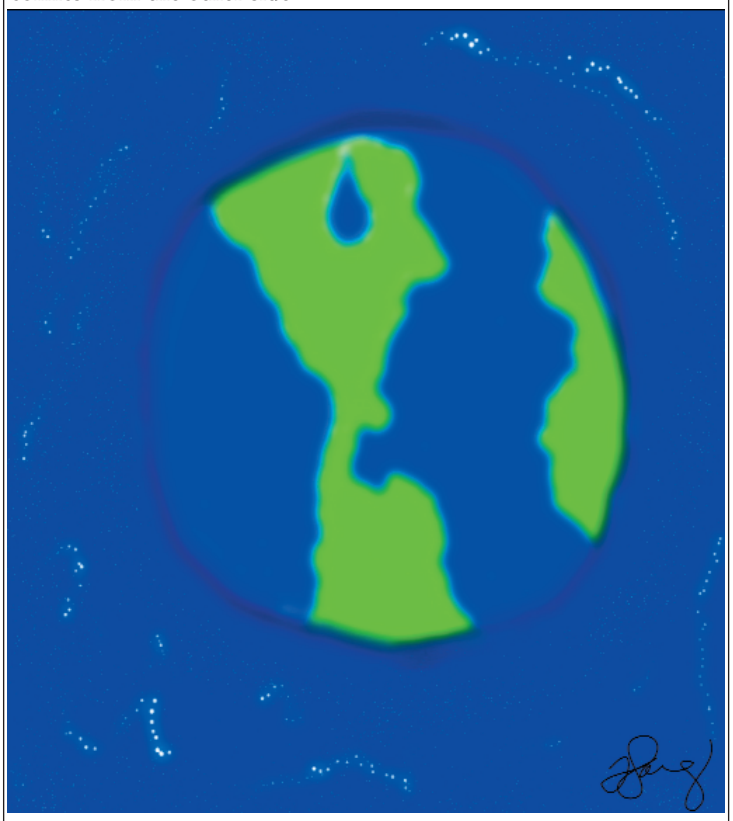
If paying by credit card: Credit Card # _____ Expiration Date _____

Signature _____

mail completed form to ACM, P.O. Box 11214 Church Street Station NY NY 10257 Or, join online at http://www.siggraph.org (click "Membership")

COMICS FROM THE OTHER SIDE

comics from the other side



"the first convex hull"

comics from the other side

"recent trends in finger painting"

comics from the other side

"vermal with camera"

About the Columnist

Teresa Lang is an opinionated eccentric two-eyed right-handed independent film animator-artist who has a day job using computer animation software.

Teresa Lang
P.O. Box 414
Place du Parc
Montreal, Quebec, Canada H2W 2N9
Email: **teresa_lang@siggraph.org**