Applications

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A Decade of Applications

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At the summer 1994 *IEEE Computer Graphics and Applications* editorial board meeting, then managing editor Nancy Hays suggested that I should volunteer to edit a regular Applications department for the magazine. I'm sure I brought this on myself, given my regular lament that we were not living up to the "…and Applications" part of our name. But in fact, this was a concern that the entire board had discussed many times. The feedback from our readership surveys was consistently that *CG&A* was too academic and not sufficiently real world. In fact, I included a number of reader comments in the original Applications department author guidelines (where they remain to this day) stating a desire for more practical content, real-world applications, practice and usage, implementation details, experience-related information, and practical application of research results, as well as to bridge the gap between theory and application.

The very name *Computer Graphics and Applications* was originally chosen out of a desire to serve this need. But the articles submitted to us more often than not focused on computer graphics technology itself. Such technology was no doubt developed to solve many problems in general, yet seemingly none in particular. So where were the practical, real-world applications articles that our readership was clamoring for?

Lack of applications articles

It still seems that across the refereed publications in our field, there's more emphasis on solving computer graphics problems than using computer graphics to solve real-world (non-computer-graphics) problems. Why is this so?

First, most graphics articles originate from computer graphics professionals in computer science departments or computer technology companies. Their job is to extend and refine graphics technology itself, and tell us of their progress. But real-world problems are often pursued in noncomputer academic departments and noncomputer industries, where the focus is on solving their practical problems and not on communicating their graphics problem-solving techniques back to us.

In addition, a lot of applied work takes place in nonacademic settings where publishing is not emphasized as much and, for confidentiality and/or intellectual property reasons, even discouraged. Plus, many academicians (and the journals they publish in) view interdisciplinary work as not quite on a par with mainstream topics in their fields. Applications articles are often viewed as "soft" and as "engineering, not science," since their methodologies and results are less clear than those arising in more formal technical or scientific work.

All of this leads to a systematic shortfall of articles telling us about new problem domains, functional requirements, and data characteristics confronted by people using graphics to solve practical problems, even though this would be invaluable information to those of us who develop computer graphics technology.

Facilitating Applications articles

To address this need, the *CG&A* editorial board decided to institute a regular Applications department, guaranteeing that every issue would contain at least one bona fide applications article. In so doing, the board decided to run the Applications department with different editorial policies and practices than the usual fare.

A key emphasis of the department is in on directed articles. About a third of our articles are author submitted, but two thirds are written by professional writers with topic selection and content development under the department editor's direction. We decided early on that if we relied exclusively on submitted articles, we couldn't ensure that topics would cover the emerging areas of interest we wanted to highlight.

Also, to feature more current and timely topics, we needed to work closer to publication deadlines, more like a few months in advance than a year or more for regular articles. As a consequence, we decided that Applications department articles would not go through the regular refereeing process, but rather would be reviewed and accepted by the department editor alone.

What makes a good Applications article?

Over the years, we have gained a sense of how authors can maximize the likelihood of creating an Applications department article that will make the grade. These guidelines apply not only to the Applications department, but to *CG&A* applications articles generally.

Solve a real-world (non-computer graphics) problem. There are plenty of opportunities to publish articles that tell us about new computer graphics techniques. But we are not so much interested in how you solved a computer graphics problem or built a graphics system as we are in

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the real-world problem you started with. The proverbial "solution in search of a problem" is not what we want, with us the problem comes first.

Apply computer graphics in a new area. The best Applications articles occur when new technologies and equipment allow a new problem domain to benefit from a graphics-based solution. And even in areas with a history of using computer graphics, finding a new technique or efficiency can give traditional applications new reach.

Teach us about a new problem domain. Since your audience is largely computer graphics professionals, your problem domain is probably not known to most of them. Tell us about your area. What are the problems? What are the conventional approaches? What are the limitations and frustrations of current users? Teach us about what do people do today, what can't they do, and what caused you to select computer graphics as a means for solving your real problem.

Actually solve one problem. We get submissions from people developing a computer graphics technique, system, or product who emphasize how it can solve a whole range of problems. Fine, but readers are often less interested in the 100 problems your system can solve than in hearing about just one problem you did solve.

Get a result. The easiest way to get a result is to solve a previously unsolved problem or discover something new. Or maybe with your system people can now do something they previously couldn't do or do as easily. Tell us why this solution works, what others were tried, and why this was better. Would any solution have worked or was yours just the right one for this task? A result is anything new you learned from actually doing something, so draw conclusions from what you did.

Tell us about your data. It's particularly important to tell us about your data. What does it look like? What are its characteristics, size, speed, accuracy, and artifacts? Show the data and images from your domain so readers can imagine what a solution would entail. Real-world data is easily distinguished from "toy" data, in that it's messy, and you have to take it as it comes. As the visualization people have discovered, real data is best.

Tell us what you did. Tell us how your solution works and how someone could reproduce it. Readers particularly like to hear interesting, nonobvious technical details, facts, and figures. This includes configurations, models, even prices, as these are all part of real-world solutions. Also tell us how many lines of code you have, how long it took, and how many people were involved. Armed with this knowledge, the readers might see areas for improvement and opportunities for different approaches.

But don't just tell us what you did. A good Applications article isn't just about what you did as an end in itself. Your work might be interesting as computer graphics technology, but we want to know what you did with it, where it got you, and what your actual solution to the problem was. Often prospective authors place too much emphasis on "here's how we built our system to solve problems" rather than "here's how we solved this particular problem."

Tell us what went wrong. It's axiomatic that if you are working on an interesting real-world problem, it won't go like you expected. There will be things that don't work, unexpected twists and turns, and things you still can't do. If you aren't failing about half the time, you aren't trying hard enough. It's unconvincing if your article is nothing but positive accomplishments, as this suggests that you selected the problem to suit your solution rather than vice versa. Many product promotional application notes, which might otherwise be good candidates for a story, fail this test. Companies hate to admit that there is anything their product can't do, that developing the product was anything but a straight line to success, and that they have anything but a "yes" answer to all questions. But the best companies recognize that their claims are vastly more credible if they tell both capabilities and limitations.

Tell us the story with beginning, middle, and end. If it's a real-world problem, then there ought to be a story about how you came to recognize the problem, how you went about solving it, what went wrong along the way, what finally worked, what the result was, and what you still can't do. If these things are missing, it probably isn't a real problem or hasn't gotten past the toy problem stage.

Tell us about real users. What actually happened when real people (not just you) used your solution? How did you improve your system based on experience? Too often we see articles where graphics researchers develop a technique that purports to be useful in a given problem domain, but there is little evidence people in that field actually used the system.

Bottom line

As fields mature, they naturally transition to working in applications areas and at the boundaries with other fields. When graphics was new, much of the energy focused on getting graphics itself to work. But once we had 1,000 useful graphics algorithms, developing the 1,001st wasn't as important as the problems we could now solve with our existing, proven techniques.

Indeed, over the 10-year existence of the Applications department, the pages of *CG&A* devoted to practical content have steadily increased. One reason is the growth of the other *CG&A* departments, all of which strive to feature real-world fare. Another reason is *CG&A*'s emphasis on theme issues, whose guest editors generally solicit their content and often seek out work by people at the interface of new techniques and their application. The Applications department might have started as a special initiative designed to plug a recognized hole, but is now just one avenue for featuring practical, real-world content. Table 1 (on the next page) lists all the Applications department articles published over the past 10 years.

We have one last rule: If the story is interesting enough and something we'd like to learn more about, all the other rules can be bent. I hope that over the years, these pages have given you something new to think about as you pursue your areas of interest. If so, please also think about sharing your own stories with us. If you are doing something new with computer graphics, we want to hear about it! ■

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Table 1. Ten years of Applications stories.

Issue	Title	Authors	Description
2004			
November/December	A Decade of Applications	Mike Potel	Reflections on 10 years of editing the *IEEE Computer Graphics and Applications* Applications department.
September/October	Visual Analytics in the Pharmaceutical Industry	Jeffrey D. Saffer, Vicki L. Burnett, Guang Chen, and Peter van der Spek	Multiple applications of visual analytics technologies in the biotechnology industry.
July/August	Streaming Video Transforms the Media Industry	Jan Krikke	Streaming video technologies for cell phones, netcasters, portals, media convergence, and "The World's Smallest Film Festival."
May/June	Seeing Data: New Methods for Understanding Information	Kirk L. Kroeker	Thinkmap, Inxight, and The Brain, three innovative mapping and categorization systems for database and Web navigation.
March/April	Noble Ape Simulation	Tom Barbalet	Landscape rendering and brain activity modeling in the open source Noble Ape Simulation project.
January/February	Virtual Building for Construction Projects	Laurel M. Sheppard	Examples of construction engineering projects that employ 4D modeling and planning using time-dependent CAD systems.
2003			
November/December	Modeling Supernovae: Braving a Bold New Frontier	Anna Turnage	Astrophysicists use supercomputing and visualization software and hardware to probe black holes.
September/October	An Animated Day at the Races	Gene J. Koprowski	A real-time horseracing animation and broadcast system by Scotland's VIS Entertainment.
July/August	Understanding Fire and Smoke Flow Through Modeling and Visualization	Glenn P. Forney, Daniel Madrzykowski, Kevin B. McGrattan, and Laurel Sheppard	Fire Dynamics Simulator and Smokeview viewer for studying building fires.
May/June	3D Design Tools Speed NASA Space Shuttle Work	Chad Mills	Use of 2D annotation on digital photos to facilitate electrical project planning.
March/April	Pervasive 3D Viewing for Product Data Management	Bruce D'Amora and Fausto Bernardini	Design, implementation, and performance of 3D viewers on PDAs for mechanical CAD applications.
January/February	*Samurai Romanesque*, J2ME, and the Battle for Mobile Cyberspace	Jan Krikke	Mobile-phone-based games, including massive multiplayer games, technologies, development, and standards (J2ME vs. MS).
2002			
November/December	Biomechanics and the Cyberhuman	Stephen Figgins	Physics simulation, finite-element analysis, and human modeling for auto crash studies at Wayne State University, ESI, and Toyota.
September/October	CAD Speeds Up Dinnerware Designs	Laurel Sheppard and Mark Kohorst	Use of 3D graphics at Pfaltzgraff for design, mold fabrication, and manufacturing of ceramic plates and containers.
July/August	Graphics and Security: Exploring Visual Biometrics	Kirk L. Kroeker	Overview of graphics technology used for biometric security including face-, fingerprint-, and iris-recognition technologies.
May/June	Reducing Aircraft Noise with Computer Graphics	Anna Turnage	Reducing helicopter noise pollution using VR and visualization in the Penn State aerospace engineering department.

Issue	Title	Authors	Description
March/April	Computer Graphics: Helping to Cope With Terrorism	Ben Delaney	Graphics used in the aftermath of 9/11: media coverage, rescue and recovery, structural analysis, rebuilding, and memorial plans.
January/February	Understanding Normal Cardiac Development Using Animated Models	Jean-Marc Schleich, Claude Almange, Stéphane Andru, Jean-Louis Dillenseger, and Jean-Louis Coatrieux	Modeling and animation of heart morphology and development.
2001			
November/December	Graphics in Computational Paleontology	Stephen Figgins	Techniques used to analyze fossils including serial sectioning, scanning, surface reconstruction, and mathematical modeling.
September/October	Speeding Things Up: Bicycle Racing Uses Computers Before Reaching the Starting Line	Mary Hanson and Emmanouil Skoufos	Graphics for optimizing design and performance in world-class bicycle racing such as the Tour de France.
July/August	Something to Smile About: 3D Graphics are Revolutionizing Oral Health Care	Mary Hanson	Examples of how 3D graphics are enabling new techniques in orthodontia, dental implants, and maxillofacial surgery.
May/June	Graphics Applications over the Wireless Web: Japan Sets the Pace	Jan Krikke	Report on the protocols, applications, and user interfaces used by third-generation wireless standards such as NTT DoCoMo's i-Mode.
March/April	3D Mapping of Underwater Caves	Barbara Anne am Ende	Exploration and mapping of Florida's Wakulla Springs underwater caves.
January/February	Wired Worlds: Exploring the Digital Frontier—a Pioneering Gallery of Digital Media Discovery	Tony Sweeney	Guided tour of the National Museum of Photography, Film, and Television and sampler of innovative digital media.
2000			
November/December	Beyond First Aid: Emergency Response Teams Turn to Graphics	Mary Hanson	Mapping, training, and emergency situation management using GIS, visualization, Web, and wireless technologies.
September/October	Fingerprint-Based Forensics Identify Argentina's *Desaparecidos*	Mary Hanson	Fingerprint identification systems used in investigation of Argentina's *Desaparecidos* [The Disappeared].
July/August	Axonometry: A Matter of Perspective	Jan Krikke	Discussion of axonometric drawing, its origins in Japanese art, and its applications in computer graphics.
May/June	Visualization in Urban Planning: They Didn't Build LA in a Day	Ben Delaney	Cities use visualization and simulation for community planning, with examples in Los Angeles, Philadelphia, New York, and Washington, DC.
March/April	Maya: "So Ya Wanna Be a Rock 'n Roll Star" Revisited	Jeffrey Abouaf	Impact of Maya on art education and its use by graphic arts students in film, game, and video production.
January/February	Envisioning Yuan Ming Yuan (Garden of Perfect Brightness)	Lifeng Wang, Christine Wang, and Alain Fournier	Reconstructing environments, buildings, and artifacts of lost Beijing gardens.
1999			
November/December	The NYSE's 3D Trading Floor	Ben Delaney	Overview of the New York Stock Exchange's real-time operations command and control center.

Issue	Title	Authors	Description
September/October	Night Vision: Infrared Takes to the Road	Keri Schreiner	Technology, design, and user interface considerations underlying Cadillac's Night Vision driver-assist system.
July/August	Parametric Wafer Map Visualization	Y. Arthur Lin	Analysis of quality and yield metrics during semiconductor fabrication.
May/June	Virtual Recovery of Excavated Relics	Jiang Yu Zheng and Zhong Li Zhang	Use of 3D imaging, VR, and multimedia in excavating the Terra Cotta Warriors and Horses archeological find in Xi'an, China.
March/April	VizSim Technology Helps Find Oil Faster	Ben Delaney	History and recent advances in systems for visualizing seismic data in the oil exploration industry.
January/February	The Florentine Pietá: Can Visualization Solve the 450-Year-Old Mystery?	Jeffrey Abouaf	Creation of a detailed 3D model of the famous Michelangelo statue and analysis of its controversial restoration.
1998			
November/December	Variations on Perfection: The Séquin-Collins Sculpture Generator	Jeffrey Abouaf	The use of computer graphics to design, prototype, and fabricate sculptures based on high-order mathematical shapes.
September/October	On the Trail of the Shadow Woman: The Mystery of Motion Capture	Ben Delaney	Using motion capture in movies, commercials, and games, plus history, technologies, economics, applications, and issues.
July/August	Trial by Fire: Teleoperated Robot Targets Chernobyl	Jeffrey Abouaf	SGI and partners' Pioneer Project to build a robot for investigation and visualization of Chernobyl Power Plant containment.
May/June	Imaging in Medicine—Here's Looking at You, Kid	Ben Delaney	Imaging and VR techniques in medicine for diagnosis and treatment of unique conditions, training applications, and planning.
March/April	Fraunhofer Institute: Building on a Decade of Computer Graphics Research	Rae Earnshaw	Report on the opening of the Fraunhofer Institute, Darmstadt, Germany.
January/February	Motion Sick in Cyberspace	Mike Potel	Report on motion sickness from VR systems, immersive displays, and video games.
1997			
November/December	Faster, Better, Cheaper—NASA Visualizes the Solar System	Ben Delaney	Survey of latest NASA planetary missions, economics and technologies for imaging, transmission, processing, visualization.
September/October	Digital Orthophotography: Mapping with Pictures	Anne C. Lear	Overview of the US Geological Society National Digital Orthophoto project.
July/August	Virtual Reality Provides Real Therapy	Anne C. Lear	Using VR systems to treat phobias, anxiety and neurological disorders, pain and disability management.
May/June	Meeting the Future at the University of Michigan Media Union	William P. Flanagan with Rae Earnshaw (sidebar by Randy Frank)	Guided tour of the University of Michigan's Media Union facility.
March/April	The FoxTrax Hockey Puck Tracking System	Rick Cavallaro	Problems, goals, and alternatives for Fox TV NHL hockey puck enhancement system.
January/February	Archaeological Models: Pretty Pictures or Research Tools?	Dave Sims	Harrison Eiteljorg talks about using computer models in archaeology: appreciation and study, research, and restoration.

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1996			
November	Computer Graphics and DNA Sequencing	Michael J. Potel	DNA sequencing, instrument control, analysis, storage/retrieval, and matching on genetic data sets.
September	3D Scanning in Apparel Design and Human Engineering	Steven Paquette	3D whole body scanning systems in clothing manufacture, anthropometry, equipment design, and medicine.
July	VRML Adds a New Dimension to Web Browsing	Karen Whitehouse	A survey of interesting VRML sites, featuring a wide range of commercial, scientific, and artistic applications.
May	WWW Extends "Apprentice's Assistant" to Global Medical Resource/Re-Creating a Lost Village in 3D Space	Dave Sims	Tour of University of Iowa's innovative Virtual Hospital. Anthropologists recreate a pre-Columbian village in Peru using VR.
March	Weather Without the Weatherman	Karen Whitehouse	Multiple uses of graphics at WWW sites for weather maps, forecasting, live weather cameras, and study of special phenomena.
January	Putting the Visible Human to Work	Dave Sims	Four examples of applications and products based on the data sets from the National Library of Medicine's Visible Human project.
1995			
November	Molecules at Your Fingertips	Dave Sims	Using stereolithographic fabrication to assist molecular visualization for a blind chemist at New Jersey Institute of Technology.
September	Undersea and in the Air: VR Offers a Thrill a Minute	Dave Sims	Four of the latest examples of advanced graphics-based rides and amusements.
July	From the Ground Up/ Building a High-Resolution Seismic Model	Dave Sims	James Starrs' (George Washington University) VR solves a 1953 CIA agent murder. Kevin Furlong (Penn State and USGS) reconstructs San Francisco Bay 3D geology.
May	At Oak Ridge, a Car Crash on the World Wide Web	Dave Sims	ORNL uses high-resolution car crash simulation instead of real cars.
March	See How They Run: Modeling Evacuations in VR	Dave Sims	Colt Virtual Reality, Ltd. performs dynamic simulations and visualization of crowd behavior in support of architectural design.
January	Keeping an Electronic Eye on the Road	Karen Whitehouse	University of Michigan Transportation Research Institute uses Perceptron 3D imaging camera to study traffic patterns.
1994			
November	Comet Explodes on Jupiter—and the Web	Karen Whitehouse	Shoemaker-Levy comet collision causes unprecedented WWW graphics activity.

Web Extra: A Decade of Articles

IEEE CG&A subscribers can access the last 10 years of Applications articles at http://csdl.computer.org/comp/mags/cg/2004/06/g6toc.htm. One article from each year is available at no charge to nonsubscribers.

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