News & Notes from Sitterson Hall

Issue Twenty-Nine, Spring 2001

Department of Computer Science
The University of North Carolina at Chapel Hill

In This Issue

Chairman's Corner

Frederick P. Brooks Jr., Kenan professor, has been elected to membership in the National Academy of Sciences (NAS), in recognition for his distinguished and continuing achievements in original research. Election to the NAS is one of the highest honors a U.S. scientist or engineer can receive. Congratulations, Fred!

Over the years, Fred has been honored with many awards; most notably with the 1999 ACM A. M. Turing Award. The department will recognize Fred's sizeable contributions to computer science with a professional conference this October. For more details, see the separate article below.

We welcome **Sarang Joshi** as an adjunct assistant professor. His primary appointment is in the departments of Biomedical Engineering and Radiation Oncology at UNC. Sarang is a member of

the Medical Image Display and Analysis Group (MIDAG) and is working on several MIDAG projects.

The department is concluding its faculty search that began earlier this spring. I will introduce our new faculty in the fall issue.

In the past several months, the university has received both very good and very bad financial news. First the good news. In November's election, North Carolinians voted in favor of a $3.1 billion bond referendum that will allow all of the UNC system campuses and all of the community colleges across the state to renovate old facilities and to build new ones. UNC's plan for a new science complex involves replacing some existing outdated facilities and renovating, or adding to others. Sitterson Hall will add an addition on its south end.

The bad news is that the State of North Carolina announced in April that it faces a significant budget shortfall. To deal with the shortfall, the UNC system has been asked to look at cutting as much as seven percent from its recurring budget. According to UNC Chancellor **James Moeser**, such cuts on our campus would affect every aspect of the university's teaching, research, and service mission. He hopes to minimize the effect of the cuts, but the outcome is not yet certain.

Each year in my message to you, I ask you to consider a donation to the department. As the university faces a difficult budget situation, I hope we can count on your support. Thank you and have a wonderful summer!

Stephen F. Weiss

Conference to honor Brooks

On 18th and 19th October 2001, the department will host a professional conference to honor **Frederick P. Brooks Jr.**, Kenan professor, for his continuing contributions to the field of computer science. Many of the details are still being determined at this stage, but the conference is likely to include talks by prominent computer scientists; a Thursday evening banquet, at which Fred will be the featured speaker; and a Friday afternoon open house with research demonstrations in Sitterson Hall. All activities will take place at UNC. Current and former faculty, staff, and students, and friends of the department are invited to attend the free two- day event; there will be no charge for the conference or for the associated meals. Additional information will appear soon on the department's web site.

Fred Brooks Turns 70!
On 19th April, the department threw a 70th birthday party for Fred Brooks. Fred was presented with a giant birthday card, which included messages from colleagues, alumni, and friends. At left: Nancy and Fred Brooks and Sara Elizabeth Moore Jones enjoy pieces of the computer-shaped birthday cake. (Photo: Claire Stone)

Congratulations to...

Frederick P. Brooks Jr., Kenan professor, who was elected to the National Academy of Sciences.

Maxim Garber and **Vincent Scheib**, graduate students, who each received $800 scholarships to attend the 2001 Game Developers Conference in San Jose, Calif., in March.

Bil Hays, network manager, **Catherine Perry**, accounting manager, and **Claire Stone**, publications and publicity manager, who each received "Star Heel" awards from UNC for excellence in their work for the department.

William Jiang, Windows systems administrator, who received an award from UNC recognizing his outstanding contributions to information technology support.

Undergraduates **John Ehrhardt**, **Serge Gagarin**, and **Bennett Rogers**, who were inducted into Phi Beta Kappa on 30 April.

And to our August and December 2000 graduates:

Doctor of Philosophy
Timothy D. Culver, "Computing the Medial Axis of a Polyhedron Reliably and Efficiently" (adviser: Dinesh Manocha).

Stefan A. Gottschalk, "Collision Queries Using Oriented Bounding Boxes" (Ming C. Lin and Dinesh Manocha).

Brian C. Ladd, "Lingua Graphica: A Language for Concise Expression of Graph-Based Algorithms" (John B. Smith).

Master of Science
August: Matthew J. Waibel
December: William V. Baxter III*, Alex B. Blate, Yanlin Hou, Yuquan Jiang, Man-Chi Leung, Xiaosi Li, David T. Marshburn II, David E. Ott*, Bian Wu, Paul A. Yushkevich*

*Continuing on to Ph.D. at UNC

B.S. Mathematical Sciences (CS Option)
Neda Crigler, Eric J. Edge, Michael J. Hirschel**, Amarish D. Khopkar, Daniel C. McPherson, Joseph D. Russ Jr., Harold D. Ryel-Lindsey, Daniel A. Sarisky*, Daniel R. Williams

*With Honors **With Highest Honors

Staff Promotions and Transfers

Mike Carter transferred to the position of Electronics Technician III in April.

Linda Houseman transferred to the position of Computing Consultant I in February.

Claire L. Stone was promoted to a higher grade classification of Information and Communications Specialist, as of 26 March.

Mike Stone was promoted to an Electronics Technician IV, effective 26 March.

Welcomes and Farewells

New Faculty

Sarang Joshi, adjunct assistant professor (assistant professor, Biomedical Engineering and Radiation Oncology, UNC), D.Sc. 1998, Washington University. *Image analysis; medical image processing; computer vision; computational anatomy.*

Sarang joined UNC last summer and began a joint appointment with our department in December. He is a member of the Medical Image Display and Analysis Group (MIDAG). Sarang is currently involved in several MIDAG projects concerning medical image registration and object and shape based medical image analysis.

New Students

Jay Aikat, Angus Antley, Jun Jia, Yuanxin Liu, Haolong Ma, and Daniel Wiegand

Postdoctoral Researchers

Robert-Paul Berretty joined us in January after receiving his Ph.D. in computer science in December from the Institute of Information and Computing Sciences at Utrecht University in the Netherlands. His research interests are in computational geometry and robotics. Robert-Paul is working with Jack Snoeyink, professor.

Joël Goossens joined us in April to work with Sanjoy Baruah, associate professor. He received his Ph.D. in computer science from the Université Libre de Bruxelles in Belgium in 1999. His research interests include scheduling algorithms for real-time systems.

Young J. Kim joined us in January to work with Ming Lin, associate professor, and Dinesh Manocha, professor, on the study of haptic computation. He received his Ph.D. in computer science in August 2000 from Purdue University.

Susan Paulsen joined us in January. She works with Lars Nyland, research associate professor, Jan Prins, associate professor, and William Wright, research professor emeritus, on the Self-Scheduling N-body Algorithms project. She received her Ph.D. in zoology and genetics in 1992 from Duke University.

New Staff

Charles Bauserman, Windows systems administrator, joined the Computer Services staff in March. He previously worked in the School of Medicine at UNC.

Delphine Bull, administrative assistant to faculty members Stephen M. Pizer and Guido Gerig and to MIDAG, joined us full time in March, after working as a temporary since January. She previously worked for Nasera Corp. She is working on her B.A. in management and society at UNC.

Paul Morris, administrative assistant, joined us full time in December, after working as a temporary since September. He provides support to faculty members Frederick P. Brooks Jr., Russell M. Taylor II, and Mary Whitton. Paul has a B.A. in religion from the University of the South.

Jenni Styron, office assistant, joined us full time in January as an assistant to several faculty members, after working as a temporary since August. Jenni majored in history at UNC.

Thanks and farewell to . . .

Laura Schutz Duggan, computing consultant, who left in February to be home with her new daughter (see **"Family Matters"**). She had worked with the department since November 1998, providing general technical support, systems support on Macintoshes, and backups of UNIX and Macintosh systems.

Lynne Duncan (M.S. 1985), systems programmer/administrator for the Microelectronic Systems Laboratory, who joined UNC's Academic Technology and Networks office in January. She had been with us since July 1985.

Nicole Harper, administrative assistant to faculty members Stephen M. Pizer and Guido Gerig and to MIDAG, who joined Quintiles Transnational in Research Triangle Park, N.C., in November. Nicole had been with us since October 1997.

Lori Rodman, computing consultant, who joined UNC's Kenan Flagler Business School in April. Her new position will allow her to broaden her skills as a computing consultant. Lori had been with the department since December 1993.

Betty Solorzano, office assistant, who left in May to return to Miami, Fla., after her husband's graduation from UNC's Kenan Flagler Business School. She had been with us for two years.

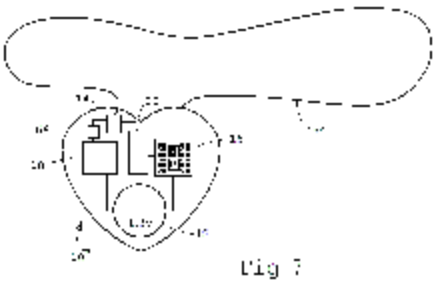
Research Highlights

Auto 911 Patent Issued

A patent awarded in January to **Leandra Vicci**, lecturer and Microelectronic Systems Laboratory director, could make it easier for people to get help in an emergency. The patent, "Automatic Emergency and Position Indicator" (U.S. Pat. 6,175,329), is for a device that combines a global positioning system (GPS) receiver, which provides precise coordinates of its location, with a microprocessor and cell phone chips to make a wireless connection with a geographic information system (GIS) server. The server then translates geographic coordinates into locations understandable in plain language and notifies an emergency response service.

Leandra envisions that the device could be packaged in some form that a person would wear or carry, such as in a pendant on a necklace that could be activated by a pull on the chain. It could include a microphone that would relay local sounds, such as threats or a struggle, to the receiving service, but that would remain locally mute so that the assailant would not become aware of it. Leandra is working with UNC's Technology Development office to find a company to develop and market the device.

Leandra's inspiration for the Auto 911 device was fueled by several attempted rapes on and near UNC's campus in recent years. "When you are accosted, you just don't have time to pull out your cell phone, dial 911 and tell people exactly where you are and what's happening," she said. She also sees potential uses for the device in other situations, such as when somebody hiking alone in the woods becomes injured.

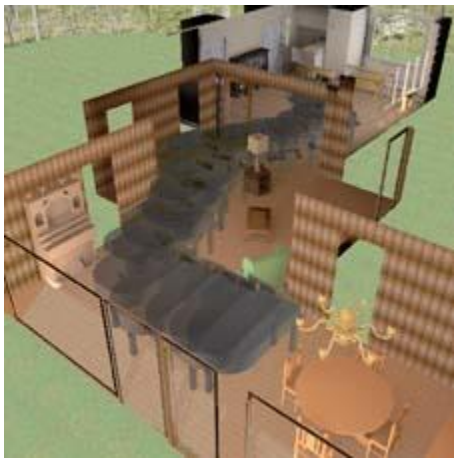


Potential use for the Auto 911 device: A necklace that sends an emergency signal when its chain is pulled.

Gamma Group Investigates Motion Planning

Members of the Geometric Algorithms for Modeling Motion and Animation (Gamma) Research Group--professors **Ming Lin** and **Dinesh Manocha** and graduate students **Mark Foskey** and **Max Garber**--have been tackling a classic problem in theoretical computer science and robotics: Finding a collision-free path for an object from one specified location to another through a 3D environment. This problem also arises in virtual prototyping, molecular modeling, surgical simulation, and computer animation.

A key challenge of motion planning is the difficulty of converting 3D representations of the robot and the environment into a characterization of the higher dimensional (6D or higher) space of possible positions and orientations. Previous approaches that have worked well in practice use probabilistic roadmap algorithms, but problems arise when the robot needs to move through "narrow passages"--constricted portions of the environment--because it is unlikely that a sufficient number of configurations can be generated randomly in these narrow passages.



Motion Planning. A piano avoids moving furniture as it navigates through a cluttered house.

The researchers have developed a hybrid approach in which an estimated path is first generated by a geometric analysis of the environment. This path may have portions where the robot collides with the environment. In a second step, these portions are replaced by small, correct paths, which are generated by a randomized planning algorithm. The geometric analysis relies on the generalized Voronoi diagram of the geometry in the scene. The robot follows Voronoi edges (arcs) that are equidistant from at least three primitives. The researchers use an algorithm that

computes a discrete approximation to the Voronoi diagram. Compared to earlier randomized planners, the new hybrid planner works well when a robot must navigate through a tight workspace or narrow passages.

Currently, the researchers are investigating a potential field approach for generating the initial estimated path, whereby the robot is repelled from the walls by simulated forces. They are also considering ways to use a more detailed geometric analysis to determine good orientations for the robot as it travels through a scene. For more on motion planning research, see: **www.cs.unc.edu/~geom/planning/**.

Other Gamma Group Research
Motion planning is one of a number of topics Gamma group members are currently researching. Other focus areas include collision detection and proximity queries, simulation and animation, haptic interaction, walkthrough of massive models, modeling of interaction between deformable bodies, geometric and solid modeling, and other related topics.

The group's faculty leaders have received several new grants in recent months, including:

- **Ming Lin**, "Physically Based Haptic Interaction With Virtual Environments," Office of Naval Research (ONR).
- **Ming Lin**, "Real-Time Physically Based Modeling and Interaction," Intel Corp.
- **Dinesh Manocha**, "Instrumentation for Interactive Display of Complex Datasets," U.S. Department of Defense.

The ONR and Intel grants will support the development of computational approaches to enable real-time physically based modeling and interaction between a user and virtual objects.

For more on the Gamma Group, see: **www.cs.unc.edu/~geom/**.

Other News

Research and Study Leave

Ming Lin, associate professor, took a research and study assignment this spring. In addition to exploring new research topics with a group of ten graduate students and publishing several technical papers, she started two new research projects on haptic painting and real-time physically based interaction, supported by Intel Corp. and the Office of Naval Research. See: **www.cs.unc.edu/~lin** and **www.cs.unc.edu/~geom/DAB** for more on Ming's recent research.

Real-Time Scheduling Theory

Work by associate professors **Jim Anderson** and **Sanjoy Baruah** on real-time scheduling theory was featured in a *Distributed Systems Online* article, "Where is Real-Time and Embedded Systems Research Going?" last fall. Read it at **www.computer.org/dsonline/embedded/**.

3rd Tech Products Win Awards

Two products being developed by 3rdTech Inc. recently won awards. **The HiBall-3000 Wide Area Tracker** received *Computer Graphics World* magazine's Year 2000 Innovation Award. Selected from hundreds of nominated new products, winners are chosen for "demonstrating true innovation by expanding the boundaries of visual computing." **DeltaSphere-3000 Scene Digitizer** was selected as one of the top ten hardware products of 2000 by *IEEE Computer Graphics and Applications.* Both products are based on technology first developed in our department. See **www.3rdtech.com** for more information on these and other 3rdTech products.

Most Cited Paper Award

Guido Gerig, Taylor Grandy professor, has received an award from IEEE's *Transactions on Medical Imaging* for the most frequently cited paper published in 1992: Gerig, G., et al. "Nonlinear Anisotropic Filtering of MRI Data," *IEEE Transactions on Medical Imaging,* 11(2), June 1992, 221-232.

Pixel-Planes 5 Goes to Museum

Last fall, the department donated a Pixel-Planes 5 system to the Computer Museum History Center at the NASA Ames Research Center in Mountain View, Calif. The center maintains one of the largest collections of artifacts in the world related to the development of computing machinery (**www.computerhistory.org**). Pixel-Planes 5 was one of a series of scalable, processor-per-pixel graphics computers designed and built at UNC. In 1991, it achieved the then-unprecedented rendering rate of over two million triangles per second.

Recent Conferences

RTSS 2000

UNC was well represented by faculty, students, and alumni at the 21st annual IEEE Real-Time Systems Symposium (RTSS), which was held in late November 2000 in Orlando, Fla. RTSS is the premier technical conference for real-time systems research. **Kevin Jeffay**, S. S. Jones professor, chaired the program committee, which included **Sanjoy Baruah**, associate professor, and alumni **Stephen Goddard** (Ph.D. 1998) of the University of Nebraska, and **Mark Moir** (Ph.D. 1996), formerly of the University of Pittsburgh, now at Sun Microsystems Laboratories. Mark also co-authored a paper with fellow alumnus **Srikanth Ramamurthy** (Ph.D. 1997) of IBM Pittsburgh Lab (formerly Transarc), entitled "Static-Priority Periodic Scheduling on Multiprocessors." Graduate student **John Carpenter** presented the paper, "A Framework for Achieving Inter-Application Isolation in Multiprogrammed Hard-Real-Time Environments,"

which was co-authored by **Sanjoy Baruah**, and **Giuseppe Lipari** of the Scuola Superiore S. Ana in Pisa, Italy. Giuseppe was a visiting scholar at UNC a year ago. Presentations describing work in progress were made by **Stephen Goddard**, and by graduate students **Anand Srinivasan** (M.S. 2000) and **Philip Holman**, who each collaborated with Jim Anderson, associate professor. For more on the conference, see **www.cs.unc.edu/~jeffay/meetings/rtss00/.**

UNC's close association with RTSS continues this fall when the symposium moves to London, England. Kevin Jeffay is general chair of the conference, and Sanjoy Baruah and Jim Anderson are on the program committee.

I3D 2001

In March, the Graphics and Image Cluster hosted the ACM 2001 Symposium on Interactive 3D Graphics (I3D) in Research Triangle Park, N.C. **Mary Whitton**, research assistant professor, chaired the symposium, and a number of faculty and staff served on the organizing committee. Many current and former students also participated.

Gary Bishop (Ph.D. 1984), associate professor, and **Mark Mine** (Ph.D. 1997) of Disney Imagineering chaired paper sessions. Alumni with papers included **Subodh Kumar** (Ph.D. 1996) of Johns Hopkins, **Marc Levoy** (Ph.D. 1989) of Stanford, **Leonard McMillan** (Ph.D. 1997) of MIT, and **Amitabh Varshney** (Ph.D. 1994) of Maryland-College Park. UNC faculty and students had several papers (see **"Recent Publications"**). **Bill Verplank** of the Center for Computer Research in Music and Acoustics at Stanford presented the keynote address, "From Haptics to Music: Experiences in Physical Interaction Design." At a dinner, novelist **Andrew Glassner** (Ph.D. 1988) spoke on "Graphics, Stories, and Games."

The department hosted a reception and evening of demos in Sitterson Hall. Conference attendees enjoyed a North Carolina-style barbecue dinner, catered by Bullock's Barbecue of Durham, and tried out a number of graphics demos including Avatar Reconstruction for Interactive Synthetic Environments (ARISE), Interactive Haptic Painting with 3D Virtual Brushes (dAb), Hardware-Accelerated Voronoi Computation (HAVOC), Interactive Multiresolution Modeling and 3D Painting with a Haptic Interface (inTouch), Light Field Mapping, nanoManipulator, Proximity Information from Voronoi Techniques (PIVOT), Office of the Future and Tele-Immersion, Redirected Walking, Six-Degree-of-Freedom Haptic Rendering, and Voronoi-Based Motion Planning. Handouts in PDF format for these and many other projects are available at **www.cs.unc.edu/Research/ProjectSummaries/**. For more information about I3D 2001, see **www.siggraph.org/conferences/i3d/**.

I3D Demo Night. Graduate student Stephen Ehmann (M.S. 2000) discusses the inTouch system with Wolfgang Stürzlinger, an assistant professor at York University in Toronto and a former postdoctoral researcher at UNC. (Photo: Claire Stone)

Contracts and Grants

Boom in Industry Funding for the DiRT Group

In the past year, researchers in the Distributed and Real-Time Systems (DiRT) group have succeeded in obtaining significant industry funding to help support a variety of Internet-related projects.

Dell Computer Corp.'s STAR (Strategic Technology and Research) program, has awarded **Kevin Jeffay**, S. S. Jones professor, **Don Smith** (Ph.D. 1978), research professor, and **Russell M. Taylor II** (Ph.D. 1994), research associate professor, a $25,000 grant to help fund the networking component of an outreach project to introduce public school students to nanotechnology (see article below). The goal is both to provide additional funding for nanoManipulator outreach efforts and to use the resulting "virtual field trips" as vehicles for furthering multimedia networking research.

An IBM Shared University Research Grant awarded last October to Kevin, Don, and **Paul Jones** of Information and Library Science, is providing $250,000 worth of equipment to support networking and Internet technologies research. Two-thirds of the equipment is for servers to run the information repository for *ibiblio,* UNC's new digital library (**www.ibiblio.org**). Paul is its chief architect. With our one-third of the award, the department has received several IBM Netfinity computers and servers that are being used to collect and analyze network trace data. Kevin, Don, and students are using the resulting data to research how the nature of Internet traffic evolves over time and how the congestion control and quality-of-service mechanisms proposed for the Internet must evolve in turn.

Kevin and Don also received an $80,000 equipment grant from Sun Microsystems as part of Sun's Academic Equipment Grant program. The Sun systems are Enterprise servers that also will be used to store and process network traces. Together, the Sun and IBM grants have raised the

storage capacity of the DiRT group's research server farm to multiple terabytes of secondary storage. A multi-year Intel equipment grant also continues to provide support.

Related to the traffic monitoring work is new research on the construction of empirical models of application-level protocols such as HTTP. Cisco Systems has donated $85,000 to the department to support the construction of application-level traffic models from trace data. These models also contribute to the design of advanced congestion control mechanisms for the Internet and are being used by networking researchers both on and off the UNC campus.

Finally, the department has received several graduate fellowships to support networking-related research. Students of Kevin Jeffay and **Ketan Mayer-Patel**, assistant professor, have received awards through the North Carolina Networking Initiative's Graduate Fellowship Program and the related Cabletron/Aprisma Graduate Fellowship. These programs provide support for graduate student research in the development of middleware for applications to be used in next-generation networks. In addition, MCNC and Lucent Corp. have provided student support for network monitoring and traffic analysis research.

NSF and Industry Grants Fund Nanotechnology Outreach Project

Funding from the National Science Foundation (NSF) and from several corporations, is allowing researchers at UNC to introduce nanotechnology--the exploration and manipulation of objects at the atomic and molecular levels--to middle school and high school students. Participants in the first two years will be students at two Chapel Hill-area schools. In the third year, the project will expand to include hundreds of students at schools throughout North Carolina and in Iowa.

Gail Jones, associate professor of science education, is the principal investigator on the three-year NSF grant, and **Richard Superfine**, associate professor of physics, and **Russell M. Taylor II** (Ph.D. 1994), research associate professor of computer science, are co-investigators. See the related article (above) for information on the industry-funded grants.

Students will use the nanoManipulator system to manipulate and to "feel" the 3D image of a virus on a computer screen--an image projected from an atomic force microscope located at UNC through an Internet connection. The sensation of "feeling" DNA and viruses adds a dimension to investigations and allows discussion between scientists and students on the stickiness, viscosity, or strength of the virus's protein coat.

The researchers will study the effectiveness of nanotechnology in helping students acquire and gain interest in scientific knowledge. "Many students have never had a scientist visit the classroom," said Gail Jones. "We believe this interaction, plus the technology component, will inform their knowledge of the processes and excitement surrounding scientific study."

The researchers conducted two exploratory studies with the nanoManipulator at a local high school in 1998 and 1999. Russell Taylor said that feedback from students indicated that they began to see science as an enjoyable and rewarding pursuit. Richard Superfine observed, "The students glow when they 'feel' their first virus or DNA, and they immediately understand why the scientists love discovery so much." (**www.cs.unc.edu/Research/nano/**)

Foundation of Hope Grant

Guido Gerig, Taylor Grandy professor of computer science and psychiatry, has received a grant from the Foundation of Hope for "Neonatal Cerebral Ventricle Shape from 3D Ultrasound in Neuro-Psychiatric Disorders." He and **John Gilmore**, associate professor of psychiatry, are using 3D ultrasound to study the cerebral ventricle volume of premature infants. Enlargement of the cerebral lateral ventricles is the most consistent neurostructural abnormality observed in schizophrenia and it is thought to arise during early brain development. Ventricle enlargement in premature infants is associated with poor neurodevelopmental outcome. The researchers hope that by studying ventricle volume, they can identify children at risk for schizophrenia and other neurodevelopmental disorders and that they can also increase understanding of the causes of neurodevelopmental disorders associated with ventricle enlargement.

MERL Gives $50,000 Grant

Mitsubishi Electric Research Laboratories (MERL) has awarded a $50,000 grant to the department. The gift will support the projector-based graphics and vision research being pursued by **Henry Fuchs**, Federico Gil professor, **Gregory F. Welch** (Ph.D. 1997), research assistant professor, and **Herman Towles**, senior research associate.

Recent Publications

Amaro, C., S. Baruah, T. Marlowe, and A. Stoyenko. "Non-Preemptive Scheduling to Maximize the Minimum Intercompletion Time," *Journal of Combinatorial Mathematics and Combinatorial Computing*, Vol. 34, 2000, 33-50.

Anderson, J., and P. Holman. "Efficient Pure-Buffer Algorithms for Real-Time Systems," *Proc. Seventh International Conference on Real-Time Computing Systems and Applications*, December 2000, 57-64.

Anderson, J., and Y.-J. Kim. "A New Fast-Path Mechanism for Mutual Exclusion," *Distributed Computing*, 14(1), January 2001, 17-29

Anderson, J., M. Moir, and S. Ramamurthy. "A Simple Proof Technique for Priority-Scheduled Systems," *Information Processing Letters*, 77(2-4), 28 February 2001, 63-70.

Anderson, J., and A. Srinivasan. "Pfair Scheduling: Beyond Periodic Task Systems," *Proc. Seventh International Conference on Real-Time Computing Systems and Applications*, December 2000, 297-306.

Ehmann, S., and M. C. Lin. "Accelerated Proximity Queries Between Convex Polyhedra By Multi-Level Voronoi Marching," *Proc. IEEE/RSJ International Conference on Intelligent Robots and Systems 2000*, 2101-2106.

Erikson, C., D. Manocha, and W. V. Baxter III. "HLODs for Faster Display of Large Static and Dynamic Environments," *Proc. ACM 2001 Symposium on Interactive 3D Graphics*, March 2001, 111-120, 255; also Department of Computer Science technical report TR00-012.

Goossens, J., and S. Baruah. "Multiprocessor Algorithms for Uniprocessor Feasibility Analysis," *Proc. International Conference on Real-Time Computing Systems and Applications*, December 2000.

Hoff III, K. E., A. Zaferakis, M. C. Lin, and D. Manocha. "Fast and Simple Geometric Proximity Queries Using Graphics Hardware," *Proc. ACM 2001 Symposium on Interactive 3D Graphics*, March 2001, 145-148, 259.

Hudson, T., D. H. Sonnenwald, K. Maglaughlin, M. C. Whitton, and R. Bergquist. "Enabling Distributed Collaborative Science: The Collaborative nanoManipulator," *Video Proceedings of 2000 ACM Conference on Computer-Supported Cooperative Work*, December 2000.

Hudson, T. C., M. C. Weigle, K. Jeffay, and R. M. Taylor II. "Experiments in Best-Effort Multimedia Networking for a Distributed Virtual Environment," *Proc. Multimedia Computing and Networking*, January 2001, 88-98.

Lipari, G., J. Carpenter, and S. Baruah. "A Framework for Achieving Inter-Application Isolation in Multiprogrammed, Hard Real-Time Environments," *Proc. IEEE Real-Time Systems Symposium*, November 2000, 217-226.

Lok, B. "Online Model Reconstruction for Interactive Virtual Environments," *Proc. ACM 2001 Symposium on Interactive 3D Graphics*, March 2001, 69-72, 248; also *Computer Graphics World*, February 2001, 17.

Paulson, S., A. Helser, M. Buongiorno Nardelli, R. M. Taylor II, M. Falvo, R. Superfine, and S. Washburn. "Tunable Resistance of a Carbon Nanotube-Graphite Interface," *Science*, Vol. 290, December 2000, 1742-1744.

Popescu, V., and A. Lastra. "The Vacuum Buffer," *Proc. ACM 2001 Symposium on Interactive 3D Graphics*, March 2001, 73-76, 249.

Seeger, A., A. Henderson, G. L. Pelli, M. Hollins, and R. M. Taylor II. "Haptic Display of Multiple Scalar Fields on a Surface," *Proc. Workshop on New Paradigms in Information Visualization and Manipulation*, November 2000, 33-38.

Sonnenwald, D., R. Bergquist, K. Maglaughlin, E. Kupstas Soo, and M. Whitton. "Designing to Support Scientific Research Across Distances: The nanoManipulator Environment," *Collaborative Virtual Environments*, E. Churchill, D. Snowdon, and A. Munro, eds., London: Springer Verlag, 2001, 202-224.

Styner, M., G. Gerig, C. Brechb&#65533;hler, and G. Szekely. "Parametric Estimate of Intensity Inhomogeneities Applied to MRI," *IEEE Transactions on Medical Imaging*, 19(3), 2000, 153-165.

Welch, G., G. Bishop, L. Vicci, S. Brumback, K. Keller, and D. Colucci. "High-Performance Wide-Area Optical Tracking--The HiBall Tracking System," *Presence: Teleoperators and Virtual Environments*, 10(1), January 2001.

Computer Services

Work Request System Replaced

Bil Hays, network manager, has upgraded the system Computer Services uses to track trouble reports and work requests. The new system, Remedy, is a full-featured commercial product supported by campus support personnel. Among the new features Remedy provides is automatic escalation of trouble reports over time. It also allows users to check the status of their requests.

DHCP and DNS Servers Deployed

Murray Anderegg (M.S. 1991), Linux and e-mail administrator, set up Linux systems to run DHCP (Dynamic Host Configuration Protocol) and DNS (Domain Name System) services. DHCP provides PCs with host information as they boot, while DNS is a distributed Internet directory service. These systems replace older less-reliable systems with the same function.

Mail Servers Upgraded

John Sopko, UNIX systems manager, upgraded our IMAP e-mail server to Solaris 2.7 and the latest version of the Netscape Messenger server. The latter upgrade provides various bug fixes. It also allows us to run a web-based e-mail client, so our users can read their e-mail from any web browser. We also upgraded our SMTP (Simple Mail Transfer Protocol) server hardware and software, improving the reliability of this system.

New Computers Installed

William Jiang, PC systems administrator, and **Jane Stine**, desktop systems manager, led efforts to install 61 IBM computers provided to the department as part of the Carolina Computing Initiative, as well as the last computers from our multi-year Intel grant. This installation allowed us to retire the last old Sun and HP workstations and to replace the 200 MHz PCs. Now all faculty, staff, and students have 300 MHz PCs or better.

Machine Room Reorganized

Mike Carter, electronics technician, set up two computer cabinets in the main machine room with 14 PC servers inside. The cabinets contain switches that allow us to use two monitors for the 14 systems, and they also make it possible to stack the systems higher while hiding the cabling. This was the first of several steps to use the space in the machine room more efficiently and in a more aesthetically pleasing way. The second step was a console switch that allows us to control all the Sun servers from a single location via telnet. Future changes include adding an additional cabinet and replacing PC servers with rack-mounted units.

Alumni News

M.S. and Ph.D. Alumni

Jim Begley (M.S. 1993) has joined Coactive Systems Corp. as a senior software developer. *(JimBegley@yahoo.com)*

Steven Bellovin (Ph.D. 1982) has been elected to the National Academy of Engineering. *(smb@research.att.com)*

Sam Black (M.S. 1986) is at Pixar Animation Studios, where he is developing RenderMan and designing future renderers. He was recently cast as a voice performer in Pixar's next movie, *Monsters, Inc.*, which will be released this November. In his spare time, Sam builds cabinetry, flies anything he can get his hands on, and instructs airplane and hot-air balloon pilots. *(penguin@mahasamatman.com)*

Randy Brown (M.S. 1990) joined the Research Triangle Institute (RTI) in Research Triangle Park, N.C., in January as a senior research engineer. He previously worked for SouthPeak Interactive, whose Video Reality(TM) technology and Profiler(TM) product line have been purchased by RTI. Randy is one of the creators of the Profiler products. *(rbrown@rti.org)*

Tim Culver (Ph.D. 2000) has joined think3 as a software developer. The company, located near Boston, Mass., makes 3D CAD software for mechanical engineering and industrial design. *(culver@acm.org)*

Victoria Interrante (Ph.D. 1996) has been awarded the McKnight Land-Grant Professorship, a distinguished junior-level professorship at the University of Minnesota, where she is an assistant professor in the Department of Computer Science and Engineering. *(interran@cs.umn.edu)*

Robert Keeler (M.S. 1980) has received a $10,000 unrestricted grant-in-aid from the Whiting Foundation. The grant recognizes the accomplishments of writers in the early years of promising careers. Two of Robert's poems appear in the Spring 2001 issue of *Ploughshares.* *(robert.j.keeler@ieee.org)*

David Luebke (Ph.D. 1998) has received a CAREER award from NSF and a University Teaching Fellowship from the University of Virginia where he is an assistant professor. *(luebke@cs.virginia.edu)*

Mark Moir (Ph.D. 1996) is currently a staff engineer at Sun Microsystems Laboratories in Burlington, Mass. *(Mark.Moir@sun.com)*

Daniel Palmer (Ph.D. 1996) has been granted tenure and promoted to associate professor at John Carroll University in Cleveland, Ohio. He is in the Mathematics and Computer Science Department. He and his wife also have a new daughter (see **"Family Matters"**). *(dpalmer@jcu.edu)*

Alumnus Greg Turk (Ph.D. 1992) of Georgia Tech (right), catches up with associate professor Anselmo Lastra at the I3D Demo Night in March. (Photo: Claire Stone)

Undergraduate Alumni

Jay Blackburn (B.S. MSci. 1989), a co-owner of TEKgroup International, Inc. (**www.tekgroup.com**), reports that his company has opened a new office in Ann Arbor, Mich. TEKgroup, whose headquarters are in Fort Lauderdale, Fla., is an Internet consulting company that specializes in work for Fortune 500 companies and for the sports and entertainment industries. *(jay@tekgroup.com)*

Cindy Hong (B.S. MSci. 1996) began an eight-month internship at Pixar Animation Studios in January. She is working as a lighting technical director for their next movie, *Monsters, Inc.* *(hong@cs.unc.edu)*

Scott Leslie (B.S. MSci. 1991) was recently promoted to principal systems developer at SAS Institute. *(Scott.Leslie@sas.com)*

Todd D. Taft (B.S. MSci. 1997) left IBM Corp. in February and joined Nokia at its headquarters in Helsinki, Finland, where he is doing DCE/DFS design and administration. *(taft@cs.unc.edu)*

Former Faculty News

Jim Foley, former assistant professor, left Mitsubishi Electric Research Laboratories in Cambridge, Mass., in late 1999 to return to Atlanta, Ga. Initially, he provided centralized management for Yamacraw, an interagency economic development activity for the State of Georgia, which focused on increasing the number of jobs in Georgia in the design of broadband systems, devices, and chips. Yamacraw's success allowed Jim to turn over its responsibilities to the individual agencies and to return to Georgia Tech., where he has a joint appointment in the College of Computing and the School of Electrical and Computer Engineering. He is associate dean in the College of Computing and holds the Steven Fleming chair in Telecommunications. Jim is also chairman-elect of the Computing Research Association, and was recently inducted into the ACM/SIGCHI Academy. *(foley@cc.gatech.edu)*

Family Matters

Jenna Grace Anderson was born on 23 December 2000 in Kirkland, Wash., to George (Chip) Anderson (B.S. MSci. 1987) and Sally Noecker Anderson. *(chipa@stockcharts.com)*

Macie Helena Brandt was born on 17 April 2001 in Boulder, Colo., to Andrew Brandt (M.S. 1993) and Lisa Brandt. She has an older brother, Colton (2). *(brandt@axiswest.com)*

Graham Thompson Certain was born on 3 March 2001 in Seattle, Wash., to Andrew Certain (B.S. MSci. 1992) and Margaret Certain. *(certain@manifoldgraphics.com)*

Samantha Elanor Duggan was born on 1 March 2001 in Cary, N.C., to Adam Duggan (M.S. 1995) and Laura Schutz Duggan, former computing consultant for the department. *(adam@logicalsky.com)*

Aneesha Manocha was born on 23 March 2001 in Chapel Hill, N.C., to Dinesh Manocha, professor, and Ming Lin, associate professor. She has an older sister, Aninda (3). *(dm@cs.unc.edu, lin@cs.unc.edu)*

Sydney Kaitlin McDaniel was born on 30 April 2001 in Durham, N.C., to Jason McDaniel and Candice McDaniel, former receptionist for the department. She has an older sister, Selina (2).

Michael Benjamin Menges was born on 8 September 2000 to John Menges (M.S. 1990) and Nancy Menges. He has three siblings: Nathaniel (12), Lewis (9), and Amelia (3). *(john_menges@hp.com)*

Emily Grace Xiaoyun Palmer was born on 24 December 1999 in China and joined the family of Daniel Palmer (Ph.D. 1996) and Diane Palmer on 22 November 2000. *(dpalmer@jcu.edu)*

In the media

The department's research projects, faculty, and other activities received significant coverage in the media this past year. Following is a selection of recent media appearances. Research areas receiving the most attention were tele-immersion and the nanoManipulator. See our web site's "Media and News Archive" for a complete list and for links to many articles (**www.cs.unc.edu/Events/News/Media.html**).

nanoManipulator
Coverage has ranged from brief overviews to in-depth articles. A new focus has been the nanoManipulator's use over Internet2:

- Baumgartner, Henry. "Putting a Dent in that Cold," *Mechanical Engineering,* 123(2), February 2001, 100.
- Obermayer, Joel B. "Honey, I Shrunk the Scientist," *MSNBC,* 15 January 2001.
- Port, Otis. "It's a Nano World," *Business Week,* 27 November 2000, 76-82.
- Sincell, Mark. "NanoManipulator Lets Chemists Go Mano a Mano With Molecules," *Science,* 290(5496), 24 November 2000, 1530.

Tele-Immersion
A number of recent media stories have focused on the Office of the Future project and tele-immersion research. Several discussed tele-immersion via Internet2:

- Ananthaswamy, Anil. "Being There," *New Scientist,* 21 October 2000.
- Ditlea, Steve. "Tele-immersion: Tomorrow's Teleconferencing," *Computer Graphics World,* 24(1), January 2001.
- Garreau, Joel. "Closeness at a Distance: Can Virtual Technology Ever Achieve That Human Touch?" *Washington Post,* 28 November 2000, C1.
- Lanier, Jaron. "Virtually There: Three- Dimensional Tele-Immersion May Eventually Bring the World to your Desk," *Scientific American,* 284(4), April 2001, 66-75.

Other Research
Leandra Vicci's Auto 911 patent daughter (see **"Research Highlights"**). was covered by local TV news and by an in-depth New York Times article:

- Chartrand, Sabra. "Tapping Global Positioning Technology to Send an S.O.S., Raise Drawbridges and Monitor Workouts," *New York Times,* 5 March 2001, C6.

Another recent New York Times article on digital mammography, discussed the work of UNC radiology professor, and MIDAG member, Dr. Etta Pisano:

- Tarkan, Laurie. "An Upgrade that Matters? Mammography's Next Step is Assessed," *New York Times,* 2 January 2001, D5.

Miscellaneous
UNC's alumni magazine recently profiled **Frederick P. Brooks Jr.**, Kenan professor:

- O'Kelly, Kevin. "Virtuous Reality," *Carolina Alumni Review,* University of North Carolina, 90(1), January/February 2001, 22-30.

Finally . . . just in case you had forgotten last November's election: Fred and **Stephen F. Weiss,** professor and chairman, were quoted in a December newspaper article about the origin of the word "chad":

- Blythe, Anne. "Holes in Stories of 'Chad' Origin," *News & Observer,* Raleigh, N.C., 8 December 2000, 20A.

In Memoriam

Arjun Jerath Baruah, son of associate professor Sanjoy Baruah and his wife Maya Jerath, was born on 20 March 2001 at Duke University Medical Center in Durham, N.C. He was diagnosed with congenital heart defects that necessitated open heart surgery three days after birth. Arjun died of complications from his surgery on 1 April 2001. His ashes were immersed in the Ganges River at Varanasi, India.

Alexander Jones, 69, died on 12 April 2001 in Durham, N.C., following a battle with cancer. Alex, a professional interior designer, was the husband of Sara Elizabeth Moore Jones, the department's founding secretary. Messages of condolence may be sent to her at *alexjones@webtv.net,* or to 2735 Montgomery Street, Durham, N.C. 27707.

About News & Notes

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- **To the Department's home page**