

News & Notes

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

from Sitterson Hall

SPRING 2004 • ISSUE THIRTY-THREE

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Chairman's corner



Spring has arrived in Chapel Hill, and with it comes much growth and change in the department and throughout the University.

Phase I of the new science complex construction project is well underway. The complex will eventually provide additional space for our department as well as the departments of chemistry, physics and astronomy, materials science and marine science. For the latest news on all the construction projects at Carolina, visit the university home page and click on the "construction" link.

We are very pleased to welcome Daniel Reed back to Carolina. Dan has been named UNC's first Kenan Eminent Professor and will be heading the new Institute for Renaissance Computing. You can read more about his appointment on page 10.

Congratulations to graduate student Philip Holman, recipient of the 2003-2004 Computer Science Alumni Fellowship. For more about his research, see page 3. Generous contributions from alumni and friends help make this fellowship possible.

This summer will mark the end of my term as chairman of the Department of Computer Science. It has been an exciting fifteen-and-a-half years for me

as chairman. In this time, the University has had four chancellors and four provosts, and the College of Arts and Sciences is currently on its fifth dean. When I started as chair, there was no web, and our goal was to have a computer access device (a dumb terminal) in every room. Things certainly have changed!

Being chair of this department has given me the opportunity to meet chairs of other departments at UNC as well as other computer science departments at other universities. This helped me to appreciate how great this place is. Many thanks to Ralph Mason and Tim Quigg, who managed to keep the department running during my tenure despite me! I am also grateful to those who have served as associate chairs for academic affairs during my chairmanship – Peter Calingaert, Don Stanat, James Coggins, and David Stotts – as well as to Kevin Jeffay, who really made the undergraduate major happen. Finally, I want to extend my thanks to the department staff, who all pitch in to make this a great place to work and to make my job easy.

At this time, I would like to encourage you to make a donation to the department. Your gifts are needed now more than ever as the state budget crisis continues. If your time at UNC has given you more than you would have had otherwise, please consider giving some back. Contributions to the department are tax-deductible and count toward the University's \$1.8 billion Carolina First campaign. Thank you for supporting our department.

Stephen F. Weiss



Left to right: **David Harrison**, **Missy Wood** and **Catherine Perry** check for pregnant and hanging chads on the ballots for the new department chairman. (photo: Herman Towles)

Family matters

Divya Aikat was born in Chapel Hill on July 9, 2003, to **Debashis** and **Jay Aikat**, graduate student and research assistant. She joins big brother **Vikram**, age five. (*aikat@cs.unc.edu*)

Ronald Azuma (Ph.D. 1995) was married to **Sun Chang** in August 2003 in Los Angeles, Calif. (*azuma@hrl.com*)

Fred and Nancy Brooks proudly announce the arrival of their eighth grandchild, **Edmund Joseph LaDine**, in San Antonio, Texas, on December 2, 2003. (*brooks@cs.unc.edu*)

Graduate students **Swaha Das** and **Dorian Miller** were married on November 21 and 22, 2003, in Chapel Hill and Morrisville, NC. (*swaha@cs.unc.edu, dorianm@cs.unc.edu*)

Aiden David Ehmann was born in Durham on October, 10, 2003, to **Ginger** and **Stephen Ehmann** (M.S. 2000). (*ehmann@cs.unc.edu*)

Patrick John Elijah Forrest was born in Durham on November 21, 2003, to **Sue** and **Alan Forrest**, Computing Consultant IV. (*forrest@cs.unc.edu*)

Cole Emerson Holloway was born in Chapel Hill, on May 17, 2003, to **Barbara** and **Rich Holloway** (M.S. 1987, Ph.D. 1995). (*holloway@3rdtech.com*)

Leif Thorson Mahaney was born in Durham on September 15, 2003, to **Lori** and **Jim Mahaney**, Computing Consultant and Assistant to Henry Fuchs. He joins big sister **Georgia**, age six. (*mahaney@cs.unc.edu*)

Darcy Edward McCoy was born in Ottawa, Ontario, Canada, on February 13, 2004, to **Nalini D'Souza** (B.S. MSci. 1994) and **Brendan McCoy**. He joins big brother **Declan**, age two. (*nalini_dsouza@botmail.com*)

Mayanna Iliya Mueller was born in Seattle, Washington, on December 12, 2003, to **Carl Mueller** (Ph.D. 2000) and **Masha Boitchouk**. She joins big brother **Dimitry** who is 16. (*zayetz@comcast.net*)

Laura Rose Stone was born in Durham on March 25, 2004, to **Claire Stone**, former publications and publicity manager, and **Don Stone** (Ph.D. 1993). She joins big brother **Ian**, age two. (*clairestone@nc.rr.com, dstone@rateintegration.com*)

John Russell Wendt was born in Chapel Hill on March 4, 2004, to graduate student **Jeremy Wendt** and his wife, **Heather**. (*jwendt@cs.unc.edu*)

Congratulations to...

FACULTY AND STAFF

Gary Bishop, associate professor, received a "Distinguished Service Award" from the Orange County Disability Awareness Council in October 2003.

Katrina Coble, administrative manager, received a Robert E. Bryan Public Service Award in March 2004 for her work as chair of the university-wide blood drive.

Myra Gwin-Summers, was named research associate in September 2003. Myra has been with the department since April 2003, and will continue to work with Henry Fuchs and his research teams.

Alan Forrest, was promoted from a Computing Consultant II to a Computing Consultant IV. He also won an Employee Forum Award for Customer Service.

Jasleen Kaur, assistant professor, was awarded a University Junior Faculty Development Award.

Ming Lin, associate professor, and **Dinesh Manocha**, professor, along with former postdoctoral researcher **Young Kim** and graduate student **Gokul Varadhan**, received the best paper award at the 2003 ACM/SIGGRAPH Conference on Solid Modeling and its Applications for their paper titled "Fast Swept Volume Approximation of Complex Polyhedral Models."

Maria Papadopouli, assistant professor, received the IBM Faculty Award 2003-2004.

Brian White, computer services director, was elected as a delegate to the Employee Forum for 2004-2005.

GRADUATE STUDENTS

Liz Dolan, received the Beale-Orchard-Hays Prize for excellence in computational mathematical programming on August 18, 2003, at the International Symposium on Mathematical Programming in Copenhagen, Denmark. The prize was given to the four co-authors of a paper on the NEOS Server, which she administered and further developed during her four years with the Optimization Technology Center.

Tom Fletcher, a Ph.D. student supervised by Stephen Pizer, won one of the two honorable mentions for the best first presentation by a young scholar at IPMI 2003. His paper was co-authored by department members Sarang Joshi, Conglin Lu, and Stephen Pizer.

Long Le and **Jay Aikat** won the best student paper award at SIGCOMM 2003 in Karlsruhe Germany for their paper "The Effects of Active Queue Management on Web Performance."

Michael Rosenthal was the recipient of the 2004 Boka W. Hadzija Award for Distinguished University Service. Awarded by the Chancellor, this honor is given to the graduate or professional student selected as most outstanding in character, scholarship and leadership.

August 2003 Ph.D. Recipients:
Alexandra A. Bokinsky, "Visualization of Multiple Spatial Variables with Data-Driven Spots." (Frederick Brooks)

Gregory Clary, "Image Sequence Classification via Anchor Primitives." (Stephen M. Pizer)

2003-2004 STUDENT FELLOWSHIPS AND SPECIAL AWARDS

William Baxter	NVIDIA Fellowship
Greg Coombe	NVIDIA Fellowship
Elizabeth Dolan	UNC-Chapel Hill Graduate School Fellowship
Nicolas Galoppo von Borries	Belgian American Education Foundation Fellowship (1 year)
George Greene	School of Education Fellowship
Brad E. Hinson	UNC-Chapel Hill Graduate School Minority Fellowship
Jason J. Jerald	National Physical Sciences Consortium Fellowship
Hye-Chung (Monica) Kum	UNC-Chapel Hill Graduate School Doctoral Dissertation Fellowship
Andrew Leaver-Fay	UNC-Chapel Hill Bioinformatics Training Program
Brandon Lloyd	National Science Foundation Fellowship
Henry McEuen	UNC-Chapel Hill Scholars for Tomorrow
Olufisayo Omojokun	AT&T Labs Fellowship (4th year)
Miguel Otaduy	Government of the Basque Country Fellowship (4th year)
Peter J. Parente	National Science Foundation Fellowship (3 years)
Erin Parker	Lawrence Livermore Graduate Fellowship (4th year)
Josh Steinhurst	National Science Foundation Fellowship
Karl Strohmaier	UNC Graduate School Merit Assistantship
Shriram Thirthala Venkata	UNC-Chapel Hill Scholars for Tomorrow
Kelly Van Busum	Depauw University Fellowship
Alicia L. Wright	American Society for Engineering Education
	National Defense Science and Engineering Graduate Fellowship
Jingdan Zhang	UNC Graduate School Merit Assistantship

Aditi Majumder, “The Emineoptic Function: A Comprehensive Framework for Modeling and Correcting Color Variations Across Multi Projector Displays.” (Greg Welch)

Vassil R. Roussev, “Flexible Sharing of Distributed Objects Based on Programming Patterns.” (Prasun Dewan)

Michele Aylene Clark Weigle, “Investigating the Use of Synchronized Clocks in TCP Congestion Control.” (Kevin Jeffay)

Ruigang Yang, “View-dependent Pixel Coloring—A Physically-based Framework for 2D View Synthesis.” (Greg Welch)

August 2003 M.S. Recipient:
Dean Andrew Herington, “A Declarative Framework for Application Coordination.” (David Stotts)

UNDERGRADUATE STUDENTS

Guest student from CPE Lyon, undergraduate **Pierre Fillard**, won the best student paper award for his paper and oral presentation, “Quantitative Analysis of White Matter Fiber Properties along Geodesic Paths,” (Pierre Fillard, John Gilmore, Weili Lin, Guido Gerig).

Besides winning the student award, the paper also got the highest score among all the papers. Pierre was an exchange student from CPE Lyon at UNC CS for one year.

Welcomes and farewells

NEW GRADUATE STUDENTS

Priscilla Alexander, Christopher Ashworth, Nathan Beddes, Vasile Bud, John Chek, Liz Dolan, Brian Eastwood, Craig Falls, Nathan Fisher, Nico Galoppo, Todd Gamblin, Russell Gayle, Sean Hanlon, Michael Henson, Nitin Jain, Ritesh Kumar, William Luebke, Henry McEuen, Derek Merck, Priyank Porwal, Jason Repko, Anup Sahni, Erica Stanley, Karl Strohmaier, Sriram Thirthala Venkata, Sundeep Tirumalareddy, Angie Van Osdol, Sankar Vijayaraghaven, Hao Wang, Tian Wang, Xueyi Wang, Jeremy Wendt, Christine (Shun) Xu, Jingyi Yu, Jingdan Zhang

THANKS AND FAREWELL TO ...

Pankaj K. Agarwal, adjunct professor, whose appointment ended in November. Pankaj is a professor of computer science and mathematics at Duke University and had been with us since fall 2001. (*pankaj@cs.duke.edu*)

Herbert Edelsbrunner, adjunct professor, whose appointment ended in November. Herbert is a professor of computer science and mathematics at Duke University and had been with us since fall 2001. (*edels@cs.duke.edu*)

GRANTS

Sanjoy Baruah, associate professor (PI), and James Anderson, professor (Co-PI). “Energy-Aware Synthesis of Embedded Systems on Multiprocessor Platforms,” NSF.

Prasun Dewan, professor (PI). “User-Interface Generation for Mobile and Desktop Computing,” NSF.

Henry Fuchs, Federico Gil professor (PI); Bruce Cairns, assistant professor of surgery (Co-PI); Ketan Meyer-Patel, assistant professor (Co-PI); Diane Sonnenwald, adjunct associate professor (Co-PI); Herman Towles, senior research associate (Co-PI); and Greg Welch, research associate professor (Co-PI). “Three-Dimensional Tele-Presence for Medical Consultation: Extending Medical Expertise Throughout, Between and Beyond Hospitals,” National Library of Medicine.

Kevin Jeffay, S. Shepard Jones Distinguished Term professor (PI); F. Donelson Smith (Ph.D. 1978), research professor (Co-PI); Anselmo Lastra, associate professor (Co-PI); Leonard McMillan (Ph.D. 1997), associate professor (Co-PI); and Ketan Mayer-Patel, assistant professor (Co-PI). “RI: Tera-Pixels: Using High-Resolution Pervasive Displays to Transform Collaboration and Teaching,” NSF.

Kevin Jeffay, S. Shepard Jones Distinguished Term professor (PI); F. Donelson Smith (Ph.D. 1978), research professor (Co-PI); and Andrew Nobel, adjunct associate professor (Co-PI). “Generation and Validation of Synthetic Internet Traffic,” NSF.

Kurtis Keller, research associate and engineer (PI), and Andrei State, senior research associate (Co-PI). “SBIR Phase I: Three-Dimensional Laparoscope,” NSF.

Anselmo Lastra, associate professor (PI). “Fifth Generation Graphics Hardware,” NSF.

Ming C. Lin, associate professor (PI). “DURIP: Physically-based Interaction with Massive Datasets,” Army Research Office.

Ming C. Lin, associate professor (PI). “Enabling Real-Time Interaction for Moving Avatars in Virtual Environments,” Office of Naval Research.

Ketan Mayer-Patel, assistant professor (PI). “CAREER: Enabling Futuristic Distributed Application with Integrative Multistream Network,” NSF.

Marc Pollefeys, assistant professor (PI). “Heterogeneous Networks of Camera for Improving Situational Awareness,” DARPA.

Marc Pollefeys, assistant professor (PI). “Converting 2D Video to 3D with

Applications to 3D-TV, Video Analysis and Compression,” NSF.

Jack Snoeyink, professor (PI). “Streaming Meshes for Storing, Transmitting and Accessing Compressed Geometric Models,” Lawrence Livermore National Labs.

Mary Whitton, research assistant professor (PI). “VE Technologies for Effective Training,” Office of Naval Research.

ALUMNI FELLOWSHIP RECIPIENT

Philip Holman (M.S. 2002) was the recipient of the 2003-2004 Computer Science Alumni Fellowship. The fellowship is awarded annually to a Ph.D. candidate in his or her final year of study, allowing the student to work full time on dissertation research. Generous contributions by alumni and friends help to make this fellowship possible.

Philip is pursuing a dissertation under his advisor James Anderson. His research focuses on guaranteeing predictable execution of programs on multiprocessor systems. Specifically, Philip is investigating the use of the proportionate-fair (Pfair) scheduling approach. This approach strives to guarantee a specified share of the system’s processor time to each program. By providing such a guarantee, one can ensure that programs will complete execution by specified deadlines. In addition, allowing tasks to fairly share the available processor time facilitates support for programs that require quality-of-service guarantees. Philip’s primary focus within this area are adding support for data sharing and process synchronization, and developing techniques for improving performance and efficiency.

In memoriam

We are saddened by the untimely death of **Anup Singh Sahni**, one of our new graduate students. Anup was an excellent student who always had a smile and a kind word for everybody. We will certainly miss him. Our deepest condolences to Anup’s sister, Assistant Professor Jasleen Kaur, and to his family.

Anup died in his sleep on February 10, 2004. He joined the department in fall 2003. He attended the Birla Institute of Technology and Science, Pilani, India where he was a member of the batch of 1987.

- Aikat, J., J. Kaur, D. Smith, and K. Jeffay. "Variability in TCP Round-Trip Times," *Proc. ACM Sigcomm Internet Measurement Conference*, October 2003, 279-284.
- Alliez, P., E.C. de Verdiere, O. Devillers, and M. Isenburg. "Isotropic Surface Remeshing," *Proc. Shape Modeling International*, May 2003, 49-58.
- Anderson, J., Y.-J. Kim, and T. Herman. "Shared-memory Mutual Exclusion: Major Research Trends Since 1986," *Distributed Computing*, 16, 2003, 77-110. (Special issue celebrating the 20th anniversary of PODC.)
- Baruah, S., and J. Anderson. "Energy-aware Implementation of Hard-real-time Systems upon Multiprocessor Platforms," *Proc. ISCA 16th International Conference on Parallel and Distributed Computing Systems*, August 2003, 430-435.
- Bennett, E.P., and L. McMillan. "Proscenium: A Framework for Spatio-Temporal Video Editing," *ACM Multimedia conference*, November 2003.
- Berlin, K., J. Huan, M. Jacob, G. Kochhar, J. Prins, W. Pugh, P. Sadayappan, J. Spacco, and C.-W. Tseng. "Evaluating the Impact of Programming Language Features on the Performance of Parallel Applications on Cluster Architectures," *Languages and Compilers for Parallel Computing (LPC)*, 2003.
- Brooks, Jr., F.P. "Three Great Challenges for Half-Century-Old Computer Science," *Journal of the ACM*, 50(1), 2003, 25-26.
- Culver, T., J. Keyser, and D. Manocha. "Exact Computation of a Medial Axis of a Polyhedron," *Computer-Aided Geometric Design*, 2003.
- Govindaraju, N., B. Lloyd, S.-E. Yoon, A. Sud, and D. Manocha. "Interactive Shadow Generation in Complex Environments," *Proc. ACM SIGGRAPH/ACM Transactions on Graphics*, 2003.
- Govindaraju, N., S. Redon, M.C. Lin, and D. Manocha. "CULLIDE: Interactive Collision Detection Between Complex Models in Large Environments using Graphics Hardware," *Proc. Eurographics/SIGGRAPH Workshop on Graphics Hardware*, 2003.
- Hernández-Campos, F., A.B. Nobel, F.D. Smith, and K. Jeffay. "Statistical Clustering of Internet Communication Patterns," *Proc. 35th Symposium on the Interface of Computing Science and Statistics*, July 2003.
- Hernández-Campos, F., K. Jeffay, and F.D. Smith. "The Evolution of Web Traffic," *Proc. 11th IEEE/ACM International Symposium on Modeling, Analysis, and Simulation of Computer and Telecommunication Systems (MASSCOTS)*, October 2003, 16-25.
- Huan, J., J. Prins, W. Wang, and T. Vision. "Reconstruction of ancestral gene order following segmental duplication and gene loss," *Proc. IEEE Computer Society Bioinformatics Conference (CSB)*, 2003, 484-485.
- Huan, J., W. Wang, and J. Prins. "Efficient mining of frequent subgraphs in the presence of isomorphism," *Proc. 3rd IEEE International Conference on Data Mining (ICDM)*, 2003.
- Hudson, T., M. C. Whitton, A. Helser and D. H. Sonnenwald. "Managing collaboration in the nanoManipulator," *Presence*, 13(2), 2003.
- Isenburg, M., and J. Snoeyink. "Binary Compression Rates for ASCII Formats," *Proc. Web3D Symposium*, March 2003, 173-178.
- Isenburg, M., and J. Snoeyink. "Compressing Texture Coordinates with Selective Linear Predictions," *Proc. Computer Graphics International*, July 2003, 126-131.
- Isenburg, M., P. Lindstrom, S. Gumhold, and J. Snoeyink. "Large Mesh Simplification using Processing Sequences," *Proc. Visualization*, October 2003, 465-472.
- Jones, G., A. Bokinski, T. Tretter, A. Negishi, D. Kubasko, R. Superfine and R. M. Taylor II. "Atomic force microscopy with touch: Educational applications," *Science, Technology and Education of Microscopy: an Overview*, Vol. 1, A. Mendez-Vilas, ed., Formatex, 2002.
- Jones, G., T. Andre, R. Superfine and R. M. Taylor II. "Learning at the Nanoscale: The Impact of Students' Use of Remote Microscopy on Concepts of Viruses, Scale, and Microscopy," *Journal of Research in Science Teaching*, 40(3), 2003, 303-322.
- Kim, T., and M.C. Lin. "Visual Simulation of Ice Crystal Growth," *Proc. ACM/Eurographics Symposium on Computer Animation*, 2003.
- Kim, Y.J., M.A. Otaduy, M.C. Lin, and D. Manocha. "Six-degree-of-freedom Haptic Display using Incremental and Localized Computations," *Presence-Teleoperators and Virtual Environments*, 12(3), June 2003.
- Kum, H.-C., D. Duncan, K. Flair, and W. Wang. "Social welfare program administration and evaluation and policy analysis using knowledge discovery and data mining (KDD) on administrative data," *Proc. NSF National Conference on Digital Government Research (DG.O)*, 2003, 39-44.
- Kum, H.-C., J. Pei, W. Wang, and D. Duncan. "ApproxMAP: Approximate Mining of Consensus Sequential Patterns," *Proc. 3rd SIAM International Conference on Data Mining (SDM)*, 2003, 311-315.
- Le, L., J. Aikat, K. Jeffay, and F.D. Smith. "The Effects of Active Queue Management on Web Performance," *Proc. ACM SIGCOMM*, August 2003, 265-276.
- Lok, B., S. Naik, M. C. Whitton and F. P. Brooks Jr. "Effects of Handling Real Objects and Avatar Fidelity on Cognitive Task Performance in Virtual Environments," *Proc. IEEE Virtual Reality*, 2003.
- Lok, B., S. Naik, M.C. Whitton, and F.P. Brooks, Jr. "Incorporating Dynamic Real Objects into Immersive Virtual Environments," *ACM Transactions on Graphics*, 22(3), 2003, 701.
- Low, K.-L., A. Ilie, G. Welch, and A. Lastra. "Combining Head-Mounted and Projector-Based Displays for Surgical Training," *Proc. IEEE Virtual Reality*, March 2003.
- Meehan, M., S. Razzaque, M.C. Whitton, and F.P. Brooks, Jr. "Effect of Latency on Presence in Stressful Environments," *Proc. IEEE Virtual Reality*, 2003.
- Otaduy, M.A., and M.C. Lin. "CLODs: Dual Hierarchies for Multiresolution Collision Detection," *Proc. ACM/Eurographics Symposium on Digital Geometry Processing*, 2003.
- Otaduy, M.A., and M.C. Lin. "Sensation Preserving Simplification for Haptic Rendering," *Proc. ACM SIGGRAPH/ACM Transactions on Graphics*, 2003.
- Plaisted, D.A., A. Biere, and Y. Zhu. "A Satisfiability Procedure for Quantified Boolean Formulae," *Discrete Applied Mathematics*, 130, 2003, 291-328.
- Plaisted, D.A., and A. Yahya. "A Relevance Restriction Strategy for Automated Deduction," *Artificial Intelligence*, 144, 2003, 59-93.
- Prakash, R., S. Washburn, R. Superfine, R. E. Cheney and M. Falvo. "Visualization of individual carbon nanotubes with fluorescence microscopy using conventional fluorophores," *Applied Physics Letters*, 83, 2003, 1219-1221.
- Salomon, B., M. Garber, M.C. Lin, and D. Manocha. "Interactive Navigation in Complex Environments Using Path Planning," *Proc. ACM SIGGRAPH Symposium on Interactive 3D Graphics*, 2003.
- Sonnenwald, D. H., M. C. Whitton and K. L. Maglaughlin. "Evaluating a scientific laboratory: Results of a controlled experiment," *ACM Transactions on Computer Human Interaction*, 10(2), 2003, 150-176.
- Srinivasan, A., P. Holman, J. Anderson, and S. Baruah. "The Case for Fair Multiprocessor Scheduling," *Proc. 11th International Workshop on Parallel and Distributed Real-Time Systems*, April 2003. (On CD-ROM)
- Srinivasan, A., P. Holman, J. Anderson, S. Baruah, and J. Kaur. "Multiprocessor Scheduling in Processor-based Router Platforms: Issues and Ideas," *Proc. Second Workshop on Network Processors*, February 2003, 48-62.
- Van Dam, A., H. Fuchs, S. Becker, L. Holden, A. Ilie, K.-L. Low, A.M. Spalter, R. Yang, and G. Welch. "Immersive Electronic Books for Teaching Surgical Procedures," *Pre-ICAT CREST Symposium on Telecommunication, Teleimmersion, and Telexistence*, December 2002.

Varadhan, G., S. Krishnan, Y.J. Kim, S. Diggavi, and D. Manocha. "Efficient Max-Norm Distance Computation and Reliable Voxelization," *Proc. ACM/Eurographics Workshop on Digital Geometry Processing*, 2003.

Ward, K., and M.C. Lin. "Adaptive Grouping and Subdivision for Simulating Hair Dynamics," *Proc. Pacific Graphics*, 2003.

Weigle, M.C., K. Jeffay, and F.D. Smith. "Quantifying the Effects of Recent Protocol Improvements to Standards-Track TCP," *Proc. 11th IEEE/ACM International Symposium on Modeling, Analysis, and Simulation of Computer and Telecommunication Systems (MASCOTS)*, October 2003, 226-229.

Williams, P., S. J. Papadakis, A. Patel, M. Falvo, S. Washburn and R. Superfine. "Fabrication of Nanometer scale Mechanical Devices Incorporating Individual Multiwalled Carbon Nanotubes as Torsional Springs," *Applied Physics Letters*, 82, 2003, 805.

Wilson, A., and D. Manocha. "Rendering Acceleration using Incremental Textured Depth Meshes," *Proc. ACM SIGGRAPH/ACM Transactions on Graphics*, 2003.

Yang, J., W. Wang, and P. Yu. "Mining asynchronous periodic patterns in time series data," *IEEE Transactions on Knowledge and Data Engineering (TKDE)*, 15(3), 2003, 613-628.

Yang, J., W. Wang, and P. Yu. "STAMP: discovery of statistically important pattern repeats in a long sequence," *Proc. 3rd SIAM International Conference on Data Mining (SDM)*, 2003, 224-238.

Yang, R., M. Pollefeys, and G. Welch. "Dealing with Textureless Regions and Specular Highlights—A Progressive Space Carving Scheme Using a Novel Photo-consistency Measure," *9th International Conference on Computer Vision*, October 2003.

UNC-MIDAG contribute 15 papers at premier international conference in medical image computing

The UNC Medical Image Display and Analysis Group (MIDAG) had 15 papers accepted for presentation and publication at the conference on Medical Image Computing & Computer-Assisted Intervention (MICCAI), the premier annual conference in medical image computing, in November 2003. MIDAG, which also contributed to two tutorials at MICCAI 2003, had 83% of its submissions accepted, as compared to a 37% acceptance rate for all conference submissions. Four of the 49 papers to be orally presented at MICCAI came from MIDAG, a number exceeded by no other university in the world. Two of the first authors of these 4 papers are undergraduates who have been studying at UNC, and the other two did the research reported in their paper as graduate students at UNC. MIDAG is a research group of approximately 100 faculty, students, and staff across 11 UNC departments, in the School of Medicine, College of Arts & Sciences, and School of Public Health.

The MIDAG papers presented at MICCAI cover such areas as

- the description of brain structures in relation to mental illnesses;
- extracting brain tumors from images, measuring them, and diagnosing their malignancy via blood vessel shape;
- extraction of blood vessels and using them to diagnose retinal and brain disease; aids to minimally invasive surgery and radiotherapy.

Bullitt, E., G. Gerig, S. Aylward, S. Joshi, K. Smith, M. Ewend, and W. Lin, "Vascular Attributes and Malignant Brain Tumors."

Chillet, D., J. Jomier, D. Cool, and S. Aylward, "Vascular Atlas Formation Using a Vessel-to-Image Affine Registration Method."

Cool, D., D. Chillet, J. Kim, J-P. Guyon, M. Foskey, and S. Aylward, "Tissue-Based Affine Registration of Brain Images to form a Vascular Density Atlas."

Crouch, J., S. Pizer, E. Chaney, M. Zaider, "Medially Based Meshing with Finite Element Analysis of Prostate Deformation."

Fillard, P. and G. Gerig, "Analysis Tool For Diffusion Tensor MRI."

Fillard, P., J. Gilmore, W. Lin, G. Gerig, "Quantitative Analysis of White Matter Fiber Properties along Geodesic Paths."

Fridman, Y., S. Pizer, S. Aylward, and E. Bullitt, "Segmenting 3D Branching Tubular Structures using Cores."

Gerig, G., K. Muller, E. Kistner, Y.Y. Chi, M. Chakos, M. Styner, J. Lieberman, "Age and treatment related local hippocampal changes in schizophrenia explained by a novel shape analysis method."

Gerig, G., M. Prastawa, W. Lin and J. Gilmore, "Assessing Early Brain Development in Neonates by Segmentation of High-Resolution 3T MRI."

Guyon, J-P, M. Foskey, J. Kim, Z. Firat, B. Davis, and S. Aylward, "VETOT, Volume Estimation and Tracking Over Time: Framework and Validation."

Jolly, B., M. Van Horn, S. Aylward, E. Bullitt, "Needle Detection and Tracking in the TIPS Endovascular Procedure."

Jomier, J., D. Wallace, S. Aylward, "Quantification of Retinopathy of Prematurity via Vessel Segmentation."

Prastawa, M., E. Bullitt, S. Ho, and G. Gerig, "Robust Estimation for Brain Tumor Segmentation."

Styner, M., J. Lieberman, and G. Gerig, "Boundary and Medial Shape Analysis of the Hippocampus in Schizophrenia."

Vetsa, Y., M. Styner, S. Pizer, J. Lieberman, and G. Gerig, "Caudate Shape discrimination in Schizophrenia using Template-free non-parametric tests."

International Journal of Computer Vision Special issue on UNC-MIDAG research November/December 2003, 55(2/3)

Pizer, S. Guest Editorial – "Medial & Medical: A Good Match for Image Analysis," 79-84.

Pizer, S., P.T. Fletcher, S. Joshi, A. Thall, Z. Chen, Y. Fridman, D. Fritsch, G. Gash, J. Glotzer, M. Jiroutek, C. Lu, K. Muller, G. Tracton, P. Yushkevich, E. Chaney. "Deformable M-reps for 3D Medical Image Segmentation," 85-106.

Styner, M., G. Gerig, S. Pizer, S. Joshi. "Automatic and Robust Computation of

3D Medial Models Incorporating Object Variability," 107-122.

Aylward, S., J. Jomier, S. Weeks, E. Bullitt. "Registration and Analysis of Vascular Image," 123-138.

Katz, R., S. Pizer. "Untangling the Blum Medial Axis Transform," 139-153.

Pizer, S., K. Siddiqi, G. Székely, J. Damon, S. Zucker. "Multiscale Medial Loci and their Properties," 155-179.

Dr. Stephen F. Weiss

Career highlights

B.S., Mathematics, 1966

Carnegie Institute of Technology
(now Carnegie Mellon University)

M.S., Computer Science, 1969

Cornell University

Ph.D., Computer Science, 1970

Cornell University

UNC career highlights:

Assistant professor, 1970-75

Associate professor, 1975-84

Professor, 1984-89

Professor and Chairman, 1989-2004

Department service:

Chairman, 1989-2004

Associate Chairman, 1981-87

Director of Graduate Studies, 1975-89

Summer Season Coordinator, 1981-90

Honors:

1997 NC Professor of the Year
(Carnegie Foundation for the
Advancement of Teaching and the
Council for the Advancement and
Support of Education)

1997 Board of Governors Award for
Teaching Excellence

1995 Computer Science Students
Association Teaching Award

1983 Tanner Award (University
Award for excellence in teaching)

Phi Kappa Phi

Tau Beta Pi



Left: University Day, October 1973 (photo by Mike Pique)

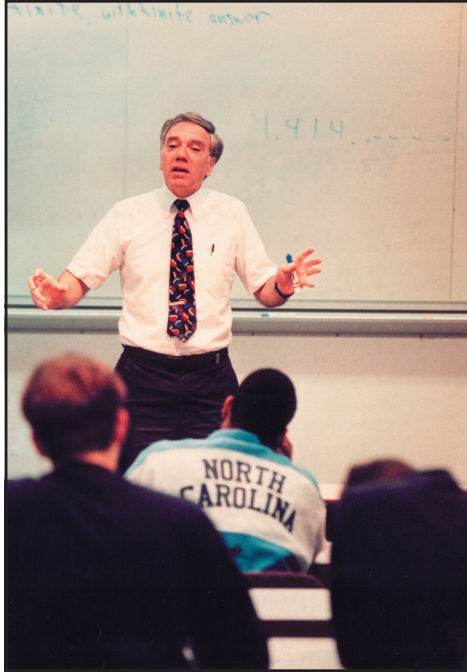
Right: Department commencement ceremony, May 1997
(photo by Sherry Palmer)



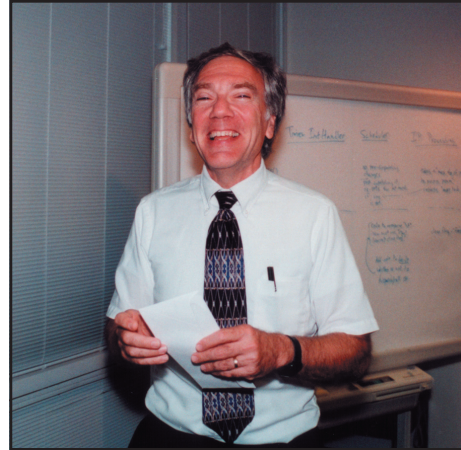
Retirement reception for Peter Calingaert, May 1995.
(photo by Li-Yun Yu)



Peter Calingaert, Martha Seaver, and Steve Weiss at
the May 1981 commencement.



Teaching a class in
Sitterson 014, 1997.
(photo by David Alford)



(photo by Todd Gaul, August 1998)

A message from Chancellor James Moeser:

“I’ve come to know and appreciate Steve Weiss for his service on several university committees. It’s the kind of unsung service that is vital to the well-being of our faculty, staff and students but that usually goes unnoticed. Steve, I noticed! Thank you for being a great university citizen.”

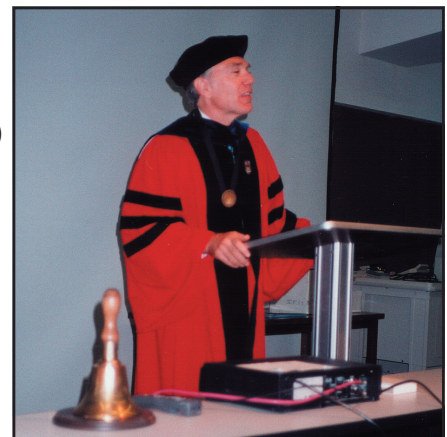


Steve's 50th birthday
party, March 1994
(photo by Carrie Stolle)



Ceremony to commission
SGI Reality Monster and
PixelFlow, March 1999
(photo by Todd Gaul)

With the bell -
Commencement 1999
(photo by Claire L. Stone)



Backbone motion by inverse kinematics for protein design

Andrew Leaver-Fay and Jack Snoeyink

Motivation

The problem of protein design is to construct an amino acid sequence that folds to a desired structure. Dr. Homme Hellinga at the Duke department of biochemistry has had significant success in designing receptor proteins, such as modifying ribose binding protein to recognize and bind to TNT [1]. He and his team start with a given protein, fix the backbone as a scaffold, and use Dead End Elimination (DEE) to search for sequence changes that will create desired structure in a binding pocket.

We (Dr. Jack Snoeyink, with Andrew Leaver-Fay, David O'Brien, and Kimberly Noonan) have been collaborating with Drs. Hellinga and David & Jane Richardson (Duke Biochemistry) to allow motion of the backbone in protein design. We use robotics techniques to develop general tools that can be applied to expand the space of rotamers that fit at a given position and allow DEE to find a sequence of amino acids that better accommodates the desired molecule – filling unoccupied space or allowing stabilizing hydrogen bonds. They can also be applied for specific motions, such as resolving structural defects in the TNT binding protein.

Motion By Loop Closure

We apply techniques from robotics for exact analysis of motions of small fragments of protein backbone. For a robot arm with 6 torsional degrees of freedom,

the inverse kinematics (IK) problem is to find the angles that will position the end of the arm in a desired position and orientations. Raghavan and Roth [2] reduced this to finding the real roots of a degree 16 polynomial. Dinesh Manocha [3] had turned this into a robust algorithm by casting it as an eigenvalue problem. We apply this to fragments of protein backbones that contain six ϕ and ψ dihedrals, which we treat as free variables, while keeping bond angle, bond lengths, and ω dihedrals fixed. The IK solver returns all real valued solutions (at most 16) that preserve the chain endpoints and orientations. This includes the original solution, plus alternate solutions, which usually must be discarded because of collisions with the surrounding structure. To generate motions near the original solution, we vary each of the other parameters, one by one, before calling the IK solver.

Motion Selection

With the large number of degrees of freedom, the number of feasible solutions can be overwhelmingly large, and the biological criteria for optimality are not always clear. There are several ways we can extract preferences and constraints from our collaborators. First, we can prefer motions within the standard deviations for what the biochemist call “ideal bond geometries” that move the backbone atoms conservatively ($< 0.2 \text{ \AA}$). Even such bond angle changes are effective in producing sizeable motions ($\sim 0.4 \text{ \AA}$) of the off-backbone C β carbon

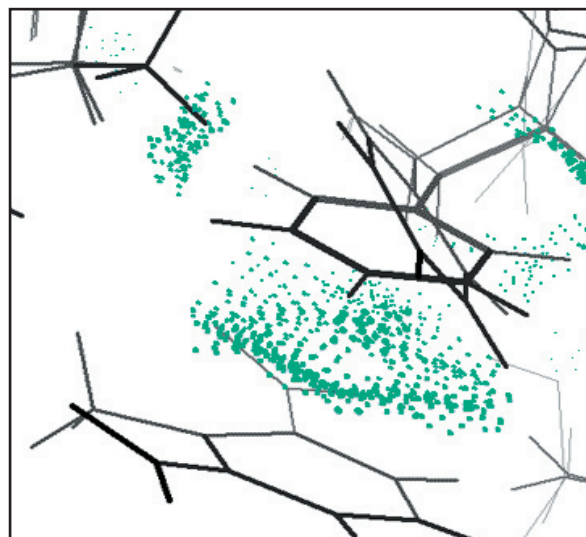
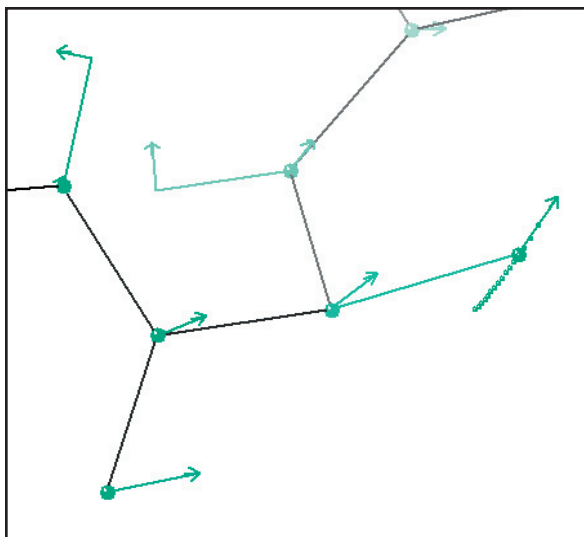
or carbonyl oxygens. Second, we can compute and display atomic motion derivatives with respect to a variable parameter, allowing the biochemists to look at several sets of derivative vectors and quickly determine if the corresponding motions are effective. Third, as we understand the relative importance of the geometric and energetic constraints, we can sample the parameters and filter the resulting configurations.

Extensions

Backbone modification also has a role in x-ray crystallography. Model creation from electron density maps is a tricky process. A poor fitting of the backbone can lead to poor, non-rotameric choices for side chains to fit the density. A tool for backbone motion can support better choices in model creation and refinement.

References

- [1] Looger, L. L., M. A. Dwyer, J. J. Smith, and H. W. Hellinga. “Computational design of receptor and sensor proteins with novel functions,” *Nature*, 423, 2003, 185-190.
- [2] Raghavan, M., and B. Roth. “Inverse kinematics of the general 6R manipulator and related linkages,” *Transactions of ASME, Journal of Mechanical Design*, 1992.
- [3] Manocha, D., and J. F. Canny. “Efficient inverse kinematics for general 6R manipulators,” *IEEE Journal on Robotics and Automation*, 1994, 648-657.



Dr. Daniel A. Reed named first Kenan Eminent Professor



Dr. Daniel A. Reed, one of the world's foremost leaders in high-performance computing and the key architect of many national computing initiatives, has been named the first Kenan Eminent Profes-


sor at Carolina, and will teach and conduct research in the Department of Computer Science. He also has been named director of the Institute for Renaissance Computing, a venture based at Carolina with strong collaborative ties to Duke and N.C. State, where Reed holds additional faculty appointments. The institute will explore the interactions of computing technology with the sciences, arts and humanities. It also will partner with business leaders to enhance the competitiveness of North

Carolina industries. A "Renaissance team" approach will bring scientists, engineers, artists and institute staff together to explore interdisciplinary approaches to scholarship, discovery and education.

Reed returns to Carolina from the University of Illinois at Urbana-Champaign, where he served in many roles over the past 20 years, including director of the National Center for Supercomputing Applications (NCSA), a 400-person research institute with a mission to develop computing infrastructure in support of scientific research.

The \$3 million Kenan Eminent Professorship, the largest endowed professorship in the university's history, is part of a \$27 million commitment to the Carolina First campaign from the William R. Kenan Jr. Charitable Trust.

Reed's work focuses on the design of very high-speed computers and on providing new computing capabilities for scholars in science, medicine, engineering and the humanities. He is a principal investigator for the National Science Foundation's TeraGrid project, an effort to build and deploy the world's largest, most comprehensive computing system for open scientific research.

Reed served as an assistant professor of computer science at Carolina in 1983-84. He joined the faculty at the University of Illinois at Urbana-Champaign in 1984 as an assistant professor of computer science and headed the department from 1996 to 2001. An Arkansas native, he received his doctorate in computer science in 1983 from Purdue University. He holds a master's in computer science from Purdue and a bachelor's in computer science from the University of Missouri at Rolla. 

National grant funds '3D telepresence technology' research

The National Library of Medicine recently awarded the Department of Computer Science a three-year, \$2.6 million contract to develop and test technology allowing 3D video of the patient and surroundings, with opportunity for medical professionals on-and off-site to communicate in real-time.

UNC computer science researchers are now developing a preliminary prototype for use in medical facilities. The research team plans to test its effectiveness by

exploring its use, compared to the use of two-dimensional (2D) teleconferencing, during tracheostomies being performed at UNC Hospitals.

"Tracheostomies do not take long but are critical procedures in many emergencies and have a degree of difficulty," said Dr. Henry Fuchs, the study's Principal Investigator and Federico Gil Professor of Computer Science.


"Airway obstruction is the leading cause of preventable death in situations where patients die en-route to the hospital," said Dr. Bruce Cairns, Co-Principal Investigator on the study, Research Director in the NC Jaycee Burn Center and Assistant Professor of Surgery in the UNC School of Medicine. "Testing this technology in an acute situation allows us to assess the hypotheses regarding the capture of these procedures and determine whether we can effectively bring the consultant to the bedside and the bedside to the consultant."

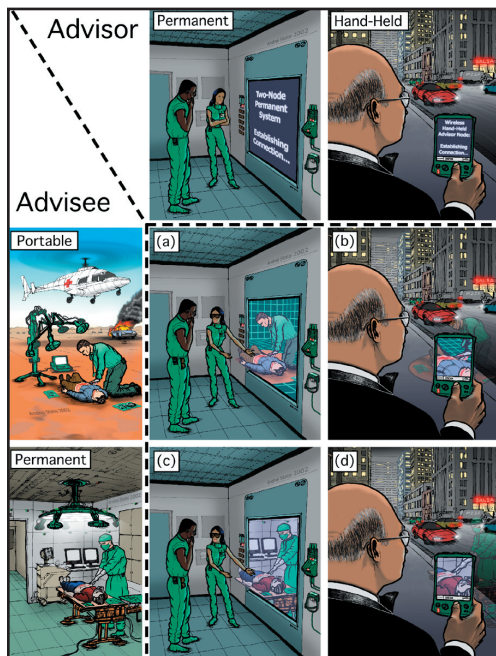
Fuchs said the idea behind the grant originated two years ago, when the team of investigators sent a proposal to the National Library of Medicine to study how high-speed mobile networks could improve health-care management. Two-dimensional teleconferencing, or telemedicine, is being done but

does not allow full enough immersion into an emergency scenario, he said.

"What we wanted to explore was how to make that link significantly stronger in an emergency," he added. "We hope that ultimately this 3D technology will prove helpful not just in immediate treatment but in the ride in the ambulance to a medical facility, so that an EMT alone with a patient during that ride will not feel so alone."

The technical questions involved in extending telepresence are substantial, but the need for such advances is intuitively obvious, Cairns said. "If you could use technology to cross geographical barriers, you could extend opportunity to people who live in rural or remote areas. We believe people should be able to get the very best care they can get and not have their access to specialized acute care limited by where they live."

The other Co-Principal Investigators on the National Library of Medicine project are Dr. Ketan Mayer-Patel, Assistant Professor, and Dr. Greg Welch, Research Associate Professor, both of UNC's Department of Computer Science; and Dr. Diane Sonnenwald, Professor, Göteborg University and University College of Borås, Sweden. Additional collaborators include Dr. Anthony Meyer, Professor and Chair Department of Surgery; Dr. Eugene Freid, Associate Professor of Anesthesiology and Pediatrics and Dr. Robert Vissers, Assistant Professor of Emergency Medicine. 



M.S. AND PH.D. ALUMNI

Ronald Azuma (Ph.D. 1995) was an invited attendee to the National Academy of Engineering's 9th Frontiers of Engineering Symposium, held Sept. 18-20, 2003, in Irvine, Calif. He presented the following paper: Azuma, R., and C. Furmanski. "Evaluating Label Placement for Augmented Reality View Management," Proc. IEEE and ACM Int'l Symp. on Mixed and Augmented Reality (ISMAR 2003) (Tokyo, 7-10 Oct. 2003), pp. 66-75. (azuma@HRL.com)

Sam Black (M.S. 1996) has been named chairman of the SIGGRAPH 2005 Computer Animation Festival. (penguin@mahasamatman.com)

Reid Christenberry (M.S. 1975) became Miami University's first vice president for information technology on April 1, 2003. Miami, ranked in the top 14 public universities in the recent US News and World Report and located in Oxford, Ohio, created this position to emphasize the important success factor that information technology has become to higher education. Christenberry was selected from a national search as Miami's top candidate. He and his wife, Karen, moved to Oxford in July from his previous position as Associate Provost and CIO of Georgia State University. (chrisjr@muohio.edu)

A publication for **Geoff Frank** (Ph.D. 1979) and **Randy Brown** (M.S. 1990): Frank, G., B. Whiteford, R. Brown, G. Cooper, N. Evens, and K. Merino. "Web-Delivered Simulations for Lifelong Learning" in the "Interservice/Industry Training, Simulation and Education Conference," December 1-4, 2003, Orlando, Fla. Conference information at <http://www.iitsec.org> (gaff@rti.org, rbrown@rti.org)

Lenwood S. Heath (Ph.D. 1985) has been promoted to full professor in the Department of Computer Science at Virginia Tech. (beath@vt.edu, <http://people.cs.vt.edu/~beath/>)

Lee Nackman (Ph.D. 1982) has been named Chief Technology Officer and VP of Desktop Tool Products for Rational Software, a division of IBM's Software Group. Lee, his wife Ava, and two sons Joel and Sam continue to live in Chapel Hill and would love to hear from friends. Their other big news is that their daughter Rachel has gone off to college at Tufts University in Boston. Lee says, "Boy, does that make us feel 'mature!'" (lee@nackman.com, ava@nackman.com)

Ramesh Raskar (Ph.D. 2002) was named recipient of Global Indus Technovators Award (one of top 20 young Indian researchers worldwide from more than 150 nominations from 15 countries) by the Indian Business Club at MIT. Ramesh is a research scientist at MERL Research Lab, Cambridge, Mass. (raskar@merl.com)

Ray Van Dyke (M.S. 1989, J.D. 1990) continues to lecture on technology and law, last year at conferences in New York, London, Atlanta, Boston, Washington and San Francisco on topics in nanotechnology, bioinformatics, patent damages, trademarks and business method patents. He taught a course in international IP law at American University (Fall 2003), where he is an Adj. Prof., and is also an Adj. Prof. at Southern Methodist University's Computer Engineering Department in Dallas. He continues his technology, IP, litigation and regulatory practice in Nixon Peabody's Washington, DC office, where he is a partner, and is active in numerous IP associations. He is working on a book on the law of emerging technologies, such as proteomics. (nandyke@acm.org)

UNDERGRADUATE ALUMNI

Wally Dietrich (B.S. M.Sci. 1979) was recently promoted to Senior Technical Staff Member in IBM Global Services. Wally's responsibilities include architecture and design of Internet applications for businesses, and adoption of new technology by Global Services. He was elected for IEEE Senior Membership in 2002. Wally lives in Yorktown Heights, NY. (wallyd@us.ibm.com)

Phil Fittante (B.S. M.Sci. 1987) was recently promoted to the rank of Lieutenant Colonel in the United States Air Force. He currently serves as a test pilot at Holloman Air Force Base in New Mexico. His first novel, Spirit Flight, was recently released for national publication by Salvo Press (www.salvopress.com). Spirit Flight is an

aviation thriller that soars from the desert realm of test pilots, to the coastal Carolina birthplace of aviation and ultimately, on a perilous mission into the heart of North Korea. (pfittante@charter.net)

Harry Halpin (B.S. M.Sci. 2001) received a Master of Science with Distinction in Informatics Degree from the University of Edinburgh, which was funded by a scholarship from St. Andrew's Society. His Masters thesis won the "Outstanding Project Prize." He will be completing his Ph.D. in Informatics at the University of Edinburgh fully funded by an ORS/ICCS scholarship under Henry Thompson of the W3C. (hhalpin@ibiblio.org)

Patsy Schwegman Kerkoulas (B.S. M.Sci. 1984) was promoted to data specialist in information systems data administration at Memorial Sloan-Kettering Cancer Center. She also published "Eight Days a Week" on time management in donkey training in The Brayer, published by the American Donkey and Mule Society, September 2003, pp. 86-90. (kerkoulp@MSKCC.ORG)

Cynthia (Kiki) Pettit (B.S. M.Sci. 1995) was a team member on the Junkyard Megawars episode "Combat Harvesters" on September 17, 2003, on The Learning Channel (TLC). Currently she's working as a metal sculptor making water fountains on fire (<http://burningideas.com>) and is also teaching 3D graphics (lighting and texture) at the Academy of Art College in San Francisco. (kiki@kiki.org)

Bruce Tindall (B.S. M.Sci. 1977) is teaching writing at Richland College in Dallas, Texas. His poems (including one entitled "I Am Passed Over For The Directorship of the Software Systems Department") have recently appeared in such literary magazines as the Southern Poetry Review, Atlanta Review, and West Branch. (tindall@panix.com)



Left to right: Joe Marks, MERL director, and Dean Kamen, Segway inventor, are pictured with **Ramesh Raskar** (Ph.D. 2002) following his receipt of the Global Indus Technovators Award. (See Ramesh's alumni news note above.) (photo courtesy Ramesh Raskar)



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EDITOR

KELLI GASKILL
gaskill@cs.unc.edu

DEPARTMENT OF COMPUTER SCIENCE
COLLEGE OF ARTS & SCIENCES
THE UNIVERSITY OF NORTH CAROLINA
CB# 3175, SITTERSON HALL
CHAPEL HILL, NC 27599-3175

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Research highlights (continued)

Haptic rendering using sensation preserving simplification

Haptic rendering, or force display, is emerging as an alternative form or an augmentation for information presentation, in addition to visual and auditory rendering. The sense of touch is one of the most important sensory channels, yet it is relatively poorly understood as a form of human-machine interface. Coupled with graphical rendering, force feedback can enhance the user's ability to interact intuitively with complex synthetic environments and increase the sense of presence in exploring virtual worlds.

The first step in displaying force and torque between two 3D virtual objects is collision query and contact handling. Collision detection has been well studied, and many practical techniques and theoretical advances have been developed. Yet, despite the huge body of literature in this area, the existing algorithms cannot run at the desired force update rates (at least hundreds of Hz but preferably several kHz) for haptic rendering of complex models.

This is mainly due to the fact that the optimal running time of any collision detection algorithm intrinsically depends on both the input and output sizes of the problem. Those in turn depend on both the combinatorial complexity and the contact configuration of the objects involved in the queries. While it is possible to render millions of polygons at interactive rates today, it is challenging to create a force display of an environment consisting of merely tens of thousands of polygons at the desired update rates.

Miguel Otaduy and Ming Lin have been working on addressing this computational

issue for haptic display of complex models. They have recently developed a novel "sensation preserving simplification" algorithm for faster collision queries between two polyhedral objects in haptic rendering. Given a polyhedral model, their algorithm constructs a multiresolution representation, subject to constraints imposed by collision detection. The resulting hierarchical representation is then used to compute fast contact response for haptic display. This computation model is inspired by human tactual perception of contact information.

Their algorithm has been successfully applied and demonstrated on a time-critical collision query framework for haptically displaying complex object-object interaction (see various scenarios below).



Figure 9: Benchmark Models. From left to right, moving upper and lower jaws, interlocking ball joints and interacting golf club and ball.

Compared to existing exact contact query algorithms, their approach has been able to achieve up to two orders of magnitude performance improvement in update rates, with little degradation in the haptic perception of contacts.

This work was published in the ACM Transactions on Computer Graphics (Proceedings of ACM SIGGRAPH 2003). It is supported in parts by ARO, Intel, NSF and ONR, as well as a fellowship by the Government of Basque Country. For more detail, please refer to the project Web site: <http://gamma.cs.unc.edu/LODHaptics>



Left to right: Jack Snoeyink, Tammy Pike and Andrea Mantler show off their Halloween attire! (photo: Kelli Gaskill)