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Russell M. Taylor II

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Main Academic Interests:

Studying, designing and building user interfaces and analysis for microscopy and scientific instrumentation. Teaching scientific visualization. Virtual environments. Distributed systems. Computer Graphics.

Education:

Program for Technology Managers, Kenan-Flagler School of Business Administration, University of North Carolina – Chapel Hill (Spring 2000).

Ph.D. Computer Science, **University of North Carolina at Chapel Hill** (May 1994)
"The Nanomanipulator: A Virtual-Reality interface to a Scanning Tunneling Microscope", under F.P. Brooks, Jr.

M.S. Computer Science, **University of North Carolina at Chapel Hill** (May 1991)

B.S. Mathematics with highest honors, **UNC, Chapel Hill** (May, 1989)

Experience:

VP of Technology Systems, Rheomics, Inc.: December 2010-present

A company developing microscopy systems for the measurement of (passive and active) microbead rheology for application to research and diagnostic measurement. Member of the Board of Directors. Responsible for overseeing user-interface, control, and analysis development.

Independent Consulting: Continuing

Open-source virtual-reality library architecture and implementation: Sensics (OSVR, named CES "best of show" by Popular Science). Multi-camera predictive image transmission, user-interface design, software engineering for multi-camera sports video broadcast: Aqueti. Virtual-reality device driver development: Schlumberger Cambridge Research. Disney VR Studios for application in location-based entertainment and amusement-park attractions. Eyes-free application for submillimeter calibration of motor mounts using 3D optical tracking technology, Kistler/3rdTech. Nanotechnology advisory board, NCSU scale and scaling education project. Force-feedback molecular docking simulator, Wright-Patterson AFB.

Research Professor of Computer Science, Physics & Astronomy, and Applied Physical Sciences:
UNC Chapel Hill. July 2006-January 2015

Director, Biomedical Analysis and Simulation Supercomputer. Co-Director (with Richard Superfine), Nanoscale Science Research Group (NSRG). Laid out research plan, obtained funding. Advised graduate and undergraduate students. Designed "Visualization in the Sciences" course (annual course for computer science and natural science graduate students); course materials used at UNC Wilmington, NC A&T, Duke.

VP of Systems, Megawatt Solar, Inc.: April 2007-August 2009

A company developing utility-scale concentrated solar power solutions. Member of the Board of Directors (through December 2007). Responsible for overseeing tracking and control system architecture. Developed closed-loop maximum-power-yield tracking algorithms.

Chairman of the Board: NanoManipulator, Incorporated. Spring 2000-2013

A company that sells and supports a commercial version of the nanoManipulator system developed by our NIH National Research Resource, winner of an R&D magazine R&D 100 award for 2001, which recognizes "the 100 most technologically significant new products of the year."

Visiting Professor, Faculty of Informatics: University of Hamburg, Germany April-July 2004
Taught course on *Visualization and Nanomanipulation*. Supervised student team developing analysis algorithms for nanomanipulation.

Research Associate Professor of CS, P&A, CAMS: UNC Chapel Hill. Spring 2000-June 2006

Research Assistant Professor of Computer Science: UNC Chapel Hill. Fall 1994-Spring 2000

Software Engineer: Division, Inc. Spring 1994-Fall 1994

Team Leader: Nanomanipulator project (UNC) Fall 1991-Spring 1994

Honors and Awards:

UNC Inventor of the Year Award (2014)
White House/Smithsonian Millennium Celebration Panelist (2000)
UNC Computer Science Students Association Teaching Award (Spring 2007)
NSF CISE Postdoctoral Research Associate (1995-1997)
1993/94 Alumni Fellowship, Department of Computer Science
Merit Assistantship, University of North Carolina at Chapel Hill (1989/90)
Phi Beta Kappa National Honor Society (inducted Junior year)
Pi Mu Epsilon National Mathematical Honor Society
James M. Johnston Scholarship (Undergraduate)

Funding: $10.2M as PI, $42.5M total.

NIH R21CA179204: "Quantitative Motility Phenotyping of Basal Breast Cancer in a 3D Microenvironment," $185K, 2014-2015. Co-PI.

NIH SBIR 1R43HL110556-01A1: "Triple Analysis of Blood Clotting using Driven and Diffusing Microbeads," $481K, 2012-2014. Senior Personnel.

NSF-REU 1156614: "The UNC CAP (Computational Astronomy and Physics) Program: UNCCAPing Enthusiasm for Computational Careers," $382K, 2012-2016. Co-PI.

NIH 5-P41-EB002025-27: "Computer-Integrated Systems for Microscopy and Manipulation," $5.6M, 2010-14. Co-PI.

NAT Cancer 1R33CA155618: "Array Microscope Assay for Cancer Cell Mechanics," $322K, 2011-14. Co-PI.

NIH-RO1HL105241: "Predictive Modeling for Treatment of Upper Airway Obstruction in Young Children," $3.6M, 2010-2014. Co-PI.

Molecular Devices: "Evaluating Clarity deconvolution performance," $4K, 2013. PI.

Sandia National Laboratories: "Scalable Statistical Visualization Components," $160K, 2012-2013. PI.

NLM ARRA: "Adding Deconvolution Algorithms to ITK," $150K, 2010. Co-PI.

Sandia National Laboratories: "Scalable Statistical Visualization Components," $356K, 2009-2011. PI.

NSF CDI-0941373: "From Models and Data to Knowledge and Understanding," $1.8M 2009-2014. Senior Personnel, then Co-PI.

NSF CNS-0751187: "CRI:IAD Integrated Projector-Camera Modules for the Capture and Creation of Wide-Area Immersive Experiences." $373K, 2008-2011. Senior Personnel.

NSF DMR 0817489: "Development of the Multiscope: An array microscope for high throughput microliter rheology," $443K. 2008-2010. Co-PI.

UNC Radiology NC TraC Pilot Program: "Clinical Biomarkers Based on Magnetic Resonance Spectroscopy Atlases," $10K, 2009-2010. Co-PI.

NIH 1S10RR023069-01: "Supercomputer Instrumentation for Biomedical Image Analysis and Simulation," $1.9M, 2007-2009. PI.

NC Museum of Life and Science: "Two Haptic Interactives: Shaky, Sticky, Bumpy & Nanoscale Materials Stretching," $22.5K, 2007, Co-PI.

NIH 5-P41-RR02170-21: "Computer-Integrated Systems for Microscopy and Manipulation," $4.5M, 2005-9. Co-PI.

NSF NER: "Modeling and Simulation of Fibrin Fibers," $100K, 2004-5. Co-PI.

Keck Foundation: "AIMS: Atomic Imaging and Manipulation System," $1M, 2001. Co-PI.

NIH 5-P41-RR02170-18: "Interactive Graphics for Molecular Studies & Microscopy," $3.6M, 2001-4. PI.

NSF ROLE: "Investigating Viruses With Touch: Nanotechnology and Science Inquiry," $821K, 2001-3. Co-PI.

NSF ITR: "Rate-Based Scheduling Technology for Latency-Sensitive Graphics Applications," $350K, 2000-3. Co-PI.

NSF ECS: "Biomolecular Motor/Nanotube integration for actuating nanotechnology," $1.1M, 2000-3. Co-PI.

ONR MURI: "Science and Technology of Nanotube-based Materials and Devices," $5.6M, 1998-2003. Co-PI.

NIH 5-P41-RR02170: "Interactive Graphics For Molecular Studies and Microscopy," $4.4M, 1995-2001. Co-PI.

NIH 3-P41-RR02170-15S1: Interactive Graphics for Molecular Studies & Microscopy- Supplement for Col-laboratory," $1.9M, 1998-2001. PI.

NSF ASC-9527192: "Application of High-Performance Graphics Supercomputers and Communication to Provide Improved Interfaces to Scanning Probe Microscopes," $2.3M, 1995-2000. PI.

NSF ASC-9527192-005: "Application of High-Performance Graphics Supercomputers and Communication to Provide Improved Interfaces to Scanning Probe Microscopes – Supplement for Haptic Display," $9.4K, 2000. PI.

ARO DURIP: "Acquisition and Development of a Unique SEM/AFM Analytical System," $330K, 1999-2000. Co-PI.

ARO DURIP DAAG55-98-1-0133: "The nanoLaboratory: An integrated manipulation/microscopy system for the nanometer scale", $250K, 1998-1999. Co-PI.

NSF DMR-9512431: "Development of the Nanomanipulator: A Real-Time Scanning Probe Microscope Interface for Nanometer Science," total (including matching) of $500k for 1995-1997. Co-PI.

Intellectual Property:

Russell Morton Taylor II, Chong Shao, Alfred Zhong, and Ketan Mayer-Patel. METHODS, SYSTEMS, AND COMPUTER READABLE MEDIA FOR COMPRESSING VIDEO IMAGES, U.S. Provisional patent application. 2014.

Russell M. Taylor II, J. Adam Crain, Charles Evans, U.S. patent no. 8178775 for "Methods, systems, and computer readable media for controlling orientation of a photovoltaic collection system to track apparent movement of the sun", issued May 15, 2012 (assigned to Megawatt Solar).

David Borland, John Clarke, Russell M. Taylor II, U.S. Patent 8,150,111, "Methods, Systems, and Computer program products for processing three-dimensional image data to render an image from a viewpoint within or beyond an occluding region of the image data," issued April 3, 2012 (licensed to Siemens).

David Borland, John P. Clarke, Russell M. Taylor II, U.S. Patent 7,961,187, "Methods, Systems, and Computer readable media for flexible occlusion rendering", issued June 14, 2011 (licensed to Siemens).

J. Chris Clemens, Charles Evans, Daniel Gregory, Russell M. Taylor II, U.S. patent no. 7875796, "Reflector assemblies, systems, and methods for collecting solar radiation for photovoltaic electricity generation", issued 1/25/2011 (assigned to Megawatt Solar).

Brian Eastwood and Russell M. Taylor II, "Methods, Systems, and Computer-Readable Media for Microscopy Tracking," Provisional patent application docket #421/252. 2010.

Kalpit Desai, Thomas G. Bishop, Leandra Vicci, Russell M. Taylor II, Richard Superfine, "Agnostic tracking". Provisional patent application 421/202. 2007.

James Clemens, Charles Evans, Russell Taylor, "Triple-junction silicon concentrated solar collector," Invention disclosure OTD05-143, November 1, 2005 (licensed to Megawatt Solar).

Taylor II, Russell M., "A method for rendering non-polygonal surfaces on programmable graphics hardware," Provisional patent application made on February 20, 2004.

Book Sections:

Russell M. Taylor II and Kerry Bloom, "Intersecting Art and Computer Graphics," in Visual Strategies by Felice Frankel and Angela H. DePace. ISBN 978-0-300-17644-5. pp. 102-107. 2012.

E. Tim O'Brien, Jeremy Cribb, David Marshburn, Russell M. Taylor II, Richard Superfine, "Magnetic Manipulation for Force Measurements in Cell Biology," Chapter 16 in *Methods in Cell Biology*. Elsevier. pp. 433-450. 2008.

Wen Qi, Russell M. Taylor II, Chris Healey, Jean-Bernard Martens, "3D Interaction with Scientific Data through Virtual Reality and Tangible Interfacing," in User Centered Design for Medical Visualization. Idea Group Publishing. ISBN: 978-1-59904-777-5, May 2008.

Russell M. Taylor II. "Haptics for Scientific Visualization," in Haptic Rendering: Foundations, Algorithms, and Applications, A.K. Peters. Ming Lin and Miguel Otaduy, editors. 2008.

J. K. Fisher, L. Vicci, K. Bloom, E. Timothy O'Brien, C.W. Davis, R. M. Taylor, II, R. Superfine, "Magnetic Manipulation for the Biomedical Sciences," in the Handbook of Nanoscale Science, Engineering, and Technology, Second Edition. Taylor and Francis. 2007.

Taylor II, R. M., D. Borland, F. P. Brooks Jr., M. Falvo, M. Guthold, T. Hudson, K. Jeffay, G. Jones, D. Marshburn, S. J. Papadakis, L.-C. Qin, A. Seeger, F. D. Smith, D. H. Sonnenwald, R. Superfine, S. Washburn, C. Weigle, M. C. Whitton, P. Williams, L. Vicci and W. Robinett. "Visualization and Natural Control Systems for Microscopy." In: Visualization Handbook; Edited by C. Johnson and C. Hansen. Harcourt Academic Press. 2004. pp. 875-900.

Jones, G., A. Bokinski, T. Tretter, A. Negishi, D. Kubasko, R. Superfine and R. M. Taylor II, "Atomic force microscopy with touch: Educational applications," in: Science, Technology and Education of Microscopy: an Overview. A. Mendez-Vilas. Madrid, Spain, Formatex. 2003.

R. Superfine, M. Falvo, R. M. Taylor II, S. Washburn, "Nanomanipulation: Buckling, Transport and Rolling at the Nanoscale," in CRC Handbook of Nanoscience, Engineering, and Technology. S. Lyshevski, D. Brenner, J. Lafrate and W. Goddard. Boca Raton, CRC Press LLC. 2002.

R.M. Taylor II and R. Superfine, "Advanced Interfaces to Scanning Probe Microscopes," in Handbook of Nanostructured Materials and Nanotechnology, H.S. Nalwa, Ed., (Academic Press, New York, 1999) Volume 2 (Spectroscopy and Theory), Chapter 5. pp. 271-308. (This handbook received the **1999 Award of Excellence in Engineering Handbooks** from the Association of American Publishers.)

Journal Articles and SIGGRAPH (* denotes most significant):

Cory Quammen, Oluwafemi Alabi, Hal Canary, Michael T. Keifer, Russell M. Taylor II, "Folding Fan Glyphs for Comparing Two Vector Fields," In preparation.

Chong Shao, Alfred Zhong, Jeremy Cribb, Lukas D. Osborne, E. Timothy O'Brien III, Richard Superfine, Ketan Mayer-Patel, Russell M. Taylor II, "Analysis-preserving video microscopy compression via correlation and mathematical morphology," In preparation, 2015.

Jeremy Cribb, Lukas Osborne, Joe Hsiao, Leandra Vicci, Alok Meshram, E. Tim O'Brien III, Russel Taylor, II, and Richard Superfine, "A High Throughput Array Microscope for the Mechanical Characterization of Biomaterials," Review of Scientific Instruments 86, 2015.

Robert M. Judith, Jay K. Fisher, Richard Chasen Spero, Briana L. Fiser, Adam Turner, Bruce Oberhardt, R.M. Taylor, Michael R. Falvo, and Richard Superfine, "Micro-elastometry on whole blood clots using actuated surface-attached posts (ASAPs)," Lab on a Chip, 10.1039/C4LC01478B, 2015.

Lihong Huang, Joe Ping-Lin Hsiao, Camilla Powierza, Russell M. Taylor II, and Susan T. Lord, "Does topology drive fibrin polymerization?" Biochemistry 53(49), pp. 7824-7834, 2014. doi: 10.1021/bi500986z.

Shawn Waldon, Patrick Hahn Russell M. Taylor II, "SketchBio: A Scientist's 3D Interface for Molecular Modeling and Animation," BMC Bioinformatics 15, pp. 334, 2014. doi:10.1186/1471-2105-15-334.

Russell M. Taylor II and Jonathan Harter, "Random Per-Element Luminance Modulation for Improved Visual Tracking," IEEE CG&A 34(6), pp. 83-87, 2014.

Hal Canary, Russell M. Taylor II, Cory Quammen, Scott Pratt, Facundo A. Gomez, Brian O'Shea, Christopher G. Healey, "Visualizing Likelihood Density Functions via Optimal Region Projection," Computers & Graphics, Volume 41, 2014, pp. 62-71.

Andrew D. Stephens, Cory W. Quammen, Binny Chang, Julian Haase, Russell M. Taylor II, Kerry Bloom (2013) "The spatial segregation of pericentric cohesin and condensin in the mitotic spindle" Mol. Biology of the Cell. 24(24), pp. 3909-3919.

Julian Haase, Prashant Mishra, Andrew Stephens, Rachel Haggerty, Cory Quammen, Russell Taylor, Elaine Yeh, Munira Basrai, Kerry S Bloom, "A 3D map of the yeast kinetochore reveals the presence of core and accessory centromere specific histone," Current Biology 23: 1939-1944. 2013.

* Andrew D. Stephens, Rachel A. Haggerty, Paula A. Vasquez, Leandra Vicci, Chloe E. Snider, Fu Shih, Cory Quammen, Christopher Mullins, Julian Haase, Russell M. Taylor II, Jolien S. Verdaasdonk, Michael R. Falvo, Yuan Jin, M. Gregory Forest, Kerry Bloom, "Pericentric Chromatin Loops Function as a Non-linear Spring in Mitotic Force Balance," *J. Cell Bio.*, 200 (6). pp. 757-772. 2013.

Steffen A. Bass, Hannah Petersen, Cory Quammen, Hal Canary, Christopher G. Healey and Russell M. Taylor II, "Probing the QCD Critical Point with Relativistic Heavy-Ion Collisions," Central European Journal of Physics. 10(6). pp. 1278-1281. 2012.

Jeffrey Caplan, Marc Niethammer, Russell M. Taylor II, Kirk J. Czymmek, "The Power of Correlative Microscopy: Multi-modal, Multi-scale, Multi-dimensional," *Current Opinion in Structural Biology*. 2011. PubMedID 21782417.

* Andrew D. Stephens, Julian Haase, Leandra Vicci, Russell M. Taylor II, and Kerry Bloom, "Cohesin, condensin, and the intramolecular centromere loop together generate the mitotic chromatin spring," *J. Cell Bio.* 193(7) (2011) pp. 1167-1180. PMC3216333. (Selected by a member of the Faculty of 1000, top 2% of published articles in biology and medicine.)

D. Fronczek, C. Quammen, H. Wang, C. Kisker, R. Superfine, R. Taylor, D.A. Erie, I. Tessmer, "High accuracy FIONA-AFM hybrid imaging," *Ultramicroscopy*, 111 (2011). pp. 350-355. PMC3179268.

David Feng, Yueh Lee, Lester Kwock, Russell Taylor, "Matching Visual Saliency to Confidence in Plots of Uncertain Data," TVCG, 16(6). 2010. pp. 980-989. PubMedID 20975135. PMCID: PMC3179257.

Nathan E. Hudson, John R. Houser, E. Timothy O'Brien III, Russell M. Taylor II, Richard Superfine, Susan T. Lord, and Michael R. Falvo, "Stiffening of Individual Fibrin Fibers Equitably Distributes Strain and Strengthens Networks," Biophysical Journal, Vol 98, April 2010. pp.1632-1640. PMC2856168.

* Russell M. Taylor II, Jason Jerald, Chris VanderKnyff, Jeremy Wendt, David Borland, David Marshburn, William R. Sherman, Mary C. Whitton, "Lessons about Virtual-Environment Software Systems from 20 years of VE building," *Presence*. Vol. 19, No. 2. pp. 163-178. 2010. PMC2887604.

Kalpit V. Desai, T. Gary Bishop, Leandra Vicci, E. Timothy O'Brien, Sr., Russell M. Taylor, II and Richard Superfine, "Agnostic Particle Tracking for Three-Dimensional Motion of Cellular Granules and Membrane-Tethered Bead Dynamics," *Biophysical Journal*, 94. pp. 2374-2384. 2008.

J.K. Fisher, L. Vicci, J. Cribb, E.T. O'Brien, R.M. Taylor II, R. Superfine, "Magnetic force micromanipulation systems for the biological sciences," *NANO* 1(3), 2006. pp. 1-16.

* Hirotoshi Matsui, Victoria E Wagner, David B Hill, Ute E Schwab, Troy D Rogers, Brian Button, Russell M Taylor, Richard Superfine, Barbara H Iglewski, Richard C Boucher, "A physical linkage between CF airway surface dehydration and *P. aeruginosa* biofilms," *PNAS* 103(48), 2006. pp. 18131-18136.

O. J. Sul, M. R. Falvo, R. M. Taylor, II, S. Washburn, and R. Superfine, "Thermally actuated untethered impact-driven locomotive microdevices," Applied Physics Letters 89(20), 2006. (3 pages)

* Fielding JR, Borland D, Lee KH, Clarke JP, Wallen E, Pruthi R, Taylor RM. "Virtual pyeloscopy using volumetric depth peeling." *Acad Radiol*, 13 (6). (June 2006) pp. 759-763.

Fisher, J.K., Cribb, J., Desai, K.V., Vicci, L., Wilde, B., Keller, K., Taylor II, R. M., Haase, J., Bloom, K., O'Brien, E. Timothy, and R. Superfine, "Thin-foil magnetic force system for high-numeric-aperture microscopy," *Review of Scientific Instruments* 77, February 2006. 9 pages.

Fisher, J., J. Cummings, K. V. Desai, L. Vicci, B. Wilde, K. Keller, C. Weigle, G. Bishop, R. M. Taylor II, C. W. Davis, R. Boucher, E. T. O'Brien and R. Superfine (2005). "Three-dimensional force microscope: A nanometric optical tracking and magnetic manipulation system for the biomedical sciences." *Review of Scientific Instruments* 76(5): 053711-053722. (11 pages.)

Mark Hollins, Florian Lorenz, Adam Seeger, Russell Taylor, "Factors Contributing to the Integration of Textural Qualities: Evidence from Virtual Surfaces," *Somatosensory and Motor Research*, 22 (3), September 2005. pp. 193-206.

C. Dwyer, L. Vicci, J. Poulton, R. Taylor, "DNA Self-assembled Parallel Computer Architectures", Nanotechnology, vol. 15, 2004. pp. 1688-94.

Mark Hollins, Adam Seeger, Gabriele Pelli, Russell Taylor, "Haptic perception of virtual surfaces: Scaling subjective qualities and interstimulus differences," *Perception*, vol. 33. pp. 1001-1019. 2004.

M. Guthold, W. Liu, B. Stephens, S. T. Lord, R. R. Handtgan, D. A. Erie, R. M. Taylor, and R. Superfine, "Visualization and Mechanical Manipulations of Individual Fibrin Fibers Suggest that Fiber Cross-Section has Fractal Dimension 1.3," *Biophysics Journal* 87 (6), December., 2004. pp. 4226-4236.

* Dwyer, C., Erie D., Superfine R., Washburn, S., L. Vicci, Taylor R., "The Design of DNA Self-Assembled Computing Circuitry," *IEEE Trans. on VLSI*, vol. 12, no. 11, 2004. pp. 1214-1220.

* Dwyer C., Taylor R., Vicci L., "Performance Simulation of Nanoscale Silicon Rod Field-Effect Transistor Logic", *IEEE Transactions on Nanotechnology*, 2 (2): 69-74, 2003.

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): 303-322. 2003.

Adam Seeger, Charalampos Fretzagias, Russell Taylor II, "Software Acceleration Techniques for the Simulation of Scanning Electron Microscope Images," *Scanning*, Vol. 25, (2003) pp. 264-273.

* Russell M. Taylor II, "Visualizing Multiple Scalar Fields on the Same Surface," *IEEE Computer Graphics and Applications*, 22(2), Mar-Apr 2002. pp. 6-10.

P.A. Williams, A.M. Patel, S.J. Papadakis, A. Seeger, R.M. Taylor II, A. Helser, M. Sinclair, M.R. Falvo, S. Washburn, R. Superfine, "Controlled placement of an individual carbon nanotube onto a MEMS structure" *Applied Physics Letters*, Vol. 80, No. 14 (2002) pp. 2574-2576.

M. Guthold, R. Superfine, and R.M. Taylor II, "The rules are changing: Force measurements on single molecules and how they relate to bulk kinetics." *Biomedical microdevices, bioMEMs and biomedical nanotechnology.* (eds. Lee S., Baker, J., Zhang, M.), Vol. 3 No. 1 (2001) pp. 9-18.

A. Seeger, S. Paulson, M. Falvo, A. Helser, R. M. Taylor II , R. Superfine, and S. Washburn. "Hands-on tools for nanotechnology" *Journal of Vacuum Science & Technology* Vol. B 19, (2001) pp. 2717-2722

Andre, T., Jones, M. G., Superfine, R., & Taylor, R. (2001). Helping teachers and students use advanced technology in teaching high school science: A preliminary feasibility study of the use of a WWW-controlled atomic force microscope in high school science. Technology and Teacher Education Annual, 3, 2510-2515.

M.R. Falvo, J. Steele, R. M. Taylor II, and R. Superfine, "Gearlike rolling motion mediated by commensurate contact: Carbon nanotubes on HOPG." *Physics Review B*, Vol. 62, (2000) pp. 10665-10667.

M.R. Falvo, J. Steele, R. M. Taylor II, and R. Superfine, "Evidence of commensurate contact and rolling motion: AFM manipulation studies of carbon nanotubes on HOPG," *Tribology letters*, Vol. 9, (2000) pp. 73-76

* S. Paulson, 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) pp. 1742-1744.

M. Guthold, M.R. Falvo, W.G Matthews, S. Paulson, S. Washburn, D. Erie, R. Superfine, F.P. Brooks, and R.M. Taylor II, "Controlled Manipulation of Molecular Samples with the nanoManipulator," *IEEE/ASME Transactions on Mechatronics*, Vol. 5, No. 2 (June 2000) pp. 189-198.

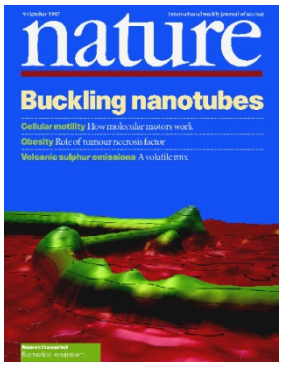
A. Gregory, M.C. Lin, S. Gottschalk and R.M. Taylor II, "Real-Time Collision Detection for Haptic Interaction Using a 3-DOF Force Feedback Device," *Computational Geometry*, Vol. 15 (2000) pp. 69-89.

M. Guthold, W.G. Matthews, A. Negishi, R.M. Taylor II, D.A. Erie, F.P. Brooks Jr, and R. Superfine, "Quantitative Manipulation of DNA and Viruses with the nanoManipulator Scanning Force Microscope," *Surf. Interf. Anal*. Vol. 27 (1999) pp. 437-443.

M. Guthold, M. Falvo, W.G. Matthews, S. Paulson, A. Negishi, S. Washburn, R. Superfine, F.P. Brooks Jr. and R.M. Taylor II, "Investigation and Modification of Molecular Structures Using the NanoManipulator." *Journal of Molecular Graphics & Modeling*, Vol. 17, No. 3, (1999) pp. 187-197.

M. Falvo, G. Clary, A. Helser, S. Paulson, R.M. Taylor II, V. Chi, F.P. Brooks Jr., S. Washburn, and R. Superfine, "Nanomanipulation Experiments Exploring Frictional and Mechanical Properties of Carbon Nanotubes," *Microscopy and Microanalysis*, Vol. 4, No.5 (1999) pp. 504-512.

S. Paulson, M.R. Falvo, N. Snider, A. Helser, T. Hudson, A. Seeger, R.M. Taylor II, R. Superfine and S. Washburn, "In situ resistance measurements of strained carbon nanotubes," *Applied Physics Letters*, Vol. 75, No. 19. (1999) pp. 2936-2938.



G.M. Jones, R. Superfine and R.M. Taylor II, "Learning on the Edge: Students Feeling Viruses," *Science Teacher*, Vol. 66, No. 7 (October 1999) pp. 48-50.

M.R. Falvo, G. Clary, A. Helser, S. Paulson, R.M. Taylor II, V. Chi, F.P. Brooks, Jr., S. Washburn, and R. Superfine. "Nanomanipulation Experiments Exploring Frictional and Mechanical Properties of Carbon Nanotubes." *Microscopy and Microanalysis*, Vol. 4, No. 5 (1999) pp. 504-512.

* M.R. Falvo, G.J. Clary, A. Helser, R.M. Taylor II, V. Chi, F.P. Brooks Jr., S. Washburn and R. Superfine. "Rolling and Sliding on the Nanometer Scale," *Nature*, Vol. 397, No. 6716 (1999) pp. 236-238.

* M.R. Falvo, G.J. Clary, R.M. Taylor II, V. Chi, F.P. Brooks Jr., S. Washburn and R. Superfine, "Bending and buckling of carbon nanotubes under large strain," *Nature*, Vol. 389, No. 6651 (October 9, 1997) pp. 582-584.

* W. Mark, S. Randolph, M. Finch, J. Van Verth and R.M. Taylor II, "Adding Force Feedback to Graphics Systems: Issues and Solutions," *Computer Graphics: Proceedings of SIGGRAPH '96*, (August 1996) pp. 447-452.

R.M. Taylor II, R.S. Williams, V.L. Chi, G. Bishop, J. Fletcher, W. Robinett and S. Washburn, "Nanowelding: Tip response during STM modification of Au surfaces," *Surface Science Letters*, Vol. 306, No. 1 and 2 (March 1994) pp. 534-538.

* R.M. Taylor II, W. Robinett, V.L. Chi, F.P. Brooks, Jr., W.V. Wright, R.S. Williams, and E.J. Snyder, "The Nanomanipulator: A Virtual-Reality Interface for a Scanning Tunneling Microscope," *Computer Graphics: Proceedings of SIGGRAPH '93*, (August 1993) pp. 127-134. (Also: technical slide set, video review) (Reprinted in *Proceedings of Imagina '94*, (February 1994) pp. 69-76) (Reprinted in Italian as "I dominatori dell'atomo," *VIRTUAL* magazine, No. 2 (October 1993) pp. 18-21.).

Other Publications and Abstracts (* denotes most significant):

Yuval S. Boger, Ryan A. Pavklik, and Russell M. Taylor II, "OSVR: An Open-Source Virtual Reality Framework for both Industry and Academia," presented at the IEEE VR 2015 Industrial Track.

Shawn Waldon, Patrick Hahn, and Russell M. Taylor II, "SketchBio: A Scientist's 3D Interface for Molecular Modeling and Animation," Proceedings of BioVis 2014, 2014 (in press).

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J. Leech and R.M. Taylor II, "Interactive Modeling Using Particle Systems," *Proceedings of the 2nd Discrete Element Methods conference at MIT*, (November 1992) pp. 105-116.

W. Robinett, R.M. Taylor II, V.L. Chi, W.V. Wright, F.P. Brooks Jr., R.S. Williams, and E.J. Snyder, "The Nanomanipulator: An Atomic-Scale Teleoperator," *SIGGRAPH '92* Course notes for course #9: "Implementation of Immersive Virtual Environments," (August 1992) pp. 2.1-2.8.

Systems Built (* denotes most significant):

Infrastructure:

* **VRPN:** *Virtual-Reality Peripheral Network* open-source library and servers that provides a common interface for fast local and remote network access to VR input and output devices (trackers, buttons, force display, sound servers, cameras, A/D and D/A devices). VRPN has been widely adopted internationally and has been ported to form the device-control layer for seven systems in industry and nine research systems. VRPN has more than 60,000 downloads and the VRPN mail list has 131 members from US and international universities, companies, and national laboratories. www.vrpn.org.

Research:

Microscopy well layout: Database front end for 96-well plate experiment layout. Qt-based grid connected to PostgreSQL database back-end. Enables creation of new database tables and insertion of entries for multiple data types in arbitrary subsets of the wells.

Image template-based matching: Analysis tool for locating and categorizing objects in atomic-force microscope images. Developed in collaboration with Dorothy Erie from chemistry to study protein conformations. Released as a tool by our CISMM NIH Resource.

ScalarStack: Visualization program for the direct display of correlation between multiple scalar fields. Implements best-of-breed available algorithms (*data-driven spots* and *oriented slivers*), both developed within the UNC NSRG and both validated in user studies. This includes a generic framework where novel techniques can be described in an algorithm description file. Released as a tool by our CISMM NIH Resource.

Spot tracker: www.cs.unc.edu/Research/nano/cismm/download/spottracker/video_spot_tracker.html. Provides subpixel-accurate estimation of the motion of the centers of multiple spots in video data. Tracks beads as they change focal depth relative to the image plane, and operates at 60 frames/second to enable tracking during experiments. Released as a tool by our CISMM NIH Resource.

3DFM User Interface: Led a team of students and staff in the development of this stereo 3D graphics plus force-feedback haptic control system for the CISMM NIH Resource's 3D magnetic force microscope system. This system adds to the open-source Visualization ToolKit real-time video and rendering of real-time data feeds from the microscope. The UI integrates the output from and control of operations on four computers (bead feedback control, video input, magnetic control, graphics and haptics interface).

* **nanoManipulator:** www.nanomanpulator.com, www.nanomanipulator.org. This system, my dissertation work and following, provides an immersive teleoperation interface to scanned-probe microscopes. Distributed, heterogeneous real-time system that provides direct, natural control over microscope experiments as if the scientist were interacting directly with the surface itself. Commercial development begun in spring 2000 has resulted in seventeen U.S. and international installations (www.3rdtech.com).

Parallel CFD visualization: Implemented cutting plane, streamline and particle system (many thousands of particles in real time) visualization tools on Division's Pixel-Planes 6 architecture.

Parallel, distributed Docker: http://www.cs.unc.edu/graphics/GRIP. Extended Ming Ouh-Young's molecular drug docking simulator into distributed system with force-feedback, visualization, and simulation one three separate hosts; parallel simulation code on MasPar MP-1. System used at multiple universities and government labs.

Tools for internal use:

* **Clot Estimator:** Automated microscopy system applies magnetic fields to a blood-clotting specimen and synchronously and in feedback measures the reduction in light transmission through a camera. Plots force-vs-time curve and stores images and brightness changes.

* **Cell Puller:** Automated microscopy application to scan in X and Y across a surface, auto-focus to locate beads, move to center a bead, bring down a magnetic probe to apply forces while tracking bead motion, and data analysis to estimate the viscoelastic properties of the attached cell membranes.

Site Planner: Estimates yield of a two-axis tracking concentrating solar photovoltaic plant based on unit sizes and locations and site. Computes partial and total shadowing between units compared with NREL Typical Meterological Year data for the site. Also estimates wiring and land use for a given plant. Enables comparison of both concentrated and flat-panel systems from a variety of vendors.

* **Solar Tracker:** Auto-calibrating two-axis solar tracking system for MegaWatt Solar Basic Power Unit. Reads light sensors and motor angles and controls motor motion. Searches sky to find the sun, then follows the sun closed-loop. Builds solar ephemeris from these points to enable open-loop tracking during clouds and sunrise. Robust to clouds and wind shake.

BPU Simulator: Simulates the power and incident-light-sensor signal response of a MegaWatt Solar Basic Power Unit. Includes simulation of motor acceleration and deceleration, limit switches, sun motion, fractal moving clouds, and wind shake. Used to design and debug tracking algorithms.

Parabolish: Ray-traced concentrated photovoltaic solar design tool. Enables comparison of various mirror shapes (parabolic, sine-wave, circular, fraction of a sine wave) and system parameters (distortions and faceting, focal lengths, efficiencies, cell sizes and placement, defocus) against power generation, heat generation, and incident-light-sensor response.

Graphics file translation: Converter from Pixel-Planes PPHIGS format to Division's MAZ file format. Includes geometry, color, hierarchy, lighting and converting procedural textures to bitmaps at optimal resolution. Converter from PPHIGS format to openGL (source code modules).

Professional Activities:

Member: IEEE, ACM, ACM SIGGRAPH.
Various NSF and NIH proposal panels, approximately 1 per year. Center-level proposals and single-investigator proposals.
Scientific Visualization Conference Chair, IEEE VisWeek 2012 conference.
Panels Co-chair, IEEE VisWeek 2011 conference.
Panels Co-chair, IEEE VisWeek 2010 conference.
Panels Co-chair, IEEE VisWeek 2009 conference.
Member, North Carolina Visualization Summit Planning Committee, 2008.
Member, Morehead Planetarium and Science Center Faculty Advisory Board, 2008-2014.
Visualization Contest Chair, IEEE Visualization 2008 conference.
Visualization Contest Co-chair, IEEE Visualization 2006 conference.
Networking and Equipment Co-chair, IEEE Visualization 2004 conference.
National Nanotechnology Initiative Workshop on Nanotechnology in Space Exploration, Aug 24-26, 2004.
Panelist, NSF BIO Directorate Workshop on Cyber Infrastructure, July 14-15, 2003.
Member, EuroHaptics 2003 Program Committee.
Member, IEEE Technical Committee on Nanorobotics and Nanomanufacturing, 2002-2005.
Networking and Equipment Co-chair, ACM Interactive 3D Graphics 2001 conference.
Creative Applications Lab (CAL) Co-chair, IEEE Visualization 2000 conference.
Program Committee, 6th EUROGRAPHICS Workshop on Virtual Environments.
Creative Applications Lab (CAL) Co-chair, IEEE Visualization '99 conference.
CAL, Mini-Workshops, and Birds-of-a Feather Co-chair, IEEE Visualization '98 conference.

Other Service:

Member, Director and Advisor Board, Sensics	Spring 2015-present
Secretary and Treasurer, Executive Board, Pharaoh's Daughter NC	Fall 2012-present
Applied Physical Sciences Faculty Hiring Committee	Spring 2014
Audio team leader, Chatham Community Church	Spring 2011-Fall 2014
Pen-Pal Letters to a Pre-Scientist	Fall 2013-Spring 2014
Facilitator, NC Association for Women Re-entrants and their Children meeting	Fall 2012
Pastor search committee, Chatham Community Church	Fall 2011
Curriculum on Applied Sciences and Engineering Executive Committee, UNC-CH	Sept 2008-June 2013
Institute for Advanced Materials Steering Committee, UNC-CH	Fall 2003-Spring 2013.
Arts & Sciences Advisory Planning group for Materials Science, UNC-CH	Spring 2002
Applied and Materials Sciences Curriculum Advisory Board, UNC-CH	July 2001-Sept 2008
Secretary, Fair Oaks Home Owners' Association	July 2001-June 2004
Network Upgrade Planning Group, UNC-CH/CS	July 2000-Spring 2002
Chairman of the board, NanoManipulator Incorporated	April 2000-2013
Chairman, Multimedia Technology Subcommittee, Chapel Hill Bible Church New Facility Committee	April 1999-August 2001

CS Departmental Facilities Committee (Chair Spring 2008) Fall 1995-Fall 2009

Artistic Work

Alexis Chan, Joohwi Lee, and Russell M. Taylor II, "Visualization of Vortex Core Differences between Ensemble Simulations," Second Place, IEEE Visualization Contest, 2011.

Russell M. Taylor II, Andrew Stephens, Kerry Bloom, Leandra Vicci, Jolien Verdaasdonk, Steven Nedrud, Matt Larson, and Michael Falvo, "Proposed Structure of Yeast Mitotic Spindle," Honorable Mention, NSF/Science Visualization Challenge 2011.

Callie Holderman, Russell M. Taylor II, and Richard Superfine, "Scene 1: I can breathe clearly now," Animated 3D computer-graphics YouTube video describing mucociliary clearance in the lung. August, 2009.

Callie Holderman, Russell M. Taylor II, and Richard Superfine, "Scene 2: Clearance," Animated 3D computer-graphics YouTube video describing mucociliary clearance in the lung. August, 2009.

Fragia, Tania and Russell M. Taylor II, "Fluid Cloth," HorizonZero online publication, Dream Team Project, http://www.horizonzero.ca, Issue 15, May/June 2004.

Student Advising:

Postdocs Supervised: Kalpit Desai.

Ph. D. Advisor: Chris Dwyer, Tom Hudson, Adam Seeger, Chris Weigle, David Borland, Brian Eastwood, David Feng, Oluwafemi Alabi.

Masters Advisor: Charalampos Fretzagias, Tom Lassanske, Amy Henderson, Jeff Juliano, Leila Plummer, Xiaohu Guan, Aron Helser, Chris DiMattia, Renee Maheshwari, Peter Parente, Alvin Richardson, Ben Wilde, Serdar Cakici, Jonathan Herman, Jon Harter, Anya Derbakova, Alfred Zhong (CASE), Alexis Chan, Cory Quammen.

Research Supervisor: Xiaojie Zhao, Jeremy Graham, Shawn Waldon, Alok Meshram, Hal Canary, Pavel Krajcevski, Belinda Kerchmar, Ryan Schubert, Edward Dale, Serhat Tekin, Ben Wilde, Kent Rosenkoetter, Ja-Yeon Jeong, Dennis Jen, Alvin Richardson, Jonathan Robbins, Andrea Marie Hilchey, Yonatan Fridman, Tanner Lovelace, Mark Foskey, Ramkumar Parameswaran, Stephen Ehmann, Zhi Chen, Gokul Varadhan, Michele Clark, Ashes Ganguly, Jason Clark, Kelly Van Busum, Gokul Varadhan, Tom Lassanske, Stefan Sain, Daniel Rohrer, Alexandra Bokinsky, Sang-Uok Kum, Sharif Razzaque, Jun Chen, Brian Grant, Kimberly Passarella-Jones, Dongxiang Wu, Christine Yao, Lin Cui, Mave Houston, Qiang Liu, Noel Llopis-Artime, Shoji Okimoto, Mark Finch.