

# Kyle B. Reed

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## RESEARCH INTERESTS

My primary research interests are in designing intelligent devices that interact with humans, particularly doctors and physical therapists. I strive to develop robots that follow implicit human interactions instead of requiring users to learn how to interact with the apparatus. Additionally, I want to continue studying how the perception of a robot and surrounding environment affects the performance of an individual.

## EDUCATION

**Northwestern University**, Evanston, Illinois

Ph.D. in Mechanical Engineering

**June, 2007**

- Thesis: *Understanding the Haptic Interactions of Working Together* (Advisor: Michael A. Peshkin)

**Northwestern University**, Evanston, Illinois

M.S. in Mechanical Engineering

**December, 2004**

- Thesis: *Specialization in Dyadic Shared Manual Tasks*

**University of Tennessee**, Knoxville, Tennessee

B.S. in Mechanical Engineering

**May, 2001**

- Minors in Material Science and Engineering Communications

## RESEARCH EXPERIENCE

**Johns Hopkins University**, Post-Doctoral Fellow

**September, 2007 – present**

- Conceived and designed a portable mechanism to correct irregular walking patterns in patients with cerebellar damage.
- Contributing to the design of a steerable needle with image based feedback for medical interventions.
- Formulated control algorithms to compensate for torsional friction in the steerable needle.
- Integrating stochastic models of the steerable needle with planning and control algorithms.

**Northwestern University**, Graduate Research Assistant

**2002 – 2007**

- Designed and built an experimental testbed for studying human-human and human-robot physical interaction. Conceived and performed psychophysical experiments.
- Discovered an unsuspected latent capacity for haptic communication between partners. Dyads developed a new emergent strategy to divide the task while improving task performance.
- Modeled and implemented the human interaction in a robotic partner that surreptitiously took the place of one participant.
- Programmed the graphics, control algorithms, data acquisition, and servo control in C on QNX.

**Los Alamos National Lab** – Mechanical Engineer Intern

**Summers of 2000 & 2001**

- Performed finite element and probabilistic analysis to determine the strength of explosion confinement vessels. Designed simulations to compare theoretical to actual results with high correlations.
- Analyzed data from a finite element analysis of crushing hollow spheres. This was part of a project to non-destructively confirm proper functioning of military components.

**Los Alamos National Lab** – Computer Programmer Intern

**Summers of 1998 & 1999**

- Designed and wrote data analysis software for a missile explosion simulation.

## REFEREED JOURNAL PUBLICATIONS

**K. Reed** and R. Webster. "Towards Tactile Haptics in Manual and Teleoperated Robot-Assisted Surgery." In preparation to submit to *International Journal of Biomechatronics and Robotics*.

**K. Reed** and M. Peshkin. "Physical Collaboration of Human-Human and Human-Robot Teams." *IEEE Transactions on Haptics*, in Press.

**K. Reed**, M. Peshkin, M. J. Hartmann, M. Grabowecky, J. Patton, and P. M. Vishton. "Haptically Linked Dyads: Are Two Motor-Control Systems Better Than One?" *Psychological Science*, 17(5), May, 2006.

## REFEREED CONFERENCE PUBLICATIONS

**K. Reed**, R. Decker, and A. de Groot. "Gait Enhancing Mobile Shoe for Walking Rehabilitation," In preparation to submit to *World Haptics 2009*.

**K. Reed**, A. Okamura, and N. Cowan. "Controlling a Robotically Steered Needle in the Presence of Torsional Friction," Submitted to the *Proc. of IEEE International Conference on Robotics and Automation (ICRA)*, 2009.

S. Misra, **K. Reed**, B. Schafer, K. Ramesh, and A. Okamura. "Observations and Models for Needle-Tissue Interactions," Submitted to the *Proc. of IEEE International Conference on Robotics and Automation (ICRA)*, 2009.

**K. Reed**. "Compensating for Torsion Windup in Steerable Needles," *Proc. of IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics (BioRob)*, Scottsdale, USA 2008.

**K. Reed**, V. Kallem, R. Alterovitz, K. Goldberg, A. Okamura, and N. Cowan. "Integrated Planning and Control for Planar Needle Steering," *Proc. of IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics (BioRob)*, Scottsdale, USA 2008.

S. Misra, **K. Reed**, A. Douglas, K. Ramesh, and A. Okamura. "Needle-Tissue Interaction Forces for Bevel-Tip Steerable Needles," *Proc. of IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics (BioRob)*, Scottsdale, USA 2008.

**K. Reed**, J. Patton, and M. Peshkin. "Replicating Human-Human Physical Interaction," *Proc. of IEEE International Conference on Robotics and Automation (ICRA)*, Rome, April 2007.

**K. Reed**, M. J. Hartmann, J. Patton, P. M. Vishton, M. Grabowecky, and M. Peshkin. "Haptic Cooperation Between People, and Between People and Machines," *Proc. of IEEE International Conference on Intelligent Robots and Systems (IROS)*, Beijing, October 2006.

**K. Reed**, M. Peshkin, M. J. Hartmann, J. E. Colgate, and J. Patton. "Kinesthetic Interaction," *Proc. of the 9th International Conference on Rehabilitation Robotics (ICORR)*, Chicago, June, 2005.

**K. Reed**, M. Peshkin, J. E. Colgate, and J. Patton. "Initial Studies in Human-Robot-Human Interaction: Fitts' Law for Two People," *Proc. of IEEE International Conference on Robotics and Automation (ICRA)*, New Orleans, April 2004.

## CONFERENCE ABSTRACTS AND NON PEER-REVIEWED PAPERS

**K. Reed**, N. Cowan, and A. Okamura. "Torsion Windup in Steerable Needles," Poster presentation at Needle Steering Workshop during Medical Image Computing and Computer-Assisted Intervention (MICCAI), 2008.

## TEACHING AND MENTORING EXPERIENCE

Mentoring for NSF Research Experience for Undergrads (REU) Program

- *Allison de Groot* - Portable gait altering shoe for patients with hemiparesis **Summer, 2008**
- *Ryan Decker* - Portable gait altering shoe for patients with hemiparesis **Summer, 2008**

- Guest Lecturer, Northwestern University** **Springs of 2006 & 2007**
- Taught several classes of Freshman Engineering at Northwestern University.
- Strain Gauge Workshop, Northwestern University** **June, 2004**
- Formulated and taught a workshop on installing and instrumenting devices with strain gauges. Instructed graduate students and faculty in the Mechanical and Biomedical Engineering departments.
- English Teacher, Shenzhen, China** **2001 – 2002**
- Designed and taught a two month course on engineering English to workers at Foxconn, an electronics manufacturing company.
  - Created and taught English as a second language classes to high school and middle school students.
- Teaching Assistant for Freshman Engineering, University of Tennessee** **1999 – 2001**
- Managed design teams, taught labs, and conducted help sessions for an integrated Freshman Engineering curriculum. Helped create a video of the program for advertising.

### INVITED TALKS AND PODIUM PRESENTATIONS

- Integrated Planning and Control for Planar Needle Steering **(to occur in) October 2008**  
*IEEE/EMBS Conference on Biomedical Robotics and Biomechatronics (BioRob), Scottsdale, USA*
- Robotics Seminar, Nanyang Technological University, Singapore **April, 2008**
- Replicating Human-Human Physical Interaction **April 2007**  
*IEEE International Conference on Robotics and Automation (ICRA), Rome*
- Robotics Seminar, Johns Hopkins University, Baltimore, MD **February, 2007**
- Robotics Seminar, Union College, Schenectady, NY **February, 2007**
- Haptic Cooperation Between People, and Between People and Machines **October 2006**  
*IEEE International Conference on Intelligent Robots and Systems (IROS), Beijing*
- Fundamentals of Image Editing, Northwestern University **September, 2006**  
 Taught a seminar on how to edit and manipulate graphics/images in various programs. Also discussed different image formats and when to use them.
- Kinesthetic Interaction **June, 2005**  
*International Conference on Rehabilitation Robotics (ICORR), Chicago*
- Initial Studies in Human-Robot-Human Interaction: Fitts' Law for Two People **April 2004**  
*IEEE International Conference on Robotics and Automation (ICRA), New Orleans*
- China in the World Trade Organization, Shenzhen Education Bureau, China **Spring, 2002**  
 Presented and led a discussion about the effects of China entering the World Trade Organization (WTO).

### HONORS AND AWARDS

- da Vinci award** for NÜberwalker, by National Multiple Sclerosis Society **2006**  
  - Team project to design a body weight support system for rehabilitation.
- Awarded the National Science Foundation (NSF) Graduate Research Fellowship** **2001**
- Tau Beta Pi** Engineering Honor Society induction **1999**
- Pi Tau Sigma** Mechanical Engineering Society induction **1999**
- Finner Family Scholarship** awarded twice. **1998 and 1999**

### PROFESSIONAL ACTIVITIES

- Member of the American Society of Mechanical Engineers (ASME).
- Member of the Institute of Electrical and Electronics Engineers (IEEE).

Reviewer for:

*IEEE Transactions on Haptics*

*Journal of Neurophysiology*

*Workshop on the Algorithmic Foundations of Robotics (WAFR)*

*IEEE International Conference on Robotics and Automation (ICRA)*

*World Haptics Conference (WHC)*

*International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*

### PROFICIENCY AND SKILLS

**Software:** I-DEAS, Abaqus, Dyna3d, Nessus, Solidworks, Autocad, and Mechanical Desktop, and LaTeX.

**Programming:** Java, C, C++, Matlab, Fortran, Perl, SQL, JSP, PHP, Javascript, and XML.

**Operating Systems:** Linux, Mac OS (9 & X), Windows (9\* & XP), and QNX (Realtime).

**Hardware:** Printed circuit board design, data acquisition, and servo control.

**Foreign Languages:** Basic spoken Mandarin Chinese.

### COMMUNITY SERVICE

Volunteered at Asian Youth Services serving underprivileged children in Chicago.

- Mentored and tutored kids (grades 7-12) weekly in all subjects.
- Setup and maintained 10 Linux computers for daily use by the kids and the director.
- Helped write a proposal to the Hewitt Associates Foundation for funding. The \$15,000 grant was awarded to Asian Youth Services in December, 2006.

Organized lab tours of the Laboratory for Intelligent Mechanical Systems (LIMS).

- Robot operating buddies of Schaumburg, 2006; Bring you daughters to work day, 2005, 2006, & 2007; Cubscouts, 2005; Middle school students from surrounding schools, 2005.

Judge for the Tennessee State Science Olympiad competition in 2000 and 2001.