

Kyle B. Reed

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last updated June 2, 2009

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 adapt to 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 – July, 2009

- Mentored by Allison M. Okamura and Noah J. Cowan
- Contributed 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.
- Integrated stochastic models of the steerable needle with planning and control algorithms.
- Conceived and designed a portable mechanism to correct irregular walking patterns in patients with cerebellar damage.

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

- Finite element and probabilistic analysis to determine the strength of explosion confinement vessels. Designed simulations to compare theoretical to actual results with high correlations.

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

- [J1] K. B. Reed, A. M. Okamura, and N. J. Cowan, “Modeling and control of needles with torsional friction,” *IEEE Trans. Biomed. Eng.*, accepted.
- [J2] K. B. Reed and M. A. Peshkin, “Physical collaboration of human-human and human-robot teams,” *IEEE Trans. on Haptics*, vol. 1, pp. 108–120, July–Dec. 2008.
- [J3] K. B. Reed, M. A. Peshkin, M. J. Hartmann, M. Grabowecy, J. Patton, and P. M. Vishton, “Haptically linked dyads: Are two motor-control systems better than one?,” *Psychological Science*, vol. 17, no. 5, pp. 365 – 366, 2006.

 REFEREED CONFERENCE PUBLICATIONS

- [C1] S. Misra, K. B. Reed, K. T. Ramesh, and A. M. Okamura, “Observations of needle-tissue interactions,” in *Conf. Proc. IEEE Eng. Med. Biol. Soc.*, accepted.
- [C2] K. B. Reed, A. M. Okamura, and N. J. Cowan, “Controlling a robotically steered needle in the presence of torsional friction,” in *Proc. IEEE Int. Conf. Robot. Autom.*, pp. 3476–3481, May 2009.
- [C3] S. Misra, K. B. Reed, B. Schafer, K. T. Ramesh, and A. M. Okamura, “Observations and models for needle-tissue interactions,” in *Proc. IEEE Int. Conf. Robot. Autom.*, pp. 2687–2692, May 2009.
- [C4] A. de Groot, R. Decker, and K. B. Reed, “Gait enhancing mobile shoe (GEMS) for rehabilitation,” in *Proc. Joint Eurohaptics Conf. and Symp. on Haptic Interfaces for Virtual Environment and Teleoperator Systems*, pp. 190–195, March 2009.
- [C5] K. B. Reed, “Compensating for torsion windup in steerable needles,” in *Proc. IEEE Conf. Biorob*, (Scottsdale, AR, USA), pp. 936–941, October 2008.
- [C6] K. B. Reed, V. Kallem, R. Alterovitz, K. Goldberg, A. M. Okamura, and N. J. Cowan, “Integrated planning and image-guided control for planar needle-steering,” in *Proc. IEEE Conf. Biorob*, (Scottsdale, AR, USA), pp. 819–824, October 2008.
- [C7] S. Misra, K. B. Reed, A. S. Douglas, K. T. Ramesh, and A. M. Okamura, “Needle-tissue interaction forces for bevel-tip steerable needles,” in *Proc. IEEE Conf. Biorob*, pp. 224–231, October 2008.
- [C8] K. B. Reed, J. Patton, and M. Peshkin, “Replicating human-human physical interaction,” in *Proc. IEEE Int. Conf. Robot. Autom.*, pp. 3615–3620, April 2007.
- [C9] K. B. Reed, M. Peshkin, M. J. Hartmann, J. Patton, P. M. Vishton, and M. Grabowecy, “Haptic cooperation between people, and between people and machines,” in *Proc. IEEE/RSJ Int. Conf. Intell. Robots Syst.*, pp. 2109–2114, October 2006.
- [C10] K. B. Reed, M. Peshkin, M. J. Hartmann, J. E. Colgate, and J. Patton, “Kinesthetic interaction,” in *Proc. IEEE Int. Conf. Rehabilitation Robotics*, pp. 569–574, June 2005.
- [C11] K. B. Reed, M. Peshkin, J. E. Colgate, and J. Patton, “Initial studies in human-robot-human interaction: Fitts’ law for two people,” in *Proc. IEEE Int. Conf. Robot. Autom.*, pp. 2333–2338, April 2004.

PATENTS

- [P1] K. B. Reed, R. Decker, and A. de Groot. “Gait Enhancing Mobile Shoe for Rehabilitation,” U.S. Patent Pending.

GRANT PROPOSALS

1. Human and Social Dynamics (HSD) grant from the National Science Foundation awarded in **2004**
 - “Emergent social behaviors in sensorimotor control”
 - I helped write significant portions of the background and preliminary experiment sections. I also contributed to many discussions about the future of this research. PIs: Michael A. Peshkin, Mitra J. Hartmann, James L. Patton, and Peter M. Vishton.
2. Awarded the National Science Foundation **Graduate Research Fellowship** **2001**

NON-REFEREED CONFERENCE ARTICLES AND ABSTRACTS

1. K. B. Reed, “Human-human interaction blah blah blah,” IEEE/RSJ International Conference on Intelligent Robotic Systems, Workshop on Haptic Human-Robot Interaction, St. Louis, USA, October, 2009.
2. Allison de Groot, Ryan Decker, and K. B. Reed. “Design of the Gait Enhancing Motion Shoe (GEMS) for the Improvement of Gait Irregularity Due to Stroke,” Colonial Academic Alliance Undergraduate Research Conference, Baltimore, USA, April, 2009.
3. K. B. Reed, N. Cowan, and A. Okamura. “Torsion Windup in Steerable Needles,” Needle Steering Workshop during Medical Image Computing and Computer-Assisted Intervention (MICCAI), New York, USA, September, 2008.

TEACHING AND MENTORING EXPERIENCE

Electronics and Instrumentation, Johns Hopkins University **Spring, 2009**

- Taught and redesigned labs on electrical systems to Junior undergraduate students.

Mentoring, Johns Hopkins University

- *Allison de Groot* - Gait Enhancing Mobile Shoe for Rehabilitation **Summer, 2008**
through the NSF Research Experience for Undergrads (REU) Program
- *Ryan Decker* - Gait Enhancing Mobile Shoe for Rehabilitation **2008**

Guest Lecturer, Northwestern University **Spring quarters 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 PRESENTATIONS

1. Workshop on Haptic Human-Robot Interaction at Int. Conf. on Intelligent Robots and Systems (IROS), to occur in October, 2009.
2. Computational Neuroscience Laboratory, Advanced Telecommunications Research (ATR) Institute International, Kyoto, Japan, May, 2009.
3. Workshop on Innovation of Medical Robotics at IEEE Int. Conf. on Robotics and Automation (ICRA), May, 2009.
4. School of Engineering and Textiles, Philadelphia University, Philadelphia University, PA, March, 2009.
5. Mechanical Engineering Department, University of South Florida, Tampa, FL, January, 2009.
6. Institute of Automatic Control Engineering, Technical University of Munich, Germany, December, 2008.
7. Mechanical and Aerospace Department, Nanyang Technological University, Singapore, April, 2008.
8. Laboratory for Computational Sensing and Robotics, Johns Hopkins University, Baltimore, MD, February, 2007.
9. Mechanical Engineering Department, Union College, Schenectady, NY, February, 2007.

HONORS AND AWARDS

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|---|----------------------|
| 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

IEEE Transactions on Biomedical Engineering

Workshop on the Algorithmic Foundations of Robotics (WAFR)

IEEE International Conference on Robotics and Automation (ICRA)

World Haptics Conference (WHC)

International Conference on Rehabilitation Robotics (ICORR)

IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)

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

PROFICIENCY AND SKILLS

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

Operating Systems: Linux, Mac OS, Windows, 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. **2003-2007**

- 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.
- Coauthored 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.