

Katherine K. Fu

Assistant Professor of Mechanical Engineering and Industrial Design (joint)
Georgia Institute of Technology
kfu@me.gatech.edu

Education

Carnegie Mellon University, Pittsburgh, PA

Ph.D. Mechanical Engineering, May 2012

Thesis:

Discovering and Exploring Structure in Design Databases and Its Role in Stimulating Design

Advisors:

Dr. Jonathan Cagan, Mechanical Engineering

Dr. Kenneth Kotovsky, Psychology

M.S. Mechanical Engineering, May 2009

Brown University, Providence, RI

B.S. Mechanical Engineering, May 2007

Research Experience

Assistant Professor, Georgia Institute of Technology, Atlanta, GA
November 2014 – Present

Postdoctoral Fellow, Massachusetts Institute of Technology, Cambridge, MA and Singapore
University of Technology and Design, Singapore, Republic of Singapore
September 2012 – September 2014

Graduate Research Assistant, Carnegie Mellon University, Pittsburgh, PA
August 2007 – May 2012

Teaching Experience

Instructor, ME1770 Introduction to Engineering Graphics and Visualization, Georgia Institute of Technology, Atlanta, GA
Spring semester, 2015

Engineering Design Instructor, Introduction to Design (3.007), Singapore University of Technology and Design, Singapore
Fall semester, 2013

Collaboratively taught a 300 student freshmen course in introduction to design, among a team of 18 instructors; Directly responsible for the active learning experience of a cohort 50 students, shared with an instructor of architectural design (Anna Chan, ASD) and industrial design (Ricardo Sosa, Assistant Professor, EPD);

The course introduces students to concepts of design at a variety of scales and through both engineering and architectural design disciplines. Students are exposed to core technology and design themes including principles, design processes, modes of thinking and analysis, relationships between form, space, structure and materials, and social and cultural aspects of design. The course introduces essential skills and mindset of innovation, entrepreneurship, and methods in design including teamwork, workflow organization, team building, leadership, written and oral communication, site analysis, graphic and analytical representation, fabrication techniques, and a variety of computational techniques. Student teams formulate and complete design projects; projects will be defined in connection with applications under the theme of “Energy @ Home”.

Engineering Design Lead, Instructor, Integrated Product Development (IPD), Carnegie Mellon University, Pittsburgh, PA
Spring semester, 2009

Collaboratively taught a corporate-sponsored integrated product development course in an active learning format, as the engineering design lead among an interdisciplinary team of instructors (Peter Boatwright, Associate Professor of Marketing, and Eric Anderson, Associate Professor in the School of Design);

The IPD course consists of four modules: identifying, understanding, conceptualizing and realizing a product opportunity. It is designed to simulate the interdisciplinary collaborative environment that students might encounter in jobs or internships in the design industry. The course is meant to give students practice using a rigorous design methodology, while learning communication, delegation, leadership, and respect for other disciplines. Through working with a company sponsor, students learn about business relations, professionalism, and the realities of what goes into bringing a real product to market for a real client. This course is core class in the Masters of Product Development program, but is geared toward and enriched by students from engineering, business, and design fields.

Documentation of Teaching Development Program, Eberly Center for Teaching Excellence, Carnegie Mellon University, Pittsburgh PA
2008-2012

Transcript and Letter of Certification available upon request

Completed 14 seminars on a wide range of teaching and professional development topics.

Completed 2 teaching observations, including one guest lecture on “Design by Analogy” given to the Integrated Product Development class at CMU and one micro-teaching workshop observation consisting of a five-minute lecture and feedback from participants and facilitators of the workshop.

Completed a 40-hour project to create two evaluation rubrics for the two major reports required for the Integrated Product Development course at CMU, to be used to grade the reports during the Spring 2012 semester.

Completed a syllabus design consultation project, designing a course in product development and receiving feedback on it from the Eberly Center for Teaching Excellence.

Archival Journal Papers

Fu, K., Murphy, J., Yang, M., Otto, K., Jensen, D., Wood, K.L., 2014, "Design-by-Analogy: Experimental Evaluation of a Functional Analogy Search Methodology for Concept Generation Improvement", *Research in Engineering Design*, DOI: 10.1007/s00163-014-0186-4.

Fu, K., Moreno, D., Yang, M. C., Wood, K. L., 2014, "Bio-Inspired Design: An Overview Investigating Open Questions from the Broader Field of Design-by-Analogy," *Journal of Mechanical Design*, Special Issue 2014: Biologically Inspired Design, 136(11), 111102, DOI: 10.1115/1.4028289

Murphy, J., **Fu, K.**, Otto, K., Yang, M., Jensen, D., Wood, K., 2014, "Function Based Design-by-Analogy: A Functional Vector Approach to Analogical Search," *Journal of Mechanical Design*, 136(10) 101102, DOI: 10.1115/1.4028093.

Fu, K., Chan, J., Schunn, C., Cagan, J., and Kotovsky, K., 2013, "Expert Representation of Design Repository Space: A Comparison to and Validation of Algorithmic Output," *Design Studies*, 34(6), 729-762, DOI: 10.1016/j.destud.2013.06.002.

Fu, K., Cagan, J., Kotovsky, K., and Wood, K., 2013, "Discovering Structure In Design Databases Through Functional And Surface Based Mapping," *J. of Mech. Des.*, 135 (3), 031006.

Fu, K., Chan, J., Cagan, J., Kotovsky, K., Schunn, C., and Wood, K., 2013, "The Meaning of "Near" and "Far": The Impact of Structuring Design Databases and the Effect of Distance of Analogy on Design Output," *J. of Mech. Des.*, 135 (2), 021007.

Chan, J., **Fu, K.**, Schunn, C., Cagan, J., Wood, K., and Kotovsky, K., 2011, "On the Benefits and Pitfalls of Analogies for Innovative Design: Ideation Performance Based on Analogical Distance, Commonness, and Modality of Examples," *J. of Mech. Des.*, 133 (8), 081004.

Fu, K., Cagan, J., and Kotovsky, K., 2010, "Design Team Convergence: The Influence of Example Solution Quality," *J. of Mech. Des.*, 132 (11), 111005.

Linsey, J.S., Tseng, I., **Fu, K.**, Cagan, J., Wood, K. L., and Schunn, C. D., 2010, "A Study of Design Fixation, Its Mitigation and Perception in Design Faculty," *J. of Mech. Des.*, 132 (4), 041003.

Peer-Reviewed Conference Publications

- Fu, K.**, Yang, M., Wood, K.L., 2015, "Design Principles: The foundation of Design", Proceedings of the ASME 2015 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, August 2-5, 2015, Boston, MA.
- Fu, K.**, Tan, U., Teo, T. H., Soh, G. S., Wood, K. L., "Interdisciplinary Learning Through Design Activities Uniting Fundamentals of Engineering Curriculum", Proceedings of the International Conference on Engineering Design, July 27-30, 2015, Milan, Italy.
- Murphy, J., **Fu, K.**, Otto, K., Yang, M., Jensen, D., Wood, K.L., 2014, "Facilitating Design-by-Analogy: Development of a Complete Functional Vocabulary and Functional Vector Approach to Analogical Search", Proceedings of the ASME 2014 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, August 17-20, 2014, Buffalo, NY.
- Fu, K.**, Murphy, J., Yang, M., Otto, K., Jensen, D., Wood, K.L., 2013, "Investigating the Effect of Functionality Level of Analogical Stimulation on Design Outcomes", Proceedings of The 13th Design Engineering Workshop, November 28 - 30, 2013, Kitakyushu, Fukuoka, Japan.
- Fu, K.**, Reid, T.N., Terpenney, J.P., Thurston, D.L., Vance, J.M., Finger, S., Wiens, G.J., Kazerounian, K., Allen, J.K., Jacobson, K., 2013, "Ac 2013 - 6781: Broadening Participation: A Report On A Series Of Workshops Aimed At Building Community And Increasing The Number Of Women And Minorities In Engineering Design," Proceedings of the ASEE Annual Conference, June 23-26, Atlanta, Georgia.
- Fu, K.**, Chan, J., Schunn, C., Cagan, J., Kotovsky, K., 2013, "Substantiating the Basis for an Automated Design-by-Analogy Tool through Comparison to Expert Thinking," Proceedings of the ASME 2013 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, August 4-7, 2013, Portland, Oregon.
- Fu, K.**, Dilmore, J., Cagan, J., Dougherty Jr., C.H., 2013, "Using Design Database Structures to Characterize Freedom-to-operate in a Design Space: A Legal Case Study," Proceedings of the International Conference on Engineering Design, August 19-22, 2013, Seoul, South Korea.
- Fu, K.**, Chan, J., Cagan, J., Kotovsky, K., Schunn, C., and Wood, K., 2012, "The Meaning of "Near" and "Far": The Impact of Structuring Design Databases and the Effect of Distance of Analogy on Design Output," Proceedings of the ASME Design Theory and Methodology Conference, Chicago, IL.
- Wood, M., Chen, P., **Fu, K.**, Cagan, J., and Kotovsky, K., 2012, "The Role of Design Team Structure on Individual and Shared Mental Models," Proceedings of the Conference on Design Computing and Cognition, College Station, TX.
- Chan, J., **Fu, K.**, Schunn, C., Cagan, J., Wood, K., and Kotovsky, K., 2011, "On the Benefits and Pitfalls of Analogies for Innovative Design: Ideation Performance Based on Analogical Distance, Commonness, and Modality of Examples," Proceedings of the 2011 International Conference on Engineering Design, Copenhagen, Denmark.

Fu, K., Cagan, J., Kotovsky, K., 2011, "A Methodology for Discovering Structure in Design Databases," Proceedings of the 2011 International Conference on Engineering Design, Copenhagen, Denmark.

Fu, K., Cagan, J., Kotovsky, K., and Wood, K., 2011, "Discovering Structure In Design Databases Through Functional And Surface Based Mapping," Proceedings of the ASME Design Theory and Methodology Conference, Washington, D.C.

Fu, K., Cagan, J., and Kotovsky, K., 2009, "Design Team Convergence: The Influence of Example Solution Quality," Proceedings of the ASME Design Theory and Methodology Conference, San Diego, CA.

Linsey, J.S., Tseng, I., **Fu, K.**, Cagan, J., and Wood, K. L., 2009, "Reducing and Perceiving Design Fixation: Initial Results from an NSF-Sponsored Workshop," Proceedings of the 2009 International Conference on Engineering Design, Stanford, CA.

Patents

Cheung, T., Fu, K., Jura, J., Kaushal, N., Sato, G., Theis, P., "Stowable Table Unit System for a Vehicle," United States Patent Number 8096599, Issued 17 January 2012, Assignee: International Truck Intellectual Property Company, LLC

Committee Work

IDSA Student Merit Award Internal Selection Committee, School of Industrial Design, Georgia Institute of Technology, Spring 2015

Graduate Committee, George W. Woodruff School of Mechanical Engineering, Georgia Institute of Technology, 2014 - Present

Co-chair, Committee Broadening Participation of Underrepresented Groups, American Society of Mechanical Engineers, Design Engineering Division, 2010-2015; Planned and chaired 1-day workshop for underrepresented minorities in ASME IDETC on Navigating and Leading Change in 2011, 2013, 2014 (Vice Chair).

Selection Committee Member, The William H. and Frances S. Ryan Award for Meritorious Teaching, 2009-2010

Selection Committee Member, Graduate Student Teaching Award, 2009-2010

Graduate Student Panel Member for the Advisory Board outside evaluation team for Carnegie Mellon University's Mechanical Engineering Department assessment, 2009

Organize and run mock qualifying exams for CMU Mechanical Engineering department's PhD students to help prepare for and pass the exam required to remain in the program.

Workshops

Fu, K., Terpenney, J., Allen, J., Chen, L., de Vries, C., Du, P., Finger, S., He, L., Jacobson, K., Kazerounian, K., MacDonald, E., Nagel, J., Reid, T., Rosenberg, M., Thurston, D., Vance, J.,

Wiens, G., "How to Feel as Bright and Capable as They "Think" You Are: Why Capable People Suffer from the Impostor Syndrome and How to Thrive in Spite of It, " ASME *International Design Engineering Technical Conference*, Portland, OR, USA, August 4, 2013. **Workshop Chair**

Fu, K., J. Allen, S. Finger, K. Jacobson, K. Kazerounian, T. Reid, J. Terpenney, D. Thurston, J. Vance, G. Wiens, C. Zook, "Navigating and Leading Change," ASME *International Design Engineering Technical Conference*, Washington, D.C., USA, August 28, 2011. **Workshop Chair**

Industry Experience

Product Design/Engineer Intern, The Office of Design and Architecture (TODA), June-August 2006

Responsible for producing three-dimensional CAD models for approximately fifteen products in OXO's new bathroom product line, as well as additional products for other OXO lines and an in-house design project. Participated in design charrettes for new products; built product "breadboards" to test functionality; developed original CAD models and refined existing models for production; developed orders for rapid prototyping; tested "looks like/feels like" models for strength, durability and functionality; constructed prototypes; and prepared client presentations.

Engineering Technician II, PB Power, June-August 2005 and January 2006

Wrote specifications for design projects, including installation of fuel cells in built environment and refurbishment of low-voltage electrical systems. Developed bid packages for procurement of construction and installation services; interacted with potential bidders to solicit bids, respond to questions, and view sites. Calculated energy savings and building loads; analyzed/interpreted mechanical and electrical engineering drawings; and conducted research/wrote reports to support decisions regarding investments in pollution control technology.

Website Designer/Programmer, Fu Associates, Ltd., June-August 2004

Conducted requirements analysis, developed and tested website under contract with the Federal Centers for Medicaid and Medicare. Programmed Java server pages and web pages for consumer use, linking with database for query/response display on webpage.

Studio Assistant, LKStudio, July-August 2003

Constructed scale model of proposed architectural/art design for public space at Winona State University; company was awarded contract. Assisted in art installations and computer research.

Honors and Awards

Reviewer's Favourite Award, 2013 International Conference on Engineering Design (ICED), Fu, K., Dilmore, J., Cagan, J., Dougherty Jr., C.H., 2013, "Using Design Database Structures to Characterize Freedom-to-operate in a Design Space: A Legal Case Study"

Best Paper Award, 2012 ASME Design Theory and Methodology (DTM) Conference, Fu, K., Chan, J., Cagan, J., Kotovsky, K., Schunn, C., and Wood, K., 2012, "The Meaning of "Near" and "Far": The Impact of Structuring Design Databases and the Effect of Distance of Analogy on Design Output"

Best Design Cognition Paper Prize, Conference on Design Computing and Cognition 2012, "The Role of Design Team Structure on Individual and Shared Mental Models"

John and Claire Bertucci Graduate Fellowship, 2010-2011

ARCS Foundation Scholar, Lawrence J. Rhoades Memorial Award, 2007-2008, 2008-2009, 2009-2010

Memberships

American Society of Mechanical Engineers
The Design Society