

Jon Wetzel

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Research Interests

I like to use artificial intelligence to both study and improve human learning. Currently I am researching an intelligent tutoring and assessment software for science and math education. My research interests include intelligent tutoring/coaching systems, sketch understanding, human-computer interaction, and educational technology.

Current Appointment

Arizona State University (Sept 2014 – present)

Assistant Research Scientist
School of Computing, Informatics, and Decision Systems

Education

Northwestern University

Ph.D. in Computer Science with Specialization in Cognitive Science (August 2014)
Advisor: Professor Kenneth D. Forbus

Massachusetts Institute of Technology

Master of Engineering in Computer Science and Engineering (June 2007)
Advisor: Professor Edwin J. Selker

Bachelor of Science in Computer Science and Engineering (June 2006)

Research Experience

Arizona State University: FACT.JS Project (Dec 2015-present)

Research Scientist; Project Manager – Project PI: Professor Kurt VanLehn

- Project goal is to create a new javascript based user interface for the Formative Assessment with Computational Technologies (FACT) research project
- Used Agile methodology to manage a team of six programmers
- Executed the recruiting and interviewing process for research assistants

Arizona State University: Dragoon Project (Sept 2014-present)

Research Scientist; Project Manager – Project PI: Professor Kurt VanLehn

- Researched the development and efficacy of an intelligent tutoring system for science and math education (high school and college level) using system dynamics modelling.
- Oversaw deployment and execution of three classroom interventions using Dragoon at Arizona State University in Fall of 2014, Spring of 2015, and Fall of 2015, respectively.
- First-authored one journal article and co-authored two others on the aforementioned research.
- Gave demonstrations of Dragoon at three Office of Naval Research meetings and one workshop on educational technology.
- Used Agile methodology to manage a team of up to nine software and curriculum developers.
- Executed the recruiting and hiring of research assistants.
- Link to the Dragoon homepage: (<http://dragoon.asu.edu>).

Arizona State University: ASU Primer Project (Dec 2014 – June 2015)

Project Manager and Postdoctoral Scholar - Advisor: Professor Kurt VanLehn

- Facilitated the work of ten undergraduate students to create an electronic system for teaching children through storytelling as inspired by the “Young Lady’s Illustrated Primer” from Neal Stephenson’s novel *The Diamond Age*.
- Invited to consult and judge design competition during the continuation of the project in Spring 2016.
- Link to the 2015 ASU Primer Project: (<http://www.public.asu.edu/~kvanlehn/primer/index.html>)

Northwestern University: Qualitative Reasoning Group (2007-2014)

Graduate Research Assistant - Advisor: Professor Kenneth Forbus

Artificial Intelligence, Sketch Understanding, and Qualitative Reasoning

- Devised and implemented a qualitative representation for two-dimensional mechanisms for CogSketch, QRG’s sketch understanding software platform, using predicate calculus, horn clauses, and the OpenCyc ontology.
- Created an intelligent coaching system, CogSketch Design Coach, with the goal of lowering first-year engineering students’ anxiety with using sketching to communicate engineering designs (implemented in common lisp)
 - Design Coach gives on-demand feedback on the consistency and clarity of the student’s sketched explanation.
 - AI research (PhD thesis work) included creating:
 - Representations for spatial and physics reasoning
 - Algorithms for converting sketched input into qualitative representations
 - A teleological ontology for engineering designs
 - Algorithms for giving feedback on engineering design explanations
 - Piloted Design Coach prototypes in Northwestern University’s first-year engineering class from Fall 2009 to Fall 2013, initially with pull-out studies and then as assigned work. Over 130 students have used the program.
 - Developed a measure for sketching anxiety to help instructors of the course gauge their effectiveness and that of software. Found significant decrease compared to control group in Fall 2012.

MIT Media Lab: Context Aware Computing Group (2004-2007)

Undergraduate Researcher/Graduate Research Assistant

Computer Vision and Human-Computer Interaction

- Designed and implemented “Attention Meter,” which uses face detection, to gauge the visual attention of a group. Received patent for vending machine which uses attention meter for interactions.
- Created computer vision programs for the “Smart Sink,” used adjust sink to user's height and to recognize objects placed within.
- Implemented user interface for “Context Aware Kitchen”, used proximity sensors and a logic based system to guess the intentions of the user and display useful information accordingly.
- Mentored an undergraduate researcher (2006-2007)

Teaching Experience

Northwestern University (Fall 2009, Fall 2010, Winter 2011)

Teaching Assistant

Introduction to Cognitive Modeling (2009 and 2010), Building Problem Solvers (2011)

Industry Experience

Microsoft Corporation (Summer 2006)

Software Development Engineer Intern

Windows Live Messenger Team

Dell Incorporated (Summer 2004, Summer 2005)

Software Engineer Intern

Linux Development Lab

Theses

Jon Wetzel. (2014). **Understanding and Critiquing Engineering Design Explanations**. Thesis. Doctorate of Philosophy in Computer Science, Northwestern University in Evanston, IL.

Jon Wetzel. (2007). **Face Interface: A Methodology for Experiential Learning of Input Modalities**. Thesis. Master of Engineering in Computer Science and Engineering, Massachusetts Institute of Technology in Cambridge, MA.

Journals

Wetzel, J., VanLehn, K., Grover, S., Van de Sande, B., & Dragoon, t. t.,(in press). The design and development of the Dragoon intelligent tutoring system for model construction: Lessons learned. *Intelligent Learning Environments*.

VanLehn, K., Chung, G., Grover, S., Madni, A., Wetzel, J., & Dragoon, t. t. (submitted). Learning about dynamic systems and domain principles: The effectiveness of the Dragoon intelligent tutoring system. *International Journal of Artificial Intelligence in Education*.

VanLehn, K., Wetzel, J., Grover, S., Van de Sande, B., & Dragoon, t. t. (submitted). Learning how to construct models of dynamic systems: The effectiveness of the Dragoon intelligent tutoring system. *IEEE Transactions on Learning Technologies*.

Forbus, K., Usher, J., Lovett, A., Lockwood, K., & Wetzel, J. (2011). **CogSketch: Open-domain sketch understanding for cognitive science research and for education**. *Topics in Cognitive Science*. 3(4), 648-666.

Conferences

Chang, M., Wetzel, J. and Forbus, K. (2014). **Spatial Reasoning in Comparative Analyses of Physics Diagrams**. To appear in the proceedings of 6th International Conference on Spatial Cognition. Bremen, Germany.

Wetzel, J. and Forbus, K. (2009). **Automated Critique of Sketched Mechanisms**. Proceedings of the 21st Innovative Applications of Artificial Intelligence Conference. Pasadena, California.

Forbus, K., Lovett, A., Lockwood, K., Wetzel, J., Matuk, C., Jee, B., and Usher, J. (2008). **CogSketch**. Demonstration description in the Proceedings of AAAI 2008.

Lee, C.-H. J., Wetzel, J., and Selker, T. (2006). **Enhancing interface design using attentive interaction design toolkit**, ACM SIGGRAPH 2006 Educators program, July 30-August 03, 2006, Boston, Massachusetts

Lee, C.-H. J., Jang, C.-Y. I., Chen, T.-H. D., Wetzel, J., Shen, Y.-T. B., Selker, T. (2006). **Attention meter: a vision-based input toolkit for interaction designers**. CHI Extended Abstracts 2006: 1007-1012

Workshop Proceedings

Wetzel, J. and Forbus, K. (2012). **Teleological Representations for Multi-Modal Design Explanations.** Proceedings of the 26th International Workshop on Qualitative Reasoning. Los Angeles, California.

Chang, M.D., Wetzel, J. and Forbus, K. (2011). **Qualitative and Quantitative Reasoning over Physics Textbook Diagrams.** Proceedings of the 25th International Workshop on Qualitative Reasoning. Barcelona, Spain.

Wetzel, J. and Forbus, K. (2010). **Design Buddy: Providing Feedback for Sketched Multi-Modal Causal Explanations.** Proceedings of the 24th International Workshop on Qualitative Reasoning. Portland, Oregon.

Wetzel, J. and Forbus, K. (2009). **Automated Critique of Sketched Designs in Engineering.** Proceedings of the 23rd International Workshop on Qualitative Reasoning. Ljubljana, Slovenia.

Wetzel, J. and Forbus, K. (2008). **Integrating Open-Domain Sketch Understanding with Qualitative Two-Dimensional Rigid-Body Mechanics.** In the Proceedings of the 22nd International Workshop on Qualitative Reasoning. Boulder, CO.

Forbus, K., Usher, J., Lovett, A., Lockwood, K., & Wetzel, J. (2008). **CogSketch: Open-domain sketch understanding for cognitive science research and for education.** In the Proceedings of the Fifth Eurographics Workshop on Sketch-Based Interfaces and Modeling. Annecy, France.

Symposia

Forbus, K., Chang, M., and Wetzel, J. (2012). **Sketching for Learning: Computer-Based Coaching of Student-Created Visual Representations.** Symposium presented at the 5th International Conference on Spatial Cognition. Kloster Seon, Bavaria, Germany.

Wetzel, J. and Forbus, K. (2011). **Sketch Understanding for Learning Engineering Design.** Symposium presented at Spatial Cognition for Architectural Design. New York, NY.

Posters

Wetzel, J. and Forbus, K. (2010). **Design Buddy: Multi-Modal Sketch Analysis with Exploratory Study.** Poster presented at the Third Annual Inter-Science of Learning Centers Conference. Boston, MA.

Wetzel, J. and Forbus, K. (2009). **Automated Critique of Engineering Design Explanations.** Poster presented at the Second Annual Inter-Science of Learning Centers Conference. Seattle, WA.

Wetzel, J. and Forbus, K. (2008). **Design Buddy: Sketch-Understanding Software as a Tool for Engineering Design Education.** Poster presented at the First Annual Inter-Science of Learning Centers Conference. Pittsburgh, PA

Bonanni, L., Lee, C.-H. J., Sarcia, S., and Wetzel, J. (2004). **SmartSink: Context-Aware Work Surface.** Poster presented in the 31st International Conference on Computer Graphics and Interactive Techniques. Los Angeles, California.

Patents

Selker, E., Connor, D., Hockenberry, M., Wetzal, J., and Akinyemi, J. (2013) **Vending Machine**.
U.S. Patent 8,594,838, filed December 14, 2009, and issued November 26, 2013

Honors & Proficiencies

Fellowships

National Science Foundation Graduate Research Fellowship (2008-2011)

Graduate Coursework

Artificial Intelligence, Knowledge-Based Systems, User Interface Design, Design of Learning
Environments, Design of Technological Tools for Thinking and Learning

Programming Languages

Experience with Python, Java, Common Lisp, C/C++