

# Eric Schweikardt Curriculum Vitae

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## Research Interests

My research is focused on explaining, representing and improving the design of robotic systems. I use my background in design and computation, combined with knowledge of robotics and rapid prototyping methods, to explore the space of robot design by building real, physical systems. I attempt to understand how different representations and languages can support or constrain designs and the intent behind them. I'm also interested in how people interact with robots once they've been built – particularly in how modular robots can be used as effective models for other complex systems.

## Education

**Ph.D, Computational Design** 2008  
*Carnegie Mellon University, Pittsburgh, PA, USA*  
Thesis: Designing Modular Robotics  
GPA: 4.0/4.0  
Advisory Committee:  
Mark D. Gross, Architecture  
Illah Nourbakhsh, CREATE Lab, Robotics Institute  
Metin Sitti, NanoRobotics Laboratory, Robotics Institute

**Bachelor of Environmental Design, Special Honors**, 1998  
*University of Colorado, College of Architecture and Planning, Boulder, CO, USA*  
Major: Design Studies  
Minor: Computer Science

## Professional Experience

**Design Director, Founder** 2007 – present  
*Modular Robotics LLC, Boulder, CO, USA*  
Started a small business to bring roBlocks, one of my research projects, to market. Received over \$600,000 in grant funding from the National Science Foundation (SBIR) and the Heinz endowments. Managed product design, engineering, manufacturing, user testing, marketing, intellectual property, and business development. Worked with Carnegie Mellon Office of Technology Transfer on a licensing agreement and to refine the business strategy. Oversaw manufacturing in both China and the USA. We're going to ship Cubelets, our first modular robotic construction kit, in April 2011.

**Visiting Scientist** September 2008 – August 2009

*Cornell Computational Synthesis Lab, Cornell University, NY, USA*

Built interactive 3D graphics tools to explore the reconfiguration possibilities of heterogeneous modular robotics. Worked with Hod Lipson to explore the idea of Machine Metabolism, in which robots built out of an optimized kit of parts consume other robots.

**Research Assistant** 2005 - 2008

*Computational Design Lab, Carnegie Mellon University, Pittsburgh, PA, USA*

**roBlocks** is a robotic construction kit created to scaffold children's understanding of math and science concepts. By snapping together the plastic modules, kids can create interesting, dynamic systems that encourage them to think about real-world complexity. I designed and built the system, tested with children and supervised project assistants.

**StickyBricks** is a modular robotic system I am designing to act as a physical substrate on which children can explore the relationships between local interaction and global behavior. The modules are 30mm square, reconfigure on a tabletop, and connect using dry adhesion and magnets. With Metin Sitti.

The **Egklet** is a hardware/software system designed to encourage musicians to experiment with sensor fusion concepts. It's modular design lets musicians plug in several sensors and easily send MIDI commands. With Tina Blaine.

**Sporto** is a little expanding robot designed to encourage users to meet their exercise goals. With Vincent Crossley and Min Kyung Lee.

**Triboingus** is an inexpensive, robust three-wheeled robot base intended for remote exploration and land mine detection.

**Flexy** is a computationally enhanced hub and spoke construction kit with real-time graphic feedback. With Michael Weller.

**Director of Web Development** 1999 - 2005

*Allegory Design Group, Boulder, CO, USA*

I formed the Allegory Design Group to design, build, and maintain small and medium sized corporate web sites. I designed innovative graphics and animation while also incorporating commerce and database applications. Oversaw project teams up to 10 people, and worked directly on most projects completed by the company.

**Designer** 2003 - 2004

*Tavel Weise Architects, Denver, CO, USA*

Worked on Solar Village, a mixed-use sustainable city block in Prospect, a new town outside of Longmont, CO. Created accurate digital models, renderings and AutoCAD drawings to assist in the design process and present our work.

**Instructor** 2003 - 2004

*College of Architecture, University of Colorado, Boulder, CO, USA*

Developed a digital modeling applications class for undergraduate architecture students. The course focused on creating professional-level models, animations, and renderings for use in design reviews and presentations. I taught and refined the course for four semesters and consistently rated in the 95th percentile in student evaluations.

**Research Assistant** 1996 - 1998

*Sundance Laboratory for Computing in Design and Planning, University of Colorado, Boulder, CO, USA*

At the Sundance Lab, I designed and built Digital Clay, a 3D sketch recognition application. Written in Lisp and Quickdraw3D, it used the Huffman-Clowes algorithm to extract depth information from a designer's isometric sketches.

## Teaching Experience

**Teaching Assistant** Spring 2006  
*Architectural Robotics, Carnegie Mellon University*

**Instructor** Spring 2003, Summer 2003, Fall 2003 (two sections)  
*Digital Modeling, Rendering and Animation, University of Colorado at Boulder*

## Publications

**2011** Schweikardt, E. and M. D. Gross, *Experiments in Design Synthesis When Behavior is Determined by Shape* Journal of Personal and Ubiquitous Computing Special Issue on Material Computing. Volume 15, Number 2, 123-132.

**2009** Schweikardt, E. "User Centered Is Off Centered" *Interactions*, May/June 2009(3), ACM Press.

**2009** Schweikardt, E., Elumeze, N., Eisenberg, M., and M. D. Gross, "A Tangible Construction Kit for Exploring Graph Theory" TEI 2009: Third International Conference on Tangible and Embedded Interaction, Cambridge, UK, ACM Press.

**2009** Yun, Seung-kook, David Alan Hjelle, Eric Schweikardt, Hod Lipson and Daniela Rus, "Planning the Reconfiguration of Grounded Truss Structures with Truss Climbing Robots that Carry Truss Elements" ICRA 2009: IEEE International Conference on Robotics and Automation. May 12-17, 2009, Kobe, Japan. IEEE Press.

**2009** Schweikardt, E. and M. D. Gross, "Designing Systems to Design Themselves" CHI 2009 Workshop: Programming Reality, Boston, MA.

**2008** Schweikardt, E. and M. D. Gross, "Learning About Complexity With Modular Robots" DIGITEL 2008: The Second IEEE International Workshop on Digital Game and Intelligent Toy Enhanced Learning, Banff, Canada. **Best Full Paper – Honorable Mention.**

**2008** Schweikardt, E. and M. D. Gross, "The Robot is the Program: Interacting with roBlocks" TEI 2008: Second International Conference on Tangible and Embedded Interaction, Bonn, Germany, ACM Press.

**2007** Schweikardt, E. and M.D. Gross, "roBlocks: Understanding Emergent Complexity from the Bottom Up" RSS 2007: Robotics Science and Systems Workshop on Research in Robots for Education, June 27-30, 2007, Atlanta, GA.

**2007** Schweikardt, E., "Envisioning the Robot Design Studio" CHI 2007 Workshop: Supporting Design Studio Culture in HCI, San Jose, CA.

**2007** Schweikardt, E., "Modular Robotics as Tools for Design" in *Creativity and Cognition 2007*, June 13-15, Washington, DC, ACM Press.

**2007** Schweikardt, E. and M. D. Gross, "A Brief Survey of Distributed Computational Toys" DIGITEL 2007: The First IEEE International Workshop on Digital Game and Intelligent Toy Enhanced Learning, Jhongli, Taiwan.

**2006** Schweikardt, E., and Gross, M.D., "roBlocks: A Robotic Construction Kit for Mathematics and Science Education," Proceedings ACM International Conference on Multimedia Interaction, Banff, Canada, Nov 2-4 2006, pp. 72-75.

**2000** Schweikardt, E., and Gross, M.D., "Digital Clay: Deriving Digital Models from Freehand Sketches." *Journal of Automation in Construction* 9:107-115. (first appeared in Proceedings of ACADIA '98 , Quebec City) **Google Scholar: Cited by 85.**

**1998** Schweikardt, E. and M.D. Gross. Digital Clay: Deriving Digital Models from Freehand Sketches. Published in 'Digital Design Studios: Do Computers Make A Difference?', Proceedings of ACADIA '98, Quebec City, Canada, October 22-25, 1998 pp. 202-211.

## Invited Talks

**Thousands and Thousands of Tiny Robots** April 20, 2011  
*Durango Science and Discovery Museum*

**Cubelets** March 17, 2011  
*University of Colorado at Boulder Computer Science Colloquium*

**There's No Such Thing as Society** March 9 and 10, 2011  
*Carnegie Science Center*

**Hot Oil, Cold Steel, and Free Money** July 24, 2010  
*Sketching in Hardware 2010, LAX*

**Thousands and Thousands of Tiny Robots** October 25, 2008  
*Ithaca Sciencenter*

**Designing Modular Robots** April 28, 2008  
*Computational Synthesis Lab, Cornell University*

**roBlocks** April 24, 2008  
*Dorkbot Pittsburgh*

**Tips on Being a Deliberate Comprehensivist** March 20, 2008  
*Making Things Interactive, Carnegie Mellon University*

## Press Coverage

**Cubelets: modular, affordable robotics for kids and students** February 23, 2011  
*Ars Technica*

**Cubelets: Modular Robotic Blocks** Feb. 20, 2011

Make: Technology on your time

**Cubelets Make Creating Our Robotic Overlords as Easy as Building Blocks** Feb. 18, 2011

Wired Geek Dad Blog

**Toy Design: Cubelets, modular robotic blocks** Februaru 14, 2011

Core77

**Modular Robotics' Cubelets Prototypes on Video** February 11, 2011

IEEE Spectrum

**CMU startup builds learning kits for kids with \$100K NSF grant** December 18, 2008

Keystone Edge

**Pittsburgh Innovates** November 19, 2008

Pop City

**At CMU, Building Fun Toys That Also Teach** May 14, 2008

Pittsburgh Post-Gazette

**Children Experiment with roBlocks** April 7, 2008

The Tartan

**The Dawn of Robo-Blocks** April 3, 2008

GadgetLeak

**roBlocks: Simple Blocks to Make Robots** April 3, 2008

O'Reilly Radar

**Plugged In: CMU's Robotic Toys** February 28, 2008

*WTAE TV: The Pittsburgh Channel*

## Service

2011 **Reviewer** INTERACT 2011: 13th IFIP TC13 Conference on Human-Computer Interaction

2011 **Technology Reviewer** 2011 National Science Foundation SBIR Phase I proposals: Educational Applications

2011 **Reviewer** TEI 2011: ACM Fifth International Conference on Tangible and Embedded, and Embodied Interaction

2010 **Publicity Chair** TEI 2010: ACM Fourth International Conference on Tangible and Embedded Interaction

2010 **Reviewer** UIST 2010: ACM 23<sup>rd</sup> Symposium on User Interface Software and Technology

2010 **Reviewer** CHI 2010: ACM 28<sup>th</sup> Conference on Human Factors in Computing Systems

2009 **Program Committee** ACM Creativity and Cognition

2009 **Reviewer** TEI 2009: ACM Third International Conference on Tangible and Embedded Interaction

2009 **Reviewer** Journal of Personal and Ubiquitous Computing Special Issue on Material Computing

2008 **Program Committee** Digitel 2008: 2nd IEEE International Conference on Digital Game and Intelligent Toy Enhanced Learning

#### **Studio Critic**

2008 Making Things Interactive, Carnegie Mellon University, Instructor: Mark D. Gross

2007 Making Interactive Furniture, Carnegie Mellon University, Instructor: Mark D. Gross

2007 Design Research Workshop, Carnegie Mellon University, Instructors: Gross, Herbsleb, Shaw, Finger

2006 Architectural Robotics, Carnegie Mellon University, Instructor: Mark D. Gross

2004 Design Studio IV, University of Colorado at Boulder, Instructor: Vaughn Moyer

2003 Sustainable Design Studio at Aspen, University of Colorado at Boulder, Instructor: Fred Andreas

2001 Design Studio II, University of Colorado at Boulder, Instructor: Fred Andreas

#### **Workshops Organized**

*Architectural Robotics: Human Hive*, sponsored by Robot250 and part of the *Meet the Made* exhibit at the Mattress Factory Museum, Pittsburgh, PA, USA. July 20, 2008.

#### **Design Review Committee** 2005 - 2007

Carnegie Mellon University, Pittsburgh, PA, USA