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**I'm applying for funding for:**
Summer 2014
Fall 2014
Spring 2015

**By submitting this application, I confirm that, if selected to receive a Chancellor's Award for Excellence in STEM Education, I will:**

- ✓ Attend and be recognized at the annual Symposium on STEM Education (fall 2014).
- ✓ Give a brief introduction (~10-15 min) to my project at DBER in fall 2014.
- ✓ Actively engage in the CU-Boulder STEM education community by attending Chancellor's Fellow events.
- ✓ Present my work to the STEM education community by giving at least one DBER seminar, OR, if that is an impossibility, I will give a talk that the CU-Boulder STEM education community is invited to attend.
- ✓ Submit a 1000 to 3000-word report detailing the outcomes of the project at the end of the funding period.

# Empowered Learners: Using in-class Hack-a-thons as a Basis for Teaching STEM Technical Skills in College and High School Classrooms

Submitted by Michael Skirpan, *Doctoral Candidate, Department of Computer Science*
Faculty Advisors: Mark Gross, *Professor, Director of ATLAS, Department of Computer Science;* Tom Yeh, *Assistant Professor, Department of Computer Science*

## Goals and Objectives

Research Questions: What technological and teaching resources are necessary for designing an active classroom setting that teaches technical skills? Using in-class hack-a-thons *can instructors gain richer data on learning progressions* and *do students develop stronger technical skills*?

My PhD research focuses on how to interweave principles of democratic and experiential learning into the design and implementation of education technologies that are useful to STEM educators. Starting as both TA and RA for CSCI 4830 User Centered Design and Development, I have begun to address initial questions of how to run a class driven by student interaction, what data relevant to learning can be gathered from this context, and what software is helpful for mediating both the teacher and student roles through these experiences. Our first run of this method has been promising as in-class hack-a-thons have manifested impressive student projects [see Figure 1], and mechanisms for collecting quantitative and qualitative data have been created via GoogleDocs and the GoogleDrive API, and the peer learning process has become a rudiment of class. Recently, I have begun collaborating with Google's Drive Team who has shown interest in supporting this project. In the area of activity design, in Spring 2014, I

**Figure 1: Students During In-Class Hack-a-thon Spring 2014. I propose to extend this to another CS course in Fall 2014 and then a High School Computer Class Spring 2015.**

have been working on Active Learning activities with K-12 populations introducing STEM concepts such as circuits and programming [see Figure 2]. These activities are part of my research on exploring novel classroom practices that support principles of active and experiential learning. Having had the opportunity to work with younger populations doing hands-on learning, and college students on in-class active experiences, I plan to combine these efforts to support a high school classroom.

I am applying to this fellowship in order to support myself in extending this method to another college classroom (Fall 2014) and a high school classroom (Spring 2015) and evaluate the method's efficacy. The goal of this style is to *immerse and empower students to be active* in their education, leave them with *tangible technical skills* relevant to computer design and implementation, and *increase student retention* by engaging students as participants.

**Figure 2: Children Playing with a Water Circuits Activity I Crafted. I propose to build on activities like these to support an in-class hack-a-thon style class for high schoolers.**

**Motivation**

Since the 1950's there has been an interest in ensuring we train an ample number of scientists and engineers. During the first boom in science education funding, it was an economic competition against the Russians motivating the nation's interest; however, now we find ourselves in a transitioning world where an increasing number of jobs require technical skills. According to a 2012 report given by the President's Council of Advisors on Science and Technology, at current rates we will be at a shortage of approximately 1 million STEM professionals in the next decade. Moreover, they point to the fact that only 40% of students who enter college intending to work in a STEM field actually graduate with a STEM degree [11].

Having these problems in mind, STEM education is again hot topic in both the public and private sector with objectives like Obama's Educate to Innovate campaign [10] and the MacArthur Foundation's Digital Media and Learning initiative (http://www.macfound.org/programs/learning). Even though STEM education innovation is on the minds of millions, we continue to see traditional classroom formats dominate most of our primary and secondary schools as well as early college. The goal of our work is to establish and document progressive classroom practices for teaching technical skills; specifically, computer programming and design.

A technical skill gets its fullest definition by comparing it to conceptual understanding. This distinction is elucidated in the debate between *situativist* and *cognitivist* viewpoints on education. Famously debated by Anderson and Greeno, they separate their camps in the following ways:

> **Cognitivist:** interested in processes and structures at the level of individual agents. These include perception, memory, inference, and decision.
>
> **Situativist:** Focused primarily at the level of interactive systems that include individuals as participants, interacting with each other and with material and representational systems. [5]

So, in the realm of STEM education, a technical skill is one that requires experience and application, interaction with a team, and hands-on representation. Whereas a conceptual understanding is abstracted, fact-based, and builds upon cognitive frameworks.

Examples of technical skills would be competency in web development through the use of CSS, HTML, and JavaScript, the ability to work with datasets using Python, or comfort in prototyping simple circuits and sensors using Arduino boards or Raspberry Pi. These are the kinds of skills that often are shaped during summer internships or early job training. However, as scientists have attempted to figure out what does and does not work in STEM education, it has been seen that interactive classrooms avail improved knowledge of fundamental concepts, help non-science majors gain basic understanding and skills in STEM areas, and promote attainment of early college science majors in their respective fields [4, 6, 12]. Even with these educational techniques being tried in core science classrooms – particularly physics – we have yet to see wide-scale implementation

of these methods nor their methods leaking into other disciplines (e.g., computer science, environmental science, etc.) or age groups (e.g., high school).

Currently at CU, in the company of many other schools, computer programming is mostly taught using the traditional mode of giving lectures, assigning homeworks, preparing for exams, and completing a class project. This has the student taking a passive role during class, scouring class notes to answer homework problems, memorizing terms and syntax for exams, and then pairing with friends for a project. Of course there is some merit to the traditional style: teachers have the opportunity to transfer correct frameworks for thinking about the material, projects give students a chance to show what they've learned, and homework and exams reinforce material. With that said, there are also many downfalls that possibly account for our struggle in teaching STEM content: classrooms lack hands-on process leaving students bored, assignments and projects cluster friends who are often all struggling or all doing well, it is hard to account for whom is actually doing the work on assignments and projects, memorizing science concepts and doing science are drastically different (a problem often not addressed until jobs or grad school), class content is primarily dictated and owned by the teacher rather than students, and students come to expect formulaic patterns and binary (i.e., right or wrong) solutions to problems.

These problems have been well documented and it has since been empirically established in STEM education literature that active and collaborative instructional methods are far-and-away more effective than traditional classroom methodologies [7,9]. The issues of traditional classroom instruction have been stated on repeat to a point that in a 2008 white paper by the NSF Board of Science Education, the authors recommended that we do *not* need to support more research supplying evidence that active classrooms provide better results [3]. What we do need, however, are more curricular and instructional models that aid teachers in forming and implementing new classroom practices. The belief of this need provides the fundamental driving force to our research, which hopes to focus on instructional and technological designs that support a learn-by-doing (i.e., hack-a-thon) style classroom for teaching technical skills.

**Theoretical Framework**

The foundational theoretical concepts for our work are Experiential Education (EE), Democratic Education (DE), and Active Learning (AL). While each of these concepts has a contemporary formation, they are deep rooted in the history and philosophy of education. All three of these concepts now get lumped into frameworks such as constructivism, constructionism, situative learning, or connected learning; however, their provenance is far older. We can find these ideas in Plato who posed the Socratic Dialogue as a method of engaging the intellect, John Locke the father of the empiricist tradition in philosophy and believer in first-hand experience as a primary educational driver, Jean Jacque Rousseau who advocated for a natural education from exploration and inquiry, and John Dewey the champion of progressive education and the democratic idea within schools and classrooms. Nowadays we see these same ideas touted by academics and practitioners like Eric Mazur, David Hake, Isaac Graves, Alfie Kohn, and Mitch Resnick, all proponents of some form of active engagement in classroom learning.

While these three concepts have their distinct flavor, their affinity can be seen in certain shared principles:

1. Knowledge is not attained passively, rather through taking an active role in its production.
2. Teachers are facilitators rather than dictators of learning.
3. Learning is a process of iterative experiments containing both failures and success.
4. Students are most engaged when put in control of their learning.

Experiential Education (EE) and Active Learning (AL) are closely related insofar as EE is an overarching theory of knowledge attainment and AL is an instructional concept for realizing this theory. AL has been a thread in the past 20 years of physics education research, and has been developed through the work of Eric Mazur, Richard Hake, and David Meltzer. EE dictates that the learner must go through the motions of shaping their own learning experience through the processes like designing, creating, inquiring, and teaching. Dewey decrees two principles of these experiences: interaction and continuity. Interaction involves shaping a situation that creates an educative dynamic between the internal state of the learner (dictated by what information he/she has) and the

environmental conditions in which you place him or her [2]. Traditional education is one-sided in that it relies primarily on a unidirectional transmission of knowledge from lecturer to student. Straying from one-sided lectures, AL has tested methods such using clickers for instantaneous Q&A, think-pair-share for peer discussion, and the minute paper to give the student time to digest and express [1,8]. AL is a blanket term that encompasses many of the progressive methods proponents of engaged learning experiences employ. These methods have shown success, and have continued to drive more immersive approaches to learning in the classroom. Our research hopes to continue along the stream of AL methodologies.

Democratic Education (DE), on the other hand, is primarily about aiding students toward participating in a community of actors, and being empowered to choose their own educational paths. DE is a growing trend with acclaimed examples such as the Brooklyn Free School (Brooklyn, NY) and The Academy of Global Citizenship (Chicago, IL), and budding examples such as the Patchwork School here in Louisville, CO. While DE has primarily been about learning to participate in democracy, it is also an educational practice that has been shown to improve student engagement and promote ownership over learning. Democratic practices include creating public forums for students to communicate to one another as well as their instructor, having the freedom to choose what they will learn and how they will apply it, and becoming comfortable with open-ended problem solving as opposed to structured activity. DE has yet to be integrated into practices of STEM education though we see it as a compliment to the approaches offered in EE and AL. The democratic process also affords important opportunities for honest feedback and evaluation of the classroom setting (which will be covered below).

*Table 1: How our methodology fits with theoretical framework*

| Experiential Education | Democratic Education | Active Learning |
|---|---|---|
| • At-home Challenges<br>• Scenarios<br>• Semester Project | • Feedback Journal<br>• Class Forum<br>• Open-ended problem solving | • In-class Hack-a-thon<br>• Demoing<br>• Hands-on Instruction |

**Methodology**

Our approach to the challenges and motivations set out above have already begun being developed through the work of Tom Yeh and myself in this spring's offering of CSCI 4830 User Centered Design and Development [see Figure 2]. The primary methodology chosen for creating an active learning experience is to hold weekly in-class hack-a-thons, turning the classroom into a workshop where teams of students are designing, planning, and implementing full solutions to problems that are posed by the instructors. We call this the 'flipped classroom,' where expectations are set for exploratory learning that should happen outside of the classroom to make room for active participation within the classroom.

*Traditional Classroom*

| Mon | Tues | Weds | Thurs | Fri | Sat | Sun | Mon |
|---|---|---|---|---|---|---|---|
| Class | Home | Home | Home | Home | Home | Home | Class |
| Lecture | Homework | Homework | Homework | Homework | Homework | Homework | Lecture |
| Topic 1 | Topic 1 | Topic 1 | Topic 1 | Topic 1 | Topic 1 | Topic 1 | Topic 2 |

*Flipped Classroom*

| Tues | Weds | Thurs | Fri | Sat | Sun | Mon | Tues |
|---|---|---|---|---|---|---|---|
| Home | Home | Home | Home | Home | Home | Class | Home |
| Learning Challenge | Learning Challenge | Learning Challenge | Learning Challenge | Learning Challenge | Learning Challenge | Hack-a-Thon | Learning Challenge |
| Topic 1 | Topic 1 | Topic 1 | Topic 1 | Topic 1 | Topic 1 | Topic 1 | Topic 2 |

In order to meet these goals, the following structure was devised:

- Class is once a week for 150 minutes.
- Students work in teams of four during class to complete a design challenge which are posted on the class website at the beginning of class.

- The hack-a-thon involves submitting a design, team implementation plan, and demo onto a public document that everyone is using simultaneously.
- 'Homework' involves doing a series of hands-on challenges to familiarize students with the material.
- Students must meet with a group of peers once a week to participate in collaborative learning.
- Each week students fill out a personal journal with a variety of questions (open-ended and specific) that give direct feedback to the instructors about that week's work and the class dynamics in general.
- A final semester-long team project that shows the culmination of skills learned.

The hack-a-thon has proven to be effective at accomplishing the goals of active learning and allows instructors to personalize their interactions with students. By the time students come into class, a design scenario is posted online as well as a set of milestones, which act as a scaffold for expectations of student performance. Beyond these loose criteria, the design is largely in the hands of the teams. Currently we have been switching between letting students choose their own teams and then matching teams based on skills and competency shown from their at-home learning tasks. Once class is in motion the instructors are able to go around and answer questions, take feedback, and have individualized discussions with each student and team. Team progress is tracked by seeing submissions in real-time, allowing the instructors to identify issues as they arise.

Outside of class, students are asked to learn new material by following an online document that steps them through a series of challenges starting with downloading the software and takes them all the way through a first basic design using the new skill. They prove they have accomplished these challenges through screenshots, video demos, and code snippets. In order the keep the class active as a community of learners, students are asked to meet with a few peers each week to answer each other questions and tinker with the new tools they are learning. To prove they have done this, they are asked to submit a 'selfie' photograph of them working with their team. On top of the technical skills, students are requested to reflect on, discuss, and criticize the class through weekly journal

submissions that give them the chance to tell us how they liked the lesson, what could have been done better, and what resources were most useful.

With these two parts of the class working in tandem – at-home challenges and in-class hack-a-thons –the goal of experiential learning is achieved within the setting of an active classroom. Each piece of material is 'taught' through iterative attempts to solve challenges and class is completely devoted to proactive creation rather than passive lecture. Also using the journal, in-class personal feedback, and open-ended problem solving, this instructional methodology is progressing toward our goal of democratic education as well.

The medium through with the class interacts with the content is Google Drive. Each student has an individual folder for documenting their personal learning using a Google Presentation Document, which includes their at-home challenge submissions and answers to our journal questions. In-class hack-a-thons similarly use Google Presentations where a template is provided for submissions based on that week's design challenge then all students go into the same document and claim a section for their team's submissions.

For the semester projects, students are allowed to work in teams of their own choosing and design anything they like to show off the skills they acquire. The only restraints put on them is that they must use GitHub to submit all of their code and they must commit to certain project milestones that keep us up to date on their progress. These two resources give us access into the team dynamics and whether or not the students are progressing toward the commitments they set out for themselves.

Moving beyond this semester we plan to extend this methodology first for the purpose of CSCI 4830 HCC Big Data, then for the purpose of a high school computer class. In the CSCI 4830, the hack-a-thon style class will be continued, but now in the realm of physical computing and data analysis. Currently, ATLAS's lounges are used as a space to host our hack-a-thons, but in the autumn we plan to host our class in ATLAS's black-box theater and utilize their computing labs to create an optimal environment for designing environmental sensors and then doing applied data science.

In the coming year, we hope to take the data we have already gathered to find an ideal balance between time spent designing and coding, and that spent participating in

some discussion during class. Also, having built up our software resources the plan is to improve the online materials students are using and develop a public forum for the students to answer each others' questions and place pressure on the instructors for what they want out of the class from week to week. Further, we plan to begin generating a model to support teachers who want to run classes in this format. Our focus here will not just be on other computer science professors, but high school teachers and other STEM educators who can reuse and modify many of the software resources, evaluative methods, content, and code created during the class.

**Evaluation**

Our primary mode of evaluation comes from the data students the provide as they work on publicly recorded documents like Google Documents and GitHub, and the direct feedback they give us from week-to-week. This data comes in both quantitative and qualitative forms. Items tracked quantitatively are:

- When students submit assignments/projects
- How long they spend on assignments/projects
- Size of individual contributions to a group submission
- The size of individual changes between submissions
- Scaled measures of enjoyment, frustration, etc.

Qualitatively:

- What goals students have
- Resources they used for learning and problem solving
- Changes they'd like to see made in the class
- Places they got stuck in an assignment
- What they learned from their teammates

Using this evaluative data I can do a number of analyses on the effectiveness of individual curricular modules (taught via at-home challenges and in-class hackathons), class social dynamics, student satisfaction, and the relationship between student efforts to project outcomes. Evaluation will take many forms, such as: statistical measures, discourse analysis and coding, graphical representations [see Figure 3], and network analysis. Not only will this allow me to evaluate how our classroom model is working

for students and make predictions and inferences about who works best together and what resources are likely to be helpful, but also I will be able to provide students with evaluative representations of their individual working trends.

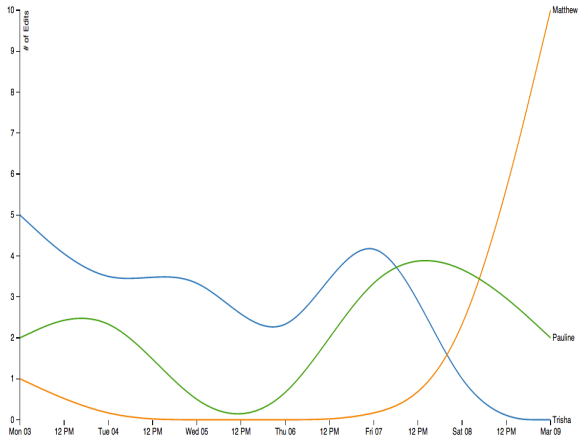


**Figure 3: Edits on a File vs. Date (Sunday 5/9 was Due Date). I propose to employ graphical evaluations like this to examine classroom behaviors and trends.**

The above evaluations will be done on internal variables – that is, figuring out what works better or worse within our own class – however, I will also do a cross-class comparison with students to evaluate our class in terms of other classes. This will be achieved by asking our own students what courses they took before and are taking concomitantly. In this way, I can obtain personal perspectives on the costs and benefits of our methodology against those being taught in other courses. By asking other professors in our department and from other universities to deploy a survey derived from our journal questions, I will be able to obtain some information on the differences in student sentiments across classes. Further, by looking into similar courses at other universities and online courses on related topics, I get a broader comparison of our methodology with others.

My hope is to be able to measure two primary variables to determine the overall success of our class: student engagement and retention. Student engagement can be roughly understood through the survey questions described above along with the comparisons of how students felt about other courses. For retention, a baseline measure is derived by merely comparing drop-out and withdrawal statistics between our class and others. In my continued research, I also hope to be able to begin collecting data on long-term student retention within the computer science major; though, robust results will only be found by following up with consenting students in later years.

**Proposed Timeline**

| *Time* | *Funding* | *Planned activities* |
|---|---|---|
| Spring 2014 | Ed School Fellowship (25%) + CS RA (25%) | Pilot Methodology with College Classroom<br>Collect Preliminary Data |
| Summer 2014 | **STEM Fellowship (50%)** | Analyze Data<br>Work on SIGCSE manuscript [Deadline 9/2014]<br>Write Curricular Modules for Fall 2014 |
| Fall 2014 | **STEM Fellowship (25%)**+ CS RA (25%) | Second Run with College Classroom<br>Create Reusable Resources<br>Attend the annual Symposium on STEM education<br>Present at DBER |
| Spring 2015 | **STEM Fellowship (25%)** + CS RA (25%) | Work with High-school classroom<br><br>Attend SIGCSE (March) |
| Summer 2015 | Volunteer (or future funding opportunity) | Work on a final report for CSL<br>Work on a manuscript for SIGCSE to report full results. |

Our timeline will begin over the summer while doing analysis and drawing conclusions from the first iteration of our AL classroom. I will be writing up these results for a first paper to submit to SIGSCE's 2015 conference (http://www.sigcse.org/). Before the fall 2014 semester, I will determine improvements that can be made to aspects of our methodology that have already implemented (e.g., balance between in-class hack-a-thon time and discussion time, how students were grouped, and adjustments that come from student feedback). Then, planning will begin on how to extend our methodology by coming up with a strategy to implement a public-forum and make more flexible challenges to give students for more freedom in their design process. Finally, in the summer, I will design and write curricular modules for our next class on physical computing and big data. These modules will center on building technical proficiency with arduino boards and collecting data from sensors.

Once the fall 2014 term begins, the aim is to enroll 40 junior and senior undergraduate students in our class and introduce approximately 25% all new content into the class coming from the designs I am responsible for over the summer. During the autumn, evaluation will continue on the methods using in the spring within our new context, while concomitantly developing ways to evaluate new content. I will also work on contacting other professors and dispersing surveys to accomplish our goals in generating comparative evaluations. Finally, by the end of the autumn, I hope to have developed a partnership with a local high school in Denver/Boulder area to find a teacher who will agree to experiment with the hack-a-thon style class for teaching technical skills to his/her students (e.g., for a computer lab course). For this, I plan to work with the DSST Public Schools (http://dsstpublicschools.org), which focus on innovative methods to teach STEM content and are likely to have a curriculum that can support our instructional methodology.

Spring 2015 will involve working with a high school teacher to shape our curricular resources to be appropriate for application in a secondary school setting. Thus, rather than creating new materials and perfecting our data collection like in the autumn, my spring work will primarily focus on the question of how to modify our model for other age groups, and gather some preliminary results on the sentiments of high schoolers placed in this style of class.

Summer 2015 will be devoted to drawing conclusions from all of the data for the purpose of writing up and sharing our results. My goal will be to take all our materials and build an online resource that aids other teachers in adopting a model similar to ours. This will involve writing in-depth descriptions of how to develop the class structure, providing model content for others to modify to their needs, and create templates of evaluative resources (e.g., graphs) that teachers can re-use.

**Project Outcomes**

*Personal Development*

Obtaining this fellowship will help greatly in my goals for research and after graduate school. My goal in pursuing a PhD is to develop a deep understanding of what it takes to implement design curriculum that are true to EE, AL, and DE, and after graduate to open

a school based on these principles. I also want to contribute to open-source education technologies by creating software based on the classroom resources I build to support other educators in achieving better instructional techniques.

*Home Department Benefits*

Completing this project will provide a space for reflecting on our departmental pedagogical practices. By innovating in regard to how to teach CS and developing comparative evaluations, all professors in our department who are interested in improving their classrooms will have an abundance of information based on what I collect. As a student who has strong connections to the School of Education and am continuing to build partnerships with local school districts, my project will help foster relationships between my home department and others inside and outside CU.

*CU STEM Community and Beyond*

I started my PhD program in the School of Education before moving to the computer science department, and thus my work will not only feed my department, but interested STEM educators in the School of Education will play an integral role in designing and seeing the results of my work. Moreover, the educators in other disciplines of science and engineering will have an example of how changing the dynamics of their class may help them in engaging and retaining students. With the open-source resources I put online, many other educators who are working on similar projects will be able to build off of my research, and, ideally this work will be the first phase in constructing a foundational resource for progressive educators everywhere who are interested in rethinking how to teach science.

## References

[1] Crouch, C. H., & Mazur, E. (2001). Peer instruction: Ten Years of Experience and Results. American Journal of Physics, 69, 970.

[2] Dewey, J. (2007). Experience and Education. Free Press.

[3] Fairweather, James. "Linking evidence and promising practices in science, technology, engineering, and mathematics (STEM) undergraduate education."Board of Science Education, National Research Council, The National Academies, Washington, DC (2008).

[4] Fraser, James M., et al. "Teaching and physics education research: bridging the gap." Reports on Progress in Physics 77.3 (2014): 032401.

[5] Greeno, James G. "On claims that answer the wrong questions." Educational researcher 26.1 (1997): 5-17.

[6] Hake, Richard R. "Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses." American journal of Physics 66.1 (1998): 64-74.

[7] Kuh, G., Kinzie, J., Schuh, J., & Witt, E. (2005). Student success in college: Creating conditions that matter. Washington, D.C.: Association for the Study of Higher Education.

[8] Meltzer, David E., and Kandiah Manivannan. "Transforming the lecture-hall environment: The fully interactive physics lecture." American Journal of Physics 70.6 (2002): 639-654.

[9] Pascarella, E., and Terenzini, P. (2005). How college affects students: A third decade of research. San Francisco: Jossey-Bass.

[10] *President Obama Launches "Educate to Innovate" Campaign for Excellence in Science, Technology, Engineering & Math (Stem) Education.* White House Office of the Press Secretary. November 23, 2009.

[11] President's Council of Advisors on Science and Technology. (Febrary 2012) *Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics.* Washington, D.C.: Executive Office of the President.

[12] Thacker, Beth, et al. "Comparing problem solving performance of physics students in inquiry-based and traditional introductory physics courses." American Journal of Physics 62.7 (1994): 627-633.

# Michael Warren Skirpan

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## Education:

*University of Colorado – Boulder:* (Current)
PhD Candidate (advisor: Tom Yeh, Computer Science) – Human Computer Interaction

*University of Pittsburgh:*
BPhil - Philosophy (3.7 GPA in major)
BS – Economics (3.55 GPA in major),
Minor- Physics

*Oxford University – Christ Church College:*
Visiting Student, 2007-2008
Area of Study: Philosophy, Politics, Economics
US Equivalent GPA: 3.8

## Honors and Awards:

- Received Honors for Undergraduate Thesis
- 2009 Honors College Dean's Fellow

## Current Work:

*University of Colorado – Boulder*

- Primary research involves creating technological tools for dynamic and democratic classrooms using feedback systems, public forum, and analytics.
- Secondarily, involved in the creation of hands-on educational toolkits using open source hardware
- Work on big data issues; particularly on visualization, interface, and analysis.

## Current Work – continued:

*CoLab*

- Co-founder of non-profit organization founded on principles of 'equal access to education and open access to information.'
- Research and build our own sustainability projects then create online educational models for others to learn from and replicate.

## Past Experience:

*University of Pittsburgh – Fiez Lab*
*(April 2011 – January 2013):*

- Research Assistant with primary responsibilities of programming behavioural experiments and writing.
- Secondary responsibilities include data management, overseeing and directing the work of other researchers, working on grant proposals, and editing works we are publishing.

*Carnegie Museum of Natural History*
*(June 2012 – September 2012):*

- Volunteer as a teen mentor helping students around the area learn about science and develop projects for the museum to prepare them for college.
- Consulted on SEPA grant proposal
- Aid in exhibit design.

*The Original Magazine*
*(April 2011 – March 2012):*

- Writer for Pittsburgh-based culture magazine. Wrote feature articles in Fall 2011 and Spring 2012 issues on the dynamics of university life and the history of jazz and labor in Pittsburgh, respectively.

*WPTS – Pittsburgh*
*(September 2011 – December 2011)*

- Hosted two-hour talk show about current political and cultural topics.

## Past Experience – continued:

*Epic Systems*
*(August 2010 – March 2011):*

- Project manager in charge of software installation at hospitals and medical centers.
- Certification: Epic – Radiant

*University of Pittsburgh Academic Resource Center*
*(December 2008 – May 2010)*

- Role of Master Tutor whose job was tutoring students in economics, physics, philosophy, logic, and writing.
- Taught a workshop on "Surviving Math and Science Courses."

*Carnegie Science Center: Program Presenter/Educator*
*(May 2007 – September 2007)*

- Created and presented physics experiments for kids while working on the center's submarine.
- Gave tours and answered questions about both science and the submarine.

*Seven Springs Mountain Resort: Snowboard Instructor*
*(December 2006 – March 2007)*

- Taught both children and adults of all experience levels snowboarding.

*Engineering Field Study: Augsburg, Germany*
*(Summer 2006)*

- Researched and created presentation on Audi looking at the integration of business strategies with scientific development.

## Language Skills:

*Spoken*

- English (Native)
- French (Intermediate)
- Romanian (Beginner)

*Programming*

- Python, Java, JavaScript, CSS, HTML, Arduino, ActionScript

## Other Interests and Activities:

- Doing editing work for other writers. Most recently, Edward McCord's book, *The Value of Species*.
- Writing fiction, screenplays, poetry, and blogs
- Travelling
- Making music (piano and guitar)

**Student's Full Name**
Mike Skirpan

**Adviser's Full Name**
Tom Yeh & Mark Gross

**Adviser's Home Department**
Computer Science

**Adviser's Email Address**
tom.yeh@colorado.edu & mdgross@Colorado.EDU

**By submitting this application, I confirm that, if my advisee is selected to receive a Chancellor's Award for Excellence in STEM Education, I will:**

- ✓ Attain a GRA salary match (25% during the academic year, and 50% during the summer) from my own funding sources or from my department.
- ✓ Attend the annual Symposium on STEM Education (fall 2014).
- ✓ Actively engage in the CU-Boulder STEM education community by attending the weekly DBER Seminar Series when possible.

University of Colorado Boulder

Dear CGA Selection Committee,

As co-advisors, we are writing to you to express our full commitment to mentoring and supporting Mike Skirpan's PhD research on computer science education as outlined in his proposal for STEM Chancellor's Fellowship. Mike is proposing to study in-class hack-a-thons as a novel active learning framework to teach technical skills in college and high-school classrooms.

## 1. Mentoring description

We are committed to mentoring Mike in three ways:

**Advisor/Advisee level:** The most personal and intimate level of mentoring will be provided through existing PhD advisor/advisee relationship. Both Prof. Tom Yeh and Mark Gross have been meeting Mike on a regular basis and will continue to do so.

**Course level:** In Fall 2014, Mike will be taking a lead to introduce several new modules about physical computing to an existing computer science course on HCC and Big Data. Mike will receive mentorship from Prof. Tom Yeh, who is the main instructor of the course. The course will be held in ATLAS. Prof. Mike Gross will mentor Mike to make sure the course can be run smoothly and can make the most use of ATLAS's facilities.

**Department level:** Mike will receive mentoring from the members of the curriculum committee in the CS department as well as in ATLAS. The committee has agreed to meet at least once every semester the review the progress of Mike's research and provide feedback.

## 2. Inclusion of research results in the student's degree program

**Publications:** Mike will publish his research outcomes at the annual SIGCSE (Special Interest Group on Computer Science Education) conference. SIGCSE is the premier conference on computer science education research. In fact, Mike is already planning to work on the manuscript over summer to report the preliminary findings from the pilot study we are carrying out this semester (Spring 2014). The submission window is September. Next year, Mike will write a manuscript to report the complete findings from the one-year study he is proposing.

**Presentations:** Mike will participate in the student research colloquium to present his research outcomes. In fact, Mike has already been scheduled to present at the colloquium on April 16 to report the preliminary findings from the pilot study. The student research

colloquium is a forum where PhD candidates from various research topic areas in our department present their research to their peers.

**Dissertation:** Mike will include the research results in his PhD dissertation. The proposed research described in Mike's application is well aligned with his dissertation research.

## 3. Matching fund

We are committed to provide financial support to provide matching fund if Mike is awarded the STEM graduate fellowship. We currently have an NSF proposal under review, which, if funded, may provide the 25% matching fund. An alternative funding resource will be Prof. Tom Yeh's research startup.

## 4. Broader Impact

**Further development:** We both look forward to mentoring and working with Mike to implement and validate the in-class hack-a-thon method in CS courses. Moreover, Mike is proposing to bring this method to high-school classrooms. This will be an exciting opportunity for both of us as faculty advisors to advance the frontier of STEM education by taking part in Mike's effort to bring democratic education, experiential learning, and active learning to STEN classrooms.

**Support STEM education within the home department:** We are both pleased that Mike is joining our department. His background in education research is a valuable asset. Very few in our current pool of PhD students have the kind of background like Mike's. He is serving as a bridge between the CS department and the School of Education. One outcome of the proposed project is validation of the in-class hack-a-thon method. If successfully, other colleagues may become interested in adopting this method for his or her courses. Mike's experiences will be valuable. He can help our colleagues to adapt curriculum and design new hack-a-thon activities. Also, he can help train other PhD students to TA for the course.

**Benefits to the CU-Boulder community:** We believe the benefits of the in-class hack-a-thon method is not limited to CS courses. It can very well be applied to other disciplines. Mike is very eager to share his findings with others in the CU-Boulder community. As mentioned above, Mike has already signed up to present his preliminary findings to his fellow graduate students. He will continue to make strong efforts to disseminate his research outcomes. Moreover, there proposed project will result in a suite of software to support and monitor student progress through hack-a-thons. Mike is planning to open-source the software.

Please do not hesitate to contact us regarding Mike Skirpan's qualification and dedication to his proposed research. He is a deserving recipient of the STEM fellowship.

Sincerely,

Mark Gross
Professor
Director, ATLAS Institute
Department of Computer Science
University of Colorado Boulder

Tom Yeh
Assistant Professor
Department of Computer Science
University of Colorado Boulder

**Mark D. Gross** **Summer 2013**

http://code.arc.cmu.edu/~mdg

## EDUCATION

Massachusetts Institute of Technology Ph.D. Design Theory & Methods 1986
Dissertation title: ***Design as Exploring Constraints***; committee: NJ Habraken, A Fleisher, S Papert

Massachusetts Institute of Technology B.S., Architectural Design, 1978

## PROFESSIONAL EXPERIENCE

| | |
|---|---|
| 2004 – present | **Carnegie Mellon University**<br>Professor, Computational Design,<br>Associate Head & Director of Graduate Programs, School of Architecture 2008-2012<br>Affiliate faculty Human Computer Interaction Institute |
| 2008 – present | **Modular Robotics Incorporated**<br>co-founder; Research and Education Director |
| 2013 – present | **Blank Slate Systems**<br>co-founder; Research and Outreach Director |
| 2012 | **National University of Singapore**, CUTE Center, visiting professor (1 month) |
| 1999 - 2004 | **University of Washington, Seattle**<br>Professor (from Sept 2002), Department of Architecture |
| 1990 - 1999 | **University of Colorado, Boulder and Denver**<br>Associate (1997-1999) and Assistant (1990-1997) Professor, College of Architecture and Planning, Department of Planning and Design |
| 1998 | **Nara Advanced Institute of Science and Technology, Nara, Japan**<br>Visiting Research Scholar, Cognitive Science Lab, Information Systems Division |
| 1988 - 1990 | **Design Technology Research, Cambridge, MA and Tokyo**<br>Principal Investigator |
| 1981 - 1988 | **Massachusetts Institute of Technology**<br>Lecturer & Postdoctoral Research Associate, School of Architecture and Planning |
| 1982-1984 | **Atari Cambridge Research Laboratory, Cambridge, Massachusetts**<br>Research Staff, Computers and Education |
| 1981 | **Logo Computer Systems Inc, Boston, MA**<br>Programming Language Design, Computer Animation |
| 1980 - 1981 | **Technical University of Eindhoven (SAR)**<br>Visiting Researcher |
| 1978 - 1980 | **MIT Artificial Intelligence Laboratory**<br>System Programmer, Logo Project |
| 1976 - 1978 | **The Architecture Machine Group, MIT**<br>Undergraduate Research Assistant |

## JOURNAL ARTICLES

2012 **A theoretical framework of design critiquing in architecture studios**, Oh, Y, Ishizaki, S, Gross, MD and Oh, Y. *Design Studies, online Sept 25 2012*

2011 **Experiments in Design Synthesis when Behavior is Determined by Shape**, Schweikardt, E and Gross, MD *J Personal and Ubiquitous Computing, special issue on Material Computing,* 15(2): 123-132

**Hyperform Specification: designing and interacting with self-reconfiguring materials,** Weller, M, Gross, MD, and Goldstein SC *J Personal and Ubiquitous Computing, special issue on Material Computing* 15(2): 133-149

2010 **A Constraint-Based Furniture Design Critic**, Yeonjoo Oh, Mark D Gross, Suguru Ishizaki, Ellen Yi-Luen Do, *Research and Practice in Technology-Enhanced Learning* **5**(2):97-122

2009 **Computational Support for Sketching in Design: A Review**, Johnson, G., Gross, M.D., Hong, J. and Do, E. Y-L. *Foundations and Trends in Human-Computer Interaction,* 2(1): 1-93

**Educating the New Makers: Cross-disciplinary creativity**, M.D. Gross, and Do, E Y-L. *Leonardo* **42**(3) (June 2009).

**ArchiDNA: An Interactive System for Creating 2D and 3D Conceptual Drawings in Architectural Design**, Kwon, Doo Young, M.D. Gross, and Do, E Y-L. *J. Computer Aided Design* 41(3):159-172 (March 2009)

2006 **FlexM: Designing a Physical Construction Kit for 3D Modeling**, Markus Eng, Ken Camarata, Ellen Yi-Luen Do, Mark D Gross, *International Journal Architectural Computing,* **4**(2):27- 47

**Energy Cube and Energy Magnets**, Ken Camarata, Ellen Yi-Luen Do, Mark D Gross, *International Journal Architectural Computing*, Volume 4, Number 2, pp 49- 66

2004 **Let there be light**, E. Y-L Do and M. Gross, *International Journal Architectural Computing,* Volume 2, Number 2, 1 June 2004 pp 211: 227

2003 **A Physical Computing Studio: Exploring Computational Artifacts and Environments**, K Camarata, M Gross, E Y-L Do *International Journal Architectural Computing* **1**(2):169-190.

**Design of Software and Software for Design**, M. Gross and Y. Yamamoto, *Journal of the Human Interface Society* (in Japanese)

2001 **Thinking with Diagrams in Architectural Design**, Do, E. Y-L and M.D. Gross, in *Artificial Intelligence Review* **15**:135-149.

2000 **Drawing on the Back of an Envelope: a framework for interacting with application programs by freehand drawing,** M.D. Gross and E. Do. in *Computers and Graphics Journal* **24**(2000):835-849.

**Intentions in and Relations among Design Drawings,** Do, E. Y-L, Gross, M.D., Neiman, B., Zimring, C., *Design Studies*, 21 (5):483-503.

**Digital Clay: Deriving Digital Models from Freehand Sketches.** Schweikardt, E., and Gross, M.D., *J. Automation in Construction* 9:107-115. (first appeared in Proceedings of ACADIA '98 National Conference, Quebec)

1999 **From Critiquing to Representational Talkback: Computer Support for Revealing Features in Design**, Nakakoji K, Yamamoto, Y., Suzuki, S., Takada, S., Gross, M., *Knowledge Based Systems,* 457-468.

1998 **Collaboration and Coordination in Architectural Design: approaches to computer mediated work**, Gross, M.D., E. Do, R. McCall, W. Citrin, P. Hamill, A. Warmack, and K. Kuczun. J. *Automation in Construction* 7:465-473. (first appeared in Proceedings 1997 TeamCAD conference, Atlanta GA).

1997 **Resolving archaeological site data with 3D computer modeling: The case of Ceren,** Lewin, J. and M.D. Gross, *J. Automation in Construction,* 6(4) 323-334. (first appeared in Proceedings 1996 ACADIA National Conference, Tucson AZ).

1996 **Why can't CAD be more like Lego?** Gross, M.D., *Automation in Construction Journal,* 5:285-300.

**The Electronic Cocktail Napkin - computer support for working with diagrams,** Gross, M.D., *Design Studies* **17**(1), 53-70.

**PDA based Graphical Interchange for Field Service and Repair Workers,** Citrin, W.V., and M.D. Gross, *Computers and Graphics*, **20**(5):641-649.

1994 **Avoiding conflicts in architectural subsystem layout,** Gross, M.D., *Journal of the Concurrent Engineering Research Association* **2**:163-171.

**Roles for Computing in Schools of Architecture and Planning**, Gross, M.D., *Journal of Architectural Education*, **48**(1):56-64.

**EML: A Modeling Environment for Exploring Landscape Dynamics,** Theobald, D. and M.D. Gross. *Computers, Environment, and Urban Systems,* **18**(3):193-204

1988 **Concept Design Games**, Habraken, N.J. and M.D. Gross, *Design Studies* **9**(3):150-158.

**Constraints: Knowledge Representation in Design,** Gross, M.D., S. Ervin, J. Anderson, A.Fleisher, *Design Studies* **9**(3):133-143.

1987 **RoadLab - A Constraint-based Laboratory for Road Design,** Gross, M.D. and S. Ervin, *Artificial Intelligence in Engineering Journal,* **2**(4): 224-234.

1984 **A Computer Model for Design,** Gross, M.D., *Design Studies* **3**(5):142-145.

**Design as the Exploration of Constraints,** Gross, M. and A. Fleisher, *Design Studies* **3**(5),137-138.

**Writing Form,** Gross, M.D. and N.J. Habraken, *Design Studies* **3**(5).

1982 **The Turtle Tissue Project,** Gross, M.D. and N.J. Habraken. *Open House International*, **7**(2):3-12.

## CONFERENCE PAPERS IN PEER-REVIEWED PROCEEDINGS

2012 **Motivating Exercise with a Pedometer-Gift Box.** Yu, Y, Gross, MD., and Yu, D Pegi: Proceedings of APCHI2012 (10th Asia Pacific Conference on Computer Human Interaction). HCD-Net Journal (ISSN: 1882-9635).

**Sketch it, make it: sketching precise drawings for laser cutting,** Johnson, GG, Gross MD, Do, E Y-L, and Hong, J. Proceedings, CHI EA '12 CHI '12 Extended Abstracts on Human Factors in Computing Systems**,** 1079-1082

2011 **The RayMatic: a thermostat with a human face**, Yun R and Gross MD, ACM SIGCHI Proc Tangible Embedded, Embodied Interaction, (TEI) Madeira Portugal, 61-62.

**Interactive Fabrication: New Interfaces for Digital Fabrication,** Willis KDD, Xu C, Wu KJ, Levin G, and Gross MD, ACM SIGCHI Proc Tangible Embedded, Embodied Interaction (TEI), Madeira Portugal, 69-72.

**Red Balloon, Green Balloon, Sensors in the Sky,** Stacey Kuznetsov, George Noel Davis, Eric Paulos, Mark D. Gross, Jian Chiu Cheung. ACM SIGCHI Proc Ubiquitous Computing (UbiComp), Beijing China 237-246.

2010 **Interactive Paper Devices: End-user Design & Fabrication,** Saul G, Xu C, Gross, MD, Proc. ACM Tangible Embedded and Embodied Interaction (TEI), Boston, 205-212.

**WearAir: Expressive T-shirts for Air Quality Sensing**, Kim S, Paulos E, and Gross MD, Proc. ACM Tangible Embedded and Embodied Interaction (TEI), Boston, 295-296.

**Supporting Coordination in Surgical Suites: Physical Aspects of Common Information Spaces,** Scupelli, P, Xiao Y, Fussell SR, Kiesler S, Gross MD, ACM Human Factors in Computing (CHI), Atlanta GA, 1777-1786

**Ubiquitous Drums, a tangible, wearable musical interface,** Smus B and Gross MD, ACM Human Factors in Computing ( CHI) Work In Progress, 4009-4014.

**Personal, Public: Using DIY to explore citizen-led efforts in urban computing**: Bisker S, Gross M, Carter D, Paulos E, Kuznetsov S; ACM Human factors in Computing (CHI) Work in Progress, 3547-3552

**Topaoko: Interactive Construction Kit**, Wu KJ, Gross MD, ACM Human factors in Computing (CHI) Work in Progress, 3619-3624.

**WallBots: Interactive Wall-Crawling Robots In the Hands of Public Artists and Political Activists**, Kuzenetsov, S., Paulos E, and Gross MD, ACM SIGCHI Designing Interactive Systems (DIS), Aarhus Denmark, 208-217.

2009 **Design of Prismatic Cube Modules for Convex Corner Traversal in 3D,** Weller MP, Kirby BT, Brown,HB, Gross MD and Goldstein SC, IEEE Intelligent Robotics and Systems (IROS) St Louis, Oct 11-13, 1490-1495.

**State Machines are Child's Play: Observing children ages 9 to 11 playing Escape Machine**, Weller, M., Do, E. Y-L., Gross M., ACM Interaction Design for Children (IDC), Como Italy, 282-289.

**Tangible Sketching in 3D with Posey**, Weller, M., Do, E. Y-L., Gross M., ACM Human Factors in Computing (CHI) Interactive Demonstrations: April 4-6. 3193-3198.

**Easigami: A reconfigurable folded-sheet TUI**, Huang, Y., Gross, M.D. Do, Y-L,, Eisenberg, M. ACM Tangible and Embedded Interaction (TEI), Cambridge UK, Feb 16-19. 107-112.

**A Tangible Construction Kit for Exploring Graph Theory**, Schweikardt, E., Elumeze, N., Eisenberg, M., Gross, M. , ACM Tangible and Embedded Interaction (TEI), Cambridge UK, Feb 16-19. 373-376.

**An Optocoupled Poseable Ball and Socket Joint for Computationally Enhanced Construction Kits**, Weller, M.P., E YL Do, and M. Gross. ROBOCOMM, IEEE 2nd International Conference on Robotic Communication and Coordination, Odense Denmark, March 2009.

**Co-designed Paper Devices**, Saul, G and Gross MD, Workshop on Material Computing and Programmable Reality, Conference on Human Factors (CHI)

**Designing Systems to Design Themselves,** Schweikardt, E and Gross MD, Workshop on Material Computing and Programmable Reality, Conference on Human Factors (CHI)

**Hyperform Specification – designing with self-reconfiguring material**s, Weller MP, Gross MD, and Goldstein SC, Workshop on Material Computing and Programmable Reality, Conference on Human Factors (CHI)

**Delivery types and communication modalities in the furniture factory design critiquing system**, Oh Y, Do, EY-L, Gross, MD, Ishizaki, S, Proc. Computer Aided Architectural Design Futures (CAAD Futures), Montreal, June 17-19.

2008 **Computing Spatial Qualities in Architecture**, Key, S., Do, E. Y-L., Gross, M., Proc. Association for Computer Aided Design in Architecture (ACADIA), Minneapolis, MN Oct 15-17.

**Learning About Complexity with Modular Robots**, Schweikardt E. and Gross, M. Proc. IEEE Digital Game and Intelligent Toy Enhanced Learning (DIGITEL), Banff, Canada November 16-19. pp.116-123

**Posey: Instrumenting a Poseable Hub and Strut Construction Toy**, Weller, M.P., Do, E. Y-L., and Gross, M.D. Proceedings, Tangible and Embedded Interaction 2008 (TEI), Bonn, Germany, pp 39-46.

**The Robot is the Program: Interacting with roBlocks**, Schweikardt, E., and Gross, M.D., Proceedings, Tangible and Embedded Interaction (TEI) 2008, Bonn, Germany, pp 167-168.

**Computer-aided Critiquing Systems: Lessons Learned and New Research Directions**, Oh, Y., Gross, M.D., and Do, E. Y-L., Proc. Computer Aided Architectural Design Research in Asia (CAADRIA), Chiang-Mai, Thailand

**Escape Machine: Building a tangible state machine game controller with Posey,** Weller, M.P., Do, E. Y-L., and Gross, M.D. ACM Conference on Interaction Design for Children (IDC) Chicago, IL, June 2008.

**A Perspective on Computer Aided Design after Four Decades,** Earl Mark, Gross, M.D., Goldschmidt, G. in 26th international conference on Education in Computer-Aided Architectural Design in Europe (eCAADe), Antwerp, Sept 17-20, 2008. pp. 169-178.

2007 **Environments for Creativity – A Lab for Making Things** Gross, M.D. and Do, E. Y-L. Proceedings, ACM SIGCHI Creativity and Cognition 2007, pp. 27-36

**Why Toys Shouldn't Work Like Magic: Children's Technology and the Values of Construction and Control Gross,** M.D. and M. Eisenberg, Proceedings First IEEE workshop on Digital Game and Intelligent Toy Enhanced Learning (DIGITEL) 2007, Jhongli Taiwan, March 26-28 2007, pp. 25-32.

**A Brief Survey of Distributed Computational Toys,** Schweikardt, Eric and M.D. Gross, Proceedings First IEEE workshop on Digital Game and Intelligent Toy Enhanced Learning (DIGITEL) 2007, Jhongli Taiwan, March 26-28 2007, pp. 57-64.

**Strategies for Research about Design: a multidisciplinary graduate curriculum,** Gross, Mark D., S.Finger, J.Herbsleb, M.Shaw, Proc. 2nd Intl Conf on Design Science Research in Information Systems & Technology (DESRIST), Claremont CA, May 13-15 2007

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

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

**The Designosaur and the Furniture Factory,** Yeonjoo Oh, Gabe Johnson, Mark D Gross and Ellen Yi-Luen Do, in *Design Computing and Cognition,* (ed) John S Gero, Springer, pp. 123-140

**Flow Select: A Time-Based Selection and Operation Technique for Sketching Tools**, Gabe Johnson, Mark D Gross, Ellen Yi-Luen Do, International Conference of Advanced Visual Interfaces (AVI 2006) Venice, Italy, May 23-26, 2006

2004 **3 R's of Drawing and Design Computation,** M. Gross and E. Y-L Do, Design Computing and Cognition, J. Gero (ed), Kluwer, Cambridge Massachusetts, pp 613-632

**A Computationally Enhanced Play Board for Group Interaction,** O. Shaer, B. Ziraknejad, K. Camarata, E. Y-L. Do, M. Gross. (poster) Pervasive 2004, Vienna

**As if You Were Here – Intelligent Annotation in Space: 3D Sketching as an Interface to Knowledge Based Systems**, E. Y-L. Do, M. Gross, American Association for Artificial Intelligence (AAAI), Fall Symposium Oct 22-24

**Critiquing Design Sketches,** Y. Oh, E. Y-L. Do, M. Gross, American Association for Artificial Intelligence (AAAI), Fall Symposium Oct 22-24

2003 **MouseHaus Table, a Physical Interface for Urban Design** (poster) , Chen-Je Huang, Ellen-Yi Luen Do, Mark D Gross, Proc. User Interface Software Tools (UIST) 2003, Vancouver, CA

**Light Pen: Sketching light in 3D,** Thomas Jung, Mark D. Gross, Ellen Yi-Luen Do, Computer Aided Architectural Design Futures 2003, Tainan, Taiwan

**MouseHaus Table** (poster) Chen-Je Huang, Ellen Yi-Luen Do, Mark D Gross, Computer Aided Architectural Design Futures 2003, Tainan, Taiwan

**Window Seat** (poster), YeonJoo Oh, Ellen Yi-Luen Do, et al., Computer Aided Architectural Design Futures 2003, Tainan, Taiwan

**Junk Mail to Spam Converter** (poster), Michael Weller, Ellen-Yi-Luen Do, Jim Nicholls, Mark D. Gross, Fifth International Conference on Ubiquitous Computing, Seattle WA, ACM: 229-230.

2002 **Physical Computing: A Design Studio Bridging Art and Engineering,** Ken Camarata, Mark D. Gross, Ellen Yi-Luen Do, Proc. Int'l Conf. of the Learning Sciences (ICLS) 2002 (Seattle, WA) pp. 520-521.

**Computationally-Enhanced Construction Kits for Children: Prototype and Principles**, Michael Eisenberg, Ann Eisenberg, Mark Gross, Khomkrit Kaowthumrong, Nathaniel Lee, and Will Lovett, Proc. Int'l Conf. of the Learning Sciences (ICLS) 2002 (Seattle, WA). pp. 79-85.

**Sketching Annotations in 3D on the Web** T. Jung, E. Do, and M. Gross, ACM Conference on Human Factors (SIGCHI), ACM Press, pp. 618-619.

**Navigational Blocks: Tangible Navigation of Digital Information**, K. Camarata, E. Do, M. Gross, B. Johnson, ACM Conference on Human Factors (SIGCHI), ACM Press, pp. 751-752.

**Annotating and Sketching on 3D Web Models**, T. Jung, E. Do, and M. Gross, ACM Intelligent User Interfaces 2002, San Francisco, Jan 13-16, ACM Press, pp 95-102.

**Navigational Blocks: Navigating Information Space with Tangible Media,** K. Camarata, E. Do, M. Gross, B. Johnson, ACM Intelligent User Interfaces 2002, San Francisco, Jan 13-16, ACM Press, pp 31-38.

2001 **Smart Objects: Constraints and Behaviors in a 3D Design Environment,** D. Eggink, M.Gross, E. Do, in Proceedings of 19th Conference on Education in Computer Aided Architectural Design in Europe, Helsinki, August 31, 2001, pp 460-465.

**FormWriter: A Little Language for Generating Three-Dimensional Form Algorithmically,** Gross, M.D., in B. de Vries, J. van Leeuwen, and H. Achten. *Proc. Computer Aided Architectural Design Futures 2001, Eindhoven, Netherlands*. Kluwer Academic Publishers, pp. 577-588.

**The Design Amanuensis: an Instrument for Multimodal Design Capture,** Gross, M.D. Do, E. Y-L., and Johnson, B.R., in B. de Vries, J.P. van Leeuwen, and H.H. Achten. *Proc. Computer Aided Architectural Design Futures 2001, Eindhoven, Netherlands*. Kluwer Academic Publishers, pp. 1-13.

**Gesture Modelling: Using Video to Capture Freehand Modeling Commands,** Gross M.D. and A. Kemp, in B. de Vries, J.P. van Leeuwen, and H.H. Achten. *Proc. Computer Aided Architectural Design Futures 2001, Eindhoven, Netherlands*. Kluwer Academic Publishers, pp. 33-46.

**Space Pen: Annotating and Sketching on 3D Models on the Internet,** Jung, T., Gross M.D., and Do, E., in B. de Vries, J.P. van Leeuwen, and H.H. Achten. 2001. *Proc. Computer Aided Architectural Design Futures 2001, Eindhoven, Netherlands*. Kluwer Academic Publishers, pp. 257-270.

**Emergence in a Recognition Based Drawing Interface,** Gross, M.D., in *Visual and Spatial Reasoning II*, J. Gero, B. Tversky, T. Purcell, eds., Key Centre for Design Cognition and Computing, Sydney Australia, pp. 51-65.

2000 **Beyond the Low-hanging Fruit: Information Technology in Architectural Design, Past, Present, and Future,** Gross, M.D., Do, E.Y., and Johnson, B.R., Proc. ACSA Technology Conference 2000, Cambridge MA, pp. 100-106.

**Place Based Web Resources for Historic Buildings,** M. A. Ehrhardt and M.D. Gross, *Proc. Education in Computer Aided Architectural Design in Europe (eCAADe) 2000*, Weimar, Germany, pp. 177-179.

1999 **Collaborative Design with NetDraw,** Dongqiu Qian and M.D. Gross, *Proceedings of Computer Aided Architectural Design Futures '99*, G. Augenbroe and C. Eastman, eds., Kluwer, Dordrecht, the Netherlands, pp. 213-226.

**Immersive Redlining and Annotation of 3D Design Models on the Web,** T. Jung, E. Do, and M.D. Gross, *Proceedings of Computer Aided Architectural Design Futures '99*, G. Augenbroe and C. Eastman, eds., Kluwer, Dordrecht, the Netherlands, pp. 81-98.

**Drawing and Design Intentions — an Investigation of Freehand Drawing Conventions in Design,** E. Do, M.D. Gross, and C. Zimring, in *Proceedings Design Thinking Research Symposium*, G. Goldschmidt and W. Porter, eds., Cambridge MA, pp. 1-10.

**Sketches and Their Functions in Early Design: A Retrospective Analysis of Two Houses,** Neiman, B. Do, E. and M.D. Gross. In *Proceedings Design Thinking Research Symposium*, G. Goldschmidt and W. Porter, eds., Cambridge MA, pp. 255-266.

**Integrating Digital Media in Design Studio: Six Paradigms**, Gross, M.D. and E. Do., *Proc. American Collegiate Schools of Architecture (ACSA) National Conference '99*, pp. 144-148.

1998 **Digital Clay: Deriving Digital Models from Freehand Sketches.** Schweikardt, E., and Gross, M.D., Digital Design Studios: Do Computers Make A Difference? ACADIA 98, T. Seebohm and S. V. Wyk, eds, *Association for Computer-Aided Design in Architecture*, Quebec City, pp. 202-211

**Representational Talkback: An Approach to Support Writing as Design**, Yamamoto, Y., Gross, M.D., Takada, S., Nakakoji K, *IEEE Asia Pacific Computer Human Interaction (APCHI) Conference*. IEEE, Los Alamitos, CA, pp.125-131.

**The Ceren Web Resource: Enabling Students to Become Anthropologists In A Virtual Site,** Lewin,J. Ehrhardt, M. and M.D. Gross, *ACM Conference on Computer Graphics (SIGGRAPH 98) Educators Program*, pp. 42-43.

3**D Modeling of Historic Makkah: Strategies for Constructing Accurate CAD Models of Historic Buildings,** N. Koshak and Gross, M.D., in *Proc. CAADRIA 98 (The Third Conference on Computer Aided Architectural Design Research in Asia*.

1997 **Support for Mobile Pen-Based Applications,** Citrin, W.V., M.D. Gross, P. Hamill, and A. Warmack, *Proc. Third ACM/IEEE International Conference on Mobile Computing and Networking (MobiCom'97)* 241-247.

**Network Design Tools and Tasks,** Kuczun, Kyle and M.D. Gross, *Proc. ACM Conference on Designing Interactive Systems*, Amsterdam, pp. 215-222.

**Tools for visual and spatial analysis of CAD models,** Do, E. and M.D. Gross, *Computer Assisted Architectural Design Futures '97*, R. Junge, ed., Kluwer, Dordrecht, pp. 189-202.

**Not Just Another Pretty Face: Image and argument in an archaeological web site,** Lewin, J., M. Erhardt, and M.D. Gross*, Computer Assisted Architectural Design Futures '97*, R. Junge, ed., Kluwer, Dordrecht, pp. 635-654.

**MUD: Exploring Tradeoffs in Urban Design,** Parker, L., A. Elliott, and M.D. Gross, *Computer Assisted Architectural Design Futures '97*, R. Junge, ed., Kluwer, Dordrecht, pp. 373-388.

**Digital Sketchbooks for Collaborative Design,** W. Citrin, P. Hamill, M.D. Gross, and A. Warmack, Collaboration and Coordination in Architectural Design: approaches to computer mediated work, *TeamCAD symposium on collaborative CAD,* Graphics, Visualization, and Usability Center, Georgia Tech. May 12-13, 1997, pp. 213-217.

**Collaboration and Coordination in Architectural Design: approaches to computer mediated work,** Gross, M.D., E. Do, R. McCall, W. Citrin, P. Hamill, A. Warmack, and K. Kuczun. *TeamCAD symposium on collaborative CAD,* Graphics, Visualization, and Usability Center, Georgia Tech, May 12-13, 1997, pp. 17-24.

**Inferring Design Intentions from Sketches,** Do, E. and M.D. Gross, *Proceedings of Computer Aided Architectural Design Research in Asia '97*, pp. 217-227.

1996 **Elements that Follow Your Rules: Constraint Based CAD layout,** Gross, M.D., *Proceedings of Association for Computer Aided Design in Architecture (ACADIA) '96*, Tuscon, AZ, pp. 115-122.

**Resolving archaeological site data with 3D computer modeling: The case of Ceren,** Lewin, J. and M.D. Gross, *Proceedings of Association for Computer Aided Design in Architecture (ACADIA) '96*, Tucson, AZ, pp. 255-266.

**Ambiguous Intentions: A paper-like interface for creative design,** Gross, M.D. and E. Do., *Proc. ACM Conf. on User Interface Software Technology (UIST)'96* Seattle, WA, pp. 183-192.

**Reasoning about cases with diagrams,** Do, E. and M.D. Gross, American Society of Civil Engineers (*ASCE) 3rd Congress on Computing in Civil Engineering*, Anaheim CA, J. Vanegas and P. Chinowsky, eds., pp. 314-320.

**Drawing as a means to design reasoning,** Do, E. and M.D. Gross, *Artificial Intelligence in Design (AID) '96 Workshop on Visual Representation, Reasoning and Interaction in Design*, Palo Alto, CA.

**Demonstrating the Electronic Cocktail Napkin,** Gross, M.D. and E. Do, *Conference Companion, ACM Conference on Human Factors in Computing (CHI '96)*, Vancouver, pp. 5-6.

**Distributed Architectures for Pen-Based Input and Diagram Recognition,** Citrin, W. and M.D. Gross, *ACM Conference on Advanced Visual Interfaces '96*, pp. 132-140.

1995 **Drawing Analogies - Supporting Creative Architectural Design with Visual References,** Gross, M.D. and E. Do, in *3d International Conference on Computational Models of Creative Design*, M-L Maher and J. Gero, eds., Sydney: University of Sydney, pp. 37-58.

**Drawing Analogies: Finding visual references by sketching,** Do, E. and M.D. Gross, *Proc. Association Computer Aided Design in Architecture (ACADIA), 1995 National Conf.*, Seattle, pp. 35-52.

**Shape Based Reminding as an aid to Creative Design,** Do, E. and M.D. Gross, *Global Design Studio Computer Aided Architectural Design Futures '95*, M. Tan and R. Teh, eds., National University of Singapore: Singapore, pp. 79-89.

1994 **The Fat Pencil, the Cocktail Napkin, and the Slide Library,** Gross, M.D., *Proc. Association for Computer Aided Design in Architecture (ACADIA),* 1994 National Conf., St Louis, pp. 103-113.

**Stretch-A-Sketch, a dynamic diagrammer,** Gross, M.D., in A. Ambler, ed., *IEEE Symposium on Visual Languages 1994,* pp. 232-238.

**Recognizing and Interpreting Diagrams in Design,** Gross, M.D., in T. Catarci. M. Costabile, S. Levialdi, G. Santucci eds., *Advanced Visual Interfaces '94*, ACM Press, pp. 89-94.

**Using Diagrams to Access a Case Base of Architectural Designs,** Gross, M.D., C. Zimring, and E. Do., in J. Gero, ed., *Artificial Intelligence in Design '94*, Kluwer, pp. 129-144.

1992 **Graphical Constraints in CoDraw,** Gross, M.D., *IEEE Workshop on Visual Languages*, Seattle, pp. 81-87.

1991 **Grids in Design and CAD**, Gross, M.D., in G. Goldman and S. Zdepski, eds., *Proceedings ACADIA 91 - Reality and Virtual Reality,* Los Angeles, pp. 33-43.

1990 **Knowledge-Based Support for Subsystem Layout in Architectural Design,** Gross, M.D., in Gero, J., ed., *Proceedings 1990 Conference on Artificial Intelligence in Engineering — Design*, Southampton: Computational Mechanics Press.

**Buildings, Memory, and Wayfinding,** Gross, M.D. and C. Zimring, *Environmental Design Research Association (EDRA) Conference*, Champaign-Urbana, Illinois, pp. 85-93.

**Relational Modeling: A Basis for Computer-Assisted Design,** Gross, M.D., in McCullough, Mitchell and Purcell, eds., The Electron*ic Design Studio*, Cambridge, MA: MIT Press, pp. 123-136.

1987 **Designing With Constraints**, Gross, M.D., J. Anderson, S. Ervin, A. Fleisher, in *The Computability of Design,* Y. Kalay, ed., New York: Wiley and Sons, pp. 53-83.

## INVITED ARTICLES AND BOOK CHAPTERS

2013 **The Blind Men and the Elephant, or the Race of the Hobbyhorses**, M Gross, in *Software Designers in Action: A Human-Centric Look at Design Work*, Petre M and van der Hoek, A, Taylor and Francis (to appear).

2012 **Architectural Robotics, Inevitably**, Green, KE and M Gross, Interactions Magazine xix,1 January•February

2010 **Tangible Interaction = Form + Computing**, Baskinger, M and M Gross; Interactions Magazine xvii.1 January•February 2010 pp 6-11.

2009 **Visual Languages and Visual Thinking: Sketch Based Interaction and Modeling**, Gross MD, Eurographics Workshop on Sketch-Based Interaction and Modeling (keynote address), New Orleans, August 1 2009

**Editor's Introduction: Back to the real world—Tangible interaction for design,** Do, E-Y and M. Gross, Artificial Intelligence for Engineering, Design, Analysis, and Manufacturing (AI-EDAM), 23, 221-223.

**Now More Than Ever: computational thinking and a science of design**, Gross M.D., *JSSD: Journal of the Japanese Society for the Science of Design,* Vol 16-2 No 62

**Thinking with Diagrams in Architectural Design**, Do EY-L, Gross MD, in special student edition of "The Diagram," Architectural Review, p 50-54, printed by the Concrete Centre

2008 **Teletables and Window Seat: bilocative furniture-based interfaces,** Oh, Y., Camarata, K., Weller, M., Gross, M., Do, Y-L. in TYL Theng and H. Duh, Ubiquitous Computing: Design, Implementation and Usability, Idea Group Publishers.

2004 **Between Worlds: Visions and View for the Future of CAD,** Ellen Yi-Luen Do and Mark D Gross, in Generative CAD Systems, Edited by Ö. Akin, R. Krishnamurti, and K.P. Lam, pp. 61-78, Carnegie Mellon University (ISBN 0-9762941-0-9)

2004 **Diagramming and Drawing in Computer Aided Design –** entry for the Encyclopedia of Human-Computer Interaction, Berkshire Publishing Group.

2003 **How is a piece of software like a building? Toward general design theory and methods.** Position paper for National Science Foundation workshop on Science of Design: Software Intensive Systems, Virginia, Nov 2-4.

2002 **An Interactive Guide to Ancient Cerén Before the Volcano Erupted** Jen Lewin, Mark A. Ehrhardt, Mark D. Gross, and Payson Sheets CD-ROM, University of Texas Press

1999 **Drawing, Seeing, and Reasoning: The Added Value of Computer Aided Architectural Design,** Gross, M.D., in Proceedings Second Conference on Added Value of Computer Aided Architectural Design (AVOCAAD), Brussels, 8-10 April, 1999, [keynote], pp. 26-33.

1998 **Sketchy (Informal) Interfaces for Design of Intelligent Systems,** Gross, M.D., in Trends and Controversies, *IEEE Intelligent Systems (formerly IEEE Expert)* May, pp. 10-19.

**Smart House- I**n *Encyclopedia of Housing,* W. van Vliet--, ed Sage, pp. 546-547.

**Computer Assisted Design** - In *Encyclopedia of Housing*, W. van Vliet--, ed., Sage, pp. 75-76.

1995 **Diagram Query and Image Retrieval in Design,** Gross, M.D. and E. Do, in *Proceedings, 2nd IEEE International Conference on Image Processing*, vol II: 308-311.

**Indexing visual databases in architecture with diagrams**, Gross, M.D., in A. Koutamanis, H. Timmermans and I. Vermeulen, eds., *Visual Databases,* Aldershot: Avebury, pp. 1-14.

1992 **Predicting wayfinding in buildings - a schema-based approach,** Gross, M.D. and C. Zimring, in Y. Kalay and L. Swerdloff, eds., *Evaluating and Predicting Design Performance*. New York: Wiley, pp. 367-378.

1991 **Searching for the Environment in Environmental Cognition Research**, Gross, M.D. and C. Zimring, in Evans and Gärling, eds. *Environmental Cognition and Action*, Oxford University Press. pp. 78-95.

**Constraint Based Design Environments for Architecture and Engineering,** Gross, M.D., *Proceedings SOBRACON 1991 Conference on Computer Graphics in Architecture and Engineering Construction.* São Paulo. [keynote address]

**A New Learning Environment: the NeoMuseum.** Ueda, N. and M.D. Gross, *Proceedings International Conference on Hypermedia and Interactivity in Museums*, Pittsburgh, pp. 169-178.

1987 **Design and Use of a Constraint-Based Laboratory for Learning Design,** Gross, M.D., in *Artificial Intelligence and Education,* R. Lawler and M. Yazdani eds., New Jersey: Ablex, pp. 167-181.

## BOOK REVIEWS

1998 Designing Digital Space by Daniela Bertol, *Computer Aided Design Journal* **30**(1):91.

1995 Electronic Color by Richard Norman. *Journal of Architecture and Planning Research* **12**(4):386-387.

1993 Visual Methods in Design Research by H. Sanoff. *J .Architecture and Planning Research* **10**(4):269-70.

## PROCEEDINGS AND OTHER NON-REFEREED VOLUMES

2011 **Proceedings, Tangible Embedded, Embodied Interaction** of the ACM SIGCHI conference in Funchal, Madeira, Portugal, January 23-26 (co-editor with Nuno Nunes, Ellen Yi-Luen Do, Stephen Brewster, and Ian Oakley)

2011 **Proceedings, Work-in-Progress Tangible Embedded, Embodied Interaction Workshop** of the ACM SIGCHI conference in Funchal, Madeira, Portugal, January 23-26 (co-editor with Ellen Yi-Luen Do, and Ian Oakley)

2009 **Proceedings, Creativity and Cognition 2009** of the ACM SIGCHI conference in Berkeley, California, October 27-30 (editor).

2009 **Tangible Interaction in Design**, editor (with EY-L Do) special issue of *Artificial Intelligence in Engineering Design, Analysis, and Manufacturing (AI-EDAM)*.

2007 **Strategies for Research about Design: a multidisciplinary graduate curriculum**, Gross, M.D. Finger, S., Herbsleb, J., Shaw, M., in Humboldt State University (CA) Science of Design Workshop

2007 **Creative Design Computing**, Gross, M.D. Do, E., in Humboldt State University (CA) Science of Design Workshop

2007 **roBlocks: Understanding Emergent Complexity from the Bottom Up,** Eric Schweikardt and Mark D Gross, Robotics Science and Systems, Workshop on Robots for Education, Atlanta June 30

2004 **FlexM, Designing a Physical Construction Kit for 3D Modeling,** M. Eng, K. Camarata, E. Y-L Do, M. Gross, in Proceedings on CD ROM, Generative Computer Aided Design Systems conference, Carnegie Mellon University, Pittsburgh July 11-14.

**Design Evaluator, Critiquing Freehand Sketches,** Y. Oh, E. Y-L. Do, M. Gross, in Proceedings on CD ROM, Generative Computer Aided Design Systems conference, Carnegie Mellon University, Pittsburgh July 11-14

**EspressoCAD, a System to support the design of dynamic structure configurations,** M. Weller, E. Y-L Do, M. Gross, in Proceedings on CD ROM, Generative Computer Aided Design Systems conference, Carnegie Mellon University, Pittsburgh July 11-14

A**rtifacts for Displaying Home Energy Use,** K. Camarata, D. Bregel, E. Y-L. Do, M.. Gross, in Proceedings on CD ROM, Generative Computer Aided Design Systems conference, Carnegie Mellon University, Pittsburgh July 11-14

2001 ***Tools and Conceptual Frameworks for Early Stages of Design***, Workshop Proceedings, ACM CHI '01 (Human Factors in Computing) conference, Seattle WA, Nakakoji, K. Gross, M.D., Candy, L., Edmonds, E., eds.

1992 ***Equitable and Sustainable Habitats, Proceedings of the 23d annual meeting of the Environmental Design Research Association (EDRA-23)*****,** Arias, E. and Gross, M.D. eds., April 7-12 1992, Boulder

1989 ***Spatial Coordination Demonstration Program*****,** Gross, M.D.; N.J. Habraken; C. Fry; and M. Ruano, Final Project Report to Shimizu Corporation (3 volumes).

***Designing and Designing Knowledge in Engineering and Architecture: Final Report to the National Science Foundation***, Bucciarelli, L., S. Ervin, A. Fleisher., G. Goldschmidt, M.D. Gross, D. Schön, G. Wiggins, Grant # 8611357-DMC.

1988 ***Concept Design Games*** **(volume 1: *Defining*; volume 2 *Playing*)**, Habraken, N.J., Gross M.D. et al, final report to the National Science Foundation.

1986 ***Design as Exploring Constraints*****,** Gross, M.D., Ph.D. dissertation, Massachusetts Institute of Technology.

## TECHNICAL REPORTS

2007 Design Research Summer School report to the National Science Foundation (Gross, Finger, Herbsleb, Shaw); http://code.arc.cmu.edu/~johnsogg/drss_wrapped/

2001 Final report to National Science Foundation, Back of an Envelope Project, Grant # IIS-96-19856 and IIS-00-96138. Gross, M.D.

2000 The PlaceMaker, Design Machine Group Technical Report, Gross, M.D.

1999 Collaboratively Annotating 3D Design Worlds Design Machine Group Technical Report, Gross, M.D. E, Do, T. Jung.

Sketch that Scene for Me: Creating Virtual Worlds by Freehand Drawing, Design Machine Group Technical Report, Gross, M.D., E. Do.

1997 HyperSketch II, Final report to Colorado Advanced Software Institute, Gross, M.D. and M. Dalrymple, Undergraduate Research Grant.

PDA based graphical interchange for field service and repair workers, Gross, M.D., W. Citrin, P. Hamill, A. Warmack, and S. Laufmann, Final report to Colorado Advanced Software Institute.

1996 Drawing as an Interface to Knowledge Based Design, Gross, M.D., J. Lewin, E, Do, K. Kuczun, and A. Warmack, final report of a Colorado Advanced Software Institute Undergraduate Research Grant.

1993 User Interfaces with Intelligent Objects, Gross, M.D. and Boyd, C., Colorado Advanced Software Institute Technical Report

1992 Constraints Provide Domain Behavior in a Construction Kit, Gross, M.D. and Boyd, C. University of Colorado Computer Science Technical Report (CU-CS-583-92).

1989 Summary Report CM2: A Constraint Based Design Environment, Ervin, S., M.D. Gross, and A. Fleisher. in Bucciarelli, L.; S. Ervin; A. Fleisher.; G. Goldschmidt; M.D. Gross; D. Schön; G. Wiggins Designing and Designing Knowledge in Engineering and Architecture: Final Report to the National Science Foundation, Grant #DMC-86-11357.

CM2: A Constraint Manager for Design Exploration on the Macintosh, Ervin, S., and M.D. Gross, in Bucciarelli, L.; S. Ervin; A. Fleisher.; G. Goldschmidt; M.D. Gross; D. Schön; G. Wiggins Designing and Designing Knowledge in Engineering and Architecture: Final Report to the National Science Foundation, Grant #DMC-86-11357.

1981 SAR/LOGO Tissue Model, Gross, M.D. and J. Kapteijns, S.A.R. Working Paper.

## NON-REFEREED PAPERS

2007 Gross, M. D. (2007). Designers Need End-User Software Engineering. End-User Software Engineering, Dagstuhl, Germany, Internationales Begegnungs- und Forschungszentrum fuer Informatik (IBFI), Schloss Dagstuhl, Germany.

1999 Freehand Drawing as an Interface to Knowledge Based Design, Gross, M.D. and E. Do, in Proc. Human-Computer Interface Grantees Workshop ’99, K. Stanney and G. Strong, eds., Orlando FL, Feb. 21-23, pp. 162-163

1998 The Sundance Lab: Design Systems of the Future, Do, E. and M.D. Gross, *Association for Computer Aided Design in Architecture Quarterly*, December 1998

1997 Thinking with Diagrams in Architectural Design, Do, E. and M.D. Gross, paper for Thinking with Diagrams workshop, Alan Blackwell, chair Portsmouth, UK.

1995 Avoiding Conflicts in Subsystem Layout, Gross, M.D., NSF Grantees Conference, San Diego

1993 CAD in Education, Gross, M.D., in *ACADIA Quarterly*.

1989 Automated Coordination for Construction Management, Gross, M.D., *Proceedings of the Conference International Batiment (CIB)* Paris.

## BROCHURES, CATALOGS, AND OTHER PUBLICATIONS

2001 Design Machine Group, project work catalog at University of Washington's Design Machine Group.

1999 Introduction to Into 3D with form•Z: Modeling, Rendering, and Animation by Lachmi Khemlani, McGraw Hill, Gross, M.D.

1998 Multimedia Unplugged: A Learning Design Workshop, Workshop Catalog, NeoMuseum, Yoshino, Japan.

1998 KosmoPolis MultiOptikon, Workshop Catalog, Istanbul from Taksim to Sultanahmet Square. Yildiz Multimedia Workshop.

## VIDEOTAPES AND ELECTRONIC PUBLICATIONS

2001 SpacePen, Videotape demonstration, Jung, T., E. Do, and M.D. Gross

Digital Sandbox, Videotape demonstration, Harris, R., E. Do, (production M.D. Gross)

1999 Digital Clay, Videotape demonstration (5:00), Gross, M.D. and E. Do

Collaborative Design with NetDraw, Videotape demonstration (6:00), Gross, M.D., D. Qian, & E. Do

the Electronic Cocktail Napkin, Videotape demonstration, Gross, M.D. and E. Do

Architects for the Twenty-first Century: Race, Class, and Culture, Videotape (30:00) of workshop held at University of Colorado, March 13,1999, Gross, M.D., J. Ramos, and A. Fabrikant.

Immersive Redlining, Videotape demonstration (8:55), Gross, M.D., T. Jung, E. Do, J. Davidson.

The Ceren Web Resource (CD-ROM) and Web Site (http://ceren.colorado.edu), Gross, M.D., Sheets, P., Lewin, J., and Ehrhardt, M.

The Pyramids of Knowledge (CD-ROM) and Web Site. Thomas Jung, Developer; Project Supervisors Mark D. Gross and Ellen Yi-Luen Do.

1998 the Hagia Sophia Web Resource, Gross, M.D. and M.Ehrhardt., interactive Web site http://depts.washington.edu/dmachine/istanbul

KosmoPolis MultiOptikon: Istanbul from Taksim to Sultanahmet Square, interactive Web site Gross, M.D. and Lewin, J. (with students from Yildiz Technical University) http://depts.washington.edu/dmachine/kosmopolis

1997 Local Area Networks Tools and Tasks, Videotape demonstration, Gross, M.D. and K. Kuczun.

1996 Ambiguous Intentions: Contextual Recognition, Gross, M.D. & E. Do, Video (8:00) demo.

## INVITED TALKS AND PRESENTATIONS

2011 Invited talk and workshop: Tokyo Denki University "Architectural Robotics", (October)

2010 Keynote: Global COE Conference on "Biofied Buildings", Keio University, Japan (November)

Invited talks: Tainan University of Technology, Shu-Te University, Taiwan (June)

Distinguished Speaker: Institute for Software Research, University of California, Irvine (April 23 2010.

2009 Invited talks: National Central University, Jhong-Li Taiwan, Department of e-learning (November)

Keynote: Eurographics Workshop on Sketch-Based Interaction and Modeling, New Orleans, (August 1, 2009)

Colloquium, Centre for Playware, Danish Technical University, Copenhagen (March 2009)

2007 Invited participant: Dagstuhl (Germany) Workshop on End User Software Engineering

Invited talk: Brown University Pen-Centric Computing Center, Symposium on Pen-Centric Computing.

2006 Keynote: How to better design things and how to design better things? Danish HCI Symposium, Aarhus Denmark, Nov 15, 2006

2003 Invited Lecture: The Legacy of Horst Rittel: toward a science of design, computationally expressed. Design Theory & Methods Symposium, University of California, Berkeley, Oct 3-4, 2003.

2002 Keynote: Design, Computation, and the Interface - at Software Symposium 2002, Matsue, Japan (national conference of the Japan Software Engineering Association). July 17 2002

Lecture: from computing to design and back again - NTT Communication Sciences Research Lab, Kyoto, Japan. July 22, 2002

Lecture: Design, Computation, and the Interface - University of Tokyo, Research Center for Advanced Science and Technology, July 15, 2002

Lecture: Design Machine Group: current work Architecture Department, Carnegie Mellon University, March 4, 2002

2001 Lecture: Current Work at the Design Machine Group (with E. Do, B. Johnson, T. Jung) – Industrial Design Department, Technical University of Delft, July 12, 2001

Workshop co-organizer: (with L. Candy, E.Edmonds, K. Nakakoji) Tools and Conceptual Frameworks for Early Stages of Design ACM CHI '01 (Human Factors in Computing) conference, Seattle WA, April 1, 2001

Lecture: Sketchy Interfaces, ACM SIGCHI (Association for Computing Machinery: Special Interest Group in Computer Human Interaction), Puget Sound Chapter, Feb 22, 2001

2000 Lecture: Information in Place - invited speaker, Society for Technical Communication, Puget Sound Chapter, Nov 14, 2000

Invited Lecture: Collective Creativity and Interactive Systems in Design, Sakigake workshop on Collective Creativity, Nara Japan, August 7-8, 2000

Keynote address: Research and Computer Aided Design, DRN2000 - Design Research in the Netherlands 2000, Eindhoven, the Netherlands, May 24-25, 2000

1999 Keynote address: Design and Human-Computer Interaction, IHC'99 (Brazilian Human-Computer Interaction society), Campinas, Brazil, October 19, 1999

McKinley Invited Lecture: Architecture in the Digital Age: Creativity, Method, and Computer Aided Design, University of Washington, Seattle, October 7, 1999

Keynote address: Drawing, Seeing, and Reasoning,, Second International AVOCAAD Conference: the added value of computer aided architectural design, Brussels, Belgium, April 8-10, 1999

Panelist, Launch Party and Discussion Forum for the ATLAS Millennium Web Site, Front Porch Series, Department of Fine Arts, University of Colorado, 18 March, 1999

1998 Lecture and Invited workshop Digital Representations of Place at Yildiz Technical University, Istanbul, May 1- 5, 1998

Lecture: Computer Aided Design Research at the Sundance Lab, College of Architecture, Georgia Institute of Technology, March 20, 1998

Lecture: Human Computer Interaction and Computer Aided Design College of Computing, Georgia Institute of Technology, March 19, 1998

Computer Aided Design in Architecture, Department of Architecture, University of Washington, March 9, 1998

Lecture: Sketching as Media for Interacting with Computers in Design at Computer Science Department, Tokyo Institute of Technology, February 23, 1998

Lecture: CAD Tools for Collaboration at Communication Department, Tama Art University, Tokyo, February 22, 1998

Lecture: Interactive Tools for Design at Nara Advanced Institute of Science and Technology, Jan 17, 1998

1997 Lecture: PDA based graphical interchange for field service and repair workers, Colorado Advanced Software Institute, Phipps Mansion, Denver, Colorado.

Invited Talk The Design Studio, Gross, M.D. and E. Do, at NSF Workshop on Design Education, Georgia Tech, September 5-8 1997

Design Computing in Architecture, The Ohio State University, July 2, 1997

Presentation: Emergence in Sketching - ACM CHI'97 Workshop on Emergence of Concepts and Forms, Atlanta GA, April 1997

Panelist, on Design and Technology, for FORUM 97, National Conference of American Institute of Architectural Students (AIAS), Hyatt Regency, Denver, November 28, 1997

1995 Lecture: The Electronic Drawing Board - Design Studies and Computing Georgia Institute of Technology, College of Architecture, April 20-21, 1997

Invited Lecture: Architectural Computing Research and Education, University of Edinburgh, Scotland, Feb 5-7, 1995

1994 Invited visiting scholar, Nucleus of Informatics and Education, University of Campinas, Brazil. July 1-12

1993 Lectures: Advances in sketch recognition, Constraint-based techniques and their applications in design, and Artificial intelligence in architectural design, Georgia Institute of Technology.

1992 Lectures: Computing in Architectural Education and Design as Exploring Constraints University of California, Berkeley.

Project Report: User Interfaces with Intelligent Objects, Colorado Advanced Software Institute, Phipps Mansion, Denver Colorado.

1991 Keynote: Constraint Based Design Environments for Architecture and Engineering SOBRACON - Annual Conference, Society for Automation and Numerical Control, São Paulo, Brazil.

Convocation Speech, Intelligent Machines and Creative Work, Drury College, Springfield Missouri.

1990 Lectures: On the Architectural Argument, and Constraint Based Drawing, Georgia Institute of Technology, College of Architecture and College of Computing.

## RESEARCH SUPPORT AND AWARDS

2013 Sketch It, Make It —National Science Foundation (to Blank Slate Systems, PI Gabe Johnson) Small Business Innovative Research Phase I: 150,000

2012 Learning Design Synthesis with a Mechatronics Construction Kit —National Science Foundation (to Modular Robotics, PI Eric Schweikardt) Small Business Innovative Research Phase I: 150,000

2012 Innovation Corps grant, National Science Foundation, for Sketch It, Make It: $50,000

2010 Workshop: Graduate Student Consortium at Tangible Embedded Interaction 2010, National Science Foundation: $20,520.

2010 Learning about Complexity with a Modular Robotics Construction Kit —National Science Foundation (to Modular Robotics, PI Eric Schweikardt) Small Business Innovative Research Phase II: 100,000

2009 International workshop on Architectural Robotics, National Science Foundation (with Keith Evan Green, Clemson University): $32,062, at Ubicomp 2009 in Orlando, Florida.

Association for Computer Aided Design in Architecture (ACADIA), Teaching Excellence Award.

2008 Learning about Complexity with a Modular Robotics Construction Kit —National Science Foundation (to to Modular Robotics, PI Eric Schweikardt) Small Business Innovative Research Phase I: 100,000

2006 Summer Workshops for Software Design Research — National Science Foundation (with M. Shaw, J. Herbsleb, S. Finger): $130,000 to design, develop, and deliver a model interdisciplinary summer workshop in design research for graduate students.

2003 Computationally Enhanced Construction Kits — National Science Foundation (with M. Eisenberg): $1.8M for 5 years to explore the space of computationally enhanced construction kit toys and digitally produced craft.

2001 UrbanSim — National Science Foundation (with A. Borning (PI), co-PIs P. Waddell, D. Notkin, Z. Popovic, B. Friedman): $3.5M for 5 years to develop and test a system to project impacts of land use and transportation system decisions in an urban context that will enable citizens and decision makers to explore possible design alternatives.

A Center for Digital Art — University Initiative Fund (with R. Karpen (lead), P. Berger, E. Lazowska, M. Harrison, D. Thome): $700,000 per year to establish an interdisciplinary center for digital art research and education at the University of Washington.

2000 Transforming Architectural Education through Technology — University of Washington, Tools for Transformation grant: $328,248, to enable students of architecture to employ current computational media and technologies in their architectural studio work.

1999 Research Initiation funding for Design Computing Research Laboratory — University of Washington (with E. Do) $255,508 (3 years) seed funding to establish a laboratory in Architecture Hall for exploration in computational design methods and means.

1997 Back of an Envelope an Architecture for Knowledge Based Design Environments — National Science Foundation: $320,000 (3 years) to explore and demonstrate a recognition based system architecture for freehand drawing as an interface to design application programs.

1996/7 Virtual Archaeology at the Ceren Site — University of Colorado President's Changing the Learning Paradigm: (with P. Sheets), $35,000 (1 year) to develop an interactive and informative virtual environment for learning about an archaeological site in El Salvador, using diverse Web media; continuation funding (additional $30,000) for 1997/8.

1996 PDA based graphical interchange for field service and repair workers — Colorado Advanced Software Institute and USWest Advanced Technologies: (with W. Citrin), $46,800 (1 year) to develop and demonstrate prototype software for a hand-held networked digital notepad.

Bringing Learning Activities to Life — National Science Foundation: (with G. Fischer (PI) M. Dubin, E. Arias, T. Neese, A. Repenning): $50,000 (1 year). Planning grant for a CRLT (Center for Research in Learning Technologies) proposal.

1995 A Teaching Toolkit for Technology Enhanced Education — University of Colorado President's Fund for Educational Technology: (with J. Herdt) $35,000 (1 year) to develop software to support Web based teaching and learning.

1993 Avoiding Conflicts in Subsystem Layout in Architectural Design: a constraint based approach — National Science Foundation: $140,000 (2 years) to demonstrate the application of constraint based CAD to systematizing the layout of building components.

1993 Avoiding Conflicts in Subsystem Layout in Architectural Design — University of Colorado at Boulder, Grant in Aid, $2,450

1991 Intelligent Objects in User Interfaces — Colorado Advanced Software Institute: $30,000 (1 year) to demonstrate a graphics system that employs constraints to embed behavior in interface objects.

**Support for undergraduate research assistants**

1999 University of Colorado Undergraduate Research Opportunities Program: (Support for undergraduate research assistant Mark Ehrhardt, Interactive Visual Educational Environments): $600.

1997 Colorado Advanced Software Institute: Hypersketch II: Creating and Navigating Drawing Relationships- (support for undergraduate research assistant Mike Dalrymple): $3,000.

University of Colorado Teaching Award: $3000, support for undergraduate research assistant Jenniffer Lewin: Information Design Studio.

University of Colorado Faculty Grants: support for undergraduate research assistant Laura Parker: Multi-user urban design: $1400.

University of Colorado Undergraduate Research Opportunities Program: support for undergraduate research assistants (Schweikardt, Dalrymple, Page-Echols, Ehrhardt), 4 mini-grants totaling $5,000.

1996 University of Colorado Undergraduate Research Opportunities Program: support for undergraduate research assistants, 2 mini-grants totaling $2,000.

Colorado Advanced Software Institute: Drawing as an interface to knowledge based systems (support for undergraduate research assistant Kristin Mayfield): $3,000.

## MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS

European Computer Aided Architectural Design Education (eCAADe)

Association for Computer Assisted Design in Architecture (ACADIA)

Association for Computing Machinery (ACM)

Institute of Electrical and Electronic Engineers (IEEE) Computer Society

## EXCERPTS AND DESCRIPTIONS OF WORK IN POPULAR PRESS AND BOOKS

WTAE - TV local story on http://www.thepittsburghchannel.com/video/15411139/index.html

O'Reilly Radar (April 2008) Simple Blocks to Make Robots http://radar.oreilly.com/archives/2008/04/roblocks-simple-blocks-to-make.html

Center for Interactive Spaces blog: (February 2008) Posey http://www.digitalexperience.dk/

The New Scientist online (January 2008)Smart Lego Conjures Up Virtual Twin - http://technology.newscientist.com/article/dn13261-smart-lego-conjures-up-virtual-3d-twin.html

Slashdot (January 2008) slashdot.org/article.pl?sid=08/01/31/1622215 CAAD Talks, ed Mao-Lin Chiu, NCKU (2003)

Pacific Northwest Science and Technology magazine, Next Generation Tools for Architects, Autumn 2002

KUOW 94.6 FM Seattle - Weekday program on Intelligent Buildings, commentator, 7 May 2001

*Carillon, University of Colorado at Boulder,* 12 March 1999: Code As Art: Bringing Programming to the Masses as a Creativity Tool

*Science*, NetWatch column, November 20, 1998, the Ceren Virtual Archaeology Site

*CADENCE* Magazine: January 1999, Digital Clay Project

*Rendering Real and Imagined Buildings* (book by B.J. Novitski), Van Nostrand Reinhold, 1999, Ceren Virtual Archaeology Site

## INVENTION DISCLOSURES

2007 roBlocks: A Robotic Construction Kit for Mathematics and Science Education, Eric Schweikardt and Mark D Gross

2006 A control device for designed for controlling the color and brightness of digitally controlled full spectrum lighting, Jake Pierson, Ellen Do, Mark D Gross

2006 Flow Selection (a time based method of selection in graphical user computer interfaces) Gabe Johnson and Mark D Gross

## COURSES TAUGHT

Fall 2007 - Fall 2010 Making Things Interactive
June 2007 co-organizer (with Shaw, Herbsleb, Finger): Design Research Summer School, one-week workshop for PhD students from other universities, to help them formulate dissertation research about design.
Spring 2007 Strategies for Research in Design (with Shaw, Finger, Herbsleb),

Fall 2006, Spring 2007 Architectural Robotics http://www.architecturalrobotics.org
Fall 2006 Spring 2007 Digital Fabrication http://code.arc.cmu.edu/~mdg/DigFab07

Research Practice: (2003)
day-to-day skills and knowledge needed to do research (writing, bibliography, funding, ethics)

Architectural Design Studio: Mapping the Terrain: (2002)
mixed media and construction; parking garage rehab project for artist drop-city housing.

Architectural Design Studio: Digital Design Build (2001)
Explores the near-term future of architecture, where buildings will embed computational capabilities.

Theory of Design Computing (1999, 2001, 2003)
reviews design research and its applications in computer-aided design.

Design of Virtual Worlds: (1997, 2000, 2002)
Seminar about on-line communities; project work constructing web based places.

Things That Think: (1997, 1998)
Interdisciplinary studio-workshop course on integrating computation in physical artifacts.

Observing Built Form: (1996)
Students observe, document, and discuss the built environment using diverse media.

Introduction to Computing in Design:
Fundamentals of computer applications in architecture.

Making MultiMedia Maps:
Seminar using information technology to make interactive maps.

Three-Dimensional Modeling with Computer Graphics:
Fundamentals of 3D modeling in architecture.

Computer Graphics Programming:
Introduction to design and implementation of computer graphics programs.

The Future of Computer Aided Design:
Seminar considers impacts of information technology in design.

Design Theory and Methods:
Surveys design methods and processes in architectural design.

## DOCTORAL DISSERTATION COMMITTEES

Michael Weller (Computational Design, Carnegie Mellon University)
Hyunyoung Song (Computer Science, University of Maryland)
Chih-Pin Hsiao (Architecture, Georgia Institute of Technology)

Karl D.D. Willis Ph.D., ’13 (chair)
*Ubiquitous Projection: New Interfaces using Mobile Projectors*
Computational Design, School of Architecture, Carnegie Mellon University

Gabe Johnson Ph.D. ’12 (chair)
*Sketch-based Interaction for Design*
Computational Design, School of Architecture, Carnegie Mellon University

Sora Key Ph.D. ’12 (Chair)
*A Computable Language of Architecture: Towards Building Descriptive Models of Spatial Qualities*
Computational Design, School of Architecture, Carnegie Mellon University

Yingdan Hunag Ph.D. ‘12
*Easigami: Virtual Creation by Physical Folding*
Computer Science, University of Colorado, Boulder

Sunil George Abraham Ph.D. ‘11
*Evaluating the Impact of a Pattern Structure on Communicating Interaction Design Advice*
Informatics, Drexel University)

Yeonjoo Oh Ph.D. ’10 (chair)
*Toward a Theory of Design Critiquing*
Computational Design, School of Architecture, Carnegie Mellon University

Eric Schweikardt Ph.D. ’08 (chair)
*Designing Modular Robots*
Computational Design, School of Architecture, Carnegie Mellon University

Peter Scupelli Ph.D. ‘08
*Designing information hotspots for the surgical suite:*
How architecture, artifacts, and people's behavior converge to support coordination.
Human-Computer Interaction Institute, Carnegie Mellon University

Lisa Anthony Ph.D. ‘08
*Developing Handwriting-based Intelligent Tutors To Enhance Mathematics Learning*
Human-Computer Interaction Institute, Carnegie Mellon University

Leah Buechley Ph.D. ’07
*e-textiles*
Computer Science, University of Colorado

Mamoun Sakkal (pre-comprehensive exam)
*Geometry and Computation in Traditional Islamic Architecture*
Near and Middle Eastern Studies, University of Washington.

Thomas Wrensch Ph.D. ’01
*Computation and Craft*
Computer Science (University of Colorado, Boulder)

Ellen Yi-Luen Do Ph.D. ’98
*The Right Tool at the Right Time: inferring intention from designers’ sketches*
Architecture (Georgia Tech)

Judy Gurka Ph.D. ‘96
*Pedagogic Aspects of Algorithm Animation*
Computer Science (University of Colorado, Boulder)

Tamara Sumner Ph.D. ’96
*Toolbelts and Domain Oriented Design Environments*
Computer Science (University of Colorado, Boulder)

David Theobald Ph.D. ’95
*Morphology and Effects of Mountain Land Use Change in Colorado*
Geography (University of Colorado, Boulder)

Pei-Yu Huang Ph.D. ’94
*An Object Oriented Environment for Computer Aided Design*
Civil Engineering (University of Colorado, Boulder)

Jeffrey McWhirter Ph.D. ’94
*Characterization, Specification, and Generation of Visual Language Applications*
Computer Science (University of Colorado, Boulder)

Nick Wilde Ph.D. ’94
*Design of Visual Programming Environments*
Computer Science (University of Colorado, Boulder)

Roland Hübscher Ph.D. ’94
*Imposing Structure on Action: A Framework for Visual Advice-Based Programming*
Computer Science (University of Colorado, Boulder)

Alex Repenning Ph.D. ’94
*AgentSheets: From General Purpose Visual Programming Environments to Domain Tailorable Spatial Reasoning Substrates*
Computer Science (University of Colorado, Boulder)

Kumiyo Nakakoji Ph.D. ’93
*Delivering Case Based Information in Integrated, Knowledge-based Design Environments*
Computer Science (University of Colorado, Boulder)

Gerry Stahl Ph.D. ’93
*Supporting Interpretation in Design*
Computer Science (University of Colorado, Boulder)

Andreas Girgensohn Ph.D. ’92
*End User Modifiability in Knowledge-Based Design Environments*
Computer Science (University of Colorado, Boulder)

## MASTER THESIS COMMITTEES

Yeonjoo Oh Master of Science, Design Computing, (June, 2004)
*Design Evaluator: critiquing freehand sketches*

ChenJe Huang Master of Science, Design Computing, (June, 2004)
*Tangible MouseHaus Table: an physical interface for collaborative design*

Markus Eng Master of Architecture, (June 2004)
*FlexM: a computationally enhanced geometric construction kit*

Doo Young Kwon Master of Science, Design Computing, December 2003
*ArchiDNA – A Generative System for Shape Configurations*

Michael Philetus Weller Master of Architecture, June 2003
*Espresso Blocks: self-configuring building blocks*

Preechaya Therakomen Master of Architecture, December 2001 (chair)

*Mouse.class: Pedestrian Behavior in Urban Places*

Dustin Eggink Master of Architecture, December 2001 (chair)
*Smart Objects*

Ming Chun Lee Master of Architecture, December 2001 (member)
*The SpaceMaker - A Symbol-based Three-dimensional Computer Modeling Tool for Early Schematic Development of the Architectural Design*

Rob Harris Master of Landscape Architecture, August 2001 (member)
*Digital Sandbox*

William Washington Master of Technical Communication, June 2001 (member)
*Affective Media*

Kennith Camarata Master of Architecture, June 2001 (member)
*Navigational Blocks: an interplay between the physical and the virtual*

Doddy Samiaji Master of Architecture, June 2001 (chair)
*Development Simulator*

Luis F. Borrero Master of Architecture, June 2001 (chair)
*DeliverEroom: A new physical space for the residential units to come*

Mathew L. Albores Master of Architecture, June 2001 (chair)
*Y2K~02000: A Clock/Library for the Deep Future*

Misun Chung Master of Architecture, June 2000 (chair)
*A Sacred Place in CyberSpace*

Dongqiu Qian Master of Design Studies, Design Computing, June 1999 (chair)
(University of Colorado)
*A Lightweight Java-based Computer Aided Design Toolbox*

Nabeel Koshak Master of Architecture, June 1997 (chair)
(University of Colorado)
*Strategies for Constructing CAD Models of the Historic Buildings in the City of Makkah*

Paul J. Hamill III Master of Electrical and Computer Engineering, June 1998
(University of Colorado)
*Internet Structure Visualizations*

## ADVISORY AND EDITORIAL BOARDS AND PROGRAM COMMITTEES

| | |
|---|---|
| 2011 | Conference Co-Chair, Tangible Embedded Embodied Interaction '11 (Madeira, Portugal) |
| 2010 | Chair, Graduate Student Consortium, Tangible Embedded Embodied Interaction (MIT) |
| | Editorial Board, Journal of Educational Technology and Systems (JETS). |
| 2009 | Program Chair: ACM Creativity and Cognition |
| | Associate Chair: ACM Interaction Design and Children |
| 2007 | Program Committee ACM Creativity and Cognition Conference |
| 2004, 2006 | Intl Design Computing and Cognition Conference |
| 2006-present | Research in Engineering Design |
| 2002-present | Editorial board, *CoDesign Journal* |

| | |
|---|---|
| 2001 | Advisory Board, Carnegie Mellon University, Department of Architecture<br>Program Committee, Diagrams 2002, 2nd Int'l Conf.Theory & Applications of Diagrams.<br>Program Committee, IEEE Symposium on End User Programming<br>Program Committee, Spatial and Visual Reasoning II |
| 2000 | Advisory Board, 6th Int'l Conference on Artificial Intelligence in Design |
| 1999 | Program Committee, Diagrams 2000: First International Conference on Theory and Application of Diagrams |
| 1998 | Program Committee, International Round Table Conference Computational Models of Creative Design |
| 1997- | Editorial Board, International Journal of Design Computing |
| 1995-1997 | Steering Committee, Association for Computer Aided Design in Architecture |
| 1991-1997 | Advisory Board, International Conference on Artificial Intelligence in Design |
| 1996 | Advisory Board, Formal Aspects of Collaborative CAD '97 |
| 1995 | Advisory Board, Computational Models of Creative Design '95 |
| 1992-1994 | Advisory Board, Congresso Internacional de Computação Grafica |
| 1992 | co-chair (with Ernesto G. Arias), EDRA (Environmental Design Research Association) National Conference, Boulder, Colorado |
| 1991- | Advisory Board, CADLine—Bibliographic Reference Source for CAD |
| 1991- | Advisory Board, The Children's Media NeoMuseum, Yoshino, Japan |

## REFEREE OF MANUSCRIPTS, MATERIALS, AND GRANT PROPOSALS

| | |
|---|---|
| 2007 | ACM Creativity & Cognition (C&C), ACM User Interface Software Technology (UIST), ACM Human Factors in Computing (CHI), ACM Visual Languages and Human-Centric Computing (VL-HCC) , Eurographics workshop on Sketch Based Interaction and Modeling, ACM Tangible and Embedded Interaction (TEI), Computer Aided Architectural Design Futures (CAAD Futures), Computer Aided Architectural Design and Research in Asia (CAADRIA), Journal of Engineering Design, National Science Foundation proposal reviews (CISE), tenure and promotion reviews (various schools) |
| 2006 | ACM User Interface Software Technology (UIST), ACM Human Factors in Computing (CHI), ACM Visual Languages and Human-Centric Computing (VL-HCC) , Eurographics workshop on Sketch Based Interaction and Modeling, ACM Tangible and Embedded Interaction (TEI), Design Computing and Cognition (DCC), Computer Aided Architectural Design and Research in Asia (CAADRIA), International Conference on Multimodal Interaction, Open House International, Journal of Engineering Design, HCI Journal, IEEE Computer Graphics and Applications, Artificial Intelligence in Engineering Design and Manufacturing (AI-EDAM), tenure and |

promotion reviews (various schools), program review Herbst Center for the Humanities in Engineering (U. Colorado), MIT Press

2005 Children & Youth Environments (journal), ACM Human Factors in Computing (CHI), Design Decision Support Systems (DDSS), ACM User Interface Software Technology (UIST), Artificial Intelligence in Engineering Design and Manufacturing (AI-EDAM), Interacting with Computers, Eurographics workshop Sketch Based Modeling, ACM Visual Languages and Human-Centric Computing (VL-HCC), IEEE Transactions on Multimedia, CoDesign Journal, Automation in Construction, J. Computing and Information Science in Engineering.

2004 SIGGraph, eCAADe, Building Futures Conference, CoDesign Journal, Artificial Intelligence in Engineering Design and Manufacturing (AI-EDAM)

2003 CMU Conf. on Generative Computer Aided Design Systems (G-CAD), Int'l Conf. Design Computation and Cognition (DCC), Int'l Journal Document Analysis and Recognition (IJDAR), Int'l Conf. Design Decision Support Systems '04, ACM Conf. User Interface Software Technology (UIST) , 2nd International Workshop on Computer Graphics and Geometric Modeling, CGGM'2003, INTERACT '03, ACM Workshop on Interactive 3D; ACM SIGGraph '03, Education in Computer Aided Architectural Design in Europe '03; Diagrams Journal, MIT Press

2002 ACM conference on Interactive 3-D (I3D)
Research in Engineering Design Journal
First European Workshop on Diagrammatics and Design
Design Knowledge Sharing through Internet Application
ACM SIGGraph 2002,
University of Sydney doctoral dissertation (external review)

2001 Second International Conference on the Theory and Applications of Diagrams
International Conference on Artificial Intelligence in Design (AID '02)
Computer Aided Architectural Design Research in Asia (CAADRIA '02)
ACM Transactions on Internet Technology (ToIT)
Computational Models of Creativity Symposium
Computer Supported Cooperative Learning (CSCL) Conference
ACM User Interface Software and Technology (UIST) Conferfence
Human-Centered Computing Conference
INTERACT '01 conference
Education in Computer Aided Architectural Design in Europe (eCAADe)
International Conference on Spatial & Visual Reasoning II
Association for Computer Aided Design in Architecture (ACADIA)
Automation in Construction Journal
Computer Aided Design Journal
MIT Press
Tenure and promotion review, University of California, Los Angeles

2000 Computer Aided Architectural Design Futures 2001
American Society of Mechanical Engineers Design Theory & Methodology Conference
Landscape Journal
International Conference on Theory and Applications of Diagrams 2000
Co-Designing 2000
Association for Computer Aided Design in Architecture (ACADIA)
Computer Aided Architectural Design Research in Asia (CAADRIA)
Automation in Construction Journal

| | |
|---|---|
| | Computer Aided Design Journal |
| | The University of California MICRO Grants Program |
| | Canadian Fund for Innovation (FCAR) |
| 1999 | Education in Computer Aided Architectural Design in Europe (eCAADe) |
| | International Conference on Artificial Intelligence in Design (AID) |
| | Design Computing Network (DCNet) conference |
| | Association of Collegiate Schools of Architecture (ACSA) National Conference |
| | ACM Symposium on Applied Computing (SAC) |
| | Computer Aided Architectural Design and Research in Asia (CAADRIA) '99 |
| | International Conference on Visual and Spatial Reasoning '99 |
| | Computer Aided Architectural Design Futures '99 |
| | Tenure and promotion review, UC Berkeley |
| | Tenure and promotion review, Carnegie Mellon University |
| 1998 | ACM User Interface Software Tools (UIST) Conference |
| | Transactions on Computer Human Interface (ToCHI) |
| | 2nd Int'l Conference on Added Value of Computer Aided Architectural Design (AVOCAAD) |
| | Association for Computer Aided Design in Architecture (ACADIA) Conference |
| | International Conference on Artificial Intelligence in Design (AID) |
| | Encyclopedia of Creativity |
| | Int. Journal Design Computing (IJDC) |
| | NSF Small Business Innovative Research (SBIR) panel |
| | Tenure and/or promotion review, University of Virginia |
| 1997 | Association for Computer Aided Design in Architecture (ACADIA) Conference |
| | International Conference on Artificial Intelligence in Design (AID) Conference |
| | Automation in Construction Journal |
| | Int'l J. Human-Computer Systems |
| | Creativity Research Journal |
| | J. Visual Languages and Computing |
| | Van Nostrand Reinhold publishers |
| | NSF Information, Robotics, and Interactive Systems (IRIS) |
| 1996 | Association for Computer Aided Design in Architecture (ACADIA) Conference |
| | International Conference on Concurrent Engineering |
| | Knowledge Based Systems Journal |
| | Hong Kong Papers on the Built Environment |
| | J. Artificial Intelligence in Engineering Design & Manufacturing (AI EDAM) |
| 1995 | International Federation of Information Processing WG 5.2 conference on CAD |
| | IEEE Computer, special issue on visual languages |
| | Journal of Visual Languages and Computing |
| 1994 | MIT Press (Bradford Books) |
| | Society for Applied Computing (SAC) National Conference AI track |
| | Computer Aided Design Journal (special issue on artificial intelligence) |
| | Journal of Concurrent Engineering Research Association |
| 1993 | Computer Aided Architectural Design Futures '93 |

## SERVICE TO THE DEPARTMENT, COLLEGE, AND UNIVERSITY

Carnegie Mellon University

University (2009-10) Provost's committee on Tenure and Promotion
School of Architecture, Associate Head (Fall 2008-present)
School of Architecture (Spring 2007-present) Computing Task Force
School of Architecture (Fall 2007, present) director, Graduate Program

University of Washington (1999-2004)

Architecture Department: Studio Computing Integration Committee (2003/4)

College of Architecture and Urban Planning: PhD Program Steering Committee; College Council (2003/4)

Department of Civil Engineering, Search Committee (2002/3)

Provost's Advisory Committee on UIF-3 proposals, January - June 2001
Member of a faculty and staff committee reviewing 27 pre-proposals and 8 proposals for University Initiative Funding, approximately $3.5M of permanent funding for innovative academic and administrative ventures.

Graduate School Representative on Doctoral Committees
Marsha Lynn Whitney, Bioengineering
Jr-Yi Shen, Mechanical Engineering

College Computing Committee September 1999 - June 2000
Faculty advisory committee to the Associate Dean for Research + Computing on computing resource planning and management.

College Doctoral Program Proposal Committee 2002
Faculty advisory committee to develop and propose doctoral committee for the College of Architecture and Urban Planning.

Department of Landscape Architecture
Search Committee (2 positions) January - June 2001
Reviewed applications and participated in 7 faculty visits for 2 faculty hires in Landscape Architecture.

Department of Architecture
Master of Science in Design Computing implementation committee 2001 - 2002
Administrative and academic preparation for initial class of MS students; negotiating budgets, hiring staff, writing program literature.

Committee on Tenure, Promotion, Merit, Retention – Sept. 1999 - June 2001
Faculty tenure and promotion reviews, review of faculty yearly activity reports and CVs for recommendation to the Chair for merit raises .

Computing Committee - September 1999 - June 2001
Committee advises Department Chair on computing resources management and planning.

Professional Advisory Committee (IT subcommittee) Sept. 2000 - June 2001

Co-author, proposal to establish a Master of Science in Architecture (design computing), submitted November 1999, approved July 2001.

Co-author, Design Education for the Future, a Tools for Transformation proposal (granted May, 2000).

University of Colorado (1990-1999)

University Instructional Computing Working Group, 1994-1999
University committee to oversee instructional computing across the Boulder campus, allocate student technology fee funds.

University Advanced Technology, Learning, And Society (ATLAS) Committee
Advise Associate Vice President for Technology on development of Advanced Technology, Learning, And Society (ATLAS) program. Subcommittee on Technology, Arts, & Media (1998-1999)

Boulder Faculty Assembly (1992-3)
Representative for the College of Environmental Design

College of Architecture and Planning (1992-99); College of Environmental Design (1990-92)
Faculty advisor, National Organization of Minority Architecture Students (NOMAS) - 1997-99. Assisted students in setting up brown bag lunch series. Helped students organize 1-day workshop on Architects for the Twenty-first Century: Race, Class, and Culture March 13,1999. Workshop included distinguished panelists from architecture, law, ethnic studies, and women studies.

Computer Committee 1990-1999
Developed computing resources for the 600 students and associated faculty members in the College of Architecture and Planning at the Boulder campus; supervised support and teaching staff, developed curriculum, and through university proposals secured funding for instructional computing resources (approximately $50,000 annually); planned the development of student 'plug-and-play' studio desktop Internet access.

Department of Planning and Design:
Author, Proposal for a Master of Science in Design Computing (approved April 1998).

Search Committee (1996)
Design Studio Head, Undergraduate Program; Search resulted in several ranked candidates, finalist hired as Associate Professor with tenure. (Architecture)

Search Committee (1994)
Assistant / Associate Professor Architecture, and Assistant / Associate Professor Planning (2 positions). Two candidates selected; one offer made and the candidate hired (Planning).

Search Committee (1992)
Assistant Professor, architectural design (search resulted in an offer, which was declined).

Task force on a Ph.D. in Design and Planning
Member of 3-person team drafting a Ph.D. program proposal (approved, July 1997).

# Tom Yeh

430 UCB
University of Colorado
Boulder, CO, 80309

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http://tomyeh.info
(303) 492-1762

## Education

**Massachusetts Institute of Technology**, Cambridge, MA — June 2009
Ph.D. in Computer Science
Thesis: *Interacting with computers using images for search and automation*
Advisor: Trevor Darrell

**Massachusetts Institute of Technology**, Cambridge, MA — June 2004
S.M. in Computer Science
Thesis: *IDeixis : image-based deixis for recognizing locations*
Advisor: Trevor Darrell

**Simon Fraser University,** Burnaby, BC, Canada — December 2001
B.Sc. in Computer Science, Honor

## Research Interests

Human-Computer Interaction, Computer Vision, Software Engineering, Information Retrieval, Mobile Computing

## Employment

**University of Colorado Boulder,** Boulder, CO — 2012 - present
*Assistant Professor*

**University of Maryland Institute for Advanced Computer Studies,** College Park, MD — 2011 - 2012
*Assistant Research Scientist*

**University of Maryland Institute for Advanced Computer Studies,** College Park, MD — 2009 - 2011
*Postdoctoral Research Associate*

**MIT Computer Science and Artificial Intelligence Laboratory,** Cambridge, MA — 2009
*Postdoctoral Research Associate*

**MIT Computer Science and Artificial Intelligence Laboratory,** Cambridge, MA — 2003-2009
*Research Assistant*

## Research Grants

**NSF: VOSS:** Crowdsourcing Interaction Design for Citizen Space Virtual Organizations — 2012-2014

**DARPA: Active Authentication:** Screen Fingerprint as a New Modality for Active Authentication — 2012-2014

**DARPA: Automated Program Analysis for Cybersecurity:** Specialized Binary Analysis for Vetting Android Apps Using GUI Logic — 2013-2015

## Awards

**Best Paper,** ACM Symposium on User Interface Software and Technology (UIST) — 2010

**Best Student Paper,** ACM Symposium on User Interface Software and Technology (UIST) — 2009

# Publications

### Conference papers

1. Best Paper Award Honorable Mention K. Reinecke, **T. Yeh**, L. Miratrix, Y. Zhao, M. Rahmatri, J. Liu, K. Z. Gajos, "Predicting Users' First Impressions of Website Aesthetics With a Quantification of Perceived Visual Complexity and Colorfulness", Human Factors in Computing Systems (CHI), 2013.

2. J. S. Pedro, **T. Yeh**, and N. Oliver. Leveraging user comments for aesthetic aware image search reranking. In *Proceedings of the 21st international conference on World Wide We*b (WWW '12). ACM, New York, NY, USA, 439-448.

3. B. Xie, **T. Yeh**, G. Walsh, I. Watkins, and M. Huang. Co-designing an e-health tutorial for older adults. In *Proceedings of the 2012 iConference* (iConference '12). ACM, New York, NY, USA, 240-247.

4. **T. Yeh**, T. Chang, B. Xie, G. Walsh, K. Wongsuphasawat, I. Watkins, M. Huang, L. Davis, and B. Bederson. Creating Contextual Help for GUIs Using Screenshots. In *Proceedings of the 24th ACM Symposium on User Interface Software and Technology* (UIST), Santa Barbara, CA, October 2011.

5. T. Chang, **T. Yeh** and R. Miller. Correlating the Visual Representation of User Interfaces with their Internal Structures and Metadata. In *Proceedings of the 24th ACM Symposium on User Interface Software and Technology* (UIST), Santa Barbara, CA, October 2011.

6. B. Xie, **T. Yeh,** G. Walsh, I. Watkins, and M. Huang. Co-designing Contextual Tutorials for Older Adults on Searching Health Information on the Internet. In *Proceedings of the 74th Annual Meeting of the American Society for Information Science and Technology* (ASIS&T), New Orleans, LA, October, 2011.

7. **T. Yeh**, B. White, J. San Pedro, B. Katz, and L. Davis. A Case for Query by Image and Text Content: Searching Computer Help Using Screenshots and Keywords. In *Proceedings of the 20th International Conference on World Wide Web* (WWW), Hyderabad, India, March 2011.

8. Best Paper Award J. Bigham, C. Jayant, H. Ji, G. Little, A. Miller, R. C. Miller, R. Miller, A. Tatarowicz, B. White, S. White, and **T. Yeh**. VizWiz: Nearly Real-time Answers to Visual Questions. In *Proceedings of the 23rd ACM Symposium on User Interface Software and Technology* (UIST), New York, NY, USA, October 2010.

9. A. Kembhavi, **T. Yeh**, and L. Davis. Why Did the Person Cross the Road (There)? Scene Understanding using Probabilistic Logic Models and Common Sense Reasoning. In *Proceedings of the 11th European Conference on Computer Vision* (ECCV), Crete, Greece, September 2010.

10. T. Chang, **T. Yeh**, and R. Miller. GUI Testing Using Computer Vision. In *Proceedings of the Conference on Human Factors in Computing System* (CHI), Atlanta, GA, April 2010.

11. Best Student Paper Award **T. Yeh**, T. Chang, R. Miller. Sikuli: Using GUI Screenshots for Search and Automation. In *Proceedings of the 22ns ACM Symposium on User Interface Software and Technology* (UIST), Victoria, BC, Canada, October 2009.

12. **T. Yeh**, J. Lee, T. and Darrell. Fast Concurrent Object Localization and Recognition. In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition* (CVPR), Miami, FL, June 2009.

13. **T. Yeh**, J. Lee, T. and Darrell. Photo-based Question Answering. In *Proceedings of the ACM International Conference on Multimedia* (MM), Vancouver, BC, October 2008.

14. **T. Yeh** and T. Darrell. Dynamic Visual Category Learning. In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition* (CVPR), Anchorage, AK, June 2008.

15. **T. Yeh** and T. Darrell. Multimodal Question Answering for Mobile Devices. In *Proceedings of the International Conference on Intelligent User Interfaces* (IUI), Canary Island, Spain, January 2008.

16. **T. Yeh**, J. Lee and T. Darrell. Adaptive Vocabulary Forests for Dynamic Indexing and Category Learning. In *Proceedings of the IEEE International Conference on Computer Vision* (ICCV), Rio de Janeiro, Brazil, October 2007.

17. **T. Yeh**, K. Grauman, K. Tollmar, and T. Darrell. A Picture is Worth a Thousand Keywords: Image-based Object Search on a Mobile Platform. In *Proceedings of the Conference on Human Factors in Computing Systems* (CHI), Portland, OR, April 2005.

18. **T. Yeh** and T. Darrell. DoubleShot: An Interactive User-Aided Segmentation Tool. In *Proceedings of the International Conference on Intelligent User Interfaces* (IUI), San Diego, CA, January 2005.

19. K. Tollmar, **T. Yeh**, and T. Darrell. IDeixis: Image-based Deixis for Finding Location-based Information. In *Proceedings of the 6th International Conference on Human Computer Interaction with Mobile Devices and Services* (MobileHCI), Glasgow, Scotland, September 2004.

20. **T. Yeh** and T. Darrell. Searching the Web with Mobile Images for Location Recognition, In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition* (CVPR), Washington, DC, June 2004.

21. K. Voll, **T. Yeh** and V. Dahl. An Assumptive Logic Programming Methodology for Parsing, In *Proceedings of the IEEE International Conference on Tools with Artificial Intelligence* (ICTAI), Vancouver, November 2000.

**Workshop papers**

22. D. Chen, M. Bilgic, L. Getoor, D. Jacobs, L. Mihalkova, and **T. Yeh**. Active Inference for Retrieval in Camera Networks. In *Proceedings of the IEEE Workshop on Person Oriented Vision*, January 2011.

23. B. White, **T. Yeh**, J. Lin, and L. Davis. Web-Scale Computer Vision using MapReduce for Multimedia Data Mining. In *Proceedings of the KDD Multimedia Data Mining Workshop*, Washington, DC, July 2010.

24. **T. Yeh**, J. Lee and T. Darrell. Scalable Classifiers for Internet Vision Tasks. In *Proceedings of the First IEEE Workshop on Internet Vision* (IV), Anchorage, AK, June 2008.

25. J. M. Paluska, D. Saff, **T. Yeh** and K. Chen, Footloose: A Case for Physical Eventual Consistency and Selective Conflict Resolution. I*n Proceedings of the 5th IEEE Workshop on Mobile Computing Systems and Applications* (WMCSA), Monterey, CA, October 2003.

**Posters and Demonstrations**

26. B. Xie, **T. Yeh,** G. Walsh, I. Watkins and M. Huang. Co-designing an integrated e-tutorial tool to improve older adults' e-health literacy. Presented at the *64th Annual Scientific Meeting of the Gerontological Society of America (GSA)*, Boston, MA, November 2011.

27. **T. Yeh** and B. Katz. Indexing and Searching Software Documentations using Text, OCR, and Image. In *Proceedings of the 33rd International ACM SIGIR Conference on Research and Development in Information Retrieval* (SIGIR), Poster, Boston, MA, July 2009.

28. **T. Yeh**, T. Chang and R. Miller. Obtaining Help on GUI Elements using Screenshots. In *Proceedings of the 21st ACM Symposium on User Interface Software and Technology* (UIST), Poster, Monterey, CA, October 2008.

29. **T. Yeh,** K. Grauman and T. Darrell. Image-based Web Search on a Mobile Platform. In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition* (CVPR), Demo, San Diego, CA, June 2005.

30. **T. Yeh**, K. Tollmar and T. Darrell. IDeixis - Image-based Deixis for Finding Location-Based Information, In *CHI '04 Extended Abstracts on Human Factors in Computing Systems* (CHI EA), Demo, Vienna, Austria, April 2004.

**Journal Article**

31. K. Voll, **T. Yeh** and V. Dahl. An Assumptive Logic Programming Methodology for Parsing. *International Journal on Artificial Intelligence Tools,* Vol. 10 (4), pp. 573-588, December 2001.

## Software

**Sikuli Script/IDE** (www.sikuli.org)
*200,000* downloads since it was open-sourced in January 2010.
Used by many companies and organizations such as Google, Intel, Symantec, Spotify, and Office of Budget and Management

## Patent

**Photo-based Mobile Deixis System and Related Techniques –** US 7,872,669

## Service

| | | |
|---|---|---|
| *Chair* | MIT CSAIL Student Workshop | 2007 |
| *Program Committee* | ACM Symposium on User Interface Software and Technology (UIST) | 2012, 2013 |
| | IEEE Workshop on Applications of Computer Vision (WACV) | 2011 |
| *Conference Reviewer* | Conference on Human Factors in Computing System (CHI)<br>International Conference on Intelligent User Interface (IUI)<br>ACM Symposium on User Interface Software and Technology (UIST)<br>IEEE Conference on Computer Vision and Pattern Recognition (CVPR)<br>IEEE Conference on Computer Vision and Pattern Recognition (ICCV)<br>ACM International Conference on Multimodal Interaction (ICMI) | |
| *Journal Reviewer* | IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI)<br>Machine Vision and Application (MVA) | |

## Talks

| | |
|---|---|
| 2011 | Sikuli: GUI Testing using Computer Vision<br>*Office of Management and Budget, Washington, DC* |
| | Sikuli: GUI Testing using Computer Vision<br>*Northern Virginia Test Automation Interest Group, Herndon, Virginia* |
| 2010 | Online GUI Help using Computer Vision<br>*HCIL, University of Maryland, College Park, MD* |
| 2009 | Interacting with Computer using Images<br>*University of British Columbia, Vancouver, BC* |
| | Interacting with Computer using Images<br>*Harvard University, Cambridge, MA* |
| | Interacting with Computer using Images<br>*Columbia University, New York, NY* |
| | Interacting with Computer using Images<br>*University of Maryland, College Park, MD* |
| | Interacting with Computer using Images |

*Media Lab, MIT, Cambridge, MA*

## Press

2011 The UID group: Sikuli, picture-driven computing
*MIT EECS News Letter*

2010 Screen-Capture Programming: What You See is What You Script
*IEEE Computing Now*

Picture-driven Computing
*MIT Press*

Sikuli Rethinks Programming
*MIT CSAIL Spotlights*

Programming Visually with Sikuli
*Computing Community Consortium (CCC)*

MIT Offers Picture-Centric Programming To the Masses With Sikuli
*Slashdot*

Sikuli Automates Almost Anything with Screenshot Ease
*LifeHacker*

Sikuli: Scripting with Screenshots
*PC Pro*

MIT Creates Picture-Driven Programming for the Masses
*CIO*

Sikuli Can Automate Any GUI by Taking Screenshots
*TUAW: The Unofficial Apple Weblog*

MIT Project Lets You Author Code with Screenshots, Pictures
*DigitalBeat*

Sikuli: Create "Smart Macros" based on Screenshots
*dotTech*

Sikuli: the Coolest Python Project I Have yet Seen
*Python411 Podcast*

2009 Goggle Image Search Coming to Android
*LinuxDevices*

2004 When Databases Think
*Smart Device Central*

Picture This
*MIT Technology Review*

## Teaching

*Lecturer* **Introduction to Human Computer Interaction (CMSC 434)**, UMD 2010
Taught a class of 45 students and supervised 10 team projects.

*Guest Lecturer* **Developing Interfaces for Rehabilitation (IS 698),** UMBC 2011
Taught the use of computer vision and Kinect in user interfaces

**Introduction to Human Computer Interaction (CMSC 434)**, UMD 2011
Taught principles of visual design

**Multimodal User Interfaces (6.870),** MIT 2007, 2008
Taught multimodal user interfaces on mobile devices

| | | |
|---|---|---|
| *Teaching Assistant* | **Structure and Interpretation of Computer Program (6.001),** MIT<br>Led 7 sections every week, developed custom exercises and quizzes. | 2006 |

## Advising

| | | |
|---|---|---|
| *PhD Thesis Committee* | Tsung-Hsiang Chang, MIT *(Google Fellowship in HCI)* | 2009-2011 |
| *PhD Research Mentor* | Brandyn White, UMD | 2009-2011 |
| | Ejaz Ahmed, UMD | 2011 |
| | Aniruddha Kembhavi, UMD | 2009-2010 |
| | Jingchen Liu, PSU | 2010-2011 |
| *Undergrad Research Supervisor* | Eric Kuang, UMD | 2010-2011 |
| | Leyla Nornooz, UMD | 2011 |
| | Noor Siddiqi, UMD | 2010 |
| | John Lee, MIT *(M. Eng Thesis Prize, 1st place)* | 2008-2009 |
| | Allan Deckelbaum, MIT | 2006 |
| | Yunus Samaz, MIT | 2006 |

## References

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**Ben Bederson**
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University of Maryland, College Park
bederson@cs.umd.edu

**Boris Katz**
Principal Research Scientist
Massachusetts Institute of Technology
boris@mit.edu

# CURRENT AND PENDING SUPPORT

**Current:**

**Project/Proposal Title**: VOSS: Crowdsourcing interaction design for citizen science virtual organizations
**PI:** Tom Yeh
**Source of Support**: University of Maryland College Park / NSF
**Total Award Amount**: $46,146
**Total Award Period Covered**: 9/1/2012 – 8/31/2014
**Location of Project:** University of Colorado Boulder
**Person-Months Per Year Committed to the Project**: 0.6 CY

**Project/Proposal Title**: Visual Fingerprint as a New Modality for Active Authentication organizations
**PI:** Tom Yeh
**Source of Support**: University of Maryland College Park / DARPA
**Total Award Amount**: $100,000
**Total Award Period Covered**: 10/30/2013 – 09/30/2014
**Location of Project:** University of Colorado Boulder
**Person-Months Per Year Committed to the Project**: 1.0 CY

**Pending**

**Project/Proposal Title**: DIP: Collaborative Research: MultiNets - Designing Crowdsourcing Platforms to Scaffold Collaborative Learning for Students Solving Complex Problems
**PI:** Tom Yeh
**Source of Support**: NSF
**Total Award Amount** $369,643
**Total Award Period Covered**: 10/01/2014 - 09/30/2017
**Location of Project:** University of Colorado Boulder
**Person-Months Per Year Committed to the Project**: 1.0 CY

**Project/Proposal Title**: CrowdVision: New Ways of "Seeing" in Disaster Events through Computer Vision & Human-Machine Computation
**PI:** Leysia Palen
**Source of Support**: NSF
**Total Award Amount** $299,809
**Total Award Period Covered**: 09/01/2014 - 08/31/2018
**Location of Project:** University of Colorado Boulder
**Person-Months Per Year Committed to the Project**: 0.25 CY

**Project/Proposal Title**: AISL: Innovations in Development: Community-Driven Projects That Adapt Technology for Environmental Learning in Nature Preserves
**PI:** Tom Yeh
**Source of Support**: NSF

**Total Award Amount:** $444,902
**Total Award Period Covered**: 10/01/2014 - 03/31/2018
**Location of Project:** University of Colorado Boulder
**Person-Months Per Year Committed to the Project**: 1.5 CY

**Project/Proposal Title**: CHS: Small: Collaborative Research: Learning from Crowd-sourcing: A Cyber-Human System for Improving the Quality of Citizen Science
**PI:** Tom Yeh
**Source of Support**: NSF
**Total Award Amount:** $140,293
**Total Award Period Covered**: 08/01/2014 - 07/31/2017
**Location of Project:** University of Colorado Boulder
**Person-Months Per Year Committed to the Project**: 0.25 CY