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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.

**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].

![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.](image-url)
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

<table>
<thead>
<tr>
<th>Experiential Education</th>
<th>Democratic Education</th>
<th>Active Learning</th>
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</thead>
<tbody>
<tr>
<td>• At-home Challenges</td>
<td>• Feedback Journal</td>
<td>• In-class Hack-a-thon</td>
</tr>
<tr>
<td>• Scenarios</td>
<td>• Class Forum</td>
<td>• Demoing</td>
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<td>• Semester Project</td>
<td>• Open-ended</td>
<td>• Hands-on</td>
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<td></td>
<td>problem solving</td>
<td>Instruction</td>
</tr>
</tbody>
</table>
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**

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<thead>
<tr>
<th>Mon</th>
<th>Tues</th>
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<tbody>
<tr>
<td>Class</td>
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**Flipped Classroom**

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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.

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

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


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skirpan.mw@gmail.com

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


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


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


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


**CONFERENCE PAPERS IN PEER-REVIEWED PROCEEDINGS**


Designing Systems to Design Themselves, Schweikardt, E and Gross MD, 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.


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


**1998**


**1997**


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.


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.


**INVITED ARTICLES AND BOOK CHAPTERS**


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


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


  **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


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


**BOOK REVIEWS**


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


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


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


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.


**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/](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.


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.


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


NON-REFEREED PAPERS


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

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


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.


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.

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

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


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

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


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


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


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


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.


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.


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 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

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


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 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)

Explores the near-term future of architecture, where buildings will embed computational capabilities.

reviews design research and its applications in computer-aided design.

Seminar about on-line communities; project work constructing web based places.

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. Borro 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 Embodyed Interaction ‘11 (Madeira, Portugal)

2010 Chair, Graduate Student Consortium, Tangible Embedded Embodied Interaction (MIT)

2009 Program Chair: ACM Creativity and Cognition
Associate Chair: ACM Interaction Design and Children

2007 Program Committee ACM Creativity and Cognition Conference


2006-present Research in Engineering Design

2002-present Editorial board, CoDesign Journal
2001
Advisory Board, Carnegie Mellon University, Department of Architecture
Program Committee, Diagrams 2002, 2\textsuperscript{nd} Int'l Conf. Theory & Applications of Diagrams.
Program Committee, IEEE Symposium on End User Programming
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

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

2005

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

2003

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) Conference
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


**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

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University of Colorado
Boulder, CO, 80309
tom.yeh@colorado.edu
http://tomyeh.info
(303) 492-1762

Education

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

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

Simon Fraser University, Burnaby, BC, Canada
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
Assistant Professor

University of Maryland Institute for Advanced Computer Studies, College Park, MD
Assistant Research Scientist

University of Maryland Institute for Advanced Computer Studies, College Park, MD
Postdoctoral Research Associate

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

MIT Computer Science and Artificial Intelligence Laboratory, Cambridge, MA
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

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


**Workshop papers**


**Posters and Demonstrations**


**Journal Article**


**Software**

**Sikuli Script/IDE** ([www.sikuli.org](http://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**

<table>
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<tr>
<th>Chair</th>
<th>MIT CSAIL Student Workshop</th>
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<tr>
<td>Program</td>
<td>ACM Symposium on User Interface Software and Technology (UIST)</td>
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<td>Committee</td>
<td>IEEE Workshop on Applications of Computer Vision (WACV)</td>
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<td>Conference on Human Factors in Computing System (CHI)</td>
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<tr>
<td>Reviewer</td>
<td>International Conference on Intelligent User Interface (IUI)</td>
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<td></td>
<td>ACM Symposium on User Interface Software and Technology (UIST)</td>
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<td></td>
<td>IEEE Conference on Computer Vision and Pattern Recognition (CVPR)</td>
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<td></td>
<td>IEEE Conference on Computer Vision and Pattern Recognition (ICCV)</td>
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<td>ACM International Conference on Multimodal Interaction (ICMI)</td>
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<tr>
<td>Journal Reviewer</td>
<td>IEEE Transactions on Pattern Analysis and Machine Intelligence (PAMI)</td>
</tr>
<tr>
<td>Reviewer</td>
<td>Machine Vision and Application (MVA)</td>
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</table>

**Talks**

2011  Sikuli: GUI Testing using Computer Vision

*Office of Management and Budget, Washington, DC*

Sikuli: GUI Testing using Computer Vision

*Northern Virginia Test Automation Interest Group, Herndon, Virginia*

2010  Online GUI Help using Computer Vision

*HCIL, University of Maryland, College Park, MD*

2009  Interacting with Computer using Images

*University of British Columbia, Vancouver, BC*

Interacting with Computer using Images

*Harvard University, Cambridge, MA*

Interacting with Computer using Images

*Columbia University, New York, NY*

Interacting with Computer using Images

*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
          Taught a class of 45 students and supervised 10 team projects.

Guest Lecturer  Developing Interfaces for Rehabilitation (IS 698), UMBC

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

Multimodal User Interfaces (6.870), MIT
          Taught multimodal user interfaces on mobile devices
### Teaching

**Assistant**  
**Structure and Interpretation of Computer Program (6.001), MIT**  
Led 7 sections every week, developed custom exercises and quizzes.

### Advising

**PhD Thesis**  
Tsung-Hsiang Chang, MIT *(Google Fellowship in HCI)*

| PhD Committee |  
|---------------|---|
| **PhD** Brandyn White, UMD | 2009-2011 |
| **Research** Ejaz Ahmed, UMD | 2011 |
| **Mentor** Aniruddha Kembhavi, UMD | 2009-2010 |
| Jingchen Liu, PSU | 2010-2011 |

| Undergrad |  
|------------|---|
| **Research** Leyla Nornooz, UMD | 2011 |
| **Supervisor** Noor Siddiqi, UMD | 2010 |
| John Lee, MIT *(M. Eng Thesis Prize, 1st place)* | 2008-2009 |
| Allan Deckelbaum, MIT | 2006 |
| Yunus Samaz, MIT | 2006 |
References

Trevor Darrell
Professor
University of California, Berkeley
trevor@eecs.berkeley.edu

Larry Davis
Professor
University of Maryland, College Park
lsd@cs.umd.edu

Rob Miller
Associate Professor
Massachusetts Institute of Technology
rcm@mit.edu

Ben Bederson
Professor
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