I am a design generalist.

While I appreciate the talents of those who develop expertise in specific domains, with specialized tools, materials and processes, I personally enjoy bending my skill set to a wide variety of design challenges, and picking things up along the way.

This portfolio showcases my broad and exploratory approach to design.
How will pedestrians and cyclists interact with self-driving cars when there is no human driver? We developed a novel method for performing naturalistic field experiments to investigate interactions with driverless cars, by having the driver of our test vehicle dressed in a car-seat costume. We ran a benchmarking field study to understand how passersby would behave. We found that people encountering a faux driverless car managed interactions with the car smoothly, especially when they perceived the car as adhering to their expectations for its movement. Since participants could not make eye contact with the driver, they focused instead on the movement of the car itself. Only when the car misbehaved – for example, started once the pedestrian was about to cross – did any pedestrians show hesitance.

I supervised this platform and accompanying experiment.

collaborators Dirk Rothenbuecher, Jamy Li, David Sirkin
Service robots in public places need to both understand environmental cues and move in ways that people can understand and predict. We developed and tested interactions with a trash barrel robot to better understand the implicit protocols for public interaction. In eight lunch-time sessions spread across two crowded campus dining destinations, we experimented with piloting our robot in Wizard of Oz fashion, initiating and responding to requests for impromptu interactions centered on collecting people’s trash.

The trash barrel is mounted atop the iRobot Create platform for movement and is augmented with a laptop computer, two web-cameras, and a microphone to enable tele-operation.

collaborators  Stephen Yang, Brian Mok, David Sirkin, Kerstin Fischer
The Real Road Autonomous Driving Simulator (RRADS) is a Wizard of Oz platform developed to explore attitudes and concerns that people may have in real-world autonomous vehicles. The platform uses a divider to separate the study participant “driver” from the actual trained driver, the “driving wizard” of the vehicle. Another researcher, the “interaction wizard” sits in the back seat and manages interactions with the driver. We have used this platform as a way to test haptic pre-cuing systems as well as to measure physiological and emotional reactions to autonomous driving in ways that are cost-effective and safe.

I devised the original plan for this platform, and provided supervision and guidance during its development.

collaborators  Sonia Baltodano, Srinath Sibi, Nikhil Gowda, Nik Martelaro
The robotic drawers prototype was fabricated from a standard Ikea MICKE 4-drawer unit. To allow the drawers to perform consistent and repeatable motions, the drawers are retrofitted with DC motors on a rack and pinion system. Spring-loaded rotational encoders, mounted against the drawers’ frame allowed us to track each drawer’s position. The actuation is controlled by an Arduino microcontroller communicating with a local client program over a USB cable.

The gestures for the drawers were developed by workshopping interactions with dancers. The reaction to different interaction schemas with the drawers were then tested in a controlled study with participants who were tasked with an assembly task using tools inside the drawer cabinet. I supervised the design and development of the drawers, as well as the experimental design.

collaborators Stephen Yang, Brian Mok, David Sirkin
MECHANICAL OTTOMAN
2013-14

The Mechanical Ottoman is a robotic footstool that was created to understand how to engage and disengage people in interaction using only non-verbal robot motion. We originally developed the scenarios and tested the interaction techniques for the robot using puppeteering. Then, we integrated an iRobot Create platform with wireless networking capability so that we could remotely puppeteer the robot, first for improv sessions with dancers and interaction specialists. Finally, we used a Wizard of Oz technique to engage unsuspecting study participants in naturalistic interaction with the Mechanical Ottoman.

I devised and led the project, and provided technical and experimental guidance to my student collaborators on this project.

collaborators David Sirkin, Brian Mok, Aleta Hayes, Jofish Kaye
To harness students’ natural interest in their favorite gizmos, I created an introductory undergraduate class where students learn both the technical and the design-oriented skills involved in designing the interactive consumer devices. Through successive labs where students build LED lights, timers, data loggers, digital etch-a-sketches and finally an MP3 player, students learn basic electronics, sensor circuits, firmware programming, communications, interaction design, physical fabrication, user testing and design integration.

This class attracts students from many majors, and has formed the basis for a broader initiative encouraging making in the Electrical Engineering department at Stanford University.

collaborator David Sirkin

description
Ambidextrous Magazine is Stanford University’s Journal of Design. I was motivated to start Ambidextrous because I felt that there should be a forum for the wider design community to discuss their common enthusiasms and concerns. I helmed the magazine as Co-Editor in Chief for the first year, and continued as Editor At Large until the magazine shuttered in 2011. The magazine was self-published and self-distributed; because of this, I was largely responsible for the design of the magazine’s look and feel, its editorial direction, its business model, its technical production and even the web site of the magazine.

Lawrence Neeley, Charlotte Burgess Auburn, Corina Yen, Lora Oehlberg, Bjoern Hartmann, Micah Lande, & Amal Dar Aziz.
Satellite CCRMA is a musical interaction design platform designed to support the creation of new instruments for musical expression as well as sound installations. It incorporates a single-board OMAP-based Linux computer, an Arduino-based microcontroller, and a breadboard for electronics prototyping. By creating a musical synthesis platform which includes a small, inexpensive and autonomous Linux computer, I hoped to make it easier for students to build computer music instruments and art installations that would withstand the obsolescence issues associated with laptop-based development.

I have used Satellite CCRMA as the basis for instruction in my CCRMA class on Physical Interaction Design for two years now, and have been upgrading it to make it more useful to students.

collaborators Edgar Berdahl
**Telepresence Robot**

2009-10

**Description**

Does augmented movement capability improve people’s experiences with telepresent meeting participants? We prototyped and then developed a robotic telepresence robot based on an iMac G4 computer with hemispherical base and 15-inch screen, connected to by an articulating “neck.” The iMac G4’s screen was actuated by three DC motors and a cable drive system to move the neck and screen to positions controlled using a remote interface.

We designed the gestures of the robot using “head motions” we developed, prototyped and field tested using a simple four-bar linkage attached to the iMac G4.

**Collaborators**

David Sirkin, Eric Kent, Samson Phan
The WiiScience project is aimed at the design and development of software tools to support young people and teachers in repurposing the Wii game controller for their own uses. The research goals of this project are to design activities and software harness everyday technologies to support scientific inquiry in science classroom labs and projects and, more broadly, to develop activities and software tools that encourage young people to repurpose these same technologies for their own interests.

I initiated this project, applied for and was granted funding from the Wallenberg Foundation, and have been the technical development lead for this project. I have worked with instructors at Nueva School and researchers from Stanford’s Learning Sciences & Technology Program in designing curriculum for the software and Wii hardware.

collaborators Sarah Lewis, Ugochi Acholonu, Pote Pothongsunan & Kim Saxe
The Intel Digital Health Pulse Oximeter Earring Project is a distributed health sensing application to provide persistent health monitoring. Pulse oximetry hardware clipped to the patients ear communicates over Bluetooth using compact Intel iMote technology to send data to the patient’s cell phone, which acts as a gateway for disseminating information to their personal computer, their dedicated health weblog or possibly to their doctor’s health server.

I designed the concept and a functional prototype of this pulse oximeter system in a short time period by re-appropriating sensor technologies and integrating disparate open-source toolkits; this project incorporated sensor design, embedded programming, mobile device application development, and server-side web application design.

collaborators
Margaret Morris, Intel Digital Health Group
The ACM SIGGRAPH Reports Program was created to help broaden the experience of SIGGRAPH conference sponsors and attendees through online news coverage of the ideas, events and stories of the conference. The student volunteers of the program aspire not only to convey the breadth of the conference’s many venues, but also to explore in depth the personalities, issues and culture that are an enduring legacy of the graphics community.

As the editor for this program, I created the online template for the Reports web site, as well as designing the backend that enabled reporters to easily upload stories and photos. My technical designs made it possible to initiate real-time coverage of the conference, and to substantially increase the number of articles logged by Reporters each year.
MECHANICAL

CUSTOM ROAD BICYCLE FRAME
Spring 2003

description I designed this custom road bicycle frame as a project for a bicycle frame-building course. The frame is built of steel tubing, which I designed and milled to fit my physical geometry, and is joined using old-fashioned lugs, which I hand-carved and silver-brazed for a unique Art Nouveau look. The decorative elements on the top tube and the seat tube were formed from brass strips, which were silver-brazed to the tube and masked during the paint process to create visual contrast.
WorkspaceNavigator supports knowledge capture and reuse for teams engaged in unstructured, dispersed, and prolonged collaborative design activity in a dedicated physical workspace. It enables post-facto retrieval of multiple streams of data from the work environment, including overview snapshots of the workspace, screenshots of in-space computers, whiteboard images, and digital photos of physical objects.

As part of the Workspace Navigator project, I designed WorkspaceNavigator Viz to provide an overview of overall workspace activity for the teaching team of the class where we deployed Workspace Navigator in a six-month field test. This Java program, created using the Processing development environment, allowed course instructors and project managers to gain high-level awareness into the activity and production of different teams, and provided a good point of access for more detailed information.
**HITCHHIKER’S GUIDE**
Spring 2002

**description** Hitchhiker’s Guide is a storyboard that outlines the features and function of a collaborative community-based context-aware travel guide. It demonstrates these features through the depiction of the adventures of an imaginary user, Cliff, a twenty-something guy backpacking his way across Italy. This project won first-prize in Stanford’s annual Big Idea Festival.

For this project, I created a novel illustration technique for our storyboard which combines digital photos of existing contexts and settings and sketches of hypothetical users. This format is effective at communicating the details of a designed scenario; at the same time, it is easy to produce and conveys the provisional nature of the storyboard.

**collaborators** Thai Tran
Origami Desk is an interactive installation where users learn to fold paper into beautiful shapes. Origami Desk improves on traditional origami diagrams by showing videos that demonstrate what the hands should do, projecting lines onto the paper indicating where the folds should be, and monitoring the paper folding to give the budding origami artist feedback if their folding should go awry.

I directed the overall project, but I personally spearheaded the design, testing and production of the projects chief invention, the fold-sensing paper. By using strategically placed Electronic Article Surveillance tags of different frequencies, the Origami Desk was able to sweep resonant frequencies to detect and give people feedback on their folding. The paper itself doubled as promotional material; it was designed using velum so that participants could see the tags and better understand how the system worked; the resulting products worked as advertising for the exhibit.

**Collaborators**
Leonardo Bonanni, Jenn Yoon, Becky Hurwitz, Tlke Judd, Rich Fletcher, Matthew Reynolds & Rehmi Post
PENGACHU
Winter/Spring 2001

description
Pengachu is a handheld Linux server; it was designed as a low-cost open-source effort to enable broader access to computing technology. Its design is based on Motorola’s Dragonball processor capable of running uCLinux. The server was fully autonomous; its form factor, roughly the size of a cassette deck, included a LCD display and interface buttons. We were subsequently contracted to build a version of this server that would piggyback on the StarTac phone.

I modelled the physical layout of components on the Pengachu’s board to make its tiny form factor possible, and used Solidworks to design the SLA plastics that housed the electronics. As we developed demonstration software, I designed prototype software applications for the phone using C.

collaborators
Rehmi Post & Matthew Reynolds
The CounterActive kitchen counter provides instructions and pictures to show people how to cook a variety of recipes—but it also has the capability to provide movies, music and help on demand. The goal of the project was to use embedded technologies to make cooking easier and more entertaining.

CounterActive integrates capacitive sensing hardware, projection technology and dynamic web pages as part of its overall system design. The recipes themselves were feats of design that required food photography, digital video editing and javascript programming. Part of the counter’s appeal was our visual language, which was distinct from that of Microsoft Windows, and based on the aesthetic we observed by benchmarking cooking shows and magazines.

collaborators Tilke Judd, Bonny Lee, Camillo Guacqueta, & Becky Hurwitz
SGI’s Origin2000 scalable server system used a ccNUMA architecture to allow customers to configure systems with anywhere from 4 to 256 processors using modular hardware. Part of the challenge of this design was developing a scalable architecture for the embedded system controllers that monitors and controls the server’s physical and electrical performance prevent and remedy system failures.

On this project, I developed the interfaces between electromechanical parts (such as fans) and the embedded controllers. I also designed all the cables and mechanical circuit boards for the system, and helped design the user interface featured on the front of the machines. In addition, I was also involved in designing the scalable architecture of the system, and in allotting different degrees of functionality to different levels of the control hierarchy.
Each year, Tau Beta Pi invites 10-15 local high schools to the Stanford campus to teach students what engineering is about. As TBP’s Pre-college Outreach officer, I planned the Spring Field Day Event, coordinated volunteers and acted as a liaison to local teachers to organize logistics.

My most inspired addition to this annual tradition is the invention of the Egg Launch. As many students seemed to have experience with tried and true engineering challenges such as the Egg Drop, the Spaghetti Cantilever Bridge and the Newspaper Tower, I devised a new and exciting challenge in which students were given limited materials to design a rocket payload unit that would protect an egg through a 150 foot launch.
INTERACTIVE FURNITURE SET
Spring 1997

description
For Interval Research’s 1997 University Workshop, which asked student teams to develop human–computer interactions filled with humor, I lead a team of student designers in the creation of an interactive furniture set that enabled diners to draw funny messages and sketches that would appear over the heads of their fellow diners. The set consisted of chairs equipped with screens in their tall backs, and a table with PDAs embedded in its bezeled edges which users could draw in. We created two generations of chair prototypes, which used Apple Powerbooks running screens created in Macromedia Director 5.0. This project won the “Best Prototyping Award” at the workshop.

collaborators
Nancy Bersteinsson, Mathieu Farrugia, & Antonio Sistos