Cover Page

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Teaching embodied interaction design practice

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Abstract
Increasingly, user experiences are addressing our interactions in the world—the physical, the social, and the situated. This sketch presents our experiences introducing embodied interaction themes to a project-based Interaction Design studio course. We present and discuss examples of student-created designs, illustrating the relationship between these design methods, domains, and artifacts created. These in-the-world domains and methods appealed to budding interaction designers because it encouraged them to transcend the computer screen and design for the world at large. However, the challenge of effectively evaluating in-the-world interactions inhibited iteration. Balancing observation, craft, and evaluation was critical to project success, and we are exploring how to help students navigate these process tradeoffs.

Keywords
Interaction design, studio, education, teaching, embodied interaction, urban computing, tangible UI

Project statement
Interaction design practice has been traditionally organized around screen-based applications and graphical user interfaces on desktop computers. Interaction design is increasingly adopting a broader approach that takes into account the physical, social and "in-the-world" context of users [5]. These embodied interactions encourage designers to leverage their understandings of the world at large, to bring them to bear on their designs and increase the diversity of user experiences

We highlight some of the issues with translating embodied interaction theory to practice through the lens of our Interaction Design studio course. These are found in the creation of the course projects, and also in the design work of the student teams. We outline the scoping and framing of each design project and discuss examples of designs from each project to illustrate the ideas generated by the students, with an eye towards generalizing possibilities and pitfalls in practice.

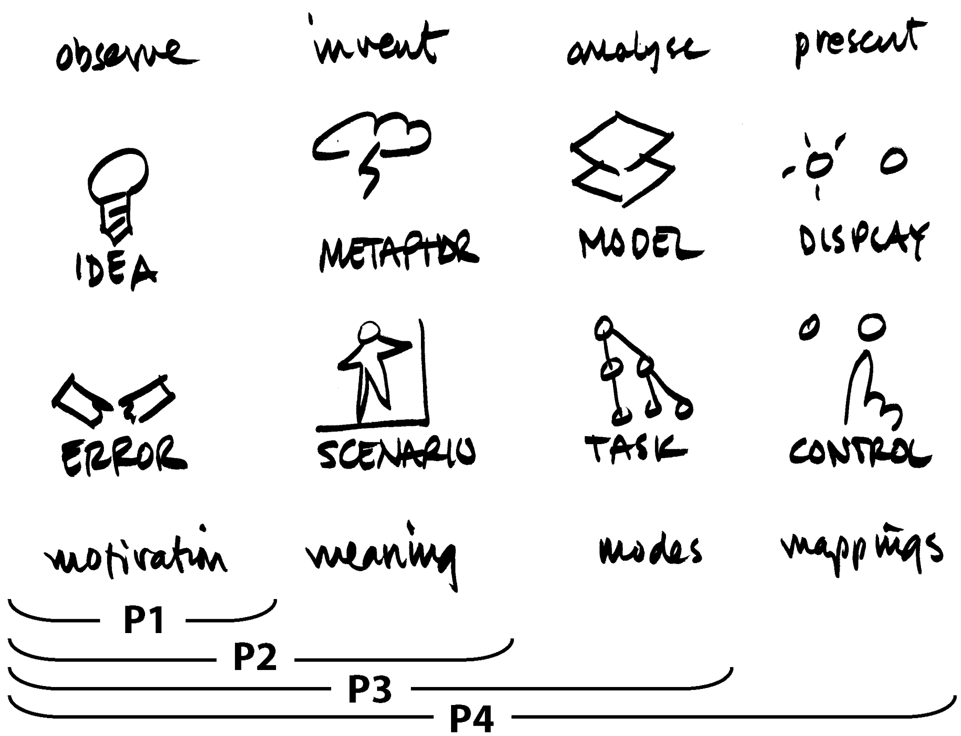

Figure 1. Verplank's four-column Interaction Design framework, and the methods used in each project.

Background

Our Human-Computer Interaction Design Studio course is the second of three in the core HCI sequence, and the course primarily responsible for teaching interaction design practice. 30 to 50 students take this course each winter; it is a mix of master's students and upper-level undergraduates. Students usually come to the course with a background in HCI theory, but with limited exposure to practice.

The course is structured around the four-column interaction design framework shown in Figure 1. Both the course and this figure attempt to convey that successful interaction designs can begin in a number of distinct ways. This framework helps to facilitate the conception, implementation and evaluation of designed interaction. Each icon in the figure represents a key concern of interaction design; each of the techniques taught in the course is a method for addressing one (or more) of these concerns.

Challenge

The primary challenge in designing the course was to translate the concepts embedded in these emerging interaction domains into realistic design projects that would hone students' skills and sensibilities. For pedagogical purposes, we wanted the projects to vary in topic, timbre, and physical scale. The projects needed to be scoped to fit the ten-week timeframe of the course. We also needed to generate criteria by which the designs would be evaluated.

The main challenge for the students was to navigate the array of observation, ideation, prototyping and implementation tools and techniques presented to arrive at a strong response to the project statements.

Solution

The course was structured through four, themed projects. Each successive project incorporated an additional column of methods from the framework, and each addressed a different aspect of embodied computing:

- *Human Error* emphasized real-world, situated observation, to understand how designs are actually used.
- *Urban Computing* directed students towards finding needs and opportunities in social situations in the urban setting of San Francisco.
- *(Nearly) Invisible Computing* targeted the design of interfaces that generally operate in the background, requiring foreground attention only occasionally.
- *The Gates* asked students to create physical experiences through the design of interactive passageways.

A. Process

The course drew its format from the studio art tradition. As such, design critiques and supervised project work play a larger role than lectures. Within the structure of the assignments, students worked on projects of their own choosing. The course places a strong emphasis on observation, reflection, and testing, and pushed students to provide rationales for design decisions that were firmly situated in the context of the design. Students were evaluated by the quality of their process, rationale, and reflection—as evidenced by the designed artifacts; by the project presentations; and by the idea logs [11] of each student (see Figure 2).

This course is one of the few places in the curriculum where students are taught *problem-finding* in addition to *problem-solving*. We teach documenting designs in idea logs [11], sketching, storyboarding, bodystorming [8], and visual design. Within each of these broad areas are a set of concrete techniques. One example is "idea boggle." All of the students first brainstorm individually; then, one by one, they announce their ideas to the class; while listening, other students cross out those of the ideas on their own list that match with ideas read out.

This year, we introduced evening tutorials as a forum for teaching applied technical knowledge. We taught Macromedia Flash, Phidgets [6], and the Motes sensor networks [4]. We believe in providing students with fluency in rapid development tools, but also wanted to distinguish the details of learning a particular tool from the broader pedagogical issues of interaction design.

A challenge that emerged is that students were accustomed to engineering grading criteria, where goals are clearly outlined and assessment is largely objective. This course differed in two ways. First, design assessment operates through dialogue and critique rather than by a formulaic checklist. Second, grades comprised rigor of process in addition to success of result. We plan to address this by increasing the amount of descriptive feedback that we provide to students.

B. Solution details

Human Error introduced need-finding and observation by asking students to create a collection of sketches of users' interaction errors [9], observed or personally experienced. The errors that students catalogued spanned interactive technologies such as computers and information appliances, and physical products, architectures, and environments. This practice of observation both sharpens our critical design eye and helps develop a point of view about the reasons for success and failure of interaction designs in actual use.

Urban Computing asked students to prototype interfaces at the confluence of social interfaces and mobile devices. [10] Student teams were tasked to observe people in large-scale ad-hoc mobile communities such as Friday Night Skate and Critical Mass in San Francisco. Students developed user personas [3], employed ethnographic techniques [1], joined in as participant-observers, and crafted low-fidelity prototypes on their way to a conceptual design for a product or service for this user set; we introduced “bodystorming” and “informance” for improvisational skits [8].

(Nearly) Invisible Computing explored implicit interactions [12]: those that are nearly always at our periphery, but at appropriate moments come to our foreground attention. Building on the prior observation and ideation skills, this project introduced careful analysis of tasks and conceptual models. Students drew on the knowledge from the tutorials to build and functioning prototypes and evaluate them with users.

In *The Gates*, inspired by “The Gates,” Christo and Jeanne-Claude’s Central Park installation [2], the assignment was to design interactive gates to be exhibited in the loft of the Center for Design Research. The emphasis in this final project was creating an interactive physical experience: crafting a functioning design, testing it before the opening, and understanding the role of presentation and performance in the success of a design.

C. Results

The first project, Human Error, was open-ended, and students focused on issues encountered in their own daily routines—dorm cafeteria juice machines that were confusing, library card scanners that require multiple swipes, bad mapping on demonstration interfaces at the local electronics market. Unless encouraged otherwise, we often observe and design for ourselves—A benefit in that we understand the user community; a drawback in that we are navel-gazing.

The concrete domain introduced in Urban Computing provoked students to design for others: guiding homeless people to shelters, preventing garbage can overflow in Chinatown, capturing the fun of skate-a-thons, keeping track of students on a class field trip. Students’ observations in San Francisco provided a shared context—they all began with the same observational "raw material.” When students presented design ideas, the shared context helped their peers better understand the successes and shortcomings. It taught the students the power of observation as a source of design inspiration, and the diversity of designs that can arise from the same observation—needs inspire designs but do not dictate them.

The third project was again open-ended, and students returned to their own worlds to create their prototypes, including cell phones that remind the owner to charge them when in a opportunistic locale, refrigerators that anticipate the lettuce going bad, and MP3 players that display to the user everyone else in the world who is listening to the same song. A majority of these prototypes were implemented using Phidgets; those that were screen-based were often implemented with Flash. While the ideas were creative and the domain inspiring, calm technologies present a tremendous challenge to evaluation. Sporadic, lightweight interactions resist evaluation in formal settings, as their real use never commands full attention. It is future work to work with students on better techniques for reasoning through the success of these ambient designs.

The final project offered an excellent capstone. The human-scale physical gates and their mechatronic interactions transcended most anything students had prior experience with. They seized the opportunity in The Gates to create their own context for the interactions, grappling with a range of associated issues such as how to explain the rules for their “prisoner’s dilemma” game, how to set up the physical parameters to demonstrate “remote door answering”, or how to create a fun but competitive ambiance for an interactive limbo game.

Our transition of a studio-based design course from GUIs to embodied interfaces was on the whole a success. Students gained skills, an appreciation, and an aesthetic for breaking out of pixels and into the physical world. They explored a range of interfaces, from the fully immersive to the peripheral. And these domains were explored in the context of design methods: observation, ideation, prototyping, and evaluating. Looking forward to next year, we have two primary areas where the staff and the students see a need for improvement. The first is to present a grading rubric that seems fair to the students and makes the assignment clear, but without being overly formulaic and inhibiting creativity. The second is working more with students on how *they* evaluate their interfaces. As we expand beyond the screen, we must also expand beyond the usability lab.

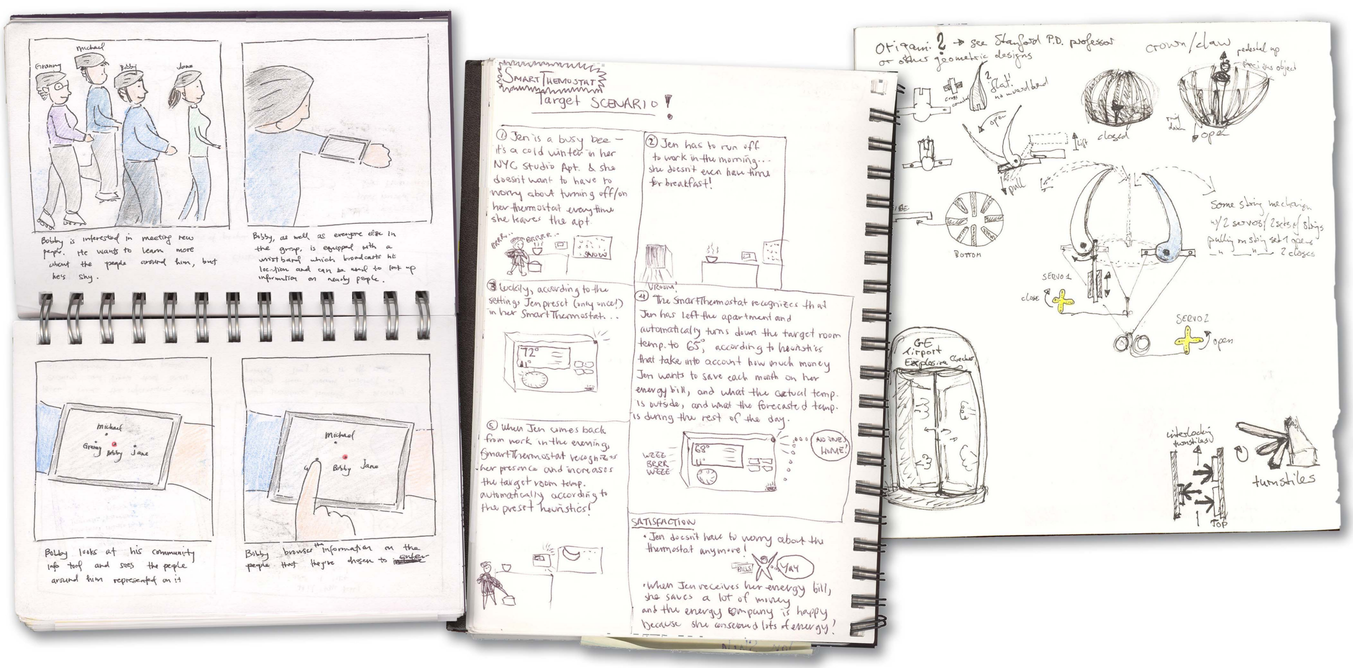

Figure 2. Idea Logs showing storyboards and mechanisms from various students.

Conclusions

This course provides insight on the concerns that this generation of interaction designers will be dealing with as their practice becomes increasingly embodied. Designers will need to be resourceful in putting themselves in the world to observe needs in an empathetic fashion, and develop field techniques for validating their observations. They will increasingly be focused guiding and capturing social communications, artifacts and experiences. The designed interactions will need to incorporate the designers understanding of the user's world and goals, as well as sensing, monitoring and tagging technology to enable proactivity. And finally, the physicality of embodied computing will make rapid prototyping skills and tools increasingly important [7], since it is important to test "in-the-world" designs by designing in the world.

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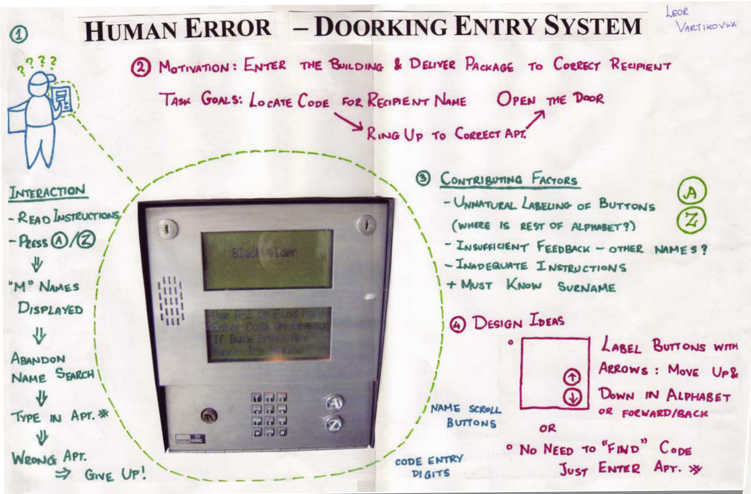
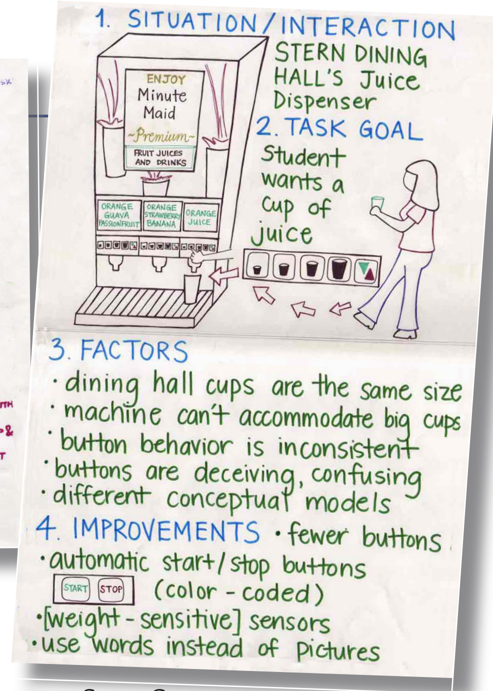


Leor Vartikovski



Susan Gov

Project 1: Human Error

Although the domains were centered around students' day-to-day life, these project posters show thoughtful analysis of the cognitive and contextual factors that influence the observed errors.

One student commented how few of the problems he observed were "computer science" problems--a great breakthrough towards design thinking.

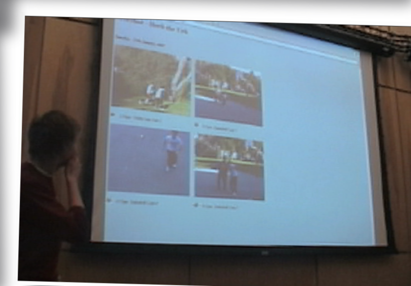
The Umlaut: Wilson Chew, Björn Hartmann, Aditya Mandayam

Project 2: Urban Computing

Students did a great job canvassing San Francisco to find a diverse set of contexts and needs. They also used enactment to understand the social and physical aspects of interaction.

On the left, a team demonstrates the difficulty of operating electronic equipment while skating. To the right, a student team targets trash reduction in China town, and other team presents a system to capture shots of sports activity.

Garbage: Brandon Burr, Clara Shih, Andy Szybalski



Freeshot: Michael Bernstein, Rombout Freiling, Leor Vartikovski

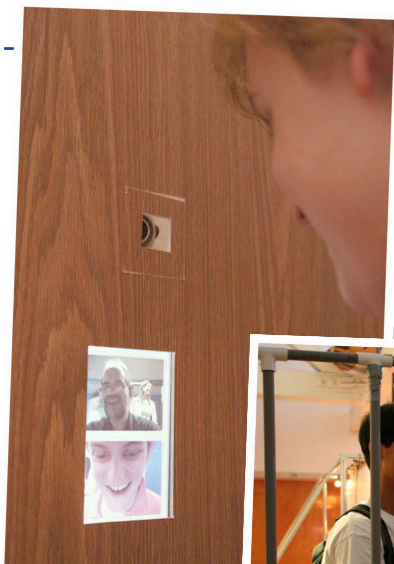
Project 3: (Nearly) Invisible Computing

The hurdle of designing for what users should and should not pay attention to was the most challenging on a conceptual and methodologial front.

Example projects included a chair that helps you maintain good posture, interfaces to remind you to take medicine, and ambient displays to show who else is listening to your song.

Slouch-aware chair: Björn Hartmann, Leor Vartikovski

World Music: Chris Chan, Greg Cuellar



Celludoor: Wilson Chew, Zhenghao Chen, Adam Kahn

Limbo-Star: Michael Bernstein, Brandon Burr, Clara Shih, Andy Szybalski

Jailbreak: Devin Carter, Nick Lovell, Luping May

Project 4: The Gates

The final project gave teams the opportunity to design the context their interfaces were used in.

Students grappled with problems like how high a camera should be mounted for a remote door answering system, what audio-visual elements might make a limbo game seem more festive, and what phsyical infrastructure might give a prisoner's dilemma game a properly clausterphobic feel. These problems highlighted the importance of design over technology in embodied interaction.