

# The iX Experience: Project-Based Learning in HCI Design

Wendy Ju and Lora Oehlberg  
Stanford Center for Design Research  
424 Panama Mall, Stanford CA 94305  
wendyju@stanford.edu, lorao@stanford.edu

## ABSTRACT

The integration of design research and human-computer interactions promises to enrich both communities with knowledge and methods of the other. Educational programs centered on this nascent relationship are as yet rare and experimental. This paper relates the case story of a team of four undergraduates engaged in a prototype project-based learning experience in human-computer interaction design.

The team, self-named “iX” for “interactive something”, was given an open-ended design project with a research-oriented goal. The team produced a map-based interface for collaborative navigation and browsing of world news. In the course of their work, they performed ethnographic studies of people interacting at tables, researched existing projects in interactive tables, designed and built a working prototype and performed experimental tests of the interface to measure its effectiveness. This project may serve as a prototype for more formalized courses of education for students of human computer interaction and design research.

## INTRODUCTION

The fields of product design and human-computer interactions research clearly have much to learn from each other, but the process of cross-fertilization is challenging for practitioners of each respective field. Academic groups can help to pioneer interdisciplinary practice in this area by cooperating to educate new groups of students, whose sense-making process can be a valuable asset in determining which processes belong in the emerging discipline. We present the case story an experimental project in which four undergraduates were given the opportunity of working on a human-computer interaction design project.

## PROJECT OVERVIEW

This case was a three-month summer project in the area of interactive interfaces. The team was given the open-ended goal of creating an interactive artifact to interrogate human-computer interactions issues. They were given access to existing technologies developed by graduate students, shared set of tools and a small budget (\$2000) to cover materials and supplies. The students were mentored by a

graduate student advisor, met occasionally with faculty members and were included in the communities of graduate human-computer interactions researchers and design researchers.

Early on, the undergraduates named their team “iX,” a playful commentary on the local trend towards affixing the letter ‘i’ before names to indicate interactivity, and ‘X’ to the end of names to indicate that something was experimental or as-yet-unknown. The students were given free reign over the design and orientation of their “interactive something,” but were naturally influenced by the on-going research in their immediate vicinity, and by the tools and technologies they were given.

The outcome of this project was the MapNews Table [3], a table-based interface with a map that allows groups of people to select international news sources. The interface consisted of a large projection screen on which English-speaking news-sites from around the world were displayed, an untethered puck that allowed users to select countries for the news-sites, and a table with a large static world map, augmented equipment to sense the location of the puck. The interface also featured a beveled display that previewed the name of the country being selected by the puck. A photo of the interface is shown in Figure 1.



Figure 1. The MapNews Table created by the iX team

## RESEARCH DESIGN PROCESS

The iX design research process came about in a fairly organic matter. Although the overarching process will be familiar to all who have worked on design projects or research projects, the specific actions taken by the team were usually guided by a plethora of advice offered by their disparate array of advisors.

### Orientation

At the outset of the project, the students were given a diffuse goal to design something interactive for the purpose of furthering HCI research. Strong emphasis was placed on scoping their work to be something that could be completed and studied during the time-frame of the project. During this initial period, the students were introduced to their graduate colleagues. They were encouraged to ask questions about ongoing research, ideas for their project, interesting technologies and unsolved problems. The students were invited to weekly research group lunches, and were pointed to everybody's favorite research papers.

The iX team was instructed create and maintain a good record of ideas, designs, references, etc. Each student kept their own individual log-book of sketches and notes, and they also created a group weblog in order to keep a public record of their ideas, actions and process.

### Developing a research focus

The team was asked in their second week to begin developing a general area to focus their efforts on a problem, an opportunity, or an observation. The students indicated that they wanted to synthesize the design research groups focus on group collaboration, and the human-computer interaction group's work on interactive rooms and furniture, and so they were interested in how people interacted with each other around tables.

The iX team then went about "performing ethnography," profiling how people interact with information and with one another when seated at tables. They surreptitiously captured people meeting throughout the college campus, at restaurants, during business meetings, and at bookstores. They analyzed books and furniture catalogs. Each student brought their disparate observations to group brainstorming sessions, and they worked together to pick out resonant ideas. They categorized the function of tables into four areas: storage, rest-and-gesture, social focus and display.

Searches online and surveys into the bibliographies of recommended papers lead to a wide array of prior work into the area of interactive tables. Amongst the favorites were installations such as Furnichat[4] or the InteractTable [8]. Also very influential were papers detailing possible technologies to use, such as the SenseTable [6]. The team members debated the merits of the different designs, which helped them sharpen their evaluation criteria and point of view into the topic of interactive tables. During this period, the iX team happened to attend a meeting where the visiting presenter was a prominent researcher who worked on

interactive tables; this visit really motivated a great deal of excited



**Figure 2. Sample photo, sketch from ethnographic study**

discussion. The team commented how amazing it was both that so much work was being done in this area, and how many interesting opportunities were still untapped.

### Developing a point of view

At this point, the team was asked to formulate a more concrete statement as to what they were planning to build and why. The team stated that they wanted to design an interactive table "with personality," something that actively engages users in a task. They also wanted something scaled to accommodate a group of three to five users who were working on some shared goal. A second round of brainstorming for a specific application for their abstract goals lead to the more concrete idea of developing a table to help groups of people surf world news sites.

### Iterative instantiation

Design occurred on multiple fronts. The iX team worked on high level design, with storyboards and narration, to work out what the user experience with their table would be. They isolated pragmatic engineering issues to figure out how to create an interface and modify existing technology to serve their goals. The team worked on formulating research questions, and designed an experiment to compare the use of this interface with the more typical use of laptops.

### Presentation

The iX team was asked to present their ongoing work in formal presentations several times throughout the summer. They presented once to the design research group, and once to the human-computer interaction group. In addition, they fielded a number of requests for impromptu demonstrations of what they were working on. This process helped the team consolidate their thoughts on what they were doing. This emphasis on external validation was followed up with encourage to submit publications to relevant conferences. The students also set up a website about their project of their own accord.

## Testing

The MapNews Table had several features that were designed to support collaboration: a large interface, a set-up that encouraged users to stand in a position with shared orientation and perspective, a “pass-able” puck which allowed sharing of interface control. To test the effectiveness of their design decisions, the iX team designed and ran a study comparing the use of the MapNews Table to laptops for groups of three people tasked with various news activities. In running the experiment on nine groups of three people, team members were exposed to experiment design, questionnaire design, participant recruitment and data analysis.

## DISCUSSION

The iX project was a prototype of how work in the field of human-computer interaction design might be pursued on a larger scale. Although the MapNews table is a worthy product concept, the students in the iX team are far more impressive products of the summer project; any member of the team can tell you where to obtain Plexiglas for building with, the ins and outs of learning Java on the fly, the trade-offs between static and dynamic displays for input, or the best places to find research papers. Ultimately, it is the experience of working on the project that is of most value. [5] The project process incorporated considerations of how groups work together which are a product of design research [1] and understanding of how people interact with technologies [7]. Looking forward, it is important to consider several issues that may affect future projects in this vein.

## Teamwork

During the course of the summer project, one of the iX team members defected from the main project to work on pen-input devices for large-screen displays. The late date of this switch affected this individual’s ability to successfully prototype and test her design in the time allotted.

People working in teams often feel that they might get more work done if they did everything themselves. The challenges of working on teams makes it easy to overlook the benefits of having multiple viewpoints and multiple people to get tasks done. In the future, more consideration into personality issues will be considered in assembling teams, and more emphasis will be placed on the benefits of and strategies for working together.

## Coaching

One key feature of the iX team’s information resources is that they were able to get *situational* knowledge *on-demand*. This distinguishes the “coaching” that they received from teaching, wherein students receive general knowledge in advance. The plurality of viewpoints helped the team develop an idea of what they could and should do despite the lack of pre-established direction. The team returned the favor by helping faculty and graduate students form clear explanations of their work, by asking tough

questions, and by serving as a conduit between researchers with different perspectives. [2]

Coaching could be difficult to scale to a wider group of students, but technologies such as e-mail and weblogs may also help make advising numerous teams more practical. It is also possible that having a larger community of peers working on similar projects might also serve this function.

## Open-ended vs. closed-ended problems

The hardest part of the MapNews table project was the long process of finding a problem worth working on. This is a challenge and opportunity that not many students get. Closed-ended problems, where the desired solution is proscribed at the outset of the project, take less time and are easier to evaluate. However, they are also less rewarding, because learning to define a problem for yourself is an important experience for researchers and innovators to have.

## CONCLUSION

At its heart, the iX experience was about having those with a fresh and unbiased perspective taken on the challenge of merging the disciplines of human-computer interactions and design research. This case story shows aspects of each discipline in the resulting design and research process. It is our hope that the lessons gleaned from this project might influence this emerging field in the years to come.

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