The "Prototype Walkthrough": A Studio-Based Learning Activity for the Next Generation of HCI Education

Christopher Hundhausen

Visualization and End User Programming Lab

School of Electrical Engineering and Computer Science

Washington State University

Pullman, WA 99164-2752

hundhaus@wsu.edu

Dana Fairbrother

College of Education

Washington State University

Pullman, WA 99164, USA

danafairbrother@wsu.edu

Marian Petre

Faculty of Mathematics & Computing

The Open University

Walton Hall, Milton Keynes

MK7 6AA, UK

m.petre@open.ac.uk

Abstract

For over a century, *studio-based* instruction has served as an effective pedagogical model in architecture and fine arts education. Because of its design orientation, human-computer interaction (HCI) education is an excellent candidate for studio-based instruction. In an undergraduate HCI course, we have been exploring a studio-based learning activity called the *prototype walkthrough*, in which a student project group simulates its evolving user interface prototype while a student audience member acts as a test user. The audience is encouraged to ask questions and provide feedback. We have observed that prototype walkthroughs create ideal conditions for learning about design. In order to better understand the educational value of the activity and how best to support it technologically, we are performing a content analysis of a video corpus of prototype walkthroughs supported by two alternative forms of prototyping technology: simple art supplies and a computer-based low fidelity prototyping tool.

Keywords
Studio-based instruction, design crits, prototype walkthroughs, user interface prototyping, content analysis

ACM Classification Keywords
K.3.2 [Computer and Information Science Education]: Computer science education; H.5.2 [User Interfaces]: Prototyping, Evaluation/methodology.

General Terms
Design, experimentation, human factors

Introduction
For over a century, studio-based instruction has served as an effective pedagogical model in architecture and fine arts education. In this model, students iteratively develop solutions to a series of design problems. Each iteration culminates in a "design crit" (design critique) in which students present their evolving solutions to their peers and instructors for feedback and discussion.

User interface design is a central skill taught in an undergraduate computer science course on human-computer interaction (HCI). In such a course, students often undertake a capstone design project that takes them through all phases of the user-centered design process, including initial data gathering, user interface prototyping, and usability testing. Because of its focus on design, an undergraduate HCI course has been identified as an excellent candidate for studio-based instruction [4,6].

Within the context of a multi-institutional research project in which we are adapting and refining the studio-based instructional model for computing education [2], we have been exploring a new kind of studio-based learning activity—the *prototype walkthrough*—in our undergraduate HCI course at Washington State University. In preparation for prototype walkthroughs, student capstone project teams develop low fidelity user interface prototypes of their evolving project designs, and a set of five core tasks to be completed with their prototypes. In prototype walkthrough sessions lasting approximately 20 minutes each, project teams simulate their low fidelity prototypes on a large projected screen in front of the class. A student from the audience serves as the test user by interacting with the prototype, and thinking aloud in the process. At any point, the audience can jump in with questions, comments, or feedback. After the five tasks have been completed, the instructor invites the class to engage in a reflective design discussion intended to help the project team improve its design.

In this paper, we argue that the prototype walkthrough should play a prominent role in the next generation of HCI education. Drawing on relevant literature, we begin by motivating the activity's pedagogical value for HCI education. We then describe an empirical study that we are conducting to explore key research questions surrounding prototype walkthroughs as a pedagogical activity in HCI education. We conclude by providing a status report on the study, and future work to be completed.

Why Prototype Walkthroughs?
A form of "design crit" in the studio-based instructional model, prototype walkthroughs engage students in discussions about their user interface designs and how to improve them. Kehoe [4] calls this kind of discussion

critical design dialog, and points out that it differs from other forms of learning discussions in that it is directed toward critiquing students' work in a public forum, with the dual-aim of (a) influencing the trajectory of the work, and (b) providing opportunities for students to learn from each other's design work and feedback.

Kehoe [4] (see also [6]) makes a strong case for the educational value of critical design dialog as a means of learning about HCI design. In brief, Kehoe argues that the kinds of design problems that are common in HCI are fuzzy and have no clear-cut solutions. Design principles and heuristics that might guide one to solutions are necessarily vague, and learners often find them unclear and overly ambiguous [7]. Students can therefore best develop design expertise when they (a) receive feedback on their own designs that is also connected to more general design principles and heuristics, and (b) observe how experts think about design. Critical design dialog provides ideal conditions for both of these.

In addition to Kehoe's arguments in favor of critical design dialog as a valuable HCI learning activity, we see a secondary learning benefit—one that makes it especially appropriate for the next generation of HCI education: Critical design dialog engages students in the acts of communication, critical thinking, and collaboration. Thus, it can help prepare students for future careers in the software industry, which increasingly covets these so-called "soft" skills.

Empirical Study

The use of prototype walkthroughs in an HCI course raises key research questions concerning not only the conversations and learning outcomes they promote, but also the ways in which they can be best supported. Along these lines, we are particularly interested in the following five questions:

RQ1. *What is the focus of conversation in prototype walkthroughs?*

RQ2. *How do participants in the prototype walkthroughs justify, defend, and refute design ideas?*

RQ3. *Do students actually make positive changes to their designs based on the prototype walkthroughs?*

RQ4. *How do "low tech" tools (art supplies) and "high tech" tools (prototyping software) compare with respect to their ability to mediate critical design dialog?*

RQ5. *How can experts (instructors) best stimulate good critical design dialog?*

In order to address these questions, we conducted an empirical study in conjunction with the spring 2007 and spring 2008 offerings of CptS 443 ("Human-Computer Interaction"), the undergraduate HCI course at Washington State University. In both offerings of the course, students were required to complete a capstone user interface design project in groups of two to three. Student groups could choose the focus of their projects, or they could take on a project suggested by the instructor.

During the tenth week of the 15-week semester, student groups presented prototypes of their evolving designs to the class within prototype walkthrough sessions scheduled during the regular course lecture periods. In the 2007 offering of the course, student groups constructed their prototypes out of simple art

supplies (pen, paper, transparencies), whereas in the 2008 offering of the course, students constructed their prototypes using WOZ Pro [3], a computer-based low fidelity prototyping tool we have been developing specifically for this purpose.

We videotaped all prototype walkthroughs in the 2007 (n = 7 project groups) and 2008 (n = 9 project groups) offerings of the course, resulting in a video corpus of nearly five hours. In order to address RQ1, we are undertaking a detailed content analysis [5] of the prototype walkthrough discussions. We have iteratively developed a sophisticated content coding scheme with nine top-level categories, and codified it in a detailed 30-page coding manual [1]. To get at RQ2, our coding scheme includes twelve subcategories of *Design Justification*.

In order to get at those research questions that consider the goodness of critical design dialog (RQ4 and RQ5), we are flagging conversational exchanges that seem educationally productive, and examining them in greater detail qualitatively. In order to determine whether students actually change their designs based on the discussions in the prototype walkthroughs (RQ3), we are comparing project groups' prototype designs against the final designs they handed in.

Status and Future Work

Over the past year, two of us independently coded a 20 percent sample of the video corpus, attaining a level of agreement of 84 percent (0.82 kappa). Having reached a sufficiently high level of agreement, we are now coding the remaining videos. As of this writing, the video coding is nearly complete. In the coming months, we are planning to perform a preliminary quantitative

and qualitative content analysis. We anticipate that we will be able to present our preliminary results at the workshop.

References
1. Hundhausen, C., Fairbrother, D., and Petre, M. Studying Prototype Walkthroughs in a Human-Computer Interaction Course: Video Analysis Manual (ver. 20). 2009. http://eecs.wsu.edu/~veupl/pub/Prototype-Walkthrough-Analysis-Manual-v20.doc.
2. Hundhausen, C., Narayanan, N., and Crosby, M. Exploring studio-based instructional models for computing education. In *Proc. 39th SIGCSE Technical Symposium on Computer Science Education*. ACM Press, New York, 2008, 392-396.
3. Hundhausen, C., Trent, S., Balkar, A., and Nuur, M. The design and experimental evaluation of a tool to support the construction and wizard-of-oz testing of low fidelity prototypes. In *Proc. 2008 IEEE Symposium on Visual Languages and Human-Centric Computing*. IEEE, Piscataway, NJ, 2008, 86-90.
4. Kehoe, C. Supporting critical design dialog. 2001, 293.
5. Krippendorff, K. *Content analysis: an introduction to its methodology*. Sage Publications, Beverly Hills, 1980.
6. Reimer, Y. and Douglas, S. Teaching HCI design with the studio approach. *Computer Science Education 13*, 3 (2003), 191-205.
7. Schon, D. *Educating the reflective practitioner*. Jossey-Bass Publishers, San Francisco, 1987.