End User Software Engineering: CHI'2008 Special Interest Group Meeting

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Abstract
End users create software whenever they write, for instance, educational simulations, spreadsheets, or dynamic e-business web applications. Researchers are working to bring the benefits of rigorous software engineering methodologies to these end users to try to make their software more reliable. Unfortunately, errors are pervasive in end-user software, and the resulting impact is sometimes enormous. This special interest group meeting has two purposes: to incorporate attendees' ideas and feedback into an emerging survey of the state of this interesting new sub-area, and generally to bring together the community of researchers who are addressing this topic, with the companies that are creating end-user programming tools.

Keywords
End-User Software Engineering (EUSE), End Users Shaping Effective Software (EUSES), Natural Programming, Empirical Studies of Programmers (ESP), Psychology of Programming

ACM Classification Keywords
D.2.5 Testing and Debugging; H.1.2 User/Machine Systems—Software psychology

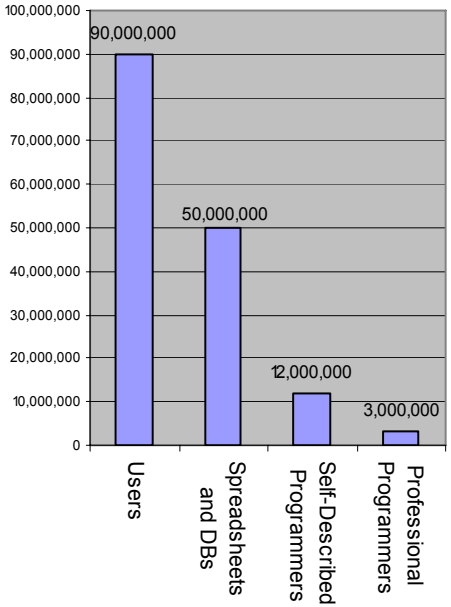

Figure 1: Estimates for the number of people in the US in 2006 who use computers at work, who use spreadsheets at work, who describe themselves as programmers, and who say they are professional programmers [20].

Introduction

One way to define "programming" is as the process of transforming a mental plan of desired actions for a computer into a representation that can be understood by the computer [9]. Expressed this way, it seems obvious that the study of humans and programming should be a topic of HCI. Indeed, this area of study has a long history, and has appeared under many names, including "Software Psychology" [21], "Psychology of Programming" [6, 8] and "Empirical Studies of Programming" (ESP).

We define "end-user programmers" (EUP) as people who write programs, but *not* as their primary job function — they write programs in support of achieving their main goal, which is something else, such as accounting, designing a web page, doing office work, scientific research, entertainment, etc. End-user programmers generally use special-purpose languages such as spreadsheet languages or web authoring scripts, but some EUPs, such as chemists or other scientists, may learn to use "regular" programming languages such as C or Java to achieve their programming goals.

Two NSF workshops determined that end-user software is in need of serious attention [3]. The reasons are compelling. Our research shows that while there are about 3 million professional programmers in the United States, over 12 million people say they do programming at work, and over 12 million people use spreadsheets and databases, and thus may also be considered to be doing programming [20] (see Figure 1). The NSF reports that there are about 6 million scientists and engineers in the US, most of whom program as part of their jobs [16]. Unfortunately, however, errors are pervasive in software created by end users. When the software that end users create is not dependable, there can be serious consequences for the people whose retirement funds, credit histories, e-business revenues, and even health and safety rely on decisions made based on that software. For example, a Texas oil firm lost millions of dollars in an acquisition deal through spreadsheet errors [19].

Two recent large collaborative efforts, one in the U. S. (the EUSES Consortium http://eusesconsortium.org/), and one in Europe (the Network of Excellence on End-User Development, http://giove.cnuce.cnr.it/eud-net.htm) have produced a number of promising results in this area (see, e.g., [24]). Special Interest Group meetings at CHI'2004 [13], CHI'2005 [14], and CHI'2007 [15], and the WEUSE series of workshops at ICSE'2005 [7], CHI'2006 [5], and upcoming at ICSE'2008, very successfully brought together researchers and companies interested in this topic. In addition, a Dagstuhl meeting was held in February, 2007, at which about 50 researchers in the areas of HCI, programming languages, and software engineering spent a week studying the state of the art in this area (see www.dagstuhl.de/07081).

The special interest group (SIG) meeting at CHI'08 is designed to bring this community back together, as well as to introduce the area to others who are interested in allowing users to create more correct software. The meeting will solicit attendees' inputs and feedback on an emerging survey that aims to capture the current state of this active new sub-area. We especially want to involve practitioners interested in current and future techniques that can be embodied in tools and development processes.

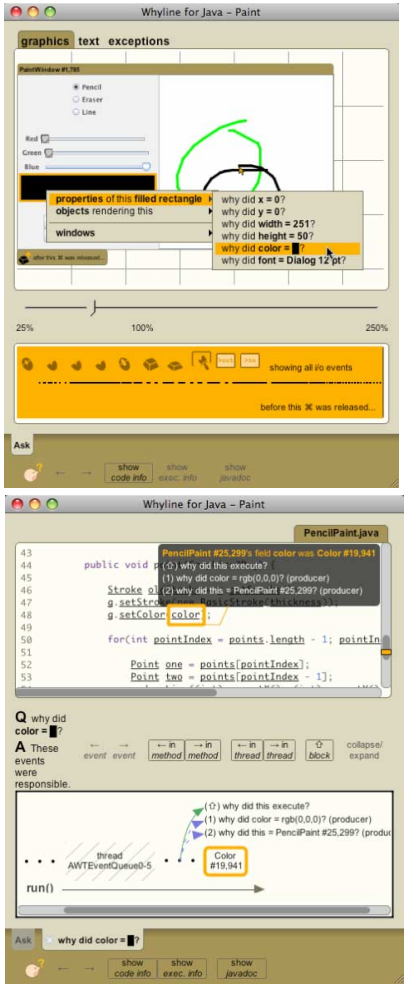

Figure 2: The Whyline for Java [10], showing a user asking about a black rectangle that was supposed to be blue (top), and the answer visualization (bottom).

Examples of Current Work

A few End-User Software Engineering (EUSE) projects, some of which have been presented at CHI, are already successful. Here are just a few examples.

The "Natural Programming" project at Carnegie Mellon University has been working for more than 10 years to make programming more "natural", or closer to the way people think. Many studies were performed (e.g., [11, 12, 17]), and new programming languages [18] and environments were created. For example, Figure 2 shows a new technique for debugging which lets users ask about program output [10].

The "End-User Software Engineering" project at Oregon State University aims to improve the reliability of software produced by end-user programmers in general, and by spreadsheet users in particular. Some results have included "What You See Is What You Test" (WYSIWYT) integrated with fault localization (Figure 3) [4], semi-automated detection of erroneous combinations of units in spreadsheets (Figure 4) [1], and new methods for involving end users in the "debugging" of machine-learned programs [22]. The work emphasizes research on how to engage users in end-user software engineering practices without detrimentally interrupting their problem-solving efforts.

The Gender HCI Project [2], a collaboration of Oregon State University and Drexel University, has the goal to support both males' and females' problem solving, especially in end-user software development tasks. Our results show that females are less willing than males to try out and adopt software features that support testing and dataflow-oriented debugging, and further that male and female end-user programmers use different strategies when debugging [23].

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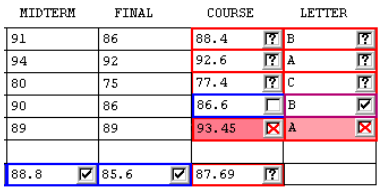

Figure 3: WYSIWYT supports systematic testing for end users, to help the user test and debug the formulas and values [4].

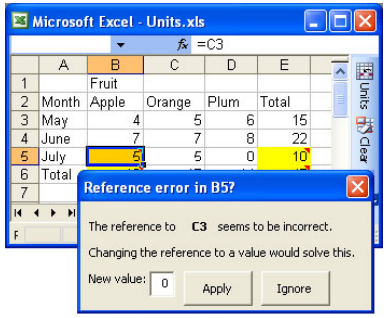

Figure 4: Microsoft Excel spreadsheet augmented by the Ucheck system that tries to help the user find errors [1].

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