End User Software Engineering:
CHI 2010 Special Interest Group Meeting

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Abstract

End users create software whenever they create, for instance, interactive web pages, games, educational simulations, or spreadsheets. 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 will bring together the community of researchers who are addressing this topic with the companies that are creating and using end-user programming tools.

Keywords

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

ACM Classification Keywords

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

General Terms: Design, Documentation, Human Factors, Languages, Performance, Reliability.

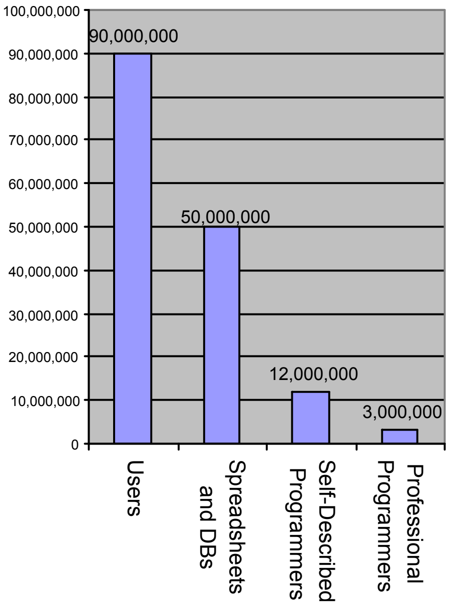


Figure 1: Estimates for the number of people in the US in 2006 who used computers at work, who used spreadsheets at work, who would describe themselves as programmers, and who would say they are professional programmers [25].

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 [13]. 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" [27], "Psychology of Programming" [9, 12] 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 web pages, 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 [5]. 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 [25] (see Figure 1). 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 [23]. Beyond correctness, end-user programs often lack other hallmark qualities of software, including good performance, scalability, reusability, and interoperability.

Two 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., [17]). Special Interest Group meetings at CHI'2004, CHI'2005, CHI'2007, CHI'2008, and CHI'2009. and the WEUSE series of workshops at ICSE'2005 [10], CHI'2006 [7], Dagstuhl 2007 (see www.dagstuhl.de/07081) ICSE'2008 [2], and ICSE'2009 [3] very successfully brought together researchers and companies interested in this topic.

The special interest group (SIG) meeting at CHI'10 is designed to bring this community back together, as well as to introduce the area to other researchers and companies who are interested in allowing users to create higher-quality programs.

Examples of Current Work

End-User Software Engineering (EUSE) research has been gaining momentum and a number of EUSE projects have been presented at CHI. 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

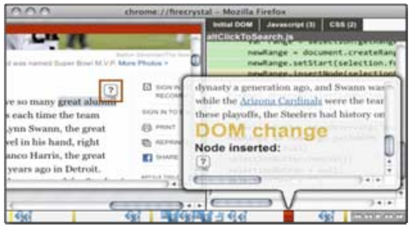
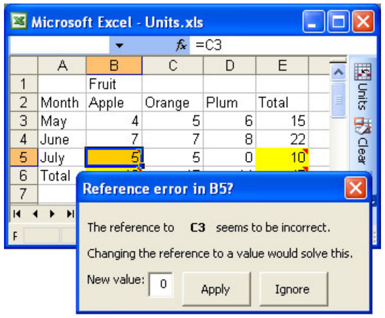

chrome://firecrystal – Mozilla Firefox
Initial DOM
Javascript (3)
CSS (2)
altClickToSearch.js
newRange = document.createRang
newRange.setStart(selection.f
DOM change
Node inserted:

Figure 2: FireCrystal [19] records user events and DOM changes so it can help users understand which HTML and JavaScript code is responsible for elements and behaviors on a web page.



	A	B	C	D	E
1		Fruit			
2	Month	Apple	Orange	Plum	Total
3	May	4	5	6	15
4	June	7	7	8	22
5	July	5	5	0	10
6	Total				
7					

Reference error in B5?

The reference to C3 seems to be incorrect.

Changing the reference to a value would solve this.

New value: 0 Apply Ignore

Figure 3: Microsoft Excel spreadsheet augmented by the Ucheck system, which tries to help the user find errors [1].

way people think. Many studies were performed (e.g., [14, 18, 20, 21]), and new programming languages [22] and tools [15, 28] were created. For example, Figure 2 shows a "Why"-oriented technique for helping users understand how web pages are authored [19].

The "End-User Software Engineering" project involving researchers at Oregon State University and University of Washington aims to improve the reliability of software produced by end-user programmers. Some results have included "What You See Is What You Test" (WYSIWYT) integrated with fault localization [6], semi-automated detection of erroneous combinations of units in spreadsheets (Figure 3) [1], new type systems for end-user code (Figure 4) [26], and new methods for involving end users in the "debugging" of machine-learned programs (Figure 5) [16]. 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 [4], 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 [29]. We have recently developed a debugging tool that centers on strategies rather than individual tactics [11]. Current work also focuses on support for males and females in designing and reusing applications, for example, design of mashups and reuse of artifacts in web design [8]. Related work at Penn State has been exploring the impacts of up-front design planning in end-user programming, using simple representations like concept maps [24].

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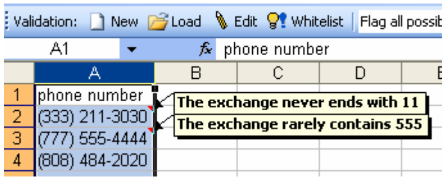

phone number

A
phone number
(333) 211-3030
(777) 555-4444
(808) 484-2020

The exchange never ends with 11

The exchange rarely contains 555

Figure 4: Topes allows end users to identify questionable values in Excel spreadsheets [26].

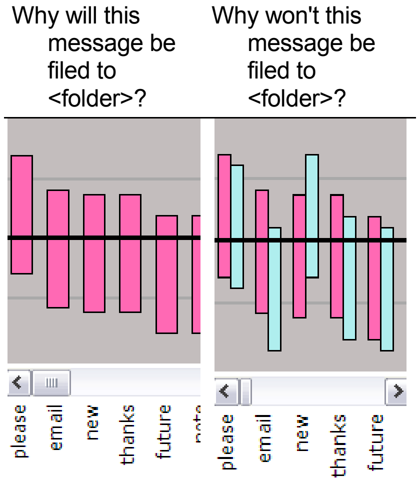
Why will this message be filed to <folder>?
Why won't this message be filed to <folder>?
please
email
new
thanks
future
please
email
new
thanks
future

Figure 5: WhyLine approach for debugging machine-learned programs [16].

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