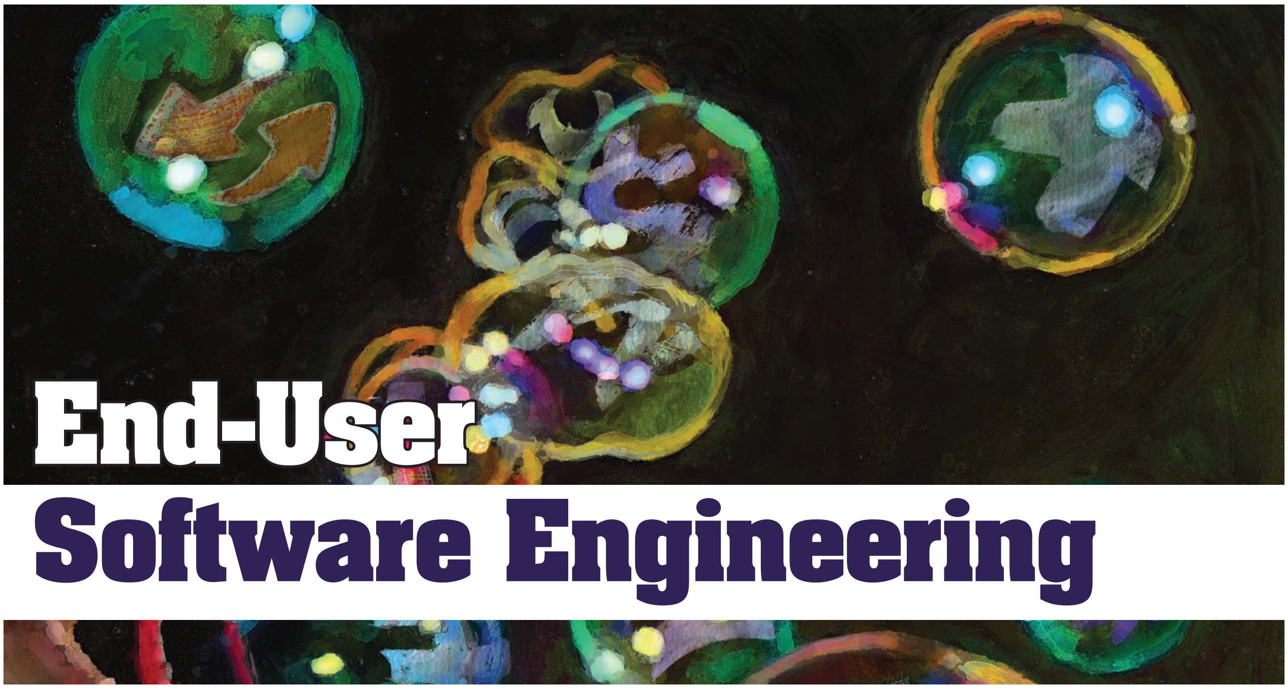

End-User Software Engineering

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Languages and tools such as Excel, Visual Basic, Alice, CoScripter, Matlab, and JavaScript have brought programming to the masses. In fact, the number of people using spreadsheets or databases at work in the US is expected to reach 55 million by 2012.[1] Even today, the landscape of end-user programming tools is incredibly diverse. People use ActionScript to create interactive Web content, and Matlab and the R language to reinvent finance and science applications. These tools' users now number in the tens of millions, if not more. In all these cases, people are creating their own software solutions to redefine their work.

However, because many end-user programmers lack training in software engineering practices such as testing and revision control, their programs often have costly errors. For example, in 2005, a number from an old version of a spreadsheet was accidentally sent to the US Federal Energy Regulation Commission, causing it to unnecessarily raise consumer natural gas prices by as much as $1 billion (see www.eusprig.org/stories.htm, example 72). In other cases, Web site or database query errors can prevent small businesses from attracting customers or lead to embarrassment and loss of customer trust.

The traditional remedy for such software problems is to apply well-known software engineering practices to the design and maintenance of these software solutions. But how can this be done, given that end-user programmers rarely have training in such practices and rarely have the time (or desire) to acquire it?

In This Issue

Here we present articles, an interview, and a Point-Counterpoint discussion that begin to answer this question, as part of an area called *end-user software engineering.* This content comes from several perspectives. For example, in "Opportunistic Programming: Writing Code to Prototype, Ideate, and Discover," Joel Brandt and his colleagues show that when code is a means to an end (rather than a deliverable), opportunism is often quite rational. They highlight the unique challenges that arise in debugging, reuse, and version control for populations whose view of programming is often based on a short-term, opportunistic mindset.

Two articles represent contrasting responses to this opportunism. In "Software Engineering for Spreadsheets," Martin Erwig embraces the opportunism, describing a pair of type-checking and debugging systems for spreadsheets that work with users' opportunistic habits, instead of against them. The systems he describes exploit patterns in the underlying structure of spreadsheets and spreadsheet formulas to automatically detect type errors and recommend changes.

In contrast, in "Test-Driven Development for Spreadsheet Risk Management," Kevin McDaid and Alan Rust describe how to train users in test-driven development. They find that asking users to learn even a small amount of software engineering discipline goes a long way in improving dependability and software quality. In the Point-Counterpoint department, Janice Singer and Mark Vigder debate this issue with Judith Segal and Steven Clarke, exploring whether tools should be adapted to users or users should learn more-rigorous principles.

The other articles step back from these issues, considering the larger problem of empowering the masses to create real, robust software solutions. For example, in "Metadesign: Guidelines for Supporting Domain Experts in Software Development," Gerhard Fischer and his colleagues argue that what makes software design difficult these days is the scarcity of domain expertise. They claim that the only way to truly design software for the myriad of domains is to empower domain experts to create their own solutions. Their viewpoint has several implications for the software that professional developers create. For example, they propose that systems must be "underdesigned" to support "hackability" and "remixability," making it easier for domain experts to appropriate and adapt software for their needs.

Christian Dörner and his colleagues provide an example of this approach for the domain of enterprise resource planning (ERP) systems. In "End Users at the Bazaar: Designing Next-Generation Enterprise Resource Planning Systems," they analyze the limitations of monolithic ERP systems supported by SAP and Oracle's service-oriented architectures. They describe a new tool that lets users stitch together services to support their unique business needs.

We also offer an interview with Tessa Lau, who discusses CoScripter, which empowers Web users to automate repetitive Web actions and share their scripts. She discusses the challenges of supporting script reuse and reflects on the hackability of Web sites today and in the future.

This diverse collection of articles reveals not only that the masses need more helpful, lightweight tools to catch bugs but also that the software industry itself must adapt to these shifting demands to truly serve user needs. If any of these topics pique your interest, we encourage you to dive deeper into the 10 years of R&D during which the end-user software engineering field has emerged (a useful collection of resources is at http://eusesconsortium.org), and stay tuned for its future.

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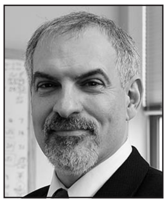
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Reference

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