Assignment Statement + References = Disaster

Bruce W. Weide
The Ohio State University

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B29 Atanasoff Hall

One of the most important properties a good software engineer seeks is the ability to reason modularly (a.k.a. "compositionally") about software system behavior. If this property holds then summary information about the behavior of a concrete component -- i.e., its abstract behavioral specification, as opposed to its implementation code -- can be used to predict how the component will behave when it is composed with other components into a larger unit. Software that does not have the modular reasoning property is inherently difficult to understand, to reverse engineer, and to change.

It turns out that the good old assignment statement and the explicit use of object references ("reference variables", "reference semantics"), which underpin virtually all imperative and especially object-oriented programming today, conspire to defeat modular reasoning. Many others have noticed that this is a problem. But the two standard suggestions to restore modular reasoning seem unacceptable from the software engineering standpoint: (1) move from an imperative/object-oriented style to a pure functional style of design and programming, or (2) further complicate the imperative/OO programming model with various twists that limit (but do not eliminate) references. We will show how to keep software engineers firmly within an imperative/OO paradigm without giving up modular reasoning, while making surprisingly minor changes in the discipline by which we normally design and implement software components.

Bruce W. Weide is Professor of Computer and Information Science at The Ohio State University, where he co-directs the Reusable Software Research Group with Tim Long, Bill Ogden, and Stu Zweben. His research interests include all aspects of software component engineering, especially in applying RSRG work to practice and in teaching its principles to beginning CS students. Weide holds a Ph.D. in Computer Science from Carnegie Mellon University and a B.S.E.E. from the University of Toledo. He is a member of the IEEE, ACM, and CPSR. Address: Department of Computer and Information Science, The Ohio State University, Columbus, Ohio 43210, USA; +1-614-292-1517; weide.1@osu.edu; http://www.cis.osu-state.edu/~weide.