

UNIVERSITY OF CALIFORNIA,  
IRVINE

Cognitive Support Features for Software Development Tools

DISSERTATION

submitted in partial satisfaction of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in Information and Computer Science

by

Jason Elliot Robbins

Dissertation Committee:  
Professor David F. Redmiles, Chair  
Professor Debra J. Richardson  
Professor David S. Rosenblum

1999



The dissertation of Jason Elliot Robbins is approved  
and is acceptable in quality and form  
for publication on microfilm:

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Committee Chair

University of California, Irvine  
1999

## DEDICATION

To  
my loving wife Sua-Yu  
and my family  
for their love and support

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## **CURRICULUM VITAE**

Jason Elliot Robbins

- 1988-91, 1994-97      Summer Student, and Flex-Force Engineer  
Rockwell International Science Center, Thousand Oaks, CA
- 1992                      B.S. in Computer Science, Cum Laude  
University of California, Los Angeles  
Major GPA: 3.9
- 1993                      Senior Coder, CoBase Reseach Group  
University of California, Los Angeles  
Computer Science Dept.
- 1994 - 95                Teaching Assistant  
ICS 52 - Systematic Software Construction  
ICS 125 - Project in System Design  
ICS 141 - Compilers and Interpreters  
University of California, Irvine  
Dept. Information and Computer Science
- 1995                      M.S. in Information and Computer Science  
University of California, Irvine  
Major Emphasis: Software  
Cumulative GPA: 4.00
- 1995 - present         Graduate Student Researcher, Software Research Group  
University of California, Irvine  
Dept. Information and Computer Science
- 1999                      Ph.D. in Information and Computer Science  
University of California, Irvine  
Software Research Group  
Dissertation: "Cognitive Support Features for Software  
Development Tools"  
Advisor: Dr. David F. Redmiles

## PUBLICATIONS

### Journal Publications

**A Component- and Message-Based Architectural Style for GUI Software.** Richard N. Taylor, Nenad Medvidovic, Kenneth M. Anderson, E. James Whitehead, Jr., Jason E. Robbins, Kari A. Nies, Peyman Oreizy, and Deborah L. Dubrow. *IEEE Transactions on Software Engineering*. vol. 22. no. 6. June 1996. pp. 390-406. A significant revision and extension of the ICSE'95 paper.

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Jason E. Robbins, Nenad Medvidovic, David F. Redmiles, David S. Rosenblum. August 1997. Technical Report UCI-ICS-97-35.

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Taylor and D. F. Redmiles). Submitted to the Defense Advanced Research Projects Agency (DARPA). Funded with a three-year budget of \$2,606,666. October, 1996.

**PROFESSIONAL ASSOCIATIONS**



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Thomas J. Watson Memorial Scholar  
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UCLA School of Engineering Dean's Honor List  
UCLA School of Engineering Dean's Circle  
MICRO Fellowship

## **ABSTRACT OF THE DISSERTATION**

Cognitive Support Features for Software Development Tools

By

Jason Elliot Robbins

Doctor of Philosophy in Information and Computer Science

University of California, Irvine, 1999

Professor David F. Redmiles, Chair

Software design is a cognitively challenging task. Most software design tools provide support for editing, viewing, storing, sharing, and transforming designs, but lack support for the essential and difficult cognitive tasks facing designers. These cognitive tasks include decision making, decision ordering, and task-specific design understanding. To date, software design tools have not included features that specifically address key cognitive needs of designers, in part, because there has been no practical method for developing and evaluating these features.

This dissertation contributes a practical description of several cognitive theories relevant to software design, a method for devising cognitive support features based on these theories, a basket of cognitive support features that are demonstrated in the context of a usable software design tool called Argo/UML, and a reusable infrastructure for building similar features into other design tools. Argo/UML is an object-oriented design tool that includes several novel features that address the identified cognitive needs of software designers. Each feature is explained with respect to the cognitive theories that inspired it and the set of features is evaluated with a combination of heuristic and empirical techniques.