

CHI + GI
1987

CONFERENCE
PROCEEDINGS

SPECIAL ISSUE OF THE SIGCHI BULLETIN

EDITED BY JOHN M. CARROLL
AND PETER P. TANNER

HUMAN FACTORS IN
COMPUTING SYSTEMS
AND
GRAPHICS INTERFACE

APRIL 5-9, 1987
TORONTO, CANADA

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WELCOME TO CHI+GI'87

We took this conference on with a very definite mission in mind. Our experience over the past several years has convinced us of the powerful benefits that can result by bringing together work in human-computer interaction and in computer graphics. While this is not an original concept, being able to organize a joint conference with CMCCS and SIGCHI has provided a unique and important forum from which to give this view a voice. The articles in the proceedings and the multitude of conference events have convinced us more than ever that this motivating idea was a good one.

This conference is clearly different from previous conferences of either of the parent organizations. Besides being a joint conference, it is the first time that SIGCHI has held a conference outside of the USA. Clearly, no initiative of this magnitude occurs in a vacuum. Perhaps the biggest shock for us as co-chairs was discovering in December 1986 that we already had over 100 people actively working on our various committees, many of them people whom we have still never met. It is a tribute to the field and to the people working in it that there is so much support and energy willing to help in making such an event happen. In the final analysis, that is the ultimate "human factor", and the one that has made everything worthwhile to us, personally. From all those who attend this conference or read the proceedings, to all those who worked on CHI+GI'87, a heartfelt "Thank You".



Ronald Baecker

William Buxton
Conference Co-Chairs

THE CHI + GI '87 PROGRAM

New computer systems were once engineered just to store internally and retrieve more information in less time than their progenitors. Faster and larger storage capacities and more powerful CPU's were the end objectives in computer design. This enterprise has been so successful that it is now possible to package overwhelming computational power in a desktop workstation. But too often it is the user who is overwhelmed!

Today, internal performance considerations are largely eclipsed by the requirement to engineer systems to present and accept information for human users: to provide simple and direct command dialogues, rich and informative displays. Computer design must now focus on external performance considerations, performance as measured by the utility, ease and enjoyability of a human-computer interaction. Overwhelming computational power is no longer an appropriate end objective in computer design, but it can be a means to the real end of providing satisfying experiences for people.

How do we get there?

This year's conference is a joint undertaking of two annual conferences - CHI'87 (Human Factors in Computing Systems), and GI'87 (Graphics Interface). The CHI conferences have traditionally been concerned with many areas affecting human-computer interaction, including diverse aspects of computer graphics. Graphics Interface is a computer graphics conference with a tradition of concern for human-computer interaction and user interface design. The synergy of this pairing, especially evident in the papers on user interface management systems and graphics interfaces for information systems, affords all of us a unique opportunity to expand the scope of our own considerations of how better to present and accept information for human users.

The CHI + GI '87 proceedings will be of both immediate and archival importance to this endeavor. We are grateful to the authors of the 166 papers submitted for presentation at the conference for providing this possibility. We are especially grateful to the thirty program committee members who thoughtfully reviewed all these papers and then met in Toronto last November to come to a consensus over the final program of forty-six papers. This effort, especially complex this year because of the greater scope of the conference, is critical to the success of the conference and too easily taken for granted. They made the possibility into a reality. It is exciting to see this conference taking form and to realize that as new computational power becomes available in the future, there will be many directions in which to apply it for enhancing the utility, ease and enjoyability of human-computer interaction.



John M. Carroll



Peter P. Tanner
Technical Program Chairs and Proceedings Editors

FROM THE SIGCHI CHAIR

Welcome to CHI + GI '87, a very special event.

This opportunity of being able to offer a combined CHI plus Graphics Interface conference is unusual and all of us in SIGCHI are extremely pleased to be able to co-sponsor this event. The program looks exciting, the paper and panels sessions which are reported on in this Proceedings, represent the best work of 1986, and the special conference events, together with lots of time for meeting with friends and colleagues, will truly make this conference extra-ordinaire.

On behalf of all of us in SIGCHI, I would like to thank the conference and program committees for their work. Planning for, and coordinating, a "mixed mode" event is not simple. They did a superb job and deserve our thanks.

To you, the attendees, my heartiest welcome. Enjoy!

A handwritten signature in cursive script, reading "Lorraine Borman". The signature is fluid and elegant, with a large initial 'L' and 'B'.

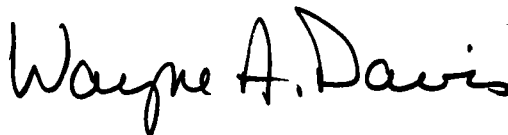
Lorraine Borman
Chair, ACM/SIGCHI

FROM THE CMCCS PRESIDENT

It is a pleasure to welcome you to CHI+GI'87 in Toronto, a very special combined conference of Graphics Interface, the longest running regularly scheduled graphics conference in the world and CHI, the key American conference on human factors in computing systems. The week that has been put together is state of the art, important, and of interest to anyone associated with any aspect of this exciting field of computer-human interaction and computer graphics. With two full days of tutorials followed by three full days of conference, plus the many events that will be taking place during the week, the conference will surely satisfy everyone's needs.

We have attempted to establish a milestone for graphics conferences in Canada. The cooperation with SIGCHI has guaranteed both increased exposure and depth that will be difficult to repeat in the future, although I am sure that the organizers of future Graphics Interface conferences will certainly attempt to measure up to the high level of activity and quality set by CHI+GI'87. To our ACM colleagues, we thank you for your patience and assistance and hope that you have benefited as much as we have.

The number of people and the amount of effort involved to produce this program has been significant. I would like to thank everyone for their efforts and hope that you will also show your appreciation for the job they did in providing us all with such a stimulating and challenging five days. I hope that CHI+GI'87 will be as rewarding an experience for you as it will be for me.



Wayne Davis
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Chair: Tom Carey, Univ. of Guelph.
Moderators: Kellogg S. Booth, Univ. of Waterloo; Deborah
 Boehm-Davis, George Mason Univ.; Peter G. Polson, Univ. of
 Colorado.

Doctoral Candidates: Ronald P. Blanford, Univ. of Washington; Richard
 Catrambone, Univ. of Michigan; Kathleen Culver-Lozo, Univ. of Michigan;
 David England, Univ. of Lancaster; Christina Haas, Carnegie Mellon Univ.;
 Bonnie E. John, Carnegie Mellon Univ.; Richard Koubek, Purdue Univ.;
 Deborah A. Krawczak, Ohio State Univ.; Donna Lamberti, Rensselaer
 Polytechnic Institute; Melissa Monty, Univ. of California; Maung K. Sein,
 Indiana Univ.; Ray Waddington, Univ. of Nottingham; Suzanne Penn
 Weisband, Carnegie Mellon Univ.

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SUMMARY OF THE CHI'87 DOCTORAL CONSORTIUM

Tom Carey
University of Guelph, Canada

Thirteen selected Ph.D students who are currently working on dissertation research in human-computer interaction met for two days prior to the CHI+GI'87 Conference in a Doctoral Consortium. The consortium was designed to provide these students with an opportunity to exchange ideas on their dissertation research and to build a cohort group of colleagues. Of particular interest for the participants was the opportunity to compare research questions, paradigms and techniques, and the consortium encourages interdisciplinary dialogue.

The four faculty researchers who guided the consortium were:

Deborah Boehm-Davis
George Mason University

Kelly Booth
University of Waterloo

Peter Polson
University of Colorado

Tom Carey
University of Guelph (Chair)

The students who were selected for participation represented thirteen different departments in ten academic institutions in North America and Europe. They came from a variety of disciplinary interests including psychology, computing science, management science, industrial engineering, languages and literature, and sociology. The research methods evident in the various projects included field studies, laboratory experiments, model development and evaluation, and design of prototype systems.

The CHI+GI'87 Doctoral Consortium was organized around four sessions of related dissertation topics. In addition, an introductory session allowed the faculty to describe their backgrounds and current research interests, and a concluding session discussed the various research methods and issues which emerged during the consortium.

SESSION I. MODELS FOR HUMAN-COMPUTER INTERACTION

(Peter Polson, moderator)

The model with which Bonnie John is working predicts response times by modelling the algorithms people use to perform skilled cognitive tasks. Richard Catrambone applies production rule models to characterize and evaluate principles for the design of effective user manuals. Deborah Krawczak focusses on how properties of an interface can affect the learning strategies that people use to acquire a conceptual model. Maung Sein examines the features of different conceptual models and how they are influenced by characteristics of individual users.

Contributions to the Model Human Processor

Bonnie E. John
Department of Psychology
Carnegie-Mellon University

Principles for the Design of Manuals : An Empirical Study and Production Rule Analysis

Richard Catrambone
Department of Psychology
University of Michigan

User Strategies for Acquiring Mental Models of a Knowledge-Based System

Deborah A. Krawczak
Department of Industrial and Systems Engineering
Ohio State University

Conceptual Models in Training Novice Users of Computer Systems: Effectiveness of Abstract vs. Analogical Models and Influence of Individual Differences

Maung. K Sein
Department of Operations and Systems Management
Indiana University

SESSION II : DESIGN TOOLS
(Kelly Booth, moderator)

The three theses in this session all involve tools for designers of software. Ronald Blanford's thesis focuses on tools for design of algorithms in image processing; it provides insights into the balance between human and automatic control of the design process, and presents a spreadsheet environment for the presentation of the resultant algorithms. David England is developing a design notation and tool for user interfaces, with a model-view-dialogue paradigm for the objects in the interface. In contrast, Kathleen Culver-Lozo uses a frame representation to organize the information in a user interface design.

Automatic Algorithm Design for High-Speed Image Processors

Ronald P. Blanford
Department of Computer Science
University of Washington

A User Interface Design Tool

David England
Department of Computing
University of Lancaster

Representing the Details of Human-Computer Interfaces: The Development of a Theory, Frame Organization and Prototyping Tool

Kathleen Culver-Lozo
Department of Computer and Information Systems
University of Michigan

SESSION III: EXPERT PERFORMANCE
(Deborah Boehm-Davis, moderator)

Many studies of human-computer interaction have examined the novice stage of using an interactive system. These three dissertations all include aspects of expert performance. Ray Waddington's thesis research studies both novice and expert in programming debugging : the work with novices illustrates some dangers encountered when testing skills at this level, and the work with experts concerns team work in software engineering environments. Richard Koubek has studied three levels of performance, novice, expert, and super-expert, to identify some of the differences in cognitive factors and behaviours. Donna Lamberti reports on a human factors study of an expert system used in a diagnostic task.

What Information is Required for Program Debugging

Ray Waddington
Department of Psychology
University of Nottingham

Beyond the Expert : Toward an Understanding of Super-Expert Performance

Richard Koubek
School of Industrial Engineering
Purdue University

A Framework for Evaluating the Effect of Expert System User Interfaces

Donna Lamberti
Department of Statistical, Management and Information Sciences
Rensselaer Polytechnic Institute

SESSION IV: IMPACTS OF TECHNOLOGY ON TASKS

(Tom Carey, moderator)

The three presentations in this session examine how a computer system affects the way people carry out tasks. Christina Haas compares the writing process using a word processor with the traditional process without computer aids. Melissa Monty examines the effects of taking and using notes to aid memory, and explores ways to maintain more of the notetaker's context in the computer environment. Suzanne Weisband looks at the impacts of computer-mediated communication on group discussions and the resulting group decisions.

Constraints on Composing and Strategies for Compensation : Naturalistic and Experimental Studies of Computer and Pen-and-Paper Writing

Christina Haas
Department of English
Carnegie Mellon University

Memory Tasks of Note Taking in the Computer Environment

Melissa Monty
Department of Psychology
University of California, San Diego

Group Discussion Effects in Computer-Mediated and Face-to-Face Communication

Suzanne Penn Weisband
Department of Social and Decision Sciences
Carnegie Mellon University

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FUTURE CONFERENCES

HUMAN FACTORS IN COMPUTING SYSTEMS

CHI'88
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May 15-19
John O'Hare, Conference Chair
202/696-4502

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