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Preface

This International Conference on Computer Assisted Learning ICCAL '90 is the third conference to be held in this series. The first conference, which was held at the University of Calgary in 1987, demonstrated the need for a regularly scheduled international conference of high quality focusing on research, development, and application of computer assisted learning, with an emphasis on the post secondary environment. A second conference ICCAL '89 was held at the University of Texas at Dallas in May 1989, hosted by the Computer Learning Research (CLEAR) Center. For this third conference ICCAL '90 the venue moves to Europe, to the University of Hagen, which is well known for its distance education programs and 'electronic courses'. The coherence of the ICCAL conference series is maintained by its International Steering Committee and International Advisory Board.

The Program Committee for ICCAL '90 comprises: S.A. Cerri (DIDA*EL, Italy), N. Gardner (University of Oxford, UK), R. Hartog (Wageningen Agricultural University, The Netherlands), J. Hebenstreit (ESE, France), F. Hill (University of Massachusetts, USA), G. Kovacs (Szamalk, Hungary), A. Lorentsen (Denmark), F. Makedon (University of Texas, USA), H. Maurer (Graz University of Technology, Austria), G. Oberem (South Africa), T. O'Shea (The Open University, UK), T. Ottmann (University of Freiburg, W. Germany), V. Rajamaran (Indian Institute of Science, Bangalore, India), T. Rekkedal (NKI, Norway), E. Soloway (University of Michigan, USA), A. van Dam (Brown University, USA), B. Woolf (University of Massachusetts, USA). The Co-Chairs for the Program Committee are D. H. Norrie (University of Calgary, Canada) and H.-W. Six (University of Hagen, W. Germany).

The Chairs of the Program Committee express their appreciation for the work of the committee members in the planning of the program, selection of invited presentations, and review and selection of the papers for the conference. Special thanks are also extended to all of those outside the scope of the Committee who assisted in the difficult task of refereeing the many papers submitted for the conference; a certainly

only partial list includes E. Berg (Hagen), J. Böhme (Hagen), K. Fankhänel (Hagen), E. Gaarder (Bekkestua), J. Hangan (Bekkestua), G. Holweg (Graz), F. Huber (Graz), K. Loose (Calgary), I. Mortensen (Bekkestua), O. Royrvik (Bekkestua), R. Stubenrauch (Graz), I. Tomek (Wolfville), and members of 'Computers in Teaching Initiative Support Services at the University of Oxford'.

This proceedings volume contains the thirty papers selected by the Program Committee for the conference from one hundred submitted. It also includes the invited lectures presented by eminent scholars of the field. The papers cover a wide range of topics in computer assisted learning including: knowledge acquisition; intelligent CAI; microworlds; media-based CAL; hypermedia environments and instruction; student modeling; evaluation of learning environments; simulation tools; application systems for logic, discourse, visual programming, physiology, structural frames, real time measurement, automotive maintenance, flight training and other areas; implementation of CAL in distance education in countries ranging around the world from China to Africa to Europe.

A special debt of gratitude is owed to all of the contributors to the conference program, especially to the authors of papers and the invited lectures. Our thanks are also extended to the Conference Co-Chairs G. Schlageter and C. Unger of the University of Hagen and their Local Arrangements Committee (U. Manthey, G. Rademacher and R. Braun) for the excellent organization and planning of the conference arrangements. We would also like to gratefully acknowledge the administrative support of the FernUniversität Hagen.

Finally, we wish to record our appreciation of the cooperation received from Springer-Verlag during the publication of this volume.

Calgary — D. H. Norrie
Hagen — H.-W. Six
March 1990

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Abstract

An algorithm animation environment is an "exploratorium" for investigating the dynamic behavior of programs, and makes possible a fundamental change in the way we understand and think about them. Such systems have been used successfully in a number of applications, most notably in teaching programming and algorithms, in research in algorithm design and analysis, debugging algorithms, and in technical drawings of data structures for research papers and textbooks. This multi-media talk covers my experiences in using algorithms animations for teaching at Brown University and for research at DEC Systems Research Center.

Further information:

Brown, Marc H.
Algorithm Animation
MIT Press, Cambridge, MA, 1988

Brown, Marc H.
Exploring Algorithms using Balsa-II
IEEE Computer, Vol. 21, No. 5, Pages 14-36 and cover, May 1988

Brown, Marc H. and Sedgewick, Robert
Techniques for Algorithm Animation
IEEE Software, Vol. 2, No. 1, Pages 28-39, January 1985

Brown, Marc H. and Sedgewick, Robert
A System for Algorithm Animation
Computer Graphics, Vol. 18, No. 3, Pages 177-186, July 1984