Series Editors

Gerhard Goos, Karlsruhe University, Germany
Juris Hartmanis, Cornell University, NY, USA
Jan van Leeuwen, Utrecht University, The Netherlands

Volume Editors

Norbert A. Streitz
Shin'ichi Konomi
GMD - German National Research Center for Information Technology
IPSI - Integrated Publication and Information Systems Institute
Dolivostr. 15, D-64293 Darmstadt, Germany
E-mail: {streitz/konomi}@darmstadt.gmd.de

Jane Siegel
HCI Institute, Carnegie Mellon University
5000 Forbes Avenue, Pittsburgh, PA 15213, USA
E-mail: jane.siegel@cs.cmu.edu

Volker Hartkopf
Center for Building Performance and Diagnostics
School for Architecture, Carnegie Mellon University
Pittsburgh, PA 15213 USA
E-mail: vh02@andrew.cmu.edu

Cataloging-in-Publication data applied for

Die Deutsche Bibliothek - CIP-Einheitsaufnahme

**Cooperative buildings**: integrating information, organisation and architecture
; second international workshop ; proceedings / CoBuild'99, Pittsburgh, USA,
October 1999 / Norbert A. Streitz ... (ed.) - Berlin ; Heidelberg ; New York ;
Budapest ; Hong Kong ; London ; Milan ; Paris ; Singapore ; Tokyo : Springer,
1999

(Lecture notes in computer science ; Vol. 1670)
ISBN 3-540-66596-X
ISSN 0302-9743

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is
concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting,
reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication
or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965,
in its current version, and permission for use must always be obtained from Springer-Verlag. Violations are
liable for prosecution under the German Copyright Law.

© Springer-Verlag Berlin Heidelberg 1999
Printed in Germany

Typesetting: Camera-ready by author
SPIN: 10705432 06/3142 – 5 4 3 2 1 0 Printed on acid-free paper
Preface

This volume constitutes the proceedings of the “Second International Workshop on Cooperative Buildings (CoBuild’99) – Integrating Information, Organizations, and Architecture” held at the Carnegie Museum of Art in Pittsburgh on October 1–2, 1999. The success of the First International Workshop on Cooperative Buildings (CoBuild'98), held at GMD in Darmstadt in February 1998, showed that there is a demand for an appropriate forum to present research about the intersection of information technology, organizational innovation, and architecture. Thus, it was decided to organize a follow-up event. The decision of where to organize CoBuild’99 was straightforward. Since we had many high quality contributions from the United States (U.S.) presented at CoBuild’98, we wanted to hold the second workshop in the U.S. reaching out to a large audience and at the same time turning it into an international series of events held in different places in the world. Due to the excellent work carried out at Carnegie Mellon University, it was an obvious choice to ask Volker Hartkopf from the Department of Architecture and Jane Siegel from the Human Computer Interaction Institute to be conference cochairs for CoBuild’99. The workshop is organized in cooperation with the German National Research Center for Information Technology (GMD), in particular the Integrated Publication and Information Systems Institute (IPSI) in Darmstadt providing continuity between the events. Furthermore, the workshop is held in cooperation with the following scientific societies: the German Gesellschaft für Informatik (GI), the European Association of Cognitive Ergonomics (EACE), and the American Institute of Architects.

The theme remains the same, “integrating information, organizations, and architecture”, because it still reflects the existing challenges. The basic issues have not changed. Although we see promising approaches addressing these issues and developments pointing towards possible solutions, there is still a need for research and development towards the goal of cooperative buildings constituting the workspaces of the future. The papers of this volume show that this is an interdisciplinary endeavor requiring a wide range of perspectives and the utilization of results from various areas of research and practice.

The technical program of CoBuild’99 presented in this volume is the result of the review and selection process of the international program committee. From 33 submitted contributions, we selected 15 to be presented as full papers, two as short papers, two as posters, and one as a demonstration. I want to express my sincere thanks to the members of the program committee for their careful reviews and constructive comments which often helped to improve the final versions of the papers.

Finally, I want to express my sincere thanks to Shin’ichi Konomi for compiling and copy-editing the camera-ready manuscript, to Tom Pope and Jack Moffett for creating the workshop’s website. I extend special thanks to Volker Hartkopf and Jane Siegel as conference cochairs and the people working with them for their efforts in taking care of all those additional issues that are essential for a successful workshop.

Darmstadt, August 1999
Norbert A. Streitz (Program Chair)
Supporting/Cooperating Societies

American Institute of Architects

European Association of Cognitive Ergonomics (EACE)

German Computer Science Society / Gesellschaft für Informatik (GI)
special interest groups / technical committees
  2.3  Human Factors in Computing
  2.3.1  Software-Ergonomics
  4.9.1  Hypertext-/media Systems
  5.14  CSCW in Organizations
Conference Committee

Conference Chairs
Volker Hartkopf Carnegie Mellon University, Pittsburgh
Jane Siegel Carnegie Mellon University, Pittsburgh

Program Chair
Norbert A. Streitz GMD-IPS, Darmstadt

Program Committee
Paul Allie Steelcase, Grand Rapids
Bernd Brügge Technical University München
Hans-Jörg Bullinger FhG-IAO, Stuttgart
Heinz-Jürgen Burkhardt GMD-TKT, Darmstadt
Ernest Edmonds University of Loughborough
Tom Finholt University of Michigan, Ann Arbor
Jonathan Grudin Microsoft Research & University of California, Irvine
Volker Hartkopf Carnegie Mellon University, Pittsburgh
Ludger Hovestadt University of Kaiserslautern
Hiroshi Ishii MIT MediaLab, Cambridge
Simon Kaplan University of Queensland, Brisbane
David Kirsh University of California, San Diego
Saadi Lahlou Electricité de France, Paris
Steve Lee Carnegie Mellon University, Pittsburgh
Scott Mainwaring Interval Research, Palo Alto
William Mitchell MIT School of Architecture, Cambridge
Gale Moore University of Toronto
Tom Moran Xerox PARC, Palo Alto
Steven Poltrock Boeing Company, Seattle
Ralf Reichwald Technical University München
Jun Rekimoto SONY Computer Science Lab, Tokyo
Burkhard Remmers Wilkhahn, Bad Münster
Eric Richert SUN Microsystems, Palo Alto
Mike Robinson University of Jyväskylä
Ken Sakamura University of Tokyo
Gerhard Schmitt ETH Zürich
Jean Schweitzer Siemens STZ, Saarbrücken
Jane Siegel Carnegie Mellon University, Pittsburgh
Ralf Steinmetz Darmstadt University of Technology
Konrad Tollmar Royal Institute of Technology, Stockholm
Terry Winograd Stanford University
## Publication

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shin’ichi Konomi</td>
<td>GMD-IPSI, Darmstadt</td>
</tr>
<tr>
<td>Norbert A. Streitz</td>
<td>GMD-IPSI, Darmstadt</td>
</tr>
</tbody>
</table>

## Website

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jack Moffett</td>
<td>Carnegie Mellon University, Pittsburgh</td>
</tr>
<tr>
<td>Tom Pope</td>
<td>Carnegie Mellon University, Pittsburgh</td>
</tr>
<tr>
<td>Jane Siegel</td>
<td>Carnegie Mellon University, Pittsburgh</td>
</tr>
</tbody>
</table>
Table of Contents

**Keynote Speech**

A Time for Talk and a Time for Silence................................................................. 1  
*Herbert A. Simon (Carnegie Mellon University, Pittsburgh, USA)*

**Integrated Workplace Design and Architecture**

Boeing Operations Fleet Support: A Case Study in Integrated Workplace Design...... 2  
*R. Hunt (Barclay Dean Interiors, Bellevue, USA)*  
*S. E. Poltrock (The Boeing Company, Seattle, USA)*

The GSA Adaptable Workplace Laboratory ............................................................ 12  
*V. Hartkopf, V. Loftness, A. Aziz, J. Shankavaram, S. R. Lee (Carnegie Mellon University, Pittsburgh, USA)*

The Collaborative Building: Mediating Between Climate and Interior Quality........ 29  
*V. Loftness, V. Hartkopf, S. Lee, A. Mahdavi, P. Mathew, J. Shankavaram, A. Aziz (Carnegie Mellon University, Pittsburgh, USA)*

**Critical Technologies**

Passage: Physical Transportation of Digital Information for Cooperative Buildings .......................................................................................... 45  
*S. Konomi, C. Müller-Tomfelde, N. Streitz (GMD-IPSI, Darmstadt, Germany)*

Complex Construction Kits for Coupled Real and Virtual Engineering Workspaces............................................. 55  
*W. F. Bruns (Bremen University, Bremen, Germany)*

Bringing the Marks on a Whiteboard to Electronic Life ........................................... 69  
*E. Saund (Xerox Palo Alto Research Center, Palo Alto, USA)*

**Meeting and Conferencing Environments**

Meeting Capture in a Media Enriched Conference Room........................................ 79  
*P. Chiu, A. Kapuskar, L. Wilcox (FX Palo Alto Lab, Palo Alto, USA)*  
*S. Reitmeier (University of Michigan, Ann Arbor, USA)*

Going Public: Collaborative Systems Design for Multidisciplinary Conversations............................................................................................................ 89  
*C. Geisler, E. H. Rogers, J. Tobin (Rensselaer Polytechnic Institute, New York, USA)*

The Studio: Reflections and Issues Arising ............................................................ 101  
*M. Robinson, S. Pekkola (University of Jyväskylä, Jyväskylä, Finland)*

**Infrastructure**

OWL: An Object-Oriented Framework for Intelligent Home and Office Applications................................................................. 114  
*B. Brügge, R. Pfleghar, T. Reicher (Technical University München, München, Germany)*
Predator: A Distributed Location Service and Example Applications ...................... 127
J. N. Weatherall, A. Hopper (Cambridge University and AT&T Laboratories, Cambridge, United Kingdom)

Matching Information and Ambient Media.............................................................. 140
A. Schmidt, H.-W. Gellersen, M. Beigl
(University of Karlsruhe, Karlsruhe, Germany)

Methodology and Empirical Studies
Observing Cognitive Work in Offices................................................................. 150
S. Lahlou (EDF R&D Division, Clamart Cedex, France)

Measuring Work Factors: A Case Study to Identify Relationships among Work Activities, Styles and an Environment.................................................. 164
M. Sakamaki, F. Ikeda (NTT DATA Corporation, Tokyo, Japan)
S. Takada (Keio University, Kamagawa, Japan)
K. Nakakoji (Nara Institute of Science and Technology, Nara, Japan)

Networked Home Environments
Video Mediated Communication for Domestic Environments
— Architectural and Technological Design......................................................... 177
S. Junestrand, K. Tollmar (Royal Institute of Technology, Stockholm, Sweden)

The Aware Home: A Living Laboratory for Ubiquitous Computing Research....... 191
C. D. Kidd, G. D. Abowd, C. G. Atkeson, I. A. Essa, B. MacIntyre, E. Mynatt,
T. E. Starner, W. Newstetter (Georgia Institute of Technology, Atlanta, USA)

The Importance of Homes in Technology Research ........................................... 199
D. Hindus (Interval Research Corporation, Palo Alto, USA)

Demo and Poster Presentations
A Swivel Chair as an Input Device ................................................................. 208
M. Cohen (University of Aizu, Aizu-Wakamatsu, Japan)

Progress of MUSE (Making User Friendly Spaces):
A Context-Aware Assistant for Orientation..................................................... 210
M. Halkia, J. Solari (Starlab Research Laboratories, Zaventem, Belgium)

Design of the Swisshouse: A Physical/Virtual Cooperative Workspace............ 215
J. Huang, M. Waldvogel, S. Lertsithichai (Harvard University, Cambridge, USA)

Author Index..................................................................................................... 221

Keyword Index ................................................................................................. 223