

The Human– Computer Interaction Handbook

Fundamentals,
Evolving Technologies,
and Emerging Applications

Third Edition

Edited by Julie A. Jacko, Ph.D.



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The Human- Computer Interaction Handbook

Fundamentals,
Evolving Technologies,
and Emerging Applications

Third Edition

Human Factors and Ergonomics

Series Editor

Gavriel Salvendy

Professor Emeritus

*School of Industrial Engineering
Purdue University*

Chair Professor & Head

*Dept. of Industrial Engineering
Tsinghua Univ., P.R. China*

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This handbook is dedicated to those who have lent a hand and lit the way.

And I said to the man who stood at the gate of the year:

“Give me a light, that I may tread safely into the unknown!”

And he replied:

“Go out into the darkness and put your hand into the Hand of God.

That shall be to you better than light and safer than a known way.”

*King George VI in his New Year’s message to his embattled people
at the beginning of the Second World War*

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Series Foreword

The third edition of this classic handbook is published at an opportune time when interactive technologies are a dominating presence in work, leisure, and social settings and when ambient intelligence is gaining accelerated momentum. The field of human–computer interaction (HCI) has matured to such an extent that even the words comprising the term have taken on new, expanded, and reinterpreted meanings. That is, the field has advanced significantly from its origins. Researchers in HCI are called upon now more than ever to develop new knowledge, which often resides at the intersection of multiple disciplines and spans various and innovative platforms of applications. Information technology is more ubiquitous today than ever, successfully interacting with the technologies that ensure it is more enjoyable and more productively accessible and usable by all segments of society across all five continents.

This handbook is the premier resource for the theoretical and operational foundations of HCI, providing readers access to the latest scientific breakthroughs coupled with the state of the art in the field. The book provides detailed descriptions of approaches and methodologies that are frequently illustrated with case studies and examples on how to conceptualize,

design, and evaluate interactive systems with human beings at the center of the endeavor. As such, this handbook will be invaluable to researchers, practitioners, educators, and students working in, or at the intersection of, computer science, information technology, information science, informatics, engineering, psychology, design, and human factors and ergonomics.

This book is part of the Human Factors and Ergonomics series, published by the Taylor & Francis Group. The 145 authors of this handbook include 92 from academia, 49 from industry, and 4 from government agencies. These individuals are among the very best and most respected in their fields across the globe. The more than 80 tables, 400 figures, and nearly 7000 references in this book provide the single most comprehensive depiction of this field that exists in a single volume.

The handbook authors come from 14 countries: Australia, Canada, Cyprus, Denmark, Finland, France, Germany, Greece, Ireland, Japan, South Africa, the Netherlands, United Kingdom, and the United States.

Gavriel Salvendy, Series Editor
Purdue University/Tsinghua University, China

Foreword

The Expanding Impact of Human–Computer Interaction

The remarkable growth of human–computer interaction (HCI) over the past 30 years has transformed this nascent interdisciplinary field into an intellectually rich and high impact worldwide phenomenon. We have grown from a small rebellious group of researchers who struggled to gain recognition as we broke disciplinary boundaries to a broad influential community with potent impact on the daily lives of every human. There are dozens of relevant journals, plus conferences and workshops worldwide.

The aspirations of early HCI researchers and practitioners were to make better menus, design graphical user interfaces based on direct manipulation, improve input devices, design effective control panels, and present information in comprehensible formats. HCI software developers contributed innovative tools that enabled programmers and nonprogrammers to create interfaces for widely varying applications and diverse users. HCI professionals developed design principles, guidelines, and sometimes standards dealing with consistency, informative feedback, error prevention, shortcuts for experts, and user control. Success was measured by individual performance metrics such as learning time, speed, error rates, and retention for specific tasks, whereas user satisfaction was assessed by detailed questionnaires filled with numbered scales.

In the early days, HCI researchers and professionals fought to gain recognition and often still have to justify HCI's value with academic colleagues or corporate managers. However, the larger world embraced our contributions and now has high expectations of what we can deliver. Few fields can claim such rapid expansion and broad impact as those who design the desktop, web, mobile, and cellphone interfaces that have spread around the world into the hands of at least 5 billion users. HCI designs now influence commercial success, reform education, change family life, affect the political stability of nations, are embedded in military systems and play a significant role in shaping a peaceful or conflict-ridden world.

The Handbook of Human–Computer Interaction: Third Edition details the progress of this extraordinary discipline, inviting newcomers to learn about it and helping experienced professionals to understand the rapid and continuing changes. The carefully written chapters and extensive references will be useful to readers who want to scan the territory or dig deep into specific topics. This handbook's prominent authors thoughtfully survey the key topics, enabling students, researchers, and professionals to appreciate HCI's impact.

As HCI progresses, there is a greater acceptance in the academic environment, where HCI is now part of most computer science, iSchool, business, engineering, and other departments and has advocates in medicine, social sciences, journalism, humanities, etc. Although the term *human–computer interaction* has achieved widespread recognition, many insiders feel that it is no longer an accurate description. They complain that it suggests one human interacting with one computer to complete narrow tasks. Instead, these critics believe that the discipline should reflect user-oriented technologies that are ubiquitous, pervasive, social, embedded, tangible, invisible, multimodal, immersive, augmented, or ambient. Some want to break free from the focus on computer use and emphasize user experiences, interaction design, emotional impact, aesthetics, social engagement, empathic interactions, trust building, and human responsibility.

New terms have been proposed such as *human-centered computing*, *social computing*, *human–information interaction*, *human–social interaction*, *human-centered informatics*, or just *human interaction*. Novel, but already thriving applications areas include computational biology, computational social science, e-commerce (and m-commerce), digital humanities, information visualization, open government, sustainability, biodiversity, and citizen science. Although these broader visions are important, many researchers are still working on innovative display designs, input devices, multimedia output, programming toolkits, and predictive models of user performance.

New names and applications are a good sign of success, but finding the balance between sticking with an established term and welcoming innovative directions is difficult. Maybe an old aphorism helps: "make new friends and keep the old, one is silver and the other gold." Can we retain the brand name recognition of HCI but embrace new directions by discussing *micro-HCI* and *macro-HCI*?

Micro-HCI researchers and developers would design and build innovative interfaces and deliver validated guidelines for use across the range of desktop, web, mobile, and ubiquitous devices. The challenges for micro-HCI are to deal with rapidly changing technologies, while accommodating the wide range of users: novice/expert, young/old, literate/illiterate, abled/disabled, and their cultural plus linguistic diversity. These distinctions are tied to skills, but there are further diversities in gender, personality, ethnicity, skills, and motivation that are now necessary to address in interface designs. Micro-HCI researchers can take comfort in dealing

with well-stated requirements, clear benchmark tasks, and effective predictive models.

Macro-HCI researchers and developers would explore new design territories such as affective experience, aesthetics, motivation, social participation, trust, empathy, responsibility, and privacy. The challenges for macro-HCI are to deal with new opportunities across the range of human experience: commerce, law, health/wellness, education, creative arts, community relationships, politics, policy negotiation, conflict resolution, international development, and peace studies. Macro-HCI researchers have to face the challenge of more open tasks, unanticipated user goals, and even conflicts among users in large communities.

Although micro-HCI and macro-HCI have healthy overlaps, as do micro-economics and macro-economics, they attract different types of researchers, practitioners, and activists, thereby further broadening the scope and impact. As commercial, social, legal, and ethical considerations play an increasing role, educational curricula and professional practices need to be updated regularly and midcareer continuing education for HCI professionals will keep them current.

An important goal will be to develop new metrics and evaluation methods for micro-HCI and macro-HCI. Moore's Law has been useful in charting the growth of computing, enabling everyone to admire and benefit from the increase in gigahertz, terabytes, and petaflops. These are still useful, but we need newer metrics to understand the impact of HCI designs that have enabled the spread of billions of mobile devices and the emergence of YouTube, Facebook, twitter, Wikipedia, and so on. Understanding this transformation would be facilitated by measures of giga-hellos, tera-contribs, and peta-thankyous and by newer metrics of trust, empathy, responsibility, privacy, and so on.

Traditional evaluation approaches of controlled experiments and usability testing are being continuously refined to fit the needs of micro-HCI, whereas the newer methods of qualitative, ethnographic, and case study methods are being explored to match the needs of macro-HCI. Both groups will benefit from the remarkable increased opportunities to log usage on a massive scale through the increasingly connected communications, data, and sensor networks. Traditional surveys of a small sample of users who offer biased perceptions or reports of attitudes are giving way to actual measurement

of usage that reveals the learnability, efficacy, utility, and satisfaction of users. Even more exciting is the potential to capture the manifestations of trust, empathy, responsibility, privacy, security, and motivation. Researchers are also beginning to measure brand loyalty, parental engagement, political leaning, potential for violence, community commitment, and much more. The dangers of inappropriate intrusion, misguided applications, scamming/spamming, deception, and bullying are now part of macro-HCI. Even greater concerns come from criminals, terrorists, and oppressive governments who can use these technologies in ways that threaten individuals, intimidate communities, or destroy the environment.

The power of widely used social technologies that stem from HCI's success means that we will face ethical challenges similar to what the nuclear physicists dealt with during the 1940s and beyond. We cannot and should not avoid these responsibilities. Rather, we should embrace them and show leadership in shaping technology to produce positive outcomes. This is never easy, but every worthy project that improves the health, environment, or education of children or builds capacity for constructive communities should be recognized, disseminated, scaled up, and continuously improved. Even more ambitious should be our efforts to promote open government, independent oversight, deliberative systems, and citizen participation. The research agenda for HCI should include the UN Millennium Development Goals such as eradicating extreme hunger and poverty, ensuring universal childhood education, promoting maternal health, and ensuring environmental sustainability. If HCI professionals also courageously address conflict resolution, international development, and peace studies, we can inspire others and help build a better world.

We should be proud of what HCI has accomplished, but there is much work to be done. Let's get on with it!

ACKNOWLEDGMENTS

Thanks to Ron Baecker, Jack Carroll, Susan Dray, Gerhard Fischer, Rob Jacob, Clare-Marie Karat, Clayton Lewis, Brad Myers, and Jenny Preece for comments on earlier drafts.

Ben Shneiderman
University of Maryland

Preface

This third edition of the HCI handbook represents the single largest, most complete compilation of HCI theories, principles, advances, case studies, and more that exist within a single volume. The construction of the handbook has been a massive community effort of which it was a tremendous privilege for this author and editor to be a part. The 145 authors of the 62 chapters within this book are people who have not only dedicated themselves to laying the foundation for this field but also dared to address the grand challenges that have been posed along the way, thus advancing the field of HCI by leaps and bounds. The HCI community from which these authors hail is remarkably diverse and collaborative. You will see the artifacts of this ethos throughout the book.

The handbook opens with an insightful and thought-provoking introduction written by Jonathan Grudin, which sets the tone for the entire book. Within the introduction you will find a unique and compelling depiction of the evolution of HCI. The handbook closes with a look at the evolving nature of HCI to change the world. The closing chapter is written by the largest collection of authors in the book, led by Susan Dray. The global focus of this chapter is personified by the authors' origins, which literally span the globe. The chapters in between are organized very much like those in the second edition; however, the content of the chapters has been dramatically updated to reflect the state of the art and current state of the science in HCI. There have been numerous notable additions to the third edition, which reflect the ever-growing nature of this field, including, for example, chapters on social networks and social media, grounded theory, choices and decisions of users, and the naturalistic approach to evaluation.

I offer my heartfelt thanks to Ben Shneiderman, who kindly agreed to contribute his revolutionary perspective in the Foreword to the third edition. He not only chronicles the impact of HCI but also presents a challenge to each and every one of us to embrace the responsibility of shaping technology

to produce positive outcomes. With this challenge he is asking us to be the best citizen scholars we can be. This is classic Ben Shneiderman and just one of the many reasons why I respect and admire him. This handbook would simply not have been possible without the guiding influence of my longtime mentor and good friend, Gavriel Salvendy. Gavriel sets the standard for successfully coalescing people and communities around shared goals and mutual aspirations. He has been an unwavering source of inspiration, support, advice, opportunity, and kindness for me. This book is part of a larger book series of which Gavriel is the series editor. His Series Foreword to the third edition enables us to see this book in the context of the larger whole. Both these luminaries, Ben and Gavriel, have transformed the field of HCI in their own signature ways, and I salute both of them.

A very special individual worked hand in hand with me in constructing the third edition. Molly McClellan, PhD, is a research associate with SimPORTAL at the University of Minnesota, performing postdoctoral research in the area of perioperative simulation. Completing a book of this scale and scope requires incredible persistence and perseverance. Molly demonstrates both these attributes and so much more. She is a creative problem solver with an uncanny ability to organize vast quantities of information from disparate and geographically distributed sources. She is smart, generous, and exceedingly committed to excellence. I have admired her as a scholar and as a human being. It is a privilege to serve as her major professor and mentor.

Last but not the least, I wish to recognize the support offered me by my husband François and our son Nico. They are both, quite simply, my *raison de vivre*.

Julie A. Jacko
University of Minnesota

Editor

Julie A. Jacko, PhD, is a professor of Public Health at the University of Minnesota and a faculty fellow in the Academic Health Center's Institute for Health Informatics. She is the principal investigator and director of the University Partnership for Health Informatics (UP-HI). This \$5.1-million grant from the Office of the National Coordinator for Health Information Technology is one of the nine awarded nationally and represents the first public-private partnership funded in the upper Midwest United States to infuse our nation's workforce with individuals who have been trained to perform one of six mission-critical health information technology roles.

Dr. Jacko has expertise in the design, implementation, and evaluation of interactive computing systems in complex domains such as population health and health care delivery, with the purpose of enhancing human performance and satisfaction. This is accomplished through research that is focused on the cognitive processes underlying the interaction of people with complex systems with the ultimate goal of combining robust empirical results with the development of engineering models of human performance that can aid in the design of real-world systems. Dr. Jacko has an exemplary research track record spanning nearly 20 years during which over 160 scientific publications have been generated in these research areas. She has generated nearly \$25 million by way of research funding in the last 10 years and is one of the only 20 recipients of a National Science Foundation Presidential Early Career Award for Scientists and Engineers, the highest honor awarded to young investigators by the U.S. government. Dr. Jacko served as co-author on the #1-rated published article for 2005 in the *International Journal of Medical Informatics*. She has an extensive track record of professional leadership excellence, including the following awards and honorable positions.

- Received commendation from the Office of the National Coordinator for Health Information Technology (ONC) for her innovation and leadership in the University Partnership for Health Informatics (2011).

- Ranked one of the Top Ten Influential Informatics Professors by HealthTechTopia on September 14, 2010. (<http://mastersinhealthinformatics.com/2010/top-10-most-influential-informatics-professors/>).
- Published an invited comment paper in 2011, Issue 470, in *Nature* titled, "Narrow the Gap in Health Literacy."
- Appointed by the State of Minnesota Commissioner of Health to serve on the Minnesota e-health Advisory Committee, representing academics and clinical research for the State of Minnesota.
- Elected to the Office of the President, the Association for Computing Machinery's Special Interest Group on Computer–Human Interaction (ACM SIGCHI) (2006–09).
- Elected to the Association for Computing Machinery Special Interest Group Governing Board Executive Committee, elected Member at Large (2007–2009).
- Elected to the Office of the Vice President for Membership and Communications—the Association for Computing Machinery's Special Interest Group on Computer–Human Interaction (ACM SIGCHI) (2003–06).
- Editor-in-chief of the *International Journal of Human–Computer Interaction*, published by Taylor & Francis.
- Co-editor of the 1st and 2nd Editions of the *Human–Computer Interaction Handbook*, the premier compendium of research and practice in the field of human–computer interaction.

In addition, during the last 15 years, Dr. Jacko has chaired or co-chaired numerous technical conferences and technical conference programs in the fields of human factors and human–computer interaction. She received her BS, MS, and PhD in industrial and systems engineering from Purdue University in West Lafayette, Indiana, where she held the NEC Graduate Fellowship.

Contributors

Tamara Adlin

Adlin, Inc.
Seattle, Washington

Norman Alm

School of Computing
University of Dundee
Dundee, Scotland

Chee Siang Ang

School of Engineering and Digital Arts
University of Kent
Canterbury, United Kingdom

Helen Ashman

School of Computer and Information
Science
University of South Australia
Adelaide, Australia

Alisa Bandlow

Sandia National Laboratories
Albuquerque, New Mexico

Roger Beatty

Operational Control Services
Dallas/Fort Worth, Texas

Michel Beaudouin-Lafon

Department of Computer Science
Université Paris-Sud
Paris, France

Jeanette Blomberg

IBM Almaden Research Center
San Jose, California

Tim Brailsford

School of Computer Science and
Information Technology
University of Nottingham
Nottingham, United Kingdom

Stephen Brewster

Department of Computing Science
University of Glasgow
Glasgow, Scotland

Carolyn Brodie

Brodie Consulting Group
Indianola, Iowa

Amy Bruckman

College of Computing
Georgia Institute of Technology
Atlanta, Georgia

Mark Burrell

Endeca Technologies
Cambridge, Massachusetts

Gaëlle Calvary

Grenoble Informatics Laboratory
Institut Polytechnique de Grenoble
Grenoble, France

Pascale Carayon

Department of Industrial and Systems
Engineering
Center for Quality and Productivity
Improvement (CQPI)
University of Wisconsin
Madison, Wisconsin

Stuart Card

Xerox PARC
Palo Alto, California

Alex Carmichael

School of Computing
University of Dundee
Dundee, Scotland

John M. Carroll

College of Information Sciences and
Technology
Pennsylvania State University
University Park, Pennsylvania

Sanjay Chandrasekharan

School of Interactive Computing
Georgia Institute of Technology
Atlanta, Georgia

Romeo Chua

School of Human Kinetics
University of British Columbia
Vancouver, British Columbia, Canada

Gilbert Cockton

School of Design
Northumbria University
New Castle, United Kingdom

Joseph V. Cohn

Office of Naval Research
Arlington, Virginia

Catherine Courage

Citrix Systems
Fort Lauderdale, Florida

Joëlle Coutaz

Grenoble Informatics Laboratory
Université Joseph Fourier
Grenoble, France

Sara J. Czaja

Department of Psychiatry and
Behavioral Sciences
Center on Aging
University of Miami Miller School of
Medicine
Miami, Florida

Declan Dagger

Department of Computer Science
Trinity College
Dublin, Ireland

Andrew M. Dearden

Communication and Computing
Research Centre
Sheffield Hallam University
South Yorkshire, United Kingdom

Melissa Densmore

School of Information
University of California
Berkeley, California

Jill Dimond

College of Computing
Georgia Institute of Technology
Atlanta, Georgia

Alan Dix

Talis
Birmingham, United Kingdom

Michael C. Dorneich

Human-Centered Systems
Honeywell Laboratories, Golden Valley
Minneapolis, Minnesota

Susan M. Dray
Dray and Associates, Inc.
Minneapolis, Minnesota

Allison Druin
Human–Computer Interaction Lab
College of Information Studies
University of Maryland
College Park, Maryland

Joseph S. Dumas
Dumas Consulting
Yarmouth Port, Massachusetts

Paula J. Edwards
HIMFormatics, LLC
Atlanta, Georgia

Vanessa Evers
Department of Electrical Engineering
and Computer Science
University of Twente
Enschede, the Netherlands

Todd J. Follansbee
Web Marketing Resource
West Tisbury, Massachusetts

Andrea Forte
College of Information Science and
Technology
Drexel University
Philadelphia, Pennsylvania

Jean E. Fox
Bureau of Labor Statistics
Washington, D.C.

Erik Frøkær
Department of Computer Science
University of Copenhagen
Copenhagen, Denmark

Thomas Fuller
Microsoft Studios
Redmond, Washington

Krzysztof Z. Gajos
Harvard School of Engineering and
Applied Sciences
Harvard University
Cambridge, Massachusetts

Norman D. Geddes
Applied Systems Intelligence, Inc.
Alpharetta, Georgia

Emilie W. Gould
Department of Communication
State University of New York
at Albany
Albany, New York

James Goulding
School of Computer Science and
Information Technology
University of Nottingham
Nottingham, United Kingdom

Paul A. Green
Driver Interface Group
Transportation Research Institute
University of Michigan
Ann Arbor, Michigan

Peter Gregor
School of Computing
University of Dundee
Dundee, Scotland

William M. Gibbons
Department of Human Factors
Bentley University
Waltham, Massachusetts

Jonathan Grudin
Microsoft Research
Redmond, Washington

Daniel V. Gunn
Microsoft Studios
Redmond, Washington

Kelly S. Hale
Design Interactive, Inc.
Oviedo, Florida

Gabriella M. Hancock
Department of Applied Physiology and
Kinesiology
University of Florida
Gainesville, Florida

Peter A. Hancock
Department of Psychology
and
Institute for Simulation and Training
University of Central Florida
Orlando, Florida

Vicki L. Hanson
School of Computing
University of Dundee
Dundee, Scotland

Caroline C. Hayes
Department of Mechanical
Engineering
University of Minnesota
Minneapolis/St. Paul, Minnesota

Ken Hinckley
Microsoft Research
Redmond, Washington

Jesse Hoey
School of Computer Science
University of Waterloo
Waterloo, Ontario, Canada

Eve Hoggar
Department of Computer Science
University of Helsinki
Helsinki, Finland

Karen Holtzblatt
InContext Design
Concord, Massachusetts

Kasper Hornbæk
Department of Computer Science
University of Copenhagen
Copenhagen, Denmark

Hiroshi Ishii
MIT Media Lab
Massachusetts Institute of Technology
Cambridge, Massachusetts

Hiroo Iwata
Graduate School of Systems and
Information Engineering
University of Tsukuba
Tsukuba, Japan

Julie A. Jacko
School of Public Health Division of
Environmental and Health Sciences
University of Minnesota
Minneapolis, Minnesota

Jhilmil Jain
Google
Mountain View, California

Anthony Jameson
DFKI, German Research Center for
Artificial Intelligence
Saarbrücken, Germany

Layne M. Johnson
Health Sciences Library and Institute
for Health Informatics
University of Minnesota
Minneapolis, Minnesota

Matthew Kam

Human–Computer Interaction Institute
Carnegie Mellon University
Pittsburgh, Pennsylvania

Clare-Marie Karat

Karat Consulting Group
Aptos, California

John Karat

Karat Consulting Group
Aptos, California

Kevin Keeker

Zynga, Inc.
San Francisco, California

David Kieras

Electrical Engineering and Computer
Science Department
University of Michigan
Ann Arbor, Michigan

Sandra Kogan

IBM Corporation
Cambridge, Massachusetts

Andrew Laghos

Department of Multimedia and
Graphic Arts
Cyprus University of Technology
Lemesos, Cyprus

Jennifer Lai

IBM T. J. Watson Research Center
Yorktown Heights, New York

Steven J. Landry

School of Industrial Engineering
Purdue University
West Lafayette, Indiana

Adam Larson

United States Air Force

Nicole Lazzaro

XEODesign, Inc.
Oakland, California

Chin Chin Lee

Center on Aging
University of Miami Miller School of
Medicine
Miami, Florida

V. Kathlene Leonard

Cloverture, LLC
Smyrna, Georgia

Ann Light

Communication and Computing
Research Centre
Sheffield Hallam University
Sheffield, United Kingdom

Wendy E. Mackay

INRIA Saclay
Orsay, France

Aaron Marcus

Aaron Marcus and Associates, Inc.
Berkeley, California

Gary Marsden

Department of Computer Science
University of Cape Town
Cape Town, South Africa

Deborah J. Mayhew

Deborah J. Mayhew & Associates
West Tisbury, Massachusetts

Molly A. McClellan

SimPORTAL Medical School
University of Minnesota
Minneapolis, Minnesota

Alexander Mertens

Institute of Industrial Engineering and
Ergonomics
RWTH Aachen University
Aachen, Germany

Michael J. Muller

IBM Research
Cambridge, Massachusetts

Alan F. Newell

School of Computing
University of Dundee
Dundee, Scotland

Heather Neyedli

Faculty of Kinesiology and Physical
Education
University of Toronto
Toronto, Ontario, Canada

Gary M. Olson

School of Information and Computer
Sciences
University of California
Irvine, California

Judith S. Olson

School of Information and Computer
Sciences
University of California
Irvine, California

Declan O'Sullivan

Department of Computer Science
Trinity College
Dublin, Ireland

Sharon Oviatt

Incaa Designs
Seattle, Washington

A. Ant Ozok

Department of Information
Systems
University of Maryland, Baltimore
County
Baltimore, Maryland

Randy J. Pagulayan

Microsoft Studios
Redmond, Washington

Stephen J. Payne

University of Manchester
Manchester, United Kingdom

Robert W. Proctor

Department of Psychological
Sciences
Purdue University
West Lafayette, Indiana

John Pruitt

Microsoft Corporation
Redmond, Washington

Graham Pullin

School of Computing
University of Dundee
Dundee, Scotland

Divya Ramachandran

Computer Science Division
and
Berkeley Institute of Design
University of California
Berkeley, California

Matthew Ray

Faculty of Kinesiology and Physical
Education
University of Toronto
Toronto, Ontario, Canada

Margaret Re

Visual Arts Department
University of Maryland, Baltimore
County
Baltimore, Maryland

Janice (Ginny) Redish
Redish & Associates, Inc.
Bethesda, Maryland

John T. Richards
IBM T. J. Watson Research
Center
Yorktown Heights, New York

Ramon L. Romero
Interactive Entertainment
Business
Microsoft Corporation
Redmond, Washington

Mary Beth Rosson
College of Information Sciences and
Technology
Pennsylvania State University
University Park, Pennsylvania

François Sainfort
School of Public Health
University of Minnesota
Minneapolis, Minnesota

Nithya Sambasivan
Department of Informatics
University of California
Irvine, California

Anthony Savidis
ICS-FORTH and Department of
Computer Science
University of Crete
Crete, Greece

Christopher M. Schlick
Institute of Industrial Engineering
and Ergonomics
RWTH Aachen University
Aachen, Germany
and

Fraunhofer-Institute for
Communication, Information
Processing, and Ergonomics
Wachtberg, Germany

Jan-Felix Schmakeit
School of Computer and Information
Science
University of South Australia
Adelaide, Australia

Dylan D. Schmorow
U.S. Navy
Arlington, Virginia

Kevin M. Schofield
Microsoft Research
Redmond, Washington

Ingrid U. Scott
Pennsylvania State College of Medicine
University Park, Pennsylvania

David Siegel
Dray and Associates, Inc.
Minneapolis, Minnesota

Daniel Siewiorek
Human–Computer Interaction Institute
Carnegie Mellon University
Pittsburgh, Pennsylvania

Asim Smailagic
Institute for Complex Engineered
Systems
Carnegie Mellon University
Pittsburgh, Pennsylvania

Michael J. Smith
Department of Industrial and Systems
Engineering
Center for Quality and Productivity
Improvement
University of Wisconsin
Madison, Wisconsin

Philip J. Smith
Cognitive Systems Engineering
Laboratory
The Ohio State University
Columbus, Ohio

Thomas Smyth
School of Interactive Computing
Georgia Institute of Technology
Atlanta, Georgia

Kay M. Stanney
Design Interactive, Inc.
Oviedo, Florida

Thad Starner
College of Computing
Georgia Institute of Technology
Atlanta, Georgia

Constantine Stephanidis
ICS-FORTH and Department of
Computer Science
University of Crete
Crete, Greece

Osamuyimen Stewart
IBM T. J. Watson Research Center
Yorktown Heights, New York

Marco Susani
Koz Susani Design
Chicago, Illinois

Alistair Sutcliffe
University of Manchester
Manchester, United Kingdom

James L. Szalma
Department of Psychology
University of Central Florida
Orlando, Florida

John C. Thomas
IBM T. J. Watson Research Center
Yorktown Heights, New York

Brygg Ullmer
Department of Computer Science
and
Center for Computation and
Technology
Louisiana State University
Baton Rouge, Louisiana

Darelle van Greunen
Department of Information Technology
School of Information Technology
Nelson Mandela University
Port Elizabeth, South Africa

Kim-Phuong L. Vu
Department of Psychology
California State University
Long Beach, California

Vincent Wade
School of Computer Science and
Statistics
Trinity College
Dublin, Ireland

Annalu Waller
School of Computing
University of Dundee
Dundee, Scotland

Suzanne Watzman
Watzman Information Design
Somerville, Massachusetts

Daniel J. Weeks
Department of Psychology
University of Lethbridge
Lethbridge, Alberta, Canada

Timothy N. Welsh
Faculty of Kinesiology and Physical
Education
University of Toronto
Toronto, Ontario, Canada

Daniel Wigdor

Department of Computer
Science
University of Toronto
Toronto, Ontario, Canada

Andrew D. Wilson

Microsoft Research
Redmond, Washington

Carsten Winkelholz

Fraunhofer-Institute for
Communication, Information
Processing and Ergonomics
Wachtberg, Germany

Niall Winters

London Knowledge Lab
Institute of Education
University of London
London, United Kingdom

Dennis Wixon

Startup Business Group
Microsoft Corporation
Redmond, Washington

Alan Woolrych

Department of Computing,
Engineering, and Technology
University of Sunderland
United Kingdom

Nicole Yankelovich

Open Wonderland Foundation
Weston, Massachusetts

Panayiotis Zaphiris

Department of Multimedia and
Graphic Arts
Cyprus University of
Technology
Limassol, Cyprus

Martina Ziefle

Communication Science
Human–Computer Interaction
Center
RWTH Aachen University
Aachen, Germany

Introduction

A Moving Target: The Evolution of Human–Computer Interaction

Jonathan Grudin

PREAMBLE: HISTORY IN A TIME OF RAPID OBSOLESCENCE

“What is a typewriter?” my six-year-old daughter asked. I hesitated. “Well, it’s like a computer,” I began.

WHY STUDY THE HISTORY OF HUMAN–COMPUTER INTERACTION?

A paper widely read 20 years ago concluded with the advice to design a word processor by analogy to something familiar to everyone: a typewriter. Even then, one of my Danish students questioned this reading assignment noting that “the typewriter is a species on its last legs.” For most of the computing era, interaction involved 80-column punch cards, paper tape, line editors, 1920-character displays, 1-megabyte diskettes, and other extinct species. Are the interaction issues of those times relevant today? No.

Of course, aspects of the human side of human–computer interaction (HCI) change very slowly if at all. Much of what was learned about our perceptual, cognitive, social, and emotional processes when we interacted with older technologies applies to our interaction with emerging technologies as well. Aspects of how we organize and retrieve information persist, even as the specific technologies that we use change. The handbook chapters lay out relevant knowledge of human psychology; how and when that was acquired may not be critical and is not the focus here.

Nevertheless, there is a case for understanding the field’s history, and the rapid pace of change may strengthen it:

- Several disciplines are engaged in HCI research and application, but few people are exposed to more than one. By seeing how each has evolved, we can identify possible benefits of expanding our focus and obstacles to doing so.
- Celebrating the accomplishments of past visionaries and innovators is part of building a community and inspiring future contributors, even when some past achievements are difficult to appreciate today.
- Some visions and prototypes were quickly converted to widespread application, whereas others took decades and some remain unrealized to this day. By

understanding the reasons for different outcomes, we can assess today’s visions more realistically.

- Crystal balls are notoriously unreliable, but anyone planning or managing a career in a rapidly changing field must consider the future. Our best chance to anticipate change is to find trajectories that extend from the past to the present. One thing is certain: The future will not resemble the present.

This account does not emphasize engineering “firsts.” It focuses on technologies and practices as they became widely used, reflected in the spread of systems and applications. This was often paralleled by the formation of new research fields and changes in existing disciplines, which were marked by the creation and evolution of professional associations and publications. More a social history than a conceptual history, this survey points to trends and trajectories you might download into your crystal balls.

A historical account is a perspective. It emphasizes some things while de-emphasizing or omitting others. A history can be wrong in details, but is never right in any final sense. Your questions and your interests will determine how useful a perspective is to you. This introduction covers several disciplines, but the disciplines of Communication, Design, and Marketing receive less attention than another account might provide.

A blueprint for intellectual histories of HCI was established by Ron Baecker in the opening chapters of the 1987 and 1995 editions of *Readings in Human–Computer Interaction*. It was followed in Richard Pew’s chapter in the 2003 version of this handbook. Brian Shackel’s (1997) account of European contributions and specialized essays by Brad Myers (1998) on HCI engineering history and Alan Blackwell (2006) on the history of metaphor in design provide further insights and references. Perlman, Green, and Wogalter (1995) is a compendium of early HCI papers that appeared in the Human Factors literature. Research on HCI within Information Systems is covered by Banker and Kaufmann (2004) and Zhang et al. (2009). Rayward (1983, 1998) and Burke (1994, 2007) review the predigital history of information science; Burke (1998) provides a focused study of an early digital effort in this field.

In recent years many popular books covering the history of personal computing have been published (e.g., Hiltzik 1999;

Bardini 2000; Hertzfeld 2005; Markoff 2005; Moggridge 2007). This introduction extends my contribution to the previous handbook. It includes new research and draws on *Timelines* columns that have appeared in *ACM Interactions* since March 2006.

Few of the aforementioned writers are trained historians. Many lived through much of the computing era as participants and witnesses, yielding rich insights and questionable objectivity. This account draws on extensive literature and hundreds of formal interviews and discussions, but everyone has biases. Personal experiences that illustrate points can enliven an account by conveying human consequences of changes that otherwise appear abstract or distant. Some readers enjoy anecdotes, whereas others find them irritating. I try to satisfy both groups by including personal examples in a short Appendix, akin to “deleted scenes” on a DVD.

Recent years have also seen the appearance of high-quality, freely accessed digital reproductions of some early works. My references include links to several such works. The reproductions do not always preserve the original pagination, but quoted passages can be found with a search tool. Finally, all prices and costs have been converted to U.S. dollars as of 2010.

DEFINITIONS: HCI, CHI, HF&E, IT, IS, LIS

The most significant term, HCI (human–computer interaction), is defined very broadly to cover major threads of research in four disciplines: (1) Human Factors/Ergonomics (HF or HF&E), (2) Information Systems (IS), (3) Computer Science (CS), and (4) Library and Information Science (LIS). The relevant literatures are difficult to explore because they differ in the use of simple terms. This is discussed later. Here I explain how several key disciplinary labels are used. CHI (Computer-Human Interaction) has a narrower focus, associated mainly with Computer Science, the Association for Computing Machinery Special Interest Group (ACM SIGCHI), and the latter’s annual CHI conference. I use human factors and ergonomics interchangeably and refer to the discipline as HF&E—the Human Factors Society (HFS) became the Human Factors and Ergonomics Society (HFES) in 1992. (Some writers define ergonomics more narrowly around hardware.) Information Systems (IS) refers to the management discipline that has also been labeled Data Processing (DP) and Management Information Systems (MIS). I follow common parlance in referring to organizational information systems specialists as IT professionals or IT pros. With IS taken, I do not abbreviate Information Science. LIS (Library and Information Science) represents an old field with a new digital incarnation that includes important HCI research. Increasingly this discipline goes by simply “Information,” as in newly christened Schools of Information.

HUMAN-TOOL INTERACTION AND INFORMATION PROCESSING AT THE DAWN OF THE COMPUTING ERA

In the century prior to the advent of the first digital computers, advances in technology gave rise to two fields of research that later contributed to HCI: One focused on making the human

use of tools more efficient, whereas the other focused on ways to represent and distribute information more effectively.

ORIGIN OF HUMAN FACTORS

Frederick Taylor (1911) employed technologies and methods developed in the late nineteenth century—photography, moving pictures, and statistical analysis—to improve work practices by reducing performance time. Time and motion studies were applied to assembly-line manufacturing and other manual tasks. Despite the uneasiness with “Taylorism” reflected in Charlie Chaplin’s popular satire *Modern Times*, scientists and engineers strove to boost efficiency and productivity using this approach.

Lillian Gilbreth (1914) and her husband Frank were the first engineers to combine psychology and scientific management. Lillian Gilbreth focused more holistically than Taylor on efficiency and worker experience; she is regarded by some as the founder of modern Human Factors. Her PhD was the first awarded in industrial psychology. She went on to advise five U.S. presidents and became the first woman inducted into the National Academy of Engineering.

World War I and World War II accelerated efforts to match people to jobs, train them, and design equipment that could be more easily mastered. Engineering psychology was born during World War II after simple flaws in the design of aircraft controls (Roscoe 1997) and escape hatches (Dyson 1979) led to aircraft losses and thousands of casualties. Two legacies of World War II were respect for the potential of computing, based on its use in code breaking, and an enduring interest in behavioral requirements for design.

During the war, aviation engineers, psychologists, and physicians formed the Aeromedical Engineering Association. After the war, the terms “human engineering,” “human factors,” and “ergonomics” came into use, the latter primarily in Europe. For more on this history, see Roscoe (1997), Meister (1999), and HFES (2010).

Early tool use, whether by assembly-line workers or pilots, was not discretionary. If training was necessary, people were trained. One research goal was to reduce training time, but a more important goal was to increase the speed and reliability of skilled performance.

ORIGIN OF THE FOCUS ON INFORMATION

H. G. Wells, known for writing science fiction, campaigned for decades to improve society through information dissemination. In 1905, he outlined a system that might be built using another new technology of the era: index cards!

These index cards might conceivably be transparent and so contrived as to give a photographic copy promptly whenever it was needed, and they could have an attachment into which would slip a ticket bearing the name of the locality in which the individual was last reported. A little army of attendants would be at work on this index day and night.... An incessant stream of information would come of births, of deaths, of arrivals at inns, of applications to post offices for letters,

of tickets taken for long journeys, of criminal convictions, marriages, applications for public doles, and the like. A filter of offices would sort the stream, and all day and all night forever a swarm of clerks would go to and fro correcting this central register and photographing copies of its entries for transmission to the subordinate local stations in response to their inquiries....

Would such a human-powered “Web 2.0” be a tool for social control or public information access? The image evokes the potential, and also the challenges, of the information era that is taking shape around us now, a century later.

In the late nineteenth century, technologies and practices for compressing, distributing, and organizing information bloomed. Index cards, folders, and filing cabinets—models for icons on computer displays much later—were important inventions that influenced the management of information and organizations in the early twentieth century (Yates 1989). Typewriters and carbon paper facilitated information dissemination, as did the mimeograph machine, patented by Thomas Edison. Hollerith cards and electromechanical tabulation, celebrated steps toward computing, were heavily used to process information in industry.

Photography was used to record information as well as behavior. For almost a century, microfilm was the most efficient way to compress, duplicate, and disseminate large amounts of information. Paul Otlet, Vannevar Bush, and other microfilm advocates played a major role in shaping the future of information technology.

As the cost of paper, printing, and transportation dropped in the late nineteenth and early twentieth centuries, information dissemination and the profession of librarianship grew explosively. Library associations were formed. The Dewey Decimal and Library of Congress classification systems were developed. Thousands of relatively poorly-funded public libraries sprang up to serve local demand in the United States. In Europe, government-funded libraries were established to serve scientists and other specialists in medicine and the humanities. This difference led to different approaches to technology development on either side of the Atlantic.

In the United States, library management and the training of thousands of librarians took precedence over technology development and the needs of specialists. Public libraries adopted the simple but inflexible Dewey Decimal Classification System. The pragmatic focus of libraries and emerging library schools meant that research into technology was in the province of industry. Research into indexing, cataloging, and information retrieval was variously referred to as bibliography, documentation, and documentalism.

In contrast, the well-funded European special libraries elicited sophisticated reader demands and pressure for libraries to share resources, which promoted interest in technology and information management. The Belgian Paul Otlet obtained Melvyn Dewey’s permission to create an extended version of the Dewey Decimal System that supported what we would today call hypertext links. Otlet had to agree not to implement his “universal decimal classification” (UDC) in English for a time, an early example of a

legal constraint on technology development. UDC is still in use in some places.

In 1926, the Carnegie Foundation dropped a bombshell: It endowed the Graduate Library School (GLS) at the University of Chicago to focus solely on research. For two decades, University of Chicago was the only university granting PhDs in library studies. GLS positioned itself in the humanities and social sciences, with research into the history of publishing, typography, and other topics (Buckland 1998). *An Introduction to Library Science*, the dominant library research textbook for 40 years, was written at Chicago (Butler 1933). *It did not mention information technology at all.* Library science was shaped by the prestigious GLS program until well into the computer era, and human–tool interaction was not among its major concerns. Documentalists, researchers who focused on technology, were concentrated in industry and government agencies.

Burke (2007, p. 15) summarized the early history with its emphasis on training librarians and other specialists: “Most information professionals ... were focusing on providing information to specialists as quickly as possible. The terms used by contemporary specialists appeared to be satisfactory for many indexing tasks and there seemed no need for systems based on comprehensive and intellectually pleasing classification schemes. The goal of creating tools useful to nonspecialists was, at best, of secondary importance.”

My account emphasizes when computer technologies came into what might be called “nonspecialist use.” The early history of information management is significant, however, because the Web and declining digital storage costs have made it evident that everyone will soon become their own information managers, just as we are all now telephone operators. But I am getting ahead of our story. This section concludes with accounts of two individuals who, in different ways, shaped the history of information research and development.

Paul Otlet and the Mundaneum

Like his contemporary H.G. Wells, Otlet envisioned a vast network of information. But unlike Wells, Otlet and his collaborators built one. Otlet established a commercial research service around facts that he had been cataloging on index cards since the late nineteenth century. In 1919, the Belgian government financed the effort, which moved to a record center called the Mundaneum. By 1934, 15 million index cards and millions of images were organized using UDC, whose formula enabled the linking of items. Curtailed by the Depression and damaged during World War II, the work was largely forgotten. It was not cited by developers of the metaphorically identical Xerox NoteCards, an influential hypertext system of the 1980s.

Technological innovation continued in Europe with the development of mechanical systems of remarkable ingenuity (Buckland 2009). Features included the use of photoreceptors to detect light passing through holes in index cards positioned to represent different terms, enabling rapid retrieval of items on specific topics. These innovations inspired a well-known American scientist and research manager to go ahead with his endeavors.

Vannevar Bush and Microfilm Machines

Massachusetts Institute of Technology (MIT) professor Vannevar Bush was one of the most influential scientists in American history. He advised Presidents Franklin Roosevelt and Harry Truman, served as director of the Office of Scientific Research and Development, and was president of the Carnegie Institute.

Bush is remembered today for “As We May Think,” his 1945 *Atlantic Monthly* essay. It described the MEMEX, a hypothetical microfilm-based electromechanical information-processing machine. The MEMEX was to be a personal workstation that enabled a professional to quickly index and retrieve documents or pictures and create hypertext-like associations among them. The essay, excerpted later in this section, inspired computer engineers and computer scientists who made major contributions to HCI in the 1960s and beyond.

Not so well known is that Bush wrote the core of his essay in the early 1930s. Then, shrouded in secrecy he spent two decades and unprecedented resources on the design and construction of several machines that comprised a subset of MEMEX features. None were successful. The details are recounted in Colin Burke’s (1994) comprehensive book *Information and Secrecy: Vannevar Bush, Ultra, and the Other Memex*.

Microfilm—photographic miniaturization—had qualities that attracted Bush, as they had Otlet. Microfilm was light, could be easily transported, and was as easy to duplicate as paper records (Xerox photocopiers did not appear until 1959). The cost of handling film was brought down by technology created for the moving picture industry. Barcodelike patterns of small holes could be punched on a film and read very quickly by passing the film between light beams and photoreceptors. Microfilm was tremendously efficient as a storage medium. Memory based on relays or vacuum tubes would never be competitive, and magnetic memory, when it eventually arrived, was less versatile and far more expensive. It is easy today to overlook the compelling case that existed for basing information systems on microfilm.

Bush’s machines failed because he set overly ambitious compression and speed goals, ignored patent ownership issues, and most relevant to our account, was unaware of what librarians and documentalists had learned through decades of work on classification systems. American documentalists were active, although not well funded in their work. In 1937, the American Documentation Institute (ADI) was formed, predecessor of present-day American Society for Information Science and Technology (ASIST). Had he worked with them, Bush, an electrical engineer by training, might have avoided the fatal assumption that small sets of useful indexing terms could easily be defined and agreed upon. Metadata design is still a research challenge.

At times Bush considered libraries and the public as potential users, but his machines cost far too much for library patrons to be plausible users. He began with the Federal Bureau of Investigation (FBI) in mind and focused on military uses of cryptography and information retrieval, and a major project

was for the Central Intelligence Agency (CIA). Despite the classified nature of this work, through his academic and government positions, his writings, the vast resources he commandeered, and the scores of brilliant engineers he enlisted to work on microfilm projects, Bush promoted his vision and exerted influence for two decades, well into the computer era.

Bush’s vision emphasized both associative linking of information sources and discretionary use: Associative indexing, the basic idea of which is a provision whereby any item may be caused at will to select immediately and automatically another. This is the essential feature of the MEMEX.... Any item can be joined into numerous trails.... New forms of encyclopedias will appear, ready-made with a mesh of associative trails [which a user could extend].....

The lawyer has at his touch the associated opinions and decisions of his whole experience and of the experience of friends and authorities. The patent attorney has on call the millions of issued patents, with familiar trails to every point of his client’s interest. The physician, puzzled by a patient’s reactions, strikes the trail established in studying an earlier similar case and runs rapidly through analogous case histories, with side references to the classics for the pertinent anatomy and histology. The chemist, struggling with the synthesis of an organic compound, has all the chemical literature before him in his laboratory, with trails following the analogies of compounds and side trails to their physical and chemical behavior.

The historian, with a vast chronological account of a people, parallels it with a skip trail which stops only on the salient items, and can follow at any time contemporary trails which lead him all over civilization at a particular epoch. There is a new profession of trail blazers, those who find delight in the task of establishing useful trails through the enormous mass of the common record. (Bush 1945).

Bush knew that the MEMEX was not realistic. None of his many projects included designs for the “essential” associative linking. His inspirational account nicely describes present-day hands-on discretionary use of computers by professionals. But that would arrive 50 years later, built on technologies then undreamt of. Bush did not support the early use of computers, which were slow, bulky, and expensive. Computers were clearly inferior to microfilm.

1945–1955: MANAGING VACUUM TUBES

World War II changed everything. Prior to the war, government funding of research was minimal and primarily managed by the Department of Agriculture. The unprecedented investment in science and technology during the war years revealed that huge sums could be found—for academic or industrial research that addressed national goals. Research expectations and strategies would never again be the same.

Sophisticated electronic computation machines built before and during World War II were designed for specific purposes, such as solving equations or breaking codes. Each of the extremely expensive cryptographic machines that helped win the war was designed to attack a specific encryption

device. A new one was needed whenever the enemy changed machines. These limitations spurred interest in general-purpose computational devices. Wartime improvements in technologies such as vacuum tubes made them more feasible, and their deployment brought HCI into the foreground.

When engineers and mathematicians emerged from military and government laboratories (and secret project rooms on university campuses), the public became aware of some of the breakthroughs. Development of ENIAC, arguably the first general-purpose computer, was begun in secret during the war but announced publicly as a “giant brain” only when it was completed in 1946. (Its first use, for calculations supporting hydrogen bomb development, was not publicized.) Accounts of the dimensions of ENIAC vary, but it stood 8–10-feet high, occupied about 1800 square feet, and consumed as much energy as a small town. It provided far less computation and memory than what can be acquired today for a few dollars, slipped into a pocket, and powered with a small battery.

Memory was inordinately expensive. Even the largest computers of the time had little memory, so they were used for computation and not for symbolic representation or information processing. Reducing operator burden was a key HCI focus, including replacing or resetting vacuum tubes more quickly, loading stored-program computers from tape rather than by manually attaching cables, and setting switches. Following “knobs and dials” human factors improvements, one computer operator could accomplish work that had previously required a team.

Libraries installed simple microfilm readers to assist the retrieval of information as publication of scholarly and popular material soared. Beyond that, library and library school involvement with technology was limited, even as the foundation for information science came into place. The war had forged alliances among the documentalists, electrical engineers, and mathematicians interested in communication and information management. Vannevar Bush’s collaborators who were involved in this effort included Claude Shannon and Warren Weaver, coauthors in 1949 of the seminal work on information theory (called communication theory at that time). Prominent American documentalist Ralph Shaw joined Bush’s efforts. Library schools continued to focus on librarianship, social science, and historical research. The GLS orientation still dominated the field. If anything the split was greater: In the 1930s, the technology-oriented ADI had included librarians and support for systems that spanned the humanities and sciences; with the coming of the war and continuing after it, ADI’s concerns became those of government and Big Science.

THREE ROLES IN EARLY COMPUTING

Early computer projects employed people in the following roles: managers, programmers, and operators. Managers oversaw the design, development, and operation of projects. They specified the programs to be written and distributed the output. Scientists and engineers wrote the programs, working with mathematically adept programmers who decomposed a

task into components that the computer could manage (for ENIAC, this was a team of six women). A small army of operators was needed. Once written, a program could take days to load by setting switches, dials, and cable connections. Despite innovations that boosted reliability, including operating vacuum tubes at lower power than normal and providing visible indicators of their failure, ENIAC was often stopped to locate and replace failed tubes. Vacuum tubes were reportedly wheeled around in shopping carts.

Eventually, each occupation—computer operation, management and systems analysis, and programming—became a major focus of HCI research, centered respectively in human factors, information systems, and computer science. Computers and our interaction with them evolved, but our research spectrum still reflects aspects of this early division of labor.

Grace Hopper: Liberating Computer Users

As computers became more reliable and capable, programming became a central activity. Computer languages, compilers, and constructs such as subroutines facilitated “programmer–computer interaction.” Grace Hopper was a pioneer in these areas. She described her goal as freeing mathematicians to do mathematics (Hopper 1952; see also Sammet 1992). This is echoed in today’s usability goal of freeing users to do their work. HCI professionals often argue that they are marginalized by software developers; in much the same way, Hopper’s accomplishments have arguably been undervalued by theoretical computer scientists.

1955–1965: TRANSISTORS, NEW VISTAS

Early forecasts that the world would need few computers reflected the limitations of vacuum tubes. Solid-state computers, which first became available commercially in 1958, changed this. Computers were still used primarily for scientific and engineering tasks, but they were reliable enough not to require a staff of computer engineers. The less computersavvy operators who oversaw them needed better interfaces. And although computers were too expensive and limited to be widely used, the potential of transistor-based computing was evident. Some researchers envisioned possibilities that were previously unimaginable.

Another major force was reaction to the then Soviet Union’s launch of the Sputnik satellite in October 1957. This was a challenge to the West to invest in science and technology; becoming part of the response was a way to tie a research program to the national interest, which World War II had revealed to be so effective.

SUPPORTING OPERATORS: THE FIRST SYSTEMATIC HUMAN–COMPUTER INTERACTION RESEARCH

In the beginning, the computer was so costly that it had to be kept gainfully occupied for every second; people were almost slaves to feed it.

Brian Shackel (1997, p. 97)

Almost all computer use of this period involved programs and data that were read in from cards or tape. Programs then ran without interruption until they terminated, producing printed, punched, or tape output along the way. This “batch processing” restricted human interaction to basic operation, programming, and use of the output. Of these, only computer operation, the least intellectually challenging and lowest-paying job, involved hands-on computer use.

Computer operators loaded and unloaded cards and magnetic or paper tapes, set switches, pushed buttons, read lights, loaded and burst printer paper, and put printouts into distribution bins. Operators interacted directly with the system via a teletype: Typed commands interleaved with computer responses and status messages were printed on paper that scrolled up one line at a time. Eventually, they yielded to “glass tty’s” (glass teletypes), also called cathode-ray tubes (CRTs) and visual display units/terminals (VDUs/VDTs). For many years, these displays also scrolled commands and computer responses one line at a time. The price of a monochrome terminal that could display alphanumeric characters was equivalent to US\$50,000 today—expensive, but only a small fraction of the cost of the computer. A large computer might have one or more consoles. Programmers did not use the interactive consoles. Programs were typically written on paper and keypunched onto cards or tape.

Improving the design of buttons, switches, and displays was a natural extension of human factors. Experts in HF&E authored the first HCI papers. In 1959 British researcher Brian Shackel published “Ergonomics for a Computer,” followed in 1962 by “Ergonomics in the Design of a Large Digital Computer Console.” These described console redesign for analog and digital computers called the EMiac and EMIdec 2400. Shackel (1997) described the latter as the largest computer of the time.

In the United States, American aviation psychologists created the Human Engineering Society in 1956, which was focused on skilled performance including improving efficiency, reducing errors, and training. The next year it adopted the more elegant title Human Factors Society and in 1958 it initiated the journal *Human Factors*. Sid Smith’s (1963) “Man–Computer Information Transfer” marked the start of his long career with the human factors of computing.

VISIONS AND DEMONSTRATIONS

As transistors replaced vacuum tubes, a wave of imaginative writing, conceptual innovation, and prototype building swept through the research community. Some of the language is dated, notably the use of male generics, but many of the key concepts resonate even today.

J.C.R. Licklider at Bolt Beranek and Newman and Advanced Research Projects Agency

Licklider, a psychologist, played a dual role in the development of this field. He wrote influential essays and backed important research projects as a manager at Bolt Beranek and Newman (BBN) from 1957 to 1962 and as director of

the Information-Processing Techniques Office (IPTO) of the Department of Defense Advanced Research Projects Agency (called ARPA and DARPA at different times) from 1962 to 1964.

BBN employed dozens of influential researchers on computer-related projects funded by the government, including John Seely Brown, Richard Pew, and many MIT faculty members such as John McCarthy, Marvin Minsky, and Licklider himself. Funding by IPTO was crucial in creating computer science departments and establishing artificial intelligence (AI) as a discipline in the 1960s. It is best known for a Licklider project that created the forerunner of the Internet called the ARPANET.

In 1960, Licklider outlined a vision he called *man-machine symbiosis*: “There are many man–machine systems. At present, however, there are no man–computer symbioses—answers are needed.” The computer was “a fast information-retrieval and data-processing machine” destined to play a larger role: “One of the main aims of man–computer symbiosis is to bring the computing machine effectively into the formulative parts of technical problems” (pp. 4–5).

This required rapid, real-time interaction, which batch systems did not support. In 1962, Licklider and Wes Clark outlined the requirements of a system for “online man–computer communication.” They identified capabilities that they felt were ripe for development: time-sharing of a computer among many users; electronic input–output surfaces to display and communicate symbolic and pictorial information; interactive, real-time support for programming and information processing; large-scale information storage and retrieval systems; and facilitation of human cooperation. They foresaw that other desirable technologies, such as speech recognition and natural language understanding, would be very difficult to achieve.

In a 1963 memorandum that cleverly tied computing to the emerging post-Sputnik space program, Licklider addressed his colleagues as “the members and affiliates of the Intergalactic Computer Network” and identified many features of a future Internet (Licklider 1963). His 1965 book *Libraries of the Future* expanded this vision. Licklider’s role in advancing computer science and HCI is detailed by Waldrop (2001).

John McCarthy, Christopher Strachey, and Wesley Clark

McCarthy and Strachey worked out details of time-sharing, which made interactive computing possible (Fano and Corbato 1966). Apart from a few researchers who had access to computers built with no-expenses-spared military funding, computer use was too expensive to support exclusive individual access. Time-sharing allowed several (and later dozens) simultaneous users to work at terminals. Languages were developed to facilitate the control and programming of time-sharing systems (e.g., JOSS in 1964).

Clark was instrumental in building the TX-0 and TX-2 at MIT’s Lincoln Laboratory to demonstrate time-sharing and other innovative concepts. These machines, which cost on the order of US\$10 million, helped establish the Boston area as a center for computer research. The TX-2 was the

most powerful and capable computer in the world at the time. It was much less powerful and capable than a present-day smartphone. Clark and Ivan Sutherland discussed this era in a CHI'05 panel, which is accessible online (Buxton 2006).

Ivan Sutherland and Computer Graphics

Sutherland's 1963 PhD thesis may be the most influential document in the history of HCI. His Sketchpad system, built on TX-2 to make computers "more approachable," launched computer graphics, which would have a decisive impact on HCI 20 years later. A nice version restored by Alan Blackwell and Kerry Rodden is available (<http://www.cl.cam.ac.uk/TechReports/UCAM-CL-TR-574.pdf>).

Sutherland demonstrated iconic representations of software constraints, object-oriented programming concepts, and the copying, moving, and deleting of hierarchically organized objects. He explored novel interaction techniques, such as picture construction using a light pen. He facilitated visualization by separating the coordinate system used to define a picture from the one used to display it, and demonstrated animated graphics, noting the potential for digitally rendered cartoons 20 years before *Toy Story*. His frank descriptions enabled others to make rapid progress in the field—when engineers found Sketchpad too limited for computer-assisted design (CAD), he called the trial a "big flop" and indicated why.

In 1964, with his PhD behind him, Sutherland succeeded Licklider as the director of IPTO. Among those he funded was Douglas Engelbart at the Stanford Research Institute (SRI).

Douglas Engelbart: Augmenting Human Intellect

In 1962, Engelbart published "Augmenting Human Intellect: A Conceptual Framework." Over the next several years he built systems that made astonishing strides toward realizing this vision. He also supported and inspired engineers and programmers who went on to make major independent contributions.

Echoing Bush and Licklider, Engelbart saw the potential for computers to become congenial tools that people would choose to use interactively:

By 'augmenting human intellect' we mean increasing the capability of a man to approach a complex problem situation, to gain comprehension to suit his particular needs, and to derive solutions to problems.... By 'complex situations' we include the professional problems of diplomats, executives, social scientists, life scientists, physical scientists, attorneys, designers.... We refer to a way of life in an integrated domain where hunches, cut-and-try, intangibles, and the human 'feel for a situation' usefully coexist with powerful concepts, streamlined terminology and notation, sophisticated methods, and high-powered electronic aids.

(Engelbart 1962, p. 1)

Engelbart used ARPA funding to rapidly develop and integrate an extraordinary set of prototype applications into his NLS system. In doing so, he conceptualized and implemented the foundations of word processing, invented or refined input devices including the mouse and the multikey control box, and made use of multidisplay environments that

integrated text, graphics, and video in windows. These unparalleled advances were demonstrated in a sensational 90-minute live event at the 1968 Fall Joint Computer Conference in San Francisco, California (<http://sloan.stanford.edu/MouseSite/1968Demo.html>). The focal point for interactive systems research in the United States was moving from the East Coast to the West Coast.

Engelbart, an engineer, supported human factors testing to improve efficiency and reduce errors in skilled use, focusing on effects of fatigue and stress. Engelbart's systems required training. He felt that people should be willing to tackle a difficult interface if it delivered great power once mastered. Unfortunately, the lack of concern for initial usability was a factor in Engelbart's loss of funding. His demonstration became something of a success disaster: DARPA was impressed and installed NLS, but found it too difficult to use (Bardini 2000). Years later, the question "Is it more important to optimize for skilled use or initial use?" was widely debated, and still occasionally surfaces in HCI discussions.

Ted Nelson's Vision of Interconnectedness

In 1960, Ted Nelson, a graduate student in sociology who coined the term hypertext, founded Project Xanadu. The goal was an easily used computer network. In 1965, he published a paper titled "A File Structure for the Complex, the Changing and the Indeterminate." Nelson continued to write stirring calls for systems to democratize computing through a highly interconnected, extensible network of digital objects (e.g., Nelson 1973). Xanadu was never fully realized. Nelson did not consider the early World Wide Web to be an adequate realization of his vision, but lightweight technologies such as weblogs, wikis, collaborative tagging, and search enable many of the activities he envisioned.

Later, Nelson (1996) foresaw intellectual property issues arising in digital domains and coined the term "micropayment." Although his solutions were again not fully implemented, they drew attention to important issues.

FROM DOCUMENTATION TO INFORMATION SCIENCE

The late 1950s saw the last major investments in microfilm and other predigital systems. The most ambitious were military and intelligence systems, including Vannevar Bush's final efforts (Burke 1994). Documentalists began to see that declining memory costs would enable computation engines to become information-processing machines. The conceptual evolution was relatively continuous, but at the institutional level change could come swiftly. New professions—mathematicians and engineers—were engaged in technology development, new initiatives were launched that still bore few ties to contemporary librarianship or the humanities orientation of library schools. A new banner was needed.

Merriam Webster dates the term information science to 1960. Conferences held at Georgia Institute of Technology in 1961 are credited with shifting the focus from information as a technology to information as an incipient science. In 1963, chemist-turned-documentalist Jason Farradane taught the

first information science courses at City University, London, United Kingdom. The profession of chemistry had long invested in organizing its literature systematically, and another chemist-turned-documentalist Allen Kent was at the center of a major information science initiative at the University of Pittsburgh (Aspray 1999). In the early 1960s, Anthony Debons, a psychologist and friend of Licklider, organized a series of NATO-sponsored congresses at Pittsburgh. Guided by Douglas Engelbart, these meetings centered on people and on how technology could augment their activities. In 1964 the Graduate Library School at the University of Pittsburgh became the Graduate School of Library and Information Sciences, and Georgia Tech formed a School of Information Science initially with one full-time faculty member.

CONCLUSION: VISIONS, DEMOS, AND WIDESPREAD USE

Progress in HCI can be understood in terms of inspiring visions, conceptual advances that enable aspects of the visions to be demonstrated in working prototypes, and the evolution of design and application. The engine, enabling visions to be realized and soon thereafter to be widely deployed, was the relentless hardware advance that produced devices that were millions of times more powerful than the much more expensive systems designed and used by the pioneers.

At the conceptual level, much of the basic foundation for today's graphical user interfaces (GUIs) was in place by 1965. However, at that time it required individual use of a US\$10-million custom-built machine. Pew (2003, p. 3) describes the 1960 Digital Equipment Corporation (DEC) PDP-1 as a breakthrough, "truly a computer with which an individual could interact." The PDP-1 came with a CRT display, keyboard, light pen, and paper tape reader. It cost about US\$1 million and had the capacity that a Radio Shack TRS 80 had 20 years later. It required considerable technical and programming support. Even the PDP-1 could only be used by a few fortunate researchers.

Licklider's man-computer symbiosis, Engelbart's augmenting human intellect, and Nelson's "conceptual framework for man-machine everything" described a world that did not exist. It was a world in which attorneys, doctors, chemists, and designers chose to become hands-on users of computers. For some time to come, the reality would be that most hands-on users were computer operators engaged in routine, nondiscretionary tasks. As for the visions, 40 years later some of the capabilities are taken for granted, some are just being realized, and others remain elusive.

1965–1980: HUMAN-COMPUTER INTERACTION PRIOR TO PERSONAL COMPUTING

Control Data Corporation launched the transistor-based 6000 series computer in 1964. In 1965, commercial computers based on integrated circuits arrived with the IBM System/360. These powerful systems, later called mainframes to distinguish them from minicomputers, firmly established computing in the business realm. Each of the three computing

roles—operation, management, and programming—became a significant profession.

Operators still interacted directly with computers for routine maintenance and operation, and as time-sharing developed, hands-on use expanded to include data entry and other repetitive tasks. Managers and systems analysts oversaw hardware acquisition, software development, operation, and the use of output. They were usually not hands-on users, although people who relied on printed output and reports did call themselves "computer users."

Apart from those working in research settings, few programmers were direct users until late in this period. Many prepared flowcharts and wrote programs on paper forms. Keypunch operators then punched the program instructions onto cards, which were sent to computer centers for computer operators to load into the computer and run. Printouts and other output were picked up later. Many programmers used computers directly when they could, but the cost generally dictated more efficient division of labor.

We are focusing on broad trends. Business computing took off in the mid-1960s, although the 1951 LEO I was probably the first commercial business computer. This interesting venture, which ended with the arrival of the mainframe era, is detailed in Wikipedia (under 'LEO computer') and the books and articles referenced there.

HUMAN FACTORS AND ERGONOMICS EMBRACE COMPUTER OPERATION

In 1970, Brian Shackel founded the Human Sciences and Advanced Technology (HUSAT) center at Loughborough University in Leicestershire, the United Kingdom, which is devoted to ergonomics research that emphasizes HCI. Sid Smith and other human factors engineers worked on input and output issues, such as the representation of information on displays (e.g., Smith, Farquhar, and Thomas 1965) and computer-generated speech (Smith and Goodwin 1970). The Computer Systems Technical Group (CSTG) of the HFS was formed in 1972, and soon it was the largest technical group in the society.

The general *Human Factors* journal was joined in 1969 by the computer-focused *International Journal of Man-Machine Studies (IJMMS)*. The first widely read HCI book was James Martin's (1973) *Design of Man-Computer Dialogues*. Martin's comprehensive survey of interfaces for operation and data entry began with an arresting opening chapter that described a world in transition. Extrapolating from declining hardware prices, he wrote, "The terminal or console operator, instead of being a peripheral consideration, will become the tail that wags the whole dog.... The computer industry will be forced to become increasingly concerned with the usage of people, rather than with the computer's intestines" (pp. 3–4).

In the mid-1970s, U.S. government agencies responsible for agriculture and social security initiated large-scale data-processing system projects, described by Pew (2003). Although not successful, these efforts led to methodological innovations in the use of style guides, usability laboratories, prototyping, and task analysis.

In 1980, three significant HF&E books were published: two on VDT design (Cakir, Hart, and Stewart 1980; Grandjean and Vigliani 1980) and one general guideline (Damodaran, Simpson, and Wilson 1980). Drafts of a German work on VDT standards, made public in 1981, provided an economic incentive to design for human capabilities by threatening to ban noncompliant products. Later in the same year, a corresponding American National Standards Institute standards group for “office and text systems” was formed.

INFORMATION SYSTEMS (IS) ADDRESSES THE MANAGEMENT OF COMPUTING

Companies acquired expensive business computers to address major organizational concerns. Even when the principal concern was simply to appear modern (Greenbaum 1979), the desire to show benefits from a multimillion dollar investment could chain managers to a computer almost as tightly as were the operator and data entry “slaves.” In addition to being expected to make use of output, they might encounter resistance to system acceptance.

Beginning in 1967, the journal *Management Science* published a column titled “Information Systems in Management Science.” Early definitions of IS included “an integrated man-machine system for providing information to support the operation, management, and decision-making functions in an organization” (Davis 1974) and “the effective design, delivery, and use of information systems in organizations” (Keen 1980 quoted in Zhang, Nah, and Preece 2004). In 1968, an MIS center and degree program was established at Minnesota. It initiated several influential research streams and in 1977 launched *MIS Quarterly*, the leading journal in the field. The MIS field juxtaposed a focus on specific tasks in organizational settings with demands for general theory and precise measurement, a challenging combination.

A historical survey (Banker and Kaufmann 2004) identifies HCI as one of five major IS research streams and dates it back to Ackoff’s (1967) paper describing challenges in handling computer-generated information. There was some research into hands-on operator issues such as data entry and error messages, but for a decade most HCI work in IS dealt with the users of information, typically managers. Research included the design of printed reports, but the drive for theory led to a strong focus on cognitive styles: individual differences in how people (notably managers) perceive and process information. Articles on HCI were published in the human factors-oriented *IJMMS* as well as management journals.

Sociotechnical approaches to system design (Mumford 1971, 1976; Bjørn-Andersen and Hedberg 1977) were developed in response to user difficulties and resistance. These involved educating representative workers about technological possibilities and involving them in design, in part to increase their acceptance of the resulting system. Late in this period, sophisticated views of the complex social and organizational dynamics around system adoption and use emerged (e.g., Kling 1980; Markus 1983).

PROGRAMMING: SUBJECT OF STUDY, SOURCE OF CHANGE

Even programmers who were not hands-on users were interacting with computers, and more than 1000 research papers on variables affecting programming performance were published in the 1960s and 1970s (Baecker and Buxton 1987). Most were studies of the behavior of programmers in isolation, independent of organizational context. Influential reviews of this work included Gerald Weinberg’s landmark *The Psychology of Computer Programming* in 1971; Ben Shneiderman’s *Software Psychology: Human Factors in Computer and Information Systems* in 1980; and Beau Sheil’s 1981 review of studies of programming notation (conditionals, control flow, data types), practices (flowcharting, indenting, variable naming, commenting), and tasks (learning, coding, debugging).

Software developers changed the field through invention. In 1970, Xerox Palo Alto Research Center (PARC) was founded to advance computer technology by developing new hardware, programming languages, and programming environments. It attracted researchers and system builders from the laboratories of Engelbart and Sutherland. In 1971, Allen Newell of Carnegie Mellon University (CMU), Pennsylvania, proposed a project to PARC, which was launched 3 years later: “Central to the activities of computing—programming, debugging, etc.—are tasks that appear to be within the scope of this emerging theory [a psychology of cognitive behavior]” (Card and Moran 1986, p. 183).

Like HUSAT, which was also launched in 1970, PARC had a broad charter. HUSAT focused on ergonomics, anchored in the tradition of nondiscretionary use, one component of which was the human factors of computing. PARC focused on computing, anchored in visions of discretionary use, one component of which was also the human factors of computing. Researchers at PARC, influenced by cognitive psychology, extended the primarily perceptual motor focus of human factors to higher-level cognition, whereas HUSAT, influenced by sociotechnical design, extended human factors by considering organizational factors.

COMPUTER SCIENCE: A NEW DISCIPLINE

Computer science departments in educational institutions emerged in the mid-1960s. Some originated in engineering, others in applied mathematics. From engineering, computer graphics was a specialization of particular relevance to HCI. Applied mathematics was the background of many early AI researchers, which has interacted with HCI in complex ways in subsequent years.

The expensive early machines capable of interesting work were funded without consideration to cost by branches of the military. Technical success was the sole evaluation criterion (Norberg and O’Neill 1996). Directed by Licklider, Sutherland, and their successors, ARPA played a major role. The need for heavy funding concentrated researchers in a few centers, which bore little resemblance to the batch and time-shared business computing environments of that era.

User needs differed: The technically savvy hands-on users in research settings did not press for low-level interface enhancements.

The computer graphics and AI perspectives that arose in these centers differed from the perspectives of HCI researchers who focused on less expensive, more widely deployed systems. Computer graphics and AI required processing power; hardware advances meant declining cost for the same high level of computation. For HCI researchers, hardware advances meant greater computing capability at the same low price. Only later would this difference diminish, when widely available machines could support graphical interfaces and some AI programs. Despite this gap, between 1965 and 1980 some computer science researchers focused on interaction, which is not surprising given that interaction was an element of the visions formulated in the previous decade.

Computer Graphics: Realism and Interaction

In 1968, Sutherland joined David Evans to establish an influential computer graphics laboratory at the University of Utah. The Utah Computer Science Department was founded in 1965, as part of computer science's first move into academic prominence. Utah contributed to the western migration as graduates of the laboratory, including Alan Kay and William Newman (and later Jim Blinn and Jim Clark), went to California. Most graphics systems at the time were built on the DEC PDP-1 and PDP-7. These expensive machines—the list price of a high-resolution display alone was equivalent to more than US\$100,000 in today's dollars—were in principle capable of multitasking, but in practice most graphics programs required all of a processor's cycles.

In 1973 the Xerox Alto arrived, a powerful step toward realizing Alan Kay's vision of computation as a medium for personal computing (Kay and Goldberg 1977). The Alto was too expensive to be widely used—it was never widely marketed—and not powerful enough to support high-end graphics research, but it did support graphical interfaces of the kind Engelbart had prototyped. In doing so, the Alto signaled the approach of inexpensive, interactive, personal machines capable of supporting graphics. Computer graphics researchers had to decide whether to focus on high-end graphics or on more primitive features that would soon run on widely affordable machines.

William Newman, coauthor in 1973 of the influential *Principles of Interactive Computer Graphics*, described the shift in a personal communication: "Everything changed—the computer graphics community got interested in realism; I remained interested in interaction, and I eventually found myself doing HCI." He was not alone. Other graphics researchers whose focus shifted to broader interaction issues included Ron Baecker and Jim Foley. Foley and Wallace (1974, p. 462) identified requirements for designing "interactive graphics systems whose aim is good symbiosis between man and machine." The shift was gradual: A total of 18 papers in the first SIGGRAPH conference, in 1974, had the words "interactive" or "interaction" in their titles. A decade later, there would be none.

At Xerox, Larry Tesler and Tim Mott recognized that Alto could support a graphical interface accessible to untrained people. The latter point had not been important given the prior focus on trained, expert performance. By early 1974, Tesler and Mott had developed the Gypsy text editor. Gypsy and Xerox's Bravo editor developed by Charles Simonyi preceded and influenced Microsoft Word (Hiltzik 1999).

The focus on interaction was highlighted in 1976 when SIGGRAPH sponsored a 2-day workshop in Pittsburgh, User-Oriented Design of Interactive Graphics Systems (UODIGS). Participants who were later active in CHI included Jim Foley, William Newman, Ron Baecker, John Bennett, Phyllis Reisner, and Tom Moran. Licklider and Nicholas Negroponte presented vision papers. The conference was managed by the chair of Pittsburgh's computer science department. One participant was Anthony Debons, Licklider's friend who had helped build Pittsburgh's world-renowned information science program. The UODIGS'76 workshop arguably marked the end of a visionary period, embodying an idea whose time had not quite yet come. Licklider saw it clearly:

Interactive computer graphics appears likely to be one of the main forces that will bring computers directly into the lives of very large numbers of people during the next two or three decades. Truly user-oriented graphics of sufficient power to be useful to large numbers of people has not been widely affordable, but it will soon become so and, when it does, the appropriateness and quality of the products offered will to a large extent determine the future of computers as intellectual aids and partners of people.

(Licklider 1976, p. 89)

UODIGS was not repeated. Despite the stature of its participants, the 150-page proceedings were not cited. Not until 1981 was another user-oriented design conference held, after which such conferences were held every year. Application of graphics was not quite at hand; most HCI research remained focused on interaction driven by commands, forms, and full-page menus.

Artificial Intelligence: Winter Follows Summer

In the late 1960s and early 1970s AI burst onto the scene, promising to transform HCI. It did not go as planned. Logically, AI and HCI are closely related. What are intelligent machines for if not to interact with people? Research on AI has influenced HCI: Speech recognition and natural language are perennial HCI topics; expert, knowledge-based, adaptive, and mixed-initiative systems have been tried, as have applications of production systems, neural networks, and fuzzy logic. Today, human–robot interaction and machine learning are attracting much attention.

Although some AI features make it into systems and applications, frequent predictions that powerful machines would soon bring major AI technologies into wide use and thus become a focus of HCI research were not borne out. AI did not come into focus in HCI, and AI researchers showed limited interest in HCI.

To piece this together one requires a brief review of early AI history. The term “artificial intelligence” first appeared in a 1955 call by John McCarthy for a meeting on machine intelligence that was held in Dartmouth. In 1956, Alan Turing’s prescient essay “Computing Machinery and Intelligence” attracted attention when it was reprinted in *The World of Mathematics*. (It was first published in 1950, as were Claude Shannon’s “Programming a Computer for Playing Chess” and Isaac Asimov’s *I, Robot*, which explored his three laws of robotics.) Newell and Simon presented their logic theory machine in 1956 and then focused on developing a general problem solver. McCarthy invented the LISP programming language in 1958 (McCarthy 1960).

Many AI pioneers were trained in mathematics and logic, where almost everything can be derived from a few axioms and a small set of rules. Mathematical ability is considered a high form of intelligence, even by non-mathematicians. AI researchers anticipated that machines that operate logically and tirelessly would achieve high levels of intelligence—applying a small set of rules to a limited number of objects. Early AI focused on theorem-proving and games and problems that had a strong logical focus, such as chess and go. McCarthy (1988), who espoused predicate calculus as a foundation for AI, summed it up as follows:

As suggested by the term ‘artificial intelligence’, we were not considering human behavior except as a clue to possible effective ways of doing tasks. The only participants who studied human behavior were Newell and Simon. (The goal) was to get away from studying human behavior and consider the computer as a tool for solving certain classes of problems. Thus, AI was created as a branch of computer science and not as a branch of psychology.

Unfortunately, by ignoring psychology, mathematicians overlooked the complexity and inconsistency that mark human beings and our social constructs. Underestimating the complexity of intelligence, they overestimated the prospects for creating it artificially. Hyperbolic predictions and AI have been close companions. In the summer of 1949 the British logician and code breaker Alan Turing wrote in the *London Times*:

I do not see why [the computer] should not enter any one of the fields normally covered by the human intellect, and eventually compete on equal terms. I do not think you can even draw the line about sonnets, though the comparison is perhaps a little bit unfair because a sonnet written by a machine will be better appreciated by another machine.

Optimistic forecasts by the 1956 Dartmouth workshop participants attracted considerable attention. When they collided with reality, a pattern was established that was to play out repeatedly. Hans Moravec (1998) wrote:

In the 1950s, the pioneers of AI viewed computers as locomotives of thought, which might outperform humans in higher mental work as prodigiously as they outperformed them in

arithmetic, if they were harnessed to the right programs.... By 1960 the unspectacular performance of the first reasoning and translation programs had taken the bloom off the rose.

A significant part of the pattern is that HCI thrives on resources that are freed when interest in AI declines. In 1960, with the bloom wearing off the AI rose, the managers of MIT’s Lincoln Laboratory looked for new uses for the massive government-funded TX-0 and TX-2 computers. Ivan Sutherland’s Sketchpad and early computer graphics were a result.

The response to Sputnik reversed the downturn in AI prospects. Licklider, as director of ARPA’s IPTO (1962–1964), provided extensive support for computer science in general and AI in particular. MIT’s Project Mac, founded in 1963 by Marvin Minsky and others, initially received US\$13 million per year, rising to US\$24 million in 1969. ARPA sponsored the AI Laboratory at SRI, AI research at CMU, and Nicholas Negroponte’s Machine Architecture Group at MIT. A dramatic early achievement, SRI’s Shakey the Robot, was featured in articles in *Life* (Darrach 1970) and *National Geographic* (White 1970). Given a simple but nontrivial task, Shakey could apparently go to the desired location, scan and reason about the surroundings, and move objects as needed to accomplish the goal (for Shakey at work, see <http://www.ai.sri.com/shakey/>).

In 1970, Negroponte outlined a case for machine intelligence: “Why ask a machine to learn, to understand, to associate courses with goals, to be self-improving, to be ethical—in short, to be intelligent?” He noted common reservations, “People generally distrust the concept of machines that approach (and thus why not pass?) our own human intelligence,” and identified a key problem: “Any design procedure, set of rules, or truism is tenuous, if not subversive, when used out of context or regardless of context.” This insight, that it is risky to apply algorithms without understanding the situation at hand, led Negroponte to a false inference: “*It follows that a mechanism must recognize and understand the context before carrying out an operation.*” (Negroponte 1970, p. 1; my italics).

A perfectly reasonable alternative is that the mechanism is guided by humans who understand the context: Licklider’s human-machine symbiosis. Overlooking this, Negroponte built a case for an ambitious research program:

Therefore, a machine must be able to discern changes in meaning brought about by changes in context, hence, be intelligent. And to do this, it must have a sophisticated set of sensors, effectors, and processors to view the real world directly and indirectly.... A paradigm for fruitful conversations must be machines that can speak and respond to a natural language.... But, the tete-à-tete [sic] must be even more direct and fluid; it is gestures, smiles, and frowns that turn a conversation into a dialogue.... Hand waving often carries as much meaning as text. Manner carries cultural information: The Arabs use their noses, the Japanese nod their heads.... Imagine a machine that can follow your design methodology and at the same time discern and assimilate your conversational idiosyncrasies. This same machine after observing

your behavior could build a predictive model of your conversational performance. Such a machine could then reinforce the dialogue by using the predictive model to respond to you in a manner that is in rhythm with your personal behavior and conversational idiosyncrasies.... The dialogue would be so intimate—even exclusive—that only mutual persuasion and compromise would bring about ideas, ideas unrealizable by either conversant alone. No doubt in such a symbiosis it would not be solely the human designer who would decide when the machine is relevant (pp. 1–13).

The same year, Negroponte's MIT colleague Minsky went further, as reported in *Life*:

In from three to eight years we will have a machine with the general intelligence of an average human being. I mean a machine that will be able to read Shakespeare, grease a car, play office politics, tell a joke, and have a fight. At that point, the machine will begin to educate itself with fantastic speed. In a few months, it will be at genius level and a few months after that its powers will be incalculable.

(Darrach 1970, p. 60)

Other AI researchers told Darrach that Minsky's timetable was ambitious: “Give us 15 years was a common remark—but all agreed that there would be such a machine and that it would precipitate the third Industrial Revolution; wipe out war and poverty; and roll up centuries of growth in science, education, and the arts” (Darrach 1970, p. 60).

Such predictions were common. In 1960, Nobel laureate and AI pioneer Herb Simon wrote: “Machines will be capable, within 20 years, of doing any work that a man can do.” (Simon 1960, p. 38). Five years later, I. J. Good, an Oxford mathematician, wrote, “The survival of man depends on the early construction of an ultraintelligent machine” that “could design even better machines; there would then unquestionably be an ‘intelligence explosion’, and the intelligence of man would be left far behind” (Good 1965, pp. 31–33).

The Darrach article ended by quoting Ross Quillian:

I hope that man and these ultimate machines will be able to collaborate without conflict. But if they can't, we may be forced to choose sides. And if it comes to choice, I know what mine will be. My loyalties go to intelligent life, no matter in what medium it may arise”.

(Darrach 1970, p. 68)

It is important to understand the anxieties of the time and the consequences of such claims. The world had barely avoided a devastating thermonuclear war during the Cuban missile crisis of 1962. Leaders seemed powerless to defuse the Cold War. Responding to a sense of urgency, ARPA initiated major programs in speech recognition and natural language understanding in 1971.

Ironically, central to funding this research was a psychologist not wholly convinced by the vision. Citing an Air Force study that predicted that intelligent machines might take 20 years to arrive, Licklider (1960) noted that in this interval HCI would be useful: “That would leave, say, 5 years to

develop man–computer symbiosis and 15 years to use it. The 15 may be 10 or 500, but those years should be intellectually the most creative and exciting in the history of mankind.” Ten to five hundred years represent breathtaking uncertainty. Recipients of Licklider’s funding were on the optimistic end of this spectrum.

Five years later, disappointed with the progress, ARPA discontinued speech and language support—for a while. In Europe, a similar story unfolded. Through the 1960s, AI research expanded in Great Britain. A principal proponent was Turing’s former colleague Donald Michie. Then in 1973 the Lighthill report, commissioned by the Science and Engineering Research Council, reached generally negative conclusions about AI’s prospects for scaling up to address real-world problems. Almost all government funding was cut off.

The next decade was an AI winter, a recurring season in which research funding is withheld due to disillusionment over unfulfilled promises. The bloom was again off the rose, but it would prove to be a hardy perennial (Grudin 2009).

LIBRARY SCHOOLS EMBRACE INFORMATION SCIENCE

Early information science research and studies of “human information behavior” were initiated in the 1960s and 1970s, which focused on scholarship and application in science and engineering (Fidel 2011). The response to Sputnik proved that Big Science research did not end when the war ended. Aligning their work with national priorities became a priority for many researchers.

The terms “information science,” “information technology,” and “information explosion” swept into use. The Pittsburgh and Georgia Tech programs flourished. Pittsburgh created the first information science PhD program in the United States in 1970, identifying humans “as the central factor in the development of an understanding of information phenomena” (Aspray 1999, p. 12). The program balanced behavioral sciences (psychology, linguistics, communication) and technical grounding (automata theory, computer science). In 1973, Pittsburgh established the first information science department. Its program developed a strong international reputation. Slowly, the emphasis shifted from behavior to technology. On being awarded a major National Science Foundation (NSF) center grant in 1966, the Georgia Tech school expanded. In 1970 it became a PhD-granting school, rechristened as Information and Computer Science.

In 1968, the American Documentation Institute became the American Society for Information Science, and 2 years later the journal *American Documentation* became *Journal of the American Society for Information Science*. In 1978, the ACM Special Interest Group on Information Retrieval (SIGIR) was formed. It launched an annual conference for “Information Storage and Retrieval” (since 1982, “Information Retrieval”), modeled on a 1971 conference. In 1984, the American Library Association belatedly embraced the i-word by creating the Association for Library and Information Science Education (ALISE), which convened an annual research conference.

By 1980, schools at over a dozen universities had added the word information to their titles. Many were library school transitions. Delivery on the promise of transformative technology lagged, however. For example, from 1965 to 1972 the Ford and Carnegie Foundations, NSF, DARPA, and the American Newspaper Publishers Association invested over US\$30 million in MIT's Project Intrex (Burke 1998). The largest nonmilitary information research project of its time, Intrex was to be the library of the future. Online catalogs were to include up to 50 index fields per item, accessible on CRT displays, with full text of books and articles converted to microfilm and read via television displays. None of this proved feasible.

Terminal-based computing costs declined. The ARPANET debuted in 1969, and supported e-mail in 1971 and file sharing in 1973. This spurred visions of a “network society” of the future (Hiltz and Turoff 1978).

As an aside, the technological optimism that marked this era lacked the nuanced psychological insight of E. M. Forster who in 1909 anticipated AI and networking developments in his remarkable story *The Machine Stops*.

1980–1985: DISCRETIONARY USE COMES INTO FOCUS

In 1980, most HF&E and IS research focused on the down-to-earth business of making efficient use of expensive mainframes. The beginning of a major shift went almost unnoticed. Less expensive but highly capable minicomputers based on LSI technology enabled DEC, Wang Laboratories, and Data General to make inroads into the mainframe market. At the low end, home computers gained traction. Students and hobbyists were drawn to these minis and micros, creating a population of hands-on discretionary users. There were experimental trials of online library catalogs and electronic journals.

Then, between 1981 and 1984 a flood of innovative and powerful computers were released: Xerox Star; IBM PC; Apple Lisa; LISP machines from Symbolics and Lisp Machines, Inc. (LMI); workstations from Sun Microsystems and Silicon Graphics; and the Apple Macintosh. On January 1, 1984, AT&T's breakup into competing companies took effect. AT&T had more employees and more customers than any other U.S. company. It was a monopoly: Neither its customers nor its employees had discretion in technology use. Both AT&T and its Bell Laboratories research division had employed human factors research to improve training and increase efficiency. Suddenly freed from a ban on entering the computer business, AT&T launched the ill-fated Unix PC in 1985. AT&T and the new regional operating companies now faced customers who had choices, and their HCI focus broadened accordingly (Israelski and Lund 2003).

In general, lower-priced computers created markets for shrink-wrap software. For the first time, computer and software companies targeted significant numbers of nontechnical hands-on users who received little or no formal training.

It had taken 20 years, but early visions were being realized. Nonprogrammers were choosing to use computers to do their work. The psychology of discretionary users intrigued two groups: (1) psychologists who liked to use computers and (2) technology companies who wanted to sell to discretionary users. Not surprisingly, computer and telecommunication companies started hiring a lot of experimental psychologists.

DISCRETION IN COMPUTER USE

Technology use lies on a continuum bracketed by the assembly-line nightmare of *Modern Times* and the utopian vision of completely empowered individuals. To use a technology or not to use it—sometimes we have a choice, other times we do not. On the phone, we may have to wrestle with speech recognition and routing systems. At home, computer use may be largely discretionary. The workplace often lies in between: Technologies are prescribed or proscribed, but we ignore some injunctions or obtain exceptions, we use some features but not others, and we join with colleagues to press for changes.

For early computer builders, work was more a calling than a job, but operation required a staff to carry out essential if less interesting tasks. For the first half of the computing era, most hands-on use was by people with a mandate. Hardware innovation, more versatile software, and steady progress in understanding the psychology of users and tasks—and transferring that understanding to software developers—led to hands-on users who had more choice regarding how they worked. Rising expectations played a role; people learned that software is flexible and expected it to be more congenial. Competition among vendors produced alternatives. With more emphasis on marketing to consumers came more emphasis on user-friendliness.

Discretion is not all-or-none. No one must use a computer, but many jobs and pastimes require it. People can resist, sabotage, or quit their jobs. However, a clerk or a systems administrator has less discretion than someone using technology for a leisure activity. For an airline reservation clerk, computer use is mandatory. For a traveler booking a flight, computer use is discretionary. This distinction, and the shift toward greater discretion, is at the heart of the history of HCI.

The shift was gradual. About 30 years ago, John Bennett (1979) predicted that discretionary use would lead to more emphasis on usability. The 1980 book *Human Interaction with Computers*, edited by Harold Smith and Thomas Green, perched on the cusp. It included an article by Jens Rasmussen, “The Human As a Systems Component,” that covered the nondiscretionary perspective. One-third of the book covered research on programming. The remainder addressed “non-specialist people,” discretionary users who are not computer savvy. Smith and Green wrote, “It is not enough just to establish what computer systems can and cannot do; we need to spend just as much effort establishing what people can *and want to do*” (p. viii, italics in original).

A decade later, Liam Bannon (1991) noted broader implications of a shift “from human factors to human actors.” The

trajectory is not always toward choice. Discretion can be curtailed—for example, word processor use is now often a job requirement and not an alternative to using a typewriter. Even in an era of specialization, customization, and competition, the exercise of choice varies over time and across contexts. Discretion is only one factor, but an analysis of its role casts light on how HCI efforts differ and why they have remained distinct through the years.

MINICOMPUTERS AND OFFICE AUTOMATION

Cabinet-sized minicomputers that could support several people were available from the mid-1960s. By late 1970s, superminis such as the VAX 11/780 supported integrated suites of productivity tools. In 1980, DEC, Data General, and Wang Laboratories were growth companies near Boston.

A minicomputer could handle personal productivity tools or a database of moderate size. Users sat at terminals. With “dumb terminals,” the central processor handled each key-stroke. Other terminals had a processor that supported a user who entered a screenful of data, which was then on command sent as a batch to the central processor. These minis could provide a small group (or office) with file-sharing, word-processing, spreadsheet, and e-mail, and manage output devices. They were marketed as “office systems,” “office automation (OA) systems,” or “office information systems” (OIS).

The 1980 Stanford International Symposium on Office Automation marked the emergence of a research field that remained influential for a decade and then faded away. Douglas Engelbart contributed two papers to the proceedings of this symposium (Landau, Bair, and Siegman 1982). In the same year, the American Federation of Information-Processing Societies (AFIPS, the parent organization of ACM and Institute of Electrical and Electronics Engineers [IEEE] at the time) held the first of seven annual OA conferences and product exhibitions. Also in 1980, ACM formed the Special Interest Group on Office Automation (SIGOA), which launched the biennial Conference on Office Information Systems (COIS) 2 years later. In 1983, the journal *ACM Transactions on Office Information Systems (TOOIS)* emerged, which was 1 year after the emergence of the independent journal *Office: Technology and People*.

You might ask “what is all this with offices?” Minicomputers brought down the price of computers to fit into the budget of a small workgroup or an office. (The attentive reader will anticipate: The personal computer era is approaching.) Office Information Systems, which focused on the use of minicomputers, was positioned alongside MIS, which focused on mainframes. Its scope was reflected in the charter of *TOOIS*: database theory, AI, behavioral studies, organizational theory, and communications. Minis were accessible to database researchers. Digital’s PDP series was a favorite with AI researchers until LISP machines flourished. Minis were familiar to behavioral researchers who used them to run and analyze psychology experiments. Computer-mediated communication (CMC) was an intriguing new capability: Networking was still rare, but people at different

terminals of a minicomputer could exchange e-mail or chat in real time. Minis became interactive computers of choice for many organizations. As a consequence, Digital became the second largest computer company in the world and Dr. Wang the fourth wealthiest American.

Researchers were discretionary users, but few office workers chose their tools. The term “automation” was challenging and exciting to researchers, but it conjured up less pleasant images for office workers. Some researchers, too, preferred Engelbart’s focus on augmentation rather than automation.

Papers in the SIGOA newsletter, COIS, and *TOOIS* included technical work on database theory, a modest number of AI papers (the AI winter had not yet ended), decision support and CMC papers from the IS community, and behavioral studies by researchers who later joined CHI. Papers on information systems were prevalent in the newsletter and technical papers in *TOOIS*, which also published numerous behavioral studies until the journal *Human–Computer Interaction* started in 1985.

Although OA/OIS research was eventually absorbed by other fields, it identified and called attention to important emerging topics, including hypertext, CMC, and collaboration support. OIS research was also allied with the technical side of information science, notably information retrieval and language processing.

THE FORMATION OF ASSOCIATION FOR COMPUTING MACHINERY SPECIAL INTEREST GROUP ON COMPUTER–HUMAN INTERACTION

Figure 1 identifies research fields that directly bear on HCI. Both HF and IS have distinct subgroups that focus on broad use of digital technologies. Relevant computer science research is concentrated in CHI, the subgroup primarily concerned with discretionary hands-on computer use. Other computer science influences—computer graphics, AI, office systems—have been described but are not included in Figure 1. The fourth field, information, began as support for specialists. It may come to exert the broadest influence of all.

Decreasing microcomputer prices encouraged discretionary hobbyists to use them. In 1980, as IBM prepared to launch the PC, a groundswell of attention on computer user behavior was building up. IBM, which like many hardware companies had not sold software separately, had decided to make software a product focus. Several cognitive psychologists joined an IBM group that included John Gould, who had been publishing human factors research since the late 1960s. They initiated empirical studies of programming and studies of software design and use. Other psychologists who in 1980 led recently formed HCI groups were Phil Barnard at the Medical Research Council Applied Psychology Unit in Cambridge, England; Tom Landauer at Bell Laboratories; Donald Norman at the University of California, San Diego; and John Whiteside at Digital Equipment Corp.

Xerox PARC and CMU collaborators continued research that led to an exceptionally influential project. The 1981 Star, with a carefully designed GUI, was not a commercial success

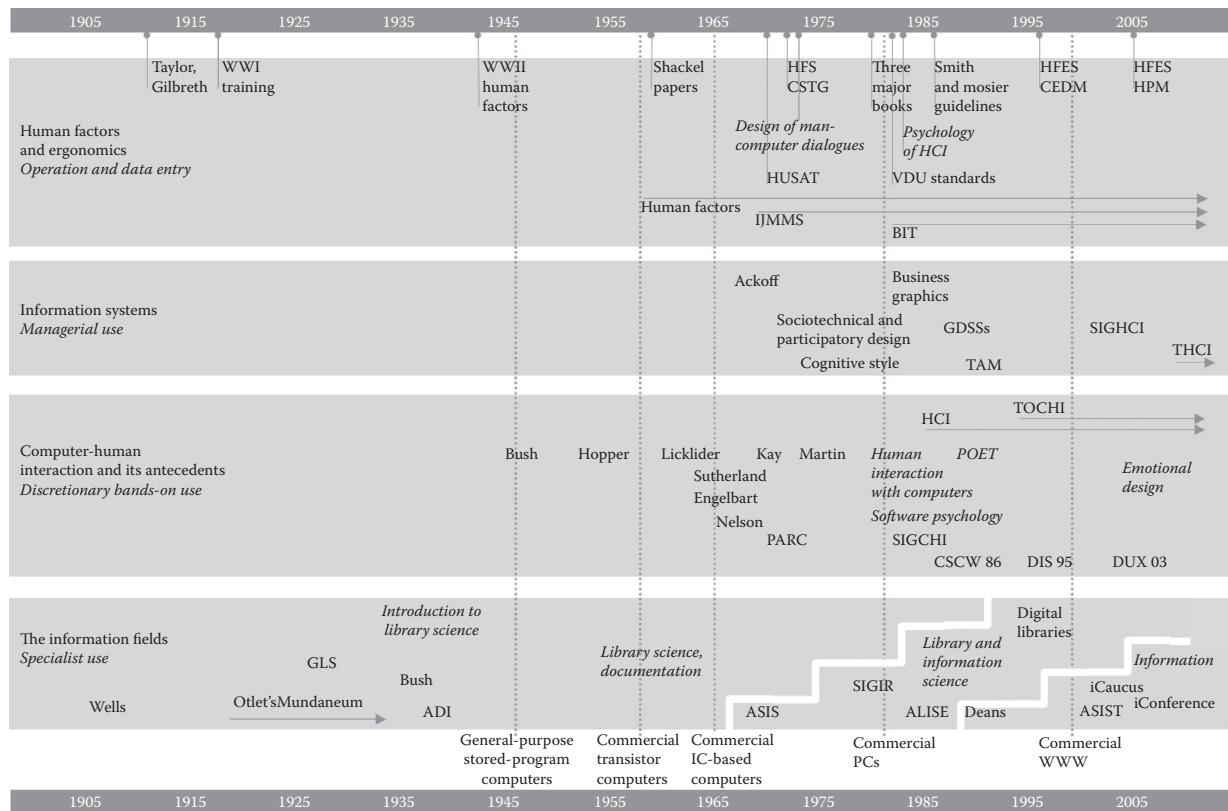


FIGURE 1 Four fields with major human–computer interaction research threads: Acronym expansions are provided in the text.

(nor were a flurry of GUIs that followed, including the Apple Lisa), but it influenced researchers and developers—and the design of the Macintosh.

Communications of the ACM created a “Human Aspects of Computing” department in 1980. The next year, Tom Moran edited a special issue of *Computing Surveys* on “The Psychology of the Computer User.” Also in 1981, the ACM Special Interest Group on Social and Behavioral Science Computing (SIGSOC) extended its workshop to cover interactive software design and use. In 1982, a conference in Gaithersburg, Maryland, on “Human Factors in Computing Systems” was unexpectedly well attended. Shortly afterward, SIGSOC shifted its focus to Computer-Human Interaction and changed its name to SIGCHI (Borman 1996).

In 1983, the first CHI conference attracted more than 1000 people. Half of the 58 papers were from the aforementioned seven research laboratories. Cognitive psychologists in industry dominated the program, although the Human Factors Society cosponsored the conference and contributed the program chair Richard Pew; committee members Sid Smith, H. Rudy Ramsay, and Paul Green; and several presenters. Brian Shackel and HFS president Robert Williges gave tutorials on the first day. The International Conference on Human–Computer Interaction (INTERACT), first held in London in 1984 and chaired by Shackel, drew HF&E and CHI researchers.

The first profession to become discretionary hands-on users was computer programming, as paper coding sheets were discarded in favor of text editing at interactive terminals, PCs, and small minicomputers. Therefore, many early

CHI papers, by Ruven Brooks, Bill Curtis, Thomas Green, Ben Shneiderman, and others, continued the psychology-of-programming research thread. Shneiderman formed the influential HCI Laboratory (HCIL) at Maryland in 1983. IBM researchers also contributed, as noted by John Thomas in a personal communication (October 2003): “One of the main themes of the early work was basically that we in IBM were afraid that the market for computing would be limited by the number of people who could program complex systems, so we wanted to find ways for ‘nonprogrammers’ to be able, essentially, to program.”

Many experimental psychologists undertook studies of text editing, a tool initially used primarily by programmers. Thomas Green remarked at INTERACT’84 that “text editors are the white rats of HCI.” As personal computing spread, studies of other discretionary use contexts were conducted. Studies of programming gradually disappeared from HCI conferences.

CHI focused on novice use. Initial experience is particularly important for discretionary users and for vendors developing software for them. Novice users are also a natural focus when studying new technologies and a critical focus when more people take up computing each year compared with the year before.

Routinized heavy use was still widespread. Databases were used by airlines, banks, government agencies, and other organizations. This hands-on activity was rarely discretionary. Managers oversaw development and analyzed data, leaving data entry and information retrieval to people hired for

those jobs. To improve data management tasks was a human factors undertaking. CHI studies of database use were few—I count three over a decade, all focused on novice or casual use.

Fewer European companies produced mass-market software. European HCI research focused on in-house development and use, as reflected in the journal *Behaviour & Information Technology*, which was launched in 1982 by Tom Stewart and published by Taylor & Francis in London. In his perceptive essay cited in the section “Discretion in Computer Use,” Bannon urged that more attention be paid to discretionary use, yet criticized CHI’s heavy emphasis on initial experience, reflecting the European perspective. At Loughborough University, HUSAT focused on job design (the division of labor between people and systems) and collaborated with the Institute for Consumer Ergonomics, particularly on product safety. In 1984, Loughborough initiated an HCI graduate program drawing on human factors, industrial engineering, and computer science.

The work of the early visionaries was unfamiliar to many CHI researchers who were helping realize some of the early visions. The 633 references in the 58 papers presented at CHI’83 included many authored by cognitive scientists, but Bush, Sutherland, and Engelbart were not cited. A few years later, more computer scientists familiar with the early work joined CHI, notably those working on interactive computer graphics. The psychologists eventually discovered and identified with the pioneers, who shared their concern for discretionary use. This conceptual continuity bestowed legitimacy on a young enterprise that sought to establish itself academically and professionally.

DIVERGENCE OF COMPUTER–HUMAN INTERACTION AND HUMAN FACTORS

Hard science, in the form of engineering, drives out soft science, in the form of human factors.

Newell and Card (1985, p. 212)

Between 1980 and 1985, Card, Moran, and Newell (1980a,b) introduced a “keystroke-level model for user performance time with interactive systems,” followed by the cognitive model goals, operators, methods, and selection rules (GOMS) in their landmark 1983 book *The Psychology of Human–Computer Interaction*. This work was highly respected by the cognitive psychologists prevalent in CHI at the time. However, these models did not address discretionary, novice use. They focused on the repetitive expert use studied in human factors. In fact, GOMS was explicitly positioned to counter the latter field’s stimulus–response bias: “Human-factors specialists, ergonomists, and human engineers will find that we have synthesized ideas from modern cognitive psychology and AI with the old methods of task analysis. . . . The user is not an operator. He does not operate the computer, he communicates with it” (Newell and Card 1985, p. viii.).

Newell and Card noted that HFs had a role in design, but continued: “Classical human factors . . . has all the earmarks of second-class status. (Our approach) avoids continuation of the classical human-factors role (by transforming) the psychology of the interface into a hard science” (p. 221).

In 2004, Card noted in an e-mail discussion: “Human Factors was the discipline we were trying to improve. . . . I personally changed the (CHI conference) call in 1986, so as to emphasize computer science and reduce the emphasis on cognitive science, because I was afraid that it would just become human factors again.”

Ultimately, human performance modeling drew a modest but fervent CHI following. Key goals differed from those of other researchers and many practitioners. “The central idea behind the model is that the time for an expert to do a task on an interactive system is determined by the time it takes to do the keystrokes,” wrote Card, Moran, and Newell (1980b, p. 397). Modeling was extended to a range of cognitive processes, but it was most useful in helping to design for non-discretionary users such as telephone operators engaged in repetitive tasks (e.g., Gray et al. 1990). Its role in augmenting human intellect was unclear.

CHI and HFS moved apart, although “Human Factors in Computing Systems” remains the CHI conference subtitle. They were never highly integrated. Most of the cognitive psychologists had turned to HCI after earning their degrees and were unfamiliar with the human factors literature. The Human Factors Society did not again cosponsor CHI. Its researchers disappeared from the CHI program committee. Most CHI researchers who previously published in the human factors literature shifted to CHI, *Communications of the ACM*, and the journal *Human–Computer Interaction* launched in 1985 by Thomas Moran and published by Erlbaum, a publisher of psychology books and journals.

The shift was reflected at IBM T.J. Watson Research Center. John Gould and Clayton Lewis authored a CHI’83 paper that nicely framed the CHI focus on user-centered, iterative design based on prototyping. Cognitive scientists at Watson helped shape CHI, but Gould’s principal focus remained human factors; he served as HFS president 4 years later. Reflecting the broader change, in 1984 the Human Factors Group at Watson began to dissolve and a User Interface Institute emerged.

CHI researchers, identifying with “hard” science or engineering, adopted the terms “cognitive engineering” and “usability engineering.” In the first paper presented at CHI’83, “Design Principles for Human–Computer Interfaces,” Donald Norman (1983) applied engineering techniques to discretionary use, creating “user satisfaction functions” based on technical parameters. These functions would not hold up long—people are fickle, yesterday’s satisfying technology is not as gratifying today—but for years CHI emulated engineering, downplaying design, marketing, and other aspects of how humans interact with technology.

WORKSTATIONS AND ANOTHER ARTIFICIAL INTELLIGENCE SUMMER

High-end workstations from Apollo, Sun, and Silicon Graphics appeared between 1981 and 1984. Graphics researchers no longer had to flock to heavily financed laboratories (notably MIT and Utah in the 1960s; MIT, New

York Institute of Technology, and PARC in the 1970s). Workstations were too expensive to reach a mass market, so graphics research that focused on photorealism and animation, which required the processing power of workstations, did not directly exert a broad influence on HCI.

The Xerox Star (formally named Office Workstation), Apple Lisa, and other commercial GUIs appeared, but when the first CHI conference was held in December 1983 none were commercial successes. They cost too much or ran on processors that were too weak to exploit graphics effectively.

In 1981, Symbolics and LMI introduced workstations optimized for the LISP programming language favored by most AI researchers. The timing was fortuitous. In October of that year, a conference on next-generation technology was held in the National Chamber of Commerce auditorium in Tokyo, Japan, and in 1982 the Japanese government established the Institute for New Generation Computer Technology (ICOT) and a 10-year fifth generation project focused on AI. AI researchers in Europe and the United States sounded the alarm. Donald Michie of Edinburgh saw a threat to Western computer technology, and in 1983 Ed Feigenbaum of Stanford and Pamela McCorduck wrote: “The Japanese are planning the miracle product.... They’re going to give the world the next generation—the Fifth Generation—of computers, and those machines are going to be intelligent.... We stand, however, before a singularity, an event so unprecedented that predictions are almost silly.... Who can say how universal access to machine-intelligence—faster, deeper, better than human intelligence—will change science, economics, and warfare, and the whole intellectual and sociological development of mankind?” (pp. 8–9, 287).

Parallel distributed processing (often called neural networks) models also seized the attention of researchers and the media. Used for modeling phenomena including signal detection, motor control, and semantic processing, neural networks represented conceptual and technical advances over earlier AI work on perceptrons. Their rise was tied to the new generation of minicomputers and workstations, which had the power to support simulation experiments. Production systems, a computer-intensive AI modeling approach with a psychological foundation, developed at CMU, also gained the attention of researchers.

These developments triggered an AI gold rush. As with actual gold rushes, most of the money was made by those who outfitted and provisioned the prospectors, although generous government funding again flowed to the actual researchers. The European ESPRIT and UK Alvey programs invested over US\$200 million per year starting in 1984 (Oakley 1990). In the United States, funding for the DARPA Strategic Computing AI program, begun in 1983, rose to almost US\$400 million in 1988 (Norberg and O’Neill 1996). Investment in AI by 150 U.S. companies was estimated at about US\$2 billion in 1985 (Kao 1998).

The unfulfilled promises of the past led to changes this time around. General problem solving was emphasized less, whereas domain-specific problem solving was emphasized

more. Terms such as intelligent knowledge-based systems, knowledge engineering, expert systems, machine learning, language understanding, image understanding, neural networks, and robotics were often favored over AI.

In 1983, Raj Reddy of CMU and Victor Zue of MIT criticized the mid-1970s abandonment of speech-processing research, and soon funds again became plentiful for these research topics (Norberg and O’Neill 1996, p. 238). Johnson (1985) estimated that 800 corporate employees and 400 academics were working on natural language-processing research. Commercial natural language-understanding (NLU) interfaces to databases such as AI Corporation’s Intellect and Microrim Clout appeared.

The optimism is illustrated by two meticulously researched Ovum reports on speech and language processing (Johnson 1985; Engelen and McBride 1991). In 1985, speech and language product “revenue” was US\$75 million, comprising mostly income from grants and investor capital. That year, Ovum projected that sales would reach US\$750 million by 1990 and US\$2.75 billion by 1995. In 1991 sales were under US\$90 million, but hope springs eternal and Ovum forecasts US\$490 million for 1995 and US\$3.6 billion for 2000.

About 20 U.S. corporations banded together, jointly funding the Microelectronics and Computer Technology Corporation (MCC). U.S. antitrust laws were relaxed to facilitate this cooperation. MCC embraced AI, reportedly becoming the leading customer for both Symbolics and LMI. MCC projects included two parallel NLU efforts; work on intelligent advising; and CYC (as in encyclopedic, and later spelled Cyc), Douglas Lenat’s ambitious project to build a commonsense knowledge base that other programs could exploit. In 1984, Lenat predicted that by 1994 CYC would be intelligent enough to educate itself. Five years later, CYC was reported to be on schedule and about to “spark a vastly greater renaissance in [machine learning]” (Lenat 1989, p. 257).

Knowledge engineering involved human interaction. This could have brought AI closer to HCI, but AI researchers who were interested in representation and reasoning were frustrated by the difficulty of eliciting knowledge from experts. As many AI systems were aimed at nondiscretionary use, this created opportunities for HF&E, especially in Europe where funding directives dictated work that spanned technical and behavioral concerns. The journal *IJMMS* became a major outlet for both HF&E and AI researchers in the 1980s.

Interaction of AI and CHI was limited. CHI’83 and CHI’85 had a few sessions on speech and language, cognitive modeling, knowledge-based help, and knowledge elicitation. Not many AI researchers and developers worried about usability. They loved powerful tools such as EMACS and UNIX, forgetting the painful weeks required to learn the badly designed command languages. In general, AI technologies did not succeed in the marketplace. Before it disappeared, AI Corporation’s primary customer for the database interface Intellect was the government, where discretionary use was not the norm.

1985–1995: GRAPHICAL USER INTERFACES SUCCEED

“There will never be a mouse at the Ford Motor Company.”
**A high-level acquisition manager, 1985
 (personal communication)**

When graphical user interfaces finally succeeded commercially, human-computer interaction was transformed. As with previous disruptive shifts—to stored programs and to interaction based on commands, full-screen forms, and full-screen menus—some people were affected before others. GUIs were particularly attractive to consumers, to new or casual users. Their success immediately transformed CHI, but only after Windows 3.0 succeeded in 1990 did GUIs influence the government agencies and business organizations that are the focus of HF&E and IS researchers. By 1990, the technology was better understood and thus less disruptive. The early 1990s also saw the maturation of local area networking and the Internet, producing a second transformation: computer-mediated communication and information sharing.

COMPUTER-HUMAN INTERFACE EMBRACES COMPUTER SCIENCE

Apple launched the Macintosh with a 1984 Super Bowl ad describing office work, but sales did not follow and by mid-1985 Apple was in trouble. Then Macs appeared with four times as much random access memory (RAM), which was sufficient to manage Aldus PageMaker, Adobe Postscript, the Apple LaserWriter, and Microsoft’s Excel and Word for Macintosh as they were released. The more powerful Mac Plus arrived in January 1986. Rescued by hardware and software advances, the Mac succeeded where many commercial GUIs before it could not. It was popular with consumers and became the platform for desktop publishing.

Within CHI, GUIs were initially controversial. They had disadvantages: An extra level of interface code increased development complexity and created reliability challenges. They consumed processor cycles and distanced users from the underlying system that, many believed, experienced users must eventually master. Carroll and Mazur (1986) showed that GUIs confused and created problems for people familiar with existing interfaces. An influential 1986 essay on direct manipulation interfaces by Hutchins, Hollan, and Norman concluded that “it is too early to tell” how GUIs would fare. The GUIs could well prove useful for novices, they wrote, but “we would not be surprised if experts are *slower* with Direct Manipulation systems than with command language systems” (pp. 119–121, *italics in the original*). Given that most prior HCI research had focused on expert use, this insight seemed significant. However, first-time use proved critical in the rapidly expanding consumer market, and hardware and software improvements overcame some early limitations. GUIs were here to stay. CHI was soon transformed. Previously active research topics, including command naming, text editing, and the psychology of programming, were

abandoned. More technical topics such as “user interface management systems” became significant.

Viewed from a higher plane, psychology gave way to computer science as the driving force in interaction design. Researchers had strived for a comprehensive, theoretical, psychological framework based on formal experiments (Newell and Card 1985; Carroll and Campbell 1986; Long 1989; Barnard 1991). Such a framework was conceivable for constrained command- and form-based interaction but could not be scaled to design spaces that included color; sound; animation; and an endless variety of icons, menu designs, and window arrangements. The new mission was to identify the most pressing problems and find satisfactory rather than optimal solutions. Rigorous experimentation, a skill of cognitive psychologists, gave way to quicker, less precise assessment methods championed by Jakob Nielsen (1989; Nielsen and Molich 1990).

Exploration of the dynamically evolving, relatively unconstrained design space required software engineering expertise. The late 1980s saw an influx of computer scientists to the CHI community. HCI entered the curricula of many computer science programs. CHI became a natural home to some computer scientists working on interactive graphics, software engineers interested in interaction, and AI researchers working on speech recognition, language understanding, and expert systems. In 1994, ACM launched the journal *Transactions on Computer-Human Interaction (TOCHI)*. Early PCs and Macs were not easily networked, but as the use of local area networks spread, CHI’s focus expanded to include collaboration support. This brought it into contact with efforts in MIS and OA research, discussed in the section on Collaboration Support below.

HUMAN FACTORS AND ERGONOMICS MAINTAINS A NONDISCRETIONARY USE FOCUS

Human factors and ergonomics research continued to respond to the needs of government agencies, the military, aviation industry, and telecommunications. Governments are the largest consumers of computing, for census, tax, social security, health and welfare, power plant operation, air traffic control, ground control for space missions, military logistics, text and voice processing for intelligence, and so on. The focus is on skilled use—users are assigned technology and trained if necessary. For routine data entry and other tasks, small efficiency gains in individual transactions can yield large benefits over time, justifying the effort to make improvements that might not be noticed by discretionary users. After SIGCHI formed, HFS undertook a study to see how CHI would affect membership in its Computer Systems Technical Group. An unexpectedly small effect was found (Richard Pew, personal communication; September 15, 2004). They had different goals.

Government agencies promoted the development of ergonomic standards to help in defining system requirements for competitive bidding while remaining at arms’ length from potential developers, who of course better understood technical possibilities and helped with standards development.

Compliance with standards could then be specified in a contract. In 1986, Sid Smith and Jane Mosier published the last of a series of government-sponsored interface guidelines, with 944 design guidelines organized into sections titled Data Entry, Data Display, Data Transmission, Data Protection, Sequence Control, and User Guidance. The authors recognized that GUIs would expand the design space beyond the reach of this already cumbersome document that omitted icons, pull-down and pop-up menus, mice button assignments, sound, animation, and so on. Smith and Mosier foresaw that requirements definition must shift to specify predefined interface styles and design processes rather than features that would be built from scratch.

DARPA's heavily funded strategic computing AI program set out to develop an autonomous land vehicle, a pilot's associate, and a battle management system. All raised human factors research issues. These systems were to include interactive technologies such as speech recognition, language understanding, and heads-up displays. People might avoid these technologies when given a choice, but pilots guiding autonomous vehicles and officers under stressful conditions might have no better alternative. Speech and language technologies have other nondiscretionary potential, some of it civilian: for translators and intelligence analysts, when a phone system provides no alternative, when a disability limits keyboard use, or when hands are otherwise occupied.

INFORMATION SYSTEMS EXTENDS ITS RANGE

Although GUIs were not quickly adopted by organizations, spreadsheets and business graphics (charts and tables) were important to managers and thus the foci of IS research. Remus (1984) contrasted tabular and graphic presentations and Benbasat and Dexter (1985) added color as a factor, although color displays were rare in the 1980s. Many studies contrasted online and paper presentations, because most managers worked with printed reports. Although research into individual cognitive styles was abandoned in the early 1980s following a devastating critique on the topic (Huber 1983), the concept of cognitive fit between task and tool was introduced to explain apparently contradictory results in the adoption literature (Vessey and Galletta 1991).

A series of symposia on human factors in IS was initiated in 1986 by Jane Carey, leading to several books on the subject (e.g., Carey 1988). Topics included user interaction with information, design and development and, as corporate adoption of minicomputers and intranets matured, communication and collaboration, including studies of e-mail use.

The involvement of end users in the development process was actively discussed in IS, but rarely practiced outside of the sociotechnical design and the participatory design movements discussed below in the section "Participatory Design and Ethnography" (Friedman 1989). Hands-on managerial use was atypical in this period, but it was central to group decision support systems (GDSS) research. Central to GDSS was support for meetings, including brainstorming, idea organization, and online voting features. GDSS emerged from

decision support systems, aimed at supporting individual executives or managers, and later evolved into group support systems. Computer-supported meeting facility research was conducted in the mid-1980s in several laboratories (e.g., Begeman et al. 1986; DeSanctis and Gallupe 1987; Dennis et al. 1988). Extensive research at the University of Arizona is summarized by Nunamaker et al. (1997). These systems were initially too expensive to be mass-market products; hence, the focus was on "decision makers," and research was conducted primarily in schools of management, not computer science departments or software companies. GDSS was a major IS contribution to computer-supported cooperative work (CSCW), discussed in the next section. In 1990, three companies began marketing GDSSs, including IBM and a University of Arizona spin-off, although without much success.

The Technology Acceptance Model (TAM) introduced by Davis (1989) led to considerable IS research. TAM and its offspring focus on perceived usefulness and perceived usability to improve "white-collar performance" that is "often obstructed by users' unwillingness to accept and use available systems" (p. 319). "An element of uncertainty exists in the minds of decision makers with respect to the successful adoption," wrote Bagozzi, Davis, and Warshaw (1992, p. 664). Although TAM is a managerial view of individual behavior, it was influenced by Davis's exposure to early CHI usability research.

TAM is probably the most cited HCI work in IS. The management view of hands-on computer use as nondiscretionary was giving way as use spread to white-collar workers who could refuse to play. TAM's emphasis on *perceived* utility and usability is a key distinction: Consumers choose technologies that they are convinced will be useful; CHI researchers assume utility and focuses on the *experience* of usability. TAM researchers focus on utility and note that perceptions of usability can influence acceptance. CHI addressed usability a decade before TAM, albeit actual usability rather than perceived usability. Perception was a secondary 'user satisfaction' measure to CHI researchers, who believed (not entirely correctly) that measurable reduction in time, errors, questions, and training would eventually translate into positive perceptions. The word "acceptance," that is, the "A" in TAM, is not in the CHI vocabulary. Discretionary users adopt, they do not accept.

The IS and CHI communities rarely mixed. When CHI was over a decade old, *Harvard Business Review*, a touchstone for IS researchers, published "Usability: The New Dimension of Product Design" (March 1994). The article did not mention CHI at all. It concluded that "user-centered design is still in its infancy" (p. 149).

COLLABORATION SUPPORT: OFFICE INFORMATION SYSTEMS GIVES WAY TO COMPUTER-SUPPORTED COOPERATIVE WORK

In the late 1980s, three research communities addressed small-group communication and information sharing: (1) OA/OIS, described above in the section "Minicomputers

and Office Automation.” (2) IS researchers building systems to support organizational decision making could, as computing costs declined, address group decision making more generally. (3) The proliferation of local area networks enabled some CHI researchers to move from individual productivity software to the quest for “killer apps” that would support teams.

OA/OIS led the way, but it declined and was fast disappearing by 1995. The Minicomputers, the platform for most OIS research, did not survive competition from PCs and workstations. The concept of office or group proved to be problematic: Organizations and individuals are persistent entities with goals and needs, but small groups often have ambiguous membership and undergo shifts in character as members join or depart. People in an organization who need to communicate often fall under different budgets, complicating acquisition decisions unless a technology is made available organization-wide.

The rapid shift was reflected in terminology use. First, “automation” fell out of favor. In 1986, ACM SIGOA shifted to SIGOIS and the annual AFIPS OA conferences were discontinued. By 1991, the term “office” followed: *Transactions on Office Information Systems* became *Transactions on Information Systems*; *Office: Information and People* became *Information Technology and People*; and “Conference on Office Information Systems” became “Conference on Organizational Communication Systems” (COOCS, in 1997 becoming the GROUP Conference).

The AI summer, which contributed to the OA/OIS effort, ended when AI failed to meet expectations: Massive funding did not deliver a pilot’s associate, an autonomous land vehicle, or a battle management system for the military. Nor were offices automated. CHI conference sessions on language processing had diminished prior to this AI winter, but sessions on modeling, adaptive interfaces, advising systems, and other uses of intelligence in interfaces increased through the 1980s before declining in the 1990s. Funding for AI became scarce, employment opportunities dried up, and conference participation dropped off.

A 1986 conference, building on a successful private 1984 workshop (Greif 1985), brought together researchers from diverse disciplines interested in issues of communication, information sharing, and coordination under the banner “Computer Supported Cooperative Work.” Participants came primarily from IS, OIS, CHI, distributed AI, and anthropology. Four of 13 CSCW program committee members and many papers were from schools of management, with similar participation by the OIS community.

The field coalesced in 1988. The book *Computer-Supported Cooperative Work*, edited by Irene Greif, was published, and SIGCHI sponsored a biennial North American CSCW conference. A European series (ECSCW) was initiated in 1989. With heavy participation from technology companies, North American CSCW had a small-group focus on networked individuals working on PCs, workstations, or minicomputers. Groups were either within an organization or linked by ARPANET, BITNET, or other networks. European

participation, primarily from academia and government agencies, focused on organizational use of technologies. It differed methodologically from most IS research in North America. Scandinavian influences, described in the next section, were felt in both CSCW and ECSCW.

Just as human factors researchers left CHI after a few years, most IS researchers who were involved with CSCW left in the early 1990s. One factor was a shift within IS from social psychology to organizational behavior in studying team behavior. The Hawaii International Conference on System Sciences (HICSS) was becoming a major IS prejournal publication venue for work with an organizational orientation. In contrast, the organizational focus conflicted with the CSCW interest in context-independent small-group support, which was the realm of social psychology and the goal of many technology companies. Some IS researchers participated in COOCS and GROUP. The split was not entirely amicable; the IS newsletter *Groupware Report* did not include CSCW on its list of relevant conferences.

The pace of technology change created challenges for CSCW. In 1985, supporting a small team was a technical challenge; 10 years later, the Web had arrived. Applications that provided awareness of the activity of distant collaborators was a celebrated achievement in the early 1990s; several years later, dark linings to the silver cloud arose in the form of privacy concerns and information overload. Phenomena, such as a “productivity paradox” in which IT investments were not returning benefits and health effects of Internet use by young people, were carefully identified only to vanish a few years later. Other changes brought European and North American CSCW into greater alignment. European organizations were starting to acquire commercial software products, a CSCW focus in North America, and North Americans were discovering that organizational context, an ECSCW focus, was often crucial in the design and deployment of products intending to support group activity. Organizational behaviorists and theorists were thriving in their home disciplines, but ethnographers studying technology use, marginalized in traditional anthropology departments, were welcomed into CSCW.

Despite the challenges of building on sands swept by successive waves of technology innovation, CSCW remains a strong research area that attracts a broad swath of HCI researchers. Content ranges from the highly technical to thick ethnographies of workplace activity, from studies of instant messaging dyads to scientific laboratories involving hundreds of people dispersed in space and time. Chapter 24 by Gary and Judy Olson in this handbook covers the technical side of this topic in depth, with references to other CSCW resources.

PARTICIPATORY DESIGN AND ETHNOGRAPHY

Prior to 1985-1995 some system developers explored methods to involve some of the future users in designing a system. Typically the users were nondiscretionary users of a system being developed by a large enterprise for its own use.

Sociotechnical design took a managerial perspective. Participatory or cooperative design, rooted in the Danish trade union movement, focused on empowering eventual users (Nygaard 1977).

Scandinavian approaches influenced human factors (e.g., Rasmussen 1986) and attracted wide notice with the publication of the proceedings of a conference held in Aarhus, Denmark, in 1985 (Bjerknes et al. 1987). Participatory design was a critique of IS approaches, yet the Scandinavians resonated with CHI researchers. Despite differences in culture, contexts of development (in-house system vs. commercial product), and contexts of use (nondiscretionary vs. discretionary), they shared the goal of empowering hands-on users. Most were also of the generation that grew up in the 1960s, unlike the World War II generation that dominated HF&E and IS.

Ethnography was a different approach to obtaining deep insights into potential users. Lucy Suchman managed a Xerox PARC group that presented studies of workplace activity at CSCW. Suchman published an influential critique of artificial intelligence in 1987 and a widely read review of the Aarhus proceedings in 1988, and as program chair she brought many Scandinavians to the CSCW 1988 conference.

LIBRARY AND INFORMATION SCIENCE: AN INCOMPLETE TRANSFORMATION

Research universities have always supported prestigious professional schools, but the prestige of library schools declined with the rise of higher-paid IT and software engineering professions. Between 1978 and 1995, 15 American library schools were shut down (Cronin 1995, p. 45). Most of the survivors were rechristened Library and Information Science. The humanities orientation had given way, and librarianship was being changed by technology. New curricula and faculty with different skills were needed.

The changes did not go smoothly or as anticipated. Forced multidisciplinarity is never easy. Exclusion of technology studies may have been a reasonable reaction to the expense and limitations of new technologies. However, Moore's law lowered costs and removed many limitations with such speed that people and organizations had little time to prepare. Young information scientists were not interested in absorbing a century of work on indexing, classifying, and providing access to complex information repositories; their eyes were fixed on a future in which many past lessons would not apply. Those that still applied would likely have to be relearned. The conflicts are exposed in a landmark 1983 collection, *The Study of Information: Interdisciplinary Messages* (Machlup and Mansfield 1983). In the book, W. Boyd Rayward outlines the humanities-oriented perspective and the technological perspective and argues that there was convergence. His essay is followed by commentaries attacking him from both sides.

In a series of meetings beginning in 1988, new library and information school deans at the universities Pittsburgh, Syracuse, Drexel, and subsequently Rutgers discussed approaches to explaining and managing multidisciplinary

schools. Despite this progressive effort, Cronin (1995) depicted LIS at loggerheads and in a "deep professional malaise." He suggested that librarianship be cut loose in favor of stronger ties to cognitive and computer sciences. Through the 1990s, schools at several universities dropped the word "library" and became schools of information (see Figure 2). More would follow.

1995–2010: THE INTERNET ERA ARRIVES

How did the spread of the Internet and the emergence of the Web affect HCI research threads? CHI researchers were Internet savvy. Although excited by the prospects, they took these changes in stride. Over time, CHI-related research, development, and use evolved. The Internet and the Web were not disruptive to HF&E either. The Web was initially a return to a form-driven interface style, and it was rarely a locus of routine work. However, the Web had a seismic impact on IS and on information science, so this section begins with these disciplines.

THE FORMATION OF ASSOCIATION FOR INFORMATION SYSTEMS SPECIAL INTEREST GROUP IN HUMAN–COMPUTER INTERACTION

The use of computers in organizations has changed. Organizations are no longer focused on maximizing computer use—almost everywhere, screen savers have become the main consumer of processor cycles. Advent of the Internet created more porous organizational boundaries. Employees in many organizations could download software such as instant-messaging clients, music players, and weblog tools inside organizational firewalls despite IT concerns about productivity and security. These are not the high-overhead applications of the past. Increasingly, software can be used from a web browser without requiring a download. Experience with all of this at home leaves employees impatient with poor software at work. In addition, many managers who had been hands-off users became late adopters in late 1990s or were replaced by younger managers. Today, managers and executives are hands-on early adopters of many technologies.

Significant as these changes are, the Web had a more dramatic effect on organizational information systems. Corporate IT groups had been focused solely on internal operations. They lived inside firewalls. Their customers were other employees. Suddenly, organizations were scrambling to create Web interfaces to external vendors and customers. Discretionary users! The Internet bubble burst, revealing that IT professionals, IS experts, and everyone else had limited understanding of Web phenomena. Nevertheless, online marketing, services, and business-to-business systems continued to grow. For many, the Web had become an essential business tool. In handling external customers, IT professionals and IS researchers were in much the same place that CHI was 20 years earlier, whether they realized it or (most often) not.

In 2001, the Association for Information Systems (AIS) established a Special Interest Group in Human–Computer

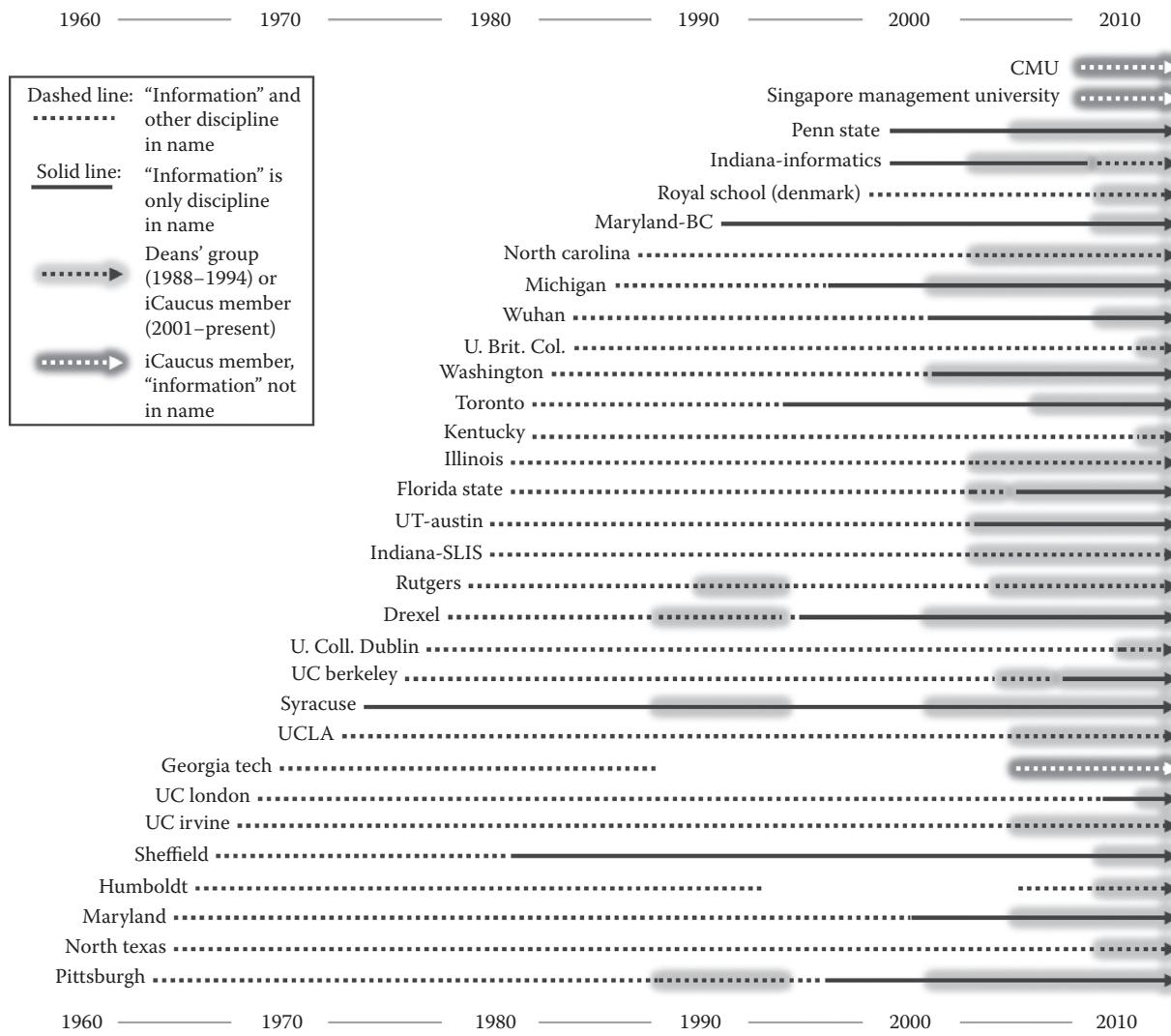


FIGURE 2 The iSchools and when “information” came into the names of the member Schools (Faculties, Colleges, etc.).

Interaction (SIGHCI). The founders defined HCI by citing 12 CHI research papers (Zhang, Nah, and Preece 2004, p. 148). Bridging the CHI and the information science communities was declared a priority. The charter of SIGHCI includes a broad range of organizational issues, but the publications emphasize interface design for e-commerce, online shopping, online behavior “especially in the Internet era” (Zhang 2004, p. 1), and effects of Web-based interfaces on attitudes and perceptions. Eight of the first 10 papers in SIGHCI-sponsored journal issues covered Internet and Web behavior.

In 2009, the journal *AIS Transactions on Human-Computer Interaction* was launched. The shift from an organizational focus to the Web and broader end-user computing is documented in Zhang et al.’s analysis (2009) of the IS literature from 1990 to 2008. This survey omits CHI from a list of the fields related to AIS SIGHCI. The bridging effort had foundered, as had three previous efforts to bridge to CHI: from Human Factors, Office Information Systems, and the Information Systems presence within CSCW.

DIGITAL LIBRARIES AND THE EVOLUTION OF LIBRARY INFORMATION SCIENCE

By 1995, an information wave had swept through universities (Figure 2). Digital technology was in the LIS curriculum. Familiarity with technology use was a prerequisite for librarianship. However, innovative research had not kept pace with professional training (Cronin 1995).

The Internet grew exponentially, but in 1995 it was still a niche activity found mainly on campuses. In the mid-1990s, Gopher, a convenient system for downloading files over the Internet, attracted attention as a possible springboard for indexing distributed materials. Wells’s (1938) concept of “world brain” seemed to be within reach. Then the Web hit, transforming information acquisition, management, and access at an ever-increasing pace. Between 1994 and 1999, two NSF/DARPA/NASA/National Library of Medicine/Library of Congress/National Endowment for the Humanities/FBI initiatives awarded close to US\$200 million for digital libraries research and development. This and other

investments galvanized the research community. In 2000, the American Society for Information Science appended “and Technology” to its name to become ASIST.

By 2000, 10 schools (or equivalent units) had information as the sole discipline in their name. In 2001 a series of deans meetings began, which were modeled on those of the late 1980s. The original members, Syracuse, Pittsburgh, and Drexel, were joined by Michigan; Berkeley, California; and the University of Washington. All are now information schools. In 2005, the first annual “iConference” drew participants from 19 universities with information programs. As of 2011, the “iCaucus” had 27 dues-paying members. Some are transformed library schools, some have closer ties with other disciplines, and some have formed recently as schools of information. Collectively, their faculty includes HCI researchers trained in each of the four disciplines highlighted in this introduction.

Expansion is not without growing pains. Conflicts arise among academic subcultures. The iConference competes with more established conferences in each field. Figure 2 suggests that a shift to a field called information is well underway, but many faculty still consider themselves “a researcher in {X} who is located in an information school,” where X could be library science, HCI, CSCW, IS, communication, education, computer science, or another discipline. We do not know how it will evolve, but we can say with confidence that information has become, and will remain, a significant player in HCI.

HUMAN FACTORS AND ERGONOMICS EMBRACES COGNITIVE APPROACHES

In 1996, the HFES formed a new technical group, Cognitive Engineering and Decision Making. It quickly became the largest technical group. A decade earlier this would have been unthinkable: Some leading human factors researchers disliked cognitive approaches. The CHI community first used the term cognitive engineering in this sense (Norman 1982, 1986). As this development suggests, CSTG declined in size and prominence as the HCI community dispersed. Most HF&E technical groups, from groups on telecommunications to those on medical systems, address digital technology and thereby HCI-related research.

Equally astonishing, in 2005 Human Performance Modeling was a new and thriving HFES technical group, initiated by Wayne Gray and Dick Pew, who had been active in CHI in the 1980s. Card, Moran, and Newell (1983) had introduced human performance modeling to reform the discipline of Human Factors from without. Some work continued within CHI that was focused on expert performance (e.g., a special issue of *Human–Computer Interaction*, vol. 12, number 4, 1997), but today the reform effort has moved within HF&E and remains focused largely on nondiscretionary use.

Government funding of HCI was largely shaped by the focus of HF&E. The Interactive Systems Program of the U.S. NSF—subsequently renamed HCI—was described thus: “The Interactive Systems Program considers scientific

and engineering research oriented toward the enhancement of human–computer communications and interactions in all modalities. These modalities include speech/language, sound, images and, in general, any single or multiple, sequential, or concurrent, human–computer input, output, or action” (National Science Foundation 1993).

One NSF program manager identified his proudest accomplishment to be doubling the already ample funding for natural language understanding research. Even after NSF established a separate Human Language and Communication Program in 2003, speech and language research was heavily supported by both the HCI and accessibility programs, with lighter support from AI and other programs. Subsequent NSF HCI program managers emphasized “direct brain interfaces” or “brain–computer interaction” based on brain waves and implants. A review committee noted that a random sample of NSF HCI grants included none by prominent CHI researchers (National Science Foundation 2003). NSF program managers rarely attended CHI conferences, which have little coverage of speech, language, or direct brain interaction. These technologies may prove useful, but they have so far made few inroads into discretionary use situations in homes and offices.

COMPUTER–HUMAN INTERACTION EVOLVES, AND EMBRACES DESIGN

The steady flow of new hardware, software features, applications, and systems ensures that people are always encountering and adopting digital technologies for the first time. This is important for technology producers and it generates new research issues. CHI has tracked this, generally focusing on an innovation when it first starts to attract a wide audience.

As an application matures, its use often becomes routine. Technologies such as e-mail and word processing, no longer discretionary for most of us, get less attention from CHI researchers whose gaze is directed toward the discretionary use of the moment, including Web design, ubiquitous and mobile computing, social computing, and use of Wikipedia. New issues include information overload, privacy, and effects of multitasking, and encourage the emergence of new methods, such as ethnography and data mining. At a higher level, continuity is found in CHI: exploration of input devices, communication channels, information visualization techniques, and design methods. Proposals to build HCI theory on these shifting sands (Barnard et al. 2000; Carroll 2003) remain largely aspirational.

Expanding participation in the Internet as its reliability and bandwidth increased steadily through the mid-1990s brought real-time and quasi-real-time communication technologies such as e-mail into greater focus. The Web temporarily slowed this by shifting attention to indirect interaction with static sites, but with the advent of Web 2.0 and greater support for animation and video the pace quickened. The Web was like a new continent. Explorers posted flags here and there. Then came attempts at settlement, with the virtual worlds research and development that blossomed in the late

1990s. Few of the early pioneers survived; there was little to do in virtual worlds other than chat and play games. But slowly some people shifted major portions of their work and play online, relying on online information sources, digital photo management, social software, digital documents, online shopping, multiplayer games, and so on. This evolution is reflected in CHI research.

The content of CSCW in North America has shifted in response to the extraordinary growth of social networking sites, Wikipedia, and other Web phenomena, which are of intense interest to students and academic researchers and the software companies who hire or consult with many of them. These technologies are not yet of great interest to the organizations and government agencies that are the customer for European CSCW research, and the move toward shared interests has been reversed. Europeans have moved more rapidly into basic research in vertical domains. The division resembles that of 20 years ago, based on a new generation of technology. In several years the two research threads may again converge, perhaps under different names: “computer supported cooperative work” is outdated. Many digital devices are not considered computers, they play central rather than support roles, activities around them can be competitive or conflictual, and they may be used more for recreation than work.

The Web curtailed research into one thread of AI research: powerful, self-contained personal productivity tools. Considerable effort is required to embed knowledge in application software, but when access to external information sources was limited, it was worth trying. With today’s easy access to information and knowledgeable people online, static, self-contained knowledge representation is less useful. In contrast, adaptive systems that merge and filter local and Internet-based information have a role to play. Steady progress in machine learning is enhancing productivity tools, although implausible AI forecasts have not disappeared.

To the psychologists and computer scientists who formed the CHI community, interface design was a matter of science and engineering. They focused on performance and assumed that people eventually choose efficient alternatives. Because human discretion involves aesthetic preferences and invites marketing and nonrational persuasion, this view was not sustained when computing costs came down. This engineering orientation gripped CHI longer than SIGGRAPH, where aesthetic appeal was a major driver. CHI researchers eventually came around, labeling the study of enjoyment “funology” (Blythe et al. 2003) lest someone think that they were having too good a time.

Some visual designers participated in graphical interface research early on. Aaron Marcus began working full time on computer graphics in the late 1960s. William Bowman’s book *Graphic Communication* (1968) was a strong influence on the development of Xerox Star, for which the designer Norm Cox’s icons were chosen (Bewley et al. 1983). However, graphic design was considered a secondary activity (Evenson 2005). In 1995, building on workshops at previous conferences, SIGCHI initiated “Designing Interactive Systems”

(DIS), a biennial conference that draws more systems designers than visual designers. In 2003, SIGCHI, SIGGRAPH, and the American Institute of Graphic Arts (AIGA) initiated the “Designing for User Experience” (DUX) conference series that fully embraced visual and commercial design. This effort lasted only through 2007, but the significance of design was established. Design is not typically assessed in research papers. The changing sensibility is reflected in *ACM Interactions*, a magazine launched by CHI in 1994, which has steadily increased the focus on design in both its content and its appearance.

Design’s first cousin, marketing, has been poorly regarded by the CHI community (Marcus 2004). Website design forced the issue. Site owners wish to keep users interested in a site, whereas users may prefer to escape quickly. Consider supermarkets, which position items that most shoppers want far apart, forcing people to traverse aisles where other products beckon. CHI professionals who align themselves with end users face a stakeholder conflict when designing for a site owner. This was not true in the past: Designers of individual productivity tools had little conflict of interest with prospective customers. Marketing is concerned with identifying and satisfying user needs, as well as shaping them. It will likely find a place in CHI, perhaps labeled “brandology.”

Finally, CHI has gradually become more open to work that takes a social or political stance. Accessibility was first addressed in the context of physical constraints. Socioeconomic factors were included in Universal Usability conferences in 2000 and 2003. Sustainability and fitness emerged as topics. This may reflect a distancing from a sense that engineering should strive for value neutrality, a bid for relevance by an increasingly academic group or aging CHI baby boomers who are considering their legacies.

The evolution of CHI is reflected in the influential contributions of Donald Norman. A cognitive scientist who introduced the term cognitive engineering, he presented the first CHI’83 paper. It defined “user satisfaction functions” based on speed of use, ease of learning, required knowledge, and errors. His influential book *Psychology of Everyday Things* (1988) focused on pragmatic usability. Its 1990 reissue as *Design of Everyday Things* reflected a field refocusing on invention. Fourteen years later he published *Emotional Design: Why We Love (or Hate) Everyday Things*, stressing the role of aesthetics in our response to objects.

LOOKING BACK: CULTURES AND BRIDGES

Despite overlapping interests, in a dynamic environment with shifting alliances, the major threads of HCI research—HF&E, IS, LIS, and CHI—have not merged. They have interacted with each other only sporadically, although not for a lack of bridge-building efforts. The Human Factors Society co-organized the first CHI conference. CSCW sought to link CHI and IS. Mergers of OIS with CHI and later CSCW were considered. AIS SIGHCI tried to engage with CHI. Researchers recently hired into Information Schools remain active in the other fields.

Even within computer science, bridging is difficult. Researchers interested in interaction left SIGGRAPH to join the CHI community rather than form a bridge. A second opportunity arose 20 years later, when standard platforms powerful enough to support photorealism loomed, but the DUX conference series managed only three meetings. For AI, SIGART and SIGCHI cosponsor the Intelligent User Interface series, but participation has remained outside mainstream HCI. What are the obstacles to more extensive interaction across fields?

DISCRETION AS A MAJOR DIFFERENTIATOR

HF&E and IS arose before discretionary hands-on use was common. The information field only slowly distanced itself from supporting specialists. CHI occupied a new niche: discretionary use by nonexperts. HF&E and especially IS researchers considered organizational factors; CHI with few exceptions avoided domain-dependent work. As a consequence, HF&E and IS researchers shared journals. For example, Benbasat and Dexter (1985) published their work in *Management Science* and cited five *Human Factors* articles. Apart from LIS, they quickly focused on broad populations. IS countered its organizational focus by insisting that work be framed by theory, which set it apart from CHI in particular.

The appropriateness of a research method is tied to the motivation of the researchers. HF&E and CHI were shaped by psychologists trained in experimental testing of hypotheses about behavior, and hypothesis-driven experimentation was also embraced by IS. Experimental subjects agree to follow instructions for an extrinsic reward. This is a reasonable model for nondiscretionary use, but not for discretionary use. CHI researchers relabeled subjects as “participants,” which sounds volitional, and found that formal experimental studies were usually inappropriate: There were too many variables to test formally and feedback from a few participants was often enough. Laboratory studies of initial or casual discretionary use usually require confirmation in real-world settings anyway, more so than studies of expert or trained behavior, because of the artificial motivation of the laboratory study participant.

The same goals apply—fewer errors, faster performance, quicker learning, greater memorability, and being enjoyable—but the emphasis differs. For power plant operation, error reduction is critical, performance enhancement is good, and other goals are less important. For telephone order entry takers performance is critical, and testing an interface that could shave a few seconds from a repetitive operation requires a formal experiment. In contrast, consumers often respond to visceral appeal and initial experience. In assessing designs for mass markets, avoiding obvious problems can be more important than striving for an optimal solution. Less rigorous discount usability or cognitive walk-through methods (Nielsen 1989; Lewis et al. 1990) can be enough. Relatively time-consuming qualitative approaches, such as contextual design or persona use (Beyer and Holtzblatt 1998; Pruitt and Adlin 2006), can provide a deeper understanding when context is critical or new circumstances arise.

CHI largely abandoned its roots in scientific theory and engineering, which does not impress researchers from HF&E or theory-oriented IS. The controversial psychological method of verbal reports, developed by Newell and Simon (1972) and foreshadowed by gestalt psychology, was applied to design by Clayton Lewis as “thinking aloud” (Lewis and Mack 1982; Lewis 1983). Perhaps the most widely used CHI method, it led some researchers in other fields to characterize CHI people as wanting to talk about their experiences instead of doing research.

ACADEMIC, LINGUISTIC, AND GENERATIONAL CULTURES

The academic culture of the sciences is that conferences are venues for work in progress and journals are repositories for polished work. The disciplines of HF&E, IS, Documentation, and Library Science adhere to this practice. In contrast, for U.S. computer science disciplines, conference proceedings are now the final destination of most work. Outside the United States, computer science retains a journal focus, which suggests that a key factor was the decision of ACM to archive conference proceedings (Grudin 2010). Information science draws on researchers from both camps, journals as archival and conferences as archival. Of course, a difference in preferred channel impedes communication. Researchers in journal cultures chafe at CHI’s insistence on polish and its high conference rejection rates; CHI researchers are dismayed by the lack of polish at other conferences and are less inclined to read journals.

CHI conferences accept 20%–25% of submissions. With a few exceptions, HF&E and IS conferences accept about 50% or more. In contrast, CHI journals receive fewer submissions and have higher acceptance rates. Many CHI researchers report that journals are not relevant. By my estimate, at most 15% of the work in CHI-sponsored conferences reaches journal publication. In contrast, an IS track organizer for HICSS estimated that 80% of research there progressed to a journal (Jay Nunamaker, opening remarks at HICSS-38, January 2004).

A linguistic divide also set CHI apart. HF&E and IS use the term “operator” and a “user” could be a manager who read printed reports. For CHI, “operator” was demeaning and a “user” was always a hands-on user. In HF&E and IS streams, “task analysis” refers to an organizational decomposition of work, perhaps considering external factors; in CHI, “task analysis” is a cognitive decomposition, such as breaking a text editing move operation into select, cut, select, and paste. In IS “implementation” means organizational deployment, whereas in CHI it is a synonym for development. The terms “system,” “application,” and “evaluation” also have different connotations or denotations in the different fields. Significant misunderstandings resulted from failures to appreciate these differences.

Different perspectives and priorities were also reflected in attitudes toward standards. Many HF&E researchers contributed to standards development, believing that standards contribute to efficiency and innovation. A view widespread

in the CHI community was that standards inhibit innovation. Both views have elements of truth, and the positions partly converged as Internet and Web standards were tackled. However, the attitudes reflected the different demands of government contracting and commercial software development. Specifying adherence to standards is a useful tool for those preparing requests for proposals, whereas compliance with standards can make it more difficult for a product to differentiate itself.

The generational divide was also a factor. Many CHI researchers who grew up in the 1960s and 1970s did not appreciate the prior generation's orientation toward military, government, and business systems. They were also put off by the lack of gender neutrality in the HF&E and IS "man–machine interaction" literature, which one still occasionally encounters. Only in 1994 did *IJMMS* become *International Journal of Human–Computer Studies*. Such differences affected the enthusiasm for building bridges and exploring literatures.

Competition for resources was another factor. Computers of modest capability were extremely expensive for much of the time span we have considered. CHI was initially largely driven by the healthy tech industry, whereas research in the other fields was more dependent on government funding that waxed and waned. When funding waxed, demand for researchers outstripped supply. HCI prospered during AI winters, starting with Sutherland's use of the TX-2 when AI suffered its first setback and recurring with the emergence of major HCI laboratories during the severe AI winter of the late 1970s. Library schools laboring to create information science programs had to compete with computer science departments that awarded faculty positions to graduates of master's programs when the supply was low.

Greater interdisciplinarity is intellectually seductive. Could we not learn by looking over fences? But a better metaphor might be the big bang. Digital technology is an explosion, streaming matter and energy in every direction, forming worlds that at some later date might discover one another and find ways to communicate, and then again, might not.

LOOKING FORWARD: TRAJECTORIES

The future of HCI will be dynamic and full of surprises. The supralinear growth of hardware capability confounds efforts at prediction: We rarely experience exponential change and do not reason well about it. In the United States, NSF is tasked with envisioning the future and providing resources for taking us there, yet two major recent HCI initiatives, "Science of Design" and "CreativIT" (focused on creativity), wound down quickly. Nevertheless, extrapolations from observations about the past and present suggest possible developments, providing a prism through which to view other chapters in this handbook and perhaps some guidance in planning a career.

DISCRETION: Now You See It, Now You Don't

We exercise prerogative when we use digital technology—sometimes. More often when at home, less often at work. Sometimes we have no choice, as when confronted by a telephone answering system. Those who are young and healthy have more choices than those constrained by injury or aging.

Many technologies follow the maturation path shown in Figure 3. Software that was discretionary yesterday is indispensable today. Collaboration forces us to adopt shared conventions. Consider a hypothetical team that has worked together for 20 years. In 1990, members exchanged printed documents. One person still used a typewriter, whereas others used different word processors. One emphasized words by underlining, another by italicizing, and a third by bolding. In 2000, the group decided to exchange digital documents. They had to adopt the same word processor. Choice was curtailed; it was only exercised collectively. Today this team is happy sharing documents in PDF format, so they can again use different word processors. Perhaps tomorrow software will let them personalize their view of a single underlying document, so one person can again use and see in italics what another sees as bold or underlined.

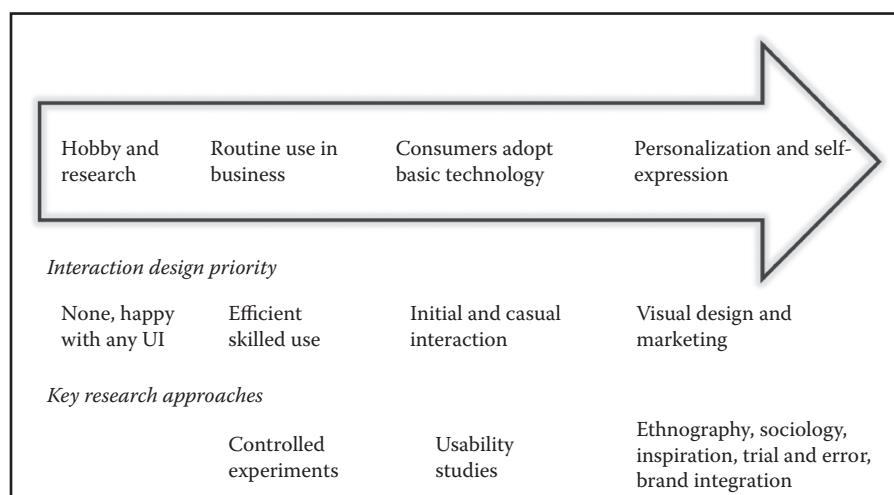


FIGURE 3 From invention to maturity.

Shackel (1997, p. 981) noted this progression under the heading “From Systems Design to Interface Usability and Back Again.” Early designers focused at the system level; operators had to cope. When the PC merged the roles of operator, output user, and program provider, the focus shifted to the human interface and choice. Then individual users again became components in fully networked organizational systems. Discretion can evaporate when a technology becomes mission-critical, as word processing and e-mail did in the 1990s.

The converse also occurs. Discretion increases when employees can download free software, bring smartphones to work, and demand capabilities they enjoy at home. Managers are less likely to mandate the use of a technology that they use and find burdensome. For example, language-processing systems appealed to military officers, until they themselves became hands-on users:

Our military users ... generally flatly refuse to use any system that requires speech recognition.... Over and over and over again, we were told “If we have to use speech, we will not take it. I don’t even want to waste my time talking to you if it requires speech....” I have seen generals come out of using, trying to use one of the speech-enabled systems looking really whipped. One really sad puppy, he said “OK, what’s your system like, do I have to use speech?” He looked at me plaintively. And when I said “No,” his face lit up, and he got so happy (Forbus 2003; see also Forbus, Usher, and Chapman [2003]).

In domains where specialized applications become essential and where security concerns curtail openness, discretion can recede. But Moore’s law (broadly construed), competition, and the ease of sharing bits should guarantee a steady flow of experimental technologies with unanticipated and thus initially discretionary uses.

UBIQUITOUS COMPUTING: INVISIBLE HUMAN-COMPUTER INTERACTION?

Norman (1988, p. 185) wrote of “the invisible computer of the future.” Like motors, he speculated, computers would be present everywhere and visible nowhere. We interact with clocks, refrigerators, and cars. Each has a motor, but who studies human–motor interaction? Marc Weiser subsequently introduced a similar concept, “ubiquitous computing.” A decade later, at the height of the Y2K crisis and the Internet bubble, computers were more visible than ever. But after a quarter century, while we may always want a large display or two, would anyone call a smartphone or a book reader a computer? The visions of Norman and Weiser may be materializing.

With digital technology embedded everywhere, concern with interaction is everywhere. HCI may become invisible through omnipresence. As interaction with digital technology becomes part of everyone’s research, the three long-standing HCI fields are losing participation.

Human Factors and Ergonomics

David Meister, author of *The History of Human Factors and Ergonomics* (1999), stresses the continuity of HF&E in the face of technology change:

Outside of a few significant events, like the organization of HFS in 1957 or the publication of Proceedings of the annual meetings in 1972, there are no seminal occurrences ... no sharp discontinuities that are memorable. A scientific discipline like HF has only an intellectual history; one would hope to find major paradigm changes in orientation toward our human performance phenomena, but there is none, largely because the emergence of HF did not involve major changes from pre-World War II applied psychology. In an intellectual history, one has to look for major changes in thinking, and I have not been able to discover any in HF (e-mail, September 7, 2004).

Membership in the Computer Systems Technical Group has declined. Technology is heavily stressed in technical groups such as Cognitive Engineering and Decision Making, Communication, Human Performance Modeling, Internet, System Development, and Virtual Environment. Nor do Aging, Medical Systems, or other technical groups avoid “invisible computers.”

Information Systems

While IS was thriving during the Y2K crisis and the Internet bubble, other management disciplines—finance, marketing, operations research, and organizational behavior—became more technically savvy. When the bubble burst and enrollments declined, the IS niche became less well defined. The research issues remain significant, but this cuts two ways. As IT organizations standardize on products and outsource IT functions, business-to-business and web portals for customers get more attention. These give rise to finance and marketing considerations, so HCI functions could be assumed by other management disciplines.

Computer-Human Interaction

This nomadic group started in psychology and then won a seat at the computer science table, which was bestowed grudgingly. Several senior CHI people moved to information schools. Lacking a well-defined academic niche, CHI ties its identity to the SIGCHI organization and the CHI conference. Membership in SIGCHI peaked in 1992 and conference attendance peaked in 2001. As new technologies become widely used, specialized conferences appear, often started by younger researchers. World Wide Web conferences included papers on HCI issues from the outset. HCI is an “invisible” presence in conferences on agents, design, and on computing that is ubiquitous, pervasive, accessible, social, and sustainable. High rejection rates for conference submissions and a new generational divide could accelerate the dispersion of research.

CHI attendance has become more exclusively academic, despite industry’s need for basic research in specific areas.

Apart from education and health, which have broad appeal, and software design and development, CHI remains largely focused on general phenomena and resistant to domain-specific work. This creates additional opportunities for regional and specialized conferences.

INFORMATION

Early in the computer era, there were no networks and memory was fantastically expensive. Computers were for computation, not information processing. Today, the situation is reversed: Memory and bandwidth are so plentiful that most computation is in the service of processing and distributing information. And the shift to an emphasis on information, with computation present but less visible, could well accelerate.

Cronin (1995) proposed that information access, in terms of intellectual, physical, social, economic, and spatial/temporal factors, is the focus of the information field. Information is acquired from sensors and human input; it flows over networks including the Web, and is aggregated, organized, and transformed. The routing and management of information within enterprises, as well as the consequences of ever more permeable organizational boundaries, is evolving. Approaches to personal information management are also rapidly changing. It was once centered on shoeboxes of photographs and boxes of old papers. Now most of us face significant online information management decisions, choosing what to keep locally, what to maintain in the cloud, and how to organize it to ensure its future accessibility. The CHI field has over a decade of work on information design and visualization (see Chapter 23 by Stuart Card).

In speculating about the future, Cronin (1995, p. 56) quotes Wersig (1992) who argued that concepts around information might function “like magnets or attractors, sucking the focus-oriented materials out of the disciplines and restructuring them within the information scientific framework.” Could this happen? Information schools have hired senior and junior people from many relevant areas. Andrew Dillon, dean of the University of Texas, School of Information, worked at Loughborough with Brian Shackel and Ken Eason. Syracuse, the first extant school of information (since 1974), has faculty with IS training and orientation. CHI faculty have migrated to information schools and departments of several leading universities.

Communication Studies is a discipline to watch. Rooted in humanities and social sciences, it is gradually assuming a quantitative focus. Centered on studies of television and other mass media, the field blossomed in the 1980s and 1990s. Only in the last several years has computer-mediated communication reached the scale of significance of other mass media. HCI is in a position to draw on past work in communication, as communication focuses more on digital media.

The rise of specialized programs—biomedical informatics, social informatics, community informatics, and information and communication technology for development

(ICT4D)—works against the consolidation of information studies. Information, like HCI, could become invisible through ubiquity. The annual Information Conference is a barometer. In 2005 and 2006, there was active discussion and disagreement about directions. Should new journals and research conferences be pursued, or should the field stick with the established venues in the various contributing disciplines? In the years since, faculty from different fields worked out pidgin languages with which to communicate with each other. Assistant professors were hired and graduate students enlisted, whose initial jobs and primary identities are with information. Will they creolize the pidgin language?

One can get a sense that the generals may still be arguing over directions, but the troops are starting to march. It is not clear where they will go. The generals, although busy with local campaigns, are reluctant to turn over command. The annual iConference vies with the less international but more established ASIST conference. However this evolves, in the long term, information is likely to be the major player in HCI. Design and information are active foci of HCI today, but the attention to design is compensation for past neglect. Information is being reinvented.

CONCLUSION: THE NEXT GENERATION

Looking back, cyclic patterns and cumulative influences are visible. New waves of hardware enabled different ways to support the same activities. E-mail arrived as an informal communication medium, was embraced by students, regarded with suspicion by organizations, and eventually became more formal and used everywhere. Then texting and instant messaging came along as an informal medium, were embraced by students, regarded with suspicion by organizations, and eventually became used everywhere. Social networking came along....

Mindful of Edgar Fiedler's admonition that “he who lives by the crystal ball soon learns to eat ground glass,” consider this: In the mid-1980s, the mainframe market lost the spotlight. Organizations were buying hundreds of PCs, but these were weak devices with little memory, hard to network. They did not need more mainframes, but what about a massive, parallel supercomputer? Government and industry invested vast sums in high-performance computing only to discover that it was hard to decompose most computational problems into parallel processes whose output could be reassembled. As these expensive and largely ineffective efforts proceeded, PCs slowly got stronger, added some memory, got networked together, and, without vast expenditures and almost unnoticed at first, the Internet and the Web emerged.

Today the PC is losing the spotlight. Organizations buy hundreds of embedded systems, sensors, and effectors, but these are weak devices with little memory, hard to network. Some tasks can be handed off to a second processor, but how far can parallel multicore computers take us? Government and industry are investing large sums in parallel computing. They are rediscovering the difficulties. Sensors and effectors will add processing and memory, harvest energy,

and get networked. What will that lead to? The role of the PC may shift, becoming a personal control station where we can monitor vast quantities of information on anything of interest—our health, the state of household appliances, Internet activity, etc.—on large displays, with specific tasks easily moved to portable or distributed devices.

New technologies capture our attention, but of equal importance is the rapid maturation of technologies such as digital video and document repositories, as well as the complex specialization occurring in virtually all domains of application. Different patterns of use emerge in different cultures and different industries. Accessibility and sustainability are wide-open, specialized research and development areas. Tuning technologies for specific settings can bring human factors approaches to the fore; designing for efficient heavy use could revive command-driven interfaces, whether the commands are typed, spoken, or gestural.

Digital technology has inexorably increased the visibility of activity. We see people behaving not as we thought they would or as we think they should. Rules, conventions, policies, regulations, and laws are not consistently followed; sanctions for violating them are not uniformly applied. Privacy and our evolving attitudes toward it are a small piece of this powerful progression. Choosing how to approach these complex and intensifying challenges—Where do we increase enforcement? Should or could we create more nuanced rules? When should we tolerate more deviance?—at the levels of families, organizations, and societies. This will be a perpetual preoccupation as technology exposes the world as it is.

Until some time after it is revoked, Moore's law broadly construed will ensure that digital landscapes provide new forms of interaction to explore and new practices to improve. The first generation of computer researchers, designers, and users grew up without computers. The generation that followed used computers as students, entered workplaces, and changed the way technology was used. Now a generation has grown up with computers, game consoles, and cell phones. They absorbed an aesthetic of technology design and communicate by messaging. They are developing skills at searching, browsing, assessing, and synthesizing information. They use smartphones, acquire multimedia authoring talent, and embrace social networking sites. They have different takes on privacy and multitasking. They are entering workplaces, and everything will be changed once again. However it is defined and wherever it is studied, human-computer interaction will for some time be in its early days.

APPENDIX: PERSONAL OBSERVATIONS

My career from 1973 to 1993 followed a common enough path. I was one of many who worked as a computer programmer, studied cognitive psychology, spent time as an HCI professional in industry, and then moved to academia. I describe personal experiences here not because I am special, but to add texture and a sense of the human impact of some of the developments I have described. My interest in history arose from the feeling of being swept along by invisible forces,

sometimes against my intention. My first effort at understanding was titled “The Computer Reaches Out” (Grudin 1990): I saw computers evolving and slowly reaching into the world and changing it in ways that we, their developers, had not foreseen.

1970: A CHANGE IN PLANS

As a student, I read and believed the *Life* magazine article that forecast computers with superhuman intelligence arriving in several years. I concluded that if we survived a few years, we could count on machines to do all useful work. Human beings should focus on doing what they enjoy. I shifted from physics to mathematics and from politics to literature.

1973: THREE PROFESSIONS

Looking for my first job in 1973, I found three computer job categories in the *Boston Globe* classifieds: (1) operators, (2) programmers, and (3) systems analysts. Not qualified to be a highly paid analyst, I considered low-paid, hands-on operator jobs, but I landed a programming job with Wang Laboratories, which was at the time a small electronics company. For 2 years, I never saw the computer that my programs ran on. I flowcharted on paper and coded on coding sheets that a secretary sent to be punched and verified. A van carried the stack of cards 20 miles to a computer center, and later that day or the next day I got the printout. It might say something like “Error in Line 20,” and I would resume work on the program.

1975: A CADRE OF DISCRETIONARY HAND-ON USERS

In 1975, Wang acquired a few teletype terminals with access to the WYLBUR line editor, developed at the Stanford Linear Accelerator. Some of us programmers chose to abandon paper and became hands-on computer users.

1983: CHILLY RECEPTION FOR A PAPER ON DISCRETION IN USE

My first HCI publication, Grudin and MacLean (1984), was written when I was a postdoctoral researcher at the MRC Applied Psychology Unit. Allan and I showed that people sometimes choose a slower interface for aesthetic or other reasons even when they are familiar with a more efficient alternative. A senior colleague asked us not to publish it. He worked on improving expert efficiency through cognitive modeling. A demonstration that greater efficiency could be undesirable would be a distraction, he said: “Sometimes the larger enterprise is more important than a small study.”

1984: ENCOUNTERING MOORE'S LAW, INFORMATION SYSTEMS, HUMAN FACTORS, AND DESIGN

I returned to Wang, which had become a large minicomputer company, and found that Moore's law had changed

the business. More hardware was ordered from catalogs and the reduced cost of memory and other factors had changed programming priorities and skills. I was soon influenced by another cognitive psychologist, Susan Ehrlich, who worked in a marketing research group and later managed the human factors group. She introduced me to the IS literature, which I found difficult to understand. I attended Boston-area chapter meetings of both HFS and SIGCHI. I saw the cultural differences but felt CHI could learn from human factors. In a futile gesture to counter CHI antipathy toward human factors, I began calling myself a human factors engineer. I drove to Cambridge to see the newly released Macintosh. Few software engineers had the visual design skills that I realized would become important, so at work I looked for industrial designers of hardware (boxes) who could be enlisted to support software interface design.

1985: THE GRAPHICAL USER INTERFACE SHOCK

In the early 1980s, Phil Barnard and I were among the many cognitive psychologists working on command naming. This was an important application in the era of command-line interfaces, but the ambition was to develop a comprehensive theoretical foundation for HCI. The success of the Mac in 1985 curtailed interest in command names. No one would build on our past work—a depressing thought. It also dashed the hope for a comprehensive theoretical foundation for HCI. We had to choose: Am I a cognitive psychologist or a computer professional? Phil remained a psychologist.

1986: BEYOND THE USER: GROUPS AND ORGANIZATIONS

I agreed to join MCC, an industry research consortium. Between jobs I worked on two papers, each addressing a major challenge encountered in product development: (1) From 1984 to 1986, I had worked on several products or features intended to support groups rather than individual users. These had not done well. Why was group support so challenging? (2) It was painfully evident that organizational structures and development processes were badly suited to interactive software development. What could be done about it? These issues formed the basis for much of my subsequent research.

1989: DEVELOPMENT CONTEXTS: A MAJOR DIFFERENTIATOR

I spent 2 years at Aarhus University. Within weeks of arriving in a country that had little commercial software development, I saw that differences in the conditions that govern product, in-house, and contract development of interactive software could shape practices and perceptions in CHI, IS, and software engineering. Sorting this out led to my first library research for purely historical purposes (Grudin 1991). Perusing long-forgotten journals and magazines in dusty library corridors felt like wandering through an archaeological site.

1990: JUST WORDS: TERMINOLOGY CAN MATTER

I felt a premonition in 1987 when my IS-oriented colleague Susan Ehrlich titled a paper “Successful Implementation of Office Communication Systems.” By “implementation,” she meant introduction into organizations. To me, implementation was a synonym for coding or development. Sure enough, the ACM editor asked her to change the word implementation to adoption (Ehrlich 1987). What she called systems I called applications. Was language, usually an ally, getting in the way?

In 1990, I described the focus of my planned HCI course at Aarhus as “user-interface evaluation.” My new colleagues seemed embarrassed. Weeks later, a book written by one of them was published (Bødker 1990). Its first sentence was a quotation: “Design is where the action is, not evaluation.” Now I was embarrassed. In an in-house development world, with its dogma of getting the design right up front, development projects could take 10 years. Evaluation occurred at the end when only cosmetic changes were possible, and had a negative stigma. In commercial product development, evaluation of the previous version, competitive products, and (ideally) prototypes was integral to design. Evaluation is central to iterative design. It draws on the experimental psychologists’ skillset. We considered it a good thing.

Later in 1990, I participated in a panel on task analysis at a European conference. To my dismay, this IS-oriented group defined task analysis differently than I did. To them, it meant an organizational task analysis: tasks as components in a broad work process. In CHI, it meant a cognitive task analysis: breaking a simple task into components; for example, is “move text” thought of as “select-delete-paste” or as “select-move-place”? Some Europeans felt North American claims to have conducted task analyses were disgraceful, not understanding the context.

Also in 1990, en route to giving a job talk at the University of California Irvine, my first lecture to an IS audience at the University of California Los Angeles Anderson School of Management ended badly when the department head asked a question. It seemed meaningless, so I replied cautiously. He rephrased the question. I rephrased my response. He started again, then stopped and shrugged as if to say, “this fellow is hopeless.” When I saw him a few months later, he was astonished to learn that his Irvine friends were hiring me. Later, I understood the basis of our failure to communicate: We attached different meanings to the word “users.” To me, it meant hands-on computer users. He was asking about IS users who specified database requirements and read reports, but were not hands-on computer users. To me all use was hands-on, so his question had made no sense.

A book could be written about the word “user.” From a CHI perspective, the IS user was “the customer.” Consultants use “client.” In IS, the hands-on user was “the end-user.” In CHI parlance, end-user and user were one and the same—a person who entered data and used the output. The word end-user seemed superfluous or an affectation. Human factors

used “operator” which CHI considered demeaning. In software engineering, user typically denoted a tool user, that is, a software engineer.

A final terminology note: the male generic. I avoided submitting to *IJMMS* and turned down an invitation to speak at a “man–machine interaction” event. I was keen on learning from other disciplines, but that was a linguistic bridge I usually avoided crossing. I generally consider words to be a necessary but uninteresting medium for conveying meaning, but such experiences led to an essay on unintended consequences of language (Grudin 1993).

2010: REFLECTIONS ON BRIDGING EFFORTS

I have been a minor participant in efforts to find synergies drawing from CHI and HFS, OIS, IS (in both CSCW and AIS SIGCHI), or Design. None succeeded. I’ve interviewed others who participated years ago and identified the obstacles touched on in the introduction, many of which I experienced. As a boomer, I experienced generational and cultural divides. Many of my MCC colleagues joined the consortium to avoid Star Wars military projects. We lived through disputes between cognitive psychologists and radical behaviorists. I was among CHI researchers who shifted from journals to conferences as the primary publication venue and from hypothesis-driven experimentation to build-and-assess and qualitative field research.

Some differences fade over time, but many persist. Conference reviewers are often irritated by unfamiliar acronyms used by authors from other fields. Writing a chapter for an IS-oriented book (Palen and Grudin 2002), my coauthor and I wrangled at great length with the editor over terminology.

In researching this article, I reviewed the literature on TAM, the model of white-collar employee perceptions of technology that is heavily cited in IS but never in CHI. I unsuccessfully searched online for TAM references. Only on my third attempt did I see the problem: TAM stands for “Technology Acceptance Model,” but I repeatedly typed in “Technology Adoption Model.” TAM examined nondiscretionary acceptance, I think in terms of discretionary adoption. Different biases lead to different terminology, and confusion.

2010: Predicting the Future

Detailed forecasts, including mine, rarely look good upon close inspection. But understanding the forces that have shaped the past offers hope of anticipating or reacting quickly to future events. Even more useful may be indications of where effort will be futile. I believe the most common error is to underestimate the impact of hardware changes, and in particular that once effects start to be felt, how rapidly they will escalate. I published some analysis and projection in the November 2006 and January 2007 issues of *ACM Interactions*—check to see how I’m doing. (<http://interactions.acm.org/content/archives.php>).

REFERENCES*

- Ackoff, R. L. 1967. Management misinformation systems. *Manage Sci* 14:B147–56.
- Asimov, I. 1950. *I, Robot*. New York: Gnome Press.
- Aspray, W. 1999. Command and control, documentation, and library science: The origins of information science at the University of Pittsburgh. *IEEE Ann Hist Comput* 21(4):4–20.
- Baecker, R., and W. Buxton. 1987. A historical and intellectual perspective. In *Readings in HCI: A multidisciplinary approach*, ed. R. Baecker and W. Buxton, 41–54. San Francisco, CA: Morgan Kaufmann.
- Baecker, R., J. Grudin, W. Buxton, and S. Greenberg. 1995. A historical and intellectual perspective. In *Readings in HCI: Toward the Year 2000*, ed. R. Baecker, J. Grudin, W. Buxton and S. Greenberg, 35–47. San Francisco, CA: Morgan Kaufmann.
- Bagozzi, R. P., F. D. Davis, and P. R. Warshaw. 1992. Development and test of a theory of technological learning and usage. *Hum Relat* 45(7):660–86.
- Banker, R. D., and R. J. Kaufmann. 2004. The evolution of research on Information Systems: A fiftieth-year survey of the literature in Management Science. *Manage Sci* 50(3):281–98.
- Bannon, L. 1991. From human factors to human actors: The role of psychology and HCI studies in system design. In *Design at Work*, ed. J. Greenbaum and M. Kyng, 25–44. Hillsdale, NJ: Erlbaum.
- Bardini, T. 2000. *Bootstrapping: Douglas Engelbart, Coevolution, and the Origins of Personal Computing*. Stanford, CA: Stanford University.
- Barnard, P. 1991. Bridging between basic theories and the artifacts of HCI. In *Designing Interaction: Psychology at the Human-Computer Interface*, ed. J. M. Carroll, 103–27. Cambridge: Cambridge University Press.
- Barnard, P., J. May, D. Duke, and D. Duce. 2000. Systems, interactions, and macrotheory. *ACM Trans Comput Hum Interact* 7(2):222–62.
- Begeman, M., P. Cook, C. Ellis, M. Graf, G. Rein, and T. Smith. 1986. Project Nick: Meetings augmentation and analysis. In *Proceedings Computer-Supported Cooperative Work 1986*, 1–6. Austin, TX: CSCW ’86.
- Benbasat, I., and A. S. Dexter. 1985. An experimental evaluation of graphical and color-enhanced information presentation. *Manage Sci* 31(11):1348–64.
- Bennett, J. L. 1979. The commercial impact of usability in interactive systems. In *Man-computer communication*, ed. B. Shackel, Vol. 2, 1–17. Maidenhead, UK: Pergamon-Infotech.
- Bewley, W. L., T. L. Roberts, D. Schroit, and W. L. Verplank. 1983. Human factors testing in the design of Xerox’s 8010 “Star” office workstation. In *Proceedings CHI’83*, 72–77. New York: ACM.
- Beyer, H., and K. Holtzblatt. 1998. *Contextual Design—Defining Customer-Centered Systems*. San Francisco, CA: Morgan Kaufmann.
- Bjerknes, G., P. Ehn, and M. Kyng, eds. 1987. *Computers and Democracy—a Scandinavian Challenge*. Aldershot, UK: Avebury.
- Björn-Andersen, N., and B. Hedberg. 1977. Design of information systems in an organizational perspective. In *Prescriptive Models of Organizations*, ed. P. C. Nystrom and W. H. Starbuck, Vol. 5, 125–42. *TIMS Studies in the Management Sciences*. Amsterdam, Netherlands: North-Holland.

* All URLs were accessed December 9, 2011.

- Blackwell, A. 2006. The reification of metaphor as a design tool. *ACM Trans Comput Hum Interact* 13(4):490–530.
- Blythe, M. A., A. F. Monk, K. Overbeeke, and P. C. Wright, eds. 2003. *Funology: From Usability to User Enjoyment*. New York: Kluwer.
- Borman, L. 1996. SIGCHI: The early years. *SIGCHI Bull* 28(1):1–33. New York: ACM.
- Borman, L. ed. 1981. *Proceedings of the Joint Conference on Easier and More Productive Use of Computer Systems, Part II: Human interface and user interface*. New York: ACM.
- Bowman, W. J. 1968. *Graphic Communication*. New York: John Wiley.
- Buckland, M. 1998. Documentation, information science, and library science in the U.S.A. In *Historical Studies in Information Science*, ed. T. B. Hahn, and M. Buckland, 159–72. Medford, NJ: Information Today/ASIS.
- Buckland, M. 2009. As we may recall: Four forgotten pioneers. *Interactions* 16(6):76–69.
- Burke, C. 1994. *Information and Secrecy: Vannevar Bush, Ultra, and the Other Memex*. Lanham, MD: Scarecrow Press.
- Burke, C. 1998. A rough road to the information highway: Project INTREX. In *Historical studies in Information Science*, ed. T. B. Hahn and M. Buckland, 132–46. Medford, NJ: Information Today/ASIS.
- Burke, C. 2007. History of information science. In *Annual review of Information Science and Technology* 41, ed. B. Cronin, 3–53. Medford, NJ: Information Today/ASIST.
- Bush, V. 1945. As we may think. *AtlMon* 176:101–8. <http://www.theatlantic.com/magazine/archive/1945/12/as-we-may-think/3881/>.
- Butler, P. 1933. *Introduction to Library Science*. Chicago, IL: Univ. of Chicago Press.
- Buxton, W. A. S. 2006. Early interactive graphics at MIT Lincoln Labs. <http://www.billbuxton.com/Lincoln.html>
- Bødker, S. 1990. *Through the Interface: A Human Activity Approach to User Interface Design*. Mahwah, NJ: Lawrence Erlbaum.
- Cakir, A., D. J. Hart, and T. F. M. Stewart. 1980. *Visual Display Terminals*. New York: Wiley.
- Card, S. K., and T. P. Moran. 1986. User technology: From pointing to pondering. In *Proceedings of the Conference on the History of Personal Workstations*, 183–98. New York: ACM.
- Card, S. K., T. P. Moran, and A. Newell. 1980a. Computer text-editing: An information-processing analysis of a routine cognitive skill. *Cogn Psychol* 12:396–410.
- Card, S. K., T. P. Moran, and A. Newell. 1980b. Keystroke-level model for user performance time with interactive systems. *Commun ACM* 23(7):396–410. New York: ACM.
- Card, S., T. P. Moran, and A. Newell. 1983. The psychology of human-computer interaction. Mahwah, NJ: Lawrence Erlbaum Associates.
- Carey, J. 1988. *Human Factors in Management Information Systems*. Greenwich, CT: Ablex.
- Carroll, J. M., ed. 2003. *HCI Models, Theories and Frameworks: Toward a Multidisciplinary Science*. San Francisco, CA: Morgan Kaufmann.
- Carroll, J. M., and R. L. Campbell. 1986. Softening up hard science: Response to Newell and Card. *Hum Comput Interact* 2(3):227–49.
- Carroll, J. M., and S. A. Mazur. 1986. Lisa learning. *IEEE Comput* 19(11):35–49.
- Cronin, B. 1995. Shibboleth and substance in North American Library and Information Science education. *Libri* 45:45–63.
- Damodaran, L., A. Simpson, and P. Wilson. 1980. *Designing Systems for People*. Manchester, UK: NCC Publications.
- Darrach, B. 1970. Meet Shaky: The first electronic person. *Life Mag* 69(21):58B–68.
- Davis, F. D. 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Q* 13(3):319–39.
- Davis, G. B. 1974. *Management Information Systems: Conceptual Foundations, Structure, and Development*. New York: McGraw-Hill.
- Dennis, A., J. George, L. Jessup, J. Nunamaker, and D. Vogel. 1988. Information technology to support electronic meetings. *MIS Q* 12(4):591–624.
- DeSanctis, G., and R. B. Gallupe. 1987. A foundation for the study of group decision support systems. *Manage Sci* 33:589–610.
- Dyson, F. 1979. *Disturbing the Universe*. New York: Harper and Row.
- Ehrlich, S. F. 1987. Strategies for encouraging successful adoption of office communication systems. *ACM Trans Office Inf Syst* 5(4):340–57.
- Engelbart, D. 1962. Augmenting human intellect: A conceptual framework. SRI Summary Report AFOSR-3223. Reprinted in *Vistas in Information Handling*, ed. P. Howerton and D. Weeks, Vol. 1, 1–29. Washington, DC: Spartan Books, 1963. <http://www.douengelbart.org/pubs/augment-3906.html>
- Engelien, B., and R. McBryde. 1991. *Natural Language Markets: Commercial Strategies*. London: Ovum Ltd.
- Evenson, S. 2005. Design and HCI highlights. Presented at the HCIC 2005 Conference, Winter Park, Colorado, February 6, 2005.
- Fano, R., and F. Corbato. 1966. Time-sharing on computers. *Sci Am* 214(9):129–40.
- Feigenbaum, E. A., and P. McCorduck. 1983. *The Fifth Generation: Artificial Intelligence and Japan's Computer Challenge to the World*. Reading, MA: Addison-Wesley.
- Fidel, R. 2011. *Human Information Interaction: An Ecological Approach to Information Behavior*. Cambridge, MA: MIT Press.
- Foley, J. D., and V. L. Wallace. 1974. The art of natural graphic man-machine conversation. *Proc IEEE* 62(4):462–71.
- Forbus, K. 2003. *Sketching for Knowledge Capture*. Lecture at Microsoft Research, Redmond, WA, May 2.
- Forbus, K. D., J. Usher, and V. Chapman. 2003. Qualitative spatial reasoning about sketch maps. In *Proceedings of the Innovative Applications of AI*, 85–92. Menlo Park: AAAI.
- Forster, E. M. 1909. *The Machine Stops*. Oxford and Cambridge Review, 8, November, 83–122.
- Friedman, A. 1989. *Computer Systems Development: History, Organization and Implementation*. New York: Wiley.
- Gilbreth, L. 1914. *The Psychology of Management: The Function of the Mind in Determining Teaching and Installing Methods of Least Waste*. NY: Sturgis and Walton.
- Good, I. J. 1965. Speculations concerning the first ultra-intelligent machine. *Adv Comput* 6:31–88. <http://commonsenseatheism.com/wp-content/uploads/2011/02/Good-Speculations-Concerning-the-First-Ultraintelligent-Machine.pdf>.
- Gould, J. D., and C. Lewis. 1983. Designing for usability—Key principles and what designers think. In *Proceedings of CHI'83*, 50–3. New York: ACM.
- Grandjean, E., and A. Vigliani. 1980. *Ergonomics Aspects of Visual Display Terminals*. London: Taylor and Francis.
- Gray, W. D., B. E. John, R. Stuart, D. Lawrence, and M. E. Atwood. 1990. GOMS meets the phone company: Analytic modeling applied to real-world problems. In *Proceedings of Interact'90*, 29–34. Amsterdam: North Holland.
- Greenbaum, J. 1979. *In the Name of Efficiency*. Philadelphia, PA: Temple University.
- Greif, I. 1985. Computer-Supported Cooperative Groups: What are the issues? In *Proceedings AFIPS Office Automation Conference*, 73–6. Montvale, NJ: AFIPS Press.

- Greif, I., ed. 1988. *Computer-Supported Cooperative Work: A Book of Readings*. San Mateo, CA: Morgan Kaufmann.
- Grudin, J. 1990. The computer reaches out: The historical continuity of interface design. In *Proceedings of CHI'90*, 261–8. New York: ACM.
- Grudin, J. 1991. Interactive systems: Bridging the gaps between developers and users. *IEEE Comput* 24(4):59–69.
- Grudin, J. 1993. Interface: An evolving concept. *Commun ACM* 36(4):110–9.
- Grudin, J. 2009. AI and HCI: Two fields divided by a common focus. *AI Mag* 30(4):48–57.
- Grudin, J. 2010. Conferences, community, and technology: Avoiding a crisis. In *Proceedings iConference 2010*. <https://www.ideals.illinois.edu/handle/2142/14921>.
- Grudin, J. 2011. Human-computer interaction. In *Annual Review of Information Science and Technology*, ed. B. Cronin, Vol. 45, 369–430. Medford, NJ: Information Today (for ASIST).
- Grudin, J., and A. MacLean. 1984. Adapting a psychophysical method to measure performance and preference tradeoffs in human-computer interaction. In *Proceedings of INTERACT'84*, 338–42. Amsterdam, Netherlands: North Holland.
- Hertzfeld, A. 2005. *Revolution in the Valley: The Insanely Great Story of How the Mac Was Made*. Sebastopol, CA: O'Reilly Media.
- HFES. 2010. HFES history. In *HFES 2010–2011, Directory and Yearbook*, 1–3. Santa Monica, CA: Human Factors and Ergonomics Society. Also found at <http://www.hfes.org/web/AboutHFES/history.html>
- Hiltz, S. R., and M. Turoff. 1978. *The Network Nation*. Reading, MA: Addison-Wesley.
- Hiltzik, M. A. 1999. *Dealers of Lightning: Xerox PARC and the Dawn of the Computer Age*. New York: HarperCollins.
- Hopper, G. 1952. The education of a computer. In *Proceedings of ACM Conference*, Reprinted in Annals of the History of Computing, 9(3–4), 271–81, 1987.
- Huber, G. 1983. Cognitive style as a basis for MIS and DSS designs: Much ado about nothing? *Manage Sci* 29(5):567–79.
- Hutchins, E. L., J. D. Hollan, and D. A. Norman. 1986. Direct manipulation interfaces. In *User Centered System Design*, ed. D. A. Norman and S. W. Draper, 87–124. Mahwah, NJ: Lawrence Erlbaum.
- Israelski, E., and A. M. Lund. 2003. The evolution of HCI during the telecommunications revolution. In *The Human-Computer Interaction Handbook*, ed. J. A. Jacko and A. Sears, 772–89. Mahwah, NJ: Lawrence Erlbaum.
- Johnson, T. 1985. *Natural Language Computing: The Commercial Applications*. London, UK: Ovum Ltd.
- Kao, E. 1998. *The History of AI*. <http://www.generation5.org/content/1999/aihistory.asp> (accessed March 13, 2007).
- Kay, A., and A. Goldberg. 1977. Personal dynamic media. *IEEE Comput* 10(3):31–42.
- Keen, P. G. W. 1980. MIS research: Reference disciplines and a cumulative tradition. In *First International Conference on Information Systems*, 9–18. Chicago, IL: Society for Management Information Systems.
- Kling, R. 1980. Social analyses of computing: Theoretical perspectives in recent empirical research. *Comput Surv* 12(1):61–110.
- Landau, R., J. Bair, and J. Siegmna, eds. 1982. Emerging office systems. In *Extended Proceedings of the 1980 Stanford International Symposium on Office Automation*. Norwood, NJ.
- Lenat, D. 1989. When will machines learn? *Mach Learn* 4:255–7.
- Lewis, C. 1983. The ‘thinking aloud’ method in interface evaluation. Tutorial given at CHI'83. Unpublished notes.
- Lewis, C., and R. Mack. 1982. Learning to use a text processing system: Evidence from “thinking aloud” protocols. In *Proceedings of the Conference on Human Factors in Computing Systems*, 387–92. New York: ACM.
- Lewis, C., P. Polson, C. Wharton, and J. Rieman. 1990. Testing a walk-through methodology for theory-based design of walk-up-and-use Interfaces. In *Proceedings of the Conference on Human Factors in Computing Systems*, 235–42. New York: ACM.
- Licklider, J. C. R. 1960. Man-computer symbiosis. *IRE Trans Hum Factors Electron HFE-1* 1:4–11. <http://groups.csail.mit.edu/medg/people/psz/Licklider.html>.
- Licklider, J. C. R. 1963. MEMORANDUM FOR: Members and Affiliates of the Intergalactic Computer Network. April 23. <http://www.kurzweilai.net/memorandum-for-members-and-affiliates-of-the-intergalactic-computer-network>.
- Licklider, J. C. R. 1965. *Libraries of the Future*. Cambridge, MA: MIT Press.
- Licklider, J. C. R. 1976. User-oriented interactive computer graphics. In *Proceedings of SIGGRAPH Workshop on User-Oriented Design of Interactive Graphics Systems*, 89–96. New York: ACM.
- Licklider, J. C. R., and W. Clark. 1962. On-line man-computer communication. *AFIPS Conf Proc* 21:113–28.
- Lighthill, J. 1973. Artificial intelligence: A general survey. In *Artificial Intelligence: A Paper Symposium*, ed. J. Lighthill, N. S. Sutherland, R. M. Needham, H. C. Longuet-Higgins, and D. Michie. London, UK: Science Research Council of Great Britain. http://www.chilton-computing.org.uk/inf/literature/reports/lighthill_report/p001.htm
- Long, J. 1989. Cognitive ergonomics and human-computer interaction. In *Cognitive Ergonomics and Human-Computer Interaction*, ed. J. Long and A. Whitefield, 4–34. Cambridge: Cambridge University Press.
- Machlup, F., and U. Mansfield, eds. 1983. *The Study of Information: Interdisciplinary Messages*. New York: Wiley.
- March, A. 1994. Usability: the new dimension of product design. *Harv Bus Rev* 72(5):144–9.
- Marcus, A. 2004. Branding 101. *ACM Interact* 11(5):14–21.
- Markoff, J. 2005. *What the Dormouse Said: How the 60s Counter-Culture Shaped the Personal Computer*. London, UK: Viking.
- Markus, M. L. 1983. Power, politics, and MIS implementation. *Commun ACM* 26(6):430–44.
- Martin, J. 1973. *Design of Man-Computer Dialogues*. New York: Prentice-Hall.
- McCarthy, J. 1960. Functions of symbolic expressions and their computation by machine, part 1. *Commun ACM* 3(4):184–95.
- McCarthy, J. 1988. B. P. Bloomfield, The question of artificial intelligence: Philosophical and sociological perspectives. *Ann Hist Comput* 10(3):224–9. <http://www-formal.stanford.edu/jmc/reviews/bloomfield/bloomfield.html>.
- Meister, D. 1999. *The History of Human Factors and Ergonomics*. Mahwah, NJ: Lawrence Erlbaum.
- Moggridge, B. 2007. *Designing Interactions*. Cambridge: MIT Press.
- Moravec, H. 1998. When will computer hardware match the human brain? *J Evol Technol* 1:1. <http://www.transhumanist.com/volume1/moravec.htm>.
- Mumford, E. 1971. A comprehensive method for handling the human problems of computer introduction. *IFIP Congr* 2:918–23.
- Mumford, E. 1976. Toward the democratic design of work systems. *Personnel Manage* 8(9):32–5.
- Myers, B. A. 1998. A brief history of human computer interaction technology. *ACM Interact* 5(2):44–54.
- National Science Foundation. 1993. *NSF 93–2: Interactive Systems Program Description*. <http://www.nsf.gov/pubs/stis1993/nsf932/nsf932.txt>

- National Science Foundation. 2003. NSF Committee of Visitors Report: Information and Intelligent Systems Division, 28 July 2003.
- Negroponte, N. 1970. *The Architecture Machine: Towards a More Humane Environment*. Cambridge: MIT Press.
- Nelson, T. 1965. A file structure for the complex, the changing, and the indeterminate. In *Proceedings of the ACM National Conference*, 84–100. New York: ACM.
- Nelson, T. 1973. A conceptual framework for man-machine everything. In *Proceedings of the National Computer Conference*, M21–6. Montvale, NJ: AFIPS Press.
- Nelson, T. 1996. Generalized links, micropayment and transcopyright. <http://www.almaden.ibm.com/almaden/npuc97/1996/tnelson.htm>.
- Newell, A., and S. K. Card. 1985. The prospects for psychological science in human-computer interaction. *Hum Comput Interact* 1(3):209–42.
- Newell, A., and H. A. Simon. 1956. The logic theory machine: A complex information processing system. *IRE Trans Inf Theory* IT-2:61–79.
- Newell, A., and H. A. Simon. 1972. *Human Problem Solving*. New York: Prentice-Hall.
- Newman, W. M., and R. F. Sproull. 1973. *Principles of Interactive Computer Graphics*. New York: McGraw-Hill.
- Nielsen, J. 1989. Usability engineering at a discount. In *Designing and Using Human-Computer Interfaces and Knowledge-Based Systems*, ed. G. Salvendy and M. J. Smith, 394–401. Amsterdam: Elsevier.
- Nielsen, J., and R. Molich. 1990. Heuristic evaluation of user interfaces. In *Proceedings of CHI'90*, 249–56. New York: ACM.
- Norberg, A. L., and J. E. O'Neill. 1996. *Transforming Computer Technology: Information Processing for the Pentagon*, 1962–86. Baltimore, MD: Johns Hopkins.
- Norman, D. A. 1982. Steps toward a cognitive engineering: Design rules based on analyses of human error. In *Proceedings of the Conference on Human Factors in Computing Systems*, 378–82. New York: ACM.
- Norman, D. A. 1983. Design principles for human-computer interfaces. In *Proc. CHI'83*, 1–10. New York: ACM.
- Norman, D. A. 1986. Cognitive engineering. In *User Centered System Design*, ed. D. A. Norman and S. W. Draper, 31–61. Mahwah, NJ: Lawrence Erlbaum.
- Norman, D. A. 1988. *Psychology of Everyday Things. Reissued as 'Design of Everyday Things' in 1990*. New York: Basic Books.
- Norman, D. A. 2004. *Emotional Design: Why We Love (or hate) Everyday Things*. New York: Basic Books.
- Nunamaker, J., R. O. Briggs, D. D. Mittleman, D. R. Vogel, and P. A. Balthazard. 1997. Lessons from a dozen years of group support systems research: A discussion of lab and field findings. *J Manage Inf Syst* 13(3):163–207.
- Nygaard, K. 1977. Trade union participation. Presentation at CREST Conference on Management Information Systems, Stafford, UK.
- Oakley, B. W. 1990. Intelligent knowledge-based systems—AI in the U.K. In *The Age of Intelligent Machines*, ed. R. Kurzweil, 346–9. Cambridge, MA: MIT Press.
- Palen, L., and J. Grudin. 2002. Discretionary adoption of group support software. In *Implementing Collaboration Technology in Industry*, ed. B. E. Munkvold, 159–90. London, UK: Springer-Verlag.
- Perlman, G., G. K. Green, and M. S. Wogalter. 1995. *Human Factors Perspectives on Human-Computer Interaction*. Santa Monica: Human Factors and Ergonomics Society.
- Pew, R. 2003. Evolution of HCI: From MEMEX to Bluetooth and beyond. In *The Human-Computer Interaction Handbook*, ed. J. A. Jacko and A. Sears, 1–17. Mahwah, NJ: Lawrence Erlbaum.
- Pruitt, J., and T. Adlin. 2006. *The Persona Lifecycle: Keeping People in Mind Throughout Product Design*. San Francisco, CA: Morgan Kaufmann.
- Rasmussen, J. 1980. The human as a system component. In *Human Interaction with Computers*, ed. H. T. Smith and T. R. G. Green, 67–96. London, UK: Academic.
- Rasmussen, J. 1986. *Information Processing and Human-Machine Interaction: An Approach to Cognitive Engineering*. New York: North-Holland.
- Rayward, W. B. 1983. Library and information sciences: Disciplinary differentiation, competition, and convergence. In *The Study of Information: Interdisciplinary Messages*, ed. F. Machlup and U. Mansfield, 343–405. New York: Wiley.
- Rayward, W. B. 1998. The history and historiography of Information Science: Some reflections. In *Historical Studies in Information Science*, ed. T. B. Hahn, and M. Buckland, 7–21. Medford, NJ: Information Today/ASIS.
- Remus, W. 1984. An empirical evaluation of the impact of graphical and tabular presentations on decision-making. *Manage Sci* 30(5):533–42.
- Roscoe, S. N. 1997. *The Adolescence of Engineering Psychology*. Santa Monica, CA: Human Factors and Ergonomics Society.
- Sammet, J. 1992. Farewell to Grace Hopper—End of an era! *Commun ACM* 35(4):128–31.
- Shackel, B. 1959. Ergonomics for a computer. *Design* 120:36–9.
- Shackel, B. 1962. Ergonomics in the design of a large digital computer console. *Ergonomics* 5:229–41.
- Shackel, B. 1997. HCI: Whence and whither? *JASIS* 48(11):970–86.
- Shannon, C. E. 1950. Programming a computer for playing chess. *Philos mag* 7(41):256–75.
- Shannon, C. E., and W. Weaver. 1949. *The Mathematical Theory of Communication*. Urbana, IL: Univ. of Illinois Press.
- Sheil, B. A. 1981. The psychological study of programming. *ACM Comput Surv* 13(1):101–20.
- Shneiderman, B. 1980. *Software Psychology: Human Factors in Computer and Information Systems*. Cambridge, MA: Winthrop.
- Simon, H. A. 1960. *The New Science of Management Decision*. New York: Harper.
- Smith, H. T., and T. R. G. Green, eds. 1980. *Human Interaction with Computers*. Orlando, FL: Academic.
- Smith, S. L. 1963. Man-computer information transfer. In *Electronic Information Display Systems*, ed. J. H. Howard, 284–99. Washington, DC: Spartan Books.
- Smith, S. L., B. B. Farquhar, and D. W. Thomas. 1965. Color coding in formatted displays. *J Appl Psychol* 49:393–8.
- Smith, S. L., and N. C. Goodwin. 1970. Computer-generated speech and man-computer interaction. *Hum Factors* 12:215–23.
- Smith, S. L., and J. N. Mosier. 1986. *Guidelines for Designing User Interface Software (ESD-TR-86-278)*. Bedford, MA: MITRE.
- Suchman, L. 1987a. *Plans and Situated Action: The Problem of Human-Machine Communication*. Cambridge, UK: Cambridge University Press.
- Suchman, L. 1987b. Designing with the user: Review of ‘Computers and democracy: A Scandinavian challenge. *ACM TOIS* 6(2):173–83.
- Sutherland, I. 1963. *Sketchpad: A Man-Machine Graphical Communication System*. Doctoral Dissertation, MIT. <http://www.cl.cam.ac.uk/techreports/UCAM-CL-TR-574.pdf>

- Taylor, F. W. 1911. *The Principles of Scientific Management*. New York: Harper.
- Turing, A. 1949. *Letter in London Times*, June 11. See Highlights from the Computer Museum report Vol. 20, Summer/Fall 1987. <http://ed-thelen.org/comp-hist/TCMR-V20.pdf>.
- Turing, A. 1950. Computing machinery and intelligence. *Mind* 49:433–60. Republished as “Can a machine think?” in J. R. Newman (Ed.), *The World of Mathematics*, (Vol. 4, pp. 2099–2123). New York: Simon and Schuster.
- Vessey, I., and D. Galletta. 1991. Cognitive fit: An empirical test of information acquisition. *Inf Syst Res* 2(1):63–84.
- Waldrop, M. M. 2001. *The Dream Machine: J.C.R. Licklider and the Revolution that Made Computing Personal*. New York: Viking.
- Weinberg, G. 1971. *The Psychology of Computer Programming*. New York: Van Nostrand Reinhold.
- Wells, H. G. 1905. *A Modern Utopia*. London, UK: Jonathan Cape. <http://www.gutenberg.org/etext/6424>.
- Wells, H. G. 1938. *World Brain*. London, UK: Methuen.
- Wersig, G. 1992. Information science and theory: A weaver bird’s perspective. In *Conceptions of Library and Information Science: Historical, Empirical, and Theoretical Perspectives*, ed. P. Vakkari and B. Cronin, 201–17. London, UK: Taylor Graham.
- White, P. T. 1970. Behold the computer revolution. *National Geographic* 38(5): 593–633. <http://blog.modernmechanix.com/2008/12/22/behold-the-computer-revolution/>
- Yates, J. 1989. *Control Through Communication: The Rise of System in American Management*. Baltimore, MD: Johns Hopkins.
- Zhang, P. 2004. AIS SIGCHI three-year report. *SIGHCI newsletter* 3(1):2–6.
- Zhang, P., F. F. -H. Nah, and J. Preece. 2004. HCI studies in management information systems. *Behav Inf Technol* 23(3):147–51.
- Zhang, P., Li, N., Scialdone, M.J. & Carey, J. 2009. The intellectual advancement of Human-Computer Interaction Research: A critical assessment of the MIS Literature. *Trans Human-Computer Interaction*, 1(3): 55–107.

Introduction

- Ackoff, R. L. 1967. Management misinformation systems. *Manage Sci* 14:B 147–156.
- Asimov, I. 1950.1. Robot. New York: Gnome Press.
- Aspray, W. 1999. Command and control, documentation, and library science: The origins of information science at the University of Pittsburgh. *IEEE Ann Hist Comput* 21(4):4–20.
- Baecker, R., and W. Buxton. 1987. A historical and intellectual perspective. In *Readings in HCI: A multidisciplinary approach*, ed. R. Baecker, and W. Buxton, 41–54. San Francisco, CA: Morgan Kaufmann.
- Baecker, R., J. Grudin, W. Buxton, and S. Greenberg. 1995. A historical and intellectual perspective. In *Readings in HCI: Toward the Year 2000*, ed. R. Baecker, J. Grudin, W. Buxton and S. Greenberg, 35–47. San Francisco, CA: Morgan Kaufmann.
- Bagozzi, R. P., F. D. Davis, and P. R. Warshaw. 1992. Development and test of a theory of technological learning and usage. *Hum Relat* 45(7):660–686.
- Banker, R. D., and R. J. Kaufmann. 2004. The evolution of research on Information Systems: A fiftieth-year survey of the literature in Management Science. *Manage Sci* 50(3):281–298.
- Bannon, L. 1991. From human factors to human actors: The role of psychology and HCI studies in system design. In *Design at Work*, ed. J. Greenbaum, and M. Kyng, 25–44. Hillsdale, NJ: Erlbaum.
- Bardini, T. 2000. Bootstrapping: Douglas Engelbart, Coevolution, and the Origins of Personal Computing. Stanford, CA: Stanford University.
- Barnard, P. 1991. Bridging between basic theories and the artifacts of HCI. In *Designing Interaction: Psychology at the Human-Computer Interface*, ed. J. M. Carroll, 103–127. Cambridge: Cambridge University Press.
- Barnard, P., J. May, D. Duke, and D. Duce. 2000. Systems, interactions, and macrotheory. *ACM Trans Comput Hum Interact* 7(2):222–262.
- Begeman, M., P. Cook, C. Ellis, M. Graf, G. Rein, and T. Smith. 1986. Project Nick: Meetings augmentation and analysis. In *Proceedings Computer-Supported Cooperative Work 1986*, 1–6. Austin, TX: CSCW '86.
- Benbasat, I., and A. S. Dexter. 1985. An experimental evaluation of graphical and color-enhanced information presentation. *Manage Sci* 31(11):1348–1364.
- Bennett, J. L. 1979. The commercial impact of usability in interactive systems. In *Man-computer communication*, ed. B. Shackel, Vol. 2, 1–17. Maidenhead, UK: Pergamon-Infotech.
- Bewley, W. L., T. L. Roberts, D. Schroit, and W. L. Verplank. 1983. Human factors testing in the design of Xerox's 8010 "Star" office workstation. In *Proceedings CHI'83*, 72–77. New York: ACM.
- Beyer, H., and K. Holtzblatt. 1998. *Contextual Design—Defining Customer-Centered Systems*. San Francisco, CA: Morgan Kaufmann.
- Bjerknes, G., P. Ehn, and M. Kyng, eds. 1987. *Computers and Democracy—a Scandinavian Challenge*. Aldershot, UK: Avebury.
- Björn-Andersen, N., and B. Hedberg. 1977. Design of information systems in an organizational perspective. In *Prescriptive Models of Organizations*, ed. P. C. Nystrom, and W. H. Starbuck, Vol. 5, 125–142. *TIMS Studies in the Management Sciences*. Amsterdam, Netherlands: North-Holland.
- Blackwell, A. 2006. The reification of metaphor as a design tool. *ACM Trans Comput Hum Interact* 13(4):490–530.
- Blythe, M. A., A. F. Monk, K. Overbeeke, and P. C. Wright, eds. 2003. *Funology: From Usability to User Enjoyment*. New York: Kluwer.
- Borman, L. 1996. SIGCHI: The early years. *SIGCHI Bull* 28(1):1–33. New York: ACM.
- Borman, L. ed. 1981. *Proceedings of the Joint Conference on Easier and More Productive Use of Computer Systems, Part II: Human interface and user interface*. New York: ACM.
- Bowman, W. J. 1968. *Graphic Communication*. New York: John Wiley.
- Buckland, M. 1998. Documentation, information science, and library science in the U.S.A. In *Historical Studies in Information Science*, ed. T. B. Hahn, and M. Buckland, 159–172. Medford, NJ: Information Today/ASIS.
- Buckland, M. 2009. As we may recall: Four forgotten pioneers. *Interactions* 16(6):76–79.
- Burke, C. 1994. *Information and Secrecy: Vannevar Bush, Ultra, and the Other Memex*. Lanham, MD: Scarecrow Press.
- Burke, C. 1998. A rough road to the information highway: Project INTREX. In *Historical studies in Information Science*, ed. T. B. Hahn, and M. Buckland, 132–146. Medford, NJ: Information Today/ASIS.
- Burke, C. 2007. History of information science. In *Annual review of Information Science and Technology* 41, ed. B. Cronin, 3–53. Medford, NJ: Information Today/ASIST.
- Bush, V. 1945. As wemaythink. *AtlMon* 176:101–108. <http://www.theatlantic.com/magazine/archive/1969/12/as-we-may-think/3881/>.
- Butler, P. 1933. *Introduction to Library Science*. Chicago, IL: Univ. of Chicago Press.
- Buxton, W. A. S. 2006. Early interactive graphics at MIT Lincoln Labs. <http://www.billbuxton.com/Lincoln.html>
- Bødker, S. 1990. *Through the Interface: A Human Activity Approach to User Interface Design*. Mahwah, NJ: Lawrence Erlbaum.
- Cakir, A., D. J. Hart, and T. F. M. Stewart. 1980. *Visual Display Terminals*. New York: Wiley.
- Card, S. K., and T. P. Moran. 1986. User technology: From pointing to pondering. In *Proceedings of the Conference on the History of Personal Workstations*, 183–198. New York: ACM.
- Card, S. K., T. P. Moran, and A. Newell. 1980a. Computer text-editing: An information-processing analysis of a routine cognitive skill. *Cogn Psychol* 12: 396–410.
- Card, S. K., T. P. Moran, and A. Newell. 1980b. Keystroke-level model for user performance time with interactive systems. *Commun ACM* 23(7):396–410. New York: ACM.
- Card, S., T. P. Moran, and A. Newell. 1983. The psychology of human–computer interaction. Mahwah, NJ: Lawrence Erlbaum Associates.
- Carey, J. 1988. *Human Factors in Management Information Systems*. Greenwich, CT: Ablex.
- Carroll, J. M., ed. 2003. *HCI Models, Theories and Frameworks: Toward a Multidisciplinary Science*. San Francisco, CA: Morgan Kaufmann.
- Carroll, J. M., and R. L. Campbell. 1986. Softening up hard science: Response to Newell and Card. *Hum Comput Interact* 2(3):227–249.
- Carroll, J. M., and S. A. Mazur. 1986. Lisa learning. *IEEE Comput* 19(11):35–49.
- Cronin, B. 1995. Shibboleth and substance in North American Library and Information Science education. *Libri* 45: 45–63.
- Damodaran, L., A. Simpson, and P. Wilson. 1980. *Designing Systems for People*. Manchester, UK: NCC Publications.

- Darrach, B. 1970. Meet Shaky: The first electronic person. *Life Mag* 69(21):58–68.
- Davis, F. D. 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Q* 13(3):319–339.
- Davis, G. B. 1974. Management Information Systems: Conceptual Foundations, Structure, and Development. New York: McGraw-Hill.
- Dennis, A., J. George, L. Jessup, J. Nunamaker, and D. Vogel. 1988. Information technology to support electronic meetings. *MIS Q* 12(4):591–624.
- DeSanctis, G., and R. B. Gallupe. 1987. A foundation for the study of group decision support systems. *Manage Sci* 33: 589–610.
- Dyson, F. 1979. Disturbing the Universe. New York: Harper and Row.
- Ehrlich, S. F. 1987. Strategies for encouraging successful adoption of office communication systems. *ACM Trans Office Inf Syst* 5(4):340–357.
- Engelbart, D. 1962. Augmenting human intellect: A conceptual framework. SRI Summary Report AFOSR-3223. Reprinted in *Vistas in Information Handling*, ed. P. Howerton and D. Weeks, Vol. 1, 1–29. Washington, DC: Spartan Books, 1963.
<http://www.dougengelbart.org/pubs/augment-3906.html>
- Engelien, B., and R. McBryde. 1991. Natural Language Markets: Commercial Strategies. London: Ovum Ltd.
- Evenson, S. 2005. Design and HCI highlights. Presented at the HCIC 2005 Conference, Winter Park, Colorado, February 6, 2005.
- Fano, R., and F. Corbato. 1966. Time-sharing on computers. *Sci Am* 214(9): 129–140.
- Feigenbaum, E. A., and P. McCorduck. 1983. The Fifth Generation: Artificial Intelligence and Japan's Computer Challenge to the World. Reading, MA: Addison-Wesley.
- Fidel, R. 2011. Human Information Interaction: An Ecological Approach to Information Behavior. Cambridge, MA: MIT Press.
- Foley, J. D., and V. L. Wallace. 1974. The art of natural graphic man-machine conversation. *Proc IEEE* 62(4):462–471.
- Forbus, K. 2003. *Sketching for Knowledge Capture*. Lecture at Microsoft Research, Redmond, WA, May 2.
- Forbus, K. D., J. Usher, and V. Chapman. 2003. Qualitative spatial reasoning about sketch maps. In *Proceedings of the Innovative Applications of AI*, 85–92. Menlo Park: AAAI.
- Forster, E. M. 1909. *The Machine Stops*. Oxford and Cambridge Review, 8, November, 83–122.
- Friedman, A. 1989. Computer Systems Development: History, Organization and Implementation. New York: Wiley.
- Gilbreth, L. 1914. The Psychology of Management: The Function of the Mind in Determining Teaching and Installing Methods of Least Waste. NY: Sturgis and Walton.
- Good, I. J. 1965. Speculations concerning the first ultra-intelligent machine. *Adv Comput* 6:31–88. <http://commonsenseatheism.com/wp-content/uploads/2011/02/Good-Speculations-Concerning-the-First-Ultraintelligent-Machine.pdf>.
- Gould, J. D., and C. Lewis. 1983. Designing for usability—Key principles and what designers think. In *Proceedings of CHI'83*, 50–53. New York: ACM.
- Grandjean, E., and A. Vigliani. 1980. Ergonomics Aspects of Visual Display Terminals. London: Taylor and Francis.
- Gray, W. D., B. E. John, R. Stuart, D. Lawrence, and M. E. Atwood. 1990. GOMS meets the phone company: Analytic modeling applied to real-world problems. In *Proceedings of Interact'90*, 29–34. Amsterdam: North Holland.
- Greenbaum, J. 1979. In the Name of Efficiency. Philadelphia, PA: Temple University.
- Greif, I. 1985. Computer-Supported Cooperative Groups: What are the issues? In *Proceedings AFIPS Office Automation Conference*, 73–76. Montvale, NJ: AFIPS Press.
- Greif, I., ed. 1988. Computer-Supported Cooperative Work: A Book of Readings. San Mateo, CA: Morgan Kaufmann.
- Grudin, J. 1990. The computer reaches out: The historical continuity of interface design. In *Proceedings of CHI'90*, 261–268. New York: ACM.
- Grudin, J. 1991. Interactive systems: Bridging the gaps between developers and users. *IEEE Comput* 24(4):59–69.
- Grudin, J. 1993. Interface: An evolving concept. *Commun ACM* 36(4): 110–119.
- Grudin, J. 2009. AI and HCI: Two fields divided by a common focus. *AI Mag* 30(4):48–57.
- Grudin, J. 2010. Conferences, community, and technology: Avoiding a crisis. In *Proceedings iConference 2010*. <https://www.ideals.Illinois.edu/handle/2142/14921>.
- Grudin, J. 2011. Human-computer interaction. In *Annual Review of Information Science and Technology*, ed. B. Cronin, Vol. 45, 369–430. Medford, NJ: Information Today (for ASIST).
- Grudin, J., and A. MacLean. 1984. Adapting a psychophysical method to measure performance and preference tradeoffs in human-computer interaction. In *Proceedings of INTERACT'84*, 338–432. Amsterdam, Netherlands: North Holland.
- Hertzfeld, A. 2005. Revolution in the Valley: The Insanely Great Story of How the Mac Was Made. Sebastopol, CA: O'Reilly Media.
- HFES. 2010. HFES history. In *HFES 2010–2011, Directory and Yearbook*, 1–3. Santa Monica, CA: Human Factors and Ergonomics Society. Also found at <http://www.hfes.org/web/AboutHFES/history.html>
- Hiltz, S. R., and M. Turoff. 1978. The Network Nation. Reading, MA: Addison-Wesley.
- Hiltzik, M. A. 1999. Dealers of Lightning: Xerox PARC and the Dawn of the Computer Age. New York: HarperCollins.
- Hopper, G. 1952. The education of a computer. In *Proceedings of ACM Conference*, Reprinted in *Annals of the History of Computing*, 9(3–4), 271–281, 1987.
- Huber, G. 1983. Cognitive style as a basis for MIS and DSS designs: Much ado about nothing? *Manage Sci* 29(5):567–579.
- Hutchins, E. L., J. D. Hollan, and D. A. Norman. 1986. Direct manipulation interfaces. In *User Centered System Design*, ed. D. A. Norman, and S. W. Draper, 87–124. Mahwah, NJ: Lawrence Erlbaum.
- Israelski, E., and A. M. Lund. 2003. The evolution of HCI during the telecommunications revolution. In *The Human-Computer Interaction Handbook*, ed. J. A. Jacko, and A. Sears, 772–789. Mahwah, NJ: Lawrence Erlbaum.
- Johnson, T. 1985. Natural Language Computing: The Commercial Applications. London, UK: Ovum Ltd.
- Kao, E. 1998. *The History of AI*. <http://www.generation5.org/con-tent/1999/aihistory.asp> (accessed March 13, 2007).
- Kay, A., and A. Goldberg. 1977. Personal dynamic media. *IEEE Comput* 10(3):31–42.
- Keen, P. G. W. 1980. MIS research: Reference disciplines and a cumulative tradition. In *First International Conference on Information Systems*, 9–18. Chicago, IL: Society for Management Information Systems.
- Kling, R. 1980. Social analyses of computing: Theoretical perspectives in recent empirical research. *Comput Surv* 12(1): 61–110.
- Landau, R., J. Bair, and J. Siegmna, eds. 1982. Emerging office systems. In *Extended Proceedings of the 1980 Stanford International Symposium on Office Automation*. Norwood, NJ.

- Lenat, D. 1989. When will machines learn? *Mach Learn* 4: 255–257.
- Lewis, C. 1983. The ‘thinking aloud’ method in interface evaluation. Tutorial given at CHI’83. Unpublished notes.
- Lewis, C., and R. Mack. 1982. Learning to use a text processing system: Evidence from “thinking aloud” protocols. In *Proceedings of the Conference on Human Factors in Computing Systems*, 387–392. New York: ACM.
- Lewis, C., P. Polson, C. Wharton, and J. Rieman. 1990. Testing a walk-through methodology for theory-based design of walk-up-and-use Interfaces. In *Proceedings of the Conference on Human Factors in Computing Systems*, 235–242. New York: ACM.
- Licklider, J. C. R. 1960. Man-computer symbiosis. *IRE Trans Hum Factors Electron HFE-1* 1:4–11. <http://groups.csail.mit.edu/medg/people/psz/Licklider.html>.
- Licklider, J. C. R. 1963. MEMORANDUM FOR: Members and Affiliates of the Intergalactic Computer Network. April 23. <http://www.kurzweilai.net/memorandum-for-members-and-affiliates-of-the-intergalactic-computer-network>.
- Licklider, J. C. R. 1965. *Libraries of the Future*. Cambridge, MA: MIT Press.
- Licklider, J. C. R. 1976. User-oriented interactive computer graphics. In *Proceedings of SIGGRAPH Workshop on User-Oriented Design of Interactive Graphics Systems*, 89–96. New York: ACM.
- Licklider, J. C. R., and W. Clark. 1962. On-line man-computer communication. *AFIPS Conf Proc* 21: 113–128.
- Lighthill, J. 1973. Artificial intelligence: A general survey. In *Artificial Intelligence: A Paper Symposium*, ed. J. Lighthill, N. S. Sutherland, R. M. Needham, H. C. Longuet-Higgins, and D. Michie. London, UK: Science Research Council of Great Britain, http://www.chilton-computing.org.uk/infl/literature/reports/lighthill_report/p001.htm
- Long, J. 1989. Cognitive ergonomics and human–computer interaction. In *Cognitive Ergonomics and Human-Computer Interaction*, ed. J. Long and A. Whitefield, 4–34. Cambridge: Cambridge University Press.
- Machlup, F., and U. Mansfield, eds. 1983. *The Study of Information: Interdisciplinary Messages*. New York: Wiley.
- March, A. 1994. Usability: the new dimension of product design. *Harv Bus Rev* 72(5): 144–149.
- Marcus, A. 2004. Branding 101. *ACM Interact* 11 (5): 14–21.
- Markoff, J. 2005. *What the Dormouse Said: How the 60s Counter-Culture Shaped the Personal Computer*. London, UK: Viking.
- Markus, M. L. 1983. Power, politics, and MIS implementation. *Commun ACM* 26(6):430–444.
- Martin, J. 1973. *Design of Man-Computer Dialogues*. New York: Prentice-Hall.
- McCarthy, J. 1960. Functions of symbolic expressions and their computation by machine, part 1. *Commun ACM* 3(4):184–195.
- McCarthy, J. 1988. B. P. Bloomfield, The question of artificial intelligence: Philosophical and sociological perspectives. *Ann Hist Comput* 10(3):224–229. <http://www-formal.stanford.edu/jmc/reviews/bloomfield/bloomfield.html>.
- Meister, D. 1999. *The History of Human Factors and Ergonomics*. Mahwah, NJ: Lawrence Erlbaum.
- Moggridge, B. 2007. *Designing Interactions*. Cambridge: MIT Press.
- Moravec, H. 1998. When will computer hardware match the human brain? *J Evol Technol* 1:1. <http://www.transhumanist.com/volumel/moravec.htm>.
- Mumford, E. 1971. A comprehensive method for handling the human problems of computer introduction. *IFIP Congr* 2: 918–923.
- Mumford, E. 1976. Toward the democratic design of work systems. *Personnel Manage* 8(9):32–35.
- Myers, B. A. 1998. A brief history of human computer interaction technology. *ACM Interact* 5(2):44–54.
- National Science Foundation. 1993. *NSF 93-2: Interactive Systems Program Description*, <http://www.nsf.gov/pubs/stisl993/nsf932/nsf932.txt>
- National Science Foundation. 2003. NSF Committee of Visitors Report: Information and Intelligent Systems Division, 28 July 2003.
- Negroponte, N. 1970. *The Architecture Machine: Towards a More Humane Environment*. Cambridge: MIT Press.
- Nelson, T. 1965. A file structure for the complex, the changing, and the indeterminate. In *Proceedings of the ACM National Conference*, 84–100. New York: ACM.
- Nelson, T. 1973. A conceptual framework for man-machine everything. In *Proceedings of the National Computer Conference*, M21–26. Montvale, NJ: AFIPS Press.
- Nelson, T. 1996. Generalized links, micropayment and transcopyright. <http://www.almaden.ibm.com/almaden/npuc97/1996/tNELSON.htm>.
- Newell, A., and S. K. Card. 1985. The prospects for psychological science in human–computer interaction. *Hum Comput Interact* 1(3):209–242.
- Newell, A., and H. A. Simon. 1956. The logic theory machine: A complex information processing system. *IRE Trans Inf Theory* IT-2:61–79.
- Newell, A., and H. A. Simon. 1972. *Human Problem Solving*. New York: Prentice-Hall.
- Newman, W. M., and R. F. Sproull. 1973. *Principles of Interactive Computer Graphics*. New York: McGraw-Hill.
- Nielsen, J. 1989. Usability engineering at a discount. In *Designing and Using Human-Computer Interfaces and Knowledge Based Systems*, ed. G. Salvendy, and M. J. Smith, 394–401. Amsterdam: Elsevier.
- Nielsen, J., and R. Molich. 1990. Heuristic evaluation of user interfaces. In *Proceedings of CHI’90*, 249–256. New York: ACM.
- Norberg, A. L., and J. E. O’Neill. 1996. *Transforming Computer Technology: Information Processing for the Pentagon*, 1962–1986. Baltimore, MD: Johns Hopkins.
- Norman, D. A. 1982. Steps toward a cognitive engineering: Design rules based on analyses of human error. In *Proceedings of the Conference on Human Factors in Computing Systems*, 378–382. New York: ACM.
- Norman, D. A. 1983. Design principles for human–computer interfaces. In *Proc. CHI’83*, 1–10. New York: ACM.
- Norman, D. A. 1986. Cognitive engineering. In *User Centered System Design*, ed. D. A. Norman, and S. W. Draper, 31–61. Mahwah, NJ: Lawrence Erlbaum.
- Norman, D. A. 1988. *Psychology of Everyday Things*. Reissued as ‘Design of Everyday Things’ in 1990. New York: Basic Books.
- Norman, D. A. 2004. *Emotional Design: Why We Love (or hate) Everyday Things*. New York: Basic Books.
- Nunamaker, J., R. O. Briggs, D. D. Mittleman, D. R. Vogel, and P. A. Balthazard. 1997. Lessons from a dozen years of group support systems research: A discussion of lab and field findings. *J Manage Inf Syst* 13(3):163–207.
- Nygaard, K. 1977. Trade union participation. Presentation at CREST Conference on Management Information Systems, Stafford, UK.
- Oakley, B. W. 1990. Intelligent knowledge-based systems—AI in the U.K. In *The Age of Intelligent Machines*, ed. R. Kurzweil, 346–349. Cambridge, MA: MIT Press.
- Palen, L., and J. Grudin. 2002. Discretionary adoption of group support software. In *Implementing Collaboration Technology in Industry*, ed. B. E. Munkvold, 159–190. London, UK: Springer-Verlag.

- Perlman, G., G. K. Green, and M. S. Wogalter. 1995 .Human Factors Perspectives on Human-Computer Interaction. Santa Monica: Human Factors and Ergonomics Society.
- Pew, R. 2003. Evolution of HCI: From MEMEX to Bluetooth and beyond. In *The Human-Computer Interaction Handbook*, ed. J. A. Jacko, and A. Sears, 1–17. Mahwah, NJ: Lawrence Erlbaum.
- Pruitt, J., and T. Adlin. 2006. The Persona Lifecycle: Keeping People in Mind Throughout Product Design. San Francisco, CA: Morgan Kaufmann.
- Rasmussen, J. 1980. The human as a system component. In *Human Interaction with Computers*, ed. H. T. Smith, and T. R. G. Green, 67–96. London, UK: Academic.
- Rasmussen, J. 1986. Information Processing and Human-Machine Interaction: An Approach to Cognitive Engineering. New York: North-Holland.
- Rayward, W. B. 1983. Library and information sciences: Disciplinary differentiation, competition, and convergence. In *The Study of Information: Interdisciplinary Messages*, ed. F. Machlup, and U. Mansfield, 343–405. New York: Wiley.
- Rayward, W. B. 1998. The history and historiography of Information Science: Some reflections. In *Historical Studies in Information Science*, ed. T. B. Hahn, and M. Buckland, 7–21. Medford, NJ: Information Today/ASIS.
- Remus, W. 1984. An empirical evaluation of the impact of graphical and tabular presentations on decision-making. *Manage Sci* 30(5):533–542.
- Roscoe, S. N. 1997. *The Adolescence of Engineering Psychology*. Santa Monica, CA: Human Factors and Ergonomics Society.
- Sammet, J. 1992. Farewell to Grace Hopper—End of an era! *Commun ACM* 35(4):128–131.
- Shackel, B. 1959. Ergonomics for a computer. *Design* 120: 36–39.
- Shackel, B. 1962. Ergonomics in the design of a large digital computer console. *Ergonomics* 5: 229–241.
- Shackel, B. 1997. HCI: Whence and whither? *J ASIS* 48(11):970–986.
- Shannon, C. E. 1950. Programming a computer for playing chess. *Philos mag* 7(41):256–275.
- Shannon, C. E., and W. Weaver. 1949. *The Mathematical Theory of Communication*. Urbana, IL: Univ. of Illinois Press.
- Sheil, B. A. 1981. The psychological study of programming. *ACM Comput Surv* 13(1):101–120.
- Shneiderman, B. 1980. *Software Psychology: Human Factors in Computer and Information Systems*. Cambridge, MA: Winthrop.
- Simon, H. A. 1960. *The New Science of Management Decision*. New York: Harper.
- Smith, H. T., and T. R. G. Green, eds. 1980. *Human Interaction with Computers*. Orlando, FL: Academic.
- Smith, S. L. 1963. Man-computer information transfer. In *Electronic Information Display Systems*, ed. J. H. Howard, 284–299. Washington, DC: Spartan Books.
- Smith, S. L., B. B. Farquhar, and D. W. Thomas. 1965. Color coding in formatted displays. *J Appl Psychol* 49: 393–398.
- Smith, S. L., and N. C. Goodwin. 1970. Computer-generated speech and man-computer interaction. *Hum Factors* 12: 215–223.
- Smith, S. L., and J. N. Mosier. 1986. *Guidelines for Designing User Interface Software (ESD-TR-86-278)*. Bedford, MA: MITRE.
- Suchman, L. 1987a. *Plans and Situated Action: The Problem of Human-Machine Communication*. Cambridge, UK: Cambridge University Press.
- Suchman, L. 1987b. Designing with the user: Review of 'Computers and democracy: A Scandinavian challenge'. *ACM TOIS* 6(2):173–183.
- Sutherland, I. 1963. *Sketchpad: A Man-Machine Graphical Communication System*. Doctoral Dissertation, MIT.
<http://www.cl.cam.ac.uk/techreports/UCAM-CL-TR-574.pdf>
- Taylor, F. W. 1911. *The Principles of Scientific Management*. New York: Harper.
- Turing, A. 1949. *Letter in London Times*, June 11. See Highlights from the Computer Museum report Vol. 20, Summer/Fall 1987. <http://ed-thelen.org/comp-hist/TCMR-V20.pdf>.
- Turing, A. 1950. Computing machinery and intelligence. *Mind* 49:433–460. Republished as "Can a machine think?" in J. R. Newman (Ed.), *The World of Mathematics*, (Vol. 4, pp. 2099–2123). New York: Simon and Schuster.
- Vessey, I., and D. Galletta. 1991. Cognitive fit: An empirical test of information acquisition. *Inf Syst Res* 2(1):63–84.
- Waldrop, M. M. 2001. *The Dream Machine: J.C.R. Licklider and the Revolution that Made Computing Personal*. New York: Viking.
- Weinberg, G. 1971. *The Psychology of Computer Programming*. New York: Van Nostrand Reinhold.
- Wells, H. G. 1905. *A Modern Utopia*. London, UK: Jonathan Cape. <http://www.gutenberg.org/etext/6424>.
- Wells, H. G. 1938. *World Brain*. London, UK: Methuen.
- Wersig, G. 1992. Information science and theory: A weaver bird's perspective. In *Conceptions of Library and Information Science: Historical, Empirical, and Theoretical Perspectives*, ed. R Vakkari, and B. Cronin, 201–217. London, UK: Taylor Graham.
- White, P.T. 1970. Behold the computer revolution. *National Geographic* 38(5): 593–633.
<http://blog.modemmechanix.com/2008/12/22/behold-the-computer-revolution/>
- Yates, J. 1989. Control Through Communication: The Rise of System in American Management. Baltimore, MD: Johns Hopkins.
- Zhang, P. 2004. AIS SIGHCI three-year report. *SIGHCI newslett* 3(1):2–6.
- Zhang, P., F. F. -H. Nah, and J. Preece. 2004. HCI studies in management information systems. *Behav Inf Technol* 23(3):147–151.
- Zhang, P., Li, N., Scialdone, M.J. & Carey, J. 2009. The intellectual advancement of Human–Computer Interaction Research: A critical assessment of the MIS Literature. *Trans Human-Computer Interaction*, 1(3): 55–107.

Perceptual-Motor Interaction

- Abrams, R. A., and S. E. Chirst. 2003. Motion onset captures attention. *Psychol Sci* 14: 427–432.
- Adam, J. J., R. Mol, J. Pratt, and M. H. Fischer. 2006. Moving farther but faster: An exception to Fitts's law. *Psychol Sci* 17: 794–798.
- Adams, J. A. 1971. A closed-loop theory of motor learning. *J Mot Behav* 3: 111–150.
- Adams, J. A., and Dijkstra, S. 1966. Short-term memory for motor responses. *J Exp Psychol* 71: 314–318.
- Allport, A. 1987. Selection for action: Some behavioural and neurophysiological considerations of attention and action. In *Perspectives on Perception and Action*, ed. H. Heuer, and A. F. Sanders. 395–419. Hillsdale, NJ: Erlbaum.

- Allport, A. 1993. Attention and control: Have we been asking the wrong questions? A critical review of twenty-five years. In *Attention and Performance 14: Synergies in Experimental Psychology, Artificial Intelligence, and Cognitive Neuroscience*, ed. D. E. Meyer, and S. Kornblum, 183–218. Cambridge, MA: MIT Press.
- Barsalou, L. W. 1999. Perceptual symbol systems. *Behav Brain Sci* 22: 577–660.
- Bayerl, J., D. Millen, and S. Lewis. 1988. Consistent layout of function keys and screen labels speeds user responses. In *Proceedings of the Human Factors Society 32nd Annual Meeting*, 334–346. Santa Monica, CA: Human Factors Society.
- Beilock, S. L., and L. E. Holt. 2007. Embodied preference judgments: Can likeability be driven by the motor system? *Psychol Sci* 18: 51–57.
- Bekkering, H., and S. F. W. Neggers. 2002. Visual search is modulated by action intentions. *Psychol Sci* 13: 370–374.
- Bergen, B., N. Chang, and S. Narayan. 2004. Simulated action in an embodied construction grammar. In *Proceedings of the 26th Annual Meeting of the Cognitive Science Society*, ed. K. D. Forbus, D. Gentner, and T. Regier, 108–113. Hillsdale, NJ: Lawrence Erlbaum.
- Brass, M., H. Bekkering, and W. Prinz. 2002. Movement observation affects movement execution in a simple response task. *Acta Psychol* 106: 3–22.
- Brass, M., and C. Heyes. 2005. Imitation: Is cognitive neuroscience solving the correspondence problem? *Trends Cogn Sci* 9: 489–495.
- Broadbent, D. E. 1958. *Perception and Communication*. New York, NY: Pergamon.
- Brooks, V. B. 1974. Some examples of programmed limb movements. *Brain Res* 71: 299–308.
- Buetti, S., and D. Kerzel. 2009. Conflicts during response selection affect response programming: Reactions toward the source of stimulation. *J Exp Psychol Hum Percept Perform* 35: 816–834.
- Card, S. K., W. K. English, and B. J. Burr. 1978. Evaluation of mouse, rate-controlled isometric joystick, step keys, and text keys for text selection on a CRT. *Ergonomics* 21: 601–613.
- Carr, S. M., J. G. Phillips, and J. W. Meehan. 2008. Non-target flanker effects on movement in a virtual action centered reference frame. *Exp Brain Res* 184: 95–103.
- Casile, A., and M. A. Giese. 2006. Non-visual motor learning influences the recognition of biological motion. *Curr Biol* 16: 69–74.
- Chandrasekharan, S., A. Mazalek, Y. Chen, M. Nitsche, and A. Ranjan. 2010. Ideomotor Design: using common coding theory to derive novel video game interactions. *Pragmat Cogn* 18: 313–339.
- Chandrasekharan, S., and T. C. Stewart. 2007. The origin of epistemic structures and proto-representations. *Adapt Behav* 15: 329–353.
- Chapanis, A., and L. E. Lindenbaum. 1959. A reaction time study of four control-display linkages. *Hum Factors* 1: 1–7.
- Cheal, M. L., and D. R. Lyon. 1991. Central and peripheral precuing of forced-choice discrimination. *Q J Exp Psychol* 43 A:859–880.
- Cherry, E. C. 1953. Some experiments on the recognition of speech, with one and with two ears. *J Acoust Soc Am* 25: 975–979.
- Chua, R., and D. Elliott. 1993. Visual regulation of manual aiming. *Hum Mov Sci* 12: 365–401.
- Chua, R., D. J. Weeks, and D. Goodman. 2003. Perceptual-Motor Interaction: Some Implications for HCI. In *The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies, and Emerging Applications*, ed. J. A. Jacko, and A. Sears, 23–34. Hillsdale, NJ: Lawrence Erlbaum Assoc.
- Craighead, L., L. Fadiga, G. Rizzolatti, and C. Umiltà. 1999. Action for perception: A motor-visual attentional effect. *J Exp Psychol Hum Percept Perform* 25: 173–11692.
- Cree, G. S., K. McRae, and C. McNorgan. 1999. An attractor model of lexical conceptual processing: Simulating semantic priming. *Cogn Sci* 23: 371–414.
- Crossman, E. R. F. W., and P. J. Goodeve. 1983. Feedback control of hand movement and Fitts' Law. Paper presented at the meeting of the Experimental Psychology Society, Oxford, July 1963. Published in *Q J Exp Psychol* 35A:251–278.
- Decety, J. 2002. Is there such a thing as a functional equivalence between imagined, observed and executed actions. In *The Imitative Mind: Development, Evolution and Brain Bases*, ed. A. N. Meltzoff, and W. Prinz, 291–310. Cambridge: Cambridge University Press.
- Deubel, H., and W. X. Schneider. 1996. Saccade target selection and object recognition: Evidence for a common attentional mechanism. *Vis Res* 36: 1827–1837.
- Deutsch, J. A., and D. Deutsch. 1963. Attention: Some theoretical considerations. *Psychol Rev* 70: 880–890.
- Downing, C. J., and S. Pinker. 1985. The spatial structure of visual attention. In *Attention and Performance XI*, ed. M. I. Posner, and O. S. M. Marin, 171–187. Hillsdale, NJ: Erlbaum.
- Elliott, D., and M. A. Khan. 2010. Vision and Goal-directed Movements: Neurobehavioral Perspectives. Champaign, IL: Human Kinetics.
- Elliott, D., R. G. Carson, D. Goodman, and R. Chua. 1991. Discrete vs. continuous visual control of manual aiming. *Hum Mov Sci* 10: 393–418.
- English, W. K., D. C. Engelhart, and M. L. Berman. 1967. Display-selection techniques for text manipulation. *IEEE Trans Hum Factors Electron* 8: 5–15.
- Eriksen, B. A., and C. W. Eriksen. 1974. Effects of noise letters upon the identification of a target letter in a non-search task. *Percept Psychophys* 16: 143–146.
- Fiorio, M., M. Tinazzi, and S. M. Aglioti. 2006. Selective impairment of hand mental rotation in patients with focal hand dystonia. *Brain* 129: 47–54.
- Fisk, J. D., and M. A. Goodale. 1985. The organization of eye and limb movements during unrestricted reaching to targets in contralateral and ipsilateral space. *Exp Brain Res* 60: 159–178.
- Fitts, P. M. 1954. The information capacity of the human motor system in controlling the amplitude of movement. *J Exp Psychol* 47: 381–391.
- Fitts, P. M. 1964. Perceptual-motor skills learning. In *Categories of Human Learning*, ed. A. W. Melton, 243–285. New York: Academic Press.
- Fitts, P. M., and C. M. Seeger. 1953. S-R compatibility: Spatial characteristics of stimulus and response codes. *J Exp Psychol* 46: 199–210.
- Fitts, P. M., and M. I. Posner. 1967. *Human Performance*. Belmont, CA: Brooks-Cole.
- Fitts, P. M., and R. I. Deninger. 1954. S-R compatibility: Correspondence among paired elements within stimulus and response codes. *J Exp Psychol* 48: 483–491.
- Folk, C. L., R. W. Remington, and J. C. Johnson. 1992. Involuntary covert orienting is contingent on attentional control settings. *J Exp Psychol Hum Percept Perform* 18: 1030–1044.

- Folk, C. L., R. W. Remington, and J. H. Wright. 1994. The structure of attentional control: Contingent attentional capture by apparent motion, abrupt onset, and color. *J Exp Psychol Hum Percept Perform* 20: 317–329.
- Gawryszewski, L., L. Riggio, G. Rizzolatti, and C. Umiltá. 1987. Movements of attention in the three spatial dimensions and the meaning of "neutral" cues. *Neuropsychologia* 25: 19–29.
- Gibson, B. S., and E. M. Kelsey. 1998. Stimulus-driven attentional capture is contingent on attentional set for display-wide visual features. *J Exp Psychol Hum Percept Perform* 24: 699–706.
- Heath, M. 2005. Role of limb and target vision in the online control of memory-guided reaches. *Motor Control* 9: 281–311.
- Hegarty, M. 2004. Mechanical reasoning as mental simulation. *Trends Cogn Sci* 8: 280–285.
- Helsen, W. F., D. Elliot, J. L. Starkes, and K. L. Ricker. 1998. Temporal and spatial coupling of point of gaze and hand movements in aiming. *J Mot Behav* 30: 249–259.
- Helsen, W. F., D. Elliott, J. L. Starkes, and K. L. Ricker. 2000. Coupling of eye, finger, elbow, and shoulder movements during manual aiming. *J Mot Behav* 32: 241–248.
- Hick, W. E. 1952. On the rate of gain of information. *Q J Exp Psychol* 4: 11–26.
- Hinton, G. E., and L. A. Parsons. 1988. Scene-based and viewer-centered representations for comparing shapes. *Cognition* 30: 1–35.
- Hoffman, E. R., and J. T. A. Lim. 1997. Concurrent manual-decision tasks. *Ergonomics* 40: 293–318.
- Holt, L. E., and S. L. Beilock. 2006. Expertise and its embodiment: Examining the impact of sensorimotor skill expertise on the representation of action-related text. *Psychon Bull Rev* 13: 694–701.
- Hommel, B., J. Müseler, G. Aschersleben, and W. Prinz. 2001. The theory of event coding (TEC): A framework for perception and action planning. *Behav Brain Sci* 24: 849–878.
- Hornecker, E., R. J. K. Jacob, C. Hummels, B. Ullmer, A. Schmidt, E. V. D. Hoven, and A. Mazalek. 2008. TEI goes on: Tangible and embedded interaction. *IEEE Pervasive Comput* 7: 991–996.
- Howard, L. A., and S. P. Tipper. 1997. Hand deviations away from visual cues: Indirect evidence for inhibition. *Exp Brain Res* 113: 144–152.
- Hyman, R. 1953. Stimulus information as a determinant of reaction time. *J Exp Psychol* 45: 188–196.
- James, W. 1890. *Principles of Psychology*. New York: Holt.
- Jeannerod, M. 2006. From volition to agency: The mechanism of action recognition and its failures. In *Disorders of Volition*, ed. N. Sebanz, and W. Prinz, 175–192. Cambridge, MA: The MIT Press.
- Jonides, J. 1981. Voluntary versus automatic control over the mind's eye's movement. In *Attention and Performance IX*, ed. J. Long, and A. Baddeley, 187–203. Hillsdale, NJ: Lawrence Erlbaum Assoc.
- Kelso, J. A. S. 1982. The process approach to understanding human motor behavior: An introduction. In *Human Motor Behavior: An Introduction*, ed. J. A. S. Kelso, 3–19. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Kelso, J. A. S. 1995. *Dynamic Patterns: The Self-organization of Brain and Behavior*. Cambridge, MA: MIT Press.
- Kelso, J. A. S., D. L. Southard, and D. Goodman. 1979. On the coordination of two-handed movements. *J Exp Psychol Hum Percept Perform* 5: 229–238.
- Keulen, R. F., J. J. Adam, M. H. Fischer, H. Kuipers, and J. Jolles. 2002. Selective reaching: Evidence for multiple frames of reference. *J Exp Psychol Hum Percept Perform* 28: 515–526.
- Kilner, J. M., Paulignan, Y., Blakemore, S.-J. 2003. An interference effect of observed biological movement on action. *Current Biology* 13: 522–525.
- Khan, M. A., I. M. Franks, D. Elliott, G. P. Lawrence, R. Chua, P. M. Bernier, S. Hansen, and D. Weeks. 2006. Inferring online and offline processing of visual feedback in target-directed movements from kinematic data. *Neurosci Biobehav Rev* 30: 106–11121.
- Knoblich, G., and N. Sebanz. 2006. The social nature of perception and action. *Psychol Sci* 15: 99–104.
- Kosslyn, S. M. 1994. *Image and Brain*. Cambridge, MA: The MIT Press.
- Lindemann, O., and H. Bekkering. 2009. Object manipulation and motion perception: Evidence of an influence of action planning on visual processing. *J Exp Psychol Hum Percept Perform* 35: 1062–1071.
- Lyons, J., D. Elliott, K. L. Ricker, D. J. Weeks, and R. Chua. 1999. Action-centred attention in virtual environments. *Can J Exp Psychol* 53: 176–178.
- MacKenzie, C. L., R. G. Marteniuk, C. Dugas, D. Liske, and B. Eickmeier. 1987. Three dimensional movement trajectories in Fitts' task: Implications for control. *Q J Exp Psychol* 39A: 629–647.
- Maltz, M., and D. Shinar. 2003. New alternative methods of analyzing human behavior in cued target acquisition. *Hum Factors* 45: 281–295.
- Marteniuk, R. G. 1976. *Information Processing in Motor Skills*. New York: Holt, Rinehart and Winston.
- Marteniuk, R. G., C. L. MacKenzie, M. Jeannerod, S. Athenes, and C. Dugas. 1987. Constraints on human arm movement trajectories. *Can J Psychol* 41: 365–378.
- Marteniuk, R. G., C. L. MacKenzie, and J. L. Leavitt. 1988. Representational and physical accounts of motor control and learning: Can they account for the data? In *Cognition and Action in Skilled Behavior*, ed. A. M. Colley, and J. R. Beech, 173–190. Amsterdam: Elsevier Science Publishers.
- Martin, T., and D. L. Schwartz. 2005. Physically distributed learning: Adapting and reinterpreting physical environments in the development of fraction concepts. *Cogn Sci* 29: 587–625.
- Mazalek, A., M. Nitsche, S. Chandrasekharan, T. Welsh, P. Clifton, A. Quitmeyer, F. Peer, and F. Kirschner. 2010. Recognizing self in puppet controlled virtual avatars. In *Proceedings of Fun and Games 2010*, 66–73. New York: ACM Press.
- Mazalek, A., S. Chandrasekharan, M. Nitsche, T. Welsh, G. Thomas, T. Sanka, and P. Clifton. 2009. Giving your self to the game: Transferring a player's own movements to avatars using tangible interfaces. In *Proceedings of Sandbox 2009: ACM SIGGRAPH Videogame Symposium*, 161–168. New York, NY: ACM Press.
- Meegan, D. V., and S. P. Tipper. 1998. Reaching into cluttered visual environments: Spatial and temporal influences of distracting objects. *Q J Exp Psychol* 51A: 225–249.
- Meegan, D. V., and S. P. Tipper. 1999. Visual search and target-directed action. *J Exp Psychol Hum Percept Perform* 25: 1347–1362.
- Meyer, D. E., R. A. Abrams, S. Komblum, C. E. Wright, and J. E. K. Smith. 1988. Optimality in human motor performance: Ideal control of rapid aimed movements. *Psychol Rev* 95: 340–370.

- Müller, H. J., and P. M. A. Rabbitt. 1989. Reflexive and voluntary orienting of visual attention: Time course of activation and resistance to interruption. *J Exp Psychol Hum Percept Perform* 15: 315–330.
- Nersessian, N. J. 2002. The cognitive basis of model-based reasoning in science. In *The Cognitive Basis of Science*, ed. P. Carruthers, S. Stich, and M. Siegal, 133–153. Cambridge: Cambridge University Press.
- Nersessian, N. J. 2008. *Creating Scientific Concepts*. Cambridge, MA: The MIT Press.
- Pashler, H. 1994. Dual-task interference in simple tasks: Data and theory. *Psychol Bull* 116: 220–244.
- Posner, M. I. 1982. Cumulative development of attentional theory. *Am Psychol* 37: 168–179.
- Posner, M. I., and Y. Cohen. 1984. Components of visual orienting. In *Attention and Performance X*, ed. H. Bouma, and D. G. Bouwhuis, 531–556. Hillsdale, NJ: Lawrence Erlbaum Assoc.
- Posner, M. I., and S. W. Keele. 1969. Attentional demands of movement. In *Proceedings of the 16th Congress of Applied Psychology*. Amsterdam: Swets and Zeitlinger.
- Posner, M. I., M. J. Nissen, and W. C. Ogden. 1978. Attended and unattended processing modes: The role of set for spatial location. In *Modes of Perceiving and Processing Information*, ed. H. Pick, and E. Saltzman, 137–157. Hillsdale, NJ: Lawrence Erlbaum Assoc.
- Pratt, J., and J. McAuliffe. 2001. The effects of onsets and offsets on visual attention. *Psychol Res* 65: 185–191.
- Pratt, J., and R. A. Abrams. 1994. Action-centered inhibition: Effects of distractors in movement planning and execution. *Hum Mov Sci* 13: 245–254.
- Prinz, W. 1992. Why don't we perceive our brain states? *Eur J Cogn Psychol* 4: 1–20.
- Prinz, W. 1997. Perception and action planning. *Eur J Cogn Psychol* 9: 129–154.
- Prinz, W. 2005. A common coding approach to imitation. In *Perspectives on Imitation: From Neuroscience to Social Science*, Vol. 1, ed. S. Hurley and N. Chater, 141–156. Cambridge, MA: The MIT Press.
- Proctor, R. W., and T. Van Zandt. 1994. *Human Factors in Simple and Complex Systems*. Boston: Allyn and Bacon.
- Proctor, R. W., and K. L. Vu. 2003. Human information processing. In *The Human-computer Interaction Handbook: Fundamentals, Evolving Technologies, and Emerging Applications*, ed. J. A. Jacko, and A. Sears, 35–50. Hillsdale, NJ: Lawrence Erlbaum Assoc.
- Rizzolatti, G., and L. Craighero. 2004. The mirror-neuron system. *Annual Reviews in Neuroscience* 27: 169–192.
- Rizzolatti, G., L. Riggio, J. Dascola, and C. Umiltà. 1987. Reorienting attention across the horizontal and vertical meridians: Evidence in favor of a premotor theory of attention. *Neuropsychologia* 25: 31–40.
- Rizzolatti, G., L. Riggio, and B. M. Sheliga. 1994. Space and selective attention. In *Attention and Performance XV*, ed. C. Umiltà and M. Moscovitch, 231–265. Cambridge: MIT Press.
- Rutkowski, C. 1982. An introduction to the human applications standard computer interface, part I: Theory and principles. *Byte* 7: 291–310.
- Shepherd, M., J. M. Findlay, and R. J. Hockey. 1986. The relationship between eye-movements and spatial attention. *Q J Exp Psychol* 38A:475–491.
- Shneiderman, B. 1983. Direct manipulation: A step beyond programming languages. *IEEE Comput* 16: 557–569.
- Shneiderman, B. 1992. *Designing the User Interface: Strategies for Effective Human-computer Interaction*. Reading, MA: Addison-Wesley Publishing Company.
- Snyder, L. H., A. P. Batista, and R. A. Andersen. 1998. Change in motor plan, without a change in the spatial locus of attention, modulates activity in posterior parietal cortex. *J Neurophysiol* 79: 2814–2819.
- Song, J. H., and K. Nakayama. 2008. Target selection in visual search as revealed by movement trajectories. *Vis Res* 48: 853–861.
- Song, J. H., and K. Nakayama. 2009. Hidden cognitive states revealed in choice reaching tasks. *Trends Cogn Sci* 13: 360–366.
- Spence, C., D. Lloyd, F. McGlone, M. E. R. Nichols, and J. Driver. 2000. Inhibition of return is supramodal: A demonstration between all possible pairings of vision, touch, and audition. *Exp Brain Res* 134: 42–48.
- Stelmach, G. E. 1982. Information-processing framework for understanding human motor behavior. In *Human Motor Behavior: An Introduction*, ed. J. A. S. Kelso, 63–91. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Symes, E., M. Tucker, R. Ellis, L. Vainio, and G. Ottoboni. 2008. Grasp preparation improves change detection for congruent objects. *J Exp Psychol Hum Percept Perform* 34: 854–871.
- Telford, C. W. 1931. The refractory phase of voluntary and associative responses. *J Exp Psychol* 14: 1–36.
- Tenner, E. 1996. *Why Things Bite Back: Technology and the Revenge of Unintended Consequences*. New York: Alfred A. Knopf.
- Tipper, S. P., C. Lortie, and G. C. Baylis. 1992. Selective reaching evidence for action-centered attention. *J Exp Psychol Hum Percept Perform* 18: 891–905.
- Tipper, S. P., D. Meegan, and L. A. Howard. 2002. Action-centred negative priming: Evidence for reactive inhibition. *Vis Cogn* 9: 591–614.
- Tipper, S. P., L. A. Howard, and G. Houghton. 1999. Behavioral consequences of selection from neural population codes. In *Attention and Performance XVIII*, ed. S. Monsell, and J. Driver, 223–245. Cambridge, MA: MIT Press.
- Tipper, S. P., L. A. Howard, and S. R. Jackson. 1997. Selective reaching to grasp: Evidence for distractor interference effects. *Vis Cogn* 4: 1–38.
- Topolinski, S., and F. Strack. 2009. Motormouth: Mere exposure depends on stimulus-specific motor simulations. *J Exp Psychol Learn Mem Cogn* 35: 423–433.
- Treisman, A. M. 1964a. The effect of irrelevant material on the efficiency of selective listening. *Am J Psychol* 77: 533–546.
- Treisman, A. M. 1964b. Verbal cues, language, and meaning in selective attention. *Am J Psychol* 77: 206–219.
- Treisman, A. M. 1986. Features and objects in visual processing. *Scientific Am* 255: 114–125.
- Treisman, A. M., and G. Gelade. 1980. A feature-integration theory of attention. *Cogn Psychol* 12: 97–136.
- Wallace, R. J. 1971. S-R compatibility and the idea of a response code. *J Exp Psychol* 88: 354–360.
- Weir, P. L., D. J. Weeks, T. N. Welsh, D. Elliott, R. Chua, E. A. Roy, and J. Lyons. 2003. Action-centred distractor effects in discrete control selection. *Exp Brain Res* 149: 207–213.
- Welford, A. T. 1968. *Fundamentals of Skill*. London: Methuen.
- Welsh, T. N., and D. Elliott. 2004a. Movement trajectories in the presence of a distracting stimulus: Evidence for a response activation model of selective reaching. *Q J Exp Psychol* 57(A): 1031–1057.
- Welsh, T. N., and D. Elliott. 2004b. The effects of response priming and inhibition on movement planning and execution. *J Mot Behav* 36: 200–211.
- Welsh, T. N., D. Elliott, J. G. Anson, V. Dhillon, D. J. Weeks, J. L. Lyons, and R. Chua. 2005. Does Joe influence Fred's action? Inhibition of return across different nervous systems. *Neurosci Lett* 385: 99–104.

- Welsh, T. N., D. Elliott, and D. J. Weeks. 1999. Hand deviations towards distractors: Evidence for response competition. *Exp Brain Res* 127: 207–212.
- Welsh, T. N., and J. Pratt. 2008. Actions modulate attentional capture. *Q J Exp Psychol* 61: 968–976.
- Welsh, T. N., D. J. Weeks, R. Chua, and D. Goodman. 2007. Perceptual-motor interaction: Some implications for HCI. In *The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications*, 2nd ed., ed. A. Sears and J. A. Jacko, 27–41. Boca Raton, FL: CRC Press.
- Welsh, T. N., and M. Zbinden. 2009. Fitts' Law and action-centered reference frames in selective reaching: The “proximity-to-hand” effect revisited. *Motor Control* 13: 100–112.
- Wexler, M., S. M. Kosslyn, and A. Berthoz. 1998. Motor processes in mental rotation. *Cognition* 68: 77–94.
- Wilson, N. L., and R. W. Gibbs. 2007. Real and imagined body movement primes metaphor comprehension. *Cogn Sci* 31: 721–731.
- Wohlschlager, A. 2001. Mental object rotation and the planning of hand movements. *Percept Psychophys* 63: 709–718.
- Woodworth, R. S. 1899. The accuracy of voluntary movements. *Psychol Rev* 3(Monograph Suppl): 1–119.
- Wykowska, A., A. Schubö, and B. Hommel. 2009. How you move is what you see: Action planning biases selection in visual search. *J Exp Psychol Hum Percept Perform* 35: 155–169.
- Yeh, M., and C. D. Wickens. 2001a. Attentional filtering in the design of electronic map displays: A comparison of color coding, intensity coding, and decluttering techniques. *Hum Factors* 43: 543–562.
- Yeh, M., and C. D. Wickens. 2001b. Display signalling in augmented reality: Effects of cue reliability and image realism on attention allocation and trust calibration. *Hum Factors* 43: 355–365.
- Yeh, M., C. D. Wickens, and F. J. Seagull. 1999. Target cuing in visual search: The effects of conformality and display location on the allocation of visual attention. *Hum Factors* 41: 524–542.
- Yeh, M., J. L. Merlo, C. D. Wickens, and D. L. Bradenburg. 2003. Head up versus head down: The costs of imprecision, unreliability, and visual clutter on cue effectiveness for display signalling. *Hum Factors* 45: 390–407.
- Young, S. J., J. Pratt, and T. Chau. 2009. Misperceiving the speed-accuracy tradeoff: Imagined movements and perceptual decisions. *Exp Brain Res* 192: 121–132.

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- Anderson, J. R. 1982. Acquisition of cognitive skill. *Psychol Rev* 89: 369–406.
- Anderson, J. R., D. Bothell, M. D. Byrne, S. Douglass, C. Lebiere, and Y. Qin. 2004. An integrated theory of the mind. *Psychol Rev* 111: 1036–1060.
- Anderson, J. R., J. M. Fincham, and S. Douglass. 1999. Practice and retention: A unifying analysis. *J Exp Psychol Learn Mem Cogn* 25: 1020–1036.
- Anderson, J. R., M. Matessa, and C. Lebiere. 1997. ACT-R: A theory of higher level cognition and its relation to visual attention. *Hum Comput Interact* 12: 439–462.
- Atwood, M. E., and P. G. Polson. 1976. A process model for water jug problems. *Cogn Psychol* 8: 191–216.
- Baddeley, A. D. 2000. The episodic buffer: A new component of working memory? *Trends Cogn Sci* 4: 421.
- Baddeley, A. D. 2003. Working memory and language: An overview. *J Commun Disord* 36: 189–208.
- Baddeley, A. D., and G. J. Hitch. 1974. Working memory. In *The Psychology of Learning and Motivation*, ed. G. H. Bower, vol. 8, 47–89. New York: Academic Press.
- Baddeley, A. D., N. Thomson, and M. Buchanan. 1975. Word length and the structure of shortterm memory. *J Verbal Learn Behav* 14: 575–589.
- Bahrick, H. P., and L. K. Hall. 2005. The importance of retrieval failures to long-term retention: A metacognitive explanation of the spacing effect. *J Mem Lang* 52: 566–577.
- Bertelson, P. 1967. The time course of preparation. *Q J Exp Psychol* 19: 272–279.
- Boldini, A., R. Russo, and S. E. Avons. 2004. One process is not enough! A speed-accuracy tradeoff study of recognition memory. *Psychon Bull Rev* 11: 353–361.
- Bower, G. H., and E. R. Hilgard. 1981. *Theories of Learning*. 5th ed. Englewood Cliffs, NJ: Prentice Hall.
- Broadbent, D. E. 1958. Perception and Communication. Oxford, UK: Pergamon Press.
- Brown, J. (1958). Some tests of the decay theory pf immediate memory. *Q J Exp Psychol* 10: 12–21.
- Busemeyer, J. R., and A. Diederich. 2010. Cognitive Modeling. Thousand Oaks, CA: Sage.
- Card, S. K., W. K. English, and B. J. Burr. 1978. Evaluation of the mouse, rate-controlled isometric joystick, step keys, and text keys for text selection on a CRT. *Ergonomics* 21: 601–613.
- Card, S. K., T. P. Moran, and A. Newell. 1983. *The Psychology of Human-Computer Interaction*. Hillsdale, NJ: Erlbaum.
- Chen, Z., and N. Cowan. 2009. Core verbal working-memory capacity: The limit in words retained without covert articulation. *Q J Exp Psychol* 62: 1420–1429.
- Cherry, E. C. 1953. Some experiments on the recognition of speech, with one and with two ears. *J Acoust Soc Am* 25: 975–979.
- Craik, F. I. M., and R. S. Lockhart. 1972. Levels of processing: A framework for memory research. *J Verbal Learn Verbal Behav* 11: 671–684.
- Craik, F. I. M., and M. J. Watkins. 1973. The role of rehearsal in short-term memory. *J Verbal Learn Verbal Behav* 12: 599–607.
- De Jong, R. 1993. Multiple bottlenecks in overlapping task performance. *J Exp Psychol Hum Percept Perform* 19: 965–980.
- Deutsch, J. A., and D. Deutsch. 1963. Attention: Some theoretical considerations. *Psychol Rev* 70: 80–90.
- Donders, F. C. 1868/1969. On the speed of mental processes. In *Acta Psychologica*, 30, *Attention and Performance II*, ed. W. G. Koster, 412–431. Amsterdam, Netherlands: North-Holland.
- Duncan, J. 1977. Response selection rules in spatial choice reaction tasks. In *Attention and performance VI*, ed. S. Domic, 49–71. Hillsdale, NJ: Erlbaum.
- Eberts, R. E. 1994. *User Interface Design*. Englewood Cliffs, NJ: Prentice Hall.

- Eimer, M. 1998. The lateralized readiness potential as an on-line measure of central response activation processes. *Behav Res Methods Instrum Comput* 30: 146–156.
- Fitts, P. M. 1951. Engineering psychology and equipment design. In *Handbook of Experimental Psychology*, ed. S. S. Stevens, 1287–1340. New York: Wiley.
- Fitts, P. M. 1954. The information capacity of the human motor system in controlling the amplitude of movement. *J Exp Psychol* 47: 381–391.
- Fitts, P. M., and R. L. Deininger. 1954. S–R compatibility: Correspondence among paired elements within stimulus and response codes. *J Exp Psychol* 48: 483–492.
- Fitts, P. M., and M. I. Posner. 1967. *Human Performance*. Belmont, CA: Brooks/Cole.
- Fitts, P. M., and C. M. Seeger. 1953. S–R compatibility: Spatial characteristics of stimulus and response codes. *J Exp Psychol* 46: 199–210.
- Gibson, J. J. 1979. *The Ecological Approach to Visual Perception*. Boston, MA: Houghton Mifflin.
- Gillan, D. J., K. Holden, S. Adam, M. Rudisill, and L. Magee. 1992. How should Fitts's law be applied to human–computer interaction? *Interact Comput* 4: 291–313.
- Godden, D. R., and A. D. Baddeley. 1975. Context-dependent memory in two natural environments: On land and underwater. *Br J Psychol* 66: 325–331.
- Gonzalez, C., F. J. Lerch, and C. Lebiere. 2003. Instance-based learning in real-time dynamic decision making. *Cogn Sci* 27: 591–635.
- Grobelny, J., W. Karwowski, and C. Drury. 2005. Usability of graphical icons in the design of human–computer interfaces. *Int J Hum Comput Interact* 18: 167–182.
- Guard, Y., and M. Beaudouin-Lafon. 2004. Fitts's law 50 years later: Applications and contributions from human–computer interaction. *Int J Hum Comput Stud* 61: 747–750.
- Hastie, R., and R. M. Dawes. 2010. *Rational Choice in An Uncertain World: The Psychology of Judgment and Decision Making*. Thousand Oaks, CA: Sage.
- Healy, A. F., E. L. Wohldmann, and L. E. Bourne Jr. 2005. The procedural reinstatement principle: Studies on training, retention, and transfer. In *Experimental Cognitive Psychology and Its Applications*, ed. A. F. Healy, 559–571. Washington, DC: American Psychological Association.
- Heathcote, A., S. Brown, and D. J. K. Mewhort. 2000. The power law repealed: The case for an exponential law of practice. *Psychono Bull Rev* 7: 185–207.
- Hick, W. E. 1952. On the rate of gain of information. *Q J Exp Psychol* 4: 11–26.
- Hintzman, D. L. 1974. Theoretical implications of the spacing effect. In *Theories of Cognitive Psychology: The Loyola Symposium*, ed. R. L. Solso, 77–99. Hillsdale, NJ: Erlbaum.
- Hoffman, R. R., and K. A. Deffenbacher. 1992. A brief history of applied cognitive psychology. *Appl Cogn Psychol* 6:1–48.
- Holland, J. H., K. J. Holyoak, R. E. Nisbett, and P. R. Thagard. 1986. *Induction*. Cambridge, MA: MIT Press.
- Hommel, B., and W. Prinz, eds. 1997. *Theoretical Issues in Stimulus-Response Compatibility*. Amsterdam, Netherlands: North-Holland.
- Howes, A., and R. M. Young. 1997. The role of cognitive architecture in modeling the user: Soar's learning mechanism. *Hum Comput Interact* 12: 311–343.
- Huettel, S. A., A. W. Song, and G. McCarthy. 2004. *Functional Magnetic Resonance Imaging*. Sunderland, MA: Sinauer Associates.
- Hyde, T. S., and J. J. Jenkins. 1973. Recall of words as a function of semantic, graphic, and syntactic orienting tasks. *J Verbal Learn Verbal Behav* 12: 471–480.
- Hyman, R. 1953. Stimulus information as a determinant of reaction time. *J Exp Psychol* 45: 188–196.
- Jacko, J. A., and K. G. Ward. 1996. Toward establishing a link between psychomotor task complexity and human information processing. In *19th International Conference on Computers and Industrial Engineering*, vol. 31, 533–536.
- Jacoby, L. L., and M. Dallas. 1981. On the relationship between autobiographical memory and perceptual learning. *J Exp Psychol Gen* 110: 306–340.
- Kahneman, D. 1973. *Attention and Effort*. Englewood Cliffs, NJ: Prentice Hall.
- Kahneman, D., and A. Tversky, eds. 2000. *Choices, Values, and Frames*. New York: Cambridge University Press.
- Karpicke, J. D., and H. L. Roediger III. 2008. The critical importance of retrieval for learning. *Science* 319: 966–968.
- Kauhanen, L., P. Jylänki, J. Lehtonen, P. Rantanen, H. Alaranta, and M. Sams. 2007. EEG-based brain-computer interface for tetraplegics. *Compu Intell Neurosci* Volume 2007, Article ID 23864, 11 pages doi: 10.1155/2007/23864.
- Keppel, G., and B. J. Underwood. 1962. Proactive inhibition in short-term retention of single items. *J Verbal Learn Verbal Behav* 1: 153–161.
- Kiekel, P. A., and N. J. Cooke. 2011. Human factors aspects of team cognition. In *Handbook of Human Factors in Web Design*, 2nd ed., ed. K.-P. L. Vu and R. W. Proctor, 107–123. Boca Raton, FL: CRC Press.
- Kieras, D. E., and D. E. Meyer. 1997. An overview of the EPIC architecture for cognition and performance with application to human–computer interaction. *Hum Comput Interact* 12: 391–438.
- Klein, R. M., and D. I. Shore. 2000. Relation among modes of visual orienting. In *Control of Cognitive Processes: Attention and Performance XVIII*, ed. S. Monsell, and J. Driver, 195–208. Cambridge, MA: MIT Press.
- Komblum, S., T. Hasbroucq, and A. Osman. 1990. Dimensional overlap: Cognitive basis for stimulus–response compatibility—A model and taxonomy. *Psychol Rev* 97: 253–270.
- Kunde, W. 2001. Response-effect compatibility in manual choice reaction tasks. *J Exp Psychol Hum Percept Perform* 27: 387–394.
- Lachman, R., J. L. Lachman, and E. C. Butterfield. 1979. *Cognitive Psychology and Information Processing: An Introduction*. Hillsdale, NJ: Erlbaum.
- Lavie, N., A. Hirst, J. W. de Fockert, and E. Viding. 2004. Load theory of selective attention and cognitive control. *J Exp Psychol Gen* 133: 339–354.
- Lee, Y.-S. 2008. Levels-of-processing effects on conceptual automatic memory. *Eur J Cogn Psychol* 20: 936–954.
- Lee, E., and J. MacGregor. 1985. Minimizing user search time in menu retrieval systems. *Hum Factors* 27: 157–162.
- Lees, M. N., J. D. Cosman, J. D. Lee, M. Rizzo, and N. Fricke. 2010. Translating cognitive neuroscience to the driver's operational environment: A neuroergonomics approach. *Am J Psychol* 123:391–411.

- Loftus, E. F., and J. C. Palmer. 1974. Reconstruction of automobile destruction: An example of the interaction between language and memory. *J Exp Psychol Hum Learn Mem* 4:19–41.
- Lu, C.-H., and R. W. Proctor. 1995. The influence of irrelevant location information on performance: A review of the Simon effect and spatial Stroop effects. *Psychon Bull Rev* 2: 174–207.
- MacKenzie, I. S., and R. W. Soukoreff. 2002. Text entry for mobile computing: Models and methods, theory and practice. *Hum Comput Interact* 17: 147–198.
- Mackworth, N. H. 1948. The breakdown of vigilance during prolonged visual search. *Q J Exp Psychol* 1: 6–21.
- Macmillan, N. A., and C. D. Creelman. 2005. *Detection Theory: A User's Guide*. 2nd ed. Mahwah, NJ: Erlbaum.
- Martens, S., and B. Wyble. 2010. The attentional blink: Past, present, and future of a blind spot in perceptual awareness. *Neurosci Biobehav Rev* 34: 947–957.
- McCarley, J. S. 2009. Effects of speed-accuracy instructions on oculomotor scanning and target recognition in a simulated baggage X-ray screening task. *Ergonomics* 52: 325–333.
- McClelland, J. L. 1979. On the time relations of mental processes: A framework for analyzing processes in cascade. *Psychol Rev* 88: 375–407.
- McDonald, J. E., J. D. Stone, and L. S. Liebelt. 1983. Searching for items in menus: The effects of organization and type of target. In *Proceedings of the Human Factors Society 27th Annual Meeting*, 289–338. Hillsdale, NJ: Erlbaum.
- McGuffin, M. J., and R. Balakrishnan. 2005. Fitts's law and expanding targets: Experimental studies and designs for user interfaces. *ACM Trans Comput Hum Interact* 12: 388–422.
- Melara, R. D., H. Wang, K.-P. L. Vu, and R. W. Proctor. 2008. Attentional origins of the Simon effect: Behavioral and electrophysiological evidence. *Brain Res* 1215: 147–159.
- Meyer, D. E., R. A. Abrams, S. Kornblum, C. E. Wright, and J. E. K. Smith. 1988. Optimality in human motor performance: Ideal control of rapid aimed movements. *Psychol Rev* 86: 340–370.
- Meyer, D. E., and D. E. Kieras. 1997. A computational theory of executive cognitive processes and multiple-task performance: Part 2. Accounts of psychological refractory-period phenomena. *Psychol Rev* 104: 749–791.
- Miller, G. A. 1956. The magical number seven plus or minus two: Some limits on our capacity for processing information. *Psychol Rev* 63: 81–97.
- Miller, J. 1988. Discrete and continuous models of human information processing: Theoretical distinctions and empirical results. *Acta Psychol* 67: 191–257.
- Monsell, S., and J. Driver, eds. 2000. *Control of Cognitive Processes: Attention and Performance XVIII*. Cambridge, MA: MIT Press.
- Morris, C. D., J. D. Bransford, and J. J. Franks. 1977. Levels of processing versus transfer appropriate processing. *J Verbal Learn Verbal Behav* 16: 519–533.
- Nairne, J. S. 2003. Sensory and working memory. In *Experimental Psychology*, vol. 4 of *Handbook of Psychology*, ed. A. F. Healy and R. W. Proctor. Editor-in-Chief: I. B. Weiner. Hoboken, NJ: Wiley.
- Nairne, J. S., and Pandeirada, J. N. S. 2010. Adaptive memory: Nature's criterion and the functionalist agenda. *Am J Psychol* 123: 381–390.
- Navon, D. 1984. Resources—a theoretical soup stone? *Psychol Rev* 91: 216–234.
- Newell, A., and P. S. Rosenbloom. 1981. Mechanisms of skill acquisition and the law of practice. In *Cognitive Skills and Their Acquisition*, ed. J. R. Anderson, 1–55. Hillsdale, NJ: Erlbaum.
- Newell, A., and H. A. Simon. 1972. *Human Problem Solving*. Englewood Cliffs, NJ: Prentice Hall.
- Oulasvirta, A., L. Kärkkäinen, and J. Laarni. 2005. Expectations and memory in link search. *Comput Hum Behav* 21: 773–789.
- Oulasvirta, A., and P. Saariluoma. 2004. Long-term working memory and interrupting messages in human-computer interaction. *Behav Inf Technol* 23: 553–564.
- Pachella, R. G. 1974. The interpretation of reaction time in information-processing research. In *Human Information Processing: Tutorials in Performance and Cognition*, ed. B. H. Kantowitz, 441–482. Hillsdale, NJ: Erlbaum.
- Parasuraman, R. 2003. Neuroergonomics: Research and practice. *Theor Issues Ergon Sci* 4: 5–20.
- Parasuraman, R., and D. R. Davies. 1977. A taxonomic analysis of vigilance performance. In *Vigilance: Theory, Operational Performance, and Physiological Correlates*, ed. R. R. Mackie, 559–574. New York: Plenum.
- Park, H., and M. D. Rugg. 2008. The relationship between study processing and the effects of cue congruency at retrieval: fMRI support for transfer appropriate processing. *Cereb Cortex* 18: 868–875.
- Parsons, M. W., D. L. Harrington, and S. M. Rao. 2005. Distinct neural systems underlie learning visuomotor and spatial representations of motor skills. *Hum Brain Mapp* 24: 229–247.
- Pashler, H. 1998. *The Psychology of Attention*. Cambridge, MA: MIT Press.
- Payne, S. J. 1995. Naïve judgments of stimulus-response compatibility. *Hum Factors* 37: 495–506.
- Percival, L. C., and T. K. Noonan. 1987. Computer network operation: Applicability of the vigilance paradigm to key tasks. *Hum Factors* 29: 685–694.
- Perlman, G. 1984. Making the right choices with menus. *Proceedings of INTERACT '84*, 291–295. London, UK: IFIP.
- Peterson, L. R., and M. J. Peterson. 1959. Short-term retention of individual verbal items. *J Exp Psychol* 58: 193–198.
- Posner, M. I. 1986. Overview. In *Handbook of Perception and Human Performance*, vol. 2 of *Cognitive Processes and Performance*, ed. K. R. Boff, L. Kaufman, and J. P. Thomas, V3–10. New York: Wiley.
- Posner, M. I., and Y. Cohen. 1984. Components of visual orienting. In *Attention and Performance X*, ed. H. Bouma, and D. G. Bouwhuis, 531–556. Hillsdale, NJ: Erlbaum.
- Proctor, R. W., and Y. S. Cho. 2006. Polarity correspondence: A general principle for performance of speeded binary classification tasks. *Psychol Bull* 132: 416–442.
- Proctor, R. W., and T. Van Zandt. 2008. *Human Factors in Simple and Complex Systems*. 2nd ed. Boca Raton, FL: CRC Press.
- Proctor, R. W., and K.-P. L. Vu. 2006. *Stimulus-Response Compatibility: Data, Theory and Application*. Boca Raton, FL: CRC Press.
- Proctor, R. W., and K.-P. L. Vu. 2010. Cumulative knowledge and progress in human factors. *Annu Rev Psychol* 61: 623–651.
- Proctor, R. W., K.-P. L. Vu, and D. F. Pick. 2005. Aging and response selection in spatial choice tasks. *Hum Factors* 47: 250–270.
- Ratcliff, R., and P. L. Smith. 2004. A comparison of sequential sampling models for two-choice reaction time. *Psychol Rev* 111: 333–367.

- Reeve, T. G., and R. W. Proctor. 1990. The salient features coding principle for spatial- and symbolic-compatibility effects. In *Stimulus-Response Compatibility: An Integrated Perspective*, ed. R. W. Proctor, and T. G. Reeve, 163–180. Amsterdam, Netherlands: North-Holland.
- Roediger III, H. L., and K. B. McDermott. 1995. Creating false memories: Remembering words not presented in lists. *J Exp Psychol Learn Mem Cogn* 21: 803–814.
- Roscoe, S. 2011. Historical overview of human factors and ergonomics. In *Handbook of Human Factors in Web Design*, 2nd ed., ed. K.-P. L. Vu and R. W. Proctor, 3–12. Boca Raton: CRC Press.
- Roteilo, C. M., and N. A. Macmillan. 2006. Remember-know models as decision strategies in two experimental paradigms. *J Mem Lang* 55: 479–494.
- Rubichi, S., K.-P. L. Vu, R. Nicoletti, and R. W. Proctor. 2006. Spatial coding in two dimensions. *Psychon Bull Rev* 13: 201–216.
- Rugg, M. D., and M. G. H. Coles, eds. 1995. *Electrophysiology of Mind: Event-Related Brain Potentials and Cognition*. Oxford, England UK: Oxford University Press.
- Salthouse, T. A. 2005. From description to explanation in cognitive aging. In *Cognition and Intelligence: Identifying the Mechanisms of the Mind*, ed. R. J. Sternberg, and J. E. Pretz, 288–305. Cambridge: Cambridge University Press.
- Sanders, A. F. 1998. *Elements of Human Performance*. Mahwah, NJ: Erlbaum.
- Sartori, G., and C. Umiltà. 2000. How to avoid the fallacies of cognitive subtraction in brain imaging. *Brain Lang* 74: 191–212.
- Schweickert, R. 1978. A critical path generalization of the additive factor method: Analysis of a Stroop task. *J Math Psychol* 18: 105–139.
- Schweickert, R., and B. Boruff. 1986. Short-term memory capacity: Magic number or magic spell? *J Exp Psychol Learn Mem Cogn* 12: 419–425.
- Shaffer, L. H. 1965. Choice reaction with variable S-R mapping. *J Exp Psychol* 70: 284–288.
- Shepard, R. N., and J. Metzler. 1971. Mental rotation of three-dimensional objects. *Science* 171: 701–703.
- Sherman, D. K., C. Gangi, and M. L. White. 2010. Embodied cognition and health persuasion: Facilitating intention-behavior consistency via motor manipulations. *J Exp Soc Psychol* 46:461–464.
- Simon, J. R. 1990. The effects of an irrelevant directional cue on human information processing. In *Stimulus-Response Compatibility: An Integrated Perspective*, ed. R. W. Proctor, and T. G. Reeve, 31–86. Amsterdam: North-Holland.
- Simons, D. J., and M. S. Ambinder. 2005. Change blindness: Theory and consequences. *Curr Dir Psychol Sci* 14: 44–48.
- Slamecka, N. J., and P. Graf. 1978. The generation effect: Delineation of a phenomenon. *J Exp Psychol Hum Learn Mem* 4: 592–604.
- Smith, T. J., and R. A. Henning. 2005. Cybernetics of augmented cognition as an alternative to information processing. In *Proceedings of HCI International 2005*. Mahwah, NJ: Erlbaum.
- Somberg, B. L., and M. C. Picardi. 1983. Locus of information familiarity effect in search of computer menus. In *Proceedings of the Human Factors Society 27th Annual Meeting*, 826–830. Santa Monica, CA: Human Factors Society.
- Sternberg, S. 1969. The discovery of processing stages: Extensions of Donders' method. In *Attention and Performance II Acta Psychologica*, ed. W. G. Koster, vol. 30, 276–315. North Holland: Amsterdam.
- Sternberg, S., S. Monsell, R. L. Knoll, and C. E. Wright. 1978. The latency and duration of rapid movement sequences. In *Information Processing in Motor Control and Learning*, ed. G. E. Stelmach, 117–152. New York: Academic Press.
- Stevenson, R. A., S. Kim, and T. W. James. 2009. An additive-factors design to disambiguate neuronal and areal convergence: Measuring multisensory interactions between audio, visual, and haptic sensory streams using fMRI. *Exp Brain Res* 198: 183–194.
- Surprenant, A. M., and I. Neath. 2009. *Principles of Memory*. Philadelphia, PA: Psychology Press.
- Talmi, D., C. L. Grady, Y. Goshen-Gottstein, and M. Moscovitch. 2005. Neuroimaging the serial position curve: A test of single-store versus dual-store models. *Psychol Sci* 16: 716–723.
- Teichner, W. H., and M. J. Krebs. 1974. Laws of visual choice reaction time. *Psychol Rev* 81: 75–98.
- Tlauka, M. 2004. Display-control compatibility: The relationship between performance and judgments of performance. *Ergonomics* 47: 281–295.
- Tombu, M., and P. Jolicœur. 2005. Testing the predictions of the central capacity sharing model. *J Exp Psychol Hum Percept Perform* 31: 790–802.
- Treisman, A. M. 1964. Selective attention in man. *Br Med Bull* 20: 12–16.
- Treisman, A. M., and G. Gelade. 1980. A feature-integration theory of attention. *Cogn Psychol* 12: 97–136.
- Trimmel, M., and R. Huber. 1998. After-effects of human-computer interaction indicated by P300 of the event-related brain potential. *Ergonomics* 41: 649–655.
- Tullis, T. S., F. J. Tranquada, and M. J. Siegel. 2011. Presentation of information. In *Handbook of Human Factors in Web Design*, 2nd ed., ed. K.-P. L. Vu and R. W. Proctor, 153–189. Boca Raton, FL: CRC Press.
- Usher, M., Z. Olami, and J. L. McClelland. 2002. Hick's law in a stochastic race model with speed-accuracy tradeoff. *J Math Psychol* 46:704–715.
- van de Laar, M. C., W. P. M. van den Wildenberg, G. J. M. van Boxtel, and M. W. van der Molen. 2010. Processing of global and selective stop signals application of Donders' subtraction method to stop-signal task performance. *Exp Psychol* 57: 149–159.
- Van Zandt, T., H. Colonius, and R. W. Proctor. 2000. A comparison of two response time models applied to perceptual matching. *Psychon Bull Rev* 7: 208–256.
- Verhaeghen, P., and A. Marcoen. 1996. On the mechanisms of plasticity in young and older adults after instruction in the method of loci: Evidence for an amplification model. *Psychol Aging* 11: 164–178.
- Vu, K.-P. L., and R. W. Proctor. 2003. Naïve and experienced judgments of stimulus-response compatibility: Implications for interface design. *Ergonomics* 46: 169–187.
- Vu, K.-P. L., and R. W. Proctor. 2004. Mixing compatible and incompatible mappings: Elimination, reduction, and enhancement of spatial compatibility effects. *Q J Exp Psychol* 57A:539–556.
- Vu, K.-P. L., and R. W. Proctor. 2008. Age differences in response selection for pure and mixed stimulus-response mappings and tasks. *Acta Psychol* 129: 49–60.
- Vu, K.-P. L., R. W. Proctor, A. Bhargav-Spanzel, B. -L. Tai, J. Cook, and E. E. Schultz. 2007. Improving password security and memorability to protect personal and organizational information. *Int J Hum Comput Stud* 65: 744–757.
- Walker, N., J. B. Smelcer, and E. Nilsen. 1991. Optimizing speed and accuracy of menu selection: A comparison of walking and pull-down menus. *Int J Man Mach Stud* 35: 871–890.

- Wang, H., and R. W. Proctor. 1996. Stimulus-response compatibility as a function of stimulus code and response modality. *J Exp Psychol Hum Percept Perform* 22: 1201–1217.
- Ward, J. 2010. *The Student's Guide to Cognitive Neuroscience*. 2nd ed. New York: Psychology Press.
- Warm, J. S., R. Parasuraman, and G. Matthews. 2008. Vigilance requires hard mental work and is stressful. *Hum Factors* 50: 433–441.
- Wickelgren, W. A. 1977. Speed-accuracy tradeoff and information processing dynamics. *Acta Psychol* 41: 67–85.
- Wickens, D. D. 1970. Encoding categories of words: An empirical approach to meaning. *Psychol Rev* 77: 1–15.
- Wickens, C. D. 1984. Processing resources in attention. In *Varieties of Attention*, ed. R. Parasuraman, and D. R. Davies, 63–102. San Diego, CA: Academic Press.
- Wickens, C. D., S. Gordon, Y. Liu, and J. Lee. 2003. *An Introduction to Human Factors Engineering*. 2nd ed. New York: Prentice Hall.
- Wolfe, J. M. 2007. Guided Search4.0: Current progress with a model of visual search. In *Integrated Models of Cognitive Systems*, ed. W. D. Gray, 99–119. New York: Oxford University Press.
- Wood, L. E., and J. D. Pratt. 1987. Pegword mnemonic as an aid to memory in the elderly: A comparison of four age groups. *Educ Gerontol* 13: 325–339.
- Yantis, S. 2000. Goal-directed and stimulus-driven determinants of attentional control. In *Control of Cognitive Processes: Attention and Performance XVIII*, ed. S. Monsell, and J. Driver, 195–208. Cambridge, MA: MIT Press.
- Young, P. M., B. A. Clegg, and C. A. P. Smith. 2004. Dynamic models of augmented cognition. *Int J Hum Comput Interact* 17: 259–273.

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- Baddeley, A. 1992. Working memory. *Science* 255: 556–559.
- Baddeley, A. D., and D. J. A. Longman. 1978. The influence of length and frequency of training session on the rate of learning to type. *Ergonomics* 21: 627–635.
- Bibby, P. A., and S. J. Payne. 1993. Internalization and use-specificity of device knowledge. *Hum Comput Interact* 8: 25–56.
- Bibby, P. A., and S. J. Payne. 1996. Instruction and practice in learning about a device. *Cognitive Sci* 20: 539–578.
- Bjork, R. A., and T. W. Allen. 1970. The spacing effect: Consolidation or differential encoding? *J Verbal Learn Verbal Behav* 9: 567–572.
- Bransford, J. D., J. R. Barclay, and J. J. Franks. 1972. Sentence memory: A constructive versus interpretive approach. *Cogn Psychol* 3: 193–209.
- Carroll, J. M. 1990. *The Nurnberg Funnel: Designing Minimalist Instruction for Practical Computer Skill*. Cambridge, MA: MIT Press.
- Carroll, J. M., and J. R. Olson. 1988. Mental models in human–computer interaction. In *Handbook of Human-Computer Interaction*, ed. M. Helander, 45–65. New York: Elsevier.
- Chandler, P., and J. Sweller. 1991. Cognitive load theory and the format of instruction. *Cogn Instruct* 8: 293–332.
- Clark, H. H. 1992. *Arenas of Language Use*. Chicago, IL: Chicago University Press.
- Clark, J. M., and A. Paivio. 1991. Dual coding theory and education. *Educ Psychol Rev* 3(3): 149–170.
- Cockburn, A., and S. Jones. 1996. Which way now? Analysing and easing inadequacies in WWW navigation. *Int Hum Comput Stud* 45: 195–230.
- Collins, A., and D. Gentner. 1987. How people construct mental models. In *Cultural Models in Language and Thought*, ed. D. Holland and N. Quinn. Cambridge, UK: Cambridge University Press.
- Craik, K. J. W. 1943. *The Nature of Explanation*. Cambridge: Cambridge University Press.
- Crowston, K., and E. E. Kammerer. 1998. Coordination and collective mind in software requirements development. *IBM Syst J* 31(2):227–245.
- Curtis, B., H. Krasner, and N. Iscoe. 1988. A field study of the software design process for large systems. *Commun ACM* 31(11): 1268–1286.
- Diehl, V. A., and C. B. Mills. 1995. The effects of interaction with the device described by procedural text on recall, true/false, and task performance. *Mem Cogn* 23(6):675–688.
- Duggan, G. B., and S. J. Payne. 2001. Interleaving reading and acting while following procedural instructions. *J Exp Psychol Appl* 7(4):297–307.
- Ericsson, K. A., R. T. Krampe, and C. Tesch-Romer. 1993. The role of deliberate practice in the acquisition of expert performance. *Psychol Rev* 100(3):363–406.
- Espinosa, J. A., R. E. Kraut, S. A. Slaughter, J. F. Lerch, J. D. Herbsleb, and A. Mockus. 2002. Shared mental models, familiarity and coordination: A multi-method study of distributed software teams. In *Proceedings of the 23rd International Conference in Information Systems (ICIS)*, 425–433. Barcelona, Spain.
- Fletcher, C. R., and S. T. Chrysler. 1990. Surface forms, textbases and situation models: Recognition memory for three types of textual information. *Discourse Process* 13: 175–190.
- Gentner, D., and A. L. Stevens. 1983. *Mental Models*. Hillsdale, NJ: Erlbaum.
- Glenberg, A. M., and W. E. Langston. 1992. Comprehension of illustrated text: Pictures help to build mental models. *J Mem Lang* 31: 129–151.
- Halasz, F. G., and T. P. Moran. 1983. Mental models and problemsolving in using a calculator. In *Proceedings of CHI 83 Human Factors in Computing Systems*. New York: ACM.
- Holland, J. H., K. J. Holyoak, R. E. Nisbett, and P. R. Thagard. 1986. *Induction*. Cambridge, MA: MIT Press.
- Johnson-Laird, P. N. 1983. *Mental Models*. Cambridge, UK: Cambridge University Press.
- Johnson-Laird, P. N. 1989. Mental models. In *Foundations of Cognitive Science*, ed. M. I. Posner. Cambridge, MA: MIT Press.
- Kerr, R., and B. Booth. 1978. Specific and varied practice of a motor skill. *Percept Mot Skills* 46: 395–401.
- Kieras, D. E., and S. Bovair. 1984. The role of a mental model in learning to use a device. *Cogn Sci* 8: 255–273.
- Kintsch, W. 1998. *Comprehension*. Cambridge, UK: Cambridge University Press.
- Kraut, R. E., and L. A. Streeter. 1995. Coordination in software development. *Commun ACM* 38(3):669–681.
- Landauer, T. K., and R. A. Bjork. 1978. Optimum rehearsal patterns and name learning. In *Practical Aspects of Memory*, ed. M. M. Gagné, P. E. Morris, and R. N. Sykes, 625–632. London: Academic Press.

- Larkin, J. H., and H. A. Simon. 1987. Why a diagram is (sometimes) worth ten thousand words. *Cogn Sci* 11: 65–100.
- Lee, T. D., and R. A. Magill. 1983. The locus of contextual interference in motorskill acquisition. *J Exp Psychol: Learn Mem Cogn* 9: 730–746.
- Levesque, L. L., J. M. Wilson, and D. R. Wholey. 2001. Cognitive divergence and shared mental models in software development project teams. *J Organ Behav* 22: 135–144.
- Mathieu, J. E., T. S. Heffner, G. F. Goodwin, E. Salas, and J. A. Cannon-Bowers. 2000. The influence of shared mental models team process and performance. *J Appl Psychol* 85: 273–283.
- Mayer, R. E. 1996. Learning strategies for making sense out of expository text: The SOI model for guiding three cognitive processes in knowledge construction. *Educ Psychol Rev* 8: 357–371.
- Mayer, R. E. 1999a. Research-based principles for the design of instructional messages: The case of multimedia explanations. *Doc Des* 1: 7–20.
- Mayer, R. E. 1999b. Multimedia aids to problem solving transfer. *Int J Educ Res* 31: 611–623.
- Mayer, R. E. 1999c. Multimedia aids to problem-solving transfer. *Int J Educ Res* 31: 661–724.
- Mayer, R. E., and R. B. Anderson. 1991. Animations need narrations: An experimental test of a dual-coding hypothesis. *J Educ Psychol* 83: 484–490.
- Mayer, R. E., and R. B. Anderson. 1992. The instructive animation: Helping students build connections between words and pictures in multimedia learning. *J Educ Psychol* 84: 444–452.
- Mayer, R. E., and J. K. Gallini. 1990. When is an illustration worth ten thousand words? *J Educ Psychol* 82: 715–726.
- Mayer, R. E., and R. Moreno. 1998. A split-attention effect in multimedia learning: Evidence for dual processing systems in working memory. *J Educ Psychol* 90: 312–320.
- Mayer, R. E., and R. Moreno. 2002. Aids to computer-based multi-media learning. *Learn Instruct* 12: 107–119.
- Mayer, R. E., and V. K. Sims. 1994. For whom is a picture worth a thousand words? Extensions of a dual-coding theory of multi-media learning. *J Educ Psychol* 86: 389–401.
- Mayhew, D. J. 1992. *Principles and Guidelines in Software User Interface Design*. Englewood Cliffs, NJ: Prentice Hall.
- McCloskey, M. 1983. Naïve theories of motion. In *Mental Models*, ed. D. Gentner, and A. L. Stevens, 299–323. Hillsdale, NJ: Erlbaum.
- McIntyre, R. M., and E. Salas. 1995. Measuring and managing for team performance: Emerging principles from complex environments. In *Team Effectiveness and Decision Making in Organizations*, ed. R. A. Guzzo, and E. Salas, 9–45. San Francisco, CA: Jossey-Bass.
- McNamara, D. S., E. Kintsch, N. B. Songer, and W. Kintsch. 1996. Are good texts always better? Text coherence, background knowledge, and levels of understanding in learning from text. *Cogn Instruct* 14:1–43.
- Moheammel, S., and B. C. Dunville. 2001. Team mental models in a team knowledge framework: Expanding theory and measurement across disciplinary boundaries. *J Organ Behav* 22(2):89.
- Mohammed, S., R. Klimoski, and J. R. Rentsch. 2000. The measurement of team mental models: We have no shared schema. *Organ Res Methods* 3 (2): 123–165.
- Moray, N. 1999. Mental models in theory and practice. In *Attention and performance XVII*, ed. D. Gopher, and A. Koriat, 223–258. Cambridge, MA: MIT Press.
- Newell, A., and H. A. Simon. 1972. *Human Problem Solving*. Englewood Cliffs, NJ: Prentice Hall.
- Norman, D. A. 1983. Some observations on mental models. In *Mental Models*, ed. D. Gentner, and A. L. Stevens, 7–14. Hillsdale, NJ: Erlbaum.
- O'Hara, K. P., and S. J. Payne. 1998. The effects of operator implementation cost on planfulness of problem solving and learning. *Cogn Psychol* 35: 334–370.
- O'Hara, K. P., and S. J. Payne. 1999. Planning and user interface: The effects of lockout time and error recovery cost. *Int Hum Comput Stud* 50: 441–459.
- Paivio, A. 1986. *Mental Representations*. New York: Oxford University Press.
- Payne, S. J. 1991. A descriptive study of mental models. *Behav Inf Technol* 10: 3–21.
- Payne, S. J. 2003. Users' mental models of devices: The very ideas. In *HCI Models, Theories and Frameworks: Towards a Multidisciplinary Science*, ed. J. M. Carroll, 135–156. San Francisco, CA: Morgan Kaufmann.
- Payne, S. J., A. Howes, and E. Hill. 1992. Conceptual instructions derived from an analysis of device models. *Int J Hum Comput Interact* 4: 335–358.
- Payne, S. J., and W. R. Reader. 2006. Constructing structure maps of multiple on-line texts. *Int J Hum Comput Stud* 64(5):461–474.
- Payne, S. J., H. R. Squibb, and A. Howes. 1990. The nature of device models: The yoked state space hypothesis and some experiments with text editors. *Hum Comput Interact* 5: 415–444.
- Perfetti, C. A. 1997. Sentences, individual differences, and multiple texts. Three issues in text comprehension. *Discourse Process* 23: 337–355.
- Radvansky, G. A., D. H. Spieler, and R.T. Zacks. 1993. Mental model organization. *J Exp Psychol Learn Mem Cogn* 19: 95–114.
- Radvansky, G. A., and R. T. Zacks. 1991. Mental models and fact retrieval. *J Exp Psychol Learn Mem Cogn* 17: 940–953.
- Rouet, J. F., M. Favart, M. A. Britt, and C. A. Perfetti. 1997. Studying and using multiple documents in history: Effects of discipline expertise. *Cogn Instruct* 75(1):85–106.
- Schmidt, R. A., and R. A. Bjork. 1992. New conceptualizations of practice: Common principles in three paradigms suggest new concepts for training. *Psychol Sci* 3: 207–217.
- Schmidt, R. A., D. E. Young, S. Swinnen, and D. C. Shapiro. 1989. Summary knowledge of results for skill acquisition: Support for the guidance hypothesis. *J Exp Psychol Learn Mem Cogn* 15: 352–359.
- Shea, J. B., and R. L. 1979. Contextual interference effects on the acquisition, retention, and transfer of a motor skill. *J Exp Psychol Hum Learn Mem* 5: 179–187.
- Simon, H. A. 1955. A behavioral model of rational choice. *QJEcon* 69: 99–118.
- Simon, H. A. 1978. On the forms of mental representation. In *Minnesota Studies in the Philosophy of Science*, ed. C. W. Savage, 3–18, Vol. 9. Minneapolis, MN: University of Minnesota Press.
- Simon, H. A. 1992. What is an “explanation” of behavior? *Psychol Sci* 3: 150–161.
- Stahl, S. A., C. R. Hind, B. K. Britton, M. M. McNish, and D. Bosquet. 1996. What happens when students read multiple source documents in history. *Read Res* 31(4):430–456.

- Tognazzini, B. 1992. *Tog on Interface*. Reading, MA: Addison-Wesley.
- van Dijk, T. A., and W. Kintsch. 1983. *Strategies of Discourse Comprehension*. New York: Academic Press.
- Wegner, D. M. 1987. Transactive memory: A contemporary analysis of the group mind. In *Theories of Group Behaviour*, ed. I. B. Mullen, and G. R. Goethals, 185–208. New York: Spring er-Verlag.
- Wegner, D. M. 1995. A computer network model of human transactive memory. *Soc Cogn* 13: 319–339.
- Young, R. M. 1983. Surrogates and mappings. Two kinds of conceptual models for interactive devices. In *Mental Models*, ed. D. Gentner and A. L. Stevens, 35–52. Hillsdale, NJ: Erlbaum.

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- Ackerman, P. L., and E. D. Heggestad. 1997. Intelligence, personality, and interests: Evidence for overlapping traits. *Psychol Bull* 121: 219–245.
- Aspinwall, L. G., L. Richter, and R. R. Hoffman. 2002. Understanding how optimism works: An examination of optimists' adaptive moderation of belief and behavior. In *Optimism and Pessimism: Implications for Theory, Research, and Practice*, ed. E. C. Chang, 217–238. Washington, DC: American Psychological Association.
- Bandura, A. 1997. *Self-Efficacy: The Exercise of Control*. New York: W.H. Freeman and Company.
- Barrick, M. R., M. K. Mount, and T. A. Judge. 2001. Personality and performance at the beginning of the new millennium: What do we know and where do we go next? *Pers Perform* 9: 9–29.
- Bennett, K. B., and J. M. Flach. 1992. Graphical displays: Implications for divided attention, focused attention, and problem solving. *Hum Factors* 34: 513–552.
- Bless, H. 2001. Mood and the use of general knowledge structures. In *Theories of Mood and Cognition: A User's Guidebook*, ed. L. L. Martin, and G. L. Clore, 9–26. Mahwah, NJ: Erlbaum.
- Brown, J. M., and E. A. Campbell. 1994. *Stress and Policing: Sources and Strategies*. Chichester, UK: Wiley.
- Bursill, A. E. 1958. The restriction of peripheral vision during exposure to hot and humid conditions. *Q J Exp Psychol* 10: 113–129.
- Carver, C. S., and M. F. Scheier. 1998. *On the Self-Regulation of Behavior*. New York: Cambridge University Press.
- Conway, G. E., J. L. Szalma, and P. A. Hancock. 2007. A quantitative meta-analytic examination of whole-body vibration effects on human performance. *Ergonomics* 50: 228–245.
- Comsweet, D. M. 1969. Use of cues in the visual periphery under conditions of arousal. *J Exp Psychol* 80: 14–18.
- Cronbach, L. J. 1957. The two disciplines of scientific psychology. *Am Psychol* 12: 671–684.
- Csikszentmihalyi, M. 1990. *Flow: The Psychology of Optimal Experience*. New York: Harper & Row.
- Deci, E. L., and R. M. Ryan. 1985. *Intrinsic Motivation and Self-Determination in Human Behavior*. New York: Plenum Press.
- Deci, E. L., and R. M. Ryan. 2000. The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychol Inq* 11: 227–268.
- Deci, E. L., R. M. Ryan, and R. Koestner. 1999. A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychol Bull* 125: 627–668.
- Dirkin, G. R., and P. A. Hancock. 1984. Attentional narrowing to the visual periphery under temporal and acoustic stress. *Aviat Space Environ Med* 55: 457.
- Dirkin, G. R., and P. A. Hancock. 1985. An attentional view of narrowing: The effect of noise and signal bias on discrimination in the peripheral visual field. In *Ergonomics International 85: Proceedings of the Ninth Congress of the International Ergonomics Association*, ed. I. D. Brown, R. Goldsmith, K. Coombes, and M. A. Sinclair, 751–753. Bournemouth, England, London: Taylor & Francis.
- Driskell, J. E., J. H. Johnston, and E. Salas. 2001. Does stress training generalize to novel settings? *Hum Factors* 43: 99–110.
- Easterbrook, J. A. 1959. The effect of emotion on cue utilization and the organization of behavior. *Psychol Rev* 66: 183–201.
- Elliot, A. J., and M. V. Covington. 2001. Approach and avoidance motivation. *Educ Psychol Rev* 13: 73–92.
- Ericsson, K. A. 2006. The influence of experience and deliberate practice on the development of superior expert performance. In *The Cambridge Handbook of Expertise and Expert Performance*, ed. K. A. Ericsson, N. Charness, R. R. Hoffman, and P. J. Feltovich, 683–703. Cambridge: Cambridge University Press.
- Eysenck, H. J. 1967. *The Biological Basis of Personality*. Springfield, IL: Charles C. Thomas.
- Eysenck, M. W. 1992. *Anxiety: The Cognitive Perspective*. Hillsdale, NJ: Erlbaum.
- Eysenck, M. W., and M. G. Calvo. 1992. Anxiety and performance: The processing efficiency theory. *Cogn Emot* 6: 409–434.
- Flach, J., P. A. Hancock, J. K. Caird, and K. Vicente, eds. 1995. *Global Perspectives on the Ecology of Human-Machine systems*, vol. 1. Hillsdale, NJ: Erlbaum.
- Folkman, S., R. S. Lazarus, C. Dunkel-Schetter, A. DeLongis, and R. J. Gruen. 1986. Dynamics of a stressful encounter: Cognitive appraisal, coping, and encounter outcomes. *J Pers Soc Psychol* 50: 992–1003.
- Fromm, E. 1976. *To Have or to be?* New York: Harper & Row.
- Funke, G., G. Matthews, J. S. Warm, and A. K. Emo. 2007. Vehicle automation: A remedy for driver stress? *Ergonomics* 50: 1302–1323.
- Gable, P., and E. Harmon-Jones. 2009. The blues broaden, but the nasty narrows: Attentional consequences of negative affects low and high in motivational intensity. *Psychol Sci* 20: 1–5.
- Gagne, M., and E. L. Deci. 2005. Self-determination theory and work motivation. *J Organ Behav* 26: 331–362.
- Gibson, J. J. 1966. *The Senses Considered as Perceptual Systems*. Boston: Houghton Mifflin.
- Gibson, J. J. 1979. *The Ecological Approach to Visual Perception*. Boston: Houghton Mifflin.
- Gray, J. A. 1991. Neural systems, emotion, and personality. In *Neurobiology of Learning, Emotion, and Affect*, ed. J. Madden IV, 273–306. New York: Raven Press.
- Gross, J. J. 1998. Antecedent- and response-focused emotion regulation: Divergent consequences for experience, expression, and physiology. *J Pers Soc Psychol* 74: 224–237.
- Gross, J. J. 2002. Emotion regulation: Affective, cognitive, and social consequences. *Psychophysiology* 39: 281–291.
- Gross, J. J., and R. W. Levenson. 1993. Emotional suppression: Physiology, self-report, and expressive behavior. *J Pers Soc Psychol* 64: 970–986.

- Gross, J. J., J. M. Richards, and O. P. John. 2006. Emotion regulation in everyday life. In *Emotion Regulation in Couples and Families: Pathways to Dysfunction and Health*, ed. D. K. Snyder, J. A. Simpson, and J. N. Hughes, 13–35. Washington, DC: American Psychological Association.
- Haga, S. M., P. Kraft, and E. K. Corby. 2009. Emotion regulation: Antecedents and well-being outcomes of cognitive reappraisal and expressive suppression in cross-cultural samples. *J Happiness Stud* 10: 271–291.
- Hancock, P. A. 1986. The effect of skill on performance under an environmental stressor. *Aviat Space Environ Med* 57: 59–64.
- Hancock, P. A. 1996. Effects of control order, augmented feedback, input device and practice on tracking performance and perceived workload. *Ergonomics* 39: 1146–1162.
- Hancock, P. A. 1997. *Essays on the Future of Human-Machine Systems*. Eden Prairie, MN: BANTA Information Services Group.
- Hancock, P. A. 2009. Mind, machine and morality. Chichester, UK: Ashgate.
- Hancock, P. A. 2010. The battle for time in the brain. In *Time, Limits and Constraints: The Study of Time XIII*, ed. J. A. Parker, P. A. Harris, and C. Steineck. Leiden, the Netherlands: Brill.
- Hancock, G. M., and G. F. Beatty. 2010. The effects of automatic and deliberate emotion regulation on sustained motor force production. Program of the University of Florida's 2010 Graduate Student Council Interdisciplinary Research Conference, 39 (Abstract Only). Gainesville, FL: UF's Graduate Student Council.
- Hancock, P. A., and J. K. Caird. 1993. Experimental evaluation of a model of mental workload. *Hum Factors* 35: 413–429.
- Hancock, P. A., and M. H. Chignell. 1987. Adaptive control in human-machine systems. In *Human Factors Psychology*, ed. P. A. Hancock, 305–345. Amsterdam: Elsevier.
- Hancock, P. A., and G. R. Dirkin. 1983. Stressor induced attentional narrowing: Implications for design and operation of person-machine systems. *Proc Hum Factors Assoc Can* 16: 19–21.
- Hancock, G. M., and P. A. Hancock. 2010. Can technology create instant experts? *Ergonomist* 460: 4–5.
- Hancock, P. A., A. A. Pepe, and L. L. Murphy. 2005. Hedonomics: The power of positive and pleasurable ergonomics. *Ergon Des* 13: 8–14.
- Hancock, P. A., J. M. Ross, T. Oron-Gilad, and J. L. Szalma. 2005. The Incorporation of Comprehensive Thermal Stress Effects into IMPRINT (Tech. Rep. No. 1). Orlando, FL: University of Central Florida, Minds in Technology, Machines in Thought Laboratory.
- Hancock, P. A., J. M. Ross, and J. L. Szalma. 2007. A meta-analysis of performance response under thermal stressors. *Hum Factors* 49: 851–877.
- Hancock, P. A., and J. L. Szalma. 2003a. Operator stress and display design. *Ergon Des* 11: 13–18.
- Hancock, P. A., and J. L. Szalma. 2003b. The future of neuroergonomics. *Theor Issues Ergon Sci* 4: 238–249.
- Hancock, P. A., and J. L. Szalma. 2007. Stress and neuroergonomics. In *Neuroergonomics: The Brain at Work*, ed. R. Parasuraman, and M. Rizzo, 195–206. Oxford: Oxford University Press.
- Hancock, P. A., J. L. Szalma, and T. Oron-Gilad. 2005. Time, emotion, and the limits to human information processing. In *Quantifying Human Information Processing*, ed. D. K. McBride, and D. Schmorow, 157–175. Lanham, MD: Lexington Books.
- Hancock, P. A., and J. S. Warm. 1989. A dynamic model of stress and sustained attention. *Hum Factors* 31: 519–537.
- Hancock, P. A., and J. L. Weaver. 2005. On time distortion under stress. *Theor Issues Ergon Sci* 6: 193–211.
- Harris, W. C., P. A. Hancock, and S. C. Harris. 2005. Information processing changes following extended stress. *Mil Psychol* 17: 115–128.
- Hart, S. G., and L. E. Staveland. 1988. Development of NASA-TLX (Task Load Index): Results of empirical and theoretical research. In *Human Mental Workload*, ed. P. A. Hancock, and N. Meshkati, 139–183. Amsterdam: Elsevier.
- Hassenzahl, M., and D. Ullrich. 2007. To do or not to do: Differences in user experience and retrospective judgments depending on the presence or absence of instrumental goals. *Interact Comput* 19: 429–437.
- Hockey, R. 1984. Varieties of attentional state: The effects of environment. In *Varieties of Attention*, ed. R. Parasuraman, and D. R. Davies, 449–483. New York: Academic Press.
- Hockey, G. R. J. 1997. Compensatory control in the regulation of human performance under stress and high workload: A cognitive-energetical framework. *Biol Psychol* 45: 73–93.
- Hockey, G. R. J., A. W. K. Gaillard, and M. G. H. Coles, eds. 1986. *Energetic Aspects of Human Information Processing*. The Netherlands: Nijhoff.
- Hockey, R., and P. Hamilton. 1983. The cognitive patterning of stress states. In *Stress and Fatigue in Human Performance*, ed. G. R. J. Hockey, 331–362. Chichester: Wiley.
- Humphreys, M. S., and W. Revelle. 1984. Personality, motivation, and performance: A theory of the relationship between individual differences and information processing. *Psychol Rev* 91: 153–184.
- Illich, I. 1973. *Tools for Conviviality*. New York: Harper & Row.
- Johnston, J. H., and J. A. Cannon-Bowers. 1996. Training for stress exposure. In *Stress and Human Performance*, ed. J. E. Driskell, and E. Salas, 223–256. Mahwah, NJ: Erlbaum.
- Kahneman, D. 1973. *Attention and Effort*. Englewood Cliffs, NJ: Prentice Hall.
- Kasser, T. 2002. *The High Price of Materialism*. Cambridge, MA: MIT Press.
- Koelga, H. S. 1992. Extraversión and vigilance performance: Thirty years of inconsistencies. *Psychol Bull* 112: 239–258.
- Lang, P. J. 1995. The emotion probe: Studies of motivation and attention. *Am Psychol* 50: 372–385.
- Lazarus, R. S. 1991. *Emotion and Adaptation*. Oxford: Oxford University Press.
- Lazarus, R. S. 1999. *Stress and Emotion: A New Synthesis*. New York: Springer.
- Lazarus, R. S., and S. Folkman. 1984. *Stress, Appraisal, and Coping*. New York: Springer Verlag.
- Lepper, M. R., and D. I. Cordova. 1992. A desire to be taught: Instructional consequences of intrinsic motivation. *Motiv Emot* 16: 187–208.
- Luczak, H., M. Roettling, and L. Schmidt. 2003. Let's talk: Anthropomorphization as means to cope with stress of interacting with technical devices. *Ergonomics* 46: 1361–1374.
- Matthews, G. 1992. Extraversión. In *Handbook of Human Performance*, vol. 3: State and Trait, ed. A. P. Smith, and D. M. Jones, 95–126. London: Academic Press.
- Matthews, G. 2001. Levels of transaction: A cognitive science framework for operator stress. In *Stress, Workload, and Fatigue*, ed. P. A. Hancock, and P. A. Desmond, 5–33. Mahwah, NJ: Erlbaum.
- Matthews, G., I. J. Deary, and M. C. Whiteman. 2003. *Personality Traits*. 2nd ed. Cambridge: Cambridge University Press.

- Matthews, G., and K. Gilliland. 1999. The personality theories of H. J. Eysenck and J. A. Gray: A comparative review. *Pers Individ Dif* 26: 583–626.
- Matthews, G., L. Joyner, K. Gilliland, S. Campbell, S. Falconer, and J. Huggins. 1999. Validation of a comprehensive stress state questionnaire: Towards a state 'big three'? In *Personality Psychology in Europe*, ed. I. Mervielde, I. J. Deary, F. DeFruyt, and F. Ostendorf, vol. 7, 335–350. Tilburg, The Netherlands: Tilburg University Press.
- Matthews, G., L. Joyner, K. Gilliland, S. Campbell, S. Falconer, J. Huggins, K. Gilliland, R. Grier, and J. S. Warm. 2002. Fundamental dimensions of subjective state in performance settings: Task engagement, distress, and worry. *Emotion* 2:315–340.
- Mauss, I. B., S. A. Bunge, and J. J. Gross. 2007. Automatic emotion regulation. *Soc Personal Psychol Compass* 1: 146–167.
- McCrae, R. R., and P. T. Costa. 1986. Personality, coping, and coping effectiveness in an adult sample. *J Pers* 54: 385–405.
- McCrae, R. R., and P. T. Costa. 1999. A five-factor theory of personality. In *Handbook of Personality: Theory and Research*, 2nd ed., ed. L. A. Pervin and O. P. John, 139–153. New York: Guilford Press.
- Moray, N. 1967. Where is capacity limited? A survey and a model. *Acta Psychol* 27: 884–892.
- Moray, N., ed. 1979. *Mental Workload: Its Theory and Measurement*. New York: Plenum Press.
- Navon, D. 1984. Resources—A theoretical soupstone? *Psychol Rev* 91: 216–234.
- Navon, D., and D. Gopher. 1979. On the economy of the human information processing system. *Psychol Rev* 86: 214–255.
- Norman, D., and D. Bobrow. 1975. On data-limited and resource-limited processing. *J Cogn Psychol* 7: 444–460.
- Ochsner, K. N., and J. J. Gross. 2005. The cognitive control of emotion. *Trends Cogn Sci* 9: 242–249.
- O'Donnell, R. D., and F. T. Eggemeier. 1986. Workload assessment methodology. In *Handbook of Human Perception and Performance*, vol. II: Cognitive Processes and Performance, ed. K. R. Boff, L. Kaufman, and J. P. Thomas, 42–1–42–49. New York: Wiley.
- Parasuraman, R. 2003. Neuroergonomics: Research and practice. *Theor Issues Ergon Sci* 4: 5–20.
- Parasuraman, R., and P. A. Hancock. 2001. Adaptive control of mental workload. In *Stress, Workload, and Fatigue*, ed. P. A. Hancock, and P. A. Desmond, 305–320. Mahwah, NJ: Erlbaum.
- Penley, J. A., and J. Tomaka. 2002. Associations among the big five, emotional responses, and coping with acute stress. *Pers Individ Dif* 32: 1215–1228.
- Pezawas, L., A. Meyer-Lindenberg, E. M. Drabant, B. A. Verchinski, K. E. Munoz, B. S. Kolachana, M. F. Egan, V. S. Mattay, A. R. Hariri, and D. M. Weinberger. 2005. 5-HTTLPR polymorphism impacts human cingulate-amygdala interactions: A genetic susceptibility mechanism for depression. *Nat Neurosci* 8: 828–834.
- Pilcher, J. J., E. Nadler, and C. Busch. 2002. Effects of hot and cold temperature exposure on performance: A meta-analytic review. *Ergonomics* 45: 682–698.
- Rasmussen, J. 1983. Skills, rules, and knowledge: Signals, signs, and symbols, and other distinctions in human performance models. *IEEE Trans Syst Man Cybern SMC-13*:257–266.
- Reed, E. S. 1996. *Encountering the World: Toward an Ecological Psychology*. Oxford: Oxford University Press.
- Robert, G., and G. R. J. Hockey. 1997. Compensatory control in the regulation of human performance under stress and high workload: A cognitive-energetical framework. *Biol Psychol* 45: 73–93.
- Ross, J. M., J. L. Szalma, J. E. Thropp, and P. A. Hancock. 2003. Performance, workload, and stress correlates of temporal and spatial task demands. *Proc Hum Factors Ergon Soc* 47: 1712–1716.
- Rugg, M. D. 1986. Constraints on cognitive performance: Some problems with and alternatives to resource theory. In *Energetics and Human Information Processing*, ed. G. R. J. Hockey, A. W. K. Gaillard, and M. G. H. Coles, 353–371. Dordrecht: Martinus Nijhoff Publishers.
- Ryan, R. R., and E. L. Deci. 2000. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *Am Psychol* 55: 66–78.
- Ryan, R. R., and E. L. Deci. 2001. On happiness and human potentials: A review of research on hedonic and eudaimonic wellbeing. *Annu Rev Psychol* 52: 141–166.
- Saunders, T., J. E. Driskell, J. Johnston, and E. Salas. 1996. The effect of stress inoculation training on anxiety and performance. *J Occup Health Psychol* 1: 170–186.
- Scerbo, M. W., F. G. Freeman, and P. J. Mikulka. 2003. A brain-based system for adaptive automation. *Theor Issues Ergon Sci* 4: 200–219.
- Scheier, M. F., and C. S. Carver. 1985. Optimism, coping, and health: Assessment and implications of generalized outcome expectancies. *Health Psychol* 4:219–247.
- Scherer, K. R. 1999. Appraisal theory. In *Handbook of Cognition and Emotion*, ed. T. Dalgleish, and M. Power, 638–663. New York: Wiley.
- Schneider, W., and R. M. Shiffrin. 1977. Controlled and automatic human information processing I: Detection, search, and attention. *Psychol Rev* 84: 1–66.
- Seligman, M. E. P., and M. Csikszentmihalyi. 2000. Positive psychology: An introduction. *Am Psychol* 55: 5–14.
- Selye, H. 1976. *The Stress of life*. (Revised edition). New York: McGraw-Hill.
- Speisman, J. C., R. S. Lazarus, A. Mordkoff, and L. Davison. 1964. Experimental reduction of stress based on ego-defense theory. *J Abnorm Soc Psychol* 68: 367–380.
- Szalma, J. L. 2008. Individual differences in stress reaction. In *Performance Under Stress*, ed. P. A. Hancock, and J. L. Szalma, 323–357. Aldershot, England: Ashgate.
- Szalma, J. L., and P. A. Hancock. 2005. Individual differences in information processing. In *Quantifying Human Information Processing*, ed. D. K. McBride, and D. Schmorow, 177–193. Lanham, MD: Lexington Books.
- Szalma, J. L., and P. A. Hancock. 2011. Noise effects on human performance: A meta-analytic synthesis. *Psychological Bulletin* 137: 682–707.
- Szalma, J. L., P. A. Hancock, and S. Quinn. 2008. A meta-analysis of the effect of time pressure of human performance. *Hum Factors Ergon Soc Annu Meet Proc* 52: 1513–1516.
- Szalma, J. L., J. S. Warm, G. Matthews, W. N. Dember, E. M. Weiler, A. Meier, and F. T. Eggemeier. 2004. Effects of sensory modality and task duration on performance, workload, and stress in sustained attention. *Hum Factors* 46: 219–233.
- Thayer, R. E. 1989. *The Biopsychology of Mood and Arousal*. New York: Oxford University Press.
- Thropp, J. E., J. L. Szalma, and P. A. Hancock. 2004. Performance operating characteristics for spatial and temporal discriminations: Common or separate capacities? *Proc Hum Factors Ergon Soc* 48: 1880–1884.

- van Reekum, C., and K. R. Scherer. 1997. Levels of processing in emotion-antecedent appraisal. In *Cognitive Science Perspectives on Personality and Emotion*, ed. G. Matthews, 259–300. Amsterdam: Elsevier.
- Venkatesh, V. 2000. Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Inf Syst Res* 11: 342–365.
- Vicente, K. J., and J. Rasmussen. 1992. Ecological interface design: Theoretical foundations. *IEEE Trans Syst Man Cybem* 22: 589–606.
- Wachtel, P. L. 1967. Conceptions of broad and narrow attention. *Psychol Bull* 68: 417–429.
- Warm, J. S., W. N. Dember, and P. A. Hancock. 1996. Vigilance and workload in automated systems. In *Automation and Human Performance: Theory and Applications*, ed. R. Parasuraman, and M. Mouloua, 183–200. Hillsdale, NJ: Erlbaum.
- Warm, J. S., R. Parasuraman, and G. Matthews. 2008. Vigilance requires hard mental work and is stressful. *Hum Factors* 50:433–441.
- Watson, D., and A. Tellegen. 1985. Toward a consensual structure of mood. *Psychological Bulletin* 98: 219–235.
- Wickens, C. D. 1980. The structure of attentional resources. In *Attention and Performance VIII*, ed. R. Nickerson, 239–257. Hillsdale, NJ: Erlbaum.
- Wickens, C. D. 1984. Processing resources in attention. In *Varieties of Attention*, ed. R. Parasuraman, and D. R. Davies, 63–102. New York: Academic Press.
- Wickens, C. D. 1996. Designing for stress. In *Stress and Human Performance*, ed. J. E. Driskell, and E. Salas, 279–295. Mahwah, NJ: Erlbaum.
- Yeh, Y., and C. D. Wickens. 1988. Dissociation of performance and subjective measures of workload. *Hum Factors* 30: 111–120.
- Yerkes, R. 1918. Psychology in relation to the war. *Psychol Rev* 25: 85–115.
- Young, M. S., and N. A. Stanton. 2002. Malleable attentional resources theory: A new explanation for the effects of mental underload on performance. *Hum Factors* 44: 365–375.
- Zhang, T., D. B. Kaber, B. Zhu, M. Swangnetr, P. Mosaly, and L. Hodge. 2010. Service robot feature design effects on user perceptions and emotional responses. *Intell Sen Rob* 3: 773–788.
- Zimmerman, B. J. 2000. Attaining self-regulation: A social cognitive perspective. In *Handbook of Self Regulation*, ed. M. Boekaerts, P. R. Pintrich, and M. Zeidner, 13–39. San Diego: Academic Press.

Choices and Decisions of Computer Users

- Ariely, D. 2008. *Predictably Irrational*. New York: HarperCollins.
- Ariely, D., G. Loewenstein, and D. Prelec. 2006. "Coherent arbitrariness": Stable demand curves without stable preferences. In *The Construction of Preference*, ed. S. Lichtenstein and P. Slovic. Cambridge, UK: Cambridge University Press.
- Bagozzi, R. P. 2007. The legacy of the technology acceptance model and a proposal for a paradigm shift. *J Assoc Inf Syst* 8(4): 243–255.
- Bayley, P. J., J. C. Frascino, and L. R. Squire. 2005. Robust habit learning in the absence of awareness and independent of the medial temporal lobe. *Nature* 436(7050):550–553.
- Bettman, J. R., M. F. Luce, and J. W. Payne. 2006. Constructive consumer choice processes. In *The Construction of Preference*, ed. S. Lichtenstein and P. Slovic. Cambridge, UK: Cambridge University Press.
- Bhavnani, S. K., and B. E. John. 2000. The strategic use of complex computer systems. *Hum Comput Interact* 1(2/3):107–137.
- Bhavnani, S. K., F. A. Peck, and F. Reif. 2008. Strategy-based instruction: Lessons learned in teaching the effective and efficient use of computer applications. *ACM Trans Comput Hum Interact* 15(1), Article 2.
- Brooke, J. 1996. SUS—a quick and dirty usability scale. In *Usability Evaluation in Industry*, ed. P. W. Jordan, B. Thomas, B. A. Weerdmeester, and I. L. McClelland, 189–194. London: Taylor & Francis.
- Button, G. 2003. Studies of work in human-computer interaction. In *HCI Models, Theories, and Frameworks*, ed. J. M. Carroll. San Francisco, CA: Morgan Kaufmann.
- Card, S. K., T. P. Moran, and A. Newell. 1983. *The Psychology of Human-Computer Interaction*. Hillsdale, NJ: Erlbaum.
- Carroll, J. M., and M. B. Rosson. 1987. The paradox of the active user. In *Interfacing Thought: Cognitive Aspects of Human-Computer Interaction*, ed. J. M. Carroll, 80–111. Cambridge, MA: MIT Press.
- Charman, S. C., and A. Howes. 2003. The adaptive user: An investigation into the cognitive and task constraints on the generation of new methods. *J Exp Psychol Appl* 9(4):236–248.
- Cialdini, R. B. 2007. *Influence: The Psychology of Persuasion*. New York: HarperCollins.
- Epley, N. 2004. A tale of tuned decks? Anchoring as accessibility and anchoring as adjustment. In *Blackwell Handbook of Judgment and Decision Making*, ed. D. J. Koehler and N. Harvey. Malden, MA: Blackwell.
- Fishbein, M., and I. Ajzen. 2010. *Predicting and Changing Behavior: The Reasoned Action Approach*. New York: Taylor & Francis.
- Fogg, B. J. 2003. *Persuasive Technology: Using Computers to Change What We Think and Do*. San Francisco, CA: Morgan Kaufmann.
- Fogg, B. J., G. Cueller, and D. Danielson. 2008. Motivating, influencing, and persuading users: An introduction to captology. In *The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications*, ed. A. Sears and J. A. Jacko, 2nd ed., 133–146. Boca Raton, FL: CRC Press.
- Fu, W., and J. R. Anderson. 2006. From recurrent choice to skill learning: A reinforcement-learning model. *J Exp Psychol Gen* 135(2):184–206.
- Gabrielli, S., and A. Jameson. 2009. Obstacles to option setting: Initial results with a heuristic walkthrough method. In *Human-Computer Interaction—INTERACT 2009, 12th IFIP TC 13 International Conference*, ed. T. Gross, J. Gulliksen, P. Kotzé, L. Oestreicher, P. Palanque, R. Prates, and M. Winckler, 400–403. Berlin: Springer.
- Gardiner, M. M., and B. Christie, eds. 1987. *Applying Cognitive Psychology to User-Interface Design*. Chichester, England: Wiley.
- Gigerenzer, G. 2007. *Gut Feelings: The Intelligence of the Unconscious*. London: Penguin.
- Gigerenzer, G., and P. M. Todd, eds. 1999. *Simple Heuristics That Make us Smart*. New York: Oxford.
- Gray, W. D., and D. A. Boehm-Davis. 2000. Milliseconds matter: An introduction to microstrategies and to their use in describing and predicting interactive behavior. *J Exp Psychol Appl* 6(4):322–335.
- Hastie, R. 2001. Problems for judgment and decision making. *Annu Rev Psychol* 52: 653–683.

- Hastie, R., and R. M. Dawes. 2010. *Rational Choice in an Uncertain World*. Thousand Oaks, CA: Sage.
- Iachello, G., and J. Hong. 2007. End-user privacy in human-computer interaction. *Found Trends Hum Comput Interact* 1(1): 1–137.
- Iyengar, S. 2010. *The Art of Choosing*. New York: Hachette.
- Jameson, A., S. Gabrielli, P. O. Kristensson, K. Reinecke, C. Gena, F. Cena, and F. Verner. 2011. How can we support users' preferential choice? In *Extended Abstracts of the 2011 Conference on Human Factors in Computing Systems*, ed. D. Tan, B. Begole, and W. A. Kellogg. New York: ACM.
- Jameson, A., and K. Klöckner. 2005. User multitasking with mobile multimodal systems. In *Spoken Multimodal Human-Computer Dialogue in Mobile Environments*, ed. W. Minker, D. Bühl, and L. Dybkjær, 349–377. Dordrecht, The Netherlands: Springer.
- Jameson, A., and B. Smyth. 2007. Recommendation to groups. In *The Adaptive Web: Methods and Strategies of Web Personalization*, ed. P. Brusilovsky, A. Kobsa, and W. Nejdl, 596–627. Berlin, Germany: Springer.
- Jannach, D., M. Zanker, A. Felfernig, and G. Friedrich. 2011. *Recommender Systems: An Introduction*. Cambridge, UK: Cambridge.
- Johnson, J. 2010. *Designing with the Mind in Mind: A Simple Guide to Understanding User Interface Design Rules*. Burlington, MA: Morgan Kaufmann.
- Johnson, E. J., and D. G. Goldstein. 2006. Do defaults save lives? In *The Construction of Preference*, ed. S. Lichtenstein, and P. Slovic. Cambridge, UK: Cambridge University Press.
- Kahneman, D., and A. Tversky. 1979. Prospect theory: An analysis of decision under risk. *Econometrica* 47(2):263–295.
- Kameda, T., R. S. Tindale, and J. H. Davis. 2003. Cognitions, preferences, and social sharedness: Past, present, and future directions in group decision making. In *Emerging Perspectives on Judgment and Decision Research*, ed. S. L. Schneider and J. Shanteau. Cambridge, UK: Cambridge University Press.
- Keeney, R. L. 1992. *Value-Focused Thinking: A Path to Creative Decisionmaking*. Cambridge, MA: Harvard.
- Kieras, D. 2008. Model-based evaluation. In *The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications*, ed. A. Sears, and J. A. Jacko, 2nd ed., 191–208. Boca Raton, FL: CRC Press.
- Klein, G. 1998. *Sources of Power: How People Make Decisions*. Cambridge, MA: MIT Press.
- Klein, G. 2008. Naturalistic decision making. *Hum Factors* 50(3):456–460.
- Koehler, D. J., and N. Harvey, eds. 2004. *Blackwell Handbook of Judgment and Decision Making*. Malden, MA: Blackwell.
- Kuniavsky, M. 2010. *Smart Things: Ubiquitous Computing User Experience Design*. Burlington, MA: Morgan Kaufmann.
- Law, E. L., V. Roto, M. Hassenzahl, A. P. Vermeeren, and J. Kort. 2009. Understanding, scoping and defining user experience: A survey approach. In *Human Factors in Computing Systems: CHI 2009 Conference Proceedings*, ed. S. Greenberg, S. Hudson, K. Hinckley, M. R. Morris, and D. R. Olsen, 719–728. New York: ACM.
- Lemer, J. S., and P. E. Tetlock. 2003. Bridging individual, interpersonal, and institutional approaches to judgment and decision making: The impact of accountability on cognitive bias. In *Emerging Perspectives on Judgment and Decision Research*, ed. S. L. Schneider and J. Shanteau. Cambridge, UK: Cambridge University Press.
- Li, W., J. Matejka, T. Grossman, J. Konstan, and G. Fitzmaurice. 2011. Design and evaluation of a command recommendation system for software applications. *ACM Trans Comput Hum Interact* 18(2), Article 6.
- Lichtenstein, S., and P. Slovic, eds. 2006. *The Construction of Preference*. Cambridge, UK: Cambridge University Press.
- Loewenstein, G., and J. Elster, eds. 1992. *Choice over Time*. New York: Sage.
- Loewenstein, G., D. Read, and R. Baumeister, eds. 2003. *Time and Decision*. New York: Sage.
- Loraas, T., and M. C. Diaz. 2009. Learning new uses of technology: Situational goal orientation matters. *Int J Hum Comput Stud* 67: 50–61.
- Mackay, W. E. 1991. Triggers and barriers to customizing software, In *Human Factors in Computing Systems: CHI 1991 Conference Proceedings*, ed. S. P. Robertson, G. M. Olson, and J. S. Olson, 153–160. New York: ACM.
- Mandel, N., and E. J. Johnson. 2006. When web pages influence choice: Effects of visual primes on experts and novices. In *The Construction of Preference*, ed. S. Lichtenstein and P. Slovic. Cambridge, UK: Cambridge University Press.
- March, J. G. 1994. *A Primer on Decision Making: How Decisions Happen*. New York: The Free Press.
- Maule, A. J. 2010. Can computers help overcome limitations in human decision making? *Int J Hum Comput Interact* 26(2–3): 108–119.
- McDowell, L., O. Etzioni, S. D. Gribble, A. Halevy, H. Levy, W. Pentney, D. Verma, and S. Vlasseva. 2003. Mangrove: Enticing ordinary people onto the semantic web via instant gratification. *Proceedings of ISWC 2003*, 754–770. Sanibel Island, Florida. Berlin: Springer.
- McGrenere, J., R. M. Baeker, and K. S. Booth. 2007. A field evaluation of an adaptable two-interface design for feature-rich software. *ACM Trans Comput Hum Interact* 14(1), Article 3.
- Newell, B. R., D. A. Lagnado, and D. R. Shanks. 2007. *Straight Choices: The Psychology of Decision Making*. Hove, UK: Psychology Press.
- Norman, D. A. 1986. Cognitive engineering. In *User Centered System Design: New Perspectives on Human-Computer Interaction*, ed. D. A. Norman, and S. W. Draper, 31–61. Hillsdale, NJ: Erlbaum.
- Rachlin, H. 2000. *The Science of Self-Control*. Cambridge, MA: Harvard.
- Rakow, T., and B. R. Newell. 2010. Degrees of uncertainty: An overview and framework for future research on experience-based choice. *J Behav Decis Mak* 23: 1–14.
- Read, D. 2004. Intertemporal choice. In *Blackwell Handbook of Judgment and Decision Making*, ed. D. J. Koehler and N. Harvey. Malden, MA: Blackwell.
- Read, D., G. Loewenstein, and M. Rabin. 2006. Choice bracketing. In *The Construction of Preference*, ed. S. Lichtenstein and P. Slovic. Cambridge, UK: Cambridge University Press.
- Ricci, F., L. Rokach, B. Shapira, and P. B. Kantor, eds. 2010. *Recommender Systems Handbook*. Berlin, Germany: Springer.
- Schneider, S. L., and M. D. Barnes. 2003. What do people really want? Goals and context in decision making. In *Emerging Perspectives on Judgment and Decision Research*, ed. S. L. Schneider and J. Shanteau. Cambridge, UK: Cambridge University Press.
- Schneider, S. L., and J. Shanteau, eds. 2003. *Emerging Perspectives on Judgment and Decision Research*. Cambridge, UK: Cambridge University Press.
- Shafir, E., I. Simonson, and A. Tversky. 2006. Reason-based choice. In *The Construction of Preference*, ed. S. Lichtenstein and P. Slovic. Cambridge, UK: Cambridge University Press.
- Sorkin, R. D., S. Luan, and J. Itzkowitz. 2004. Group decision and deliberation: A distributed detection process. In *Blackwell Handbook of Judgment and Decision Making*, ed. D. J. Koehler and N. Harvey. Malden, MA: Blackwell.

- Thaler, R. H., and C. R. Sunstein. 2008. *Nudge: Improving Decisions About Health, Wealth, and Happiness*. New Haven, CT: Yale University Press.
- Tintarev, N., and J. Masthoff. 2010. Explanation of recommendations. In *Recommender Systems Handbook*, ed. F. Ricci, L. Rokach, B. Shapira, and P. B. Kantor. Berlin, Germany: Springer.
- Venkatesh, V., and F. Davis. 2000. A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Manag Sci* 46(2):186–204.
- Venkatesh, V., M. G. Morris, G. B. Davis, and F. D. Davis. 2003. User acceptance of information technology: Toward a unified view. *MIS Quart* 27(346):425–478.
- Weber, E. U., and E. J. Johnson. 2009. Mindful judgment and decision making. *Annu Rev Psychol* 60: 53–88.
- Wickens, C. D., and J. G. Hollands. 2000. *Engineering Psychology and Human Performance*. Upper Saddle River, NJ: Prentice Hall.
- Wilson, T. D. 2002. *Strangers to Ourselves: Discovering the Adaptive Unconscious*. Cambridge, MA: Harvard.
- Wood, W., and D. T. Neal. 2007. A new look at habits and the habitgoal interface. *Psychol Rev* 114(4):843–863.
- Yates, J. F., E. S. Veinott, and A. L. Patalano. 2003. Hard decisions, bad decisions: On decision quality and decision aiding, In *Emerging Perspectives on Judgment and Decision Research*, ed. S. L. Schneider and J. Shanteau. Cambridge, UK: Cambridge University Press.
- Young, R. M., and A. MacLean. 1988. Choosing between methods: Analysing the user's decision space in terms of schemas and linear models. In *Human Factors in Computing Systems: CHI 1988 Conference Proceedings*, ed. J. J. O'Hare, 139–143. New York: ACM.

Input Technologies and Techniques

- Abowd, G., and E. Mynatt. 2000. Charting past, present, and future research in ubiquitous computing. *ACM Trans Comput Hum Interact* 7(1): 29–58.
- Accot, J., and S. Zhai. 1997. Beyond Fitts' law: Models for trajectory-based HCI tasks. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. Atlanta, GA: ACM.
- Accot, J., and S. Zhai. 2001. Scale effects in steering law tasks. In *Proceedings of CHI '01 ACM Conference on Human Factors in Computing Systems*, 1–8. New York, NY, USA: ACM.
- Adler, M. J., and C. van Doren. 1972. *How to Read a Book*. New York: Simon and Schuster.
- Agarawala, A., and R. Balakrishnan. 2006. Keepin' it real: Pushing the desktop metaphor with physics, piles and the pen. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. Montréal, QC: ACM.
- Agrawala, M., A. C. Beers, I. McDowell, B. Frohlich, M. Bolas, and P. Hanrahan. 1997. The two-user Responsive Workbench: Support for collaboration through individual views of a shared space. In *Proceedings of the 24th Annual Conference on Computer Graphics and Interactive Techniques*. New York: ACM Press/Addison-Wesley Publishing Co.
- Akamatsu, M., and I. S. Mackenzie. 1996. Movement characteristics using a mouse with tactile and force feedback. *Int J Hum Comput Stud* 45: 483–493.
- Anderson, J. R. 1980. Cognitive skills. In *Cognitive Psychology and Its Implications*. San Francisco: W. H. Freeman.
- Andrews, C., A. Endert, and C. North. 2010. Space to think: Large high-resolution displays for sensemaking. In *Proceedings of the 28th International Conference on Human Factors in Computing Systems*. Atlanta, GA: ACM.
- Apitz, G., and F. Guimbretière. 2004. CrossY: A crossing-based drawing application. In *Proceedings of the 17th Annual ACM Symposium on User Interface Software and Technology*. Santa Fe, NM: ACM.
- Appert, C., M. Beaudouin-Lafon, and W. Mackay. 2004. Context matters: Evaluating interaction techniques with the CIS model. Paper read at *Proceedings of HCI 2004*, Leeds, UK.
- Arons, B. 1993. SpeechSkimmer: Interactively skimming recorded speech. In *Proceedings of the 6th Annual ACM Symposium on User Interface Software and Technology*. Atlanta, GA: ACM.
- Ashdown, M., K. Oka, and Y. Sato. 2005. Combining head tracking and mouse input for a GUI on multiple monitors. In *CHI '05 Extended Abstracts on Human Factors in Computing Systems*. Portland, OR: ACM.
- Bahl, P., and V. Padmanabhan. 2000. RADAR: An In-Building RF-based user location and tracking system. Paper read at IEEE 19th Annual Joint Conference of the IEEE Computer and Communications Societies (INFOCOM 2000).
- Balakrishnan, R., T. Baudel, G. Kurtenbach, and G. Fitzmaurice. 1997. The Rockin'Mouse: Integral 3D manipulation on a plane. Paper read at *ACM CHI 1997 Conference on Human Factors in Computing Systems*, New York.
- Balakrishnan, R., and K. Hinckley. 1999. The role of kinesthetic reference frames in two-handed input performance. In *Proceedings of the 12th Annual ACM Symposium on User Interface Software and Technology*. Asheville, NC: ACM.
- Balakrishnan, R., and G. Kurtenbach. 1999. Exploring bimanual camera control and object manipulation in 3D graphics interfaces. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems: The CHI is the Limit*. Pittsburgh, PA: ACM.
- Ball, R., and C. North. 2005. Effects of tiled high-resolution display on basic visualization and navigation tasks. In *CHI '05 Extended Abstracts on Human Factors in Computing Systems*. Portland, OR: ACM.
- Ballendat, T., N. Marquardt, and S. Greenberg. 2010. Proxemic Interaction: Designing for a Proximity and Orientation-Aware Environment. Calgary, AB: University of Calgary.
- Bau, O., I. Poupyrev, A. Israr, and C. Harrison. 2010. TeslaTouch: Electrovibration for touch surfaces. In *Proceedings of the 23rd Annual ACM Symposium on User Interface Software and Technology*. New York: ACM.
- Baudel, T., and M. Beaudouin-Lafon. 1993. Charade: Remote control of objects using hand gestures. *Commun ACM* 36(7):28–35.
- Baudisch, P., E. Cutrell, D. Robbins, M. Czerwinski, P. Tandler, B. Bederson, and A. Zierlinger. 2003. Drag-and-Pop and Drag-and-Pick: Techniques for Accessing Remote Screen Content on Touch- and Pen-operated Systems. In *Proceedings of Interact 2003*, 57–64. Switzerland: Zurich.
- Baudisch, P., E. Cutrell, K. Hinckley, and A. Eversole. 2005. Snap-and-go: Helping users align objects without the modality of traditional snapping. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. Portland, OR: ACM.
- Baudisch, P., E. Cutrell, K. Hinckley, and R. Gruen. 2004. Mouse ether: Accelerating the acquisition of targets across multimonitor displays. In *CHI '04 Extended Abstracts on Human Factors in Computing Systems*. Vienna, Austria: ACM.

- Baudisch, P., and R. Rosenholtz. 2003. Halo: A technique for visualizing off-screen objects. Paper read at CHI '03.
- Bellotti, V., M. Back, W. Keith Edwards, R. E. Grinter, A. Henderson, and C. Lopes. 2002. Making sense of sensing systems: Five questions for designers and researchers. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems: Changing our World, Changing Ourselves. Minneapolis, MN: ACM.
- Benko, H., and S. Feiner. 2005. Multi-monitor mouse. In CHI '05 Extended Abstracts on Human Factors in Computing Systems. Portland, OR: ACM.
- Benko, H., E. W. Ishak, and S. Feiner. 2004. Collaborative mixed reality visualization of an archaeological excavation. Paper read at Mixed and Augmented Reality, 2004. ISMAR 2004. Third IEEE and ACM International Symposium on, 2–5 Nov. 2004.
- Benko, H., S. Izadi, A. D. Wilson, X. Cao, D. Rosenfeld, and K. Hinckley. 2010. Design and evaluation of interaction models for multi-touch mice. In Proceedings of Graphics Interface 2010. Ottawa, ON: Canadian Information Processing Society.
- Benko, H., T. Scott Saponas, D. Morris, and D. Tan. 2009. Enhancing input on and above the interactive surface with muscle sensing. In Proceedings of the ACM International Conference on Interactive Tabletops and Surfaces. Banff, AB: ACM.
- Benko, H., A. D. Wilson, and P. Baudisch. 2006. Precise selection techniques for multi-touch screens. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. Montréal, QC: ACM.
- Bezerianos, A., and R. Balakrishnan. 2005. The vacuum: Facilitating the manipulation of distant objects. Paper read at CHI '05.
- Bi, X., S.-H. Bae, and R. Balakrishnan. 2010. Effects of interior bezels of tiled-monitor large displays on visual search, tunnel steering, and target selection. In Proceedings of the 28th International Conference on Human Factors in Computing Systems. Atlanta, GA: ACM.
- Bier, E. A., M. C. Stone, K. Pier, W. Buxton, and T. D. DeRose. 1993. Toolglass and magic lenses: The see-through interface. In Proceedings of the 20th Annual Conference on Computer Graphics and Interactive Techniques. Anaheim, CA: ACM.
- Bohus, D., and E. Horvitz. 2010. On the challenges and opportunities of physically situated dialog. Paper read at AAAI Fall Symposium on Dialog with Robots, Arlington, VA.
- Bolt, R. 1980. Put-that-there: Voice and gesture at the graphics interface. ACM SIGGRAPH Comput Graph 14(3):262–270.
- Bolt, R. A. 1981. Gaze-orchestrated dynamic windows. In Proceedings of the 8th Annual Conference on Computer Graphics and Interactive Techniques. Dallas, TX: ACM.
- Bowman, D., E. Kruijff, J. LaViola, and I. Poupyrev. 2004. 3D User Interfaces: Theory and Practice. Boston, MA: Addison-Wesley.
- Brandl, P., C. Forlines, D. Wigdor, M. Haller, and C. Shen. 2008. Combining and measuring the benefits of bimanual pen and direct-touch interaction on horizontal interfaces. Paper read at Proceedings of AVI '08 Conference on Advanced Visual interfaces.
- Brandl, P., J. Leitner, T. Seifried, M. Haller, B. Doray, and P. To. 2009. Occlusion-aware menu design for digital tabletops. Paper read at CHI 2009 Extended Abstracts.
- Britton, E., J. Lipscomb, and M. Pique. 1978. Making Nested Rotations Convenient for the User. Comput Graph 12(3):222–227.
- Brown, E., W. Buxton, and K. Murtagh. 1990. Windows on tablets as a means of achieving virtual input devices. Paper read at Interact '90, Amsterdam.
- Burdea, G. 1996. Force and Touch Feedback for Virtual Reality. New York: John Wiley & Sons.
- Buxton, W. 1986a. There's more to interaction than meets the eye. In User Centered System Design: New Perspectives on Human–Computer Interaction, ed. D. Norman and S. Draper. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Buxton, W. 1986. Chunking and phrasing and the design of human–computer dialogues. In Readings in Human–Computer Interaction: Towards the Year 2000, ed. R. Baecker, J. Grudin, W. Buxton, and S. Greenberg, 475–480. San Francisco, CA: Morgan Kaufmann.
- Buxton, W. 1990a. A three-state model of graphical input. In *Proceedings of the IFIP TC13 Third International Conference on Human–Computer Interaction*. North-Holland Publishing Co.
- Buxton, W. 1990b. Three-state model of graphical input. In Human–Computer Interaction—INTERACT '90, ed. D. Diaper, 449–456. Amsterdam: Elsevier Science Publishers B. V. (North-Holland).
- Buxton, W. 1995a. Integrating the Periphery and Context: A New Taxonomy of Telematics. Paper read at Proceedings of Graphics Interface '95, Quebec City, QC.
- Buxton, W. 1995b. Speech, language and audition. In Readings in Human–Computer Interaction: Toward the Year 2000, ed. R. Baecker, J. Grudin, W. Buxton, and S. Greenberg. Somerville, MA: Morgan Kaufmann Publishers.
- Buxton, W. 1995c. Touch, gesture, and marking. In Readings in Human–Computer Interaction: Toward the Year 2000, ed. R. Baecker, J. Grudin, W. Buxton, and S. Greenberg. Somerville, MA: Morgan Kaufmann Publishers.
- Buxton, W. 1995. Chunking and phrasing and the design of human–computer dialogues. In Human–computer interaction, ed. R. M. Baecker, J. Grudin, W. Buxton, and S. Greenberg, 494–499. San Francisco, CA: Morgan Kaufmann Publishers Inc.
- Buxton, B. 2007. Sketching User Experiences: Getting the Design Right and the Right Design. San Francisco, CA: Morgan Kaufman.
- Buxton, W., G. Fitzmaurice, R. Balakrishnan, and G. Kurtenbach. 2000. Large displays in automotive design. IEEE Comput Graph Appl 20(4):68–75.
- Buxton, W., R. Hill, and P. Rowley. 1985. Issues and techniques in touch-sensitive tablet input. Comput Graph 19(3):215–224.
- Buxton, W., and B. Myers. 1986a. A study in two-handed input. SIGCHI Bull 17(4):321–326.
- Buxton, W., and B. Myers. 1986b. A study in two-handed input. In ACM CHI 1986 Conference on Human Factors in Computing Systems. New York: ACM.
- Buyukkokten, O., H. Garcia-Molina, A. Paepcke, and T. Winograd. 2000. Power browser: efficient Web browsing for PDAs. In Proceedings of the SIGCHI conference on Human factors in computing systems (CHI '00), 430–437. New York, NY, USA: ACM.
- Cadoz, C. 1994. Les Réalités Virtuelles. Dominos, Flammarion.
- Campbell, C., S. Zhai, K. May, and P. Maglio. 1999. What you feel must be what you see: Adding tactile feedback to the trackpoint. In *Proceedings of INTERACT '99: 7th IFIP Conference on Human–Computer Interaction*.
- Cao, X., and R. Balakrishnan. 2006. Interacting with dynamically defined information spaces using a handheld projector and a pen. In Proceedings of the 19th Annual ACM Symposium on User Interface Software and Technology. Montreux, Switzerland: ACM.
- Cao, X., C. Forlines, and R. Balakrishnan. 2007. Multi-user interaction using handheld projectors. In Proceedings of the 20th Annual ACM Symposium on User Interface Software and Technology. Newport, RI: ACM.
- Cao, X., A. D. Wilson, R. Balakrishnan, K. Hinckley, and S. E. Hudson. 2008a. ShapeTouch: Leveraging contact shape on interactive surfaces. In *Horizontal Interactive Human Computer Systems, 2008. TABLETOP 2008. 3rd IEEE International Workshop*, 1–3. Amsterdam.
- Cao, X., A. D. Wilson, R. Balakrishnan, K. Hinckley, and S. E. Hudson. 2008b. ShapeTouch: Leveraging contact shape on interactive surfaces. Paper read at IEEE TABLETOP 2008 International Workshop on Horizontal Interactive Human Computer Systems.

- Card, S., W. English, and B. J. Burr. 1978. Evaluation of mouse, rate-controlled isometric joystick, step keys, and text keys for text selection on a CRT. *Ergonomics* 21: 601–613.
- Card, S., J. Mackinlay, and G. Robertson. 1990. The Design Space of Input Devices. Paper read at Proceedings of ACM CHI '90 Conference on Human Factors in Computing Systems.
- Card, S., J. Mackinlay, and G. Robertson. 1991. A Morphological Analysis of the Design Space of Input Devices. *ACM Trans Inf Syst* 9(2):99–122.
- Card, S., T. Moran, and A. Newell. 1980. The keystroke-level model for user performance time with interactive systems. *Commun ACM* 23(7):396–410.
- Chen, N., F. Guimbretiere, M. Dixon, C. Lewis, and M. Agrawala. 2008. Navigation techniques for dual-display e-book readers. In Proceeding of the Twenty-Sixth Annual SIGCHI Conference on Human Factors in Computing Systems. Florence, Italy: ACM.
- Clarkson, E., J. Clawson, K. Lyons, and T. Starner. 2005. An empirical study of typing rates on mini-QWERTY keyboards. In CHI '05 Extended Abstracts on Human Factors in Computing Systems. Portland, OR: ACM.
- Cohen, P. R., M. Dalrymple, D. B. Moran, F. C. Pereira, and J. W. Sullivan. 1989. Synergistic use of direct manipulation and natural language. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems: Wings for the Mind. ACM.
- Cohen, P., M. Johnston, D. McGee, S. Oviatt, J. Pittman, I. Smith, L. Chen, and J. Clow. 1997. QuickSet: Multimodal Interaction for Distributed Applications. Paper read at ACM Multimedial 97.
- Collomb, M., M. Hascoët, P. Baudisch, and B. Lee. 2005. Improving drag-and-drop on wall-size displays. In Proceedings of Graphics Interface 2005. Victoria, BC: Canadian Human-Computer Communications Society.
- Cunningham, H. A., and R. B. Welch. 1994. Multiple concurrent visual-motor mappings: Implications for models of adaptation. *J Exp Psychol Hum Percept Perform* 20(5):987–999.
- Cutrell, E., D. Robbins, S. Dumais, and R. Sarin. 2006. Fast, Flexible Filtering with Phlat: Personal Search and Organization Made Easy. Paper read at CHI 2006.
- Czerwinski, M., D. S. Tan, and G. G. Robertson. 2002. Women take a wider view. In Proceedings of the SIGCHI Conference on Human factors in Computing Systems: Changing our World, Changing Ourselves. Minneapolis, MN: ACM.
- Davidson, P. L., and J. Y. Han. 2008. Extending 2D object arrangement with pressure-sensitive layering cues. In Proceedings of the 21st Annual ACM Symposium on User Interface Software and Technology. Monterey, CA: ACM.
- Deasy, C. M., and T. E. Lasswell. 1985. Designing Places for People: A Handbook on Human Behavior for Architects, Designers, and Facility Managers. New York: Whitney Library of Design an imprint of Watson-Guptill Publications.
- Dietz, P., and D. Leigh. 2001. DiamondTouch: A multi-user touch technology In Proceedings of the 14th Annual ACM Symposium on User Interface Software and Technology. Orlando, FL: ACM Press.
- Dietz, P., and W. Yerazunis. 2001. Real-Time Audio Buffering for Telephone Applications. Paper read at Proceedings of ACM UIST 2001 Symposium on User Interface Software & Technology, Orlando, FL.
- Dillon, R. F., J. D. Eday, and J. W. Tombaugh. 1990. Measuring the True Cost of Command Selection: Techniques and Results. Paper read at Proceedings of ACM CHI '90 Conference on Human Factors in Computing Systems.
- Douglas, S. A., A. E. Kirkpatrick, and I. S. MacKenzie. 1999. Testing pointing device performance and user assessment with the ISO 9241, Part 9 standard. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems: The CHI is the Limit. Pittsburgh, PA: ACM.
- Douglas, S., and A. Mithal. 1994. The Effect of Reducing Homing Time on the Speed of a Finger-Controlled Isometric Pointing Device. Paper read at Proceedings ACM CHI '94 Conference on Human Factors in Computing Systems.
- Douglas, S. A., and A. K. Mithal. 1997. Ergonomics of Computer Pointing Devices, Advanced Perspectives in Applied Computing. New York: Springer-Verlag.
- Dumais, S., E. Cutrell, J. Cadiz, G. Jancke, R. Sarin, and D. Robbins. 2003. Stuff I've Seen: A system for personal information retrieval and re-use. Paper read at SIGIR 2003.
- Elrod, S., R. Bruce, R. Gold, D. Goldberg, F. Halasz, W. Jannsen, D. Lee et al. 1992. Liveboard: A large interactive display supporting group meetings, presentations, and remote collaboration. Paper read at ACM CHI 1992 Conference on Human Factors in Computing Systems, New York.
- Engelhard, L. 2008. Native Dual Mode Digitizers: Supporting Pen, Touch and Multi-Touch Inputs in One Device on any LCD. Paper read at Society for Information Display SID 08 Digest.
- English, W. K., D. C. Englebart, and M. L. Berman. 1967. Display-selection Techniques for Text Manipulation. *Trans Hum Factors Electron* 8(1):5–15.
- Fails, J. A., and D. R. Olsen. 2003. Interactive machine learning. Paper read at ACM Intelligent User Interfaces (IUI '03).
- Fitts, P. M. 1954. The information capacity of the human motor system in controlling the amplitude of movement. *J Exp Psychol* 47: 381–391.
- Fitzmaurice, G. W. 1993. Situated information spaces and spatially aware palmtop computers. *Commun ACM* 36(7):38–39.
- Fitzmaurice, G. W., R. Balakrishnan, and G. Kurtenbach. 1999. Sampling, synthesis, and input devices. *Commun ACM* 42(8):54–63.
- Fitzmaurice, G. W., and W. Buxton. 1994. The Chameleon: Spatially aware palmtop computers. In Conference Companion on Human Factors in Computing Systems. Boston, Massachusetts: ACM.
- Fitzmaurice, G. W., and W. Buxton. 1997. An empirical evaluation of graspable user interfaces: Towards specialized, space-multiplexed input. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. Atlanta, GA: ACM.
- Fitzmaurice, G. W., H. Ishii, and W. A. S. Buxton. 1995. Bricks: Laying the foundations for graspable user interfaces. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. Denver, CO: ACM Press/Addison-Wesley Publishing Co.
- Fitzmaurice, G. W., A. Khan, W. Buxton, G. Kurtenbach, and R. Balakrishnan. 2003. Sentient data access via a diverse society of devices. *ACM Queue* 1(8):52–68.
- Fitzmaurice, G., A. Khan, R. Pieké, B. Buxton, and G. Kurtenbach. 2003. Tracking menus. In Proceedings of the 16th Annual ACM Symposium on User Interface Software and Technology. Vancouver, Canada: ACM.
- Foley, J. D., V. L. Wallace, and P. Chan. 1984. The human factors of computer graphics interaction techniques. *IEEE Comput Graph Appl* 4(11): 13–48.
- Forlines, C., R. Balakrishnan, P. Beardsley, J. van Baar, and R. Raskar. 2005. Zoom-and-pick: Facilitating visual zooming and precision pointing with interactive handheld projectors. In Proceedings of the 18th Annual ACM Symposium on User Interface Software and Technology. Seattle, WA: ACM.

- Forlines, C., and C. Shen. 2005. DTLens: Multi-user tabletop spatial data exploration. In Proceedings of the 18th Annual ACM Symposium on User Interface Software and Technology. Seattle, WA: ACM.
- Forlines, C., C. Shen, D. Wigdor, and R. Balakrishnan. 2006. Exploring the effects of group size and display configuration on visual search. In Proceedings of the 2006 20th Anniversary Conference on Computer Supported Cooperative Work. Banff, AB: ACM.
- Forlines, C., D. Vogel, and R. Balakrishnan. 2006. HybridPointing: Fluid switching between absolute and relative pointing with a direct input device. In Proceedings of the 19th Annual ACM Symposium on User Interface Software and Technology. Montreux, Switzerland: ACM.
- Freeman, D., H. Benko, M. R. Morris, and D. Wigdor. 2009. ShadowGuides: Visualizations for in-situ learning of multi-touch and whole-hand gestures. In Proceedings of the ACM International Conference on Interactive Tabletops and Surfaces. Banff, AB: ACM.
- Freeman, W., and C. Weissman. 1995. Television control by hand gestures. Paper read at International Workshop on Automatic Face and Gesture Recognition, Zurich, Switzerland.
- Frisch, M., J. Heydekorn, and R. Dachselt. 2009. Investigating Multi-Touch and Pen Gestures for Diagram Editing on Interactive Surfaces. Paper read at ITS '09 Conference on Interactive Tabletops and Surfaces.
- Funkhouser, T., and K. Li. 2000. Onto the Wall: Large Displays. *IEEE Comput Graph Appl* (Special issue) 20(4).
- Gibson, J. J. 1962. Observations on active touch. *Psychol Rev* 69: 477–491.
- Goldberg, D., and C. Richardson. 1993. Touch-typing with a stylus. In Proceedings of the INTERACT '93 and CHI '93 Conference on Human Factors in Computing Systems. Amsterdam, The Netherlands: ACM.
- Grossman, T., and R. Balakrishnan. 2005. The bubble cursor: Enhancing target acquisition by dynamic resizing of the cursor's activation area. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. Portland, OR: ACM.
- Grossman, T., K. Hinckley, P. Baudisch, M. Agrawala, and R. Balakrishnan. 2006. Hover widgets: Using the tracking state to extend the capabilities of pen-operated devices. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. Montréal, QC: ACM.
- Grossman, T., D. Wigdor, and R. Balakrishnan. 2004. Multifinger gestural interaction with 3d volumetric displays. In Proceedings of the 17th Annual ACM Symposium on User Interface Software and Technology. Santa Fe, NM: ACM.
- Grudin, J. 2001. Partitioning digital worlds: Focal and peripheral awareness in multiple monitor use. Paper read at CHI 2001.
- Guillard, Y. 1987. Asymmetric division of labor in human skilled bimanual action: The kinematic chain as a model. *J Motor Behav* 19(4):486–517.
- Guillard, Y., F. Buourgeois, D. Mottet, and M. Beaudouin-Lafon. 2001. Beyond the 10-bit Barrier: Fitts' Law in Multi-Scale Electronic Worlds. Paper read at IHM-HCI 2001, Sept., Lille, France.
- Guimbretiere, F., A. Martin, and T. Winograd. 2005. Benefits of merging command selection and direct manipulation. *ACM Trans Comput Hum Interact* 12(3):460–476.
- Gunawardana, A., T. Paek, and C. Meek. 2010. Usability guided key-target resizing for soft keyboards. In Proceeding of the 14th International Conference on Intelligent User Interfaces. Hong Kong, China: ACM.
- Hancock, M., and S. Carpendale. 2007. Supporting multiple Off-Axis viewpoints at a tabletop display. Paper read at Horizontal Interactive Human-Computer Systems, 2007. TABLETOP '07. Second Annual IEEE International Workshop on, 10–12 Oct. 2007.
- Hancock, M. S., F. D. Vernier, D. Wigdor, S. Carpendale, and S. Chia. 2006. Rotation and translation mechanisms for tabletop interaction. Paper read at Horizontal Interactive Human–Computer Systems, 2006. TableTop 2006. First IEEE International Workshop on, 5–7 Jan. 2006.
- Harrison, B. L., K. P. Fishkin, A. Gujar, C. Mochon, and R. Want. 1998. Squeeze me, hold me, tilt me! An exploration of manipulative user interfaces. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. Los Angeles, CA: ACM Press/Addison-Wesley Publishing Co.
- Harrison, B., H. Ishii, K. Vicente, and W. Buxton. 1995. Transparent layered user interfaces: An evaluation of a display design to enhance focused and divided attention. Paper read at Proceedings of CHI '95: ACM Conference on Human Factors in Computing Systems.
- Hartmann, B., M. Ringel Morris, H. Benko, and A. D. Wilson. 2009. Augmenting interactive tables with mice and keyboards. In Proceedings of the 22nd Annual ACM Symposium on User Interface Software and Technology. Victoria, BC: ACM.
- Hauptmann, A. 1989. Speech and gestures for graphic image manipulation. Paper read at Proceedings of CHI '89: ACM Conference on Human Factors in Computing Systems, Apr. 30–May 4, Austin, TX.
- Hilliges, O., S. Izadi, A. D. Wilson, S. Hodges, A. Garcia-Mendoza, and A. Butz. 2009. Interactions in the air: Adding further depth to interactive tabletops. In Proceedings of the 22nd Annual ACM Symposium on User Interface Software and Technology. Victoria, BC: ACM.
- Hinckley, K., P. Baudisch, G. Ramos, and F. Guimbretiere. 2005. Design and analysis of delimiters for selection-action pen gesture phrases in scriboli. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. Portland, OR: ACM.
- Hinckley, K., E. Cutrell, S. Bathiche, and T. Muss. 2002. Quantitative analysis of scrolling techniques. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems: Changing our World, Changing Ourselves. Minneapolis, MN: ACM.
- Hinckley, K., M. Czerwinski, and M. Sinclair. 1998. Interaction and modeling techniques for desktop two-handed input. Paper read at ACM UIST 1998 Symposium on User Interface Software and Technology, New York.
- Hinckley, K., M. Dixon, R. Sarin, F. Guimbretiere, and R. Balakrishnan. 2009. Codex: A dual screen tablet computer. In Proceedings of the 27th International Conference on Human Factors in Computing Systems. Boston, MA: ACM.
- Hinckley, K., F. Guimbretiere, P. Baudisch, R. Sarin, M. Agrawala, and E. Cutrell. 2006. The springboard: Multiple modes in one spring-loaded control. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. Montréal, QC: ACM.
- Hinckley, K., M. Pahud, and B. Buxton. 2010. Direct display interaction via Simultaneous Pen + Multi-touch Input. Paper read at Society for Information Display SID 2010 Digest.
- Hinckley, K., R. Pausch, J. C. Goble, and N. F. Kassell. 1994a. A survey of design issues in spatial input. Paper read at ACM UIST 1994 Symposium on User Interface Software and Technology, New York.
- Hinckley, K., R. Pausch, J. C. Goble, and N. F. Kassell. 1994b. A three-dimensional user interface for neurosurgical visualization. Paper read at Proceedings of SPIE Vol. 2164, Medical Imaging 1994: Image Capture, Formatting, and Display.
- Hinckley, K., R. Pausch, D. Proffitt, and N. E. Kassell. 1998. Two-handed virtual manipulation. *ACM Trans Comput Hum Interact* 5(3):260–302.
- Hinckley, K., J. Pierce, E. Horvitz, and M. Sinclair. 2005. Foreground and Background Interaction with Sensor-Enhanced Mobile Devices. *ACM TOCHI* 12(1 [Special Issue on Sensor-Based Interaction]): 31–52.

- Hinckley, K., J. Pierce, M. Sinclair, and E. Horvitz. 2000. Sensing Techniques for Mobile Interaction. Paper read at ACM UIST 2000 Symposium on User Interface Software & Technology, San Diego, CA.
- Hinckley, K., G. Ramos, F. Guimbretiere, P. Baudisch, and M. Smith. 2004. Stitching: Pen Gestures that Span Multiple Displays. Paper read at ACM 7th International Working Conference on Advanced Visual Interfaces (AVI 2004), May 25–28, Gallipoli (Leece), Italy.
- Hinckley, K., and M. Sinclair. 1999. Touch-Sensing Input Devices. Paper read at ACM CHI '99 Conference on Human Factors in Computing Systems.
- Hinckley, K., and S. Hyunyoung. 2011. Sensor synesthesia: Touch in motion, and motion in touch. In Proceedings of the 2011 annual conference on Human factors in computing systems (CHI '11), 801–810. New York: ACM.
- Hinckley, K., K. Yatani, M. Pahud, N. Coddington, J. Rodenhouse, A. Wilson, H. Benko, and B. Buxton. 2010. Pen + touch = new tools. In Proceedings of the 23rd Annual ACM Symposium on User Interface Software and Technology. New York: ACM.
- Hinckley, K., S. Zhao, R. Sarin, P. Baudisch, E. Cutrell, M. Shilman, and D. Tan. 2007. InkSeine: In Situ Search for Active Note Taking. Paper read at CHI 2007.
- Hirnrichs, U., M. Hancock, C. Collins, and S. Carpendale. 2007. Examination of Text-Entry methods for tabletop displays. Paper read at Horizontal Interactive Human-Computer Systems, 2007. TABLETOP '07. Second Annual IEEE International Workshop on, 10–12 Oct. 2007.
- Hirshfield, L. M., K. Chauncey, R. Gulotta, A. Girouard, E. T. Solovey, R. J. Jacob, A. Sassaroli, and S. Fantini. 2009. Combining Electroencephalograph and Functional Near Infrared Spectroscopy to Explore Users' Mental Workload. In Proceedings of the 5th International Conference on Foundations of Augmented Cognition. Neuroergonomics and Operational Neuroscience: Held as Part of HCI International 2009. San Diego, CA: Springer-Verlag.
- Hirshfield, L. M., E. T. Solovey, A. Girouard, J. Kebinger, R. J. K. Jacob, A. Sassaroli, and S. Fantini. 2009. Brain measurement for usability testing and adaptive interfaces: An example of uncovering syntactic workload with functional near infrared spectroscopy. In Proceedings of the 27th International Conference on Human Factors in Computing Systems. Boston, MA: ACM.
- Holman, D., and R. Vertegaal. 2008. Organic user interfaces: Designing computers in any way, shape, or form. Commun ACM 51(6):48–55.
- Holz, C., and P. Baudisch. 2010. The generalized perceived input point model and how to double touch accuracy by extracting fingerprints. In Proceedings of the 28th International Conference on Human Factors in Computing Systems. Atlanta, GA: ACM.
- Honan, M., E. Serina, R. Tal, and D. Rempel. 1995. Wrist Postures While Typing on a Standard and Split Keyboard. In Proceedings of HFES Human Factors and Ergonomics Society 39th Annual Meeting 39(5):366–368.
- Horvitz, E. 1999. Principles of Mixed-Initiative user interfaces. Paper read at Proceedings of ACM CHI '99 Conference on Human Factors in Computing Systems, Pittsburgh, PA.
- Horvitz, E., J. Breese, D. Heckerman, D. Hovel, and K. Rommelse. 1998. The lumiere project: Bayesian user modeling for inferring the goals and needs of software users. Paper read at Proceedings of the Fourteenth Conference on Uncertainty in Artificial Intelligence, Madison, WI, July 1998, 256–265. San Francisco, CA: Morgan Kaufmann.
- Horvitz, E., A. Jacobs, and D. Hovel. 1999. Attention-sensitive alerting. Paper read at Proceedings of UAI '99, Conference on Uncertainty and Artificial Intelligence, July, Stockholm, Sweden.
- Hutchings, D. R., and J. Stasko. 2004. Shrinking window operations for expanding display space. In Proceedings of the Working Conference on Advanced Visual Interfaces. Gallipoli, Italy: ACM.
- Hutchings, D. R., and J. Stasko. 2005. Mudibo: Multiple dialog boxes for multiple monitors. In CHI '05 Extended Abstracts on Human Factors in Computing Systems. Portland, OR: ACM.
- Ishii, H., and B. Ullmer. 1997. Tangible bits: Towards seamless interfaces between people, bits and atoms. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. Atlanta, GA: ACM.
- Jacob, R. J. K., A. Girouard, L. M. Hirshfield, M. S. Horn, O. Shaer, E. T. Solovey, and J. Zigelbaum. 2008. Reality-based interaction: A framework for post-WIMP interfaces. In Proceeding of the Twenty-Sixth Annual SIGCHI Conference on Human Factors in Computing Systems. Florence, Italy: ACM.
- Jacob, R. J. K., L. E. Sibert, D. C. McFarlane, and M. Preston Mullen Jr. 1994. Integrality and separability of input devices. ACM Trans Comput Hum Interact 1(1):3–26.
- Jellinek, H. D., and S. K. Card. 1990. Powermice and user performance. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems: Empowering People. Seattle, WA: ACM.
- John, B. E., and D. Kieras. 1996. Using GOMS for User Interface Design and Evaluation: Which Technique? ACM Trans Comput Hum Interact 3(4):287–319.
- Jojic, N., B. Brumitt, B. Meyers, and S. Harris. 2000. Detecting and estimating pointing gestures in dense disparity maps. Paper read at Proceedings of IEEE International Conference on Automatic Face and Gesture Recognition.
- Kabbash, P., and W. A. S. Buxton. 1995. The "prince"; technique: Fitts' law and selection using area cursors. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. Denver, CO: ACM Press/Addison-Wesley Publishing Co.
- Kabbash, P., W. Buxton, and A. Sellen. 1994. Two-handed input in a compound task. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems: Celebrating Interdependence. Boston, MA: ACM.
- Kamba, T., S. A. Elson, T. Harpold, T. Stamper, and P. Sukaviriya. 1996. Using small screen space more efficiently. Paper read at Conference Proceedings on Human Factors in Computing Systems.
- Karat, C. -M., C. Halverson, D. Horn, and J. Karat. 1999. Patterns of entry and correction in large vocabulary continuous speech recognition systems. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems: The CHI is the Limit. Pittsburgh, PA: ACM.
- Karl, L., M. Petley, and B. Schneiderman. 1993. Speech-Activated versus Mouse-Activated Commands for Word Processing Applications: An Empirical Evaluation. Int J Man Mach Stud 39(4): 667–687.
- Karlson, A. K., and B. B. Bederson. 2007. ThumbSpace: Generalized one-handed input for touchscreen-based mobile devices. In Proceedings of Interact, Springer Verlag.
- Karlson, A. K., B. B. Bederson, and J. SanGiovanni. 2005. AppLens and launchTile: two designs for one-handed thumb use on small devices. In *Proceedings of CHI 2005*, Association for Computing Machinery, Inc.
- Khan, A., J. Matejka, G. Fitzmaurice, and G. Kurtenbach. 2005. Spotlight: Directing users' attention on large displays. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. Portland, OR: ACM.

- Kirsh, D. 1995. The intelligent use of space. *Artif Intell* 73: 31–68.
- Kirsh, D., and P. Maglio. 1994. On distinguishing epistemic from pragmatic action. *Cogn Sci* 18(4):513–519.
- Klemmer, S. R., M. W. Newman, R. Farrell, M. Bilezikian, and J. A. Landay. 2001. The designers' outpost: A tangible interface for collaborative web site. In Proceedings of the 14th Annual ACM Symposium on User Interface Software and Technology. Orlando, FL: ACM.
- Ko, B. K., and H. S. Yang. 1997. Finger mouse and gesture recognition system as a new human computer interface. *Comput Graph* 21(5):555–561.
- Kristensson, P.-O., and S. Zhai. 2004. SHARK 2: A large vocabulary shorthand writing system for pen-based computers. In Proceedings of the 17th Annual ACM Symposium on User Interface Software and Technology. Santa Fe, NM: ACM.
- Krueger, M. 1991. VIDEOPLACE and the interface of the future. In *The Art of Human Computer Interface Design*, ed. B. Laurel, 417–422. Menlo Park, CA: Addison-Wesley.
- Krueger, M., T. Gionfriddo, and K. Hinrichsen. 1985. VIDEOPLACE —An artificial reality. Paper read at Proceedings of CHI '85: ACM Conference on Human Factors in Computing Systems, Apr. 14–18, San Francisco, CA.
- Krumm, J., and K. Hinckley. 2004. The NearMe wireless proximity Server. Paper read at Ubicomp 2004.
- Kurtenbach, G., and B. Buxton. 1991a. GEdit: A test bed for editing by contiguous gestures. *SIGCHI Bull* 23(2):22–26.
- Kurtenbach, G., and W. Buxton. 1991b. Issues in combining marking and direct manipulation techniques. In Proceedings of the 4th Annual ACM Symposium on User Interface Software and Technology. Hilton Head, SC: ACM.
- Kurtenbach, G., G. Fitzmaurice, T. Baudel, and B. Buxton. 1997. The design of a GUI paradigm based on tablets, two-hands, and transparency. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. Atlanta, GA: ACM.
- Kurtenbach, G., A. Sellen, and W. Buxton. 1993. An empirical evaluation of some articulatory and cognitive aspects of 'marking menus.' *J Hum Comput Interact* 8(1): 1–23.
- Lank, E., and E. Saund. 2005. Sloppy Selection: Providing an Accurate Interpretation of Imprecise Selection Gestures. *Comput Graph* 29(4):490–500.
- Lansdale, M., and E. Edmonds. 1992. Using memory for events in the design of personal filing systems. *Int J Man Mach Stud* 36(1):97–126.
- LaViola, J. and R. Zeleznik. 2004. MathPad2: A System for the Creation and Exploration of Mathematical Sketches. *ACM Trans Graph* 23(3):432–440.
- Lepinski, G. J., T. Grossman, and G. Fitzmaurice. 2010. The design and evaluation of multitouch marking menus. In Proceedings of the 28th International Conference on Human Factors in Computing Systems. Atlanta, GA: ACM.
- Levine, S., and S. Ehrlich. 1991. The Freestyle system: A design perspective. In *Human-Machine Interactive Systems*, ed. A. Klinger. New York: Plenum Press.
- Lewis, J., K. Potosnak, and R. Magyar. 1997. Keys and Keyboards. In *Handbook of Human-Computer Interaction*, ed. M. Helander, T. Landauer and P. Prabhu. Amsterdam: North-Holland.
- Li, Y., K. Hinckley, Z. Guan, and J. A. Landay. 2005. Experimental analysis of mode switching techniques in pen-based user interfaces. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. Portland, OR: ACM.
- Lipscomb, J., and M. Pique. 1993. Analog Input Device Physical Characteristics. *SIGCHI Bull* 25(3):40–45.
- Lyons, K., C. Skeels, T. Starner, C. M. Snoeck, B. A. Wong, and D. Ashbrook. 2004. Augmenting conversations using Dual-Purpose speech. Paper read at UIST'04 Symposium on User Interface Software and Technology, Santa Fe, NM.
- Mackay, W. E. 2002. Which Interaction Technique Works When? Floating Palettes, Marking Menus and Toolglasses Support Different Task Strategies. Paper read at Proceedings of AVI 2002 International Conference on Advanced Visual Interfaces.
- MacKenzie, I. S. 1989. A note on the information-theoretic basis for Fitts' Law. *J Motor Behav* 21: 323–330.
- MacKenzie, I. S. 1992a. Fitts' law as a research and design tool in human-computer interaction. *Hum Comput Interact* 7: 91–139.
- MacKenzie, I. S. 1992b. Movement time prediction in human-computer interfaces. In Proceedings of the Conference on Graphics Interface '92. Vancouver, BC: Morgan Kaufmann Publishers Inc.
- MacKenzie, I. S. 1995. Input Devices and Interaction Techniques for Advanced Computing. In *Virtual Environments and Advanced Interface Design*, ed. W. Barfield, and T. Furness, 437–470. Oxford, UK: Oxford University Press.
- MacKenzie, I. S., and Y. Guiard. 2001. The two-handed desktop interface: Are we there yet? In CHI '01 Extended Abstracts on Human Factors in Computing Systems. Seattle, WA: ACM.
- MacKenzie, I. S., H. Kober, D. Smith, T. Jones, and E. Skepner. 2001. LetterWise: Prefix-based disambiguation for mobile text input. In Proceedings of the 14th Annual ACM Symposium on User Interface Software and Technology. Orlando, FL: ACM.
- MacKenzie, I. S., and A. Oniszczak. 1998. A comparison of three selection techniques for touchpads. Paper read at Proceedings of ACM CHI '98 Conference on Human Factors in Computing Systems.
- MacKenzie, I. S., A. Sellen, and W. Buxton. 1991. A comparison of input devices in elemental pointing and dragging tasks. Paper read at Proceedings of ACM CHI '91 Conference on Human Factors in Computing Systems.
- MacKenzie, I. S., and R. W. Soukoreff. 2002. A model of two-thumb text entry. In Proceedings of Graphics Interface. Toronto: Canadian Information Processing Society.
- MacKenzie, I. S., and C. Ware. 1993. Lag as a determinant of human performance in interactive systems. Paper read at Proceedings of ACM INTERCHI '93 Conference on Human Factors in Computing Systems.
- MacKenzie, I. S., and S. X. Zhang. 1997. The immediate usability of graffiti. In Proceedings of the conference on Graphics interface '97, eds. W. A. Davis, M. Mantei, and R. V. Klassen, 129–137. Toronto, Canada: Canadian Information Processing Society.
- Mackinlay, J. D., and J. Heer. 2004. Wideband displays: Mitigating multiple monitor seams. In CHI '04 Extended Abstracts on Human Factors in Computing Systems. Vienna, Austria: ACM.
- Maes, P., T. Darrell, B. Blumberg, and A. Pentland. 1997. The ALIVE system: Wireless, full-body interaction with autonomous agents. *ACM Multimedia Syst (Special Issue on Multimedia and Multisensory Virutal Worlds)* 5: 105–112.
- Malik, S., A. Ranjan, and R. Balakrishnan. 2005. Interacting with large displays from a distance with vision-tracked multi-finger gestural input. In Proceedings of the 18th Annual ACM Symposium on User Interface Software and Technology. Seattle, WA: ACM.
- Marklin, R., G. Simoneau, and J. Monroe. 1997. The Effect of Split and Vertically-Inclined Computer Keyboards on Wrist and Forearm Posture. In Proceedings HFES Human Factors and Ergonomics Society 41st Annual Meeting 41(13):1071–1813.
- Matsushita, M., M. Iida, T. Ohguro, Y. Shirai, Y. Kakehi, and T. Naemura. 2004. Lumisight table: A face-to-face collaboration support system that optimizes direction of projected information to each stakeholder In Proceedings of the 2004 ACM Conference on Computer

- Supported Cooperative Work. Chicago, IL: ACM Press.
- Matsushita, N., and J. Rekimoto. 1997. HoloWall: Designing a finger, hand, body, and object sensitive wall. In Proceedings of the 10th Annual ACM Symposium on User Interface Software and Technology. Banff, AB: ACM.
- McCallum, D. C., and P. Irani. 2009. ARC-Pad: Absolute + relative cursor positioning for large displays with a mobile touchscreen. In Proceedings of the 22nd Annual ACM Symposium on User Interface Software and Technology. Victoria, BC: ACM.
- McLoone, H., K. Hinckley, and E. Cutrell. 2003. Bimanual Interaction on the Microsoft Office Keyboard. In *INTERACT 2003*.
- Microsoft Corp. 2002. Windows XP pointer ballistics. <http://msdn.microsoft.com/en-us/windows/hardware/gg463319.aspx> (accessed on Oct 3, 2011).
- Microsoft Courier. 2010. In Wikipedia the Free Encyclopedia, http://en.wikipedia.org/wiki/Microsoft_Courier (accessed on Oct 3, 2011).
- Mine, M., F. Brooks, and C. Sequin. 1997. Moving objects in space: Exploiting proprioception in virtual environment interaction. In ACM SIGGRAPH1997 Conference on Computer Graphics and Interactive Techniques. New York: ACM.
- Moran, T. P., P. Chiu, and W. van Melle. 1997. Pen-based interaction techniques for organizing material on an electronic whiteboard. In Proceedings of the 10th Annual ACM Symposium on User Interface Software and Technology. Banff, AB: ACM.
- Morris, M. R., A. J. B. Brush, and B. R. Meyers. 2008. A field study of knowledge workers'; use of interactive horizontal displays. Paper read at Horizontal Interactive Human Computer Systems, 2008. TABLETOP 2008. 3rd IEEE International Workshop on, 1–3 Oct. 2008.
- Morris, M. R., A. Paepcke, T. Winograd, and J. Stamberger. 2006. TeamTag: Exploring centralized versus replicated controls for co-located tabletop groupware. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. Montréal, QC: ACM.
- Moscovich, T. 2009. Contact area interaction with sliding widgets. In Proceedings of the 22nd Annual ACM Symposium on User Interface Software and Technology. Victoria, BC: ACM.
- Moscovich, T., and J. F. Hughes. 2006. Multi-finger cursor techniques. In Proceedings of Graphics Interface 2006. Quebec, Canada: Canadian Information Processing Society.
- Myers, B., H. Stiel, and R. Gargiulo. 1998. Collaboration using multiple PDAs connected to a PC. Paper read at Proceedings of ACM CSCW '98 Conference on Computer Supported Cooperative Work, Nov. 14–18, Seattle, WA.
- Myers, B. A., K. P. Lie, and B. -C. Yang. 2000. Two-handed input using a PDA and a mouse. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. The Hague, The Netherlands: ACM.
- Nacenta, M. A., D. Aliakseyeu, S. Subramanian, and C. Gutwin. 2005. A comparison of techniques for multi-display reaching. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. Portland, OR: ACM.
- Ni, T., and P. Baudisch. 2009. Disappearing mobile devices. In Proceedings of the 22nd Annual ACM Symposium on User Interface Software and Technology. Victoria, BC: ACM.
- Nickel, K., and R. Stiefelhagen. 2003. Pointing gesture recognition based on 3D-tracking of face, hands and head orientation. In Proceedings of the 5th International Conference on Multimodal Interfaces. Vancouver, BC: ACM.
- Norman, D. 1990. *The Design of Everyday Things*. New York: Doubleday.
- Oakley, I., S. Brewster, and P. Gray. 2001. Solving multi-target haptic problems in menu interaction. In CHI '01 Extended Abstracts on Human Factors in Computing Systems. Seattle, WA: ACM.
- O'Hara, K., and A. Sellen. 1997. A comparison of reading paper and on-line documents. Paper read at CHI '97.
- Olson, J. R., and G. M. Olson. 1990. The growth of cognitive modeling in human–computer interaction since GOMS. *Hum Comput Interact* 5(2):221–265.
- Oviatt, S., A. DeAngelis, and K. Kuhn. 1997. Integration and synchronization of input modes during multimodal human–computer interaction. In Referring Phenomena in a Multimedia Context and their Computational Treatment. Madrid, Spain: Association for Computational Linguistics.
- Pederson, E., K. McCall, T. Moran, and F. Halasz. 1993. Tivoli: An electronic whiteboard for informal workgroup meetings. Paper read at ACM CHI Conference on Human Factors in Computing Systems, New York.
- Potter, R. L., L. J. Weldon, and B. Shneiderman. 1988. Improving the accuracy of touch screens: An experimental evaluation of three strategies. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. Washington, DC: ACM.
- Poupyrev, I., and S. Maruyama. 2003. Tactile interfaces for small touch screens. In Proceedings of the 16th Annual ACM Symposium on User Interface Software and Technology. Vancouver, Canada: ACM.
- Price, M. N., B. Schilit, and G. Golovchinsky. 1998. XLibris: The active reading machine. Paper read at CHI'98 Extended Abstracts.
- Putz-Anderson, V. 1988. *Cumulative Trauma Disorders: A Manual for Musculoskeletal Diseases of the Upper Limbs*. Bristol, PA: Taylor & Francis.
- Ramos, G., and R. Balakrishnan. 2005. Zliding: Fluid zooming and sliding for high precision parameter manipulation. Paper read at UIST 2006.
- Ramos, G., and R. Balakrishnan. 2006. Pressure marks. Paper read at UNPUBLISHED MANUSCRIPT (under review).
- Ramos, G., M. Boulos, and R. Balakrishnan. 2004. Pressure widgets. Paper read at CHI 2004.
- Raskar, R., P. Beardsley, J. van Baar, Y. Wang, P. Dietz, J. Lee, D. Leigh, and T. Willwacher. 2004. RFIG lamps: Interacting with a self-describing world via photosensing wireless tags and projectors. 23(3):406–415.
- Raskar, R., J. van Baar, P. Beardsley, T. Willwacher, S. Rao, and C. Forlines. 2005. iLamps: Geometrically aware and selfconfiguring projectors. In ACM SIGGRAPH 2005 Courses. Los Angeles, CA: ACM.
- Raskin, J. 2000. *The Humane Interface: New Directions for Designing Interactive Systems*. Boston, MA: Addison-Wesley.
- Rekimoto, J. 1996. Tilting operations for small screen interfaces. Paper read at ACM UIST Symposium on User Interface Software and Technology, New York.
- Rekimoto, J. 1998. A multiple-device approach for supporting whiteboard based interaction. Paper read at ACM CHI Conference on Human Factors in Computing Systems, New York.
- Rekimoto, J., Y. Ayatsuka, M. Kohno, and H. Oba. 2003. Proximal interactions: A direct manipulation technique for wireless networking. Paper read at INTERACT 2003.
- Rempel, D., J. Bach, L. Gordon, and R. Tal. 1998. Effects of forearm pronation/supination on carpal tunnel pressure. *J Hand Surg* 23(1):38–42.
- Rime, B., and L. Schiaratura. 1991. Gesture and speech. In *Fundamentals of Nonverbal Behaviour*. New York: Press Syndicate of the University of Cambridge.
- Rutledge, J. D., and T. Selker. 1990. Force-to-motion functions for pointing. In Proceedings of the IFIP TC13 Third International Conference on Human-Computer Interaction, 701–706. Amsterdam: North-Holland Publishing Co.

- Ryall, K., C. Forlines, C. Shen, and M. R. Morris. 2004. Exploring the effects of group size and table size on interactions with tabletop shared-display groupware. In Proceedings of the 2004 ACM Conference on Computer Supported Cooperative Work. Chicago, IL: ACM.
- Saponas, T. S., D. S. Tan, D. Morris, R. Balakrishnan, J. Turner, and J. A. Landay. 2009. Enabling always-available input with muscle-computer interfaces. In Proceedings of the 22nd Annual ACM Symposium on User Interface Software and Technology. Victoria, BC: ACM.
- Saund, E., and E. Lank. 2003. Stylus input and editing without prior selection of mode. In Proceedings of the 16th Annual ACM Symposium on User Interface Software and Technology. Vancouver, Canada: ACM.
- Sawhney, N., and C. M. Schmandt. 2000. Nomadic Radio: Speech and Audio Interaction for Contextual Messaging in Nomadic Environments. *ACM Trans Comput Hum Interact* 7(3):353–383.
- Schilit, B. N., N. I. Adams, and R. Want. 1994. Context-Aware computing applications. Paper read at Proceedings of IEEE Workshop on Mobile Computing Systems and Applications, Dec., Santa Cruz, CA.
- Schmandt, C. M., N. Marmasse, S. Marti, N. Sawhney, and S. Wheeler. 2000. Everywhere messaging. *IBM Syst J* 39(3 & 4).
- Schmidt, A., M. Beigl, and H. W. Gellersen. 1999. There is more to context than location. *Comput Graph* 23(6):893–901.
- Schwarz, J., S. Hudson, J. Mankoff, and A. D. Wilson. 2010. A framework for robust and flexible handling of inputs with uncertainty. In Proceedings of the 23rd Annual ACM Symposium on User Interface Software and Technology. New York: ACM.
- Scott, S. D., M. Sheelagh, T. Carpendale, and K. M. Inkpen. 2004. Territoriality in collaborative tabletop workspaces. In Proceedings of the 2004 ACM Conference on Computer Supported Cooperative Work. Chicago, IL: ACM.
- Sears, A. 1991. Improving touchscreen keyboards: Design issues and a comparison with other devices. *Interact Comput* 3(3):253–269.
- Sears, A. 1993. Investigating touchscreen typing: The effect of keyboard size on typing speed. *Behav Inf Technol* 12(1): 17–22.
- Sears, A., and B. Schneiderman. 1991. High Precision Touchscreens: Design Strategies and Comparisons with a Mouse. *Int J Man Mach Stud* 34(4):593–613.
- Sellen, A., G. Kurtenbach, and W. Buxton. 1992. The prevention of mode errors through sensory feedback. *Hum Comput Interact* 7(2): 141–164.
- Seow, S. C. 2008. Designing and Engineering Time, 1st ed. Boston, MA: Addison-Wesley.
- Shell, J. S., R. Vertegaal, D. Cheng, A. W. Skaburskis, C. Sohn, A. J. Stewart, O. Aoudeh, and C. Dickie. 2004. ECSGlasses and EyePliances: Using attention to open sociable windows of interaction. In Proceedings of the 2004 Symposium on Eye Tracking Research and Applications. San Antonio, TX: ACM.
- Shen, C., K. Everitt, and K. Ryall. 2003. UbiTable: Impromptu Face-to-Face collaboration on horizontal interactive surfaces. Paper read at UbiComp 2003.
- Shen, C., F. D. Vernier, C. Forlines, and M. Ringel. 2004. DiamondSpin: An extensible toolkit for around-the-table interaction. In Proceedings of the 2004 Conference on Human Factors in Computing Systems. Vienna, Austria: ACM Press.
- Smutz, W., E. Serina, T. Bloom, and D. Rempel. 1994. A System for Evaluating the Effect of Keyboard Design on Force, Posture, Comfort, and Productivity. *Ergonomics* 37(10):1649–1660.
- Snibbe, S., and K. MacLean. 2001. Haptic techniques for media control. *CHI Lett (Proc UIST 2001)* 3(2): 199–208.
- Sommer, R. 1965. Further studies of small group ecology. *Sociometry* 28: 337–338.
- Song, H., T. Grossman, G. Fitzmaurice, F. Guimbretiere, A. Khan, R. Attar, and G. Kurtenbach. 2009. PenLight: Combining a mobile projector and a digital pen for dynamic visual overlay. In Proceedings of the 27th International Conference on Human Factors in Computing Systems. Boston, MA: ACM.
- Song, H., F. Guimbretiere, T. Grossman, and G. Fitzmaurice. 2010. MouseLight: Bimanual interactions on digital paper using a pen and a spatially-aware mobile projector. In Proceedings of the 28th International Conference on Human Factors in Computing Systems. Atlanta, GA: ACM.
- Stifelman, L. J. 1996. Augmenting real-world objects: A paper-based audio notebook. In Conference Companion on Human Factors in Computing Systems: Common Ground. Vancouver, BC: ACM.
- Streitz, N. A., J. Geuler, T. Holmer, S. Konomi, C. Miller-Tomfelde, W. Reischl, P. Rexroth, P. Seitz, and R. Steinmetz. 1999. i-LAND: An interactive landscape for creativity and innovation. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems: The CHI is the Limit. Pittsburgh, PA: ACM Press.
- Surati, R. J. 1999. Scalable self-calibrating display technology for seamless large-scale displays. Massachusetts Institute of Technology.
- Sutherland, I. E. 1964. Sketch pad a man-machine graphical communication system. In *Proceedings of the SHARE Design Automation Workshop*. ACM. See <http://doi.acm.org/10.1145/800265.810742>.
- Swaminathan, K., and S. Sato. 1997. Interaction design for large displays. *Interactions* 4(1): 15–24.
- Tan, D. S., and M. Czerwinski. 2003. Effects of Visual Separation and Physical Discontinuities when Distributing Information across Multiple Displays. In *OZCHI 2003 Conference for the Computer-Human Interaction Special Interest Group of the Ergonomics Society of Australia*.
- Tan, D. S., D. Gergle, P. Scupelli, and R. Pausch. 2003. With similar visual angles, larger displays improve spatial performance. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. Ft. Lauderdale, FL: ACM.
- Tang, A., M. Pahud, K. Inkpen, H. Benko, J. C. Tang, and B. Buxton. 2010. Three's company: Understanding communication channels in three-way distributed collaboration. In Proceedings of the 2010 ACM Conference on Computer Supported Cooperative Work. Savannah, GA: ACM.
- Tilbrook, D. M. 1976. A Newspaper Pagination System. Toronto, ON: Department of Computer Science, University of Toronto.
- Toney, A., and B. H. Thomas. 2006. Considering reach in tangible and table top design. In *Horizontal Interactive Human-Computer Systems, International Workshop On*, 57–8. First IEEE International Workshop on Horizontal Interactive Human-Computer Systems (TABLETOP '06).
- Trevor, J., D. M. Hilbert, B. N. Schilit, and T. K. Koh. 2001. From desktop to phonetop: a UI for web interaction on very small devices. In Proceedings of the 14th annual ACM symposium on User interface software and technology (UIST '01), 121–130. New York, NY, USA: ACM.
- Trimble, J., R. Wales, and R. Gossweiler. 2003. NASA's MERBoard. In *Public and Situated Displays: Social and Interactional Aspects of Shared Display Technologies*, ed. K. O'Hara, M. Perry, E. Churchill and D. Russell. Kluwer.
- Tse, E., S. Greenberg, C. Shen, C. Forlines, and R. Kodama. 2008. Exploring true multi-user multimodal interaction over a digital table. In Proceedings of the 7th ACM Conference on Designing Interactive Systems. Cape Town, SA: ACM.
- Ullmer, B., and H. Ishii. 1997. The metaDESK: Models and prototypes for tangible user interfaces. In Proceedings of the 10th Annual ACM Symposium on User Interface Software and Technology. Banff, AB: ACM.

- Underkoffler, J., and H. Ishii. 1998. Illuminating light: An optical design tool with a luminous-tangible interface. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. Los Angeles, CA: ACM Press/Addison-Wesley Publishing Co.
- Villar, N., S. Izadi, D. Rosenfeld, H. Benko, J. Helmes, J. Westhues, S. Hodges et al. 2009. Mouse 2.0: Multi-touch meets the mouse. In Proceedings of the 22nd Annual ACM Symposium on User Interface Software and Technology. Victoria, BC: ACM.
- Viviani, P., and T. Flash. 1995. Minimum-jerk, two-thirds power law and isochrony: Converging approaches to the study of movement planning. *J Exp Psychol Percept Perform* 21: 32–53.
- Vogel, D., and R. Balakrishnan. 2005. Distant freehand pointing and clicking on very large, high resolution displays. In Proceedings of the 18th Annual ACM Symposium on User Interface Software and Technology. Seattle, WA: ACM.
- Vogel, D., and P. Baudisch. 2007. Shift: A technique for operating pen-based interfaces using touch. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. San Jose, CA: ACM.
- Want, R., and G. Borriello. 2000. Survey on Information Appliances. *IEEE Pers Commun* 24–31.
- Weiser, M. 1991. The Computer for the 21st Century. *Sci Am* 265(3): 94–104.
- Wickens, C. 1992. Engineering Psychology and Human Performance. Upper Saddle River, NJ: Prentice Hall.
- Wigdor, D., and R. Balakrishnan. 2003. TiltText: Using tilt for text input to mobile phones. In Proceedings of the 16th Annual ACM Symposium on User Interface Software and Technology. Vancouver, Canada: ACM.
- Wigdor, D., C. Forlines, P. Baudisch, J. Barnwell, and C. Shen. 2007. Lucid touch: A See-Through mobile device. In Proceedings of the 20th Annual ACM Symposium on User Interface Software and Technology. Newport, RI: ACM.
- Wigdor, D., C. Shen, C. Forlines, and R. Balakrishnan. 2007. Perception of elementary graphical elements in tabletop and multi-surface environments. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. San Jose, CA: ACM.
- Wigdor, D., S. Williams, M. Cronin, R. Levy, K. White, M. Mazeev, and H. Benko. 2009. Ripples: utilizing per-contact visualizations to improve user interaction with touch displays. In Proceedings of the 22nd annual ACM symposium on User interface software and technology (UIST '09). ACM, New York, NY, USA, 3–12.
- Wilson, F. R. 1998. The Hand: How Its Use Shapes the Brain, Language, and Human Culture. New York: Pantheon Books.
- Wilson, A. 2005. Play Anywhere: A Compact Interactive Tabletop Projection-Vision System.
- Wilson, A. D. 2007. Depth-Sensing Video Cameras for 3D Tangible Tabletop Interaction. In *Second Annual IEEE International Workshop on Horizontal Interactive Human-Computer Systems (TABLETOP '07)* 201–4.
- Wilson, A. D. 2009. Simulating grasping behavior on an imaging interactive surface. In Proceedings of the ACM International Conference on Interactive Tabletops and Surfaces. Banff, AB: ACM.
- Wilson, A. D., and H. Benko. 2010. Combining multiple depth cameras and projectors for interactions on, above and between surfaces. In Proceedings of the 23rd Annual ACM Symposium on User Interface Software and Technology. New York: ACM.
- Wilson, A. D., S. Izadi, O. Hilliges, A. Garcia-Mendoza, and D. Kirk. 2008. Bringing physics to the surface. In Proceedings of the 21st Annual ACM Symposium on User Interface Software and Technology. Monterey, CA: ACM.
- Wilson, A., and S. Shafer. 2003. XWand: UI for intelligent spaces. Paper read at ACM CHI 2003 Conference on Human Factors in Computing Systems, New York.
- Wilson, A., and N. Oliver. 2003. GWindows: Towards robust Perception-Based UI. Paper read at Proceedings of CVPR 2003 (Workshop on Computer Vision for HCI).
- Wobbrock, J. O., M. R. Morris, and A. D. Wilson. 2009. User-defined gestures for surface computing. In Proceedings of the 27th International Conference on Human Factors in Computing Systems. Boston, MA: ACM.
- Wu, M., and R. Balakrishnan. 2003. Multi-finger and whole hand gestural interaction techniques for multi-user tabletop displays. Paper read at UIST 2003, Vancouver, BC, Canada.
- Yamada, H. 1980. A historical study of typewriters and typing methods: From the position of planning Japanese parallels. *J Inf Process* 24(4): 175–202.
- Yee, K.-P. 2003. Peephole displays: Pen interaction on spatially aware handheld computers. Paper read at CHI 2003.
- Yee, K.P., K. Swearingen, K. Li, and M. Hearst. 2003. Faceted metadata for image search and browsing. Paper read at CHI 2003.
- Zeleznik, R., A. Bragdon, F. Adeputra, and H.-S. Ko. 2010. Hands-on math: A page-based multi-touch and pen desktop for technical work and problem solving. In Proceedings of the 23rd Annual ACM Symposium on User Interface Software and Technology. New York: ACM.
- Zeleznik, R., A. Bragdon, H.-S. Ko, and F. Adeputra. 2010. Hands-On Math: A page-based multi-touch and pen desktop for technical work and problem solving. Paper read at UIST 2010 Symposium on User Interface Software and Technology.
- Zhai, S. 1993. Human performance evaluation of manipulation schemes in virtual environments. Paper read at Proceedings of IEEE Virtual Reality International Symposium (VRAIS '93), Seattle.
- Zhai, S. 1998. User performance in relation to 3D input device design. *SIGGRAPH Comput Graph* 32(4):50–54.
- Zhai, S., W. Buxton, and P. Milgram. 1996. The Partial Occlusion Effect: Utilizing Semi-transparency for Human-Computer Interaction. *ACM Trans Comput Hum Interact* 3(3):254–284.
- Zhai, S., and P. Kristensson. 2003. Shorthand writing on stylus keyboard. Paper read at CHI '03 Proceedings of the SIGCHI Conference on Human Factors in Computing Systems April 05–10, Ft. Lauderdale, FL.
- Zhai, S., P. Kristensson, P. Gong, M. Greiner, S. A. Peng, L. M. Liu, and A. Dunnigan. 2009. Shapewriter on the iphone: From the laboratory to the real world. Paper read at CHI '09 Proceedings of the 27th International Conference Extended Abstracts on Human Factors in Computing Systems, April 04–09, Boston, MA.
- Zhai, S., and P. Milgram. 1993. Human performance evaluation of isometric and elastic rate controllers in a 6DoF tracking task. Paper read at Proceedings of SPIE Telemanipulator Technology.
- Zhai, S., P. Milgram, and W. Buxton. 1996. The influence of muscle groups on performance of multiple degree-of-freedom input. Paper read at ACM CHI 1996 Conference on Human Factors in Computing Systems, New York.
- Zhai, S., B. A. Smith, and T. Selker. 1997. Improving Browsing Performance: A study of four input devices for scrolling and pointing tasks. In Proceedings of the IFIP TC13 International Conference on Human-Computer Interaction (INTERACT '97), eds. S. Howard, J. Hammond, and G. Lindgaard, 286–293. London: Chapman & Hall, Ltd.
- Zhao, S., and R. Balakrishnan. 2004. Simple vs. compound mark hierarchical marking menus. In Proceedings of the 17th Annual ACM Symposium on User Interface Software and Technology. Santa Fe, NM: ACM.

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- Abowd, G. A., C. G. Atkeson, J. Hong, S. Long, R. Kooper, and M. Pinkerton. 1997. Cyberguide: A mobile context-aware tour guide. *ACM Wirel Netw* 3: 421–433.
- Abowd, G. A., A. Battestini, and T. O'Connell. 2003. The Location-Service: A Framework for Handling Multiple Location Sensing—Technologies (GVU Technical Report GIT-GVU-03-07). Atlanta, Georgia: Georgia Institute of Technology.
- Bao, L., and S. Intille. 2004. Activity recognition from user-annotated acceleration data. In *Proceedings of the Second International Conference in Pervasive Computing, 2001/2004*, 1–17.
- Baudel, T., and M. Beaudouin-Lafon. 1993. Charade: Remote control of objects using free-hand gestures. *Commun ACM* 36(7): 28–35.
- Baxter, L. 1996. Capacitive Sensors: Design and Applications. Hoboken, NJ: Wiley-IEEE Press.
- Bellotti, V., M. Back, W. K. Edwards, R. E. Grinter, A. Henderson, and C. Lopes. 2002. Making sense of sensing systems: Five questions for designers and researchers. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 415–22.
- Beymer, D., and M. Flickner. 2003. Eye gaze tracking using an active stereo head. In *IEEE Conference on Computer Vision and Pattern Recognition*, 451.
- Beymer, D., and T. Poggio. 1996. Image representations for visual learning. *Science* 272: 1905–1909.
- Bilmes, J. A., X. Li, J. Malkin, K. Kilanski, R. Wright, K. Kirchoff, et al. 2005. The vocal joystick: A voice-based human–computer interface for individuals with motor impairments. In *Human Language Technology Conference and Conference on Empirical Methods in Natural Language Processing*, 995–1002.
- Bishop, C. M. 1995. Neural Networks for Pattern Recognition. Oxford, UK: Oxford University Press.
- Blythe, M. A., K. Overbeeke, A. F. Monk, and P. C. Wright, ed. 2004. Funology: From Usability to Enjoyment. Human-Computer Interaction Series. Dordrecht, The Netherlands: Kluwer.
- Bobick, A., S. Intille, J. Davis, F. Baird, C. Pinhanez, L. Campbell, et al. 1999. The kidsroom. A perceptually-based interactive and immersive story environment. *Presence Teleoperators Virtual Environ* 8(4):367–391.
- Bobick, A., S. Intille, J. Davis, F. Baird, C. Pinhanez, L. Campbell, Y. Ivanov, A. Schutte, and A. Wilson. 1999. The Kidsroom: A perceptually-based interactive and immersive story environment. *Presence: Teleoperators and Virtual Environ* 8(4):367–391.
- Boyd, J., and J. Little. 2005. Biometric gait recognition. In *Advanced Studies in Biometrics: Summer School on Biometrics*, Alghero, Italy, June 2–6, 2003, ed. M. Tistarelli, J. Bigun, and D. Gross, 19–42. Revised Selected Lectures and Papers, Vol. 3161/2005. New York: Springer.
- Brashears, H., T. Starner, P. Lukowicz, and H. Junker. 2003. Using multiple sensors for mobile sign language recognition. In *Proceedings of the 5th International Symposium on Wearable Computing*, 45–52.
- Breiman, L., J. H. Friedman, R. A. Olsen, and C. J. Stone. 1984. Classification and regression trees. Boca Raton, FL: Chapman & Hall/CRC.
- Brumitt, B., and J. Cadiz. 2001. Let there be light: Examining interfaces for homes of the future. In *Proceedings of Interact '01*, 375–82.
- Brumitt, B. L., B. Meyers, J. Krumm, A. Kern, and S. Shafer. 2000. EasyLiving: Technologies for intelligent environments. In *Proceedings of the Handheld and Ubiquitous Computing, 2nd International Symposium*, 12–27.
- Caruso, M. J. 1997. Applications of magnetoresistive sensors in navigation systems. *Sensors Actuators* 15–21.
- Choudhury, T., and A. Pentland. 2003. Sensing and modeling human networks using the Sociometer. In *Proceeding of the International Conference on Wearable Computing*, 216–22.
- Cristianini, N., and J. Shawe-Taylor. 2000. An Introduction to Support Vector Machines and Other Kernel-Based Learning Methods. Cambridge, UK: Cambridge University Press.
- Crowley, J. L., and F. Berard. 1997. Multi-modal tracking of faces for video communications. In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*, 640–5.
- Curran, E., and M. J. Stokes. 2003. Learning to control brain activity: A review of the production and control of EEG components for driving brain-computer interface (BCI) systems. *Brain Cogn* 51: 326–336.
- Davies, N., K. Ceverst, K. Mitchell, and A. Efrat. 2001. Using and determining location in a context-sensitive tour guide. *IEEE Comput* 34(8):35–41.
- Dey, A. K., G. Kortuem, D. R. Morse, and A. Schmidt, ed. 2001. Special issue on situated interaction and context-aware computing. *Pers Ubiquitous Comput* 5(1): 1–3.
- Dietz, P., and D. Leigh. 2001. DiamondTouch: A multi-user touch technology. In *Proceedings of the 14th Annual ACM Symposium on User Interface Software and Technology*, 219–26.
- Fails, J. A., and D. Olsen. 2002. Light widgets: Interacting in everyday spaces. In *Proceedings of the 7th International Conference on Intelligent User Interfaces*, 63–9.
- Feng, J., C.-M. Karat, and A. Sears. 2005. How productivity improves in hands-free continuous dictation tasks: lessons learned from a longitudinal study. *Interact Comput* 17(3):265–289.
- Fischler, M. A., and R. C. Bolles. 1981. Random sample consensus for model fitting with applications to image analysis and automated cartography. *Commun ACM* 24: 381–395.
- Fitzmaurice, G. W., H. Ishii, and W. Buxton. 1995. Bricks: Laying the foundations for graspable user interfaces. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 442–9.
- Fodor, I. K. 2002. A Survey of Dimension Reduction Techniques. Livermore, CA: Center for Applied Scientific Computing, Lawrence Livermore National Laboratory.
- Forsyth, D. A., and Ponce, J. 2002. Computer vision: A modern approach. Upper Saddle River, NJ: Prentice Hall.
- Fraden, J. 2003. Handbook of Modern Sensors: Physics, Designs, and Applications. New York: Springer.
- Galvean, T. 1995. Narrative Guidance of Interactivity. Unpublished doctoral thesis, Media Laboratory. Cambridge: Massachusetts Institute of Technology.
- Garfinkel, S., and B. Rosenberg, ed. 2005. RFID: Applications, Security, and Privacy. Boston, MA: Addison-Wesley.
- Greenberg, S., and C. Fitchett. 2001. Phidgets: Easy development of physical interfaces through physical widgets. In *Proceedings of the UIST 2001 14th Annual ACM Symposium on User Interface Software*, 209–18.
- Guizard, Y. 1987. Asymmetric division of labor in human skilled bimanual action: The kinematic chain as a model. *J Mot Behav* 19: 486–517.

- Han, J. Y. 2005. Low-cost multi-touch sensing through frustrated total internal reflection. In *Proceedings of the 18th Annual ACM Symposium on User Interface Software and Technology*, 115–8.
- Hariharan, R., J. Krumm, and E. Horvitz. 2005. Web-enhanced GPS. In *Location- and Context-Awareness: First international Workshop, LoCA 2005, Oberpfaffenhofen, Germany, May 12–13, 2005, Proceedings*, ed. T. Strang, and C. Linhoff-Popien, 95–104. New York: Springer.
- Haro, A., M. Flicker, and I. Essa. 2000. Detecting and tracking eyes by using their physiological properties, dynamics and appearance. In *Proceedings of the IEEE CVPR 2000*, 163–8.
- Heckerman, D., D. Geiger, and D. M. Chickering. 1994. Learning Bayesian networks: The combination of knowledge and statistical data. In *10th Conference on Uncertainty in Artificial Intelligence*, 293–301.
- Hinckley, K., R. Pausch, D. Proffitt, and N. Kassel. 1998. Two-handed virtual manipulation. *ACM Trans Comput Hum Interact (TOCHI)* 5(3):260–302.
- Hinckley, K., J. Pierce, M. Sinclair, and E. Horvitz. 2000. Sensing techniques for mobile interaction. In *Proceedings of the ACM UIST 2000 Symposium on User Interface Software and Technology*, 91–100.
- Hinckley, K., and M. Sinclair. 1999. Touch-sensing input devices. In *Proceedings of the ACM Conference on Human Factors in Computing Systems (SIGCHI '99)*, 223–30.
- Hjelm, S. I., and C. Browall. 2000. Brainball—using brain activity for cool competition. Paper presented at NordiCHI 2000, Stockholm, Sweden.
- Hoel, P. G., S. C. Port, and C. J. Stone. 1971. *Introduction to Probability Theory*. Boston, MA: Houghton Mifflin.
- Horn, B. K. P. 1986. *Robot Vision*. Cambridge, MA: MIT Press.
- Horvitz, E. 1999. Principles of mixed-initiative user interfaces. In *Proceedings of the ACM SIGCHI Conference on Human Factors in Computing Systems*, 159–66.
- Horvitz, E., J. Breese, D. Heckerman, D. Hovel, and K. Rommelse. 1998. The Lumiere project: Bayesian user modeling for inferring the goals and needs of software users. In *Proceedings of the Fourteenth Conference on Uncertainty in Artificial Intelligence*, 256–65.
- Huber, P. J. 1981. *Robust Statistics*. New York: John Wiley & Sons.
- Ishii, H., C. Wisneski, J. Orbanel, B. Chun, J. Paradiso. 1999. PingPongPlus: Design of an athletic-tangible interface for computer-supported cooperative play. In *Proceedings of the Conference on Human Factors in Computing Systems (SIGCHI)*, 327–8.
- Jacob, R. J. K. 1993. Eye-gaze computer interfaces: what you look at is what you get. *IEEE Comput* 26(7):65–67.
- Jensen, F. V. 2001. *Bayesian Networks and Decision Graphs*. New York: Springer.
- Johansson, G. 1973. Visual perception of biological motion and a model for its analysis. *Percept Psychophys* 14: 201–211.
- Jojic, N., B. Brumitt, B. Meyers, S. Harris, and T. Huang. 2000. Detection and estimation of pointing gestures in dense disparity maps. In *Proceedings of the Fourth International Conference on Automatic Face and Gesture Recognition*, 468–75.
- Jordan, M., ed. 1999. *Learning in Graphical Models*. Cambridge, MA: MIT Press.
- Junqua, J. C. 1993. The Lombard reflex and its role on human listeners and automatic speech recognizers. *J Acoust Soc Am* 93(1):510–524.
- Kadie, C. M., D. Hovel, and E. Horvitz. 2001. MSBNx: A Component-Centric Toolkit for Modeling and Inference with Bayesian Networks (Microsoft Research Technical Report MSR-TR-2001-67). Redmond, WA: Microsoft Corporation.
- Kahn, J. M., R. H. Katz, and K. S. J. Pister. 2000. Emerging challenges: Mobile networking for “smart dust.” *J Commun Netw* 2(3): 188–196.
- Karat, C.-M., C. Halverson, J. Karat, and D. Horn. 1999. Patterns of entry and correction in large vocabulary continuous speech recognition systems. In *Proceedings of CHI '99*, 568–75.
- Kato, H., M. Billinghurst, I. Poupyrev, K. Imamoto, and K. Tachibana. 2000. Virtual object manipulation on a table-top AR environment. In *Proceedings of ISAR 2000*, 111–9.
- Kiern, Z. A., and J. I. Aunon. 1990. A new mode of communication between man and his surroundings. *IEEE Trans Biomed Eng* 37(12):1109–1114.
- Klein, J., Y. Moon, and R. W. Picard. 2002. This computer responds to user frustration: Theory, design and results. *Interact Comput* 14(2002): 119–140.
- Kovacs, G. T. 1998. *Micromachined Transducers Sourcebook*. New York: McGraw-Hill.
- Kruger, R., S. Carpendale, S. D. Scott, and S. Greenberg. 2004. Roles of orientation in tabletop collaboration: Comprehension, coordination and communication. *Comput Support Coop Work* 13(5–6):501–537.
- Krumm, J., and K. Hinckley. 2004. The NearMe wireless proximity server. In *Sixth International Conference on Ubiquitous Computing (Ubicomp 2004)*, 283–300.
- Krumm, J., and E. Horvitz. 2004. Locadio: Inferring motion and location from Wi-Fi Signal Strengths. In *First Annual International Conference on Mobile and Ubiquitous Systems: Networking and Services (MobiQuitous 2004)*, 4–13.
- LaMarca, A., Y. Chawathe, S. Consolvo, J. Hightower, I. Smith, J. Scott, et al. 2005. Place lab: Device positioning using radio beacons in the wild. *Pervasive Comput* 3468/2005:116–133.
- LaViola, J., and R. Zeleznik. 2004. Mathpad2: A system for the creation and exploration of mathematical sketches. In *ACM Transactions on Graphics (Proceedings of SIGGRAPH 2004)*, 432–40.
- Lee, S. W., and K. Mase. 2002. Activity and location recognition using wearable sensors. *IEEE Pervasive Comput* 1(3):24–32.
- Lester, J., T. Choudhury, and G. Borriello. 2006. A practical approach to recognizing physical activities. In *Proceedings Pervasive Computing 2006*, 1–16.
- Letchner, J., D. Fox, and A. LaMarca. 2005. Large-scale localization from wireless signal strength. *AAAI*, 15–20.
- Li, S. Z., and A. K. Jain. 2005. *Handbook of Face Recognition*. New York: Springer.
- Lowe, D. 2004. Distinctive image features from scale-invariant key-points. *Int J Comput Vis* 60(2):91–110.
- MacKenzie, I. S. 1992. Fitts' Law as research and design tool in human computer interaction. *Hum Comput Interact* 7: 91–139.
- MacKenzie, I. S., and C. Ware. 1993. Lag as a determinant of human performance in interactive systems. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 488–93.
- Maes, P., T. Darrell, B. Blumberg, and A. Pentland. 1995. The ALIVE system: Full-body interaction with autonomous agents. In *Proceedings of the Computer Animation*, 11.

- Matsushita, N., and J. Rekimoto. 1997. HoloWall: Designing a finger, hand, body and object sensitive wall. In Proceedings of the ACM Symposium on User Interface Software and Technology (UIST), 209–10.
- McNeill, D. 1992. What Gestures Reveal About Thought. Chicago: The University of Chicago Press.
- Mitchell, T. M. 1997. Machine Learning. Boston: McGraw-Hill.
- Mozer, M. C. 2005. Lessons from an adaptive house. In Smart Environments: Technologies, Protocols and Applications, ed. D. Cook, and R. Das, 273–294. Hoboken, NJ: J. Wiley & Sons.
- Munguia Tapia, E., S. S. Intille, and K. Larson. 2004. Activity recognition in the home setting using simple and ubiquitous sensors, in Proceedings of PERVASIVE 2004, vol. LNCS 3001, eds. A. Ferscha and F. Mattern, 158–175. Berlin Heidelberg: Springer-Verlag.
- Nachman, L., R. Kling, J. Huang, and V. Hummel. 2005. The Intel mote platform: A Bluetooth-based sensor network for industrial monitoring. In Fourth International Symposium on Information Processing in Sensor Networks, 437–42.
- Neal, R., and G. Hinton. 1999. A view of the EM algorithm that justifies incremental, sparse, and other variants. In Learning in Graphical Models, ed. M. I. Jordan, 355–368. Cambridge, MA: MIT Press.
- Nielsen, J. 1994. Usability Engineering. San Francisco: Morgan-Kaufmann.
- Norman, D. A. 2003. Emotional Design: Why we Love (or hate) Everyday Things. New York: Basic Books.
- Oliver, N., and E. Horvitz. 2005. Selective perception policies for guiding sensing and computation in multimodal systems: A comparative analysis. *Comput Vis Image Underst* 100(1–2): 198–224.
- Oviatt, S. L. 2002. Breaking the robustness barrier: Recent progress on the design of robust multimodal systems. In Advances in Computers, ed. M. Zelkowitz, Vol. 56, 305–341. London: Academic Press.
- Patten, J., H. Ishii, and G. Pangaro. 2001. Sensetable: A wireless object tracking platform for tangible user interfaces. In Proceedings of the Conference on Human Factors in Computing Systems (SIGCHI), 253–60.
- Pentland, A. 2004. Social dynamics: Signals and behavior. In Third International Conference on Development and Learning, 263–7.
- Pentland, A., B. Moghaddam, and T. Starner. 1994. View-based and modular eigenspaces for face recognition. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition, 84–91.
- Picard, R. W. 2000. Affective Computing. Cambridge, MA: The MIT Press.
- Pickering, J. 1986. Touch-sensitive screens: The technologies and their application. *Int J Man Mach Stud* 25(3):249–269.
- Platt, J. 1999. Using analytic QP and sparseness to speed training of support vector machines. *Adv Neural Inf Process Syst* 11: 557–563.
- Rabiner, L. R. 1989. A tutorial in hidden Markov models and selected applications in speech recognition. *Proc IEEE* 77(2):257–386.
- Rabiner, L., and B. Juang. 1993. Fundamentals of Speech Recognition. Englewood Cliffs, NJ: Prentice Hall.
- Rekimoto, J. 2002. SmartSkin: An infrastructure for freehand manipulation on interactive surfaces. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 113–20.
- Rekimoto, J., and Y. Ayatsuka. 2000. CyberCode: Designing augmented reality environments with visual tags. In *Proceedings of the Designing Augmented Reality Environments (DARE 2000)*, 1–10.
- Reynolds, C. 2001. The Sensing and Measurement of Frustration with Computers. Unpublished master's thesis. Cambridge: Media Laboratory, Massachusetts Institute of Technology.
- Rubine, D. 1991. Specifying gestures by example. *Comput Graph* 25(4):329–337.
- Rui, Y., and D. Florencio. 2003. New direct approaches to robust sound source localization. In Proceedings of IEEE International Conference on Multimedia Expo, 737–40.
- Schapire, R. E. 2003. The boosting approach to machine learning: An overview. In Nonlinear Estimation and Classification, ed. D. D. Denison, M. H. Hansen, C. Holmes, B. Mallick, and A. Yu. New York: Springer.
- Schmidt, A. 2000. Implicit human interaction through context. *Pers Technol* 4(2&3): 191–199.
- Schmidt, A., M. Beigl, and H. W. Gellersen. 1999. There is more to context than location. *Comput Graph J* 23(6):893–902.
- Sears, A., C. Plaisant, and B. Shneiderman. 1993. A new era for high precision touchscreens. In Advances in Human-Computer Interaction, Vol. 3, eds. H. Rex Hartson and D. Hix, 1–33. Norwood, NJ: Ablex Publishing Corp.
- Shell, J., R. Vertegaal, D. Cheng, A. W. Skaburskis, C. Sohn, A. J. Stewart, et al. 2004. ECSGlasses and EyePliances: Using attention to open sociable windows of interaction. In Proceedings of the ACM Eye Tracking Research and Applications Symposium, 93–100.
- Shen, C., N. Lesh, and F. Vernier. 2003. Personal digital historian: Story sharing around the table. *ACM Interact* 10(2): 15–22.
- Shen, C., F. D. Vernier, C. Forlines, and M. Ringel. 2004. DiamondSpin: An extensible toolkit for around-the-table interaction. In Proceedings of the ACM Conference on Human Factors in Computing Systems (SIGCHI), 167–74.
- Shumin, Z., and V. Bellotti. 2005. Introduction to sensing-based interaction. *ACM Trans Comput-Hum Interact* 12(1): 1–2.
DOI=10.1145/1057237.1057238. <http://doi.acm.org/10.1145/1057237.1057238>.
- Smith, J. R. 1999. Electric Field Imaging. Unpublished doctoral dissertation. Cambridge: Media Laboratory, Massachusetts Institute of Technology.
- Smith, A., H. Balakrishnan, M. Goraczko, and N. Priyantha. 2004. Tracking moving devices with the Cricket location system. In Proceedings of the 2nd USENIX/ACM MOBISYS Conference, 190–202.
- Stork, D. G. 1998. HAL's legacy: 2001's Computer as Dream and Reality. Cambridge, MA: MIT Press.
- Sugiura, A., and Y. Koseki. 1997. A user interface using fingerprint recognition—holding commands and data objects on fingers. In Proceedings of the Symposium on User Interface Software and Technology, 71–9.
- Tan, H. Z., L. A. Slivovsky, and A. Pentland. 2001. A sensing chair using pressure distribution sensors. *IEEE/ASME Trans Mechatronics* 6(3):261–268.
- Tashev, I., and H. S. Malvar. 2005. A new beamformer design algorithm for microphone arrays. In Proceedings of International Conference of Acoustic, Speech and Signal Processing, 101–04.
- Tenneson, D., and S. Becker. 2005. ChemPad: Generating 3D modelcules from 2D sketches. *SIGGRAPH 2005 Extended Abstracts*.
- Tobii Technology. 2005. <http://www.tobii.com> (accessed February 10, 2007).
- Tomasi, C., A. Rafii, and I. Torunoglu. 2003. Full-size projection keyboard for handheld devices. *Commun. ACM* 46(7):70–75.
- Ullmer, B., H. Ishii, and D. Glas. 1998. MediaBlocks: Physical containers, transports, and controls for online media. *Comput Graph* 32: 379–386.
- Vogel, D., and R. Balakrishnan. 2004. Interactive public ambient displays: Transitioning from implicit to explicit, public to personal, interaction with multiple users. In Proceedings of the ACM Symposium on User Interface Software and Technology (UIST 2004), 137–46.

- Vogel, D., and R. Balakrishnan. 2005. Distant freehand pointing and clicking on very large high resolution displays. In Proceedings of the ACM Symposium on User Interface Software and Technology, 33–42.
- Vranish, J. M., R. L. McConnell, and S. Mahalingam. 1991. "Capacitance" collision avoidance sensors for robots. Robot Res NASA Goddard Space Flight Center 17(3):173–179.
- Want, R., K. P. Fishkin, A. Gujar, and B. L. Harrison. 1999. Bridging physical and virtual worlds with electronic tags. In SIGCHI '99, 370–7.
- Want, R., A. Hopper, V. Falcao, and J. Gibbons. 1992. The active badge location system. ACM Transact Inf Syst (TOIS) 10(1):91–102.
- Ward, A., A. Jones, and A. Hopper. 1997. A new location technique for the active office. IEEE Pers Commun 4(5):42–47.
- Ware, C. 1990. Using hand position for virtual object placement. Vis Comput 6(5):245–253.
- Ware, C., and D. R. Jessome. 1988. Using the Bat: A six-dimensional mouse for object placement. In Proceedings of the IEEE Computer Graphics and Applications, 65–70.
- Wayman, J., A. Jain, D. Maltoni, and D. Maio, ed. 2004. Biometric Systems: Technology, Design and Performance Evaluation. New York: Springer.
- Welch, G., and G. Bishop. 2004. An Introduction to the Kalman Filter. (Dept. Computer Science Technical Report TR-95-041). Chapel Hill, NC: University of North Carolina at Chapel Hill.
- Wellner, P. 1993. Interacting with paper on the DigitalDesk. Commun ACM 36(7):87–96.
- Wilson, A. D. 2005. PlayAnywhere: A compact tabletop computer vision system. In Proceedings of the 18th Annual ACM Symposium on User Interface Software Technology, 83–92.
- Wilson, D. H., and C. G. Atkeson. 2005. Simultaneous tracking and activity recognition (STAR) using many anonymous, binary sensors. In Proceedings of Pervasive 2005, 62.
- Wilson, A. D., and H. Pham. 2003. Pointing in intelligent environments with the WorldCursor. In Proceedings of Interact, 495–502.
- Wilson, A. D., and S. Shafer. 2003. XWand: UI for intelligent spaces. In Proceedings of SIGCHI, 545–52.
- Wren, C., A. Azarbeyjani, T. Darrell, and A. Pentland. 1995. Pfnder: Real-time tracking of the human body. In Proceedings of SPIE Photonics East, 89–98.
- Wu, M., and R. Balakrishnan. 2003. Multi-finger and whole hand gestural interaction techniques for multi-user tabletop displays. In Proceedings of the 16th Annual Symposium on User Interface Software and Technology, 193–202.
- Wu, Y., K. Toyama, and T. Huang. 2000. Wide-range, person- and illumination-insensitive head orientation estimation. In Proceedings of the International Conference on Face and Gesture Recognition, 183.
- Zhai, S., C. Morimoto, and S. Ihde. 1999. Manual and gaze input cascaded (MAGIC) pointing. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 246–53.
- Zhang, Z., and J. Hershey. 2005. Fusing Array Microphone and Stereo Vision for Improved Computer Interfaces (Microsoft Research Technical Report MSR-TR-2005-174) Redmond, WA: Microsoft Corporation. Smart Technologies, Incorporated. <http://www.smarttech.com> (accessed February 10, 2007).
- Zhao, W., R. Chellappa, R. J. Phillips, and A. Rosenfeld. 2003. Face recognition: A literature survey. ACM Comput Surv 35(4):399–458.

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- Aarås, A., K. Fostervold, O. Ro, M. Thoresen, and S. Larsen. 1997. Postural load during VDU work: A comparison between various work postures. Ergonomics 40(11): 1255–1268.
- Aarås, A., G. Horgen, H.-H. Bjørset, O. Ro, and M. Thoresen. 1998. Musculoskeletal, visual and psychosocial stress in VDU operators before and after multidisciplinary ergonomic interventions. App Ergon 29(5):335–354.
- American Chemical Society. 2003. Multicolored Ink. <http://pubs.acs.org/cen/topstory/8112/8112notw8.html> (accessed October 1, 2005).
- Amft, O., P. Lukowicz. 2009. From backpacks to smartphones: Past, present, and future of wearable computers. J Pervasive Comput 8(3):8–13.
- Armbrüster, C., M. Wolter, T. Kuhlen, W. Spijkers, B. Fimm. 2008. Depth perception in virtual reality: Distance estimations in peri- and extrapersonal space. Cyberpsychol Behav 11: 9–15.
- Azuma, R. 1997. A survey of augmented reality. Presence 6(4):355–385.
- Azuma, R. T. 2001. Augmented reality: Approaches and technical challenges. In Fundamentals of Wearable Computers and Augmented Reality, ed. W. Barfield, and T. Caudell, 27–63. Mahwah, NJ: LEA.
- Baccino, T. 1999. Exploring the flicker effect: the influence of in-flight pulsations on saccadic control. Ophthalmol Physiol Opt 19(3):266–273.
- Bass, M. 1995. Handbook of Optics. Vol. 1. New York: McGraw-Hill.
- Bauer, D., and C. R. Cavonius. 1980. Improving the legibility of visual display units through contrast reversal. In Ergonomic Aspects of Visual Display Terminals, ed. E. Grandjean, and E. Vigliani, 137–142. London: Taylor & Francis.
- Baumann, K., and H. Lanz. 1998. Mensch-Maschine-Schnittstellen elektronischer Geräte. In Leitfaden für Design und Schaltungstechnik [Human-Machine-Interface for Electronic Appliances: Guideline for Design and Circuitry], Berlin: Springer.
- Bay, S., and M. Ziefle. 2004. Effects of menu foresight on information access in small screen devices. In 48th Annual Meeting of the Human Factors and Ergonomic Society, 41–45. Santa Monica: Human Factors Society.
- Best, P., M. Littleton, A. Gramopadhye, and R. Tyrell. 1996. Relations between individual differences in oculomotor resting states and visual inspecting performance. Ergonomics 39: 35–40.
- Bhowmik, A. K., Z. Li, and P. Bos. 2008. Mobile Displays: Technology and Applications, Wiley Series in Display Technology. West Sussex: John Wiley & Sons.
- Biocca, F. A., and J. P. Rolland. 1998. Virtual eyes can rearrange your body: Adaption to visual displacement in see-through, head-mounted displays. Presence 7(3):262–277.
- Blundel, B. G., and A. J. Schwarz. 2000. Volumetric Three-Dimensional Display Systems. New York: John Wiley & Sons.
- Boff, K. R., and J. E. Lincoln. 1988. Engineering Data Compendium: Human Perception and Performance. AAMRL, WPAFB, Ohio, Vol. 1–3. New York: John Wiley and Sons.

- Bosman, D. 1989. *Display Engineering: Conditioning, Technologies, Applications*. Amsterdam: Elsevier Science.
- Brennesholtz, S. M., and E. H. Stupp. 2008. *Projection Displays*. New York: John Wiley & Sons.
- Brodie, J., J. Chatrattichart, M. Perry, and R. Scane. 2003. How age can inform the future design of the mobile phone experience. In *Universal Access in HCI: Inclusive Design in the Information Society*, ed. C. Stephanidis, 822–826. Mahwah, NJ: LEA.
- Brown, S. F. 2008. hands-on computing: how multi-touch screens could change the way we interact with computers and each other. In *Scientific American Magazine*, July 2008.
- Buchner, A., S. Mayr, and M. Brandt. 2009. The advantage of positive text-background polarity is due to high display luminance. *Ergonomics* 52(7):882–886.
- Budin J.P.. 2003. Emissive displays: The relative merits of ACTFEL. In *Display Systems—Design and Applications*, 2nd ed., ed. L. MacDonald and A. Lowe, 191–219. New York: John Wiley & Sons.
- Budinger T. F. 1984. An analysis of 3-D display strategies, Processing and Display of Three-Dimensional Data II. In *Proceedings of SPIE*, Vol. 507, 2–8.
- Calero Valdez, A., M. Ziefle, A. Horstmann, D. Herding, and U. Schroeder. 2009. Effects of aging and domain knowledge on usability in small screen devices for diabetes patients. In *HCI and Usability for e-Inclusion*, LNCS 5889. ed. A. Holzinger and K. Miesenberger, 366–386. Berlin, Heidelberg: Springer.
- Calero Valdez, A., M. Ziefle, U. Schroeder, A. Horstmann, and D. Herding. 2010. Task performance in mobile and ambient interfaces. Does size matter for usability of electronic diabetes assistants? In *Proceedings of the International Conference on Information Society (i-Society 2010/IEEE)*, ed. C.A. Shoniregun and G. A. Akmayeva, 526–533. London: Infonomics Society.
- Çakir, A., D. J. Hart, and T. F. M. Stewart. 1979. *The VDT Manual—Ergonomics, Workplace Design, Health and Safety, Task Organization*. Darmstadt: IFRA (Inca-Fiej Research Association).
- Castellano, J. A. 1992. *Handbook of Display Technology*. San Diego: Academic.
- Castillo, M. 2010. E-Readers and E-Paper. *Am J Neuroradiol* 31: 1–2.
- Chen, J., W. Cranton, and M. Fihn. 2011. *Handbook of Visual Display Technology*. Berlin: Springer.
- Chen M.-T., and C.-C. Lin. 2004. Comparison of TFT-LCD and CRT on visual recognition and subjective preference. *Int J Ind Ergon* 34: 167–174.
- Crawford, G. 2005. *Flexible Flat Panel Displays*. New York: John Wiley & Sons.
- Cruz-Neira, C., D. J. Sandin, and A. T. DeFanti. 1993. Surround-screen projection-based virtual reality: The design and implementation of the CAVE. In *Proceedings of SIGGRAPH '93*, 135–142. Anaheim, CA: ACM Press.
- DeFanti, T. A., G. Dawe, D. J. Sandin, J. P. Schulze, P. O. J. Girado, F. Kuester, L. Smarr, and R. Rao. 2009. The StarCAVE, a third-generation CAVE and virtual reality OptiPortal. *Future Gener Comput Syst* 25(2): 169–178.
- Dillon, A. 1992. Reading from paper versus screens: A critical review of the empirical literature. *Ergonomics* 35(10): 1297–1326.
- Downing, E., L. Hesselink, J. Ralston, and R. Macfarlane. 1996. A three-color, solid-state, three-dimensional display. *Science* 273(5279): 1185–1189.
- Duncan, G.-R. 2008. Electronic paper targets colour video. *Nat Photon* 2(4):204–205.
- Duncan, J., and G. Humphreys. 1989. Visual search and stimulus similarity. *Psychol Rev* 96(3):433–458.
- Ellemerberg, D., T. L. Lewis, C. H. Liu, and D. Maurer. 1999. Development of spatial and temporal vision during childhood. *Vision Res* 39: 2325–2333.
- Fellowes, D. A., M. V. Wood, A. R. Hastings, D. S. Russell, A. K. Lum, A. P. Ghosh, O. Prache, and I. Wacyk. 2009. Active matrix organic light emitting diode (AMOLED)-XL performance and life test results. In *Proc. SPIE Vol. 73260F. Display Concepts and Technologies*. Orlando, FL.
- Fraehauf, N., T. Aye, K. Yua, Y. Zou, and G. Savant. 2000. Liquid crystal digital scanner-based HMD. In *Proc. SPIE Helmet- and Head-Mounted Displays Vol. 4021*, 2–10. Orlando, FL.
- Goldstein, M., G. Öqvist, M. Bayat, P. Ljungstrand, and S. Björk. 2001. Enhancing the reading experience: Using adaptive and sonified RSVP for reading on small displays. In *Proceedings of the Mobile HCI*, 2001, 1–9. Berlin: Springer.
- Gould, J., L. Alfaro, V. Barnes, R. Finn, N. Grischkowsky, and A. Minuto. 1987. Reading is slower from CRT displays than from paper: Attempts to isolate a single-variable explanation. *Human Factors*, 29(3):269–299.
- Graham-Rowe, D. 2007. Photonic fabrics take shape. *Nat Photon* 1(1):6—7.
- Gröger, T., M. Ziefle, and D. Sommer. 2003. Anisotropic characteristics of LCD TFTs and their impact on visual performance. In *Human-Centred Computing: Cognitive, Social and Ergonomic Aspects*, ed. D. Harris, V. Duffy, M. Smith and C. Stephanidis, 33–37. Mahwah, NJ: LEA.
- Heikenfeld, J. 2010. Lite, brite displays. In *IEEE Spectrum International 3.10*.
- Heikenfeld, J., K. Zhou, E. Kreit, B. Raj, S. Yang, B. Sun, A. Milarcik, A. Clapp, and R. Schwartz. 2009. Electrofluidic displays using Young-Laplace transposition of brilliant pigment dispersions. *Nat Photonics* 3(5):292–296.
- Helander, M., S. Little, and C. Drury. 2000. Adaptation and sensitivity to postural changes in sitting. *Hum Factors* 42(4):617–629.
- Heppner, F., J. Anderson, A. Farstrup, and N. Weidenman. 1985. Reading performance on standardized test is better from print than from computer display. *J Read* 28: 321–325.
- Hilton, P. J. 2008. Ultra-wide FOV Retinal Display. In *Handheld Usability*, ed. S. Weiss. New York: John Wiley.
- Hollands, J., H. Cassidy, S. McFadden, and R. Boothby. 2001. LCD versus CRT Displays: Visual search for colored symbols. In *Proceedings of the Human Factors and Ergonomics Society 45th Annual Meeting*, 1353–1355. Santa Monica: Human Factors Society.
- Hollands, J., H. Parker, S. McFadden, and R. Boothby. 2002. LCD versus CRT Displays: A Comparison of visual search performance for colored symbols. *Hum Factors* 44(2):210–221.
- Holmes, R. 2003. Head-mounted display technology in virtual reality systems. In *Display Systems—Design and Applications*, 2nd ed., ed. L. MacDonald and A. Lowe, 61–82. New York: John Wiley & Sons.
- Holzel, T. 1999. Are head-mounted displays going anywhere? *Inf Disp* 15(10): 16–18.
- Honda, T. 2000. Three-dimensional display technology satisfying “super multiview condition”. In *Proceedings Three-Dimensional Video and Display: Devices and Systems*, ed. B. Javidi and F. Okano, Vol. CR76, 218–219. San Jose, CA: SPIE Press.
- Hombeck, L. J. 2001. The DMD™ projection display chip: A MEMS-based technology. *MRS Bull* 26: 325–327.
- Howarth, P., and H. Istance. 1985. The association between visual discomfort and the use of visual display units. *Behav Inf Technol* 4:131–149.

- Huang, D.-L., P. Rau, and Y. Liu. 2009. Effects of font size, display resolution and task type on reading Chinese fonts from mobile devices. *Int J Ind Ergon* 39: 81–89.
- Hung, G., K. Ciuffreda, and J. Semmlow. 1986. Static vergence and accommodation: Population norms and orthoptic effects. *Doc Ophthalmol* 62: 165–179.
- Informa Telecoms and Media Global mobile forecasts. 2008. <http://www.intomobile.com/2008/>.
- Iwasaki, T., and S. Kurimoto. 1988. Eye-strain and changes in accommodation of the eye and in visual evoked potential following quantified visual load. *Ergonomics* 31(12):1743–1751.
- Jaschinski, W., M. Bonacker, and E. Alshuth. 1996. Accommodation, convergence, pupil and eye blinks at a CRT-display flickering near fusion limit. *Ergonomics* 39: 152–164.
- Jhuo, L.-C., C.-W. Wu, and C.-C. Hu. 2009. A Resistive Multi-Touch Screen Integrated into LCD. In *SID Symposium Digest* 40: 1187–1188.
- Jorke, H., and M. Fritz. 2006. *Stereo projection using interference filters. Stereoscopic Displays and Virtual Reality Systems XIII. Stereoscopic Displays and Applications* Proc. SPIE 6055. ed. A. J. Woods, N. A. Dodgson, J. O. Merritt, M. T. Bolas, and I. E. McDowell, 6055G.
- King, C. N. 1996. Electroluminescent displays, SID 96 Seminar Lecture Notes, M-9, 1–36.
- Kirsch, C. 2004. Laptops als Ersatz für Desktop-PCs. Überall im Büro [Laptops as a replacement for desktop PCs. The office is everywhere]. ix, 12, 40–5.
- Kleiber, M., and T. Alexander. 2011. Evaluation of a mobile AR telemaintenance system. In *Proceedings of the 14th International Conference on Human-Computer Interaction*. Orlando, FL, USA: Springer.
- Kleiber, M., and C. Winkelholz. 2008. Distortion of depth perception in virtual environments using stereoscopic displays: quantitative assessment and corrective measures. In *Proceedings of the Stereoscopic Displays and Applications XIX conference*, SPIE, Vol. 6803. San Jose, CA: SPIE Press.
- Kline, D. W., and C. T. Scialfa. 1997. Sensory and perceptual functioning: Basic research and human factors implications. In *Handbook of Human Factors and the Older Adult*, ed. A. Fisk, and W. Rogers, 27–54. San Diego: Academic.
- Kokoschka, S., and P. Haubner. 1986. Luminance ratios at visual display workstations and visual performance. *Lighting Res Technol* 17(3): 138–144.
- Kothiyal, K., and S. Tettey. 2001. Anthropometry for design for the elderly. *Int J Occup Saf Ergon* 7(1): 15–34.
- Kruger, W., C. A. Bonh, B. Frohlich, H. Schuth, W. Strauss, and G. Wesche. 1995. The Responsive Workbench: A virtual work environment. *Computer* 28(7):42–48.
- Kubota, S. 1997. Effects of reflection properties of liquid-crystal displays on subjective ratings of disturbing reflected glare. *J Light Vis Environ* 21: 33–42.
- Lambooij, M. T. M., W. A. IJsselsteijn, and I. Heynderickx. 2007. Visual discomfort in stereoscopic displays: A review, in *Stereoscopic Displays and Virtual Reality Systems XIV*. In *Proceedings of the SPIE*, Vol. 6490. San Jose, CA: SPIE Press.
- Langhans, K., D. Bezecky, D. Homann, D. Bahr, C. Vogt, C. Blohm, and K.-H. Scharschmidt. 1998. New Portable FELIX 3D Display. In *Proc SPIE*, vol. 3296, SPIE—Int'l Soc for Optical Eng., 204–216. San Jose, CA: SPIE Press.
- Leister, N., A. Schwerdtner, G. Füllerer, S. Buschbeck, J.-C. Olaya, and S. Flon. 2008. Full-color interactive holographic projection system for large 3D scene reconstruction. In *Proc SPIE*, Vol. 6911. San Jose, CA: SPIE Press.
- Li, Z., A. K. Bhowmik, and P. J. Bos. 2008. Introduction to mobile displays. In *Mobile Displays*, ed. P. Bhowmik, Z. Li, and P. Bos, 1–22. Essex, England: John Wiley & Sons Ltd.
- Lin, Y.-T., P.-H. Lin, S.-L. Hwang, S.-C. Jeng, and C.-C. Liao. 2009. Investigation of legibility and visual fatigue for simulated flexible electronic paper under various surface treatments and ambient illumination conditions. *Appl Ergon* 40: 922–928.
- Lincoln, J. 2010. March of the pico projectors. In *IEEE Spectrum: Inside Technology 5.10*.
- Lippert, T. M. 2006. Display Devices: RSD (Retinal Scanning Display). In *Avionics: Elements, Software and Functions, The Avionics Handbook*, ed. C. R. Spitzer. Boca Raton: CRC Press.
- Luczak, H., and O. Oehme. 2002. Visual Displays—developments of the past, the present and the future. In *Proceedings of the 6th International Scientific Conference on Work with Display Units*, ed. H. Luczak, A. Çakir, and G. Çakir, 2–5. Berlin: Ergonomic Institute.
- Luczak, H., M. Park, B. Balazs, S. Wiedenmaier, and L. Schmidt. 2003. Task performance with a wearable augmented reality interface for welding. In *Human-Computer Interaction. Cognitive, Social and Ergonomic Aspects*, ed. D. Harris, V. Duffy, M. Smith, and C. Stephanidis, 98–102. Mahwah, NJ: LEA.
- Lüder, E. 2003. Active matrix addressing of LCDs: Merits and shortcomings. In *Display Systems—Design and Applications*, 2nd ed., ed. L. MacDonald and A. Lowe, 157–171. New York: John Wiley & Sons.
- Lueder, E. 2010. Liquid Crystal Displays—Addressing Schemes and Electro-Optical Effect. Chichester: Wiley Series in Display Technology.
- Macadam, D. L. 1982. Caliometry. *American Institute of Physics Handbook* 6:182–197. New York: McGraw-Hill.
- Maxwell, I. 2007. An Overview of Optical-Touch Technologies. In *Information Display* 12/07.
- Menzoli, M., F. Lang, U. Nåpflin, C. Zeller, and H. Krueger. 2001. CRT versus LCD: Effects of refresh rate, display technology and background luminance in visual performance. *Displays* 22(3):779–785.
- Mertens, A., N. Jochems, C. M. Schlick, D. Dünnebacke, and J. H. Dornberg. 2010. A novel input method for trepidant users of telemedical services. In *Advances in Human Factors and Ergonomics in Healthcare*, ed. V. Duffy, 662–671. USA: CRC Press.
- Mertens, A., B. Kausch, D. Dünnebacke, P. Laing. 2009. Adequate Requirements Analysis in Homely Rehab. In *eChallenges e-2009 Conference Proceedings*, ed. P. Cunningham and M. Cunningham. Istanbul, Turkey: IIMC International Information Management Corporation.
- Mertens, A., C. Wacharamanottham, J. Hurtmanns, M. Kronenbuerger, P. H. Kraus, A. Hoffmann, C. Schlick, and J. Borchers. 2011. Model-based processing of swabbing movements on touch screens to improve accuracy and efficacy for information input of individuals suffering from kinetic tremor. In *Human-Computer Systems Interaction. Backgrounds and Applications 2, Advances in Soft Computing*. Berlin: Springer.
- Miles, M. W. 2004. Interferometric Modulation: MOEMS as an Enabling Technology for High-Performance Reflective Displays, 131. San Francisco: Iridigm Display Corp. Proc. SPIE 4985.
- Miyao, M., S. Hacisalihzade, J. Allen, and L. Stark. 1989. Effects of VDT resolution on visual fatigue and readability: An eye movement approach. *Ergonomics* 32(6):603–614.

- Mphepo, W., Y.-P. Huang, P. Rudquist, and H.-P. D. Shieh. 2010. Digital micro hinge (DMH) based display pixels. *J Disp Technol* 6(4): 142–149.
- Myeon-Cheon, C., K. Youngkyoo, and H. Chang-Sik. 2008. Polymers for flexible displays: From material selection to device applications. *Prog Polym Sci* 33(6):581–630.
- Nelson, T. J., and J. R. Wullert II. 1997. *Electronic Information Display Technologies* (Series on information display, Vol. 3). River Edge, NJ: World Scientific.
- Norman, J. F., J. T. Todd, V. J. Perotti, and J. S. Tittle. 1996. The visual perception of three-dimensional length. *J Exp Psychol Hum Percept Perform* 22(1): 173–186.
- Odenthal, B., M. Mayer, W. Kabuß, B. Kausch, and C. Schlick. 2009. Investigation of error detection in assembled workpieces using an augmented vision system, In Proceedings of the IEA2009—17th World Congress on Ergonomics, 1–9. Beijing, China.
- Oehme, O., L. Schmidt, and H. Luczak. 2003. Comparison between the strain indicator HRV of a head-based virtual retinal display and LC head mounted displays for augmented reality. *Int J Occup Saf Ergon* 9(4):411–422.
- Oehme, O., S. Wiedenmaier, L. Schmidt, and H. Luczak. 2001. Empirical studies on an augmented reality user interface for a head based virtual retinal display. In *Usability Evaluation and Interface Design: Cognitive Engineering, Intelligent Agents and Virtual Reality*, ed. M. Smith, G. Salvendy, D. Harris, and R. Koubek, 1026–1030. Mahwah, NJ: LEA.
- Oetjen, S., and M. Ziefle. 2004. Effects of anisotropy on visual performance regarding different font sizes. In *Work with Computing Systems*, ed. H. Khalid, M. Helander, and A. Yeo, 442–447. Kuala Lumpur, Malaysia: Damai Sciences.
- Oetjen, S., and M. Ziefle. 2007a. The effects of LCD anisotropy on the visual performance of users of different ages. *Hum Factors* 49(4):619–627.
- Oetjen, S., and M. Ziefle. 2007b. Children working with computers: The effects of user's age and task complexity. In *Work with Computing Systems*, ed. A. Toomingas, A. Lantz, and Th. Berns. Stockholm: Royal Institute of Technology.
- Oetjen, S., and M. Ziefle. 2009. A visual ergonomic evaluation of different screen technologies. *Appl Ergon* 40: 69–81.
- Oetjen, S., M. Ziefle, and T. Gröger. 2005. Work with visually sub-optimal displays—in what ways is the visual performance influenced when CRT and TFT displays are compared? In *Proceedings of the HCI International 2005*. Vol. 4: Theories, Models and Processes in Human Computer Interaction. St. Louis, MO: Mira Digital Publisher.
- Omori, M., T. Watanabe, J. Takai, H. Takada, and M. Miyao. 2002. Visibility and characteristics of the mobile phones for elderly people. *Behav Inf Technol* 21 (5):313–316.
- Ono, Y. A. 1993. Electroluminescent Displays, Seminar Lecture Notes, F-1/1–30. Santa Ana, CA: Society for Information Display.
- Owens, D., and K. Wolf-Kelly. 1987. Near work, visual fatigue, and variations of oculomotor tonus. *Invest Ophthalmol Vis Sci* 28(4):743–749.
- Ozawa, L. 2007. *Cathodoluminescence and Photoluminescence: Theories and Practical Applications*. Boca Raton, FL: CRC Press, Taylor & Francis Group.
- Park, M., L. Schmidt, and H. Luczak. 2005. Changes in hand-eye-coordination with different levels of camera displacement from natural eye position. In *10th International Conference on Human Aspects of Advanced Manufacturing: Agility and Hybrid Automation—HAAMAH* 2005, 191–199. San Diego, CA.
- Park, M., S. Serefoglou, L. Schmidt, K. Radermacher, C. Schlick, and H. Luczak. 2008. Hand-eye coordination using a video see-through augmented reality system. *Ergonomics Open J* 39–47.
- Patterson, R., L. Moe, and T. Hewitt. 1992 Factors that affect depth perception in stereoscopic displays. *Hum Factors* 34: 655–667.
- Pfendler, C., and C. Schlick. 2007. A comparative study of mobile map displays in a geographic orientation task. *Behav Inf Technol* 26(2):455–463.
- Pfendler, C., J. Thun, T. Alexander, C. Schlick. 2011. The influence of different electronic maps and displays on performance and operator state in geographic orientation task. In *Behaviour & Information Technology*, 1–12. Hampshire, England: Taylor & Francis.
- Pfendler, C., H. Widdel, and C. Schlick. 2005. Bewertung eines Head-Mounted und eines Hand-Held Displays bei einer Zielerkennungsaufgabe [Task related evaluation of head-mounted and hand-held displays]. *Zeitschrift für Arbeitswissenschaft* 59(1): 13–21.
- Piccoli, B., M. D'Orso, P. L. Zambelli, P. Troiano, and R. Assini. 2001. Observation distance and blinking rate measurement during on-site investigation: New electronic equipment. *Ergonomics* 44(6):668–676.
- Piccoli, B., G. Soci, P. L. Zambelli, and D. Pisaniello. 2004. Photometry in the workplace: the rationale for a new method. *Annals of Occupational Hygiene*, 48: 229–238.
- Pioneer. 2001. Why choose Plasma. <http://www.pioneer-electronics.com/Pioneer/CDA/Common/ArticleDetails/0,1484,1547,00.html> (accessed September 15, 2005).
- Plainis, S., and I. Murray. 2000. Neurophysiological interpretation of human visual reaction times: Effect of contrast, spatial frequency and luminance. *Neuropsychologia* 38: 155–164.
- Precht, M., N. Meier, and J. Kleinlein. 1997. *EDV-Grundwissen: Eine Einführung in Theorie und Praxis der Modernen EDV* [Computer Basics: An Introduction in Theory and Application of Modern Computing]. Bonn: Addison-Wesley-Longman.
- Rahman, T., and P. Muter. 1999. Designing an interface to optimize reading with small display windows. *Hum Factors* 41(1):106–117.
- Rao, B., and L. Minakakis. 2003. Evolution of Mobile Location-based Services. *Commun ACM* 46(12):661–665.
- Saffer, D. 2008. *Designing Gestural Interfaces: Touchscreens and Interactive Devices*. Sebastopol, CA: O'Reilly Media.
- Sanders, M. S., and E. J. McCormick. 1993. *Human Factors in Engineering and Design*. 7th ed. New York: McGraw-Hill.
- Schadt, M. 1996. Optisch strukturierte Flüssigkeitskristall-Anzeigen mit großem Blickwinkelbereich [Optically structured liquid crystal displays with wide viewing angles]. *Physikalische Blätter* 52(7–8):695–698.
- Schenkmann, B., T. Fukunda, and B. Persson. 1999. Glare from monitors measured with subjective scales and eye movements. *Displays* 20: 11–21.
- Schlick, C., R. Daude, H. Luczak, M. Weck, and J. Springer. 1997. Head-mounted display for supervisory control in autonomous production cells. *Displays* 17(3–4): 199–206.
- Schlick, C., B. Odenthal, M. Mayer, J. Neuhöfer, M. Grandt, B. Kausch, and S. Mütze-Niewöhner. 2009. Design and evaluation of an augmented vision system for self-optimizing assembly cells. In *Industrial Engineering and Ergonomics—Visions, Concepts, Methods and Tools—Festschrift in Honor of Professor Holger Luczak*, 539–560. Berlin: Springer, Hrsg.: Schlick, C.
- Schlick, C., R. Reuth, and H. Luczak. 2000. Virtual Reality User Interface for Autonomous Production. In *Advances in Networked Enterprises*, ed. L. M. Camarinha-Matos, H. Afsarmanesh, and H. Erbe, 279–286. Dordrecht, The Netherlands: Kluwer Academic

Publishers.

- Schlick, C., C. Winkelholz, F. Motz, and H. Luczak. 2006. Self-Generated Complexity and Human-Machine Interaction. *IEEE Trans Syst Man Cybern A Syst Hum* 36(1):220–232.
- Schmidt, U. 2009. *Professionelle Videotechnik*. Berlin: Springer.
- Schneider, N., S. Schreiber, J. Wilkes, M. Grandt, and C. Schlick. 2007. Investigation of adaptation dimensions for age-differentiated human-computer interfaces. In *Universal Access in HCI, Part I, HCII 2007, 12th International Conference on Human-Computer Interaction, Beijing, China*, ed. C. Stephanidis. Berlin: Springer.
- Schowengerdt, B. T., and E. J. Seibel. 2006. True 3-D scanned voxel displays using single or multiple light sources. *J Soc Inf Disp* 14(135): 135–143.
- Sheedy, E. J. 2005. Office lighting for computer use. In *Visual Ergonomics Handbook*, ed. J. Anshel, 37–51. Boca Raton: CRC.
- Sheedy, J., M. Subbaram, and J. Hayes. 2003. Filters on computer displays—effects on legibility, performance and comfort. *Behav Inf Technol* 22(6):427–433.
- Shen, I.-H., K. K. Shieh, C.-Y. Chao, and D.-S. Lee. 2009. Lighting, font style, and polarity on visual performance and visual fatigue with electronic paper displays. *Displays* 30: 53–58.
- Shieh, K.-K., and C.-C. Lin. 2000. Effects of screen type, ambient illumination, and color combination on VDT visual performance and subjective preference. *Int J Ind Ergon* 26(5):527–536.
- Sommerich, C., S. Joines, and J. Psihogios. 2001. Effects of computer monitor viewing angle and related factors on strain, performance, and preference outcomes. *Hum Factors* 43(1):39–55.
- Stanney, K. M., and M. Zyda. 2002. Virtual environments in the 21st century. In *Handbook of Virtual Environments*, ed. K. M. Stanney, 1–14. Mahwah, NJ: LEA.
- Stolle, H., J.-C. Olaya, S. Buschbeck, H. Sahm, and A. Schwerdtner. 2008. Technical solutions for a full-resolution autostereoscopic 2D/3D display technology. In *Proceedings SPIE, Volume 6803, Autostereoscopic Displays II*, ed. N. S. Holliman, and J. O. Merri. San Jose, CA.
- Stone, P., A. Clarke, and A. Slater. 1980. The effect of task contrast on visual performance and visual fatigue at a constant illuminance. *Lighting Res Technol* 12: 144–159.
- Sun, B., and J. Heikenfeld. 2008. Observation and optical implications of oil dewetting patterns in electrowetting displays. *J Micromech Microeng* 18(2): 1–8.
- Takaki, Y., and N. Nago. 2010. Multi-projection of lenticular displays to construct a 256-view super multi-view display. *Opt Express* 18(9): 8824.
- Tech Crunchies—Internet Statistics and Numbers. <http://techcrunchies.com/distribution-of-gsm-connections-worldwide/2009> (accessed January 15, 2010).
- Theis, D. 1999. Display technologie. In *Vom Arbeitsplatzrechner zum ubiquitären Computer [From the Desktop PC to the ubiquitous Computer]*, ed. C. Müller-Schloer and B. Schallenberger, 205–238. Berlin: VDE.
- Tumler, J., F. Doil, R. Mecke, G. Paul, M. Schenk, E. A. Pfister, A. Huckauf, L. Bockeimann, A. Roggentin. 2008. Mobile Augmented Reality in industrial applications: Approaches for solution of user-related issues. In *ISMAR '08: Proceedings of the 7th IEEE/ACM International Symposium on Mixed and Augmented Reality*. Washington, DC, USA: IEEE Computer Society.
- Urey, H., D. W. Wine, and J. R. Lewis. 1999. Scanner design and resolution tradeoffs for miniature scanning displays. In *Proceedings SPIE, Flat Panel Display Technology and Display Metrology*, ed. B. Gnade, and E. F. Kelley, Vol. 3636, 660–668. San Jose, CA: SPIE Press.
- Van Schaik, P., and J. Ling. 2001. The effects of frame layout and differential background contrast on visual search performance in web pages. *Interact Comput* 13: 513–525.
- Vetter, S., N. Jochems, B. Kausch, S. Mütze-Niewöhner, and C. M. Schlick. 2010. Age-induced change in visual acuity and its impact on performance in a target detection task with electronic information displays. *Occup Ergon* 9(2):99–110.
- Vogel, U., D. Kreye, B. Richter, and G. Bunk. 2008. OLED microdisplays: Advanced functionality and systems. In *SID-MID-Europe Chapter 2008*. Jena.
- Von Waldkirch, M. 2004. "Retinal Projection Displays for Accommodation-Insensitive Viewing". Doctoral thesis, Zurich, Swiss Federal Institute of Technology, Aachen: Shaker.
- Wang A.-H., and M. T. Chen. 2000. Effects of polarity and luminance contrast on visual performance and VDT display quality. *Int J Ind Ergon* 25: 415–421.
- Wang, A.-H., H.-T. Kui, and S.-C. Jeng. 2009. Effects of ambient illuminance on users' visual performance using various electronic displays. *J Soc Inf Disp* 17(8):665–669.
- Weiss, S. 2002. *Handheld Usability*. New York: John Wiley.
- Wiley, G. A., B. Steele, S. Saeed, and G. Raskin. 2008. Mobile Display Digital Interface (MDDI). In *Mobile Displays*, ed. A. Bhowmik, Z. Li, and P. Bos. Chichester, England: John Wiley & Sons Ltd.
- Wilkins, A., I. Nimmo-Smith, A. Tait, C. McManus, S. Della Sala, A. Tilley, K. Arnold, M. Barrie, and S. Scott. 1984. A neurological basis for visual discomfort. *Brain* 107: 989–1017.
- Winkelholz, C. 2008. Theoretische Untersuchung zur Schärfentiefe eines Retinal Laser Scanning Displays. In *Ergonomie und Mensch-Maschine-Systeme*, ed. L. Schmidt, C. Schlick, and J. Grosche, 405–422. Berlin: Springer Verlag.
- Winkelholz, C., M. Kleiber, and C. Schlick. 2010a. Analysis of the Variability of Three-Dimensional Spatial Relations in Visual Short-Term Memory. In *Proceedings of the 32nd Annual Conference of the Cognitive Science Society, August 11–14, 2010 in Portland, Oregon, USA*, ed. S. Ohlsson, and R. Catrambone, 1679–1694. Austin, TX: Cognitive Science Society.
- Winkelholz, C., M. Kleiber, and C. Schlick. 2010b. Modeling the cognitive representation of basic three-dimensional spatial relations in visual short-term memory. In *IEEE International Conference on Systems, Man, and Cybernetics, 10–13 October 2010, 1838–45. Istanbul, Turkey*. Istanbul 2010.
- Wolf, E., and A. Schraffa. 1964. Relationship between critical flicker frequency and age in flicker perimetry. *Arch Ophthalmol* 72: 832–843.
- Woodson, W. E. 1987. *Human Factor Reference Guide for Electronics and Computer Professionals*. New York: McGraw-Hill.
- Yagi, I., N. Hirai, Y. Miyamoto, M. Noda, A. Imaoka, N. Yoneya, K. Nomoto, J. Kasahara, A. Yumoto, and T. Urabe. 2008. A flexible full-color AMOLED display driven by OTFTs. *J Soc Inf Disp* 16(15): 15–20.
- Yeh, P. 2009. *Optics of Liquid Crystal Displays*. New York: John Wiley & Sons.
- Yeh, Y.-Y., and C. Wickens. 1984. Why do performance and subjective workload measures dissociate? In *Proceedings of the 28th Annual meeting of the Human Factors Society*, 504–508. Santa Monica: Human Factors and Ergonomics Society.

- Zehner, R. 2008. Electronic paper displays. In *Mobile Displays*, ed. A. Bhowmik, Z. Li, and P. Bos. Chichester, West Sussex: Wiley Series in Display Technology.
- Ziefle, M. 1998. Effects of display resolution on visual performance. *Hum Factors* 40(4):554–568.
- Ziefle, M. 2001a. CRT screens or TFT displays? A detailed analysis of TFT screens for reading efficiency. In *Usability Evaluation and Interface Design*, ed. M. Smith, G. Salvendy, D. Harris, and R. Koubek, 549–553. Mahwah: LEA.
- Ziefle, M. 2001b. Aging, visual performance and eyestrain in different screen technologies. In *Proceedings of the Human Factors and Ergonomics Society 45th Annual Meeting*, 262–266. Santa Monica: Human Factors Society.
- Ziefle, M. 2002. Lesen am Bildschirm [Reading from Screens], Münster, Germany: Waxmann.
- Ziefle, M. 2003a. Users with body heights above and below the average: How adequate is the standard VDU setting with respect to visual performance and muscular load? In *Human Factors in Organizational Design and Management*, ed. H. Luczak, and K. J. Zink, 489–494. Santa Monica: IEA Press.
- Ziefle, M. 2003b. Sitting posture, postural discomfort, and visual performance: A critical view on the independence of cognitive and anthropometric factors in the VDU workplace. *Int J Occup Saf Ergon* 9(4):495–506.
- Ziefle, M. 2008. Instruction format and navigation aids in mobile devices. In *Usability and Human Computer Interaction for Education and Work*, ed. A. Holzinger, 339–358. Berlin: Springer.
- Ziefle, M. 2009. Visual ergonomic issues in LCD-Displays. An insight into working conditions and user characteristics. In *Methods and Tools of Industrial Engineering and Ergonomics for Engineering Design, production, and Service—Traditions, Trends and Vision*, ed. C. M. Schlick, 561–572. Berlin: Springer.
- Ziefle, M. 2010a. Information presentation in small screen devices: The trade-off between visual density and menu foresight. *Applied Ergonomics* 41(6):719–730.
- Ziefle, M. 2010b. Modelling mobile devices for the elderly. In *Advances in Ergonomics Modeling and Usability Evaluation*, ed. H. Khalid, A. Hedge, and T. Z. Ahram, 280–290. Boca Raton: CRC Press.
- Ziefle, M., and S. Bay. 2005. How older adults meet cognitive complexity: Aging effects on the usability of different cellular phones. *Behav Inf Technol* 24(5):375–389.
- Ziefle, M., and S. Bay. 2006. How to overcome disorientation in mobile phone menus: a comparison of two different types of navigation aids. *Hum Comput Interact* 21(4):393–433.
- Ziefle, M., and S. Bay. 2008. Transgenerational Designs in Mobile Technology. In *Handbook of Research on User Interface Design and Evaluation for Mobile Technology*, ed. J. Lumsden, 122–140. Hershey, PA: IGI Global.
- Ziefle, M., T. Gröger, and D. Sommer. 2003. Visual costs of the inhomogeneity of contrast and luminance by viewing TFT-LCD screens off-axis. *Int J Occup Saf Ergon* 9(4):507–517.
- Ziefle, M., O. Oehme, and H. Luczak. 2005. Information presentation and visual performance in head-mounted displays with augmented reality. *Zeitschrift für Arbeitswissenschaft* 59(3–4):331–344.
- Zingale, C., V. Ahlstrom, and B. Kudrick. 2005. Human Factors Guidance for the Use of Handheld, Portable, and Wearable Computing Devices. Technical Report, DOT/FAA/CT-05/15. Springfield, Virginia: National Technical Information Service.

Haptic Interface

- Asamura, N., N. Yokoyama, and H. Shinoda. 1999. A method of selective stimulation to epidermal skin receptors for realistic touch feedback. In *Proc IEEE Virtual Reality '99*, 274–281. Washington, DC: IEEE Computer Society.
- Brooks Jr., F. P. 1986. A dynamic graphics system for simulating virtual buildings. In *Proceedings of the 1986 Workshop on Interactive 3D Graphics* (Chapel Hill, NC, October 1986), 9–21. New York: ACM.
- Brooks, F. P., M. Ouh-Young, J. J. Batter, and P. J. Kilpatrick. 1990. Project GROPE—haptic displays for scientific visualization. *Comput Graphics* 24(4):177–185.
- Burdea, G. C. 1996. *Force and Touch Feedback for Virtual Reality*. New York: A Wiley-Interscience Publication.
- Burdea, G., J. Zhuang, E. Roskos, D. Silver, and L. Langiana. 1992. A portable dexterous master with force feedback. *Presence* 1(1).
- Christensen, R., J. M. Hollerbach, Y. Xu, and S. Meek. 1998. Inertial force feedback for a locomotion interface. In *Proc. ASME Dynamic Systems and Control Division, DSC-Vol. 64*, 119–126. Cambridge, MA: MIT Press.
- Darken, R., W. Cockayne, and D. Carmein. 1997. The omni-directional treadmill: A locomotion device for virtual worlds. In *Proceedings of UIST '97*. New York: ACM.
- Hirota, K., and M. Hirose. 1996. Simulation and presentation of curved surface in virtual reality environment through surface display. In *Proc. of IEEE VRAIS '96*. Washington, DC: IEEE Computer Society.
- Iwata, H. 1990a. Artificial reality with force-feedback: Development of desktop virtual space with compact master manipulator. *ACM SIGGRAPH Comput Graphics* 24(4).
- Iwata, H. 1990b. Artificial reality for walking about large-scale virtual space. *Human Interface News and Report* 5(1):49–52 (in Japanese).
- Iwata, H. 1993. Pen-based haptic virtual environment. In *Proc of IEEE VRAIS '93*, 287–292. Seattle, WA: IEEE Computer Society.
- Iwata, H. 1994. Desktop force display. In *SIGGRAPH '94 Visual Proceedings*.
- Iwata, H. 1999. Walking about virtual space on an infinite floor. In *Proc. of IEEE Virtual Reality '99*, 286–293. Houston, Tx:IEEE.
- Iwata, H., and T. Fujii. 1996. Virtual perambulator: A novel interface device for locomotion in virtual environment. *Proc. of IEEE 1996 Virtual Reality Annual International Symposium*, 60–65. Santa Clara, CA: IEEE Computer Society.
- Iwata, H., and K. Matsuda. 1992. Haptic walkthrough simulator. In *Proc of ICAT '92*, 185–192.
- Iwata, H., and Y. Yoshida. 1999. Path reproduction tests using a Torus Treadmill. *Presence* 8(6):587–597.
- Kajimoto, H., N. Kawakami, T. Maeda, and S. Tachi. 1999. Tactile feeling display using functional electrical stimulation. In *Proc. of ICAT '99*, 107–114.
- Kawai, Y., and F. Tomita. 2000. A support system for the visually impaired to recognize three-dimensional objects, IOS Press. *Technol Disability* 12(1):13–20.
- Kontarinis, D. A., and R. D. Howe. 1995. Tactile display of vibratory information in teleoperation and virtual environment. *Presence* 4(4):387–402.

- Lederman, S. J., and R. L. Klatzky. 1987. Hand movements: A window into haptic object recognition. *Cogn Psychol* 19(3):342–368.
- Lederman, S. J., and R. L. Klatzky. 1999. Sensing and displaying spatially distributed fingertip forces in haptic interfaces for teleoperators and virtual environment system. *Presence* 8(1):86–103.
- Lorenzo, M., et al. 1995. OSIRIS. In *SIGGRAPH '95 Visual Proceedings*, 129.
- Massie, T., and K. Salisbury. 1994. The PHANTOM haptic interface: A device for probing virtual objects. In *ASME Winter Annual Meeting*, DSC, Vol. 55–1, 295–9. American Society of Mechanical Engineers.
- McNeely, W. 1993. Robotic graphics: A new approach to force feedback for virtual reality. In Proc. of IEEE VRAIS '93, 336–341. Seattle, WA: IEEE Computer Society.
- Minsky, M., and S. J. Lederman. 1997. Simulated haptic textures: Roughness. Symposium on haptic interfaces for virtual environment and teleoperator systems. In *Proceedings of the ASME Dynamic Systems and Control Division*, DSC-Vol. 58, 421–6.
- Moy, G., C. Wagner, and R. S. Fearing. 2000. A compliant tactile display for teletaction. In *IEEE Int Conf on Robotics and Automation*, 3409–3415. San Francisco, CA: IEEE.
- Murakami, T., and N. Nakajima. 1994. Direct and intuitive input device for 3D shape deformation. ACM CHI 1994, Conference on Human Factors in Computing Systems, 465–470. New York: ACM.
- Noma, H., T. Sugihara, and T. Miyasato. 2000. Development of ground surface simulator for Tel-E-Merge system. In *Proceedings of IEEE Virtual Reality 2000*, 217–224. Washington, DC: IEEE Computer Society.
- Poston, R., et al. 1997. A whole body kinematic display for virtual reality applications. In *Proc. of the IEEE International Conference on Robotics and Automation*, 3006–11.
- Prat, D. R., et al. 1994. Insertion of an articulated human into a networked virtual environment. In *Proceedings of the 1994 AI, Simulation, and Planning in High Autonomy Systems Conference*, 84–90. Gainesville, FL: IEEE.
- Sinclair, M. 1997. The haptic lens. In *SIGGRAPH '97 Visual Proceedings*, 179. New York: ACM.
- Slater, M., M. Usoh, and A. Steed. 1994. Steps and ladders in virtual reality. In *Virtual Reality Technology*, 445–454. River Edge, NJ: World Scientific Publication.
- Tachi, S., T. Maeda, R. Hirata, and H. Hoshino. 1994. A construction method of virtual haptic space. In *Proc. of ICAT '94*, 131–138. Tokyo, Japan.
- Yamao, T., S. Ishida, S. Ota, and F. Kaneko. 1996. Formal safety assessment—research project on quantification of risk on lives. In *MSC67/INF.9 IMO Information Paper*.

Nonspeech Auditory and Crossmodal Output

- Arons, B. 1992. A review of the cocktail party effect. *J Am Voice I/O Soc* 12: 35–50.
- Bagwell, C. 1998. Audio file formats FAQ. <http://www.cnpbagwell.com/audio.html> (accessed November 2005).
- Beaudouin-Lafon, M., and S. Conversy. 1996. Auditory illusions for audio feedback. Paper presented at the ACM CHI '96 Conference Companion, Vancouver, Canada.
- Berglund, B., K. Harder, and A. Preis. 1994. Annoyance perception of sound and information extraction. *J Acoust Soc Am* 95(3):1501–1509.
- Blattner, M., and R. B. Dannenberg, eds. 1992. *Multimedia Interface Design*. New York: ACM Press, Addison-Wesley.
- Blattner, M., D. Sumikawa, and R. Greenberg. 1989. Earcons and icons: Their structure and common design principles. *Hum Comput Interact* 4(1): 11–44.
- Blauert, J. 1997. *Spatial Hearing*. Cambridge, MA: MIT Press.
- Bly, S. 1982. *Sound and Computer Information Presentation* (Unpublished PhD Thesis No. UCRL53282: Lawrence Livermore National Laboratoryo. Document Number).
- Bolanowski, S. J., G. A. Gescheider, R. T. Verrillo, and C. M. Chechosky. 1988. Four channels mediate the mechanical aspects of touch. *J Acoust Soc Am* 84(5): 1680–1694.
- Brewster, S. A. 1998a. The design of sonically-enhanced widgets. *Interact Comput* 11(2):211–235.
- Brewster, S. A. 1998b. Using non-speech sounds to provide navigation cues. *ACM Trans Comput Hum Interact* 5(3):224–259.
- Brewster, S. A. 2002. Overcoming the lack of screen space on mobile computers. *Pers Ubiquitous Comput* 6(3):188–205.
- Brewster, S. A., J. Lumsden, M. Bell, M. Hall, and S. Tasker. 2003. Multimodal 'Eyes-Free' interaction techniques for wearable devices. Paper presented at the *Proceedings of ACM CHI 2003*, Fort Lauderdale, FL.
- Brewster, S. A., S. Wall, L. M. Brown, and E. Hoggan. 2008. Tactile displays. In *The Engineering Handbook on Smart Technology for Aging, Disability and Independence*, ed. A. Helal, M. Mokhtari, and B. Abdulrazak. New York: John Wiley & Sons.
- Brewster, S. A., P. C. Wright, and A. D. N. Edwards. 1994. A detailed investigation into the effectiveness of earcons. In *Auditory Display*, ed. G. Kramer, 471–498. Reading, MA: Addison-Wesley.
- Brewster, S. A., P. C. Wright, and A. D. N. Edwards. 1995. Experimentally derived guidelines for the creation of earcons. Paper presented at the *HCI '95*. Huddlesfield, UK: BCS.
- Brown, L. M., and S. A. Brewster. 2006. Multidimensional tactons for non-visual information display in mobile devices. Paper presented at the *MobileHCI '06*. New York: ACM.
- Brown, L. M., S. A. Brewster, and H. C. Purchase. 2005. A first investigation into the effectiveness of tactons. Paper presented at the *WorldHaptics 2005*, Pisa, 167–76Y. New York: IEEE.
- Buxton, W. 1989. Introduction to this special issue on nonspeech audio. *Hum Comput Interact* 4(1): 1–9.
- Buxton, W., W. Gaver, and S. Bly. 1991. Tutorial number 8: The use of non-speech audio at the interface. Paper presented at the *Proceedings of ACM CHI '91*, New Orleans, LA.
- Chang, A., S. O'Modhrain, R. Jacob, E. Gunther, and H. Ishii. 2002. ComTouch: Design of a vibrotactile communication device. Paper presented at the *Designing Interactive Systems*, London, UK.
- Chang, A., and C. O'Sullivan. 2005. Audio-haptic feedback in mobile phones. Paper presented at the *CHI '05 extended abstracts on Human factors in computing systems*, Portland, OR.

- Cholewiak, R. W., J. C. Brill, and A. Schwab. 2004. Vibrotactile localization on the abdomen: Effects of place and space. *Percept Psychophys* 66: 970–987.
- Cholewiak, R. W., and A. A. Collins. 1995. Vibrotactile pattern discrimination and communality at several body sites. *Percept Psychophys* 57(5):724–737.
- Cholewiak, R. W., and J. C. Craig. 1984. Vibrotactile pattern recognition and discrimination at several body sites. *Percept Psychophys* 35: 503–514.
- Chowning, J. 1975. Synthesis of complex audio spectra by means of frequency modulation. *J Audio Eng Soc* 21(7):526–534.
- Cohen, M. 1993. Throwing, pitching and catching sound: Audio windowing models and modes. *Int J Man Mach Stud* 39: 269–304.
- Craig, J. C., and C. E. Sherrick. 1982. Dynamic tactile displays. In *Tactual Perception: A Sourcebook*, ed. W. Schiff, and E. Foulke, 209–233. Cambridge, UK: Cambridge University Press.
- Crease, M. C., P. D. Gray, and S. A. Brewster. 2000. Caring, sharing widgets. Paper presented at the Proceedings of BCS HCI 2000, Sunderland, UK.
- Edwards, A. D. N. 1989. Soundtrack: An auditory interface for blind users. *Hum Comput Interact* 4(1):45–66.
- Edwards, A. D. N., ed. 1995. *Extra-Ordinary Human-Computer Interaction*. Cambridge, UK: Cambridge University Press.
- Edworthy, J., S. Loxley, and I. Dennis. 1991. Improving auditory warning design: Relationships between warning sound parameters and perceived urgency. *Hum Factors* 33(2):205–231.
- Enriquez, M., K. MacLean, and C. Chita. 2006. Haptic phenomes: Basic building blocks of haptic communication. Paper presented at the 8th International Conference on Multimodal Interfaces (ICMI '06). New York: ACM.
- Flowers, J. H., and T. A. Hauer. 1992. The ear's versus the eye's potential to assess characteristics of numeric data: Are we too visuocentric? *Behav Res Methods Instrum Comput* 24: 258–264.
- Flowers, J. H., and T. A. Hauer. 1995. Musical versus visual graphs: Cross-modal equivalence in perception of time series data. *Hum Factors* 37: 553–569.
- Frysinger, S. P. 1990. Applied research in auditory data representation. Paper presented at the Extracting meaning from complex data: processing, display, interaction. Proceedings of the SPIE/ SPSE symposium on electronic imaging, Springfield, MA.
- Gaver, W. 1987. Auditory icons: Using sound in computer interfaces. *ACM SIGCHI Bull* 19(1):74.
- Gaver, W. 1989. The SonicFinder: An interface that uses auditory icons. *Hum Comput Interact* 4(1):67–94.
- Gaver, W. 1997. Auditory interfaces. In *Handbook of Human-Computer Interaction*, ed. M. Helander, T. Landauer, and P. Prabhu., 2nd ed., 1003–1042. Amsterdam: Elsevier.
- Gaver, W., R. Smith, and T. O'Shea. 1991. Effective sounds in complex systems: The ARKola simulation. Paper presented at the Proceedings of ACM CHI '91, New Orleans, LA.
- Geldard, F. A. 1957. Adventures in tactile literacy. *Am Psychol* 12: 115–124.
- Geldard, F. A. 1960. Some neglected possibilities of communication. *Science* 131(3413): 1583–1588.
- Gelfand, S. A. 1981. Hearing: An Introduction to Psychological and Physiological Acoustics. New York: Marcel Dekker Inc.
- Goff, G. D. 1967. Differential discrimination of frequency of cutaneous mechanical vibration. *J Exp Psychol* 74: 294–299.
- Gunther, E., G. Davenport, and S. O'Modhrain. 2002. Cutaneous grooves: Composing for the sense of touch. Paper presented at the New Interfaces for Musical Expression, Dublin, Ireland.
- Hoggan, E. 2010a. *Crossmodal Audio and Tactile Interaction with Mobile Touchscreens*. Glasgow: University of Glasgow.
- Hoggan, E. 2010b. *Crossmodal Audio and Tactile Interaction with Mobile Touchscreens: Thesis Summary*. *IJMHCI*, 29–44, Pennsylvania (USA): IGI Global.
- Hoggan, E., and S. A. Brewster. 2010. CrossTrainer: Testing the use of multimodal interfaces in situ. Paper presented at the CHI '10, Atlanta, Georgia.
- Hoggan, E., S. A. Brewster, and J. Johnston. 2008. Investigating the effectiveness of tactile feedback for mobile touchscreens. Paper presented at the CHI '08, Florence, Italy.
- Hoggan, E., A. Crossan, S. A. Brewster, and T. Kaaresoja. 2009. Audio or tactile feedback: Which modality when? Paper presented at the CHI '09, 2253–2256. Boston, MA, USA: ACM Press.
- ISO: Ergonomics of human-computer interaction—Part 910: Framework for tactile and haptic interaction. 2009. Retrieved, from http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=51097
- Kaczmarek, K. A., and P. Bach-Y-Rita. 1995. *Tactile Displays*. New York: Oxford University Press.
- Kandel, E. R., and T. M. Jessell. 1991. Touch. In *Principles of Neural Science*, ed. E. R. Kandel, J. H. Schwartz, and T. M. Jessell, 349–414. New York: Oxford University Press.
- Kilander, F., and P. Lonnqvist. 2001. A weakly intrusive ambient soundscape for intuitive state perception. In *Continuity in Future Computing Systems*, ed. G. Doherty, M. Massink, and M. Wilson, 70–74. Oxford: CLRC.
- Kilander, F., and P. Lonnqvist. 2002. A whisper in the woods—an ambient soundscape for peripheral awareness of remote processes. Paper presented at the Proceedings of ICAD 2002, Kyoto, Japan.
- Koskinen, E., T. Kaaresoja, and P. Laitinen. 2008. Feel-good touch: Finding the most pleasant tactile feedback for a mobile touch screen button. Paper presented at the ICMI 2008, 297–304. Crete: ACM Press.
- Kramer, G. 1994a. An introduction to auditory display. In *Auditory Display*, ed. G. Kramer, 1–77. Reading, MA: Addison-Wesley.
- Kramer, G., ed. 1994b. *Auditory Display* (Vol. Proceedings volume XVIII). Reading, MA: Addison-Wesley.
- Kramer, G., and B. Walker, eds. 1999. *Sonification Report: Status of the Field and Research Agenda*. Santa Fe, NM: The International Community for Auditory Display.
- Laitinen, P., and J. Mäenpää. 2006. Enabling mobile haptic design: Piezoelectric actuator technology properties in handheld devices. Paper presented at the HAVE '06, 40–43. Ottawa, Ont, Canada: IEEE
- Lee, J. C., P. H. Dietz, D. Leigh, W. S. Yerazunis, and S. E. Hudson. 2004. Haptic pen: A tactile feedback stylus for touch screens. Paper presented at the 17th annual ACM symposium on User interface software and technology, 291–294. Santa Fe, New Mexico: ACM Press.
- Lee, S., and S. Thad. 2010. BuzzWear: Alert perception in wearable tactile displays on the wrist. Paper presented at the Proceedings of the 28th international conference on Human factors in computing systems. 433–42. Atlanta, Georgia: ACM Press.
- Lemmens, P. 2005. Using the major and minor mode to create affectively-charged earcons. Paper presented at the Proceedings of ICAD 2005, Limerick, Ireland.

- Lenay, C., S. Canu, and P. Villon. 1997. Technology and perception: The contribution of sensory substitution systems. Paper presented at the ICCT. Aizu, Japan: IEEE
- Leplatre, G., and S. A. Brewster. 2000. Designing non-speech sounds to support navigation in mobile phone menus. Paper presented at the Proceedings of ICAD 2000, Atlanta, GA.
- Mackenzie, I. S., S. Zhang, and R. W. Soukoreff. 1999. Text entry using soft keyboards. *Behav Inf Technol* 18(4):235–244.
- MacLean, K., and M. Enriquez. 2003. Perceptual design of haptic icons. Paper presented at the Eurohaptics, Dublin, Ireland.
- Mansur, D. L., M. Blattner, and K. Joy. 1985. Sound-Graphs: A numerical data analysis method for the blind. *J Med Syst* 9: 163–174.
- Marentakis, G., and S. A. Brewster. 2004. A study on gestural interaction with a 3D audio display. Paper presented at the Proceedings of MobileHCI 2004, Glasgow, UK.
- Marila, J. 2002. Experimental comparison of complex and simple sounds in menu and hierarchy sonification. Paper presented at the Proceedings of ICAD 2003, Kyoto, Japan.
- Maury, S., S. Athenes, and S. Chatty. 1999. Rhythmic menus: Toward interaction based on rhythm. Paper presented at the Extended Abstracts of ACM CHI'99, Pittsburgh, PA.
- McCormick, E. J., and M. S. Sanders. 1982. Human Factors in Engineering and Design. 5th ed. New York: McGraw-Hill.
- McGookin, D. K., and S. A. Brewster. 2004. Understanding concurrent earcons: Applying auditory scene analysis principles to concurrent earcon recognition. *ACM Trans Appl Percept* 1(2):120–155.
- Mendelson, M. J. 1979. Acoustic-optical correspondences and auditory-visual coordination in infancy. *Can J Exp Psychol* 33: 334–346.
- Miranda, E. R. 1998. Computer Sound Synthesis for the Electronic Musician. Oxford, UK: Focal Press.
- Moore, B.C. 2003. An Introduction to the Psychology of Hearing. 5th ed. Oxford, UK: Elsevier Science.
- Mursell, J. L. 1937. The Psychology of Music. New York: W.W. Norton and Company, Inc.
- Mynatt, E. D. 1994. Designing with auditory icons: How well do we identify auditory cues? Paper presented at the Proceedings of the CHI '94 conference companion, Boston, MA.
- Mynatt, E. D., M. Back, R. Want, M. Baer, and J. B. Ellis. 1998. Designing audio aura. Paper presented at the Proceedings of ACM CHI '98, Los Angeles, CA.
- Mynatt, E. D., and K. Edwards. 1995. Metaphors for non-visual computing. In Extra-Ordinary Human-Computer Interaction, ed. A. D. N. Edwards, 201–220. Cambridge, UK: Cambridge University Press.
- Mynatt, E. D., and G. Weber. 1994. Nonvisual presentation of graphical user interfaces: Contrasting two approaches. Paper presented at the Proceedings of ACM CHI '94, Boston, MA.
- Nashel, A., and S. Razzaque. 2003. Tactile virtual buttons for mobile devices. Paper presented at the CHI '03 extended abstracts, Ft. Lauderdale, FL.
- Neuhoff, J. G., ed. 2004. Ecological Psychoacoustics. San Diego, CA: Elsevier Academic Press.
- Patterson, R. D. 1989. Guidelines for the design of auditory warning sounds. *Proc Inst Acoust Spring Conf* 11(5): 17–24.
- Phillips, J. R., and K. O. Johnson. 1985. Neural mechanisms of scanned and stationary touch. *J Acoust Soc Am* 77: 220–224.
- Pohlmann, K. 2005. Principles of Digital Audio. 5th ed. New York: McGraw-Hill.
- Poupyrev, I., J. Rekimoto, and S. Maruyama. 2002. TouchEngine: A tactile display for handheld devices. Paper presented at the ACM CHI 2002, MN.
- Roads, C. 1996. The Computer Music Tutorial. Cambridge, MA: MIT Press.
- Ronkainen, S., and L. Pasanen. 2005. Effect of Aesthetics on audio-enhanced graphical buttons. Paper presented at the Proceedings of ICAD 2005, Limerick, Ireland.
- Rovers, A. F., and H. A. van Essen. 2005. Guidelines for haptic interpersonal communication applications: An exploration of foot interaction styles. *Virtual Real* 9(2):177–191.
- Sawhney, N., and C. Schmandt. 1999. Nomadic radio: Scalable and contextual notification for wearable messaging. Paper presented at the Proceedings of ACM CHI '99, Pittsburgh, PA.
- Sawhney, N., and C. Schmandt. 2000. Nomadic radio: Speech and audio interaction for contextual messaging in nomadic environments. *ACM Trans Hum Comput Interact* 7(3):353–383.
- Shengdong, Z., D. Pierre, C. Mark, B. Ravin, and B. Patrick. 2007. Earpod: Eyes-free menu selection using touch input and reactive audio feedback. Paper presented at the Proceedings of the SIGCHI conference on Human factors in computing systems, 1395–1404. San Jose, CA: ACM Press.
- Sherick, C. E., and R. W. Cholewiak. 1986. Cutaneous sensitivity. In *Handbook of Perception and Human Performance*, ed. K. Boff, L. Kaufman, and J. L. Thomas, 1–58. New York: Wiley & Sons.
- Sherick, C. E., R. W. Cholewiak, and A. A. Collins. 1990. The localization of low- and high-frequency vibrotactile stimuli. *J Acoust Soc Am* 88(1):169–179.
- Shirazi, A. S., A. H. Sarjanoja, F. Alt, A. Schmidt, and J. Hkkil. 2010. Understanding the impact of abstracted audio preview of SMS. Paper presented at the Proceedings of the 28th international conference on Human factors in computing systems, 1735–1738. Atlanta, GA: ACM Press.
- Strybel, T., C. Manligas, and D. Perrott. 1992. Minimum audible movement angle as a function of the azimuth and elevation of the source. *Hum Factors* 34(3):267–275.
- Summers, I. R. 1992. Tactile Aids for the Hearing Impaired. London, UK: Whurr Publishers Ltd.
- Summers, I. R., P. R. Dixon, and P. G. Cooper. 1994. Vibrotactile and electro tactile perception of time-varying pulse trains. *J Acoust Soc Am* 95(3): 1548–1558.
- Terhardt, E. 1974. On the perception of periodic sound fluctuations (Roughness). *Acustica* 30: 201–213.
- Thimbleby, H. 1990. User Interface Design. New York: ACM Press, Addison-Wesley.
- van Veen, H. A. H. C., and J. B. van Erp. 2000. Tactile information presentation in the cockpit. Paper presented at the First International Workshop on Haptic Human-Computer Interaction.
- Verrillo, R. T. 1966. Vibrotactile thresholds for hairy skin. *J Exp Psychol* 72(1):47–50.
- Verrillo, R. T., and G. A. Gescheider. 1992. Perception via the sense of touch. In *Tactile Aids for the Hearing Impaired*, ed. I.R. Summers, 1–36. London: Whurr Publishers.
- Walker, B. N. 2002. Magnitude estimation of conceptual data dimensions for use in sonification. *J Exp Psychol Appl* 8: 211–221.

Walker, B. N., and J. Cothran. 2003. Sonification sandbox: A graphical toolkit for auditory graphs. Paper presented at the Proceedings of ICAD 2003, Boston, MA.

Network-Based Interaction

- All web links below and other related links and material at: <http://www.hiraeth.com/alan/hbhc/network/>
- Abowd, G. D., and A. J. Dix. 1992. Giving undo attention. *Interact Comput* 4(3):317–42.
- AlexaWSP. 2006. Alexa Web Search Platform Service. http://pages.alexa.com/prod_serv/web_search_platform.html (accessed March 13, 2006).
- Amazon. 2010 Amazon Mechanical Turk, <http://www.mturk.com/> (accessed May 01, 2010).
- Androutsellis-Theotokis, S., and D. Spinellis. 2004. A survey of peer-to-peer content distribution technologies. *ACM Comput Surv* 36(4):335–371.
- Anslow, M. 2009. ‘How ‘smart fridges’ could slash UK CO₂ emissions and help renewables,’ *guardian.co.uk*, Tuesday 28th April 2009. (online) (accessed November 10, 2009). <http://www.guardian.co.uk/environment/2009/apr/27/carbon-emissions-smart-fridges-environmentally-friendly-appliances>
- Apple. 2010. *Integrating Sync Services into Your Application*, <http://developer.apple.com/macosx/syncservices.html> (accessed May 01, 2010).
- Arehart, C., N. Chidambaram, S. Guruprasad, A. Homer, R. Howell, S. Kasippillai et al. 2000. *Professional WAP*. Birmingham, UK: Wrox Press. The Wrox series includes some of the best programmer-level texts on web and related technology: <http://www.wrox.com/>
- Arons, B. 1997. SpeechSkimmer: A system for interactively skimming recorded speech. *ACM Trans Comput Hum Interact (TOCHI)* 4(1):3–38.
- Barnard, P., and J. May. 1995. Interactions with advanced graphical interfaces and the deployment of latent human knowledge. In *Eurographics Workshop on the Design, Specification and Verification of Interactive Systems*, ed. F. Paterno, 15–49. Berlin, Germany: Springer Verlag. More information about ICS at: <http://www.mrc-cbu.cam.ac.uk/personal/phil.barnard/ics/>
- Bellotti, V. 1993. Design for privacy in ubiquitous computing environments. In *Proceedings of CSCW’93*, 77–92. New York: ACM Press.
- Benford, S., R. Anastasi, M. Flintham, A. Drozd, A. Crabtree, C. Greenhalgh, N. Tandavanitj, M. Adams, and J. Row-Farr. 2003. Coping with uncertainty in a location-based game. *IEEE Pervasive Comput* 2(3):34–41.
- Benford, S., J. Bowers, L. Fahlen, J. Mariani, and T. Rodden. 1994. Supporting cooperative work in virtual environments. *Comput J* 37(8):635–668.
- Berlage, T., and M. Spenke. 1992. The GINA interaction recorder. In *Proceedings of the IFIP WG2.7 Working Conference on Engineering for Human-Computer Interaction*, Ellivuori, Finland, 69–80. Amsterdam: North-Holland.
- Bemers-Lee, T., J. Hendler, and O. Lassila. 2001. “The Semantic Web”. *Scientific American Magazine*, 17th May 2001.
- Bizer, C., T. Heath, and T. Berners-Lee. 2009. Linked data—the story so far. *Int J Semant Web Inf Syst Spec Issue Linked Data* 5(3): 1–22.
- Björk, S., J. Falk, R. Hansson, and P. Ljungstrand. 2001. Pirates!-using the physical world as a game board. In *Proceedings of Interact 2001*, ed. M. Hirose, 9–13. Amsterdam, The Netherlands: IOS Press.
- Bluetooth. 2001. *Official Bluetooth SIG Website*. <http://www.bluetooth.com/> (accessed March 13, 2006).
- Blythe, M., and A. Monk. 2005. Net neighbours: Adapting HCI methods to cross the digital divide. *Interact Comput* 17: 35–56.
- Buxton, W., and T. Moran. 1990. EuroPARC’s Integrated Interactive Intermedia Facility (IIIF): Early experiences. In *Multi-User Interfaces and Applications, Proceedings of IFIP WG8.4 Conference*, ed. S. Gibbs, and A. A. Verrijn-Stuart, 11–34. Heraklion, Greece. Amsterdam: North-Holland.
- Calder, M., M. Kolberg, E. H. Magill, and S. Reiff-Marganiec. 2003. Feature interaction: A critical review and considered forecast. *Comput Netw* 41(1):115–141. DOI = [http://dx.doi.org/10.1016/S 1389-1286\(02\)00352-3](http://dx.doi.org/10.1016/S 1389-1286(02)00352-3).
- Campbell, A., and K. Nahrstedt, eds. 1997. *Building QoS into Distributed Systems*. Boston, MA: Kluwer.
- Card, S. K., T. P. Moran, and A. Newell. 1983. *The Psychology of Human Computer Interaction*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- CASIDE. 2005. CASIDE Project (EP/C005589): Investigating cooperative applications in situated display environments. <http://www.caside.lancs.ac.uk/> (accessed March 13, 2006).
- CERN. 2001. European organisation for nuclear research, <http://public.web.cern.ch/Public/> (accessed March 13, 2006).
- Chalmers, M., M. Bell, B. Brown, M. Hall, S. Sherwood, and P. Tennent. 2005. Gaming on the edge: Using seams in ubi-comp games. In *Proceedings of ACM Advances in Computer Entertainment (ACE05)*, 306–309. New York: ACM Press.
- Clarke, D., A. Dix, D. Ramduny, and D. Trepess, eds. 1997. *Workshop on time and the web*, Staffordshire university, <http://www.hiraeth.com/conf/web97/papers/> (accessed March 13, 2006).
- Crockford, D. 2010. Introducing JSON. <http://json.org> (accessed May 1, 2010).
- DataPortability. 2010. *DataPortability Project*. <http://www.dataportability.org/> (accessed May 01, 2010).
- Denbigh, A. 2003. *The Teleworking Handbook: The Essential Guide to Working from Where You Want*. 4th ed. London, U.K.: Methuen Drama.
- Dix, A. J. 1987. The myth of the infinitely fast machine. In *People and Computers III—Proceedings of HCI’87*, 215–228. Cambridge, U.K.: Cambridge University Press.
- Dix, A. J. 1991. *Formal Methods for Interactive Systems*. New York: Academic Press.
- Dix, A. J. 1994. Seven years on, the myth continues. Research Report RR9405, University of Huddersfield, Huddersfield, U. K. <http://www.hciobook.com/alan/papers/myth95/7-years-on.html> (accessed March 13, 2006).
- Dix, A. J. 1995. Dynamic pointers and threads. *Collab Comput* 1(3): 191–216.
- Dix, A. J. 1996. Closing the loop: Modelling action, perception and information. In *Proceedings of AVI’96—Advanced Visual Interfaces*, Gubbio, Italy, ed. T. Catucci, M. F. Costabile, S. Levialdi, and G. Santucci, 220–228. New York: ACM Press.
- Dix, A. 2001a. artefact + marketing = product. *Interfaces* 48:220–221. London, UK: BCS-HCI Group, <http://www.hiraeth.com/alan/ebulletin/product-and-market/> (accessed March 13, 2006).

- Dix, A. 2001b. Cyber-economies and the Real World. Keynote—South African Institute of Computer Scientists and Information Technologists Annual Conference, SAICSIT 2001, 25–28 September 2001. Pretoria, South Africa. <http://www.hcibook.com/alan/papers/SAICSIT2001/> (accessed March 13, 2006).
- Dix, A. 2005. The brain and the web—a quick backup in case of accidents. *Interfaces* 65: 6–7.
- Dix, A. 2009. Paths and patches: Patterns of geonosy and gnosis. In Chapter 1 in *Exploration of Space, Technology, and Spatiality: Interdisciplinary Perspectives*, ed. P. Turner, S. Turner, and E. Davenport, 1–16. Hershey, PA: Information Science Reference.
- Dix, A., and S. A. Brewster. 1994. Causing trouble with buttons. In *Ancillary Proceedings of HCI'94*, Glasgow, Scotland, ed. D. England. London, UK: BCS-HCI Group. <http://www.hcibook.com/alan/papers/buttons94/> (accessed March 13, 2006).
- Dix, A., J. Finlay, G. Abowd, and R. Beale. 1998. *Human-Computer Interaction*. 2nd ed. Englewood Cliffs, NJ: Prentice Hall, Inc.
- Dix, A., A. Friday, B. Koleva, T. Rodden, H. Muller, C. Randell, and A. Steed. 2005. Managing multiple spaces. In *Space, Spatiality and Technologies*, ed. P. Turner, and E. Davenport, 151–172. Dordrecht, NL: Springer.
- Dix, A., G. Lepouras, A. Katifori, C. Vassilakis, T. Catarci, A. Poggi, Y. Ioannidis et al. 2010. From the web of data to a world of action. Special Issue on Exploring New Interaction Designs Made Possible by the Semantic Web. *J Web Semant* 8(4):394–408.
- Dix, A., T. Rodden, N. Davies, J. Trevor, A. Friday, and K. Palfreyman. 2000. Exploiting space and location as a design framework for interactive mobile systems. *ACM Trans Comput Hum Interact (TOCHI)* 7(3):285–321.
- Dix, A., and S. Subramanian. 2010. IT for sustainable growth. *J Technol Manage Growing Econ* 1(1):35–54.
- Dodge, M., and R. Kitchin. 2001. *Atlas of Cyberspace*. Reading, MA: Addison Wesley, <http://www.cybergeography.org/atlas/>
- Dourish, P., and V. Bellotti. 1992. Awareness and coordination in shared workspaces. In *Proceedings of CSCW'92*, 107–114. New York: ACM Press.
- Eagle, N. 2009. txteagle: Mobile crowdsourcing. In *Internationalization, Design and Global Development (IDGD 2009)*. LNCS 5623, 447–456. Berlin: Springer-Verlag.
- Edwards, W. K., and T. Rodden. 2001. *Jini, Example by Example*. Upper Saddle River, NJ: SUN Microsystems Press.
- Electrolux. 1999. Screenfridge. <http://www.electrolux.com/screenfridge/> (accessed March 13, 2006).
- Ellis, C. A., and S. J. Gibbs. 1989. Concurrency control in group-ware systems. In *Proceedings of 1989 ACM SIGMOD International Conference on Management of Data*, SIGMOD Record, 18(2):399–407. New York: ACM.
- FCC. 2006. Voice over Internet Protocol. Federal Communications Commission, <http://www.fcc.gov/voip/> (accessed March 13, 2006).
- Fielding, R. T. 2000. *Architectural Styles and the Design of Network-Based Software Architectures*. PhD Dissertation. Irvine, CA: University of California.
- Frank G. Halasz, Thomas P. Moran, and Randall H. Trigg. 1986. Notecards in a nutshell. *SIGCHI Bull.* 18, 4 (May 1986), 45–52. DOI = 10.1145/1165387.30859, <http://doi.acm.org/10.1145/1165387.30859>.
- FOAF. 2000. Introducing FOAF. dated early 2000 <http://www.foaf-project.org/original-intro> (accessed May 01, 2010).
- Fogg, B. J., J. Marshall, O. Laraki, A. Osipovich, C. Varma, N. Fang et al. 2001. What makes web sites credible? A report on a large quantitative study. In *Proceedings of CHI2001*, Seattle, 2001. Also *CHI Lett* 3(1):61–68. New York: ACM Press.
- Foster, I. 2000. Internet computing and the emerging grid. *Nature WebMatters*. <http://www.nature.com/nature/webmatters/grid/grid.html> (accessed March 13, 2006).
- Foster, I., and C. Kesselman, eds. 1999. *The Grid: Blueprint for a New Computing Infrastructure*. San Francisco, CA: Morgan-Kaufmann.
- Gaver, W. W., R. B. Smith, and T. O'Shea. 1991. Effective sounds in complex situations: The ARKola simulation. In *Reaching Through Technology—CHI'91 Conference Proceedings*, ed. S. P. Robertson, G. M. Olson, and J. S. Olson, 85–90. New York: ACM Press.
- Gellersen, H.-W., M. Beigl, and H. Krull. 1999. The MediaCup: Awareness technology embedded in an everyday object. In *Handheld & Ubiquitous Computing, Lecture Notes in Computer Science*, ed. H.-W. Gellersen. Vol. 1707, 308–310. Berlin, Germany: Springer.
- Google. 2010. Gears: Improving Your Web Browser. <http://gears.google.com/> (accessed March 6, 2010).
- Gray, W. D., B. E. John, and M. E. Atwood. 1992. The precis of project ernestine or an overview of a validation of goms. In *Striking a Balance, Proceedings of the CHI'92 Conference on Human Factors in Computing Systems*, ed. P. Bauersfeld, J. Bennett, and G. Lynch, 307–312. New York: ACM Press.
- Greenhalgh, C. 1997. Analysing movement and world transitions in virtual reality tele-conferencing. In *Proceedings of ECSCW'97*, ed. J. A. Hughes, W. Prinz, T. Rodden, and K. Schmidt, 313–328. Dordrecht, The Netherlands: Kluwer Academic Publishers.
- GRID. 2001. GRID Forum home page, <http://www.gridforum.org/> (accessed March 13, 2006).
- Griffiths, E., and A. Dix. 2008. The Pharmacist and the EPS (Electronic Prescription Service). In *Workshop HCI for Medicine and Health Care (HCI4MED) at HCI 2008*. Liverpool, <http://www.hcibook.com/alan/papers/HCI4MED08-Pharmacist-and-the-EPS/> (accessed 10 Sept. 2010).
- Gutwin, C., S. Benford, J. Dyck, M. Fraser, I. Vaghi, and C. Greenhalgh. 2004. Revealing delay in collaborative environments. In *Proceedings of ACM Conference on Computer-Human Interaction (CHI'04)*, 503–510. New York: ACM Press.
- Halasz, F., T. Moran, and R. Trigg. 1987. NoteCards in a nutshell. In *Proceedings of the CHI+GI*, 45–52. New York: ACM Press.
- Harrison, C., Z. Yeo, and S. E. Hudson. 2010. Faster progress bars: Manipulating perceived duration with visual augmentations. In *Proceedings of the 28th Annual SIGCHI Conference on Human Factors in Computing Systems* (Atlanta, Georgia, April 10–15, 2010). CHI'10. New York: ACM.
- Hildebrandt, M., A. Dix, and H. A. Meyer. 2004. Time design. In *CHI'04 Extended Abstracts on Human Factors in Computing Systems* (Vienna, Austria, April 24–29, 2004). CHF04, eds. E. Dykstra-Erickson, and M. Tscheligi, 37–38. New York: ACM. DOI = <http://doi.acm.org/10.1145/985921.986208>.
- Hindus, D., S. D. Mainwaring, N. Leduc, A. E. Hagström, and O. Bayley. 2001. Casablanca: Designing social communication devices for the home. In *Proceedings of CHI 2001*, 325–332. New York: ACM Press.
- Howard, S., and J. Fabre, eds. 1998. Temporal aspects of usability. Special issue of *Interact Comput* 11(1): 1–105.
- HPL. 2010. HPL India: Innovations for the Next Billion Customers. http://www.hpl.hp.com/research/hpl_india_next_billion_customers/ (accessed May 1, 2010).
- Hughes, D., S. Gibson, J. Walkerdine, and G. Coulson. 2006. Is deviant behaviour the norm on P2P file-sharing networks? In *IEEE Distributed Systems Online*, February 2006, 7(2). <http://dsonline.computer.org> (accessed March 13, 2006).
- ICQ. 2001. ICQ. <http://www.icq.com/products/whatisicq.html> (accessed March 13, 2006).
- IEEE. 2001. IEEE 802.11 Working Group. <http://www.ieee802.org/11/> (accessed March 13, 2006).

- Ipng. 2001. IP Version 6 (IPv6), <http://playground.sun.com/pub/ipng/html> (accessed March 3, 2007).
- ISO/IEC7498. 1994. Information technology—Open Systems Interconnection—Basic Reference Model: The Basic Model. International Standards Organisation, <http://www.iso.org> (accessed March 3, 2007).
- JIL. 2010. Joint Innovation Lab. <http://www.jil.org/> (accessed May 1, 2010).
- John, B. E. 1990. Extensions of GOMS analyses to expert performance requiring perception of dynamic visual and auditory information. In Empowering People—Proceedings of CHI'90 Human Factors in Computer Systems, ed. J. C. Chew, and J. Whiteside, 107–115. New York: ACM Press.
- Johnson, C. 1997. What's the web worth? The impact of retrieval delays on the value of distributed information. In Workshop on Time and the Web, ed. D. Clarke, A. Dix, D. Ramduny, and D. Trepess. Staffordshire University, <http://www.hiraeth.com/conf/web97/papers/johnson.html> (accessed March 13, 2006).
- Johnson, C., and P. Gray, eds. 1996. Temporal aspects of usability, report of workshop in glasgow, June 1995. SIGCHI Bull 28(2):32–61. New York: ACM Press.
- JPEG. 2001. Joint Photographic Experts Group home page, <http://www.jpeg.org/public/jpeghomepage.htm> (accessed March 3, 2007).
- Kistler, J. J., and M. Satyanarayanan. 1992. Disconnected operation in the CODA file system. ACM Trans Comput Syst 10(1):3–25.
- Konstan, J. 2004. Introduction to recommender systems: Algorithms and evaluation. ACM Trans Inf Syst 22(1): 1–4. DOI = <http://doi.acm.org/10.1145/963770.963771>.
- Lavery, D., A. Kilgourz, and P. Sykeso. 1994. Collaborative use of X-Windows applications in observational astronomy. In People and Computers IX, ed. G. Cockton, S. Draper, and G. Wier, 383–396. Cambridge, UK: Cambridge University Press.
- Light, A., and I. Wakeman. 2001. Beyond the interface: Users' perceptions of interaction and audience on websites. In Interfaces for the Active Web (Part 1), ed. D. Clarke and A. Dix, Special Issue of *Interact Comput* 13(3):401–426. Amsterdam, The Netherlands: Elsevier.
- Lock, S., J. Allanson, and P. Phillips. 2000. User-driven design of a tangible awareness landscape. In Proceedings of Symposium on Designing Interactive Systems, ed. D. Boyarski, and W. Kellogg, 434–440. New York: ACM Press.
- Lock, S., P. Rayson, and J. Allanson. 2003. Personality engineering for emotional interactive avatars. In Human Computer Interaction, Theory and practice (Part II) , Volume 2 of the Proceedings of the 10th International Conference on Human-Computer Interaction, 503–507. Mahwah, NJ: Lawrence Erlbaum Associates.
- Mariani, J. A., and T. Rodden. (1991). The impact of CSCW on database technology. In Proceedings of ACM Conference on Computer Supported Cooperative Work (includes critique of 'transparency' in a CSCW setting). New York: ACM Press.
- Mauve, M. 2000. Consistency in replicated continuous interactive media. In Proceedings of CSCW'2000, 181–190. New York: ACM Press.
- McDaniel, S. E., and T. Brinck. 1997. Awareness in collaborative systems: A CHI 97 workshop (report). In SIGCHI Bulletin, 29(4). New York: ACM Press.
- McManus, B. 1997. Compensatory actions for time delays. In Workshop on Time and the Web, ed. D. Clarke, A. Dix, D. Ramduny, and D. Trepess. Staffordshire University, <http://www.hiraeth.com/conf/web97/papers/barbara.html> (accessed March 13, 2006).
- Millett, L. I., B. Friedman, and E. Felten. 2001. Cookies and web browser design: Toward informed consent online. In Proceedings of CHI2001, CHI Lett 3(I):446–452. New York: ACM Press.
- Mitsopoulos, E. 2000. A Principled Approach to the Design of Auditory Interaction in the Non-Visual User Interface. DPhil Thesis. University of York, UK. <http://www.cs.york.ac.uk/ftpdir/reports/YCST-2000-07.zip> (accessed March 3, 2007).
- Mozilla Labs. 2010. Weave: Personalized, rich experiences across the web. <https://mozilla-labs.com/weave/> (accessed May 1, 2010).
- MPEG. 2001. Moving Picture Experts Group home page, <http://www.cselt.it/mpeg/> (accessed March 3, 2007).
- mqtt.org. 2009. MQ Telemetry Transport, <http://mqtt.org/> (accessed November 10, 2009).
- NextBillion. 2010. Next Billion, <http://www.nextbillion.net/about> (accessed May 1, 2010).
- Olson, M., and S. Bly. 1991. The Portland experience: A report on a distributed research group. Int J Man Mach Stud 34(2): 11–228.
- O'Reilly, T. 2005. What is web 2.0: Design patterns and business models for the next generation of software, dated 30 Sept. 2005. <http://oreilly.com/web2/archive/what-is-web-20.html> (accessed May 1, 2010).
- Palfreyman, K., and T. Rodden. 1996. A protocol for user awareness on the world wide web. In Proceedings of CSCW'96, 130–139. New York: ACM Press.
- Patterson, J. F., M. Day, and J. Kucan. 1996. Notification servers for synchronous groupware. In Proceedings of CSCW'96, 122–129. New York: ACM Press.
- Pausch, R. 1991. Virtual reality on five dollars a day. In CHI'91 Conference Proceedings, ed. S. P. Robertson, G. M. Olson, and J. S. Olson, 265–270. Reading, MA: Addison Wesley.
- Ramduny, D., and A. Dix. 1997. Why, what, where, when: Architectures for co-operative work on the WWW. In Proceedings of HCI'97, ed. H. Thimbleby, B. O'Connail, and P. Thomas, 283–301. Berlin, Germany: Springer.
- Ramduny, D., A. Dix, and T. Rodden. 1998. Getting to know: The design space for notification servers. In Proceedings of CSCW'98, 227–235. New York: ACM Press.
- Resnick, P., and H. R. Varian, eds. 1997. Communications of the ACM Special Issue on Recommender Systems 40(3):556–589.
- Riedl, J., and P. Dourish. 2005. Introduction to the special section on recommender systems. ACM Trans Comput Hum Interact 12(3):371–373. DOI = <http://doi.acm.org/10.1145/1096737.1096738>.
- Rodden, T. 1996. Populating the application: A model of awareness for cooperative applications. In Proceedings of the 1996 ACM Conference on Computer-Supported Cooperative Work (CSCW'96), ed. M. S. Ackerman, 87–96. New York: ACM Press.
- Rohs, M., J. G. Sheridan, and R. Ballagas. 2004. Direct manipulation techniques for large displays using camera phones. In Proceedings of 2nd International Symposium on Ubiquitous Computing Systems (UCS2004). <http://www.equator.ac.uk/index.php/articles/113> (accessed March 3, 2007).
- Roussel, N. 1999. Beyond webcams and videoconferencing: Informal video communication on the web. In Proceedings of the Active Web. <http://www.hiraeth.com/conf/activeweb/> (accessed March 3, 2007).
- Roussel, N. 2001. Exploring new uses of video with videoSpace. In Proceedings of EHCI'01, the 8th IFIP Working Conference on Engineering for Human-Computer Interaction, Lecture Notes in Computer Science, 73–90. Berlin, Germany: Springer-Verlag.
- Sandor, O., C. Bogdan, and J. Bowers. 1997. Aether: An awareness engine for CSCW. In Proceedings of the Fifth European Conference on Computer Supported Cooperative Work (ECSCW'97), ed. J. Hughes, 221–236. Dordrecht, The Netherlands: Kluwer Academic.
- Sangha, A. 2001. Legal Implications of Location Based Advertising. Interview for the WAP Group. http://www.thewapgroup.com/53762_I.DOC (accessed March 3, 2007).

- Sarvas, R., E. Herrarte, A. Wilhelm, and M. Davis. 2004. Metadata creation system for mobile images. In Proceedings of Second International Conference on Mobile Systems, Applications, and Services (MobiSys2004), 36–48. New York: ACM Press.
- Schneier, B. 1996. Applied Cryptography. 2nd ed. New York: Wiley. This is the best single point for cryptography, encryption, authentication, digital signatures, including full algorithms and source code on CD-ROM.
- Semacode. 2006. Semacode. <http://semacode.org/> (accessed March 3, 2007).
- SETI@home. 2001. SETI@home—the search for extra-terrestrial intelligence, <http://setiathome.ssl.berkeley.edu/> (accessed March 3, 2007).
- Shneiderman, B. 1984. Response time and display rate in human performance with computers. *ACM Comput Surv* 16(3):265–286. New York: ACM Press.
- Siegal, D. 1999. Futurize Your Enterprise. New York: Wiley.
- Skype. 2006. Skype. <http://www.skype.com/> (accessed March 3, 2007).
- Stefik, M., D. G. Bobrow, G. Foster, S. Lanning, and D. Tatar. 1987. WYSIWIS revisited: Early experiences with multiuser interfaces. *ACM Trans Office Inf Syst* 5(2): 147–167.
- Stevens, W. R. 1998. UNIX Network Programming, Volume 1, Networking APIs: Sockets and XTI. Englewood Cliffs, NJ: Prentice Hall.
- Stevens, W. R. 1999. UNIX Network Programming, Volume 2, Interprocess Communications. 2nd ed. Englewood Cliffs, NJ: Prentice Hall.
- W. Richard Stevens' books are classics on Internet protocols and programming, <http://www.kohala.com/start/>
- Stifelman, L., B. Arons, and C. Schmandt. 2001. The Audio Notebook: Paper and pen interaction with structured speech. In Proceedings of CHI2001, CHI Lett 3(1): 182–189. New York: ACM Press.
- Sun, C., and C. Ellis. 1998. Operational transformation in realtime group editors: Issues, algorithms, and achievements. In Proceedings of CSCW'98, 59–68. New York: ACM Press.
- SUN Microsystems. 2001. Awarenex. <http://www.sun.com/research/features/awarenex/> (accessed March 3, 2007).
- Taylor, A., S. Izadi, L. Swan, R. Harper, and W. Buxton. 2006. Building Bowls for Miscellaneous Media. Physicality 2006 workshop, Lancaster University, 6–7 Feb. 2006. <http://www.physicality.org/> (accessed March 13, 2006).
- thePooch. 2006. ThePooch. <http://www.thepooch.com/> (accessed March 3, 2007).
- Tillotson, J. 2005. 'Scent Whisper,' Central Saint Martins College of Art & Design. Exhibited in SIGGRAPH CyberFashion 0100, 2005. <http://psymbiote.org/cyfash/2005/> (accessed March 3, 2007).
- Toye, E., A. Madhavapeddy, R. Sharp, D. Scott, A. Blackwell, and E. Upton. 2004. Using Camera-phones to Interact with Context-Aware Mobile Services, Technical Report UC AM-CL-TR-609, University of Cambridge, Computer Laboratory. Retrieved 3 March 2007 from <http://www.cl.cam.ac.uk/TechReports/UCAM-CL-TR-609.pdf> (accessed March 3, 2007).
- txteagle. 2009. Empowering the largest knowledge workforce on Earth, <http://txteagle.com/> (accessed July 2009).
- Vidot, N., M. Cart, J. Ferriz, and M. Suleiman. 2000. Copies convergence in a distributed real-time collaborative environment. In Proceedings of CSCW'2000, 171–180. New York: ACM Press.
- von Ahn, L., B. Maurer, C. McMillen, D. Abraham, and M. Blum. 2008. reCAPTCHA: Human-based character recognition via web security measures. *Science* 321: 1465–1468.
- W3C. 2010a. Web SQL Database (Editors Draft), <http://dev.w3.org/html5/webdatabase/> (accessed March 4, 2010).
- W3C. 2010b. Web Storage (Editors Draft), dated 4th March 2010. <http://dev.w3.org/html5/webstorage/> (accessed March 4, 2010).
- Wang, D., and A. Mah. 2010. Google Wave Operational Transformation, <http://www.waveprotocol.org/whitepapers/> operational-transform (accessed May 1, 2010).
- Wikipedia contributors. 2006. File sharing. Wikipedia, The Free Encyclopedia. http://en.wikipedia.org/w/index.php?title=File_sharing&oldid=34285993 (accessed March 3, 2007).
- WiMedia. 2006. WiMedia Alliance, <http://wimedia.org/> (accessed March 3, 2007).
- Wisneski, G., H. Ishii, A. Dahley, M. Gorbet, S. Brave, B. Ullmer, and P. Yarin. 1998. Ambient display: Turning architectural space into an interface between people and digital information. In Proceedings of the First International Workshop on Cooperative Buildings (CoBuild'98), Lecture Notes in *Comput Sci* 1370:22–32. Heidelberg: Springer-Verlag.
- Witten, I. H., H. W. Thimbleby, G. Couloris, and S. Greenberg. 1991. Liveware: A new approach to sharing data in social networks. *Int J Man Mach Stud* 34: 337–348.
- Xia, S., D. Sun, C. Sun, D. Chen, and H. Shen. 2004. Leveraging single-user applications for multi-user collaboration: The CoWord approach. In Proceedings of ACM 2004 Conference on Computer Supported Cooperative Work, 162–171. New York: ACM Press.
- Zigbee. 2006. ZigBee Alliance, <http://zigbee.org/> (accessed March 3, 2007).
- Zimmerman, T. G. 1996. Personal area networks: Near-field intrabody communication. *IBM Syst J* 35(3&4):609–617.

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- Anhalt, J., A. Smailagic, D. Siewiorek et al. 2001. Towards context aware computing. *IEEE Intell Syst* 6(3):38—46.
- Azuma, R. 1997. A survey of augmented reality. *Presence* 6(4):355–386.
- Bach-y-Rita, P., and S. Kercelz. 2003. Sensory substitution and the human–machine interface. *Trends Cogn Sci* 7(12):541–546.
- Barnard, L., J. S. Yi, J. A. Jacko, and A. Sears. 2005. An empirical comparison of use-in motion evaluation scenarios for mobile computing devices. *Int J Hum Comput Stud* 62: 487–520.
- Barnard, L., J. Yi, J. A. Jacko, and A. Sears. In press. Capturing the effects of context on human performance in mobile computing systems. To appear: *Personal and Ubiquitous Computing*.
- Blackwood, W. 1997. Tactical Display for Soldiers. Washington, DC: National Academy of Sciences.
- Bodine, K., and F. Gemperle. 2003. Effects of functionality on perceived comfort of wearables. In Proceedings of Seventh IEEE International Symposium on Wearable Computers, 557–560. Los Alamitos, CA: IEEE Computer Society Press.
- Borst, C., and V. Baiyya. 2009. A 2d haptic glyph method for tactile arrays: Design and evaluation. In *Proceedings of the World Haptics Conference* 599–604. IEEE Computer Society Press.
- Brown, L., S. Brewster, and H. Purchase. 2006. Multidimensional tactons for non-visual information presentation in mobile devices. In Proceedings of the 8th Conference on Human-Computer Interaction with Mobile Devices and Services, 231–238. Helsinki, Finland: ACM.

- Chen, H. -Y., J. Santos, M. Graves, K. Kim, and H. Tan. 2008 Tactor localization at the wrist. In *Proceedings of EuroHaptics*, 209–218. Madrid, Spain.
- Christakos, C. K. 1998. *Optimizing a Language Translation Application for Mobile Use*. Master's thesis, Carnegie Mellon University, Department of Electrical and Computer Engineering, Pittsburgh, PA.
- Clawson, J., K. Lyons, T. Starner, and E. Clarkson. 2005 The impacts of limited visual feedback on mobile text entry using the mini-QWERTY and Twiddler keyboards. In Proceedings of IEEE International Symposium on Wearable Computers 170–177. Osaka, Japan: IEEE Computer Society Press.
- Collins, C., L. Scadden, and A. Alden. 1977. Mobile studies with a tactile imaging device. In *Proceedings of the Fourth Conference on Systems & Devices For The Disabled*, Seattle, WA.
- Dimitrijevic, M., N. Soroker, and F. Pollo. 1996. Mesh glove electrical stimulation. *Sci Med* 3: 554–563.
- Feiner, S., B. MacIntyre, and D. Seligmann. 1993. Knowledge-based augmented reality. *Commun ACM* 36(7):552–562.
- Frederking, R. E., and R. Brown. 1996. The Pangloss-lite machine translation system: Expanding MT horizons. In Proceedings of the Second Conference of the Association for Machine Translation in the Americas, 268–272. Montreal, Canada: AMTM Press.
- Gemperle, F., C. Kasabach, J. Stivoric, B. Bauer, and R. Martin. 1998. Design for wearability. In Second International Symposium on Wearable Computers, 116–122. Pittsburgh, PA: IEEE Computer Society Press.
- Gilson, R., E. Redden, and L. Elliot, eds. 2007. *Remote Tactile Displays for Future Soldiers*. Army Research Laboratory Technical Report ASL-SR-0152.
- Guyton, A. 1991. Basic Neuroscience and Anatomy. Philadelphia, PA: W.B. Saunders Co.
- Hoggan, E., S. Brewster, and J. Johnston. 2008. Investigating the effectiveness of tactile feedback for mobile touchscreens. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 1573–1582. Florence, Italy: ACM Press.
- Huang, K., D. Kohlsdorf, T. Starner, C. Ahlrichs, L. Ruediger, D. Do, and G. Weinberg. 2010. Mobile music touch: Mobile tactile stimulation for passive learning. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 791–800. Atlanta, GA: ACM Press.
- Just, M., Carpenter, P., Keller, T., Emery, L., Zajac, H., Thulborn, K. 2001. Interdependence of nonoverlapping cortical systems in dual cognitive tasks. *Neruolimage*, 14, 417–426.
- Kaczmarek, K., J. Webster, P. Bach-Y-Rita, and W. Tompkins. 1991. Electrotactile and vibrotactile displays for sensory substitution systems. *IEEE Trans Biomed Eng* 38: 1–16.
- Kollmorgen, G. S., D. Schmorow, A. Kruse, and J. Patrey. 2005. The cognitive cockpit-state of the art human–system integration. In Proceedings of 2005 Interservice/Interindustry Training Simulation and Education Conference, Arlington, VA: DARPA.
- Krause, A., A. Smailagic, and D. P. Siewiorek. 2006. Context-aware mobile computing: Learning context-dependent personal preferences from a wearable sensor array. *IEEE Trans Mob Comput* 5(2): 113–127.
- Krum, D. 2004. Wearable computers and spatial cognition. Ph.D Thesis, Georgia Institute of Technology, Atlanta, GA.
- Laramée, R., and C. Ware. 2002. Rivalry and interference with a head mounted display. *ACM Trans Comput Hum Interface* 9(3):238–251.
- Lee, S. 2010. Buzzwear: Supporting multitasking with wearable tactile displays on the wrist. Unpublished doctoral diss., Georgia Institute of Technology, School of Interative Computing, Atlanta, GA.
- Lee, S., and T. Starner. 2010. BuzzWear: Alert perception in wearable tactile displays on the wrist. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 433–442. Atlanta, GA: ACM Press.
- Li, K. F., H. W. Hon, M. J. Hwang, and R. Reddy. 1989. The Sphinx speech recognition system. In Proceedings of the IEEE ICASSP, 170–177. Los Alamitos, CA: IEEE Computer Society Press.
- Lindeman, R., J. Sibert, E. Mendez-Mendez, S. Patil, and D. Phifer. 2005. Effectiveness of directional vibrotactile cuing on a building-clearing task. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 271–280. Portland, Oregon: ACM Press.
- Liu, H. -Y., R. Cooper, R. Cooper, A. Smailagic, D. Siewiorek, D. Ding, and F. C. Chuang. 2010. Seating virtual coach: A smart reminder for power seat function usage. *Technol Disabil* 21(4):441–448.
- Lyons, K., C. Skeels, T. Starner, B. Snoeck, B. Wong, and D. Ashbrook. 2004. Augmenting conversations using dual-purpose speech. In *Proceedings of User Interface and Software Technology*, 237–46. Montreal, Canada.
- Lyons, K., and T. Starner. 2001. Mobile capture for wearable computer usability testing. In Proceedings of International Symposium on Wearable Computers, 170–177. Zurich, Switzerland: IEEE Computer Society Press.
- Lyons, K., T. Starner, and D. Plaisted. 2004. Expert typing using the twiddler one handed chord keyboard. In *Proceedings of the IEEE International Symposium on Wearable Computers*, 94–101. Montreal, Canada.
- Markow, T., K. Ramakrishnan, K. Huang, T. Starner, S. Eicholts, Garrett, H. Profita, A. Scarlata, C. Schooler, A. Tarun, D. Backus. 2010. Mobile Music Touch: Vibration Stimulus as a Possible Hand Rehabilitation Method. In Proceedings of Pervasive Computing Technologies for Healthcare, Munich, Germany.
- Martin, T. 1999. *Balancing Batteries, Power, and Performance: System Issues in CPU Speed-Setting for Mobile Computing*. PhD Thesis, Carnegie Mellon University, Department of Electrical and Computer Engineering, Pittsburgh, PA, USA.
- Melzer, J., and K. Moffitt. 1997. Head mounted displays: Designing for the user. New York: McGraw-Hill.
- Ockerman, J. 2000. *Task Guidance and Procedure Context: Aiding Workers in Appropriate Procedure Following*. Technical Report, Georgia Institute of Technology, Atlanta, GA.
- Oulasvirta, A., S. Tamminen, V. Roto, and J. Kuorelahit. 2005. Interaction in 4-second bursts: The fragmented nature of attentional resources in mobile HCI. In Proceedings of SIGCHI Conference on Human Factors in Computing Systems, 919–928. ACM Press.
- Ravishankar, M. 1996. Efficient Algorithms for Speech Recognition. PhD thesis, Carnegie Mellon University, School of Computer Science, Pittsburgh, PA, USA.
- Reilly, D. 1998. Power Consumption and Performance of a Wearable Computing System. Masters thesis, Carnegie Mellon University, Electrical and Computer Engineering Department, Pittsburgh, PA, USA.
- Sears, A., M. Lin, J. Jacko, and Y. Xiao. 2003. When computers fade: Pervasive computing and situationally-induced impairments and disabilities. In Proceedings of HCII 2003, 1298–1302. Amsterdam, The Netherlands: Elsevier.
- Siewiorek, D. P. 2002. Issues and challenges in ubiquitous computing: New frontiers of application design. *Commun ACM* 45(12):79–82.
- Siewiorek, D.P., A. Smailagic, L. Bass, J. Siegel, R. Martin, and A. Bennington. 1998. Adtranz: A mobile computing system for maintenance and collaboration. In Proceedings of the 2nd IEEE International Conference on Wearable Computers, 225–232. Pittsburgh, PA: IEEE Computer Society Press.

- Siewiorek, D. P., A. Smailagic, and J. C. Lee. 1994. An interdisciplinary concurrent design methodology as applied to the Navigator wearable computer system. *J Comput Softw Eng* 2(2):259–292.
- Smailagic, A. 1997. ISAAC: A voice activated speech response system for wearable computers. In *Proceedings of the IEEE International Conference on Wearable Computers*, 183–184. Cambridge, MA: IEEE Computer Society Press.
- Smailagic, A., and D. Siewiorek. 1993. A case study in embedded system design: The VuMan 2 wearable computer. *IEEE Des Test Comput* 10(3):56–67.
- Smailagic, A., and D. P. Siewiorek. 1994. The CMU mobile computers: A new generation of computer systems. In *Proceedings of the IEEE COMPCON 94*, 467–473. Los Alamitos, CA: IEEE Computer Society Press.
- Smailagic, A., and D. Siewiorek. 1996. Modalities of interaction with CMU wearable computers. *IEEE Pers Commun* 3(1): 14–25.
- Smailagic, A., D. P. Siewiorek, R. Martin, and J. Stivoric. 1998. Very rapid prototyping of wearable computers: A case study of VuMan 3 custom versus off-the-shelf design methodologies. *J Des Autom Embed Syst* 3(2–3):219–232.
- Smailagic, A., D. P. Siewiorek, and D. Reilly. 2001. CMU wearable computers for real-time speech translation. *IEEE Pers Commun* 8(2):6–12.
- Smailagic, A., D. P. Siewiorek, Maurer, U., Rowe, A., Tang, K. 2005. eWatch: Context Sensitive System Design Case Study, *Proceedings of IEEE Conference of VLSI*, IEEE Computer Society Press, Orlando, FL.
- Starner, T. 2001. The challenges of wearable computing: Part 1+2. *IEEE Micro* 21(4):44–67.
- Starner, T., C. Snoeck, B. Wong, and R. McGuire. 2004. Use of mobile appointment scheduling devices. In *Proceedings of ACM Conference Human Factors in Computing Systems*, 101–104. Vienna, Austria: ACM Press.
- Stein, R., S. Ferrero, M. Hetfield, A. Quinn, and M. Krichever. 1998. Development of a commercially successful wearable data collection system. In *Proceedings of IEEE International Symposium on Wearable Computers*, 18–24. Pittsburgh, PA: IEEE Computer Society Press.
- Velger, M. 1998. *Helmet-Mounted Displays and Sights*. Norwood, MA: Artech House, Inc.
- Wickens, C. D., and J. Hollands. 1999. *Engineering Psychology and Human Performance*. 3rd ed. Englewood Cliffs, NJ: Prentice Hall.

Design of Fixed, Portable, and Mobile Information Devices

- Albers, M., and L. Kim. 2002. Information design for small-screen interface: An overview of web design issues for personal digital assistants. *Tech Commun* 49(1):45–60.
- Andersen, P., A.-M. Lindgaard, M. Prgomet, N. Creswick, and J. I. Westbrook. 2009. Mobile and fixed computer use by doctors and nurses on hospital wards: Multi-method study on the relationships between clinician role, clinical task, and device choice. *J Med Int Res* 11(3):e32.
- Andersson, B. J. G., and R. Ortengreen. 1974. Lumbar disc pressure and myoelectric back muscle activity. *Scand J Rehabil Med* 3: 115–121.
- ANSI/HFES. 1988. *American National Standard for Human Factors Engineering of Visual Display Terminal Workstations* (ANSI/ HFS Standard No. 100–1988). Santa Monica, CA: The Human Factors Society.
- ANSI/HFES. 2007. *American National Standard for Human Factors Engineering of Computer Workstations* (ANSI/HFS Standard No. 100–2007). Santa Monica, CA: The Human Factors Society.
- Bergqvist, U. O. 1984. Video display terminals and health: A technical and medical appraisal of the state of the art. *Scand J WorkEnviron Health* 10(Suppl 2):87.
- Bernard, P. B. 1997. Musculoskeletal Disorders and Workplace Factors DHHS (NIOSH) Publication No. 97–141. Washington, DC: National Technical Information Service.
- Boyce, P. 2006. Illumination. In *Handbook of Human Factors and Ergonomics*, 3rd ed., ed. G. Salvendy, 643–669. Hoboken, NJ: John Wiley & Sons, Inc.
- BSR/HFES. 2005. *Human Factors Engineering of Computer Workstations* (BSR/HFES-100). Santa Monica, CA: The Human Factors and Ergonomics Society.
- Cakir, A., D. J. Hart, and T. F. M. Stewart. 1979. The VDT Manual. Darmstadt, Germany: Inca-Fiej Research Association.
- Carayon, P., and M. J. Smith. 2000. Work organization and ergonomics. *Appl Ergon* 31: 649–662.
- Carayon, P., M. J. Smith, and M. C. Haims. 1999. Work organization, job stress, and work-related musculoskeletal disorders. *Hum Factors* 41: 644–663.
- Carayon, P., P. Smith, A. S. Hundt, V. Kuruchittham, and Q. Li. 2009. Implementation of an electronic health records system in a small clinic. *Behav Inf Technol* 28(1):5–20.
- Casali, J. G. 2006. Sound and noise. In *Handbook of Human Factors and Ergonomics*, 3rd ed., ed. G. Salvendy, 612–642. Hoboken, NJ: John Wiley & Sons, Inc.
- CDC. 2003. *Third National Health and Nutrition Examination Survey (NHANES III) 1988–94*. Atlanta, GA: Centers for Disease Control, www.cdc.gov.
- Cohen, W. J., C. A. James, A. D. Taveira, B. Karsh, J. Scholz, and M. J. Smith. 1995. Analysis and design recommendations for workstations: A case study in an insurance company. In *Proceedings of the Human Factors and Ergonomics Society 39th Annual Meeting*, 1, 412–416. San Diego, CA: Human Factors and Ergonomics Society.
- Dainoff, M. J. 1982. Occupational stress factors in visual display terminal (VDT) operation: A review of empirical research. *Behaviour and Information Technology* 1(2): 141–176.
- Derjani-Bayeh, A. and M. J. Smith. 1999. Effects of physical ergonomics on VDT workers' health: A longitudinal intervention study in a service organization. *International Journal of Human Computer Interaction* 11(2):109–135.
- Eltayeb, S. M., J. B. Staal, A. A. Hassan, S. S. Awad, and R. A. de Bie. 2008. Complaints of the arm, neck and shoulder among computer office workers in Sudan: A prevalence study with validation of an Arabic risk factor questionnaire. *Environ Health* 7:33–.
- Eltayeb, S., J. B. Staal, A. Hassan, and R. A. de Bie. 2009. Work related risk factors for neck, shoulder and arm complaints: A cohort study among Dutch computer office workers. *J Occup Rehabil* 19(4):315–322.
- Eltayeb, S., J. B. Staal, J. Kennes, P. H. Lamberts, and R. A. de Bie. 2007. Prevalence of complaints of arm, neck and shoulder among computer office workers and psychometric evaluation of a risk factor questionnaire. *BMC Musculoskelet Disord* 8:68–.

- Feyer, A. M., P. Herbison, A. M. Williamson, I. de Silva, J. Mandryk, L. Hendrie et al. 2000. The role of physical and psychological factors in occupational low back pain: A prospective cohort study. *Occup Environ Med* 57(2): 116–120.
- Gerr, F., M. Marcus, C. Ensor, D. Kleinbaum, S. Cohen, A. Edwards, E. Gentry, D. J. Ortiz, and C. Monteilh. 2002. A prospective study of computer users: I. Study design and incidence of musculoskeletal symptoms and disorders. *Am J Ind Med* 41(4):221–235.
- Gerr, F., M. Marcus, C. Monteilh, L. Hannan, D. Ortiz, and D. Kleinbaum. 2005. A randomized controlled trial of postural interventions for prevention of musculoskeletal symptoms among computer users. *Occup Environ Med* 62(7):478–487.
- Grandjean, E. 1979. Ergonomical and Medical Aspects of Cathode Ray Tube Displays. Zurich, Switzerland: Federal Institute of Technology.
- Grandjean, E. 1980. Ergonomics of VDUs: Review of present knowledge. In *Ergonomics Aspects of Visual Display Terminals*, ed. E. Grandjean and E. Vigliani, 1–12. London, England: Taylor & Francis, p. 1–12.
- Grandjean, E. 1987. Design of VDT workstations. In *Handbook of Human Factors*, ed. G. Salvendy, 1359–1397. New York: John Wiley and Sons.
- Green, R. A., and C. A. Briggs. 1989. Effect of overuse injury and the importance of training on the use of adjustable workstations by keyboard operators. *J Occup Med* 31: 557–562.
- Gunnarsson, E., and O. Ostberg. 1977. *Physical and Emotional Job Environment in a Terminal-Based Data System* (1977:35). Stockholm, Sweden: Department of Occupational Safety, Occupational Medical Division, Section for Physical Occupational Hygiene.
- Hagberg, M., B. Silverstein, R. Wells, M. J. Smith, H. Hendrick, P. Carayon, and M. Peruse. 1995. Work Related Musculoskeletal Disorders (WRMSDs): A Reference Book for Prevention. London, England: Taylor & Francis.
- Haggerty, B., and P. Tarasewich. 2005. A new stylus-based method for text entry on small devices. In *Proceedings of the 11th International Conference on Human-Computer Interaction*, Vol. 4, Las Vegas, July 22–27, 2005. Mahwah, NJ: Lawrence Erlbaum Associates.
- HCII. 2005. *Proceedings of the 11th International Conference on Human-Computer Interaction*, July 23–27, 2005, Las Vegas. Mahwah, NJ: Lawrence Erlbaum Associates.
- HCII. 2007. *Proceedings of the 12th International Conference on Human-Computer Interaction*, LNCS 4550–4566, July 22–27, 2007, Beijing, China. Berlin and Heidelberg: Springer.
- HCII. 2009. *Proceedings of the 13th International Conference on Human-Computer Interaction*, LNCS 5610–5624, LNAI 5638–5639, July 19–24, San Diego, CA. Berlin and Heidelberg: Springer.
- HCII. 2011. *Proceedings of the 14th International Conference on Human-Computer Interaction*, July 9–14, 2011, Orlando, FL. Berlin and Heidelberg: Springer.
- Hendrick, H. 1986. Macroergonomics: A conceptual model for integrating human factors with organizational design. In *Human Factors in Organizational Design and Management*, ed. O. Brown, and H. Hendrick, 467–477. Amsterdam, the Netherlands: Elsevier Science Publishers.
- Hignett, S. 2007. Physical ergonomics in health care. In *Handbook of Human Factors and Ergonomics in Health Care and Patient Safety*, ed. P. Carayon, 309–321. Mahwah, NJ: Lawrence Erlbaum Associates.
- Hinckley, K. 2008. Input Technologies and Techniques. In *The Human-Computer Interaction Handbook*, 2nd ed., ed. A. Sears and J. A. Jacko, 161–176. New York: Lawrence Erlbaum Associates, Taylor & Francis Group.
- Hirose, M., and K. Hirota. 2005. PUI (Perceptual User Interface). In *Proceedings of the 11th International Conference on Human-Computer Interaction*, Volume 5, Las Vegas [Electronic publication]. Mahwah, NJ: Lawrence Erlbaum Associates.
- Hultgren, G., and B. Knave. 1973. Contrast blinding and reflection disturbances in the office environment with display terminals. *Arbete Och Halsa*.
- Lai, J., C.-M. Karat, and N. Yankelovich. 2008. Conversational speech interfaces and technologies. In *The Human-Computer Interaction Handbook*, 2nd ed., ed. A. Sears and J. A. Jacko, 381–391. New York: Lawrence Erlbaum Associates, Taylor & Francis Group.
- Lawler, E. E. 1986. High-Involvement Management. San Francisco, CA: Jossey-Bass Publishers.
- Mandal, A. C. 1982. The correct height of school furniture. *Hum Factors* 24(3):257–269.
- Marcus, M., F. Gerr, C. Monteilh, D. J. Ortiz, E. Gentry, S. Cohen, A. Edwards, C. Ensor, and D. Kleinbaum. 2002. A prospective study of computer users: II. Potential risk factors for musculoskeletal symptoms and disorders. *Am J Ind Med* 41(4):236–249.
- Myers, B. A., and J. O. Wobbrock. 2005. Text input to handheld devices for people with physical disabilities. In *Proceedings of the 11th International Conference on Human-Computer Interaction*, Vol. 4, Las Vegas, July 22–27, 2005. Mahwah, NJ: Lawrence Erlbaum Associates, electronic publication.
- Nachemson, A., and G. Elfstrom. 1970. Intravital dynamic pressure measurements in lumbar discs. *Scand J Rehabil Med (Suppl 1)*: 1–38.
- NAS. 1983. *Video Terminals, Work and Vision*. Washington, DC: National Academy Press.
- Noro, K. 1991. Concepts, methods and people. In *Participatory Ergonomics*, ed. K. Noro, and A. Imada, 3–29. London, England: Taylor & Francis.
- OSHA. 2008. Computer Workstations eTool. Washington, DC: Occupational Safety and health Administration, www.osha.gov/SLTC/etools/computerworkstations/.
- Ostberg, O. 1975. Health problems for operators working with CRT displays. *Int J Occup Health Saf* 6: 24–52.
- Robertson, M. 2007. Health and performance consequences of office ergonomic interventions among computer workers. In *Ergonomics and Health Aspects* (LNCS 4566), ed. M. J. Dainoff, 135–143. Berlin and Heidelberg: Springer-Verlag.
- Robertson, M., E. Huang, and N. Larson. 2009. Examining the effects of workstation design satisfaction. Computer usage, supervisory and co-worker support on perceived physical discomfort and psychosocial factors. In *Ergonomics and Health Aspects* (LNCS 5624), ed. B.-T. Karsh, 88–94. Berlin and Heidelberg: Springer-Verlag.
- Saito, S., B. Piccoli, M. J. Smith, M. Sotoyama, G. Sweitzer, M. B. G. Villanuela and R. Yoshitake. 2000. Ergonomics Guidelines for using notebook personal computers. *Industrial Health* 38: 421–434.
- Smith, M. J. 1984. Health issues in VDT work. In *Visual Display Terminals*, ed. J. Bennet, D. Case, J. Sandlin, and M. J. Smith, 193–228. Upper Saddle River, NJ: Prentice Hall.
- Smith, M. J. 1987. Mental and physical strain at VDT workstations. *Behav Inf Technol* 6(3):243–255.
- Smith, M. J. 1997. Psychosocial aspects of working with video display terminals (VDT's) and employee physical and mental health. *Ergonomics* 40(10):1002–1015.
- Smith, M. J., and P. Carayon. 1995. New technology, automation and work organization: Stress problems and improved technology implementation strategies. *Int J Hum Factors Manuf* 5: 99–116.

- Smith, M. J., P. Carayon, and W. Cohen. 2003. Design of computer workstations. In *The Human-Computer Interaction Handbook*, ed. J. Jacko, and A. Sears, 384–395. Mahwah, NJ: Lawrence Erlbaum Associates.
- Smith, M. J., P. Carayon, and W. J. Cohen. 2008. Design of computer workstations. In *The Human-Computer Interaction Handbook*, 2nd ed., ed. A. Sears and J. Jacko, 313–326. New York: Lawrence Erlbaum Associates, Taylor & Francis Group.
- Smith, M. J., and W. J. Cohen. 1997. Design of Computer Terminal Workstations. In *Handbook of Human Factors and Ergonomics*, 2nd ed., ed. G. Salvendy, 1337–1388. New York: John Wiley & Sons.
- Smith, M. J., B. G. F. Cohen, L. Stammerjohn, and A. Happ. 1981. An investigation of health complaints and job stress in video display operations. *Hum Factors* 23(4):387–400.
- Smith, M. J., and A. Derjani-Bayeh. 2003. Do ergonomic improvements increase computer workers' productivity? An intervention study in a call center. *Ergonomics* 46(1):3–18.
- Smith, M. J., and P. C. Sainfort. 1989. A balance theory of job design for stress reduction. *Int J Ind Ergon* 4: 67–79.
- Smith, M. J., L. Stammerjohn, B. Cohen, and N. Lalich. 1980. Video display operator stress. In *Economic Aspects of Visual Display Terminals*, ed. E. Grandjean, and E. Vigliani, 201–210. London, England: Taylor & Francis.
- Stead, W. W., and H. S. Lin. 2009. *Computational Technology for Effective Health Care: Immediate Steps and Strategic Directions*. Committee on Engaging the Computer Science Research Community in Health Care Informatics, National Research Council. Washington, DC: National Academy Press.
- WorkSafeBC. 2009. *How to Make Your Computer Workstation Fit You*. Vancouver, BC: Worker's Compensation Board of British Columbia. www.WorkSafeBC.com/publications/health_and_Safety/by_topic/assets/pdf/comptr_wrkstn.pdf.

Visual Design Principles for Usable Interfaces

- Berry, J. D., ed. 2004. *Now Read This: The Microsoft Clear Type Font Collection*, 15–17, 61–69. Microsoft Corporation.
- Bringhurst, R. 2005. *The Elements of Typographic Style*, 17–24. Point Roberts, WA: Hartley & Marks Publishers.
- Craig, J. et al. 2006. *Designing with Type: The Essential Guide to Typography*, 23–26. New York: Watson-Guptill Publication.
- Dair, C. 1967. *Design with Type*, 49–70. Toronto, ON: University of Toronto Press.
- Davis, M., P. Hawley, B. McMullan, and G. Spilka. 1997. *Design as a Catalyst for Learning*, 3–12. Alexandria, VA: Association for Supervision and Curriculum Development.
- Donis, D. A. 1973a. *A Primer of Visual Literacy*, ix. Cambridge, MA: MIT Press.
- Donis, D. A. 1973b. *A Primer of Visual Literacy*, 22–23. Cambridge, MA: MIT Press.
- Felici, J. 2003. *The Complete Manual of Typography: A Guide to Setting Perfect Type*, 29. Berkeley, CA: Peachpit Press.
- Meggs, P. B. 1998. *A History of Graphic Design*, 363. New York: John Wiley & Son.
- Re, M., ed. 2002a. Reading Matthew Carter's letters. In *Typographical Speaking: The Art of Matthew Carter*, 20. Baltimore, MD: Albin O. Kuhn Library & Gallery.
- Re, M., ed. 2002b. Reading Matthew Carter's letters. In *Typographical Speaking: The Art of Matthew Carter*, 23. Baltimore, MD: Albin O. Kuhn Library & Gallery.
- Re, M., ed. 2002c. Reading Matthew Carter's letters. "Type Vocabulary." In *Typographical Speaking: The Art of Matthew Carter*, 82. Baltimore, MD: Albin O. Kuhn Library & Gallery.
- Spencer, H. 1969. *The Visible Word*. New York: Hastings House.
- Tracy, W. 1986. *Letters of Credit: A View of Type Design*, 30–31. Boston, MA: David R. Godine Publisher.

Globalization, Localization, and Cross-Cultural User-Interface Design

- Adler, N. J. 2002. *International Dimensions of Organizational Behavior*. 4th ed. New York: Southwestern.
- American Institute of Graphic Arts (AIGA). 1981. *Symbol Signs*. New York: Visual Communication Books, Hastings House.
- Associated Press. 2001. Saudi Arabia issues edict against Pokemon. *San Francisco Chronicle*, March 27, F2.
- Aykin, N. 2000. (personal communication, 12 March 2000).
- Aykin, N., ed. 2005. *Usability and Internationalization of Information Technology*. Mahwah, NJ: Lawrence Erlbaum.
- Aykin, N., and A. E. Milewski. 2005. Practical issues and guidelines for international information display. In *Usability and Internationalization of Information Technology*, ed. N. Aykin, 221–250. Mahwah, NJ: Lawrence Erlbaum.
- Barboza, D. 2006. The rise of Baidu (That's Chinese for Google). *The New York Times*, nytimes.com (accessed June 25, 2010).
- BBC News. 2001. Saudi Arabia bans Pokemon. *BBC News*. http://news.bbc.co.uk/2/hi/middle_east/1243307.stm (accessed June 25, 2010).
- Carroll, J. M. 1999. Using design rationale to manage culture-bound metaphors for international user interfaces. In *Proceedings of the International Workshop on Internationalization of Products and Services (IWIPS)*, 125–131. Rochester, NY.
- Chavan, A. L. 1994. A Design Solution Project on Alternative Interface for MS Windows. Unpublished master's thesis. London, UK: Royal College of Ave.
- Chavan, A. L. 2005. Another culture, another method. In *Proceedings of the 11th Human Computer Interaction International Conference*. Las Vegas, NV: CD-ROM.
- China Hush. 2010. "Why Renren is better than Facebook", 5 April 2010. <http://www.chinahush.com/2010/04/05/why-renren-is-better-than-facebook/> (accessed October 5, 2011).
- Chinese Culture Connection. 1987. Chinese values and the search for culture-free dimensions of culture. *J Cross Cult Psychol* 18: 143–164.
- Chiu, L. H. 1972. A cross-cultural comparison of cognitive styles in Chinese and American children. *Int J Psychol* 7: 235–242.

- Choong, Y., and G. Salvendy. 1999. Implications for design of computer interfaces for Chinese users in mainland China. *Int J Hum Comput Interact* 11(1):29–46.
- Clausen, C. 2000. *Faded Mosaic: The Emergence of Post-Cultural America*. Chicago, IL: Ivan R. Dee Publisher.
- Death Penalty News. 2010. Saudi Arabia: Lebanese national sentence to death for sorcery. 18 March, 2010. <http://deathpenaltynews.blogspot.com/2010/03/saudi-arabia-lebanese-national.html>.
- del Galdo, E. M., and J. Nielsen. 1996. *International User Interfaces*. New York: John Wiley.
- Dong, Y. 2007. A cross-cultural comparative study on users' perception of the webpage: With the focus on cognitive style of Chinese, korean and american. Masters Thesis. Korea Advanced Institute of Science and Technology, Daejeon, South Korea.
- Fernandes, T. 1995. *Global Interface Design: A Guide to Designing International User Interfaces*. Boston, MA: AP Professional.
- Ferraro, G. 2006. *The Cultural Dimension of International Business*. 5th ed. Upper Saddle River, NJ: Pearson Prentice Hall.
- Forrester Research, Inc. 1998. *JIT web localization*, forrester.com (accessed July 4, 1998).
- Forrester Research, Inc. 2001. *The Global User Experience*. Cambridge, MA: Forrester Research, Inc.
- Forrester Research, Inc. 2009. *Translation and Localization of Retail Web SitesMaximizing the International Experience through Tailored Offerings*. http://forrester.com/rb/Research/translation_and_localization_of_retail_web_sites/q/id/54629/t/2 (accessed June 25, 2010).
- Frandsen-Thorlacius, O., et al. 2009. Non-universal usability? A survey of how usability is understood by Chinese and Danish users. In Proc. ACM Conf SIG Human-Computer Interaction, 41–58. Boston, MA.
- Friedman, T. L. 2005. *The World is Flat: A Brief History of the Twenty-First Century*. New York: Farrar, Staus, and Giroux.
- Gardner, H. 1985. *Frames of Mind, the Theory of Multiple Intelligences*. New York: Basic Books.
- Gisèle Foucault. 2010. Personal interview with Emilie Gould, 12 March 2010.
- Goode, E. 2000. How culture molds habits of thought. *New York Times*, August 8, D1ff.
- Gould, E. W. 2001. More than content: Web graphics, crosscultural requirements, and a visual grammar. In Proceedings of the Ninth International Conference on Human Computer Interaction 2001 (HCI 2001), Vol. 2, 506–509. New Orleans, LA.
- Gould, E. W. 2005. Synthesizing the literature on cultural values. In *Usability and Internationalization of Information Technology*, ed. N. Aykin, 79–121. Mahwah, NJ: Lawrence Erlbaum.
- Gould, E. W. 2007. "Only famous companies I would ever buy": Understanding how people learn to trust web sites. In Proceedings of the 12th HCI International Conference. Beijing, China. Heidelberg: Springer. [Electronic version]
- Gould, E. W. 2009. Intercultural usability surveys: Do people always tell "the truth"? In Proceedings of the 13th Human Computer Interaction International Conference. San Diego, CA: CD-ROM.
- Gould, E. W., N. Zakaria, and S. A. M. Yusof. 2000. Applying culture to website design: A comparison of Malaysian and US websites. In Proceedings of 2000 Joint IEEE International and 18th Annual Conference on Computer Documentation (IPCC/SIGDOC 2000), 161–171. New York: IEEE Press.
- Hall, E. T. 1976. *Beyond Culture*. New York: Anchor Books.
- Helft, M. and D. Barboza. 2010. Google shuts China site in dispute over censorship. *The New York Times*, 23 March 2010, A1.
- Hendrix, A. 2001. The nuance of language. *San Francisco Chronicle*, April 15, A10.
- Herskovitz, J. 2000. I-Pop takes off: Japanese music, movies, TV shows enthrall Asian nations. *San Francisco Chronicle*, December 26, C2.
- Hoffman, P. 2010. UPA Professional Conference. Munich, Germany. May 24–28, 2010.
- Hofstede, G. 1997. *Cultures and Organizations: Software of the Mind, Intercultural Cooperation and Its Importance for Survival*. New York: McGraw-Hill.
- Honold, P. 1999. Learning how to use a cellular phone: Comparison between German and Chinese users. *J Soc Tech Commun* 46: 196–205.
- International Organization for Standardization. 1989. Computer Display Color (Draft Standard Document 9241–8). Geneva, Switzerland: Author.
- International Standards Organization. 1990. ISO 7001: Public Information Symbols. Geneva, Switzerland: The American National Standards Institute (ANSI).
- International Standards Organization. 1998. ISO 9241–11: Ergonomic requirements for office work with visual display terminals (VDTs)—Part 11: Guidance on usability. iso.org/iso/iso_catalogue (accessed June 25, 2010).
- ISO (International Standards Organization). 2010. ISO/IEC 8859-1:1998 Information technology—8-bit single-byte coded graphic character sets—Part 1: Latin alphabet No. 1. iso.org (accessed June 25, 2010).
- Jain, J. 2010. InfoPal: A system for conducting and analyzing multimodal diary studies. In *Proceedings of the Usability Professionals Association, Annual Conference*, May 27, Munich, Germany, in preparation.
- Kim, J. H., & K. P. Lee. 2007. Culturally adapted mobile phone interface design: Correlation between categorization style and menu structure. MobileHCI '07: Proceedings of the 9th international conference on Human computer interaction with mobile devices and services, 379–382. New York: ACM Press.
- Kim, J., and J. Y. Moon. 1998. Designing towards emotional usability in customer interfaces: Trustworthiness of cyber-banking system interfaces. *Interact Comput* 10: 1–29.
- Knight, N., and R. E. Nisbett. 2007. Culture, class, and cognition: Evidence from Italy. *J Cogn Cult* 7: 283–291.
- Kuhn, A. 2005. Mulling workdays, weekends in Iraq. npr.org/templates/story/story.php?storyId=4540715 (accessed June 25, 2010).
- Kwintessential. 2010. *Text expansion or contraction in translation*. kwintessential.co.uk/translation/articles/expansion-retraction.html (accessed June 25, 2010).
- Lee, K. P. 2010. Culture, interface design, and design methods for mobile devices. In Marcus, A., Roibás, A. C., & Sala, R. (Eds.), *Mobile TV: Customizing content and experience*, 337–366. London: Springer.
- Letowt-Vorbeck, H. 2010. Mobile user experience: South Africa culture insights. In *Proceedings of the Usability Professionals Association, Annual Conference*, May 27, Munich, Germany, in preparation.
- Marcus, A. 1995. Principles of effective visual communication for graphical user interface design. In *Readings in Human-Computer Interaction*, ed. R. Baecker, J. Grudin, W. Buxton, and S. Greenberg, 2nd ed., 425–441. Palo Alto, CA: Morgan Kaufman.
- Marcus, A. 1998. Metaphor design in user interfaces. *J Comput Doc* 22: 43–57.
- Marcus, A. 2003. 12 myths of mobile UI design. *Software Development Magazine*, May, 38–40.

- Marcus, A. 2005. User interface design's return on investment: Examples and statistics. In Cost-Justifying Usability, Chapter 2 in ed. R. G. Bias and D. J. Mayhew, 2nd ed., 17–39. San Francisco, CA: Elsevier.
- Marcus, A. 2006. Cross-cultural user-experience design. In Diagrammatic Representation and Inference, Proc., 4th International Conference, Diagrams 2006, Stanford, CA, ed. D. Barker-Plummer, R. Cox, and N. Swoboda, 16–24. Berlin, Germany: Springer-Verlag.
- Marcus, A., and V. J. Baumgartner. 2004a. Mapping user interface design components vs. culture dimensions in corporate websites. *Visible Lang* 38(1): 1–65.
- Marcus, A., and V. J. Baumgartner. 2004b. A practical set of culture dimension for evaluating user interface designs. In Proceedings of the Sixth Asia-Pacific Conference on Computer-Human Interaction (APCHI 2004), 252–261. Rotorua, New Zealand.
- Marcus, A., and E. W. Gould. 2000. Crosscurrents: Cultural dimensions and global web user-interface design. *Interactions* 7(4):32–46.
- Masuda, T., and R. E. Nisbett. 2001. Attending holistically vs. analytically: Comparing the context sensitivity of Japanese and Americans. *Journal of Personality and Social Psychology* 81: 922–934.
- McSweeney, B. 2002. Hofstede's model of national cultural differences and their consequences: A triumph of faith-a failure of analysis. *Human Relations* 55(1):89–118.
- Nicol, G. 1994. *The Multilingual World Wide Web*. www.html.xml.coverpages.org/nicol-multi (accessed June 25, 2010).
- Nielsen, J., ed. 1990. Designing user interfaces for international use: Vol. 13. In *Advances in Human Factors/Ergonomics*. Amsterdam, the Netherlands: Elsevier Science.
- Nisbett, R. E. 2003. The Geography of thought: How Asians and Westerners Think Differently... and Why. New York: Free Press.
- Nisbett, R. E., and A. Norenzayan. 2002. Culture and cognition. In *Stevens' Handbook of Experimental Psychology*, Third Edition, Volume Two: Memory and Cognitive Processes, ed. D. Medin and H. Pashler. New York: John Wiley & Sons.
- Olgay, N. 1995. Safety Symbols Art. New York: Van Nostrand Reinhold.
- Ona, Y., and B. Spindle. 2000. Japan's long decline makes one thing rise: Individualism. *Wall Street Journal*, December 30, A1.
- Pierce, T. 1996. The International Pictograms Standard. Cincinnati, OH: S. T. Publications.
- Prensky, M. 2001a. Digital natives, digital immigrants. *Horizon* 9(5): 1–6. www.marcprensky.com/writing (accessed February 1, 2010).
- Prensky, M. 2001b. Digital natives, digital immigrants; Part II: Do they really think differently? *Horizon* 9(6): 1–9. www.marcprensky.com/writing (accessed February 1, 2010).
- Raby, M. 2007. Microsoft begins compliance with EU regulations. *TG Daily*, tgdaily.com/business-and-law-features/34471-microsoft-begins-compliance-with-eu-regulations (accessed June 25, 2010).
- Samovar, L. A., R. E. Porter, and E. R. McDaniel, eds. 2008. *Intercultural Communication: A Reader*. 12th ed. New York: Wadsworth.
- San Francisco Chronicle*. 2001. Saudi Arabia issues edict against Pokemon. March 27, F2.
- Schwartz, S. H. 1994. Beyond individualism/collectivism: New cultural dimensions of values. In *Individualism and Collectivism: Theory, Method, and Applications*, ed. U. Kim, H. C. Triandis, C. Kagitcibasi, S.-C. Choi, and G. Yoon, 85–119. Thousand Oaks, CA: Sage.
- Snopes.com. 2007. Come alive! snopes.com/business/misxlate/ancestor.asp (accessed June 25, 2010).
- Stephanidis, C., ed. 2000. *User Interfaces for All: Concepts, Methods, and Tools*. Boca Raton, FL: CRC Press.
- Stephanidis, C., ed. 2009. *The Universal Access Handbook (Human Factors and Ergonomics)*. Boca Raton, FL: CRC Press.
- Stille, A. 2002. *The Future of the Past*. New York: Farrar, Straus, and Giroux.
- Suchman, L. 1987. *Plans and Situated Actions: The Problem of Human-Machine Communication*. Cambridge: Cambridge University Press.
- Trompenaars, F., and C. Hampden-Turner. 1998. *Riding the Waves of Culture: Understanding Diversity in Global Business*. New York: McGraw-Hill.
- Unicode. 2010. CLDR—Unicode Common Locale Data Repository. cldr.unicode.org/ (accessed June 25, 2010).
- Victor, D. A. 1992. *International Business Communication*. New York: HarperCollins.
- Warschauer, M. 2003. *Technology and Social Inclusion: Rethinking the Digital Divide*. Cambridge, MA: MIT Press.
- Why Renren is better than Facebook. 2010. *China Hush, china-hush. com* (accessed June 25, 2010).
- Yardley, J. 2000. Faded mosaic nixes idea of "cultures." *U.S. San Francisco Examiner*, August 7, B3.
- You, I. K. 2009. *Cognitive Style and Its Effects on Generative Session Comparing Korean and European Participants*. Unpublished master's thesis. Daejeon, KR: KAIST (Korea Advanced Institute of Science and Technology).
- ACM/SIGCHI Intercultural Issues database: www.acm.org/sigchi/intercultural/
- ACM/SIGCHI Intercultural listserve: chi-intercultural@acm.org
- American National Standards Institute (ANSI): www.ansi.org
- Anthropologists in Design: <http://groups.yahoo.com/group/anthrodesign/>
- Bibliography of Intercultural publications: www.HCIBib.org//SIGCHI/Intercultural
- China National Standards: China Commission for Conformity of Elect. Equip. (CCEE) Secretariat; 2 Shoudi Tiyuguan, NanLu, 100044, P. R. China; Tel: 186-1-8320088, ext. 2659, Fax: 186-1-832-0825.
- Cultural comparisons: www.culturebank.com, www.webofculture.com, www.iir-ny.com
- Digital divide: www.digitaldivide.gov, www.digitaldivide.org, www.digitaldividenetwork.org
- Globalization and Internet language statistics: language: www.euromktg.com/globstats/, www.sapient.com, www.worldready.com/biblio.htm
- Glossary, six languages: www.bowneglobal.com/bowne.asp?page59&language51
- International Standards Organization (ISO): <http://www.iso.ch/>
- Internationalization providers: www.basistech.com, www.cij.com, www.Logisoft.com
- Internationalization resources: www.world-ready.com/r_intl.htm, www.worldready.com/biblio.htm
- Internet users survey, Nua: www.nua.ie/surveys/how_many_online
- Japan Info. Processing Society; Kikai Shinko Bldg., No. 3–5–8 Shiba-Koen, Minato-ku, Tokyo 105, Japan; Tel: 181-3-3431-2808, Fax: 181-3-3431-6493.
- Japanese Industrial Standards Committee (JISC); Min. of Internat. Trade and Industry; 1–3–1, Kasumigaseki, Chiyoda-ku, Tokyo 100, Japan; Tel: 181-3-3501-9295/6, Fax: 181-3-3580-1418.
- Java Internationalization: <http://java.sun.com/docs/books/tutori>

- Johnston, K., and P. Johal. 1999. The Internet as a 'virtual cultural region': Are external cultural classification schemes appropriate? *Internet Research* 9(3): 178–186.
- Localization Industry Standards Organization (LISA): www.lisa.org
- Localization providers: www.Alpnet.com, www.Berlitz.com, www.globalsight.com, www.Ihsl.com, www.Lionbridge.com, www.Logisoft.com, www.Logos-usa.com, www.translations.com, www.Uniscape.com
- Machine translation providers: www.babelfish.altavista.com, www.IDC.com, www.e-Lingo.com, Lernout & Hauspie <www.Ihsl.com>, www.Systransoft.com
- Microsoft global development: www.eu.microsoft.com/globaldev/
- Simplified English: userlab.com/SE.html
- Unicode: www.unicode.org/, www.ibm.com/software/developer/library/glossaries/unicode.html
- World-Wide Web Consortium: www.w3.org/International, www.w3.org/WAI
- Alvarez, G. M., L. R. Kasday, and S. Todd. 1998. How we made the website international and accessible: A case study. In Proceedings of the 4th Human Factors and the Web Conference. Holmdel, NJ: CD-ROM.
- Batchelor, D. 2000. Chromophobia. London: Reaktion Books.
- Boxer, S. 2001. Vivid color in a world of black and white. *New York Times*, April 28, A15ff.
- Brain, D. 2005. Syllabus for course in sociology of culture at New College, FL. <http://www.ncf.edu/brain/courses/culture/syl05.htm> (accessed December 31, 2005).
- Coriolis Group. 1998. How to Build a Successful International Website. Scottsdale, AZ: Author.
- Cox Jr., T. 1994. Cultural Diversity in Organizations. San Francisco: Berrett-Koehler.
- Crystal, D. 1987. The Cambridge Encyclopedia of Language. Cambridge, UK: Cambridge University Press.
- Daniels, P. T., and W. Bright, eds. 2000. The World's Writing Systems. Sandpoint, ID: MultiLingual Computing.
- Day, D. L. 2000. Gauging the extent of internationalization activities. In Proceedings of the 2nd International Workshop on Internationalization of Products and Systems, 124–136. Baltimore, MD: Backhouse Press.
- Day, D. L., E. M. del Galdo, and G. V. Prabhu, eds. 2000. Designing for global markets 2. In Proceedings of the 2nd International Workshop on Internationalisation of Products and Systems. Rochester, NY: Backhouse Press.
- Day, D. L., and L. M. Dunckley. 2001. *Proceedings of the Third International Workshop on Internationalisation of Products and Systems (IWIPS 2001)*. Milton Keynes, UK.
- Day, D. L., V. Eves, and E. del Galdo. 2005. Designing for global markets 7: Bridging cultural differences. In Proceedings of the International Workshop on Internationalization of Products and Services 2005. Amsterdam: Grafisch Centrum Amsterdam.
- Doi, T. 1973. The Anatomy of Dependence. New York: Kodansha-International.
- Doi, T. 1986. The Anatomy of Self The Individual Versus Society. New York: Kodansha International.
- Dreyfuss, H. 1966. Symbol Sourcebook. New York: Van Nostrand Rhinehold.
- Earley, P., C. Soon, and A. Soon. 2003. Cultural Intelligence: Individual Interactions Across Cultures. Stanford, CA: Stanford University Press.
- Elashmawi, F., and P. R. Harris. 1998. Multicultural Management 2000: Essential Cultural Insights for Global Business Success. Houston, TX: Gulf.
- Evers, V., et al., eds. 2003. Proceedings of the Fifth International Workshop on Internationalisation of Products and Systems (IWIPS 2003). Berlin, Germany: Products and Systems Internationalization.
- Fetterman, D. M. 1998. Ethnography: Step by Step. 2nd ed. Thousand Oaks, CA: Sage.
- Forrester Research, Inc. 1998. JIT Web localization. www.Forrester.com (accessed July 4, 1998).
- French, T., and A. Smith. 2000. Semiotically enhanced Web interfaces: Can semiotics help meet the challenge of cross-cultural design? In Proceedings of the 2nd International Workshop on Internationalization of Products and Systems, 23–38. Baltimore, MD: Rochester, NY: Backhouse Press.
- Graham, T. 2000. Unicode: A Primer. Sandpoint, ID: MultiLingual Computing and Technology.
- Gudykunst, W. B. 2003. Cross-Cultural and Intercultural Communication. Thousand Oaks, CA: Sage.
- Gudykunst, W. B. 2005. Theorizing About Intercultural Communication. Thousand Oaks, CA: Sage Publications.
- Hall, E. T. 1969. The Hidden Dimension. New York: Doubleday.
- Harel, D., and P. Girish. 1999. Global User Experience (GLUE), Design for cultural diversity: Japan, China, and India. Designing for Global Markets. In Proceedings of the First International Workshop on Internationalization of Products and Systems (IWIPS-99), 205–216. Rochester, NY: Backhouse Press.
- Harris, J., and R. McCormack. 2000. Translation is Not Enough. San Francisco, CA: Sapient.
- Harris, P. R., and R. T. Moran. 1993. Managing Cultural Differences. Houston, TX: Gulf.
- Hofmann, P. 2010. *Making Icons Make Sense: Solving Symbols for Global Audiences*. Presentation, Usability Professionals Association, Munich, Germany.
- Hoft, N. L. 1995. International Technical Communication: How to Export Information About High Technology. New York: John Wiley and Sons, Inc.
- Inglehart, R. F., M. Basanez, and A. Moreno, eds. 1998. Human Values and Beliefs: A Cross-Cultural Sourcebook. Ann Arbor, MI: University of Michigan Press.
- International Standards Organization. 1993. ISO 7001: Public Information Symbols: Amendment 1. Geneva, Switzerland: The American National Standards Institute (ANSI).
- Kimura, D. 1992. Sex differences in the brain. *Sci Am* 267(3): 118–125.
- Kohls, L. R., and J. M. Knight. 1994. Developing Intercultural Awareness: A Cross-Cultural Training Handbook. 2nd ed. Yarmouth: ME: Intercultural Press.
- Konkka, K., and A. Koppinen. 2000. Mobile devices: Exploring cultural differences in separating professional and personal time. In Proceedings of the Second International Workshop on Internationalization of Products and Systems, 89–104. Rochester, NY: Backhouse Press.
- Kuhn, A. 2005. Mulling weekends, workdays in Iraq. National Public Radio Web Archive, <http://www.npr.org/templates/story/story.php?storyId=54540715> (accessed January 12, 2006).

- Kurosu, M. 1997. Dilemma of usability engineering. In *Design of Computing Systems: Social and Ergonomics Considerations*, Volume 2. Proceedings of the 7th International Conference on Human-Computer Interaction HCI International '97, ed. G. Salvendy, M. Smith, and R. Koubek, 555–558. Amsterdam: Elsevier.
- Lee, Y. S., Y. S. Ryu, T. L. Smith-Jackson, D. J. Shin, M. A. Nussbaum, and K. Tomioka. 2005. Usability testing with cultural groups in developing a cell phone navigation system. In *Proceedings of the 11th International Conference on Human-Computer Interaction (HCII '05)*, Las Vegas, NV: CD-ROM.
- Leventhal, L. 1996. Assessing user interfaces for diverse user groups: Evaluation strategies and defining characteristics. *Behav Inf Technol* 15(3):127–138.
- Lewis, R. 1991. *When Cultures Collide*. London: Nicholas Brealey.
- Lingo Systems. 1999. The guide to translation and localization Los Alamitos, CA IEEE Computer Society, ISBN 0-7695-0022-6.
- LISA. 1999. *The Localization Industry Primer*. The Localization Industry Standards Association, (LISA) 7, rate du Monastère, 1173 Féchy, Switz., 35. www.lisa.org.
- Marcus, A. 1992. *Graphic Design for Electronic Documents and User Interfaces*. Reading, MA: Addison-Wesley.
- Marcus, A. 1993a. Designing for diversity. In *Proceedings of the 37th Human Factors and Ergonomics Society*, 258–61. Seattle, WA.
- Marcus, A. 1993b. Human communication issues in advanced UIs. *Commun ACM* 36(4): 101–109.
- Marcus, A. 2000. International and intercultural user interfaces. In *User Interfaces for All*, ed. C. Stephanidis, 47–63. New York: Lawrence Erlbaum Associates.
- Marcus, A. 2001. User interface design for air-travel booking: A case study of Sabre. *Inf Des J* 10(2): 186–206.
- Marcus, A. 2003. 12 myths of mobile UI design. *Software Development Magazine*, May, 38–40.
- Marcus, A. 2005a. User interface design and culture. In *Usability and Internationalization of Information Technology*, ed. N. Aykin, 51–78. New York: Lawrence Erlbaum.
- Marcus, A., and E. W. Gould. 2000. Crosscurrents: Cultural dimensions and global web user interface design. *Interactions* 1–32–46.
- Marcus, A., Gould, and E. Chen. 1999. Globalization of user interface design for the Web. In *Proceedings of the 5th Human Factors and the Web Conference*. Gaithersburg, MD: CD-ROM.
- Matsumoto, D., and J. LeRoux. 2003. Measuring the psychological engine of intercultural adjustment: The intercultural adjustment potential scale (ICAPS). *J Intercult Commun* 6: 27–52.
- Matsumoto, D., M. D. Weissmann, K. Preston, B. R. Brown, and C. Kupperburd. 1997. Context-specific measurement of individualism-collectivism on the individual level: The individualism-collectivism interpersonal assessment inventory. *J Cross Cult Psychol* 6(28):743–767.
- Murphy, R. 2005. Getting to know you. *Fortune Small Business*. <http://www.fortune.com/fortune/smallbusiness/technology/articles/0,15114,1062892-1,OO.html> (accessed November 6, 2005).
- Neustupny, J. V. 1987. Communicating with the Japanese. *The Japan Times*. Tokyo, Japan.
- Nisbett, R. E., P. Kaipeng, C. Incheol, and A. Norenzayan. 2001. Culture and systems of thought: Holistic versus analytical cognition. *Psychol Rev* 108: 291–310.
- Ota, Y. 1973. *Locos: Lovers Communications System* (in Japanese). Tokyo, Japan: Pictorial Institute.
- Ota, Y. 1987. *Pictogram Design*. Tokyo, Japan: Kashiwashobo Publishers.
- Peng, K. 2000. *Readings in Cultural Psychology: Theoretical, Methodological and Empirical Developments During the Past Decade (1989–1999)*. New York: John Wiley.
- Perlman, G. 1999. ACM SIGCHI intercultural issues. In *Proceedings of the Second International Workshop on Internationalization of Products and Systems*, 183–195. Rochester, NY: Backhouse Press.
- Pierce, T. 1996. *The International Pictograms Standard*. Cincinnati, OH: S. T. Publications.
- Prabhu, G. V., B. Chen, W. Bubie, and C. Koch. 1997. Internationalization and localization for cultural diversity. In *Design of Computing Systems: Cognitive Considerations*. Vol. 1: *Proceedings of the 7th International Conference on Human-Computer Interaction (HCI International '97)*, ed. G. Salvendy, 149–152. Amsterdam: Elsevier.
- Prabhu, G. V., and E. M. delGaldo, eds. 1999. *Designing for global markets 1*. In *Proceedings of the First International Workshop on Internationalization of Products and Systems*, 226. Rochester, NY: Backhouse Press.
- Prabhu, G.V., and D. Harel. 1999. GUI design preference validation for Japan and China: A case for KANSEI engineering? In *Proceedings of the 8th International Conference on Human-Computer Interaction (HCI International '99)*. Munich, Germany.
- Schwartz, S. H. 2004. Mapping and interpreting cultural differences around the world. In *Comparing Cultures, Dimensions of Culture in a Comparative Perspective*, ed. H. Virken, I. Soeters, and P. Ester, 443–473. Leiden, the Netherlands: Brill.
- Shahar, L., and D. Kurz. 1995. *Border Crossings: American Interactions with Israelis*. Yarmouth, Maine: Intercultural Press.
- Singh, N. 2004. From cultural models to cultural categories: A framework for cultural analysis. *J Am Acad Bus* 5(1/2): 1–8. [Vol. 5, Nos. 1 & 2].
- Singh, N., and D. W. Baack. 2004. website adaptation: A cross-cultural comparison of U. S. and Mexican websites. *J Comput Mediat Commun* 9(4), http://ICMC.Indiana.edu/vol9/issue4/singh_back.html (accessed September 16, 2008).
- Singh, N., and H. Matsuo. 2002. Measuring cultural adaptation on the Web: A content analytic study of U.S. and Japanese websites. *J Bus Res* 57(8):864–872.
- Spradley, J., and D. McCurdy. 1998. *The Cultural Experience: Ethnography in Complex Society*. Long Grove, IL: Waveland Press.
- Stille, A. 2001. An old key to why countries get rich: it's the culture that matters, some argue anew. *New York Times*, January 13, 81.
- Storti, C. 1994. *Cross-Cultural Dialogues: 74 Brief Encounters with Cultural Difference*. Yarmouth, ME: Intercultural Press.
- Tannen, D. 1990. *You Just Don't Understand: Women and Men in Conversation*. New York: William Morrow and Company, Inc.
- Thomas, D., and K. Inkson. 2004. *Cultural Intelligence: People Skills for Global Business*. San Francisco: Berrett-Koehler Publishers.
- Traugott, M. 2008. Syllabus for course in contemporary sociological theory. University of California at Santa Cruz, <http://ic.ucsc.edu/~traugott/soccy105a/syllabus.html> (accessed October 5, 2011).
- Vickers, B. 2000. Firms push to get multilingual on the Web. *Wall St Journal*, November 22, B11A.
- Wirtz, E. 2005. A cross-cultural analysis of websites from high-context cultures and low-context cultures. *J Comput Mediat Commun* 11(1):article 13.
- Yeo, A. W. 2001. Global-software development lifecycle: An exploratory study. In *Proceedings Computer-Human Interaction Conference 2001*, 104–111. Seattle, WA.

Speech and Language Interfaces, Applications, and Technologies

- Aykin, N. 2005. Usability and Internationalization of Information Technology. 4–19. Princeton, NJ: Lawrence Erlbaum Associates.
- Ballantine, B., and D. Morgan. 1999. How to Build a Speech Recognition Application: A Style Guide for Telephony Dialogs. San Ramon, CA: Enterprise Integration Group, Inc.
- Brabham, D. C. 2008a. Moving the crowd at iStockphoto: The composition of the crowd and motivations for participation in crowdsourcing application. *First Monday* 13: 6.
- Brabham, D. C. 2008b. Crowdsourcing as a model for problem solving: an introduction and cases. *Convergence: Int J Res New Media Technol* 14(1):75–90.
- Chai, J. 2001. Natural Language Sales Assistant—a Web-based Dialog System for Online Sales. To be presented at the Thirteenth Conference on Innovative Applications of Artificial Intelligence.
- Clark, H. 1993. Arenas of Language Use. Chicago, IL: University of Chicago Press.
- Cohen, M., J. Giangola, and J. Balogh. 2004. Voice user Interface Design. Boston, MA: Addison-Wesley.
- Dahlback, N., A. Ionsson, and L. Ahrenberg. 1993. Wizard of oz studies—why and how. In *IUI '93 Proceedings of the 1st international conference on intelligent user interfaces*, 193–200. New York: ACM.
- Feng, J., A. Sears, and C. M. Karat. 2006. A longitudinal evaluation of hands-free speech-based navigation during dictation. *Int J Hum Comput Stud* 64(6).
- Francis, A., and H. Nusbaum. 1999. Evaluating the quality of synthetic speech. In *Human Factors and Voice Interactive Systems*, ed. D. Gardner-Bonneau, Boston, MA: Kluwer Academic Publishers.
- Gao, Y., B. Zhou, Z. Diao, J. Sorensen, and M. Picheny. 2002. "MARS: A statistical semantic parsing and generation-based multilingual automatic translation system." *J Mach Transl* 17: 185–212.
- Gong, L., and J. Lai. 2003. To mix or not to mix synthetic speech and human speech: Contrasting impact on judge-rated task. *Int J Speech Technol* 6(2):123–131.
- Goshawke, W., I. D. K. Kelly, and J. D. Wigg. 1987. Computer Translation of Natural Language. Wilmslow, UK: Sigma Press.
- Halverson, C. A., D. A. Horn, C. Karat, and J. Karat. 1999. The beauty of errors: Patterns of error correction in desktop speech systems. In *Human-Computer Interaction—INTERACT '99*, ed. M. A. Sasse and C. Johnson, 133–140. Amsterdam: IOS Press.
- Howe, J. 2006. The rise of crowdsourcing. *Wired* 14(6), <http://www.wired.com/wired/archive/14.06/crowds.html> (accessed June 12, 2006).
- Howe, J. 2008. Crowdsourcing: Why the Power of the Crowd is driving the Future of Business. New York: Random House Publishers.
- Kamm, C. 1994. User interfaces for voice applications. In *Voice Communication Between Humans and Machines*, ed. D. B. Roe, and J. G. Wilpon, 422–444. Washington, DC: National Academy Press.
- Karat, C., C. Halverson, D. Horn, and J. Karat. 1999. Patterns of entry and correction in large vocabulary continuous speech recognition systems. In *Human Factors in Computing Systems—CHI 99 Conference Proceedings*, ed. M. Altom, and M. Williams, 568–575. New York, NY: ACM.
- Karat, C., and J. Karat. 2010. Designing and evaluating usable technology in industrial research: Case studies in speech recognition, personalization in ecommerce, and security and privacy. In *Lectures in Human-Centered Informatics*, ed. J. Carroll, New York, NY: Morgan-Claypool.
- Karat, J., D. Horn, C. Halverson, and C. Karat. 2000. Overcoming un-usability: Developing efficient strategies in speech recognition systems. *CHI '00 extended abstracts on Human factors in computing systems*, 141–142. New York: ACM.
- Karat, J., J. Lai, C. Danis, and C. Wolf. 1999. Speech user interface evolution. In *Human Factors and Voice Interactive Systems*, ed. D. Gardner-Bonneau, 1–35. Boston, MA: Kluwer.
- Lai, J., D. Wood, and M. Considine. 2000. The effect of task conditions on the comprehensibility of speech. In *CHI '2000 Conference on Human Factors in Computing Systems*, New York: ACM.
- Ogden, W. C. 1988. Using natural language interfaces. In *Handbook of Human-Computer Interaction*, ed. M. Helander, 281–299. North-Holland, Amsterdam: Elsevier.
- Price, K. J., M. Lin, J. Feng, R. Goldman, A. Sears, and J. A. Jacko. 2006. Motion does matter: An examination of speech-based text entry on the move. *Universal Access in the Information Society* 4(3):246–257.
- Price, K., and A. Sears. 2005. Speech-based text entry for mobile handheld devices: An analysis of efficacy and error correction techniques for server-based solutions. *Int J Hum Comput Interact* 19(3):279–304.
- Rabiner, L. R. 1989. A tutorial on hidden Markov models and selected applications in speech recognition. In *Proceedings of IEEE* 77:257–286. New Jersey: IEEE.
- Roe, D. B., and J. G. Wilpon. 1993. Wither speech recognition: The next 25 years. *IEEE Commun Mag* 11: 54–62.
- Rudnicky, A. 1995. The design of spoken language interfaces. In *Applied Speech Technology*, ed. A. Syrdal, R. Bennett, and S. Greenspan, Boca Raton, FL: CRC Press.
- Sacks, H., E. Schegloff, and G. Jefferson. 1974. A simplest systematics for the organization of turntaking for conversation. *Language* 50(4):696–735.
- Schmandt, C. 1994. *Voice Communication with Computers: Conversational Systems*. New York, NY: Van Nostrand Reinhold.
- Sears, A., C. Karat, K. Oseitutu, A. Kaimullah, and J. Feng. 2000. Productivity, satisfaction, and interaction strategies of individuals with spinal cord injuries and traditional users interacting with speech recognition software. *Universal Access in the Inf Soc* 1: 5–25.
- Stewart, O., J. Huerta, M. Sader, A. Sakrajda, J. Marcotte, and D. Lubensky. 2009b. Designing crowdsourcing for the enterprise. In *SIG KDD HCOMP Workshop*. New York: ACM.
- Stewart, O., D. Lubensky, J. Huerta, J. Marcotte, C. Wu, and A. Sakrajda. 2010. Crowdsourcing participation inequality: A SCOUT model for the enterprise domain. In *SIG KDD HCOMP Workshop*. New York: ACM.
- Stewart, O., M. Picheny, D. Lubensky, and B. Ramabhadran. 2009a. Cultural voice markers in speech-to-speech machine translation systems. *Proceedings of the International Workshop on Intercultural Collaboration*. New York: ACM.
- Surowiecki, J. 2004. *The Wisdom of the Crowds: Why the many are Smarter than the few and how Collective Wisdom Shapes Businesses, Economies, Societies, and Nations*. New York: Doubleday.
- Surowiecki, J. 2005. *The Wisdom of Crowds*. New York: Doubleday.
- TAUS Report. 2007. TAUS (Translation Automation User Society) Starter's Guide to Machine Translation: Technologies, Case Studies & Good Practices. Release 1: April 2007.

- Vertanen, K., and D. J. C. MacKay. 2010. Speech dasher: Fast writing using speech and gaze; In CHI '10 Proceedings of the 28th international conference on Human factors in computing systems, 595–598. New York: ACM.
- Viitamaki, S. 2008. The FLIRT model of crowdsourcing: planning and executing collective customer collaboration. MA thesis: Helsinki School of Economics.
- Watt, W. C. 1968. Habitability, Am Doc 19(3):338–351.
- Weinschenk, S., and D. T. Barker. 2000. Designing Effective Speech User Interfaces. New York, NY: Wiley.
- Whittaker, S., L. Terveen, W. C. Hill, and L. Cherny. 1998. The dynamics of mass interaction. In Proceedings of ACM Conference on Computer-supported Cooperative Work, CSCW '98, 257–264. New York: ACM.
- Yankelovich, N. 1996. How do users know what to say? Interactions 3(6):32–43.
- Yankelovich, N. 2008. "Using natural dialogs as the basis for speech interface design". In Human Factors and Voice Interactive Systems, ed. D. Gardner-Bonneau and H. E. Blanchard, 2nd ed., 255–290. New York: Springer Science+Business Media, LLC.
- Yankelovich, N., G. A. Levow, and M. Marx. 1995. Designing SpeechActs: Issues in speech user interfaces. In CHI '95 Proceedings of the SIGCHI conference on Human factors in computing systems, 369–376. New York: ACM Press/ Addison-Wesley.
- Zhou, B., D. Dechelotte, and Y. Gao. 2004. "Two-way speech-to-speech translation on handheld devices." In *Int. Conf. of Spoken Language Processing (ICSLP)*, 1637–1640. <http://www.isca-speech.org/archive>.

Multimedia User Interface Design

- Alty, J. L. 1991. Multimedia: What is it and how do we exploit it? In Proceedings of HCI '91: People and Computers VI, ed. D. Diaper, and N. V. Hammond, 31–41. Cambridge: Cambridge University Press.
- Baddeley, A. D. 1986. Working Memory. Oxford: Oxford University Press.
- Barnard, P. 1985. Interacting cognitive subsystems: A psycholinguistic approach to short term memory. In Progress in Psychology of Language, ed. A. Ellis, Vol. 2, 197–258. London: LEA.
- Bernsen, N. O. 1994. Foundations of multimodal representations: A taxonomy of representational modalities. *Interact Comput* 6(4):347–371.
- Bertin, J. 1983. Semiology of Graphics. Madison, WI: University of Wisconsin Press.
- Beymer, D., P. Z. Orton, and D. M. Russell. 2007. An eye tracking study of how pictures influence online reading. In Proceedings of Interact 2007, 456–460. Berlin, Germany: Springer.
- Bieger, G. R., and M. D. Glock. 1984. The information content of picture-text instructions. *J Exp Educ* 53: 68–76.
- Booher, H. R. 1975. Relative comprehensibility of pictorial information and printed word in proceduralized instructions. *Hum Factors* 17(3):266–277.
- Card, S. K., T. P. Moran, and A. Newell. 1983. The Psychology of Human Computer Interaction. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Clark, H. H. 1996. Using Language. Cambridge: Cambridge University Press.
- De Brujin, O., R. Spence, and M. Y. Chong. 2002. RSVP Browser: Web browsing on small screen devices. *Pers Ubiquitous Comput* 6(4):245–252.
- Faraday, P., and A. G. Sutcliffe. 1996. An empirical study of attending and comprehending multimedia presentations. In Proceedings ACM Multimedia '96: 4th Multimedia Conference, Boston, MA 18–22 November 1996, 265–275. New York: ACM Press.
- Faraday, P., and A. G. Sutcliffe. 1997. Multimedia: Design for the moment. In Proceedings: Fifth ACM International Multimedia Conference. Seattle, WA 9–13 November 1997, 183–192. New York: ACM Press.
- Faraday, P., and A. G. Sutcliffe. 1998. Making contact points between text and images. In Proceedings ACM Multimedia '98 of 6th ACM International Multimedia Conference, 29–37. New York: ACM Press.
- Fischer, G., E. Giaccardi, Y. Ye, A. G. Sutcliffe, and N. Mehandjiev. 2004. A framework for end-user development: Socio-technical perspectives and meta-design. *Commun ACM* 47(9):33–39.
- Fogg, B. J. 1998. Persuasive computer: Perspectives and research directions. In Proceedings: Human Factors in Computing Systems: CHI '98, Los Angeles CA 18–23 April 1998, 225–232. New York: ACM Press.
- Gardiner, M., and B. Christie. 1987. Applying Cognitive Psychology to User Interface Design. Chichester, UK: Wiley.
- Hartmann, J., A. G. Sutcliffe, and A. De Angeli. 2008. Towards a theory of user judgment of aesthetics and user interface quality. *ACM Trans Comput Hum Interact* 15(4): 15–30.
- Hassenzahl, M. 2004. The interplay of beauty, goodness and usability in interactive products. *Hum Comput Interact* 19(4):319–349.
- Hegarty, M., and M. A. Lust. 1993. Constructing mental models of text and diagrams. *J Mem Lang* 32: 717–742.
- Hochberg, J. 1986. Presentation of motion and space in video and cinematic displays. In Handbook of Perception and Human Performance, 1: Sensory Processes and Perception, ed. K. R. Boff, L. Kaufman, and J. P. Thomas. New York: Wiley.
- Hollan, J. D., E. L. Hutchins, and L. Weitzman. 1984. Steamer: An interactive inspectable simulation-based training system. *AI Mag* 5(2): 15–27.
- Hornof, A., and T. Halverson. 2003. Cognitive strategies and eye movements for searching hierarchical computer displays. In CHI 2003 Conference Proceedings of Conference on Human Factors in Computing Systems. New York: ACM Press.
- ISO. 1997. ISO 9241: Ergonomic Requirements for Office Systems with Visual Display Terminals (VDTs). Geneva, Switzerland: International Standards Organisation.
- ISO. 1998. *ISO 14915 Multimedia User Interface Design Software Ergonomic Requirements, Part 1: Introduction and Framework; Part 3: Media Combination and Selection*. International Standards Organisation. Geneva, Switzerland.
- Kristof, R., and A. Satran. 1995. Interactivity by Design: Creating and Communicating with New Media. Mountain View, CA: Adobe Press.
- Lavie, T., and N. Tractinsky. 2004. Assessing dimensions of perceived visual aesthetics of web sites. *Int J Hum Comput Stud* 60(3):269–298.
- Levie, W. H., and R. Lentz. 1982. Effects of text illustrations: A review of research. *Educ Comput Technol J* 30(4): 159–232.
- Lidwell, W., K. Holden, and J. Butler. 2003. Universal Principles of Design. Gloucester, MA: Rockport.

- Lowe, D., and W. Hall. 1998. *Hypermedia and the Web*. Chichester, West Sussex: John Wiley.
- Mann, W. C., and S. A. Thompson. 1988. Rhetorical structure theory: Toward a functional theory of text organisation. *Text* 8(3):243–281.
- May, J., and P. Barnard. 1995. Cinematography and interface design. In *Proceedings: Fifth IFIP TC 13 International Conference on Human-Computer Interaction*, Lillehammer, Norway 27–29 June 1995, ed. K. Nordbyn, P. H. Helmersen, D. J. Gilmore, and S. A. Arnesen, 26–31. London: Chapman & Hall.
- Mullet, K., and D. Sano. 1995. *Designing Visual Interfaces: Communication Oriented Techniques*. Englewood Cliffs, NJ: SunSoft Press.
- Narayanan, N. H., and M. Hegarty. 1998. On designing comprehensible interactive hypermedia manuals. *Int J Hum Comput Stud* 48: 267–301.
- Nielsen, J. 1995. *Multimedia and Hypertext: The Internet and Beyond*. Boston, MA: AP Professional.
- Norman, D. A. 2004. *Emotional Design: Why We Love (or Hate) Everyday Things*. New York: Basic Books.
- Norman, D. A., and T. Shallice. 1986. Attention to action: Willed and automatic control of behaviour. In *Consciousness and Self-Regulation*, ed. G. E. Davidson, and G. E. Schwartz, Vol. 4, 1–18. New York: Plenum.
- Ortony, A., G. L. Clore, and A. Collins. 1988. *The Cognitive Structure of Emotions*. Cambridge: Cambridge University Press.
- Papert, S. 1980. *Mindstorms: Children, Computers, and Powerful Ideas*. New York: Basic Books.
- Reeves, B., and C. Nass. 1996. *The Media Equation: How People Treat Computers, Television and New Media Like Real People and Places*. Stanford CA/Cambridge: CLSI/Cambridge University Press.
- Rogers, Y., and M. Scaife. 1998. How can interactive multimedia facilitate learning? In *Intelligence and Multimodality in Multimedia Interfaces: Research and Applications*, ed. J. Lee. Menlo Park, CA: AAAI Press.
- Scaife, M., Y. Rogers, F. Aldrich, and M. Davies. 1997. Designing for or designing with? Informant design for interactive learning environments. In *Proceedings: Human Factors in Computing Systems CHI '97*, Atlanta GA 22–27 May 1997, ed. S. Pemberton, 343–350. New York: ACM Press.
- Spool, J. M., T. Scanlon, C. Snyder, W. Schroeder, and T. de Angelo. 1999. *Web Site Usability: A Designer's Guide*. San Francisco, CA: Morgan Kaufmann.
- Sutcliffe, A. G. 1997. Task-related information analysis. *Int J Hum Comput Stud* 47(2):223–257.
- Sutcliffe, A. G. 1999. User-centered design for multimedia applications. In *Proceedings Vol. 1: IEEE Conference on Multimedia Computing and Systems*, Florence, 116–123. Los Alamitos, CA: IEEE Computer Society Press.
- Sutcliffe, A. G. 2002. Assessing the reliability of heuristic evaluation for website attractiveness and usability. In *Proceedings HICSS-35: Hawaii International Conference on System Sciences*, Hawaii 7–10 January 2002, 1838–2817. Los Alamitos, CA: IEEE Computer Society Press.
- Sutcliffe, A. G. 2003. *Multimedia and Virtual Reality: Designing Multisensory User Interfaces*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Sutcliffe, A. G. 2009. Designing for user engagement: Aesthetic and attractive user interfaces. In *Synthesis Lectures on Human Centered Informatics*, ed. J. M. Carroll. San Rafael, CA: Morgan Claypool.
- Sutcliffe, A. G., and A. De Angeli. 2005. Assessing interaction styles in web user interfaces. In *Proceedings of Human Computer Interaction—Interact 2005*, 405–417. Berlin, Germany: Springer.
- Sutcliffe, A. G., and P. Faraday. 1994. Designing presentation in multi-media interfaces. In *CHI '94 Conference Proceedings: Human Factors in Computing Systems 'Celebrating Interdependence.'* Boston, MA, April 24–28, 1994, ed. B. Adelson, S. Dumais, and J. Olson, 92–98. New York: ACM Press.
- Tan, D. S., G. R. Robertson, and M. Czerwinski. 2001. Exploring 3D navigation: Combining speed coupled flying with orbiting. In *CHI 2001 Conference Proceedings: Conference on Human Factors in Computing Systems*, Seattle, March 31–April 5, 2001, ed. J. A. Jacko, A. Sears, M. Beaudouin-Lafon, and R. J. K. Jacob, 418–425. New York: ACM Press.
- Tractinsky, N. 1997. Aesthetics and apparent usability: Empirically assessing cultural and methodological issues. In *Human Factors in Computing Systems: CHI '97 Conference Proceedings*, Atlanta GA May 22–27, 1997, ed. S. Pemberton, 115–122. New York: ACM Press.
- Tractinsky, N., A. Shoval-Katz, and D. Ikar. 2000. What is beautiful is usable. *Interact Comput* 13(2): 127–145.
- Travis, D. 1991. *Effective Colour Displays: Theory and Practice*. Boston, MA: Academic Press.
- Treisman, A. 1988. Features and objects: Fourteenth Bartlett memorial lecture. *Q J Exp Psychol* 40A(2): 201–237.
- Tufte, E. R. 1997. *Visual Explanations: Images and Quantities, Evidence and Narrative*. Cheshire, CN: Graphics Press.
- Wickens, C. D., D. Sandry, and M. Vidulich. 1983. Compatibility and resource competition between modalities of input, output and central processing. *Hum Factors* 25: 227–248.
- Zhou, M. X., and S. K. Feiner. 1998. Visual task characterization for automated visual discourse synthesis. In *Human Factors in Computing Systems of CHI '98 Conference Proceedings*. New York: ACM Press.

Multimodal Interfaces

- Abry, C., M.-T. Lallouache, and M.-A. Cathiard. 1996. How can coarticulation models account for speech sensitivity to audiovisual desynchronization? In *Speechreading by Humans and Machines: Models, Systems and Applications*, ed. D. G. Stork, and M. E. Hennecke, 247–255. New York: Springer Verlag.
- Adapx. 2011. <http://www.adapx.com/home>; retrieved Oct. 5, 2011.
- Adjoudani, A., and C. Benoit. 1995. Audio-visual speech recognition compared across two architectures. In *Proceedings of the Eurospeech Conference*, Vol. 2, 1563–1566. Madrid, Spain.
- Almor, A. 1999. Noun-phrase anaphora and focus: The informational load hypothesis. *Psychol Rev* 106: 748–765.
- Anoto. 2009. <http://www.anoto.com> (accessed May 1, 2009).
- Ai'gyle, M. 1972. Nonverbal communication in human social interaction. In *Nonverbal Communication*, ed. R. Hinde, 243–267. Cambridge: Cambridge Univ. Press.
- Arthur, A., R. Lunsford, M. Wesson, and S. L. Oviatt. 2006. Prototyping novel collaborative multimodal systems: Simulation, data collection and analysis tools for the next decade. In *Eighth International Conference on Multimodal Interfaces (ICMI'06)*, 209–226. New York: ACM.
- Baddeley, A. 1992. Working memory. *Science* 255: 556–559.

- Bangalore, S., and M. Johnston. 2000. Integrating multimodal language processing with speech recognition. In Proceedings of the International Conference on Spoken Language Processing (ICSLP'2000), ed. B. Yuan, T. Huang, and X. Tang, Vol. 2, 126–129. Beijing: Chinese Friendship Publishers.
- Bangalore, S., and M. Johnston. 2009. Robust understanding in multimodal interfaces. *Comput Ling* 35(3):345–397.
- Baithelmess, P., E. Kaiser, X. Huang, and D. Demirdjian. 2005. Distributed pointing for multimodal collaboration over sketched diagrams. In Proceedings of the Seventh International Conference on Multimodal Interfaces, 10–17. New York: ACM.
- Barthelmess, P., and S. Oviatt. 2007. User-centered design for interactive and collaborative multimodal interfaces. In IEEE Computer Special Issue on Human-Centered Multimedia Interfaces, Vol. 40(5), ed. N. Sebe, D. Gatica, A. Jaimes, and T. S. Huang. New York: ACM.
- Bengio, S. 2004. Multimodal speech processing using asynchronous Hidden Markov Models. *Inf Fusion* 5(2):81–89.
- Benoit, C. 2000. The intrinsic bimodality of speech communication and the synthesis of talking faces. In *The Structure of Multimodal Dialogue II*, ed. M. Taylor, F. Neel, and D. Bouwhuis, 485–502. Amsterdam: John Benjamins.
- Benoit, C., T. Guiard-Marigny, B. Le Goff, and A. Adjoudani. 1996. Which components of the face do humans and machines best speechread? In *Speechreading by Humans and Machines: Models, Systems, and Applications*, Vol. 150 of NATO ASI Series. Series F: Computer and Systems Sciences, ed. D. G. Stork, and M. E. Hennecke, 315–325. Berlin, Germany: Springer-Verlag.
- Benoit, C., and B. Le Goff. 1998. Audio-visual speech synthesis from French text: Eight years of models, designs and evaluation at the ICP. *Speech Commun* 26: 117–129.
- Benoit, C., J.-C. Martin, C. Pelachaud, L. Schomaker, and B. Suhm. 1999. Audio-visual and multimodal speech-based systems. In *Handbook of Multimodal and Spoken Dialogue Systems: Resources, Terminology and Product Evaluation*, ed. D. Gibbon, I. Mertins, and R. Moore, 102–203. Kluwer.
- Bernstein, L., and C. Benoit. 1996. For speech perception by humans or machines, three senses are better than one. In Proceedings of the International Conference on Spoken Language Processing (ICSLP'96), Vol. 3, 1477–1480. New York: IEEE Press.
- Bers, J., S. Miller, and J. Makhoul. 1998. Designing conversational interfaces with multimodal interaction. In *DARPA Workshop on Broadcast News Understanding Systems*, 319–21.
- Bolt, R. A. 1980. Put-that-there: Voice and gesture at the graphics interface. *Comput Graph* 14(3):262–270.
- Brandl, P., C. Forlines, D. Wigdor, M. Haller, and C. Shen. 2008. Combining and measuring the benefits of bimanual pen and direct-touch interaction on horizontal surfaces. In *Conference on Advanced Visual Interfaces*, 154–61.
- Bregler, C., and Y. Konig. 1994. Eigenlips for robust speech recognition. In Proceedings of the International Conference on Acoustics Speech and Signal Processing (IEEE-ICASSP), Vol. 2, 669–672. IEEE Press.
- Bregler, C., S. Manke, H. Hild, and A. Waibel. 1993. Improving connected letter recognition by lipreading. In Proceedings of the International Conference on Acoustics, Speech and Signal Processing (IEEE-ICASSP), Vol. 1, 557–560. Minneapolis, MN: IEEE Press.
- Brooke, N. M., and E. D. Petajan. 1986. Seeing speech: Investigations into the synthesis and recognition of visible speech movements using automatic image processing and computer graphics. In Proceedings International Conference Speech Input and Output: Techniques and Applications, Vol. 258, 104–109.
- Calder, J. 1987. Typed unification for natural language processing. In *Categories, Polymorphisms, and Unification*, ed. E. Klein and J. van Benthem, 65–72. Center for Cognitive Science, University of Edinburgh.
- Calvert, G., C. Spence, and B. E. Stein, eds. 2004. *The Handbook of Multisensory Processing*. Cambridge, MA: MIT Press.
- Carpenter, R. 1990. Typed feature structures: Inheritance, (in)equality, and extensionality. In Proceedings of the ITK Workshop: Inheritance in Natural Language Processing, 9–18. Tilburg: Institute for Language Technology and Artificial Intelligence, Tilburg University.
- Carpenter, R. 1992. *The Logic of Typed Feature Structures*. Cambridge, UK: Cambridge University Press.
- Cassell, J., J. Sullivan, S. Prevost, and E. Churchill, eds. 2000. *Embodied Conversational Agents*. Cambridge, MA: MIT Press.
- Chen, L., and M. Harper. 2009. Multimodal floor control shift detection. In Proceedings of the Seventh International Conference on Multimodal Interfaces, New York: ACM.
- Cheyer, A. 1998. MVIEWS: Multimodal tools for the video analyst. In International Conference on Intelligent User Interfaces (IUI'98), 55–62. New York: ACM Press.
- Cheyer, A., and L. Julia. 1995. Multimodal maps: An agent-based approach. In International Conference on Cooperative Multimodal Communication (CMC'95), 103–113. Eindhoven, The Netherlands.
- Choudhury, T., B. Clarkson, T. Jebara, and S. Pentland. 1999. Multimodal person recognition using unconstrained audio and video. In Proceedings of the 2nd International Conference on Audio-and-Video-based Biometric Person Authentication, 176–181. Washington, DC.
- Codella, C., R. Jalili, L. Koved, J. Lewis, D. Ling, J. Lipscomb, and D. Rabenhorst et al. 1992. Interactive simulation in a multi-person virtual world. In Proceedings of the Conference on Human Factors in Computing Systems (CHI'92), 329–334. New York: ACM Press.
- Cohen, P. R., A. Cheyer, M. Wang, and S. C. Baeg. 1994. An open agent architecture. In *AAAI'94 Spring Symposium Series on Software Agents*, 1–8. AAAI Press. (Reprinted in Huhns and Singh (Eds.). 1997. *Readings in Agents* (pp. 197–204). San Francisco, CA: Morgan Kaufmann.)
- Cohen, P. R., M. Dalrymple, D. B. Moran, F. C. N. Pereira, J. W. Sullivan, R. A. Gargan, J. L. Schlossberg, and S. W. Tyler. 1989. Synergistic use of direct manipulation and natural language. In Proceedings of the Conference on Human Factors in Computing Systems (CHI'89), 227–234. New York: ACM Press. (Reprinted in Maybury and Wahlster (Eds.). 1998. *Readings in Intelligent User Interfaces* (pp. 29–37). San Francisco: Morgan Kaufmann.)
- Cohen, P. R., M. Johnston, D. McGee, S. Oviatt, J. Pittman, I. Smith, L. Chen, and J. Clow. 1997. Quickset: Multimodal interaction for distributed applications. In Proceedings of the Fifth ACM International Multimedia Conference, 31–40. New York: ACM Press.
- Cohen, M. M., and D. W. Massaro. 1993. Modeling coarticulation in synthetic visual speech. In *Models and Techniques in Computer Animation*, ed. M. Magnenat-Thalmann, and D. Thalmann, 139–156. Tokyo: Springer-Verlag.
- Cohen, P. R., and D. McGee. 2004. Tangible multimodal interfaces for safety-critical applications. In *Communications of the ACM*, Vol. 47, 41–46. New York: ACM Press.
- Cohen, P. R., D. R. McGee, and J. Clow. 2000. The efficiency of multimodal interaction for a map-based task. In Proceedings of the Language Technology Joint Conference (ANLP-NAACL 2000), 331–338. Seattle, WA: Association for Computational Linguistics Press.
- Cohen, P. R., and S. L. Oviatt. 1995. The role of voice input for human–machine communication. *Proc Natl Acad Sci* 92(22):9921–9927. Washington, DC: National Academy of Sciences Press.
- Cohen, P., C. Swindells, S. Oviatt, and A. Arthur. 2008. A high-performance dual-wizard infrastructure supporting speech and digital pen input. In *Tenth International Conference on Multimodal Interfaces (ICMI'08)*. New York: ACM.

- Condon, W. S. 1988. An analysis of behavioral organization. *Sign Lang Stud* 58: 55–88.
- Dahlbäck, N., A. Jönsson, and L. Ahrenberg. 1992. Wizard of Oz studies—why and how. In *Proceedings of the International Workshop on Intelligent User Interfaces*, ed. W. D. Gray, W. E. Hefley, and D. Murray, 193–200. New York: ACM Press.
- Darves, C., and S. Oviatt. 2004. Talking to digital fish: Designing effective conversational interfaces for educational software. In *Evaluating Embodied Conversational Agents*, Vol. 7, ed. Z. Ruttkay and C. Pelachaud, 271–292. Dordrecht: Kluwer.
- Danninger, M., G. Flaherty, K. Bernardin, H. Ekenel, T. Kohler, R. Malkin, R. Stiefelhagen, and A. Waibel. 2005. The connector-facilitating context-aware communication. In *Proceedings of the International Conference on Multimodal Interfaces*, 69–75. New York: ACM.
- Denecke, M., and J. Yang. 2000. Partial information in multimodal dialogue. In *Proceedings of the International Conference on Multimodal Interaction*, 624–633. Beijing, China.
- Duncan, L., W. Brown, C. Esposito, H. Holmback, and P. Xue. 1999. Enhancing Virtual Maintenance Environments with Speech Understanding. Boeing M&CT TechNet.
- Dupont, S., and J. Luettin. 2000. Audio-visual speech modeling for continuous speech recognition. *IEEE Trans Multimedia* 2(3):141–151. Piscataway, NJ: Institute of Electrical and Electronics Engineers, Sept. 2000.
- Ekman, P. 1992. Facial expressions of emotion: New findings, new questions. *Am Psychol Soc* 3(1):34–38.
- Ekman, P., and W. Friesen. 1978. *Facial Action Coding System*. Palo Alto, CA: Consulting Psychologists Press.
- Encamacao, L. M., and L. Hettinger. 2003. Perceptual multimodal interfaces (special issue). *IEEE Comput Graph Appl*, 54–61.
- Epps, J., S. Oviatt, and F. Chen. 2004. Integration of speech and gesture input during multimodal interaction. In *Proceedings of the Australian International Conference on Computer-Human Interaction (OzCHI)*.
- Ernst, M., and H. Bulthoff. 2004. Merging the sense into a robust whole percept. *Trends Cogn Sci* 8(4):162–169.
- Fell, H., H. Delta, R. Peterson, L. Ferrier, Z. Mooraj, and M. Valleau. 1994. Using the baby-babble-blanket for infants with motor problems. In *Proceedings of the Conference on Assistive Technologies (ASSETS'94)*, 77–84. Marina del Rey, CA.
- Flanagan, J., and T. Huang. 2003. Multimodal human computer interfaces (special issue). *Proc IEEE'91(9)*.
- Fridlund, A. 1994. *Human Facial Expression: An Evolutionary View*. New York: Academic Press.
- Fukumoto, M., Y. Suenaga, and K. Mase. 1994. Finger-pointer: Pointing interface by image processing. *Comput Graph* 18(5):633–642.
- Fuster-Duran, A. 1996. Perception of conflicting audio-visual speech: An examination across spanish and german. In *Speechreading by Humans and Machines: Models, Systems and Applications*, ed. D. G. Stork, and M. E. Hennecke, 135–143. New York: Springer Verlag.
- Gatica-Perez, D., G. Lathoud, J.-M. Odobez, and I. McCowan. 2005. Multimodal multispeaker probabilistic tracking in meetings. In *Proceedings of the Seventh International Conference on Multimodal Interfaces*, 183–190. New York: ACM.
- Germesin, S. 2009. Agreement detection in multiparty conversation. In *Proceedings of the Eleventh International Conference on Multimodal Interfaces*. New York: ACM.
- Gomiak, P., and D. Roy. 2005. Probabilistic grounding of situated speech using plan recognition and reference resolution. In *Proceedings of the Seventh International Conference on Multimodal Interfaces*, 138–143. New York: ACM.
- Gupta, A. 2004. Dynamic time windows for multimodal input fusion. In *Proceedings of the International Conference on Spoken Language Processing (ICSLP'04)*.
- Hadar, U.T. J. Steiner, E. C. Grant, and F. Clifford Rose. 1983. Kinematics of head movements accompanying speech during conversation. *Hum Movement Sci* 2:35–46.
- Hauptmann, A. G. 1989. Speech and gestures for graphic image manipulation. In *Proceedings of the Conference on Human Factors in Computing Systems (CHI'89)*, Vol. 1, 241–245. New York: ACM Press.
- Holzman, T. G. 1999. Computer-human interface solutions for emergency medical care. *Interactions* 6(3): 13–24.
- Hsueh, P., and J. Moore. 2008. Automatic decision detection in meeting speech. In *Machine Learning for Multimodal Interaction, Lecture Notes in Computer Science LNCS* 4892, 168–179. Berlin: Springer.
- Huang, X., A. Acero, C. Chelba, L. Deng, D. Duchene, J. Goodman, H. Hon et al. 2000. MiPad: A next-generation PDA prototype. In *Proceedings of the International Conference on Spoken Language Processing (ICSLP 2000)*, Vol. 3, 33–36. Beijing, China: Chinese Military Friendship Publishers.
- Huang, X., and S. Oviatt. 2006. Toward adaptive information fusion in multimodal systems. In *Second Joint Workshop on Multimodal Interaction and Related Machine Learning Algorithms (MIML'05)*. Edinburgh, UK: Springer-Verlag.
- Iyengar, G., H. Nock, and C. Neti. 2003. Audio-visual synchrony for detection of monologues in video archives. In *Proceedings of ICASSP*.
- Iain, A., L. Hong, and Y. Kulkarni. 1999. A multimodal biometric system using fingerprint, face and speech. In *2nd International Conference on Audio- and Video-based Biometric Person Authentication*, 182–187. Washington, DC.
- Iain, A., and A. Ross. 2002. Learning user-specific parameters in a multibiometric system. In *Proceedings of the International Conference on Image Processing (ICIP)*. New York: Rochester.
- Johnston, M. 2009. Building multimodal applications with EMMA. In *Proceedings of the 11th International Conference on Multimodal Interfaces*, 47–54. New York: ACM.
- Johnston, M., P. Baggio, D. Burnett, J. Carter, D. Dahl, G. McCobb, and D. Raggett. 2009. *EMMA: Extensible MultiModal Annotation Markup Language*. <http://www.w3.org/TR/2009/REC-emma-20090210>. (accessed October 5, 2011).
- Johnston, M., P. R. Cohen, D. McGee, S. L. Oviatt, I. A. Pittman, and I. Smith. 1997. Unification-based multimodal integration. In *Proceedings of the 35th Annual Meeting of the Association for Computational Linguistics*, 281–288. San Francisco, CA: Morgan Kaufmann.
- Karshmer, A. I., and M. Blattner, (organizers). 1998. In *Proceedings of the 3rd International ACM Proceedings of the Conference on Assistive Technologies (ASSETS'98)*. New York: ACM.
- Kendon, A. 1980. Gesticulation and speech: Two aspects of the process of utterance. In *The Relationship of Verbal and Nonverbal Communication*, ed. M. Key, 207–227. The Hague: Mouton.
- Kobsa, A., J. Allgayer, C. Reddig, N. Reithinger, D. Schmauks, K. Harbusch, and W. Wahlster. 1986. Combining deictic gestures and natural language for referent identification. In *Proceedings of the 11th International Conference on Computational Linguistics*, 356–361. Bonn, Germany.
- Koons, D., C. Sparrell, and K. Thorisson. 1993. Integrating simultaneous input from speech, gaze, and hand gestures. In *Intelligent Multimedia Interfaces*, ed. M. Maybury, 257–276. Cambridge, MA: MIT Press.
- Kopp, S., P. Tepper, and J. Cassell. 2004. Towards integrated microplanning of language and iconic gesture for multimodal output. In *Proceedings of the 6th International Conference on Multimodal Interfaces*, 97–104. New York: ACM.

- Kricos, P. B. 1996. Differences in visual intelligibility across talkers. In *Speechreading by Humans and Machines: Models, Systems and Applications*, ed. D. G. Stork, and M. E. Hennecke, 43–53. New York: Springer Verlag.
- Kumar, S., and P. R. Cohen. 2000. Towards a fault-tolerant multiagent system architecture. In *Fourth International Conference on Autonomous Agents 2000*, 459–466. Barcelona, Spain: ACM Press.
- Lalanne, D., F. Evequoz, M. Rigamonti, B. Dumas, and R. Ingold. 2008. An ego-centric and tangible approach to meeting indexing and browsing. In *Machine Learning and Multimodal Interaction*, ed. A. Popescu-Belis, S. Renals, and H. Bourlard, Lecture Notes in Computer Science LNCS 4892, 84–95. Berlin: Springer.
- Lalanne, D., A. Lisowska, E. Bruno, M. Flynn, M. Georgescul, M. Guillemot, B. Janvier et al. 2005. The IM2 meeting browser family, Technical Report, Friborg.
- Leatherby, J. H., and R. Pausch. 1992. Voice input as a replacement for keyboard accelerators in a mouse-based graphical editor: An empirical study. *J Am Voice Input Output Soc* 11(2).
- Leitner, J., J. Powell, P. Brandl, T. Seifried, M. Haller, B. Dorsay, and P. To. 2009. FLUX: A tilting multi-touch and pen-based surface. In *Proceedings of Computer-Human Interaction Conference*, 11–16. New York: ACM Press.
- Lisowska, A. 2007. *Multimodal Interface Design for Multimedia Meeting Content Retrieval*, PhD thesis, Switzerland: University of Geneva.
- Liverscribe. www.livescribe.com; retrieved Oct. 5, 2011.
- Liwicki, M., and S. El-Neklawy. 2009. Enhancing a Multi-Touch Table with Write Functionality. Kyoto, Japan: Workshop on MPR.
- Lunsford, R., S. L. Oviatt, and A. Arthur. 2006. Toward open-microphone engagement for multiparty interactions. In *Eighth International Conference on Multimodal Interfaces (ICMI'06)*, 273–280. New York: ACM.
- Lunsford, R., S. Oviatt, and R. Coulston. 2005. Audio-visual cues distinguishing self-from system-directed speech in younger and older adults. In *Seventh International Conference on Multimodal Interfaces (ICMI'05)*, 167–74. New York: ACM.
- Martin, D. L., A. J. Cheyer, and D. B. Moran. 1999. The open agent architecture: A framework for building distributed software systems. *Appl Artif Intell* 13: 91–128.
- Massaro, D. W. 1996. Bimodal speech perception: A progress report. In *Speechreading by Humans and Machines: Models, Systems and Applications*, ed. D. G. Stork, and M. E. Hennecke, 79–101. New York: Springer Verlag.
- Massaro, D. W., and M. M. Cohen. 1990. Perception of synthesized audible and visible speech. *Psychol Sci* 1(1):55–63.
- Massaro, D. W., and D. G. Stork. 1998. Sensory integration and speechreading by humans and machines. *Am Scientist* 86: 236–244.
- McCowan, I., D. Gatica-Perez, S. Bengio, G. Lathoud, M. Barnard, and D. Zhang. 2005. Automatic analysis of multimodal group actions in meetings. *IEEE Trans Pattern Anal Mach Intell (PAMI)* 27(3):305–317.
- McGee, D. 2003. *Augmenting Environments with Multimodal Interaction*, Oregon Health & Science University, Doctoral dissertation.
- McGrath, M., and Q. Summerfield. 1985. Intermodal timing relations and audio-visual speech recognition by normal-hearing adults. *J Acoust Soc Am* 77(2):678–685.
- McGurk, H., and J. MacDonald. 1976. Hearing lips and seeing voices. *Nature* 264: 746–748.
- McLeod, A., and Q. Summerfield. 1987. Quantifying the contribution of vision to speech perception in noise. *Br J Audiol* 21:131–141.
- McNeill, D. 1992. *Hand and Mind: What Gestures Reveal about Thought*. Chicago, IL: University of Chicago Press.
- Meier, U., W. Hürst, and P. Duchnowski. 1996. Adaptive bimodal sensor fusion for automatic speechreading. In *Proceedings of the International Conference on Acoustics, Speech and Signal Processing (IEEE-ICASSP)*, 833–836. New York: IEEE Press.
- Morency, L.P., C. Sidner, C. Lee, and T. Darrell. 2005. Contextual recognition of head gestures. In *Proceedings of the Seventh International Conference on Multimodal Interfaces*, 18–24. New York: ACM.
- Morimoto, C., D. Koons, A. Amir, M. Flickner, and S. Zhai. 1999. Keeping an eye for HCI. In *Proceedings of SIBGRAPI'99, XII Brazilian Symposium on Computer Graphics and Image Processing*, 171–6.
- Mousavi, S. Y., R. Low, and J. Sweller. 1995. Reducing cognitive load by mixing auditory and visual presentation modes. *J Educ Psychol* 87(2):319–334.
- Naughton, K. 1996. Spontaneous gesture and sign: A study of ASL signs co-occurring with speech. In *Proceedings of the Workshop on the Integration of Gesture in Language & Speech*, ed. L. Messing, 125–134. Univ. of Delaware.
- Neal, J. G., and S. C. Shapiro. 1991. Intelligent multimedia interface technology. In *Intelligent User Interfaces*, ed. J. Sullivan, and S. Tyler, 11–43. New York: ACM Press.
- Negroponte, N. 1978. The Media Room. Report for ONR and DARPA. Cambridge, MA: MIT, Architecture Machine Group.
- Neti, C., G. Iyengar, G. Potamianos, and A. Senior. 2000. Perceptual interfaces for information interaction: Joint processing of audio and visual information for human-computer interaction. In *Proceedings of the International Conference on Spoken Language Processing (ICSLP'2000)*, Vol. 3, ed. B. Yuan, T. Huang, and X. Tang, 11–14. Beijing, China: Chinese Friendship Publishers.
- Oliver, N., and E. Horvitz. 2005. S-SEER: Selective perception in a multimodal office activity system. *Int J Comput Vision Image Understanding*, 198–224.
- Oviatt, S. L. 1997. Multimodal interactive maps: Designing for human performance. *Hum Comput Interact [Special issue on Multimodal Interfaces]* 12: 93–129.
- Oviatt, S. L. 1999a. Mutual disambiguation of recognition errors in a multimodal architecture. In *Proceedings of the Conference on Human Factors in Computing Systems (CHI'99)*, 576–583. New York: ACM Press.
- Oviatt, S. L. 1999b. Ten myths of multimodal interaction. *Commun ACM* 42(11):74–81. New York: ACM Press. (Translated into Chinese by Jing Qin and published in the Chinese journal Computer Application.)
- Oviatt, S. L. 2000a. Multimodal system processing in mobile environments. In *Proceedings of the Thirteenth Annual ACM Symposium on User Interface Software Technology (UIST'2000)*, 21–30. New York: ACM Press.
- Oviatt, S. L. 2000b. Taming recognition errors with a multimodal architecture. *Commun ACM* 43(9):45–51. New York: ACM Press.
- Oviatt, S. L. 2000c. Multimodal signal processing in naturalistic noisy environments. In *Proceedings of the International Conference on Spoken Language Processing (ICSLP'2000)*, Vol. 2, ed. B. Yuan, T. Huang, and X. Tang, 696–699. Beijing, China: Chinese Friendship Publishers.
- Oviatt, S. L. 2002. Breaking the robustness barrier: Recent progress in the design of robust multimodal systems. In *Advances in Computers*, vol. 56, ed. M. Zelkowitz, Academic Press, 305–341.
- Oviatt, S. L. 2003. Advances in robust multimodal interfaces. *IEEE Comput Graphics Appl* 62–8. (special issue on Perceptual Multimodal Interfaces).
- Oviatt, S. L. 2006. Human-centered design meets cognitive load theory: Designing interfaces that help people think. In *Proceedings of the ACM Conference on Multimedia, Special Session on "Human-Centered Multimedia Systems,"* 871–880. New York: ACM.

- Oviatt, S., A. Arthur, Y. Brock, and J. Cohen. 2007. Expressive pen-based interfaces for math education. In *Proceedings of the Conference on Computer-Supported Collaborative Learning*. International Society of the Learning Sciences. In C. Chinn, G. Erkens and S. Puntambekar, eds., Proceedings of the Conference on Computer Supported Collaborative Learning 2007: Of Mice, Minds & Society, *International Society of the Learning Sciences* 8(2):569–578.
- Oviatt, S., A. Arthur, and J. Cohen. 2006. Quiet interfaces that help students think. In *Proceedings of the Conference on User Interface Software Technology*, 191–200. New York, ACM Press.
- Oviatt, S. L., J. Bernard, and G. Levow. 1999. Linguistic adaptation during error resolution with spoken and multimodal systems. *Lang Speech* 41(3–4):415–438 (special issue on “Prosody and Speech”).
- Oviatt, S. L., and A. Cohen. 2010a. Supporting students’ thinking marks: Designing accessible interfaces for science education. *American Educational Research Association Conference*.
- Oviatt, S. L., and A. Cohen. 2010b. Toward high-performance communication interfaces for science problem solving. *Journal of Science Education and Technology* 19(6):515–531.
- Oviatt, S. L. (in press). *The Future of Educational Interfaces*, Routledge Press, forthcoming in 2012.
- Oviatt, S. L., and P. R. Cohen. 1991. Discourse structure and performance efficiency in interactive and noninteractive spoken modalities. *Comput Speech Lang* 5(4):297–326.
- Oviatt, S. L., and P. R. Cohen. 2000. Multimodal systems that process what comes naturally. *Commun ACM* 43(3):45–53. New York: ACM Press.
- Oviatt, S. L., P. R. Cohen, M. W. Fong, and M. P. Frank. 1992. A rapid semi-automatic simulation technique for investigating interactive speech and handwriting. In *Proceedings of the International Conference on Spoken Language Processing*, 2, 1351–1354. Univ. of Alberta.
- Oviatt, S. L., P. R. Cohen, and M. Q. Wang. 1994. Toward interface design for human language technology: Modality and structure as determinants of linguistic complexity. *Speech Commun* 15:283–300. European Speech Communication Association.
- Oviatt, S. L., P. R. Cohen, L. Wu, J. Vergo, L. Duncan, B. Suhm, J. Bers et al. 2000. Designing the user interface for multimodal speech and gesture applications: State-of-the-art systems and research directions. *Hum Comput Interact* 15(4):263–322. (to be reprinted in J. Carroll (Ed.) *Human-Computer Interaction in the New Millennium*, Addison-Wesley Press: Boston, 2001).
- Oviatt, S. L., R. Coulston, and R. Lunsford. 2004. When do we interact multimodally? Cognitive load and multimodal communication patterns. In *Proceedings of the Sixth International Conference on Multimodal Interfaces (ICMI'04)*, 129–136. New York: ACM Press.
- Oviatt, S. L., R. Coulston, S. Shriver, B. Xiao, R. Wesson, R. Lunsford, and L. Carmichael. 2003. Toward a theory of organized multimodal integration patterns during human–computer interaction. In *Proceedings of the International Conference on Multimodal Interfaces (ICMI'03)*, 44–51. New York: ACM Press.
- Oviatt, S. L., A. DeAngeli, and K. Kuhn. 1997. Integration and synchronization of input modes during multimodal human–computer interaction. In *Proceedings of Conference on Human Factors in Computing Systems (CHI'97)*, 415–422. New York: ACM Press.
- Oviatt, S. L., M. Flickner, and T. Darrell, eds. 2004. Multimodal interfaces that flex, adapt and persist. *Commun ACM* (special issue) 47(1).
- Oviatt, S. L., and K. Kuhn. 1998. Referential features and linguistic indirection in multimodal language. In *Proceedings of the International Conference on Spoken Language Processing*, 6, 2339–2342. Sydney, Australia: ASSTA, Inc.
- Oviatt, S. L., and R. Lunsford. 2005. Multimodal interfaces for cell phones and mobile technology. *Int J Speech Technol* 8(2):127–132.
- Oviatt, S. L., R. Lunsford, and R. Coulston. 2005. Individual differences in multimodal integration patterns: What are they and why do they exist? In *Proceedings of the Conference on Human Factors in Computing Systems (CHI'05)*, CHI Letters, 241–249. New York: ACM Press.
- Oviatt, S. L., and E. Olsen. 1994. Integration themes in multimodal human–computer interaction. In *Proceedings of the International Conference on Spoken Language Processing*, 2, ed. K. Shirai, S. Furui, and K. Kakehi, 551–554. Acoustical Society of Japan.
- Oviatt, S. L., C. Swindells, and A. Arthur. 2008. Implicit user-adaptive system engagement in speech and pen interfaces. In *Conference on Human Factors in Computing Systems (CHI '08)*, CHI Letters, 969–978. New York: ACM.
- Oviatt, S. L., and R. van Gent. 1996. Error resolution during multimodal human–computer interaction. In *Proceedings of the International Conference on Spoken Language Processing*, 2, 204–207. University of Delaware Press.
- Pankanti, S., R. M. Bolle, and A. Jain, eds. 2000. *Biometrics: The future of identification*. Computer 33(2):46–80.
- Pavlovic, V., G. Berry, and T. S. Huang. 1997. Integration of audio/ visual information for use in human–computer intelligent interaction. In *Proceedings of IEEE International Conference on Image Processing*, 121–124. IEEE Press.
- Pavlovic, V., and T. S. Huang. 1998. Multimodal prediction and classification on audio-visual features. In *AAAI'98 Workshop on Representations for Multi-modal Human-Computer Interaction*, 55–59. Menlo Park, CA: AAAI Press.
- Pavlovic, V., R. Sharma, and T. Huang. 1997. Visual interpretation of hand gestures for human–computer interaction: A review. *IEEE Trans Pattern Anal Mach Intell* 19(7):677–695.
- Pentland, S. 2005. Socially aware computation and communication. *IEEE Comput* 63–70.
- Popescu-Belis, A., P. Baudrion, M. Flynn, and P. Wellner. 2008. Towards an objective test for meeting browsers: The BET4TQB pilot experiment. In *Machine Learning and Multimodal Interaction*, Lecture Notes in Computer Science LNCS 4892, 108–119. Berlin: Springer.
- Popescu-Belis, A., S. Renals, and H. Bourlard, eds. 2008. Machine learning for multimodal interaction. In *Fourth International Workshop on MLMI'07*, Lecture Notes in Computer Science, Berlin: Springer Publ.
- Popescu-Belis, A., and M. Georgescul. 2006. TQB: Accessing multimedia data using a transcript-based query and browsing interface. In *Proceedings of LREC*, 1560–65.
- Potamianos, G., and C. Neti. 2001. Automatic speechreading of impaired speech. In *Proceedings of the International Conference on Auditory-Visual Speech Processing*, Aalborg, Denmark, 177–82.
- Potamianos, G., C. Neti, G. Gravier, and A. Garg. 2003. Automatic recognition of audio-visual speech: Recent progress and challenges. *Proc IEEE* 91(9): 1–18.
- Petajan, E. D. 1984. *Automatic Lipreading to Enhance Speech Recognition*, PhD thesis, University of Illinois at Urbana-Champaign.
- Pfleger, N. 2004. Context-based multimodal fusion. In *Proceedings of the 6th International Conference on Multimodal Interfaces*, 265–272. New York: ACM.
- Poddar, I., Y. Sethi, E. Ozyildiz, and R. Sharma. 1998. Toward natural gesture/speech HCI: A case study of weather narration. In *Proceedings 1998 Workshop on Perceptual User Interfaces (PUI'98)*, ed. M. Turk, 1–6. San Francisco, CA.
- Reithinger, N., I. Alexandersson, T. Becker, A. Blocher, R. Engel, M. Lockelt, I. Muller et al. 2003. Multimodal architectures and frameworks: SmartKom: Adaptive and flexible multimodal access to multiple applications. In *Proceedings of the 5th International Conference on Multimodal Interfaces*, 101–108. New York: ACM.

- Robert-Ribes, I., I.-L. Schwartz, T. Lallouache, and P. Escudier. 1998. Complementarity and synergy in bimodal speech: Auditory, visual, and auditory-visual identification of French oral vowels in noise. *J Acoust Soc Am* 103(6):3677–3689.
- Rogozan, A., and P. Deglise. 1998. Adaptive fusion of acoustic and visual sources for automatic speech recognition. *Speech Commun* 26(1–2): 149–161.
- Rubin, P., E. Vatikiotis-Bateson, and C. Benoit, eds. 1998. Audiovisual speech processing [Special issue]. *Speech Commun* 26: 1–2.
- Rudnicky, A., and A. Hauptman. 1992. Multimodal interactions in speech systems. In *Multimedia Interface Design*, ed. M. Blattner, and R. Dannenberg, 147–172. New York: ACM Press.
- Ruiz, N., F. Chen, and S. Oviatt. 2010. Multimodal human–computer and human–human interaction. In *Multimodal Signal Processing: Theory and Applications for Human-Computer Interaction*, ed. I.-P. Thiran, F. Marques, and H. Bourlard, 229–256. Amsterdam: Elsevier.
- Sekiya, K., and Y. Tohkura. 1991. McGurk effect in non-English listeners: Few visual effects for Japanese subjects hearing Japanese syllables of high auditory intelligibility. *J Acoust Soc Am* 90: 1797–1805.
- Seneff, S., D. Goddeau, C. Pao, and I. Polifroni. 1996. Multimodal discourse modelling in a multi-user multi-domain environment. In *Proceedings of the International Conference on Spoken Language Processing*, Vol. 1, ed. T. Bunnell and W. Idsardi, 192–195. University of Delaware & A.I. duPont Institute.
- Shaikh, A., S. Iuth, A. Medl, I. Marsic, C. Kulikowski, and I. Flanagan. 1997. An architecture for multimodal information fusion. In *Proceedings of the Workshop on Perceptual User Interfaces (PUI'97)*, 91–93. Banff, Canada.
- Sharma, R., T. S. Huang, V. I. Pavlovic, K. Schulten, A. Dalke, I. Phillips, M. Zeller, W. Humphrey, Y. Zhao, Z. Lo, and S. Chu. 1996. Speech/gesture interface to a visual computing environment for molecular biologists. In *Proceedings of 13th International Conference on Pattern Recognition (ICPR'96)*, Vol. 3, 964–968.
- Sharma, R., V. I. Pavlovic, and T. S. Huang. 1998. Toward multimodal human–computer interface. *Proc IEEE* 86(5) [Special issue on Multimedia Signal Processing]:853–60.
- Silsbee, P. L., and Q. Su. 1996. Audiovisual sensory intergration using Hidden Markov Models. In *Speechreading by Humans and Machines: Models, Systems and Applications*, ed. D. G. Stork, and M. E. Hennecke, 489–504. New York: Springer Verlag.
- Siroux, I., M. Guyomard, F. Multon, and C. Remondeau. 1995. Modeling and processing of the oral and tactile activities in the georal tactile system. In *International Conference on Cooperative Multimodal Communication, Theory & Applications*. Eindhoven, Netherlands.
- Stork, D. G., and M. E. Hennecke, eds. 1995. *Speechreading by Humans and Machines*. New York: Springer Verlag.
- Suhm, B. 1998. *Multimodal Interactive Error Recovery for Non-Conversational Speech User Interfaces*. Ph.D. thesis, Germany: Shaker Verlag: Fredericana University.
- Sumby, W. H., and I. Pollack. 1954. Visual contribution to speech intelligibility in noise. *J Acoust Soc Am* 26: 212–215.
- Summerfield, A. Q. 1992. Lipreading and audio-visual speech perception. *Philos Trans R Soc London SerB* 335: 71–78.
- Sweller, J. 1988. Cognitive load during problem solving: Effects on learning. *Cognitive Sci* 12: 257–285.
- Tang, A., P. McLachlan, K. Lowe, C. Saka, and K. MacLean. 2005. Perceiving ordinal data haptically under workload. In *Proceedings of the Seventh International Conference on Multimodal Interfaces*, 317–324. New York: ACM.
- Tomlinson, M. I., M. I. Russell, and N. M. Brooke. 1996. Integrating audio and visual information to provide highly robust speech recognition. In *Proceedings of the International Conference on Acoustics, Speech and Signal Processing (IEEE-ICASSP)*, Vol. 2, 821–824. IEEE Press.
- Turk, M., and G. Robertson, eds. 2000. *Perceptual user interfaces [Special issue]*. *Commun ACM* 43(3):32–70.
- Vatikiotis-Bateson, E., K. G. Munhall, M. Hirayama, Y. V. Lee, and D. Terzopoulos. 1996. The dynamics of audiovisual behavior of speech. In *Speechreading by Humans and Machines: Models, Systems, and Applications*, Vol. 150 of *NATO ASI Series*. Series F: Computer and Systems Sciences, ed. D. G. Stork, and M. E. Hennecke, 221–232. Berlin, Germany: Springer-Verlag.
- Vo, M. T., R. Houghton, I. Yang, U. Bub, U. Meier, A. Waibel, and P. Duchnowski. 1995. Multimodal learning interfaces. In *Proceedings of the DARPA Spoken Language Technology Workshop*.
- Vo, M. T., and C. Wood. 1996. Building an application framework for speech and pen input integration in multimodal learning interfaces. In *Proceedings of the International Conference on Acoustics Speech and Signal Processing (IEEE-ICASSP)*, Vol. 6, 3545–3548. IEEE Press.
- Wahlster, W. 1991. User and discourse models for multimodal communication. In *Intelligent User Interfaces*, Chap. 3, ed. I. W. Sullivan and S. W. Tyler, 45–67. New York: ACM Press.
- Wahlster, W. 2001. SmartKom: multimodal dialogs with mobile web users. In *Proceedings of the Cyber Assist International Symposium*, 33–34. Tokyo International Forum.
- Waibel, A., B. Suhm, M. T. Vo, and I. Yang. 1997. Multimodal interfaces for multimedia information agents. In *Proceedings of the International Conference on Acoustics Speech and Signal Processing (IEEE-ICASSP)*, Vol. 1, 167–170. IEEE Press.
- Wang, I. 1995. Integration of eye-gaze, voice and manual response in multimodal user interfaces. In *Proceedings of IEEE International Conference on Systems, Man and Cybernetics*, 3938–3942. IEEE Press.
- Whittaker, S., R. Laban, and S. Tucker. 2005. Analysing Meeting records: An Ethnographic Study and Technical Implications, in *Lecture Notes in Computer Science* 3869, *Machine Learning for Multimodal Interaction*, New York: Springer.
- Wickens, C. D., D. L. Sandry, and M. Vidulich. 1983. Compatibility and resource competition between modalities of input, central processing, and output. *Hum Factors* 25: 227–248.
- Wu, L., S. Oviatt, and P. Cohen. 1999. Multimodal integration—A statistical view. *IEEE Trans Multimedia* 1(4):334–341.
- Xiao, B., C. Girand, and S. Oviatt. 2002. Multimodal integration patterns in children. In *Proceedings of the International Conference on Spoken Language Processing (ICSLP'02)*, ed. J. Hansen, and B. Pellom, 629–632. Denver, CO: Casual Prod. Ltd.
- Xiao, B., R. Lunsford, R. Coulston, R. Wesson, and S. L. Oviatt. 2003. Modeling multimodal integration patterns and performance in seniors: Toward adaptive processing of individual differences. In *Proceedings of the International Conference on Multimodal Interfaces (ICMI'03)*, New York: ACM Press. 265–272.
- Zhai, S., C. Morimoto, and S. Ihde. 1999. Manual and gaze input cascaded (MAGIC) pointing. In *Proceedings of the Conference on Human Factors in Computing Systems (CHI'99)*, 246–253. New York: ACM Press.

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- Aleven, V., B. M. McLaren, J. Sewall, and K. R. Koedinger. 2009. A new paradigm for intelligent tutoring systems: Example-tracing tutors. *Int J Artif Intell Educ* 19(2):105–154.
- Barnard, L., J. Yi, J. Jacko, and A. Sears. 2007. Capturing the effects of context on human performance in mobile computing systems. *Pers Ubiquitous Comput* 11 (2): 81–96.
- Bartlett, M. S., G. Littlewort, I. Fasel, and J. R. Movellan. 2003. Real time face detection and facial expression recognition: Development and applications to human computer interaction. In *Proceedings of the Workshop on Computer Vision and Pattern Recognition for Human-Computer Interaction at the 2003 Conference on Computer Vision and Pattern Recognition*, 53–58. New York: IEEE.
- Beales, H. 2010. *The Value of Behavioral Targeting*. Study sponsored by the Network Advertising Initiative. http://www.network-advertising.org/pdfs/Beales_NAI_Study.pdf. Accessed date: October 1st, 2011.
- Bergman, E., and E. Johnson. 1995. Towards accessible human-computer interaction. *Adv Hum Comput Interact* 5(1). In *Advances in Human-Computer Interaction*, ed. J. Nielsen, 87–114. Norwood, NJ: Ablex.
- Billus, D., D. Hilbert, and D. Maynes-Aminzade. 2005. Improving proactive information systems. In *IUI 2005: International Conference on Intelligent User Interfaces*, ed. J. Riedl, A. Jameson, D. Billus, and T. Lau, 159–166. New York: ACM.
- Billus, D., and M. J. Pazzani. 2007. Adaptive news access. In *The Adaptive Web: Methods and Strategies of Web Personalization*, ed. P. Brusilovsky, A. Kobsa, and W. Nejdl, 550–572. Berlin, Germany: Springer.
- Bontcheva, K., and Y. Wilks. 2005. Tailoring automatically generated hypertext. *User Model User-adapt Interact* 15: 135–168.
- Brettel, H., F. Vienot, and J. D. Mollon. 1997. Computerized simulation of color appearance for dichromats. *J Opt Soc Am A* 14(10):2647–2655.
- Brusilovsky, P., A. Kobsa, and W. Nejdl, eds. 2007. *The Adaptive Web: Methods and Strategies of Web Personalization*. Berlin, Germany: Springer.
- Brzozowski, M. J., T. Hogg, and G. Szabo. 2008. Friends and foes: Ideological social networking. In *Human Factors in Computing Systems: CHI 2008 Conference Proceedings*, ed. M. Burnett, M. F. Costabile, T. Catarci, B. de Ruyter, D. Tan, M. Czerwinski, and A. Lund, 817–820. New York: ACM.
- Budzik, J., K. Hammond, and L. Birnbaum. 2001. Information access in context. *Knowl Based Syst* 14: 37–53.
- Bunt, A., G. Carenini, and C. Conati. 2007. Adaptive content presentation for the web. In *The Adaptive Web: Methods and Strategies of Web Personalization*, ed. P. Brusilovsky, A. Kobsa, and W. Nejdl, 409–432. Berlin, Germany: Springer.
- Bunt, A., C. Conati, and J. McGrenere. 2007. Supporting interface customization using a mixed-initiative approach. In *IUI 2007: International Conference on Intelligent User Interfaces*, ed. T. Lau and A. R. Puerta. New York: ACM.
- Burke, R. D., K. J. Hammond, and B. C. Young. 1997. The FindMe approach to assisted browsing. *IEEE Expert* 12(4):32–40.
- Canadian Marketing Association 2009. Behavioural advertising: Why consumer choice matters. Published on-line as part of the CMA Leadership Series at <http://www.the-cma.org/marketingresources/downloads/2009BehaviouralAdvertising.pdf>. Latest access: October 1st, 2011.
- Carmagnola, F., F. Verner, and P. Grillo. 2009. SoNARS: A social networks-based algorithm for social recommender systems. In *Proceedings of UMAP 2009, the 17th international Conference on User Modeling, Adaptation, and Personalization*, 223–234. Berlin, Springer
- Cawsey, A., F. Grasso, and C. Paris. 2007. Adaptive information for consumers of healthcare. In *The Adaptive Web: Methods and Strategies of Web Personalization*, ed. P. Brusilovsky, A. Kobsa, and W. Nejdl, 465–484. Berlin, Germany: Springer.
- Chen, J., W. Geyer, C. Dugan, M. Muller, and I. Guy. 2009. "Make new friends, but keep the old"—Recommending people on social networking sites. In *Human Factors in Computing Systems: CHI 2009 Conference Proceedings*, ed. S. Greenberg, S. Hudson, K. Hinckley, M. R. Morris, and D. R. Olsen, 201–210. New York: ACM.
- Chen, W., D. Zhang, and E. Y. Chang. 2008. Combinational collaborative filtering for personalized community recommendation. In *Proceedings of the Fourteenth International Conference on Knowledge Discovery and Data Mining*, 115–123. New York: ACM.
- Conati, C., and C. Merten. 2007. Eye-tracking for user modeling in exploratory learning environments: An empirical evaluation. *Knowl Based Syst* 20(6):557–574.
- Cranor, L. F. 2004. 'I didn't buy it for myself' : Privacy and ecommerce personalization. In *Designing Personalized User Experiences in Ecommerce*, ed. C. Karat, J. Blom, and J. Karat, 57–74. Dordrecht, The Netherlands: Kluwer.
- Daly, E. M., W. Geyer, and D. R. Millen. 2010. The network effects of recommending social connections. In *Proceedings of the Fourth ACM Conference on Recommender Systems*, ed. P. Resnick, M. Zanker, X. Amatriain, and M. Torrens, 301–304. New York: ACM.
- Dieterich, T. G., X. Bao, V. Keiser, and J. Shen. 2010. Machine learning methods for high level cyber situation awareness. In *Cyber Situational Awareness: Issues and Research*, ed. S. Jajodia, P. Liu, V. Swarup, and C. Wang. New York: Springer.
- Ehrlich, K., C. Lin, and V. Griffiths-Fisher. 2007. Searching for experts in the enterprise: Combining text and social network analysis. In *Proceedings of the 2007 International ACM Conference on Supporting Group Work*, 117–126. New York: ACM.
- Federal Trade Commission, T. 2009. *Federal Trade Commission Staff Report: Self Regulatory Principles for Online Behavioral Advertising*. <http://www.ftc.gov/os/2009/02/P085400behavadreport.pdf>. Latest access: October 1st, 2011.
- Findlater, L., and K. Z. Gajos. 2009. Design space and evaluation challenges of adaptive graphical user interfaces. *AI Mag* 30(4):68–73.
- Findlater, L., and J. McGrenere. 2008. Impact of screen size on performance, awareness, and user satisfaction with adaptive graphical user interfaces. In *Human Factors in Computing Systems: CHI 2008 Conference Proceedings*, ed. M. Burnett, M. F. Costabile, T. Catarci, B. de Ruyter, D. Tan, M. Czerwinski, and A. Lund, 1247–1256. New York: ACM.
- Findlater, L., and J. McGrenere. 2010. Beyond performance: Feature awareness in personalized interfaces. *Int J Hum Comput Stud* 68(3):121–137.
- Findlater, L., K. Moffatt, J. Mc Grenere, and J. Dawson. 2009. Ephemeral adaptation: The use of gradual onset to improve menu selection performance. In *Human Factors in Computing Systems: CHI 2009 Conference Proceedings*, ed. S. Greenberg, S. Hudson, K. Hinckley, M. R. Morris, and D. R. Olsen, 1655–1664 New York: ACM.
- Gajos, K. Z., M. Czerwinski, D. S. Tan, and D. S. Weld. 2006. Exploring the design space for adaptive graphical user interfaces. In *Proceedings of the 2006 Conference on Advanced Visual Interfaces*, 201–208. New York: ACM.
- Gajos, K. Z., D. S. Weld, and J. O. Wobbrock. 2010. Automatically personalized user interfaces with Supple. *Artif Intell* 174(12–13):910–950.
- Gajos, K. Z., J. O. Wobbrock, and D. S. Weld. 2007. Automatically generating user interfaces adapted to users' motor and vision capabilities. In *Proceedings of the 20th Annual ACM Symposium on User Interface Software and Technology*, 231–240. New York: ACM.

- Gajos, K. Z., J. O. Wobbrock, and D. S. Weld. 2008. Improving the performance of motor-impaired users with automatically generated, ability-based interfaces. In *Human Factors in Computing Systems: CHI 2008 Conference Proceedings*, ed. M. Burnett, M. F. Costabile, T. Catarci, B. de Ruyter, D. Tan, M. Czerwinski, and A. Lund, 1257–1266. New York: ACM.
- Gervasio, M. T., M. D. Moffitt, M. E. Pollack, J. M. Taylor, and T. E. Uribe. 2005. Active preference learning for personalized calendar scheduling assistance. In *IUI 2005: International Conference on Intelligent User Interfaces*, ed. J. Riedl, A. Jameson, D. Billsus, and T. Lau, 90–97. New York: ACM.
- Gutkauf, B., S. Thies, and G. Domik. 1997. A user-adaptive chart editing system based on user modeling and critiquing. In *User Modeling: Proceedings of the Sixth International Conference, UM97*, ed. A. Jameson, C. Paris, and C. Tasso, 159–170. Vienna: Springer Wien New York.
- Hammond, N. 1987. Principles from the psychology of skill acquisition. In *Applying Cognitive Psychology to User-interface Design*, ed. M. M. Gardiner, and B. Christie, 163–188. Chichester, England: Wiley.
- Heckmann, D. 2005. *Ubiquitous User Modeling*. Berlin: infix.
- Hegner, S. J., P. McEvitt, P. Norvig, and R. L. Wilensky, eds. 2001. *Intelligent Help Systems for UNIX*. Dordrecht, The Netherlands: Kluwer.
- Höök, K. 2000. Steps to take before IUIs become real. *Interact Comput* 12(4):409–426.
- Horvitz, E. 1999. Principles of mixed-initiative user interfaces. In *Human Factors in Computing Systems: CHI 1999 Conference Proceedings*, ed. M. G. Williams, M. W. Altom, K. Ehrlich, and W. Newman, 159–166. New York: ACM.
- Hwang, F., S. Keates, P. Langdon, and J. Clarkson. 2004. Mouse movements of motion-impaired users: A submovement analysis. In *Proceedings of the 6th International ACM SIGACCESS Conference on Computers and Accessibility*, 102–109. New York: ACM.
- Iachello, G., and J. Hong. 2007. End-user privacy in human-computer interaction. *Found Trends Hum Comput Interact* 1(1): 1–137.
- Jameson, A. 2003. Adaptive interfaces and agents. In *The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications*, ed. J. A. Jacko and A. Sears, 305–330. Mahwah, NJ: Erlbaum.
- Jameson, A. 2008. Adaptive interfaces and agents. In *The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications*, ed. A. Sears, and J. A. Jacko, 2nd ed., 433–458. Boca Raton, FL: CRC Press.
- Jameson, A. 2009. Understanding and dealing with usability side effects of intelligent processing. *AI Mag* 30(4):23–40.
- Jameson, A., and E. Schwarzkopf. 2002. Pros and cons of controllability: An empirical study. In *Adaptive Hypermedia and Adaptive Web-Based Systems: Proceedings of AH 2002*, ed. P. De Bra, P. Brusilovsky, and R. Conejo, 193–202. Berlin, Germany: Springer.
- Jameson, A., and B. Smyth. 2007. Recommendation to groups. In *The Adaptive Web: Methods and Strategies of Web Personalization*, ed. P. Brusilovsky, A. Kobsa, and W. Nejdl, 596–627. Berlin, Germany: Springer.
- Jefferson, L., and R. Harvey. 2006. Accommodating color blind computer users. In *Proceedings of the Eighth International ACM SIGACCESS Conference on Computers and Accessibility*, 40–47. New York: ACM.
- Jefferson, L., and R. Harvey. 2007. An interface to support color blind computer users. In *Human Factors in Computing Systems: CHI 2007 Conference Proceedings*, ed. B. Begole, S. Payne, E. Churchill, R. S. Amant, D. Gilmore, and M. B. Rosson, 1535–1538. New York: ACM.
- Kane, S. K., J. O. Wobbrock, and I. E. Smith. 2008. Getting off the treadmill: Evaluating walking user interfaces for mobile devices in public spaces. In *Proceedings of the 10th International Conference on Human Computer Interaction With Mobile Devices and Services*, 109–118. New York: ACM.
- Keates, S., P. Langdon, J. P. Clarkson, and P. Robinson. 2002. User models and user physical capability. *User Model User-adapt Interact* 12(2): 139–169.
- Kelly, D., and J. Teevan. 2003. Implicit feedback for inferring user preference: A bibliography. *ACM SIGIR Forum* 37(2):18–28.
- Kobsa, A. 2007. Generic user modeling systems. In *The Adaptive Web: Methods and Strategies of Web Personalization*, ed. P. Brusilovsky, A. Kobsa, and W. Nejdl, 136–154. Berlin, Germany: Springer.
- Krug, S. 2006. *Don't Make Me Think: A Common-Sense Approach to Web Usability*, 2nd ed. Berkeley, CA: New Riders.
- Krüger, A., J. Baus, D. Heckmann, M. Kruppa, and R. Wasinger. 2007. Adaptive mobile guides. In *The Adaptive Web: Methods and Strategies of Web Personalization*, ed. P. Brusilovsky, A. Kobsa, and W. Nejdl, 521–549. Berlin, Germany: Springer.
- Krulwich, B. 1997. Lifestyle Finder: Intelligent user profiling using large-scale demographic data. *AI Mag* 18(2):37–45.
- Lanier, J. 1995. Agents of alienation. *Interactions* 2(3):66–72.
- Law, C. M., A. Sears, and K. J. Price. 2005. Issues in the categorization of disabilities for user testing. In *Proceedings of HCI International*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Li, W., J. Matejka, T. Grossman, J. Konstan, and G. Fitzmaurice. 2011. Design and evaluation of a command recommendation system for software applications. *ACM Trans Comput Hum Interact* 18(2), Article 6.
- Lin, M., R. Goldman, K. J. Price, A. Sears, and J. Jacko. 2007. How do people tap when walking? An empirical investigation of nomadic data entry. *Int J Hum Comput Stud* 65(9):759–769.
- Linden, G., S. Hanks, and N. Lesh. 1997. Interactive assessment of user preference models: The automated travel assistant. In *User Modeling: Proceedings of the Sixth International Conference, UM97*, ed. A. Jameson, C. Paris, and C. Tasso, 67–78. Vienna: Springer Wien New York.
- Liscombe, J., G. Riccardi, and D. Hakkani-Tür. 2005. Using context to improve emotion detection in spoken dialog systems. In *Proceedings of the Ninth European Conference on Speech Communication and Technology*, 1845–1848. Grenoble: ISCA.
- Lisetti, C. L., and F. Nasoz. 2004. Using noninvasive wearable computers to recognize human emotions from physiological signals. *EURASIP J Appl Signal Process* 11: 1672–1687.
- Liu, J., P. Dolan, and E. R. Pedersen. 2010. Personalized news recommendation based on click behavior. In *IUI 2010: International Conference on Intelligent User Interfaces*, ed. M. O. Cavazza, and M. X. Zhou, 31–40. New York: ACM.
- Mackay, W. E. 1991. Triggers and barriers to customizing software. In *Human Factors in Computing Systems: CHI 1991 Conference Proceedings*, ed. S. P. Robertson, G. M. Olson, and J. S. Olson, 153–160. New York: ACM.
- Maes, P. 1994. Agents that reduce work and information overload. *Commun ACM* 37(7):30–40.
- Matejka, J., W. Li, T. Grossman, and G. Fitzmaurice. 2009. Community Commands: Command recommendations for software applications. In *UIST 2009 Conference Proceedings: ACM Symposium on User Interface Software and Technology*, 193–202. New York: ACM.
- Matejka, J., T. Grossman, and G. Fitzmaurice. 2011. Ambient Help. In *Human Factors in Computing Systems: CHI 2011 Conference Proceedings*, ed. D. Tan, B. Begole, W. Kellogg, G. Fitzpatrick, and C. Gutwin. New York: ACM.

- McGrenere, J., R. M. Baecker, and K. S. Booth. 2007. A field evaluation of an adaptable two-interface design for feature-rich software. *Trans Comput Hum Interact* 14(1), Article 3.
- McLaren, B. M., K. E. DeLeeuw, and R. E. Mayer. 2011a. A politeness effect in learning with web-based intelligent tutors. *Int J Hum Comput Stud* 69: 70–79.
- McLaren, B. M., K. E. DeLeeuw, and R. E. Mayer. 2011b. Polite web-based intelligent tutors: Can they improve learning in classrooms? *Comput Educ* 56: 574–584.
- Mehta, B. 2009. Cross System Personalization: Enabling Personalization Across Multiple Systems. Saarbrücken, Germany: VDM Verlag.
- Mislove, A., B. Viswanath, P. K. Gummadi, and P. Druschel. 2010. You are who you know: Inferring user profiles in online social networks. In *Proceedings of the Third International Conference on Web Search and Web Data Mining*, 251–260. New York: ACM.
- Mitchell, T., R. Caruana, D. Freitag, J. McDermott, and D. Zabowski. 1994. Experience with a learning personal assistant. *Commun ACM* 37(7):81–91.
- Mitchell, J., and B. Shneiderman. 1989. Dynamic versus static menus: An exploratory comparison. *SIGCHI Bull* 20(4):33–37.
- Norman, D. A. 1994. How might people interact with agents? *Commun ACM* 37(7):68–71.
- Palen, L. 1999. Social, individual and technological issues for groupware calendar systems. In *Human Factors in Computing Systems: CHI 1999 Conference Proceedings*, ed. M. G. Williams, M. W. Altom, K. Ehrlich, and W. Newman, 17–24. New York: ACM.
- Picard, R. W. 1997. Affective Computing. Cambridge, MA: MIT Press.
- Pu, P., and L. Chen. 2008. User-involved preference elicitation for product search and recommender systems. *AI Mag* 29(4):93–103.
- Rhodes, B. J. 2000. *Just-in-Time Information Retrieval*. Dissertation, School of Architecture and Planning, Massachusetts Institute of Technology. Available from <http://www.bradleyrhodes.com/Papers/rhodes-phd-JITIR.pdf>; latest access: October 1st, 2011.
- Rich, C. 2009. Building task-based user interfaces with ANSI/CEA-2018. *IEEE Comput* 42(8):20–27.
- Rich, C., C. Sidner, N. Lesh, A. Garland, S. Booth, and M. Chimani. 2005. DiamondHelp: A collaborative interface framework for networked home appliances. In *5th International Workshop on Smart Appliances and Wearable Computing, IEEE International Conference on Distributed Computing Systems Workshops*, 514–519. New York: IEEE.
- Schafer, J. B., D. Frankowski, J. Herlocker, and S. Sen. 2007. Collaborative filtering recommender systems. In *The Adaptive Web: Methods and Strategies of Web Personalization*, ed. P. Brusilovsky, A. Kobsa, and W. Nejdl, 291–324. Berlin, Germany: Springer.
- Schiele, B., T. Starner, B. Rhodes, B. Clarkson, and A. Pentland. 2001. Situation aware computing with wearable computers. In *Fundamentals of Wearable Computers and Augmented Reality*, ed. W. Barfield, and T. Caudell, 511–538. Mahwah, NJ: Erlbaum.
- Schifanella, R., A. Barrat, C. Cattuto, B. Markines, and F. Menczer. 2010. Folks in folksonomies: Social link prediction from shared metadata. In *Proceedings of the Third International Conference on Web Search and Web Data Mining*, 271–280. New York: ACM.
- Shami, N. S., Y. C. Yuan, D. Cosley, L. Xia, and G. Gay. 2007. That's what friends are for: Facilitating 'who knows what' across group boundaries. In *Proceedings of the 2007 International ACM Conference on Supporting Group Work*, 379–82.
- Shearin, S., and H. Lieberman. 2001. Intelligent profiling by example. In *IUI 2001: International Conference on Intelligent User Interfaces*, ed. J. Lester, 145–151. New York: ACM.
- Shen, J., E. Fitzhenry, and T. Dietterich. 2009. Discovering frequent work procedures from resource connections. In *IUI 2009: International Conference on Intelligent User Interfaces*, ed. N. Oliver and D. Weld. New York: ACM.
- Shen, J., J. Irvine, X. Bao, M. Goodman, S. Kolibab, A. Tran, F. Carl, B. Kirschner, S. Stumpf, and T. Dietterich. 2009. Detecting and correcting user activity switches: Algorithms and interfaces. In *IUI 2009: International Conference on Intelligent User Interfaces*, ed. N. Oliver and D. Weld. New York: ACM.
- Soller, A. 2007. Adaptive support for distributed collaboration. In *The Adaptive Web: Methods and Strategies of Web Personalization*, ed. P. Brusilovsky, A. Kobsa, and W. Nejdl, 573–595. Berlin, Germany: Springer.
- Teevan, J., S. T. Dumais, and E. Horvitz. 2010. Potential for personalization. *ACM Trans Comput Hum Interact* 17(1).
- Terveen, L., and D. W. McDonald. 2005. Social matching: A framework and research agenda. *ACM Trans Comput Hum Interact* 12(3):401–434.
- Tintarev, N., and J. Masthoff. 2010. Explanation of recommendations. In *Recommender Systems Handbook*, ed. F. Ricci, L. Rokach, B. Shapira, and P. B. Kantor. Berlin, Germany: Springer.
- Trewin, S. 2004. Automating accessibility: The Dynamic Keyboard. In *Proceedings of ASSETS 2004*, 71–78. New York: ACM.
- Tsandilas, T., and M. Schraefel. 2004. Usable adaptive hypermedia. *New Rev Hypermedia Multimedia* 10(1):5–29.
- VanLehn, K. 2006. The behavior of tutoring systems. *Int J Artif Intell Educ* 16(3):227–265.
- Vasuki, V., N. Natarajan, Z. Lu, and I. S. Dhillon. 2010. Affiliation recommendation using auxiliary networks. In *Proceedings of the Fourth ACM Conference on Recommender Systems*, ed. P. Resnick, M. Zanker, X. Amatriain, and M. Torrens, 103–110. New York: ACM.
- Vig, J., S. Sen, and J. Riedl. 2009. Tagsplanations: Explaining recommendations using tags. In *IUI 2009: International Conference on Intelligent User Interfaces*, ed. N. Oliver, and D. Weld, 47–56. New York: ACM.
- Wainer, H., ed. 2000. Computerized Adaptive Testing: A Primer. Hillsdale, NJ: Erlbaum.
- Wexelblat, A., and P. Maes. 1997. Issues for Software Agent UI. Unpublished manuscript, cited with permission. Available from <http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.51.8886>. Latest access: October 1st, 2011.
- Wobbrock, J. O., S. K. Kane, K. Z. Gajos, S. Harada, and J. Froelich. 2011. Ability-based design: Concept, principles and examples. *ACM Trans Access Comput.*, 3(3), Article 9.
- Wolfman, S. A., T. Lau, P. Domingos, and D. S. Weld. 2001. Mixed initiative interfaces for learning tasks: SMARTedit talks back. In *IUI 2001: International Conference on Intelligent User Interfaces*, ed. J. Lester, 167–174. New York: ACM.
- Zheleva, E., and L. Getoor. 2009. To join or not to join: The illusion of privacy in social networks with mixed public and private user profiles. In *Proceedings of the 2009 International World Wide Web Conference*, 531–40. Published by the International World Wide Web Conference Committee, <http://www.iw3c2.org/>.
- Ziegler, C., S. M. McNee, J. A. Konstan, and G. Lausen. 2005. Improving recommendation lists through topic diversification. In *Proceedings of the 2003 International World Wide Web Conference*, 22–32. Published by the International World Wide Web Conference Committee, <http://www.iw3c2.org/>.

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- Aish, R. 1979. 3D input for CAAD systems. *Comput Aided Des* 11(2): 66–70.
- Aish, R., and R Noakes. 1979. Architecture without numbers—CAAD based on a 3D modelling system. *Comput Aided Des* 16(6):321–328, Nov. 1984.
- Anagnostou, G., D. Dewey, and A. Patera. 1989. Geometry-defining processors for engineering design and analysis. *Visual Comput* 5: 304–315.
- Anderson, D., J. L. Frankel, J. Marks, A. Agarwala, P. Beardsley, J. Hodgins et al. 2000. Tangible interaction + graphical interpretation: A new approach to 3D modeling. In *Proceedings of the 27th Annual Conference on Computer Graphics and Interactive Techniques*, 393–402. New York: ACM.
- Arias, E., H. Eden, and G. Fischer. 1997. Enhancing communication, facilitating shared understanding, and creating better artifacts by integrating physical and computational media for design. In *Designing Interactive Systems: Processes, Practices, Methods, and Techniques*, 1–12. New York: ACM.
- Astrahan, M., B. Housman, J. Jacobs, R. Mayer, and W. Thomas. 1957. Logical design of the digital computer for the SAGE system. *IBM J Res Dev* 1(1):76–83.
- Baskinger, M., and M. Gross. 2010. Tangible interaction = form + computing. *ACM interact* 17(1):6–11.
- Baudisch, P., T. Becker, and F. Rudeck. 2010. Lumino: Tangible blocks for tabletop computers based on glass fiber bundles. In *Proceedings of the 28th International Conference on Human Factors in Computing Systems*, 1165–1174. New York: ACM.
- Beigl, M., and H. Gellersen. 2003. Smart-its: An embedded platform for smart objects. In *Smart Objects Conference (sOc)*. Paris: France Telecom and French CNRS.
- Ben-Joseph, E., H. Ishii, J. Underkoffler, B. Piper, and L. Yeung. 2001. Urban simulation and the luminous planning table: Bridging the gap between the digital and the tangible. *J Plann Educ Res* 21(2):196–203.
- Benhammous, D. 2002. Large Scale Electrostatic Actuation. B.S. Mechanical Engineering, MIT.
- Bennett, P. 2010. The representation and control of time in tangible user interfaces. *Proc. of TEI '10*, 307–308. New York: ACM.
- Biegelsen, D., A. Berlin, P. Cheung, M. Fromherz, D. Goldberg, W. Jackson et al. 2000. AirJet paper mover. In *SPIE Int. Symposium on Micromachining and Microfabrication*, 4176–4211. Bellingham, WA: SPIE.
- Blackwell, A. F. 2003. Cognitive dimensions of tangible programming languages. In *Proc. of PPIG '03*, 391–405.
- Blevins, E. 2007. Sustainable interaction design: invention & disposal, renewal & reuse. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 503–512. New York: ACM.
- Brave, S., and A. Dahley. 1997. inTouch: A medium for haptic interpersonal communication (short paper). In *Conference on Human Factors in Computing Systems (CHI '97)*. New York: ACM.
- Brave, S., H. Ishii, and A. Dahley. 1998. Tangible interfaces for remote collaboration and communication. In *Proceedings of the 1998 ACM Conference on Computer Supported Cooperative Work (CSCW '98)*, 169–178. New York: ACM.
- Buechley, L., M. Eisenberg, J. Catchen, and A. Crockett. 2008. The LilyPad Arduino: Using computational textiles to investigate engagement, aesthetics, and diversity in computer science education. In *Proceeding of the Twenty-Sixth Annual SIGCHI Conference on Human Factors in Computing Systems*, 423–432. New York: ACM.
- Burbeck, S. (Producer). 1992. Applications Programming in Smalltalk-80(TM): How to use Model-View-Controller (MVC). <http://st-www.cs.uiuc.edu/users/smarch/st-docs/mvc.html>.
- Buxton, W. 1995. Integrating the periphery and context: A new model of telematics. *Graphics Interface '95*, 239–246. New York: ACM.
- Chang, A., S. O'Modhrain, R. Jacob, E. Gunther, and H. Ishii. 2002. ComTouch: Design of a vibrotactile communication device. In *Proceedings of the Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques*, 312–320. New York: ACM.
- Chang, A., B. Resner, B. Koerner, X. Wang, and H. Ishii. 2001. LumiTouch: An emotional communication device. In *CHI '01 Extended Abstracts on Human Factors in Computing Systems*, 313–314. New York: ACM.
- Cheng, K.-Y., R.-H. Liang, B.-Y. Chen, R.-H. Laing, and S.-Y. Kuo. 2010. iCon: Utilizing everyday objects as additional, auxiliary and instant tabletop controllers. In *Proceedings of the 28th International Conference on Human Factors in Computing Systems*, 1155–1164. New York: ACM.
- Cohen, P. R., and S. L. Oviatt. 1995. The role of voice input for human–machine communication. In *Proceedings of the National Academy of Science*, 92(22):9921–9927. Washington, DC: National Academy of Sciences.
- Cohen, J., M. Withgott, and P. Piernot. 1999. LogJam: A tangible multi-person interface for video logging. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems: The CHI is the Limit*, 128–135. New York: ACM.
- Couture, N., G. Riviere, and P. Reuter. 2008. GeoTUI: A tangible user interface for geoscience. In *Proceedings of the 2nd International Conference on Tangible and Embedded Interaction*, 89–96. New York: ACM.
- Crampton Smith, G. 1995. The Hand That Rocks the Cradle. *I.D.*, 60–65.
- Csikszentmihaly, M., and E. Rochberg-Halton. 1981. *The Meaning of Things: Domestic Symbols and the Self*. Cambridge, UK: Cambridge University Press.
- Dahley, A., C. Wisneski, and H. Ishii. 1998. Water lamp and pinwheels: Ambient projection of digital information into architectural space (short paper). In *Conference on Human Factors in Computing Systems (CHI '98)*, Conference Summary of CHI '98. New York: ACM.
- DiSalvo, C., P. Sengers, and H. Brynjarsdottir. 2010. Mapping the landscape of sustainable HCI. In *Proceedings of the 28th International Conference on Human Factors in Computing Systems*, 1975–1984. New York: ACM.
- Djajadiningrat, T., S. Wensveen, J. Frens, and K. Overbeeke. 2004. Tangible products: Redressing the balance between appearance and action. *Pers Ubiquitous Comput* 8(5):294–309.
- Dodge, C. 1997. The bed: A medium for intimate communication. In *CHI '97 Extended Abstracts on Human Factors in Computing Systems: Looking to the Future*, 371–372. New York: ACM.
- Donath, J., and D. Boyd. 2004. Public displays of connection. *BT Technol J* 22(4):71–82.

- Dourish, P. 2002. Where the Action is: The Foundations of Embodied Interaction. Cambridge, MA, Mass: MIT Press.
- Dunne, A., and F. Raby. 1994. Fields and thresholds. *Presentation at the Doors of Perception* 2. <http://www.mediamatic.nl/Doors/Doors2/DunRab/-DunRab-Doors2-E.html>.
- Eden, H., E. Scharff, and E. Hornecker. 2002. Multilevel design and role play: Experiences in assessing support for neighborhood participation in design. In Proceedings of the 4th Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques, 387–392. New York: ACM.
- Edge, D., and A. Blackwell. 2006. Correlates of the cognitive dimensions for tangible user interface. *J Visual Languages Comput* 17(4):366–394.
- Etter, R., and C. Roecker. 2007. A tangible user interface for multiuser awareness systems. In Proceedings of the 1st International Conference on Tangible and Embedded Interaction, 11–12. New York: ACM.
- Everitt, K. M., S. R. Klemmer, R. Lee, and J. A. Landay. 2003. Two worlds apart: Bridging the gap between physical and virtual media for distributed design collaboration. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 553–560. New York: ACM.
- Fernaeus, Y., J. Tholander, and M. Jonsson. 2008. Towards a new set of ideals: Consequences of the practice turn in tangible interaction. In Proceedings of the 2nd International Conference on Tangible and Embedded Interaction, 223–230. New York: ACM.
- Fischer, P. T., C. Zoellner, T. Hoffmann, and S. Piatza. 2010. VR/Urban: SMSingshot. In Proceedings of the Fourth International Conference on Tangible, Embedded, and Embodied Interaction, 381–382. New York: ACM.
- Fishkin, K. P. 2004. A taxonomy for and analysis of tangible interfaces. *Pers Ubiquitous Comput* 8: 347–358.
- Fitzmaurice, G. W. 1996. *Graspable user interfaces*.
- Fitzmaurice, G. W., H. Ishii, and W. Buxton. 1995a. Bricks: Laying the Foundations for Graspable User Interfaces. In Conference on Human Factors in Computing Systems (CHI '95), 442–449. New York: ACM.
- Fitzmaurice, G. W., H. Ishii, and W. A. S. Buxton. 1995b. Bricks: Laying the foundations for graspable user interfaces. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 442–449. New York: ACM.
- Fogg, B., L. D. Cutler, P. Arnold, and C. Eisbach. 1998. HandJive: A device for interpersonal haptic entertainment. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 57–64. New York: ACM.
- Frazer, J. 1994. An Evolutionary Architecture. London, UK: Architectural Association.
- Frazer, J., J. Frazer, and P. Frazer. 1980. Intelligent physical three dimensional modelling system. *Comput Graphics* 80: 359–370.
- Frei, P., V. Su, B. Mikhak, and H. Ishii. 2000. Curlybot: Designing a new class of computational toys. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2000), 129–136. New York: ACM.
- Frey, M. 2007. CabBoots: Shoes with integrated guidance system. In Proceedings of the 1st International Conference on Tangible and Embedded Interaction, 245–246. New York: ACM.
- Gershensonfeld, N. A. 2005. Fab: The coming revolution on your desktop—from personal computers to personal fabrication.
- Geyer, R., and V. Doctori Blass. 2010. The economics of cell phone reuse and recycling. *Int J Adv Manuf Technol* 47(5):515–525.
- Goldberg, A. 1984. Smalltalk-80: The Interactive Programming Environment. Reading, MA: Addison-Wesley.
- Goldsmith, S. 1983. The readymades of marcel duchamp: The ambiguities of an aesthetic revolution. *J Aesthetics Art Criticism*, 42(2):197–208.
- Gorbet, M., M. Orth, and H. Ishii. 1998. Triangles: Tangible interface for manipulation and exploration of digital information topography. In Paper Presented at the Conference on Human Factors in Computing Systems (CHI '98), Los Angeles, CA. New York: ACM.
- Greenberg, S., and C. Fitchett. 2001. Phidgets: Easy development of physical interfaces through physical widgets. In Paper Presented at the Proceedings of the 14th Annual ACM Symposium on User Interface Software and Technology, Orlando, FL. New York: ACM.
- Hall, E.T. 1969. The Hidden Dimension. Garden City, NY: Doubleday.
- Hinckley, K., R. Pausch, J. C. Goble, and N. F. Kassell. 1994. Passive real-world interface props for neurosurgical visualization. In Conference on Human Factors in Computing Systems (CHI '94), 452–458. New York: ACM.
- Hindus, D., S. D. Mainwaring, N. Leduc, A. E. Hagstrom, and O. Bayley. 2001. Casablanca: Designing social communication devices for the home. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 325–332. New York: ACM.
- Hines, J., T. Malone, P. Gonçalves, G. Herman, J. Quimby, M. Murphy-Hoye et al. 2011. Construction by replacement: a new approach to simulation modeling. *System Dynamics Review* 27: 64–90.
- Hollan, J., and S. Stornetta. 1992. Beyond being there. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 119–125. New York: ACM.
- Holmquist, L. E., J. Redstr, and P. Ljungstrand. 1999. Token-based acces to digital information. In Proceedings of the 1st International Symposium on Handheld and Ubiquitous Computing, 234–245. Berlin: Springer.
- Holmquist, L. E., A. Schmidt, and B. Ullmer. 2004. Tangible interfaces in perspective: Guest editors' introduction. *Pers Ubiquitous Comput* 8(5):291–293.
- Holmquist, L. E., and T. Skog. 2003. Informative art: Information visualization in everyday environments. In Proceedings of the 1st International Conference on Computer Graphics and Interactive Techniques in Australasia and South East Asia, 229–235. New York: ACM.
- Hornecker, E., and J. Buur. 2006. Getting a grip on tangible interaction: A framework on physical space and social interaction. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 437–446. New York: ACM.
- Hummels, C., and A. V. D. Helm. 2004. ISH and the search for resonant tangible interaction. *Pers Ubiquitous Comput* 8(5):385–388.
- Hurtienne, J., and J. H. Israel. 2007. Image schemas and their metaphorical extensions: Intuitive patterns for tangible interaction. In Proceedings of the 1st International Conference on Tangible and Embedded Interaction, 127–134. New York: ACM.
- Hutchins, E. 1995. Cognition in the Wild. Cambridge, MA: MIT Press.
- Ishii, H. 2004. Bottles: A transparent interface as a tribute to Mark Weiser. *IEICE Trans Inf Syst* E87-D(6):1299–1311.
- Ishii, H., H. R. Fletcher, J. Lee, S. Choo, J. Berzowska, C. Wisneski et al. 1999. musicBottles. ACM SIGGRAPH '99 Conference Abstracts and Applications, 174. New York: ACM.
- Ishii, H., M. Kobayashi, and K. Arita. 1994. Iterative Design of Seamless Collaboration Media. *Commun ACM (CACM)*, 37(8):83–97.
- Ishii, H., A. Mazalek, and J. Lee. 2001. Bottles as a minimal interface to access digital information. *CHI '01 Extended Abstracts on Human Factors in Computing Systems*, 187–88.

- Ishii, H., C. Ratti, B. Piper, Y. Wang, A. Biderman, and E. Ben-Joseph. 2004. Bringing clay and sand into digital design—continuous tangible user interfaces. *BT Technol J* 22(4):287–299.
- Ishii, H., and B. Ullmer. 1997. Tangible bits: Towards seamless interfaces between people, bits and atoms. In Conference on Human Factors in Computing Systems (CHI '97), 234–241. New York: ACM.
- Ishii, H., C. Wisneski, S. Brave, A. Dahley, M. Gorbet, B. Ullmer et al. 1998. ambientROOM: Integrating ambient media with architectural space (video). In Conference on Human Factors in Computing Systems (CHI '98), Conference Summary of CHI '98. New York: ACM.
- Jacob, R. J. K., A. Girouard, L. M. Hirshfield, M. S. Horn, O. Shaer, E. T. Solovey et al. 2008. Reality-based interaction: A framework for post-WIMP interfaces. In Proceeding of the Twenty-Sixth Annual SIGCHI Conference on Human Factors in Computing Systems, 201–210. New York: ACM.
- Jacob, R. J. K., H. Ishii, G. Pangaro, and J. Patten. 2002. A tangible interface for organizing information using a grid. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems: Changing our World, Changing Ourselves, 339–346. New York: ACM.
- Johnson, J., T. L. Roberts, W. Verplank, D. C. Smith, C. H. Irby, and M. Beard et al. 1989. The Xerox Star: A retrospective. *IEEE Comput* 22(9):11–25.
- Jorda, S. 2008. On stage: The reactable and other musical tangibles go real. *Int J Arts Technol* 1(3–4):268–287.
- Jorda, S., G. Geiger, M. Alonso, and M. Kaltenbrunner. 2007. The reacTable: Exploring the synergy between live music performance and tabletop tangible interfaces. In Proceedings of the 1st International Conference on Tangible and Embedded Interaction, 139–146. New York: ACM.
- Jouppi, N. P., S. Iyer, W. Mack, A. Slayden, and S. Thomas. 2004. A first generation mutually-immersive mobile telepresence surrogate with automatic backtracking. In Robotics and Automation, 2004. Proceedings. ICRA '04. 2004 IEEE International Conference on, Vol. 1672, 1670–1675. Washington, DC: IEEE.
- Kalanithi, J. J., and V. Michael Bove Jr. 2008. Connectibles: Tangible social networks. In Proceedings of the 2nd International Conference on Tangible and Embedded Interaction, 199–206. New York: ACM.
- Kernaghan, B. 2010. *Interiority: An Anthology of Critical Writing on Interior Architecture and Design*. London, UK: Architectural Press.
- Kitamura, Y., Y. Itoh, and F. Kishino. 2001. Real-time 3D interaction with ActiveCube. *CHI '01 Extended Abstracts on Human Factors in Computing Systems*, 355–356. New York: ACM.
- Klemmer, S. R., B. Hartmann, and L. Takayama. 2006. How bodies matter: Five themes for interaction design. In Proceedings of the 6th Conference on Designing Interactive Systems, 140–149. New York: ACM.
- Klemmer, S., M. Newman, R. Farrell, M. Bilezikjian, and J. Landay. 2001. The designers' outpost: A tangible interface for collaborative web site. In Proceedings of the 14th Annual ACM Symposium on User Interface Software and Technology, 1–10. New York: ACM.
- Klemmer, S. R., M. Thomsen, E. Phelps-Goodman, R. Lee, and J. A. Landay. 2002. Where do web sites come from?: Capturing and interacting with design history. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems: Changing our World, Changing Ourselves, 1–8. New York: ACM.
- Kloepffer, W. 2008. Life cycle sustainability assessment of products. *Int J Life Cycle Assess* 13(2):89–95.
- Kobayashi, K., M. Hirano, A. Narita, and H. Ishii. 2003. A tangible interface for IP network simulation. In *CHI '03 Extended Abstracts on Human Factors in Computing Systems*, 800–801. New York: ACM.
- Koleva, B., S. Benford, K. H. Ng, and T. Rodden. 2003. A framework for tangible user interfaces. In *Physical Interaction'03*.
- Kraut, R., J. Galegher, and C. Egido. 1988. Relationships and tasks in scientific research collaboration. *SIGCHI Bull* 20(1):79–80.
- Kurtich, J., and G. Eakin. 1993. *Interior Architecture*. New York, NY: Van Nostrand Reinhold.
- Kuzuoka, H., and S. Greenberg. 1999. Mediating awareness and communication through digital but physical surrogates. In *CHI '99 Extended Abstracts on Human Factors in Computing Systems*, 11–12. New York: ACM.
- Lawson, B. 2001. *The Language of Space*. Oxford and Boston: Architectural Press.
- Lee, G. A., C. Nelles, M. Billinghurst, and G. J. Kim. 2004. Immersive authoring of tangible augmented reality applications. In Proceedings of the 3rd IEEE/ACM International Symposium on Mixed and Augmented Reality, 172–181. New York: ACM.
- Lee, J., V. Su, S. Ren, and H. Ishii. 2000. HandSCAPE: A vectorizing tape measure for on-site measuring applications. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 137–144. New York: ACM.
- Levisohn, A., J. Cochrane, D. Gromala, and J. Seo. 2007. The meat-book: Tangible and visceral interaction. In Proceedings of the 1st International Conference on Tangible and Embedded Interaction, 91–92. New York: ACM.
- Lin, R.-T. 2007. Transforming taiwan aboriginal cultural features into modern product design: A case study of a cross-cultural product design model. *Int J Des* 1(2):45–53.
- Ljungstrand, P., J. Redström, and L. E. Holmquist. 2000. WebStickers: Using physical tokens to access, manage and share bookmarks to the web. In Proceedings of DARE 2000 on Designing Augmented Reality Environments, 21–35. New York: ACM.
- Mackay, W. E., and M. Beaudouin-Lafon. 2005. FamilyNet: A tangible interface for managing intimate social networks. In Proc. of SOUPS '05. New York: ACM.
- MacLean, K. E., S. S. Snibbe, and G. Levin. 2000. Tagged handles: Merging discrete and continuous manual control. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 225–232. New York: ACM.
- Mankoff, J., A. K. Dey, G. Hsieh, J. Kientz, S. Lederer, and M. Ames. 2003. Heuristic evaluation of ambient displays. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 169–176. New York: ACM.
- Mazalek, A., and E. van den Hoven. 2009. Framing tangible interaction frameworks. *AI EDAM*, 23(Special Issue 03): 225–235.
- Mazalek, A., A. Wood, and H. Ishii. 2001. genieBottles: An interactive narrative in bottles. In Conference Abstracts and Applications of SIGGRAPH '01, 189. New York: ACM.
- McNerney, T. S. 2004. From turtles to tangible programming bricks: Explorations in physical language design. *Pers Ubiquitous Comput* 8(5):326–337.
- Merrill, D., J. Kalanithi, and P. Maes. 2007. Siftables: Towards sensor network user interfaces. In Proceedings of the 1st International Conference on Tangible and Embedded Interaction, 75–78. New York: ACM.
- Moggridge, B. 2007. *Designing Interactions*. Cambridge, MA: Mass: MIT Press.
- Moran, T. P., E. Saund, W. V. Melle, A. U. Gujar, K. P. Fishkin, and B. L. Harrison. 1999. Design and technology for collaborage: Collaborative collages of information on physical walls. In Proceedings of the 12th Annual ACM Symposium on User Interface Software and Technology, 197–206. New York: ACM.
- Mynatt, E. D. 2000. Co-opting everyday objects. In Proceedings of DARE 2000 on Designing Augmented Reality Environments, 145–146. New York: ACM.

- Norman, D.A. 1999. Affordance, conventions, and design. *Interactions* 6: 38–43.
- Oba, H. 1990. *Environment Audio System for the Future*. Sony concept video.
- Olson, G. M., and J. S. Olson. 2000. Distance matters. *Hum Comput Interact* 15: 139–179.
- Pangaro, G., D. Maynes-Aminzade, and H. Ishii. 2002. The actuated workbench: Computer-controlled actuation in tabletop tangible interfaces. In Proceedings of the 15th Annual ACM Symposium on User Interface Software and Technology (UIST 2002), 181–190. New York: ACM.
- Papert, S. 1980. *Mindstorms: Children, Computers, and Powerful Ideas*. New York: Basic Books.
- Patten, J., L. Griffith, and H. Ishii. 2000. A tangible interface for controlling robotic toys. In CHI '00 Extended Abstracts on Human Factors in Computing Systems, 277–278. New York: ACM.
- Patten, J., and H. Ishii. 2007. Mechanical constraints as computational constraints in tabletop tangible interfaces. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 809–818. New York: ACM.
- Patten, J., H. Ishii, J. Hines, and G. Pangaro. 2001. Sensetable: A wireless object tracking platform for tangible user interfaces. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 253–260. New York: ACM.
- Patten, J., B. Recht, and H. Ishii. 2002. Audiopad: A Tag-based Interface for Musical Performance. In New Interfacefor Musical Expression, 1–6. Singapore: National University of Singapore.
- Paulos, E., and J. Canny. 1998. PRoP: Personal roving presence. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 296–303. New York: ACM.
- Perlman, R. 1976. Using computer technology to provide a creative learning environment for preschool children. In *MIT Lego Memo*, #24. MIT M.S. Thesis. <http://dspace.mit.edu/handle/1721.1/5784>, <http://hdl.handle.net/1721.1/5784>.
- Piper, B., C. Ratti, and H. Ishii. 2002. Illuminating clay: A 3-D tangible interface for landscape analysis. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems: Changing our World, Changing Ourselves, 355–362. New York: ACM.
- Poupyrev, I., T. Nashida, and M. Okabe. 2007. Actuation and tangible user interfaces: The Vaucanson duck, robots, and shape displays. In Proceedings of the 1st International Conference on Tangible and Embedded Interaction, 205–212. New York: ACM.
- Pousman, Z., and J. Stasko. 2006. A taxonomy of ambient information systems: Four patterns of design. In Proceedings of the Working Conference on Advanced Visual Interfaces, 67–74. New York: ACM.
- Raffle, H. S., A. J. Parkes, and H. Ishii. 2004. Topobo: A constructive assembly system with kinetic memory. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI 2004), 647–654. New York: ACM.
- Ratti, C., Y. Wang, B. Piper, H. Ishii, and A. Biderman. 2004. PHOXEL-SPACE: An interface for exploring volumetric data with physical voxels. In Proceedings of the 2004 Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques, 289–296. New York: ACM.
- Rauterberg, M., M. Fjeld, H. Krueger, M. Bichsel, U. Leonhardt, and M. Meier. 1998. BUILD-IT: A planning tool for construction and design. In CHI '98 Conference Summary on Human Factors in Computing Systems, 177–178. New York: ACM.
- Redström, J., T. Skog, and L. Hallnas. 2000. Informative art: Using amplified artworks as information displays. In Proceedings of DARE 2000 on Designing Augmented Reality Environments, 103–114. New York: ACM.
- Reed, M. 2009. Prototyping digital clay as an active material. In Proceedings of the 3rd International Conference on Tangible and Embedded Interaction, 339–342. New York: ACM.
- Rekimoto, J., B. Ullmer, and H. Oba. 2001. DataTiles: A modular platform for mixed physical and graphical interactions. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 269–276. New York: ACM.
- Resnick, M., F. Martin, R. Berg, R. Borovoy, V. Colella, K. Kramer et al. 1998. Digital manipulatives: New toys to think with. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 281–287. New York: ACM.
- Reznik, D. S., and J. F. Canny. 2001. C'mon part, do the local motion! In Robotics and Automation, 2001. Proceedings 2001 ICRA. IEEE International Conference on, Vol. 2233, 2235–2242. Washington, DC: IEEE.
- Ryokai, K., S. Marti, and H. Ishii. 2004. I/O brush: Drawing with everyday objects as ink. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 303–310. New York: ACM.
- Sankaran, R., B. Ullmer, J. Ramanujam, K. Kallakuri, S. Jandhyala, C. Toole et al. 2009. Decoupling interaction hardware design using libraries of reusable electronics. In Proceedings of the 3rd International Conference on Tangible and Embedded Interaction, 331–337. New York: ACM.
- Shaer, O., and E. Hornecker. 2009. Tangible user interfaces: Past, present, and future directions. *Found Trends Hum Comput Interact* 3(1–2):1–137.
- Shaer, O., N. Leland, E. H. Calvillo-Gamez, and R. J. K. Jacob. 2004. The TAC paradigm: Specifying tangible user interfaces. *Personal and Ubiquitous Computing*, 8: 359–369.
- Singer, A., D. Hindus, L. Stifelman, and S. White. 1999. Tangible progress: Less is more in somewire audio spaces. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems: The CHI is the Limit, 104–111. New York: ACM.
- Smith, D. 1982. Designing the star user interface. *Byte* 7(4):242–282.
- Stifelman, L. J. 1996. Augmenting real-world objects: A paper-based audio notebook. In Conference Companion on Human Factors in Computing Systems: Common Ground, 199–200. New York: ACM.
- Streitz, N. A., J. Geissler, T. Holmer, S. I. Konomi, C. Mueller-Tomfelde, W. Reischl et al. 1999. i-LAND: An interactive landscape for creativity and innovation. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems: The CHI is the Limit, 120–127. New York: ACM.
- Strong, R., and W. Gaver. 1996. Feather, scent and shaker: Supporting simple intimacy. In Proc. of CSCW '96, 29–30. New York: ACM.
- Sutherland, I. E. 1964. Sketchpad: A man-machine graphical communication system. In DAC '64: Proc. of the SHARE Design Automation Workshop, 6.329–346. New York: ACM.
- Suzuki, H., and H. Kato. 1993. AlgoBlock: A tangible programming language—a tool for collaborative learning. In *The 4th European Logo Conference*, 297–303.
- Thacker, C., E. McCreight, B. Lampson, R. Sproull, and D. Boggs. 1984. Alto: A personal computer. In Computer Structures: Principles and Examples, 2nd ed., ed. Siewiorek, Bell, and Newell, 549–572. New York: McGraw-Hill.
- Ullmer, B. 2002. Tangible interfaces for manipulating aggregates of digital information. New York: ACM. MIT Ph.D. Thesis. <http://dspace.mit.edu/handle/1721.1/29264>, <http://hdl.handle.net/1721.1/29264>.
- Ullmer, B., Z. Dever, R. Sankaran, C. Toole, C. Freeman, B. Cassady et al. 2010. Cartouche: Conventions for tangibles bridging diverse interactive systems. In Proc. of TEI '10, 93–100. New York: ACM.

- Ullmer, B., and H. Ishii. 1997. The metaDESK: Models and prototypes for tangible user interfaces. In *Symposium on User Interface Software and Technology (UIST '97)*, 223–232. New York: ACM.
- Ullmer, B., and H. Ishii. 2000. Emerging frameworks for tangible user interfaces. *IBM Syst J* 39(3&4):915–931.
- Ullmer, B., H. Ishii, and D. Glas. 1998. mediaBlocks: Physical containers, transports, and controls for online media. In *Proceedings of the 25th Annual Conference on Computer Graphics and Interactive Techniques*, 379–386. New York: ACM.
- Ullmer, B., H. Ishii, and R. J. K. Jacob. 2003. Tangible query interfaces: Physically constrained tokens for manipulating database queries. In *INTERACT 2003 Conference*, 279–286. Amsterdam: IOS Press.
- Ullmer, B., H. Ishii, and R. J. K. Jacob. 2005. Token + constraint systems for tangible interaction with digital information. *ACM Transactions on Computer-Human Interaction* 12: 81–118.
- Ullmer, B., R. Sankaran, S. Jandhyala, B. Tregre, C. Toole, K. Kallakuri et al. 2008. Tangible menus and interaction trays: Core tangibles for common physical/digital activities. In *Proc. of TEI '08*, 209–212. New York: ACM.
- Underkoffler, J., and H. Ishii. 1998. Illuminating light: An optical design tool with a luminous-tangible interface. In *Conference on Human Factors in Computing Systems (CHI '98)*, 542–549. New York: ACM.
- Underkoffler, J., and H. Ishii. 1999. Urp: A luminous-tangible workbench for urban planning and design. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems: The CHI is the Limit*, 386–393. New York: ACM.
- Underkoffler, J., B. Ullmer, and H. Ishii. 1999. Emancipated pixels: Real-world graphics in the luminous room. In *Proceedings of the 26th Annual Conference on Computer Graphics and Interactive Techniques*, 385–392. New York: ACM.
- van den Hoven, E., and B. Eggen. 2004. Tangible computing in everyday life: Extending current frameworks for tangible user interfaces with personal objects, 230–242. Springer: Berlin.
- Villar, N., and H. Gellersen. 2007. A malleable control structure for softwired user interfaces. In *Proceedings of the 1st International Conference on Tangible and Embedded Interaction*, 49–56. New York: ACM.
- Weiser, M. 1991. The computer for the 21st century. *Sci Am* 265(3):94–104.
- Wellner, P. 1993. Interacting with paper on the DigitalDesk. *Commun ACM* 36(7):87–96.
- Wisneski, C., H. Ishii, A. Dahley, M. Gorbet, S. Brave, B. Ullmer et al. 1998. Ambient displays: Turning architectural space into an interface between people and digital information. In *International Workshop on Cooperative Buildings (CoBuild '98)*, 22–32. Springer: Berlin.
- Zigelbaum, J., and C. Csikszentmihalyi. 2009. Reflecting on tangible user interfaces: Three issues concerning domestic technology. In *CHI'07 Workshop on Tangible User Interfaces in Context and Theory*. Scientific Commons.
- Zuckerman, O., and M. Resnick. 2004. Hands-on modeling and simulation of systems. In *Proceeding of the 2004 Conference on Interaction Design and Children: Building a Community*, 157–158. New York: ACM.
- Zufferey, G., P. Jermann, A. Lucchi, and P. Dillenbourg. 2009. TinkerSheets: Using paper forms to control and visualize tangible simulations. In *Proceedings of the 3rd International Conference on Tangible and Embedded Interaction*, 377–384. New York: ACM.

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- Abley, M. 2005. *Spoken Here: Travels Among Threatened Languages*. London: Arrow Books.
- Ackerman, M., and T. Malone. 1990. Answer Garden: A Tool for Growing Organizational Memory. In *Proceedings of the ACM Conference on Office Information Systems*, 31–39, April 1990. Cambridge, MA.
- Ahlberg, C., C. Williamson, and B. Shneiderman. 1992. Dynamic queries for information exploration: An implementation and evaluation. In *Proceedings of the ACM CHI'92: Human Factors in Computing Systems*, 619–626. New York: ACM.
- Alexander, C. A. 2002. *The Nature of Order: An Essay on the Art of Building and the Nature of the Universe*. Book One: The phenomenon of Life. Berkely, CA: Center for Environmental Structure.
- Attnave, F. 1957. Physical determinants of the judged complexity of shape. *J Exp Psychol* 53: 221–227.
- Barlett, F. C. 1932. *Remembering: An Experimental and Social Study*. Cambridge: Cambridge University Press.
- Bar-Yam, Y. 1997. *Dynamics of complex systems (Studies in nonlinearity)*. Boulder, CO: Westview Press.
- Bar-Yam, Y. 2000. *Unifying Themes in Complex Systems: Proceedings of the International Conference on Complex Systems*. New York: Basic Books.
- Bass, L., and B. E. John. 2003. Linking usability to software architecture patterns through general scenarios. *J Syst Softw* 66:187–197.
- Bellamy, R., B. John, J. Richards, and J. Thomas. 2010. Using CogTool to model programming tasks. In *PLATEAU Workshop at ONWARD/SPLASH 2010*, Reno, Nevada, November. Article 1, doi>10.1145/1937117.1937118.
- Bhavnani, S. K., C. K. Bichakjian, T. M. Johnson, R. J. Little, F. A. Peck, J. L. Schwartz, and V. J. Strecher. 2006. Strategy hubs: Domain portals to help find comprehensive information. *J Am Soc Inf Sci Technol* 57(1):4–24.
- Bhavnani, S. K., and B. E. John. 2001. The strategic use of complex computer systems. In *Human-Computer Interaction in the New Millennium*, ed. J. M. Carroll. Reading, MA: Addison-Wesley/ACM Books.
- Bhavnani, S. K., F. Reif, and B. E. John. 2001. Beyond command knowledge: Identifying and teaching strategic knowledge for using complex computer applications. In *Proceedings of CHI 2001*, 229–236. New York: ACM.
- Boehm, B. W. 1981. *Software Engineering Economics*. Upper Saddle River, NJ: Prentice Hall.
- Boehm, B. W. 2000. *Software Cost Estimation with COCOMO 2000*. Upper Saddle River, NJ: Prentice Hall.
- Bovair, S., D. E. Kieras, and P. G. Polson. 1990. The acquisition and performance of text-editing skill: A cognitive complexity analysis. *Hum Comput Interact* 5(1): 1–48.
- Bransford, J. D., and M. K. Johnson. 1973. Considerations of some problems in comprehension. In *Visual Information Processing*, ed. W. G. Chase. New York: Academic Press.
- Brooks, F. P. 1975. *The Mythical Man-Month: Essays on Software Engineering*. Reading, Boston, MA: Addison-Wesley.
- Brown, G. D. A. 1984. A frequency count of 190,000 words in the London-Lund Corpus of English Conversation. *Behav Res Methods Instrum Comput* 16: 502–532.
- Brown, A. B., and J. L. Hellerstein. 2004. An approach to benchmarking configuration complexity. In *Proceedings of the 11th ACM SIGOPS European Workshop*, September, 2004. NY: ACM. Article 18, doi>10.1145/1133572.1133609.

- Brown, A. B., A. Keller, and J. L. Hellerstein. 2005. A model of configuration complexity and its application to a change management system. In Proceedings of the Ninth IFIP/IEE International Symposium on Integrated Network Management, IM 2005, 634–644, May 2005. New York: IEEE.
- Bruckman, A. S. 1997. Moose crossing: construction, community, and learning in a networked virtual world for kids. Doctoral Thesis. UMI Order Number: AAI0598541.
- Calcaterra, J. A., and D. Spangler. 2011. Designing for learnability in user interface migrations: Experiences with designing a serviceability user interface. In Proceedings of the 5th Annual Symposium on Computer Human Interaction for Management of Information Technology, 469–488. New York: ACM.
- Card, S. K., T. P. Moran, and A. Newell. 1983. *The Psychology of Human-Computer Interaction*. Hillsdale, NJ: Erlbaum.
- Carroll, J., and C. Carrithers. 1984. Training wheels in a user interface. *Commun ACM* 27(8):800–806.
- Carroll, J., and R. L. Mack. 1984. Learning to use a word processor by doing, by thinking, and by knowing. In *Human Factors in Computer Systems*, ed. J. C. Thomas and M. L. Schneider. Norwood, NJ: Ab lex.
- Carroll, J. B., and M. N. White. 1993. Word frequency and age of acquisition as determiners of picture-naming latency. *Quarterly journal of experimental psychology* 25: 85–95.
- Carroll, J., J. C. Thomas, and A. Malhotra. 1980. Presentation and representation in design problem solving. *Br J Psychol* 71(1):143–155.
- Chernoff, H. 1973. The use of faces to represent points in k-dimensional space graphically. *J Am Stat Soc* 68: 361–368.
- Connell, I., A. Blandford, and T. R. G. Green. 2004. CASSM and cognitive walkthrough: Usability issues with ticket vending machines. *Behav Inf Technol* 23(5):307–320.
- Coskun, E., and M. Grabowski. 2005. Impacts of user interface complexity on user acceptance and performance in safety-critical systems. *Emerg Manag* 2(1): 1–29.
- Dawes, R. 1982. The robust beauty of improper linear models in decision-making. In *Judgment under Uncertainty: Heuristics and Biases*, ed. D. Kahneman, P. Slovic, and A. Tversky, 391–407. Cambridge: Cambridge University Press.
- Dawes, R., D. Faust, and P. Meehl. 1989. Clinical versus actuarial judgment. *Science* 241: 1668–1674.
- DeGroot, A. D. 1978. *Thought and Choice in Chess*. 2nd ed. The Hague, The Netherlands: Mouton.
- DeMarco, T., and T. Lister. 1987. *Peopleware: Productive Projects and Teams*. New York: Dorset.
- den Ouden, E. 2006. Development of a Design Analysis Model for Consumer Complaints. Doctoral Dissertation. Technical University of Eindhoven.
- Desurvire, H., and J. C. Thomas. 1993. Enhancing the performance of interface evaluation using non-empirical usability methods. In *Proceedings of the 37th Annual Meeting of the Human Factors and Ergonomics Society*, 1132–1136. Santa Monica, CA: Human Factors & Ergonomic Society.
- Ellis, A. 2001. *Overcoming Destructive Beliefs, Feelings and Behaviors: New Directions in Rational Emotive Behavior Therapy*. New York: Albert Ellis Institute.
- Farrell, R., J. Thomas, B. Rubin, D. Gordin, A. Katriel, R. O'Donnell, E. Fuller, and S. Rolando. 2004. Personalized just-in-time dynamic assembly of learning objects. In eds. J. Nall & R. Robson, *Proceedings of the world conference on E-learning in corporate, government, healthcare, and higher education*, 607–614. Chesapeake VA: AACE.
- Flesch R. F. 1948. A new readability yardstick. *J Appl Psychol* 32: 221–233.
- Fozard, J. L., J. C. Thomas, and N. C. Waugh. 1976. Effects of age and frequency of stimulus repetitions on two-choice reaction time. *J Gerontol* 31(5):556–563.
- Furnas, G. W., T. K. Landauer, L. M. Gomez, and S. Dumais. 1984. Statistical semantics: Analysis of the potential performance of keyword information systems. In *Human Factors in Computing Systems*, ed. J. C. Thomas, and M. L. Schneider, 187–242. Norwood, NJ: Ablex.
- Gallagher, S. 2008. Neural simulation and social cognition. In *Mirror Neuron Systems: The Role of Mirroring Processes in Social Cognition*, ed. J. A. Pineda, 355–371. Totowa, NJ: Humana Press.
- Gladwell, M. 2005. *Blink: The Power of Thinking without Thinking*. New York: Little Brown.
- Gonzalez, V. M., and G. Mark. 2005. Managing currents of work: multi-tasking among multiple collaborations. In *Proceedings of the Ninth European Conference on Computer-Supported Cooperative Work*, ECSCW 2005, 113–120. The Netherlands: Springer.
- Gould, J. D., and S. J. Boies. 1984. Speech filing: An office system for principals. *IBM Syst J* 23(1): 65–81.
- Gray, W. D., B. E. John, and M. E. Atwood. 1993. Project Ernestine: Validating a GOMS analysis for predicting and explaining real-world task performance. *Hum Comput Interact* 8: 237–309.
- Gray, W. D., B. E. John, R. Stuart, D. Lawrence, and M. E. Atwood. 1990. GOMS meets the phone company: Analytic modeling applied to real-world problems. In *Proceedings of IFIP Interact'90: Hum-Comput Interact*, 29–34. Amsterdam: North Holland.
- Green, T. G. R. 1989. Cognitive dimensions of notations. In *People and Computers V*, ed. A. Sutcliffe and L. Macaulay. Cambridge: Cambridge University Press.
- Green, T. G. R., and M. Petre. 1996. Usability analysis of visual programming environments: A cognitive dimensions approach. *J Vis Lang Comput.* 7: 131–174.
- Greene, S. L., L. Jones, P. Matchen, and J. C. Thomas. 2003. Iterative development in the field. *IBM Syst J* 42(4):594–612.
- Grinter, R. E., and W. K. Edwards. 2005. The work to make a home network work. In *Proceedings of the Ninth European Conference on Computer-Supported Cooperative Work*, ECSCW 2005, 469–488. The Netherlands: Springer.
- Gunning, R. 1952. *The Technique of Clear Writing*. New York: McGraw-Hill International Book Co.
- Halstead, M. H. 1977. *Elements of Software Science*. New York: Elsevier North-Holland.
- Hanson, V. L., and J. T. Richards. 2005. Achieving a more usable World Wide Web. *Behav Inf Technol* 24(3): 231–246.
- Harris, B. N., B. E. John, and J. Brezin. 2010. Human performance modeling for all: Importing UI prototypes into CogTool. In *Proceedings of the 28th of the international Conference Extended Abstracts on Human Factors in Computing Systems* (Atlanta, Georgia, USA, April 10–15, 2010), CHI EA '10, 3481–3486. New York: ACM.
- Hart, R.P. 2001. Redefining diction: Theoretical considerations. In *Theory, Method and Practice in Computer Content Analysis*, ed. M. West. Westport, CT: Ablex.
- Hildebrandt, N., D. Caplan, S. Sokol, and L. Torreano. 1995. Lexical factors in the word-superiority effect. *Mem Cogn* 23(1):23–33.
- Holland, J. J. 1995. *Hidden Order: How Adaptation Builds Complexity*. New York: Basic Books.
- Ivory, M. Y., and M. A. Hearst. 2001. The state of the art in automating usability evaluation of user interfaces. *ACM Comput Surv* 33(4):470–516.

- Ivory, M. Y., R. R. Sinha, and M. A. Hearst. 2001. Empirically validated web page design metrics. In *Proceedings of CHI' 01*, 53–60. New York: ACM.
- John, B. E. 1990. Extensions of GOMS analyses to expert performance requiring perception of dynamic visual and auditory information. In *Proceedings of CHI'90*, 107–115. New York: ACM.
- John, B. E., L. Bass, E. Golden, and R Stoll. 2009. A responsibility-based pattern language for usability-supporting architectural patterns. In *Proceedings of the ACM SIGCHI Symposium on Engineering Interactive Computing*, Pittsburgh, PA, July 15–17, 2009. New York: ACM.
- John, B. E., K. Prevas, D. D. Salvucci, and K. Koedinger. 2004. Predictive human performance modeling made easy. In *Proceedings of CHI 2004*, Vienna, Austria, April 2004, 455–462. New York: ACM.
- Johnson, M. H., and J. Morton. 1991. *Biology and Cognitive Development: The Case of Face Recognition*. Oxford, UK and Cambridge, MA: Blackwell.
- Jones, C. 1996. *Applied Software Measurement*. New York: McGraw-Hill.
- Kessler, C., and J. Sweitzer. 2007. *Outside-In Software Development: A Practical Approach to Building Successful Stakeholder-based Products*. Indianapolis, IN: IBM Press.
- Kidd, C., S. T. Piantadosi, and R. N. Aslin. 2010. The Goldilocks effect: Infants' preference for stimuli that are neither too predictable nor too surprising. In *Proceedings of the 32nd Annual Meeting of the Cognitive Science Society*.
- Kieras, D. 2012. Model-based evaluation. In *The Human-Computer Interaction Handbook*. 3rd ed., ed. J. A. Jacko, Chapter 57. New York: Erlbaum.
- Kieras, D., and D. E. Meyer. 1997. An overview of the EPIC architecture for cognition and performance with application to human-computer interaction. *Hum Comput Interact* 12: 391–438.
- Klinger, A., and N. A. Salingaros. 2000. A pattern measure. *Environ Plann B Plann Des* 27: 537–547.
- Kucera, H., and W. N. Francis. 1967. *Computational Analysis of Present-day American English*. Providence, RI: Brown University Press.
- Laird, J. E., A. Newell, and P. S. Rosenbloom. 1987. SOAR: An architecture for general intelligence. *Artif Intell* 33: 1–64.
- Landry, B. M., and M. Guzdial. Learning from Human Support: Informing the Design of Personal Digital Story-Authoring Tools. In *iDMAa + IMS Conference: CODE*, (2006), Available at http://www.units.muohio.edu/codeconference/proceedings/conference_papers4.htm.
- Lewis, C. 2007. Simplicity in cognitive assistive technology: A framework and agenda for research. *Univers Access Inf Soc* 5(4):351–361.
- McCabe, T. J. 1976. A Complexity Measure. *IEEE Trans Softw Eng SE-2(4)*:308–320.
- McCabe, T. J., and C. W. Butler. 1989. Design complexity measurement and testing. *Commun ACM* 32(12): 1415–1425.
- Miller, G. A. 1956. The magic number seven, plus or minus two: Some limits on our capacity for processing information. *Psychol Rev* 63: 81–97.
- Myers, B. A., R. G. McDaniel, and D. S. Kosbie. 1993. Marquise: Creating complete user interfaces by demonstration. In *Proceedings of INTERCHI'93: Human Factors in Computing Systems*, 293–300, April 24–29. New York: ACM.
- Nielsen, J., and T. K. Landauer. 1993. A mathematical model of the finding of usability problems. In *Proceedings of ACM INTERCHI '93*, 206–213. New York: ACM Press.
- Norman, D. A. 1988. *The Psychology of Everyday Things*. New York: Basic Books.
- O'Neill, J., S. Castellani, A. Grasso, F. Roulland, and P. Tolmie. 2005. Representations can be good enough. In *Proceedings of Ninth European Conference on Computer-Supported Cooperative Work*, ECSCW 2005, 267–286. The Netherlands: Springer.
- Pavio, A., J. C. Yuille, and S. A. Madigan. 1968. Concreteness, imagery and meaningfulness values for 925 words. *J Exp Psychol Monogr Suppl* 76(3, part 2).
- Panciera, K., R. Priedhorsky, T. Erickson, and L. Terveen. 2010. Lurking? Cyclopaths? A quantitative lifecycle: Analysis of user behavior in a geowiki. In *Proceedings of CHI 2010*, 1917–1926. New York: ACM Press.
- Palen, L., and S. Liu. 2007 Citizen communications in crisis: Anticipating a future of ICT. In *Proceedings of ACM Conference on Human Factors in Computing Systems*. 727–736. NY: ACM.
- Papert, S. 1993. *The children's Machine: Rethinking School in the Age of the Computer*. New York: Basic Books.
- Pelz, D. 2000. *Dave Pelz's Putting Bible*. New York: Doubleday.
- Pickover, C. 1985. Tusk: A versatile graphics workstation for speech research. IBM Research Report: RC 11497.
- Pirolli, P. 2007. *Information Foraging Theory: Adaptive Interaction with Information*. New York: Oxford University Press.
- Premack, D. G., and G. Woodruff. 1978. Does the chimpanzee have a theory of mind? *Behav Brain Sci* 1: 515–526.
- Pressing, J. 1999. Cognitive complexity and the structure of musical patterns. In *Proceedings of the 4th Conference of the Australasian Cognitive Science Society*.
- Reicher, G. M. 1969. Perceptual recognition as a function of meaningfulness of stimulus material. *J Exp Psychol* 81: 275–280.
- Reisner, P. 1984. Formal grammar as a tool for analyzing ease of use: Some fundamental concepts. In *Human Factors in Computer Systems*, ed. J. C. Thomas, and M. L. Schneider, 53–78. Norwood, NJ: Ablex.
- Resnick, M., J. Maloney, A. Monroy-Hemández, N. Rusk, E. Eastmond, K. Brennan, A. Millner et al. 2009. Scratch: Programming for all. *Commun ACM* 52(11):60–67.
- Richards, J., R. Bellamy, B. John, C. Swart, and J. C. Thomas. 2010. Using CogTool to Model Programming Tasks, Psychology of Programming Interest Group: Work in Progress.
- Richards, J. T., and V. L. Hanson. 2004. Web accessibility: A broader view. In *Proceedings of the Thirteenth International ACM World Wide Web Conference*, WWW2004. New York: ACM.
- Roget's New Millennium™ Thesaurus*. 2005. 1st ed. (v 1.1.1) San Antonio, TX: Lexico Publishing Group, LLC.
- Rubin, D. C. 1980. 51 Properties of 125 words: A unit analysis of verbal behavior. *J Verb Learn Verb Behav* 19: 736–755.
- Shannon, C. E., and W. Weaver. 1949. *The Mathematical Theory of Communication*. Urbana, IL: University of Illinois Press.
- Shmulevich, I., and D. J. L. Povel. 2000. Complexity measures of musical rhythms. In *Rhythm Perception and Production*, ed. P. W. M. Desain and W. L. Windsor, 239–244. Lisse, the Netherlands: Swets & Zeitlinger (Studies on new music research, 3).
- Shmulevich, I., O. Yli-Harja, E. Coyle, D. Povel, and K. Lemstrom. 2001. Perceptual issues in music pattern recognition: complexity of rhythm and key finding. *Comput hum* 35: 23–35.
- Simon, H. A. 1962. The architecture of complexity. *Proc Am Philos Soc* 106: 467–482.
- Simon, H. A., and M. Barenfeld. 1969. Information processing analysis of perceptual processes in problem solving. *Psychol Rev* 76: 473–483.

- Simon, H. A., and K. J. Gilmartin. 1973. A simulation of memory for chess positions. *Cogn Psychol* 5:29–46.
- Smith, M. A., G. W. Cottrell, and K. L. Anderson. 2001. The early word catches the weights. In *Advances in Neural Information Processing Systems*, vol. 13, 52–58. Cambridge, MA: MIT Press.
- Taatgen, N. A., and J. R. Anderson. 2008. ACT-R. In *Constraints in Cognitive Architectures*, ed. R. Sun, 170–185. Cambridge: Cambridge University Press.
- Taylor, R. P., B. Spehar, J. A. Wise, C. W. G. Clifford, B. R. Newell, C. M. Hagerhall, T. Purcell, and T. P. Martin. 2005. Perceptual and physiological responses to the visual complexity of Pollock's dripped fractal patterns. *Non-linear Dynamics Psychol Life Sci* 9: 89–114.
- Thomas, J. C. 1974. An analysis of behavior in the hobbits-orcs problem. *Cogn Psychol* 6: 257–269.
- Thomas, J. C. 1976. Quantifiers and question-asking. IBM Research Report, RC-5886.
- Thomas, J. C. 1983. Psychological issues in the design of database query languages. In *Designing for Human-Computer Communication*, ed. M. E. Sime and M. J. Coombs. London: Academic Press.
- Thomas, J. C. 1999. Narrative technology and the new millennium. *Knowl Manag J* 2(9): 14–17.
- Thomas, J. C., A. Lee, and C. Danis. 2002. "Who Speaks for Wolf?" IBM Research Report, RC-22644. Yorktown Heights, NY: IBM Corporation.
- Thomas, J. C., and R. Farrell. 2006. HCI Techniques from idea to deployment: A case study for a dynamic learning environment. In *CHI '06 Extended Abstracts On Human Factors In Computing Systems*, April 22–27, 2006, Montréal, Québec, Canada, New York: ACM.
- Thomas, J. C., J. L. Fozard, and N. C. Waugh. 1977. Age-related differences in naming latency. *Am J Psychol* 90(30):499–509.
- Thomas, J. C., and J. D. Gould. 1975. A psychological study of query by example. In *National Computer Conference Proceedings*, 44, 439–445. New York: AFIPS Press.
- Thomas, J. C., W. A. Kellogg, and T. Erickson. 2001. The knowledge management puzzle: Human and social factors in knowledge management. *IBM Syst J* 40(4):863–884. <http://www.research.ibm.com/journal/sj40-4.html>
- Thomas, J. C., and H. Ruben. 1973. Age and mnemonic techniques in paired-associate learning. Presented at the Gerontological Society Meeting, Miami Beach, Florida, November 8, 1973.
- Vieweg, S., A. Hughes, K. Starbird, and L. Palen. 2010 Microblogging during two natural hazards events: What twitter may contribute to situational awareness. In *Proceedings of ACM Conference on Human Factors in Computing Systems*. 1079–1088. NY: ACM.
- Underwood, P. 1983. Who speaks for Wolf? A Native American learning story. San Anseimo, CA: Learning Way Company (Now, Tribe of Two Press).
- Walston, C. E., and C. P. Felix. 1977. A method of programming measurement and estimation. *IBM Syst J* 16:54–73.
- Weinberg, G. M. 1971. *The Psychology of Computer Programming*. New York: Van Nostrand Reinhold.
- Werker, J. F., and R. C. Tees. 1984. Cross-language speech perception: evidence of perceptual reorganization during the first year of life. *Infant Behav Dev* 7: 49–63.

Information Visualization

- Ahlberg, C., and B. Shneiderman. 1994. Visual information seeking using the FilmFinder. In *Conference companion on Humanfactors in computing systems*, CHI '94, 433–434. New York: ACM.
- Ahlberg, C., and B. Shneiderman 1994b. Visual information seeking: Tight coupling of dynamic query filters with starfield displays. In Paper Presented at the Proceedings of CHI'94, ACM Conference on Human Factors in Computing Systems, New York: ACM.
- Battista, G. D., P. Eades, R. Tamassia, and I. G. Tollis. 1994. Annotated bibliography on graph drawing. *Comput Geom Theory Appl* 4(5):235–282.
- Becker, R. A., S. G. Eick, and A. R. Wilks. 1995. Visualizing network data. *IEEE Trans Vis Comput Graph* 1: 16–28.
- Bederson, B. B. 2000. Fisheye Menus Proceedings of ACM Conference on User Interface Software and Technology (UIST 2000), 217–226. New York: ACM.
- Bertin, J. 1983. *Semiology of Graphics: Diagrams, Networks, Maps* (W. J. Berg, Trans.). Madison, WI: University of Wisconsin Press. (Original work published 1967).
- Bertin, J. 1981. *Graphics and graphic information-processing*. Berlin: Walter de Gruyter.
- Bray, T. 1996. Measuring the web. *Comput Netw ISDN Syst* 28(7–11-May):992.
- Card, S. K., J. D. Mackinlay, and B. Shneiderman. 1999. *Information Visualization: Using Vision to Think*. San Francisco, CA: Morgan Kaufmann Publishers.
- Card, S. K., J. D. Mackinlay, and G. G. Robertson. 1991. The Information Visualizer: An Information Workspace. *ACM Conference on Human Factors in Computing Systems (CHI '91)* 181–8
- Card, S. K., T. P. Moran, and A. Newell. 1986. The model human processor: An engineering model of human performance. In *Handbook of Perception and Human Performance*, ed. J. Thomas, 41–45. New York: John Wiley and Sons.
- Card, S. K., G. G. Robertson, and W. York. 1996. The webbook and the web forager: An information workspace for the worldwide web. In *Paper Presented at the Proceedings of CHI'96, ACM Conference on Human Factors in Computing Systems*, New York.
- Casner, S. 1991. Task-analytic approach to the automated design of graphic presentations. *ACM Trans Graph* 10: 111–151.
- Chi, E. H., and S. K. Card. 1999. Sensemaking of evolving websites using visualization spreadsheets. In Paper Presented at the Infovis 1999, IEEE Conference on Information Visualization 1999, San Francisco.
- Chi, E. H.-H., and J. T. Riedl. 1998. An Operator Interaction Framework for Visualization Systems. In *IEEE Symposium on Information Visualization*, North Carolina, 19–20. October 1998, IEEE CS, 63–70.
- Chuah, M. C., S. F. Roth, J. Mattis, and J. A. Kolojejchick. 1995. Sdm: Malleable information graphics. In Paper presented at the Proceedings of InfoVis'95, IEEE Symposium on Information Visualization, New York.
- Cleveland, W. S., and McGill, M. E. (1988). *Dynamic Graphics for Statistics*. Pacific Grove, California: Wadsworth and Brooks/Cole.
- Cruz, I. F., and R. Tamassia. 1998. Graph drawing tutorial, <http://www.cs.brown.edu/~rt/papers/gd-tutorial/gd-constraints.pdf> (accessed on October 25, 2011).
- Eick, S. G., J. L. Steffen, and E. E. Sumner. 1992. Seesoft—a tool for visualizing software. *IEEE Trans Softw Eng* 18(11):957–968.

- Eick, S. G., and G. J. Wills. 1993. Navigating large networks with hierarchies. In Paper Presented at the Proceedings of IEEE Visualization'93 Conference, San Jose, CA.
- Engelhardt, Y., J. De Bruin, T. Janssen, and R. Scha. 1996. The visual grammar of information graphics, artificial intelligence in design. Artificial Intelligence in Design (AID '96) in the Workshop on Visual Representation, Reasoning and Interaction in Design 24–27 of June, Stanford, CA.
- Fairchild, K. M., S. E. Poltrock, and G. W. Furnas. 1988. Semnet: Three-dimensional representations of large knowledge bases. In Cognitive science and its applications for human-computer interaction, ed. R. Guindon, 201. Hillsdale, New Jersey: Lawrence Erlbaum Associates.
- Feiner, S. K., and C. Beshers. 1990. Worlds within worlds: metaphors for exploring n-dimensional virtual worlds. In Proceedings of the 3rd annual ACM SIGGRAPH symposium on User interface software and technology, UIST '90, 76–83. New York, NY: ACM.
- Freeman, E., and S. Fertig, "Lifestreams: Organizing your electronic life," 1995. <http://citeseex.ist.psu.edu/viewdoc/summary?doi=10.1.1.48.6769>
- Furnas, G. W. 1981. The fisheye view: A new look at structured files. In Readings in Information Visualization: Using Vision to Think, ed. B. Shneiderman, 312–330. San Francisco, CA: Morgan Kaufmann Publishers, Inc.
- Healey, C. G., K. S. Booth, and J. T. Enns. 1995. High-speed visual estimation using preattentive processing. ACM Trans Comput-Hum Interact 3(2):107–135.
- Hutchins, E. L. 1996. Cognition in the wild. Cambridge, MA: MIT Press.
- Inselberg, A. 1997. Multidimensional detective. In Proceedings of the 1997 IEEE Symposium on Information Visualization (InfoVis '97). Washington, DC: IEEE Computer Society.
- Inselberg, A., and B. Dimsdale. 1990. Parallel coordinates: A tool for visualizing multi-dimensional geometry. In Paper Presented at the Proceedings of IEEE Visualization'90 Conference, Los Alamitos, CA.
- Keahey, T. A. 2001. Getting along: Composition of visualization paradigms. In Paper Presented at the Infovis 2001, IEEE Information Visualization 2001, San Diego, California.
- Keim, D. A., and H.-P. Kriegel. 1994. Visdb: Database exploration using multidimensional visualization. IEEE Comput Graph Appl 14: 40–49.
- Kosslyn, S. M. 1994. Image and Brain: The Resolution of the Imagery Debate. Cambridge, MA: The MIT Press.
- Lamping, J., and R. Rao. 1994. Laying out and visualizing large trees using a hyperbolic space. *Proceedings of the 7th annual ACM symposium on User interface software and technology UIST 94*, 1(November), 13–4. ACM Press. Retrieved from <http://portal.acm.org/citation.cfm?doid=192426.192430>
- Larkin, J. H., and Simon, H. A. 1987. Why a diagram is (sometimes) worth 10,000 word. *Cognitive Science* 65–99.
- Leung, Y. K., and M. D. Apperley. 1994. A review and taxonomy of distortion-orientation presentation techniques. ACM Trans Comput-Hum Interact 1(2): 126–160.
- Lin, X., D. Soergel, and G. Marchionini. 1991. A self-organizing semantic map for information retrieval. In Paper Presented at the Proceedings of SIGIR'91, ACM Conference on Research and Development in Information Retrieval, Chicago, IL.
- MacEachren, A. M. 1995. How Maps Work. New York: The Guilford Press.
- Mackinlay, J.D. 1986a. *Automatic Design of Graphical Presentations*. Unpublished doctoral dissertation, Stanford University, California.
- Mackinlay, J. D. 1986b. Automating the design of graphical presentations of relational information. ACM Trans Graph 5(2): 110–141.
- Mackinlay, J. D., G. G. Robertson, and S. K. Card. 1991. The perspective wall: Detail and context smoothly integrated. In Paper Presented at the Proceedings of CHI'91, ACM Conference on Human Factors in Computing Systems, New York.
- McCormick, B. H., and T. A. DeFanti. 1987. Visualization is scientific computing. Comput Graph 21: 15–21.
- Munzner T., Burchard P. 1995. Visualizing the Structure of the World Wide Web in 3D Hyperbolic Space, Special issue of Computer Graphics, ACM SIGGRAPH, 33–38. New York: ACM.
- Norman, Donald A. 1993. Things That Make Us Smart: Defending Human Attributes in the Age of the Machine. Reading, MA: Perseus.
- Playfair, W. 1786. The Commercial and Political Atlas. London.
- Resnikoff, H. L. 1989. The Illusion of Reality. New York: Springer-Verlag.
- Risch, J. S., D. B. Rex, S. T. Dowson, T. B. Walters, R. A. May, and B. D. Moon. 1997. The starlight information visualization system. In Paper Presented at the Proceedings of IEEE International Conference on Information Visualization, London, England.
- Robertson, G. G., S. K. Card, and J. D. Mackinlay. Mackinlay. 1989. The cognitive co-processor for interactive user interfaces. In Paper Presented at the Proceedings of UIST'89, ACM Symposium on User Interface Software and Technology, 10–18. New York: ACM.
- Robertson, G. G., S. K. Card, and J. D. Mackinlay. 1993. Information visualization using 3d interactive animation. Commun ACM 36(4):57–71.
- Robin, H. 1992. The Scientific Image: From Cave to Computer. New York: H. N. Abrams, Inc.
- Roth, S. F., and J. Mattis. 1990. Data characterization for intelligent graphics presentation. In Paper Presented at the Proceedings of CHI'90, ACM Conference on Human Factors in Computing Systems, New York.
- Russell, D. M., M. J. Stefk, P. Pirolli, and S. K. Card. 1993. The cost structure of sensemaking. In Paper Presented at the Proceedings of INTERCHI'93, ACM Conference on Human Factors in Computing Systems, Amsterdam.
- Shneiderman, B. 1992. Tree visualization with tree-maps: A 2-dimensional space filling approach. ACM Trans Graph, 11(1):92–99.
- Shneiderman, B., and M. Wattenberg. 2001. Ordered tree layouts. In Paper Presented at the IEEE Symposium on Information Visualization, San Diego, California.
- Spence, R. 2000. Information Visualization. Harlow, England: Addison-Wesley.
- Spence, R., and M. Apperley. 1982. Data base navigation: An office environment for the professional. Behav Inf Technol 1(1):43–54.
- Tamassia, R. 1996. Strategic directions in computational geometry working group report. ACM Comput Surv 28: 591–606.
- Tufte, E. R. 1983. The Visual Display of Quantitative Information. Cheshire, CT: Graphics Press.
- Tufte, E. R. 1990. Envisioning Information. Cheshire, CT: Graphics Press.
- Tufte, E. R. 1997. Visual Explanations: Images and Quantities, Evidence and Narrative. Cheshire, CT: Graphics Press.
- Tukey, J. W. 1977. Exploratory Data Analysis. Reading, MA: Addison-Wesley.
- Tweedie, L., R. Spence, H. Dawkes, and H. Su, 1996. Externalising abstract mathematical models. In Proceedings CHI'96, 406–412. New York: ACM Press.

Collaboration Technologies

- Abbate, J. 1999. *Inventing the Internet*. Cambridge, MA: MIT Press.
- Abbott, K. R., and S. K. Sarin. 1994. Experiences with workflow management: Issues for the next generation. In *Proceedings of the Conference on Computer Supported Cooperative Work*, 113–120. Chapel Hill, NC: ACM Press.
- Abowd, G. D. 1999. Classroom 2000: An experiment with the instrumentation of a living educational environment. *IBM Syst J* 38: 508–530.
- Ackerman, M. S., B. Starr, D. Hindus, and S. D. Mainwaring. 1997. Hanging on the 'wire': A field study of an audio-only media space. *ACM Trans Comput Hum Interact* 4(1):39–66.
- Adamic, L. A., and N. Glance. 2005. The political blogosphere and the 2004 U.S. election: Divided they blog. Presented at LinkKDD-2005, Chicago, IL. www.blogpulse.com/papers/2005/ (accessed March 13, 2007).
- Anderson, R. H., T. K. Bikson, S. A. Law, and B. M. Mitchell. 1995. *Universal Access to E-Mail: Feasibility and Societal Implications*. Santa Monica, CA: Rand.
- Argyle, M., and M. Cook. 1976. *Gaze and Mutual Gaze*. New York, NY: Cambridge University Press.
- Arrow, H., J. L. Berdahl, K. S. Bouas, K. M. Craig, A. Cummings, L. Lebei, J. E. McGrath, K. M. O'Connor, J. A. Rhoades, and A. Schlosser. 1996. Time, technology, and groups: An integration. *Comput Support Coop Work* 4: 253–261.
- Atkins, D. E., K. K. Droege, S. I. Feldman, H. Garcia-Molina, M. L. Klein, D. G. Messerschmitt, P. Messina, J. P. Ostriker, and M. H. Wright. 2003. Revolutionizing science and engineering through cyberinfrastructure. Report of the National Science Foundation Blue-Ribbon Advisory Panel on Cyberinfrastructure. National Science Foundation. Arlington, VA.
- Baecker, R. M. 1993. *Readings in Groupware and Computer-Supported Cooperative Work*. San Mateo, CA: Morgan Kaufmann Publishers.
- Bainbridge, W. S. 2007. The scientific research potential of virtual worlds. *Science* 317: 472–476.
- Ball, R., C. North, and D. A. Bowman. 2007. Move to improve: Promoting physical navigation to increase user performance with large displays. In *Proceedings of CHI 2007*, 191–200. New York: ACM.
- Baragh, J. A., and K. Y. A. McKenna. 2004. The Internet and social life. *Annu Rev Psychol* 55: 573–590.
- Bell, A. 2009. *Exploring Web 2.0: Second Generation Interactive Tools—Blogs, Podcasts, Wikis, Networking, Virtual Worlds, and More*. Georgetown, TX: Katy Crossings Press.
- Bellotti, V., and P. Dourish. 1997. Rant and RAVE: Experimental and experiential accounts of a media space. In *Video-Mediated Communication*, ed. K. E. Finn, A. J. Sellen, and S. B. Wilbur, 245–272. Mahwah, NJ: Lawrence Erlbaum Associates.
- Bellotti, V., N. Ducheneaut, M. Howard, I. Smith, and R. E. Grinter. 2005. Quality versus quantity: E-mail centric task management and its relation with overload. *Hum Comput Interact* 20: 89–138.
- Benford, S., C. Greenhalgh, G. Reynard, C. Brown, and B. Koleva. 1998. Understanding and constructing shared spaces with mixed-reality boundaries. *ACM Trans Comput Hum Interact* 5: 185–223.
- Benkler, Y. 2006. *The Wealth of Networks: How Social Production Transforms Markets and Freedom*. New Haven, CT: Yale University Press.
- Berners-Lee, T. 1999. *Weaving the Web*. New York: Harper Collins.
- Birnholtz, J. P., T. Grossman, C. Mak, and R. Balakrishnan. 2007. An exploratory study of input configuration and group process in a negotiation task using a large display. In *Proceedings of CHI 2007*, 91–100. New York: ACM.
- Bos, N., D. Gergle, J. S. Olson, and G. M. Olson. 2001. Being there vs. seeing there: Trust via video. Short paper presented at the Conference on Human Factors in Computing Systems: CHI-2001. New York: ACM Press.
- Brown, J. S., and D. Thomas. 2006. You play World of Warcraft? You're hired. *Wired Magazine*, 14(4).
- Bryant, S. L., A. Forte, and A. Bruckman. 2005. Becoming Wikipedian: Transformation of participation in a collaborative online encyclopedia. In *Proceedings of GROUP 2005*, 1–10. New York: ACM.
- Bush, V. 1945. As we may think. *Atl Mon* 176(1): 101–108.
- Cadiz, J., A. Balachandran, E. Sanocki, A. Gupta, J. Grudin, and G. Jancke. 2000. Video conferencing as a technology to support group work: A review of its failure. Paper presented at the CSCW '88, New York: ACM Press.
- Cairncross, F. 1997. *The Death of Distance: How the Communications Revolution Will Change Our Lives*. Boston, MA: Harvard Business School Press.
- Camp, L. J. 2000. *Trust and Risk in Internet Commerce*. Cambridge, MA: MIT Press.
- Campasoto, O., and K. Nilson. 2011. *Web 2.0 Fundamentals for Developers: With AJAX, Development Tools, and Mobile Platforms*. Sudbury, MA: Jones & Bartlett Publishers.
- Carley, K., and K. Wendt. 1991. Electronic mail and scientific communication: A study of the Soar extended research group. *Knowl Creation Diffus Util* 12: 406–440.
- Carmel, E. 1999. *Global Software Teams*. Upper Saddle River, NJ: Prentice-Hall.
- Comer, D. E. 2008. *Computer Networks and Internets*. Englewood Cliffs, NJ: Prentice-Hall.
- Connaughton, S. L., and M. Shuffler. 2007. Multinational and multicultural distributed teams: A review and future agenda. *Small Group Res* 38: 387–412.
- Cosley, D., D. Frankowski, S. Kiesler, L. Terveen, and J. Riedl. 2005. How oversight improves member-maintained communities. In *Proceedings of CHI 2005*, 11–20. New York: ACM.
- Crabtree, A., T. Rodden, and S. Benford. 2005. Moving with the times: IT research and the boundaries of CSCW. *Comput Support Coop Work* 14: 217–251.
- Daly-Jones, O., A. Monk, and L. Watts. 1998. Some advantages of video conferencing over high-quality audio conferencing: Fluency and awareness of attentional focus. *Int J Hum Comput Stud* 49(1):21–58.
- DeSanctis, G., B. M. Jackson, M. S. Poole, and G. W. Dickson. 1996. Infrastructure for telework: Electronic communication at Texaco. In *Proceedings of SIGCPR/SIGMIS '96*, 94–102. New York: ACM.
- Diamant, E. I., S. R. Fussell, and F.-L. Lo. 2009. Collaborating across cultural and technological boundaries: Team culture and information use in a map navigation task. In *Proceedings of the ACM International Workshop on Intercultural Collaboration (IWIC 2009)*, 175–184.

- New York: ACM.
- Dourish, P., and S. Bly. 1992. Portholes: Supporting awareness in a distributed work group. In *Proceedings of CHI '92*, 541–547. New York: ACM Press.
- Drolet, A. L., and M. W. Morris. 2000. Rapport in conflict resolution: Accounting for how nonverbal exchange fosters coordination on mutually beneficial settlements to mixed motive conflicts. *J Exp Soc Psychol* 36(1):26–50.
- Ducheneaut, N., and R. J. Moore. 2005. More than just 'XP': Learning social skills in massively multiplayer online games. *Interact Technol Smart Educ* 2: 89–100.
- Egido, C. 1988. Video conferencing as a technology to support group work: A review of its failure. Paper presented at the CSCW '88, New York: ACM Press.
- Ehrlich, S. F. 1987. Strategies for encouraging successful adoption of office communication systems. *ACM Trans Office Inf Syst* 5: 340–357.
- Ellis, C. A., S. J. Gibbs, and G. L. Rein. 1991. Groupware: Some issues and experiences. *CACM* 34(1):38–58.
- Ellis, C. A., and G. Nutt. 1980. Office information systems and computer science. *Comput Surv* 12(1):27–60.
- Elrod, S., R. Bruce, R. Gold, D. Goldberg, F. Halasz, W. Janssen, D. Lee et al. 1992. LiveBoard: A large interactive display supporting group meetings, presentations, and remote collaboration. In *Proceedings of CHI '92*, 599–607. Monterey, CA: ACM Press.
- Engelbart, D., and W. English. 1968. A research center for augmenting human intellect. *Proc FJCC* 33: 395–410.
- Federal Trade Commission. 2005. E-mail address harvesting and the effectiveness of anti-spam filters. Report by Federal Trade Commission, Division of Marketing Practices. Washington, DC.
- Finholt, T. A. 2002. Collaboratories. In *Annual Review of Information Science and Technology*, ed. B. Cronin, 74–107. Washington, DC: American Society for Information Science.
- Finholt, T. A., and G. M. Olson. 1997. From laboratories to collaboratories: A new organizational form for scientific collaboration. *Psychol Sci* 8: 28–36.
- Finholt, T., L. Sproull, and S. Kiesler. 1990. Communication and performance in ad hoc task groups. In *Intellectual Teamwork: Social and Technological Foundations of Cooperative Work*, ed. J. Galegher, R. Kraut, and C. Egido, 291–325. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Finn, K., A. Sellen, and S. Wilbur, eds. 1997. *Video-Mediated Communication*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Fish, R. S., R. E. Kraut, R. W. Root, and R. E. Rice. 1993. Video as a technology for informal communication. *Commun ACM* 36(1):48–61.
- Fogerty, J., S. E. Hudson, C. G. Atkeson, D. Avrahami, J. Forlizzi, S. Kiesler, J. C. Lee, and J. Yang. 2005. Predicting human interruptibility with sensors. *ACM Trans Comput Hum Interact* 12:119–146.
- Foster, I., and C. Kesselman. 2004. *The Grid: Blueprint for a New Computing Infrastructure*. 2nd ed. San Francisco: Morgan Kaufmann.
- Fussell, S. R., R. E. Kraut, and J. Siegel. 2000. Coordination of communication: Effects of shared visual context on collaborative work. Paper presented at the CSCW 2000, New York: ACM Press.
- Gale, C., and A. Monk. 2000. Where am I looking? The accuracy of video-mediated gaze awareness. *Percept Psychophys* 62: 586–595.
- Giles, J. 2005. Internet encyclopaedias go head to head. *Nature* 438: 900–901.
- Godefroid, P., J. D. Herbsleb, L. J. Jagadeesan, and D. Li. 2000. Ensuring privacy in presence awareness systems: An automated verification approach. In *Proceedings of CSCW 2000*, 59–68. New York: ACM.
- Grayson, D. M., and A. Monk. 2003. Are you looking at me? Eye contact and desktop video conferencing. *ACM Trans Comput Hum Interact* 10(3):221–243.
- Greif, I., ed. 1988. *Computer-Supported Cooperative Work: A Book of Readings*. San Mateo, CA: Morgan Kaufmann.
- Grinter, R. E. 2000. Workflow systems: Occasions for success and failure. *Comput Support Coop Work* 9: 189–214.
- Grudin, J. 1988. Why CSCW applications fail: Problems in the design and evaluation of organizational interfaces. In *Proceedings of the Conference on Computer Supported Cooperative Work*, 85–93. Portland, OR: ACM Press.
- Grudin, J. 1994. Groupware and social dynamics: Eight challenges for developers. *Commun ACM* 37(1):92–105.
- Grudin, J., and L. Palen. 1995. Why groupware succeeds: Discretion or mandate? In *Proceedings of the European Computer Supported Cooperative Work*, 263–278. Stockholm, Sweden: Springer.
- Grudin, J., and S. Poltrack. 2011. Taxonomy and theory in computer supported cooperative work. In *Oxford Handbook of Organizational Psychology*, ed. S. W. J. Kozlowski. New York: Oxford University Press.
- Gunaratne, J. A., and A. J. B. Brush. 2010. Newport: Enabling sharing during mobile calls. In *Proceedings of CHI 2010*, 343–352. New York: ACM.
- Gutwin, C., and S. Greenberg. 1999. The effects of workspace awareness support on the usability of real-time distributed groupware. *ACM Trans Comput Hum Interact* 6: 243–281.
- Hartmann, B., M. R. Morris, H. Benko, and A. D. Wilson. 2009. Augmenting interactive tables with mice & keyboards. In *Proceedings of UIST 2009*, 149–152. New York: ACM.
- Herbsleb, J. D., A. Mockus, T. A. Finholt, and R. E. Grinter. 2000. Distance, dependencies, and delay in a global collaboration. In *Proceedings of CSCW 2000*, 319–328. New York: ACM.
- Herlocker, J. L., J. A. Konstan, and J. Riedl. 2000. Explaining collaborative filtering recommendations. In *Proceedings of CSCW 2000*, 241–208250. New York: ACM.
- Hindmarsh, J., M. Fraser, C. Heath, S. Benford, and C. Greenhalgh. 1998. Fragmented Interaction: Establishing Mutual Orientation in Virtual Environments. In *Proceedings of Conference on Computer-Supported Cooperative Work*, 217–226. Portland, OR: ACM Press.
- Hollingshead, A. B., J. E. McGrath, and K. M. O'Connor. 1993. Group performance and communication technology: A longitudinal study of computer-mediated versus face-to-face work. *Small Group Res* 24: 307–333.
- Horvitz, E., and J. Apacible. 2003. Learning and reasoning about interruption. In *Proceedings of the International Conference on Multimodal Interfaces*, 20–27. New York: ACM.
- Huang, W., J. S. Olson, and G. M. Olson. 2002. Camera angle affects dominance in video-mediated communication. Paper presented at the CHI 2002, New York: ACM Press.
- Huberman, B., D. M. Romero, and F. Wu. 2009. Social networks that matter: Twitter under the microscope. *First Monday*, 14(1).
- Isaacs, E., A. Walendowski, S. Whittaker, D. J. Schiano, and C. Kamm. 2002. The character, functions, and styles of instant messaging in the workplace. Paper presented at the CSCW 2002, New York: ACM Press.

- Isenberg, P., D. Fisher, M. R. Morris, K. Inkpen, and M. Czerwinski. 2010. An exploratory study of co-located collaborative visual analytics around a tabletop display. In *Proceedings of Visual Analytics Science and Technology*. Los Alamitos, CA: IEEE Computer Society.
- Jensen, C., S. D. Famham, S. M. Drucker, and P. Kollock. 2000. The effect of communication modality on cooperation in on-line environments. In *Proceedings of CHI '2000*, 470–477. New York: ACM Press.
- Jones, M., and G. Marsden. 2006. *Mobile Interaction Design*. New York: Wiley.
- Karsenty, L. 1999. Cooperative work and shared visual context: An empirical study of comprehension problems in side-by-side and remote help dialogues. *Hum Comput Interact* 14: 283–315.
- Kellogg, W. A., et al. 2006. Leveraging digital backchannels to enhance user experience in electronically mediated communication. In *Proceedings of CSCW 2006*, 451–454. New York: ACM.
- Kendon, A. 1967. Some functions of gaze direction in social interaction. *Acta Psychol* 26: 22–63.
- Kiesler, S., and J. N. Cummings. 2002. What do we know about proximity and distance in work groups? A legacy of research. In *Distributed Work*, ed. P. J. Hinds, and S. Kiesler, 57–80. Cambridge, MA: MIT Press.
- Kiesler, S., L. Sproull, and K. Waters. 1996. Prisoner's dilemma experiment on cooperation with people and human-like computers. *J Pers Soc Psychol* 70(1):47–65.
- Kittur, A., and R. E. Kraut. 2010. Beyond Wikipedia: Coordination and conflict in online production groups. In *Proceedings of CSCW 2010*, 215–224. New York: ACM.
- Klein, M., C. Dellarocas, and A. Bernstein. 2000. Introduction to the special issue on adaptive workflow systems. *Comput Support Coop Work* 9: 265–267.
- Kraemer, K. L., and A. Pinsonneault. 1990. Technology and groups: Assessments of empirical research. In *Intellectual Teamwork: Social and Technological Foundations of Cooperative Work*, ed. J. Galegher, R. Kraut, and C. Egido, 373–405. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Krauss, R. M., and P. D. Bricker. 1966. Effects of transmission delay and access delay on the efficiency of verbal communication. *J Acoust Soc* 41: 286–292.
- Kraut, R. E., S. R. Fussell, and J. Siegel. 2003. Visual information as a conversational resource in collaborative physical tasks. *Hum Comput Interact* 18(1–2): 13–39.
- Kraut, R. E., D. Gergle, and S. R. Fussell. 2002. The use of visual information in shared visual spaces: Informing the development of virtual co-presence. Paper presented at the CSCW 2002, New York: ACM Press.
- Kraut, R., S. Kiesler, B. Boneva, J. Cummings, V. Helgeson, and A. Crawford. 2002. Internet paradox revisited. *J Soc Issues* 58(1):49–74.
- Kraut, R., M. Patterson, V. Lundmark, S. Kiesler, T. Mukopadhyay, and W. Scherlis. 1998. Internet paradox: A social technology that reduces social involvement and psychological well-being. *Am Psychol* 53: 1017–1031.
- Kraut, R. E., S. Sunder, R. Telang, and J. Morris. 2005. Pricing electronic mail to solve the problem of spam. *Hum Comput Interact* 20: 195–223.
- Kurose, J. F., and K. W. Ross. 2009. *Computer Networking: A Top Down Approach*. 5th Ed. Reading, MA: Addison-Wesley.
- Lange, B. M. 1992. Electronic group calendaring: Experiences and expectations. In *Groupware*, ed. D. Coleman, 428–432. San Mateo, CA: Morgan Kaufmann.
- Ling, R., and J. Donner. 2009. *Mobile Phones and Mobile Communications*. Malden, MA: Polity Press.
- Lipford, H. R., and G. D. Abowd. 2008. Reviewing meetings in TeamSpace. *Hum Comput Interact* 23: 406–432.
- Longstaff, T. A., J. T. Ellis, S. V. Heman, H. F. Lipson, R. D. McMillan, L. H. Pesanti, and D. Simmel. 1997. Security on the Internet. In *The Froehlich/Kent Encyclopedia of Telecommunications*, Vol. 15, 231–255. New York: Marcel Dekker.
- Luff, P., C. Heath, H. Kuzuoka, J. Hindmarsh, and S. Oyama. 2003. Fractured ecologies: Creating environments for collaboration. *Hum Comput Interact* 18(I-2):51–84.
- Mackay, W. E. 1989. Diversity in the use of electronic mail: A preliminary inquiry. *ACM Trans Office Inf Syst* 6: 380–397.
- Malone, T. W., K. R. Grant, K. Y. Lai, R. Rao, and D. A. Rosenblitt. 1989. The information lens: An intelligent system for information sharing and coordination. In *Technological Support for Work Group Collaboration*, ed. M. H. Olson, 65–88. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Marca, D., and G. Bock. 1992. *Groupware: Software for Computer-Supported Cooperative Work*. Los Alamitos, CA: IEEE Computer Society Press.
- Mark, G., B. Al-Ani, and B. Semaan. 2009. Resilience through technology adoption: Merging the old and the new in Iraq. In *Proceedings of CHI 2009*, 689–698. New York: ACM.
- Mark, G., V. M. Gonzalez, and J. Harris. 2005. No task left behind? Examining the nature of fragmented work. In *Proceedings of CHI 2005*, 321–330. New York: ACM.
- Markus, M. L. 1983. *Systems in Organization: Bugs and Features*. San Jose, CA: Pitman.
- Markus, M. L., and T. Connolly. 1990. Why CSCW applications fail: Problems in the adoption of interdependent work tools. In *Proceedings of the Conference on Computer Supported Cooperative Work*, 371–380. Los Angeles, CA: ACM Press.
- McDaniel, S. E., G. M. Olson, and J. S. Magee. 1996. Identifying and analyzing multiple threads in computer-mediated and face-to-face conversations. In *Proceeding of the ACM Conference on Computer Supported Cooperative Work*, 39–47. Cambridge, MA: ACM Press.
- McLeod, P. L. 1992. An assessment of the experimental literature on electronic support of group work: Results of a meta-analysis. *Hum Comput Interact* 7: 257–280.
- Miller, M. 2009. *Cloud Computing: Web-Based Applications that Change the Way You Work and Collaborate Online*. Indianapolis, IN: Cue Publishing.
- Monk, A., and C. Gale. 2002. A look is worth a thousand words: Full gaze awareness in video-mediated communication. *Discourse Process* 33(3):257–278.
- Moran, T. P., P. Chiu, S. Harrison, G. Kurtenbach, S. Minneman, and W. van Melle. 1996. Evolutionary engagement in an ongoing collaborative work process: A case study. In *Proceeding of the ACM Conference on Computer Supported Cooperative Work*, 150–159. Cambridge, MA: ACM Press.
- Morris, M. R., J. Lombardo, and D. Wigdor. 2010. WeSearch: Supporting collaborative search and sensemaking on a tabletop display. In *Proceedings of CSCW 2010*, 401–410. New York: ACM.
- Mosier, J. N., and S. G. Tammaro. 1997. When are group scheduling tools useful? *Comput Support Coop Work* 6: 53–70.
- Muller, M. J., M. E. Raven, S. Kogan, D. R. Millen, and K. Carey. 2003. Introducing chat into business organizations: Toward an instant messaging maturity model. Paper presented at the GROUP '03, New York: ACM Press.

- Nardi, B. A. 2010. *My Life as a Night elf Priest: An Anthropological Account of World of Warcraft*. Ann Arbor, MI: University of Michigan Press.
- Nardi, B. A., D. J. Schiano, M. Gumbrecht, and L. Swartz. 2004. Why we blog? *Commun ACM* 47(12):41–46.
- Nardi, B. A., H. Schwarz, A. Kuchinsky, R. Leichner, S. Whittaker, and R. Sclabassi. 1993. Turning away from talking heads: the use of video-as-data in neurosurgery. Paper presented at the CHI '93, New York: ACM Press.
- Nardi, B. A., and S. Whittaker. 2002. The place of face-to-face communication in distributed work. In *Distributed Work*, ed. P. Hinds, and S. Kiesler, 83–110. Cambridge, MA: MIT Press.
- Nardi, B. A., S. Whittaker, and E. Bradner. 2000. Interaction and outeraction: Instant messaging in action. In *Proceedings of the ACM Conference on Computer Supported Cooperative Work*, 79–88. Philadelphia, PA: ACM Press.
- National Research Council. 1993. *National Collaboratories: Applying Information Technology for Scientific Research*. Washington, DC: National Academy Press.
- Nguyen, D., and J. Canny. 2007. MultiView: Improving trust in group video conferencing through spatial faithfulness. In *Proceedings of CSCW 2007*, 1465–1474. New York: ACM.
- Nohria, N., and R. G. Eccles, eds. 1992. *Networks and Organizations: Structure, Form, and Action*. Boston, MA: Harvard Business School Press.
- Nunamaker, J. F., A. R. Dennis, J. S. Valacich, D. R. Vogel, and J. F. George. 1991. Electronic meeting systems to support group work. *Commun ACM* 34(7):40–61.
- O'Conaill, B., S. Whittaker, and S. Wilbur. 1993. Conversations over videoconferences: An evaluation of the spoken aspects of video mediated communication. *Hum Comput Interact* 8: 389–428.
- O'Hara-Devereaux, M., and R. Johansen. 1994. *Global Work: Bridging Distance, Culture & Time*. San Francisco, CA: Jossey-Bass.
- Okada, K., F. Maeda, Y. Ichicawaa, and Y. Matsushita. 1994. Multiparty videoconferencing at virtual social distance: MAJIC design. Paper presented at the CSCW '94, New York: ACM Press.
- Olson, G. M., D. Atkins, R. Clauer, T. Weymouth, A. Prakash, T. Finholt, F. Jahanian, and C. Rasmussen. 2001. Technology to support distributed team science: The first phase of the Upper Atmospheric Research Collaboratory (UARC) In *Coordination Theory and Collaboration Technology*, ed. G. M. Olson, T. Malone, and J. Smith, 761–783. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Olson, M. H., and S. A. Bly. 1991. The Portland experience: A report on a distributed research group. *Int J Man Mach Stud* 34: 211–228.
- Olson, J. S., E. C. Hofer, N. Bos, A. Zimmerman, G. M. Olson, D. Cooney, and I. Faniel. 2008. A theory of remote scientific collaboration (TORSC). In *Scientific Collaboration on the Internet*, ed. G. M. Olson, A. Zimmerman, & N. Bos. Cambridge, MA: MIT Press.
- Olson, G. M., and J. S. Olson. 2000. Distance matters. *Hum Comput Interact* 15: 139–179.
- Olson, J. S., G. M. Olson, and D. K. Meader. 1995. What mix of video and audio is useful for remote real-time work? In *Proceedings of CHI '95*, 362–368. Denver, CO: ACM Press.
- Olson, J. S., G. M. Olson, M. Storrøsten, and M. Carter. 1993. Group work close up: A comparison of the group design process with and without a simple group editor. *ACM Trans Inform Syst* 11:321–348.
- Olson, J. S., and S. Teasley. 1996. Groupware in the wild: Lessons learned from a year of virtual collocation. In *Proceeding of the ACM Conference on Computer Supported Cooperative Work*, 419–427. Cambridge, MA: ACM Press.
- Olson, G. M., A. Zimmerman, and N. Bos. 2008. *Scientific Collaboration on the Internet*. Cambridge, MA: MIT Press.
- Orlikowski, W. J., and D. C. Gash. 1994. Technological frames: Making sense of information technology in organizations. *ACM Trans Inf Syst* 12: 174–207.
- Palen, L., and J. Grudin. 2002. Discretionary adoption of group support software: Lessons from calendar applications. In *Implementing Collaboration Technologies in Industry*, ed. B. E. Munkvold, 159–180. London: Springer-Verlag.
- Palen, L., S. Vieweg, S. Liu, and A. Hughes. 2009. Crisis in a networked world: Features of computer-mediated communication the April 16, 2007, Virginia Tech event. *Social Science Computing Review* 27(4):467–480.
- Park, K. S., A. Kapoor, and J. Leigh. 2000. Lessons learned from employing multiple perspective in a collaborative virtual environment for visualizing scientific data. In *Proceedings of ACM CVE '2000 Conference on Collaborative Virtual Environments*, 73–82. San Francisco, CA: ACM Press.
- Prinz, W., and S. Kolenbach. 1996. Support for workflows in a ministerial environment. In *Proceedings of the Conference on Computer Supported Cooperative Work*, 199–208. Cambridge, MA: ACM Press.
- Putnam, R. D. 2000. *Bowling Alone: The Collapse and Revival of American Community*. New York: Simon & Schuster.
- Resnick, P. 2002. Beyond bowling together: Sociotechnical capital. In *Human-Computer Interaction in the New Millennium*, ed. J. M. Carroll, 647–672. New York: ACM Press.
- Resnick, P., and H. R. Varian, eds. 1997. Special section: Recommender systems. *Commun ACM* 40(3):56–89.
- Rheingold, H. 2002. *Smart Mobs: The Next Social Revolution*. New York: Basic Books.
- Robertson, G., M. Czerwinski, P. Baudisch, B. Meyers, D. Robbins, G. Smith, and D. Tan. 2005. The large—display user experience. *IEEE Comput Graph Appi* 25(4):44–51.
- Rocco, E. 1998. Trust breaks down in electronic contexts but can be repaired by some initial face-to-face contact. In *Proceedings of CHI '98*, 496–502. Los Angeles, CA: ACM Press.
- Rocco, E., T. Finholt, E. C. Hofer, and J. D. Herbsleb. 2000. Designing as if Trust Mattered. (CREW Technical Report). Ann Arbor, MI: University of Michigan.
- Ruhleder, K., and B. Jordan. 2001. Co-constructing non-mutual realities: Delay-generated trouble in distributed interaction. *Comput Support Coop Work* 10(1): 113–138.
- Satzinger, J., and L. Olfman. 1992. A research program to assess user perceptions of group work support. In *Proceeding of CHI '92*, 99–106. Monterey, CA: ACM Press.
- Schafer, W. A., C. H. Ganoe, and J. M. Carroll. 2007. Supporting community emergency management planning through a geocollaboration software architecture. *Comput Support Coop Work* 16: 501–537.
- Schafer, J. B., J. Konstan, and J. Riedl. 2001. Electronic commerce recommender applications. *J Data Min Knowledge Discovery* 5(1/2): 115–152.
- Schatz, B. R., and J. B. Hardin. 1994. NCSA Mosaic and the World Wide Web: Global hypermedia protocols for the Internet. *Science* 265: 895–901.
- Schmandt, C., and S. Marti. 2005. Active messenger: E-mail filtering and delivery in a heterogeneous network. *Hum Comput Interact* 20: 163–194.

- Schmidt, K. 2002. The problem with 'awareness.' *Comput Support Coop Work* 11: 285–298.
- Schmidt, K. 2010. 'Keep up the good work!': The concept of 'work' in CSCW. In *Proceedings of COOP 2010*, 265–285. London: Springer-Verlag.
- Setlock, L. D., S. R. Fussell, and C. Neuwirth. 2004. Taking it out of context: Collaborating within and across cultures in face-to-face settings and via instant messaging. In *Proceedings of CSCW 2004*, 604–613. New York: ACM.
- Short, J., E. Williams, and B. Christie. 1976. *The Social Psychology of Telecommunications*. New York: Wiley.
- Siegel, J., V. Dubrovsky, S. Kiesler, and T. W. McGuire. 1986. Group processes in computer-mediated communication. *Organ Behav Hum Decis Process* 37(2): 157–187.
- Singhal, S., and M. Zyda. 1999. *Networked Virtual Environments: Design and Implementation*. New York: Addison-Wesley.
- Sproull, L., and S. Kiesler. 1991. *Connections: New Ways of Working in the Networked Organization*. Cambridge, MA: MIT Press.
- Starner, T., and B. Rhodes. 2004. Wearable computer. In *Berkshire Encyclopedia of Human-Computer Interaction*, ed. W. S. Bainbridge, Vol. 2, 797–802. Great Barrington, MA: Berkshire Publishing Group.
- Straus, S. G. 1996. Getting a clue: The effects of communication media and information distribution on participation and performance in computer-mediated and face-to-face groups. *Small Group Res* 1:115–142.
- Straus, S. G. 1997. Technology, group process, and group outcomes: Testing the connections in computer-mediated and face-to-face groups. *Hum Comput Interact* 12(3):227–266.
- Straus, S. G., and J. E. McGrath. 1994. Does the medium matter: The interaction of task and technology on group performance and member reactions. *J Appl Psychol* 79: 87–97.
- Tanenbaum, A. S. 2011. *Computer networks* (5th Ed.). Boston: Pearson Education.
- Tang, J. C., and E. Isaacs. 1993. Why do users like video? *Comput Support Coop Work* 1(3): 163–196.
- Tang, A., M. Tory, B. Po, P. Neumann, and S. Carpendale. 2006. Collaborative coupling over table top displays. In *Proceedings of CHI 2006*, 1181–1190. New York: ACM.
- Tang, J. C., N. Yankelovich, J. Begole, M. van Kleek, F. Li, and J. Bhalodia. 2001. ConNexus to Awarenex: Extending awareness to mobile users. In *Proceedings of CHI 2001*, 221–228. New York: ACM.
- Teasley, S. D., L. A. Covi, M. S. Krishnan, and J. S. Olson. 2002. Rapid software development through team collocation. *IEEE Trans Software Eng* 28: 671–683.
- Veinott, E., J. S. Olson, G. M. Olson, and X. Fu. 1999. Video helps remote work: Speakers who need to negotiate common ground benefit from seeing each other. In *Proceedings of the Conference on Computer-Human Interaction, CHI '99*, 302–309. Pittsburgh, PA: ACM Press.
- Vertegaal, R. 1999. The GAZE groupware system: Mediating joint attention in multiparty communication and collaboration. Paper presented at the CHI '99, New York: ACM Press.
- Vertegaal, R., R. Slagter, G. van der Veer, and A. Nijholt. 2001. Eye gaze patterns in conversations: There is more to conversational agents than meets the eye. Paper presented at the CHI 2001, New York: ACM Press.
- Viegas, F. B., M. Wattenberg, and K. Dave. 2004. Studying cooperation and conflict between authors with history flow visualizations. In *Proceedings of CHI 2004*, 575–582. New York: ACM.
- Vieweg, S., A. Hughes, K. Starbird, and L. Palen. 2010. Microblogging during two natural hazard events: What Twitter may contribute to situational awareness. In *Proceedings of CHI 2010*, 1079–1088. New York: ACM.
- Wang, H.-C., S. R. Fussell, and L. D. Setlock. 2009. Cultural difference and adaptation of communication styles in computer-mediated group brainstorming. In *Proceedings of CHI 2009*, 669–678. New York: ACM.
- Wellman, B. 2002. Little boxes, globalization, and networked individualism? In P. van den Besselaar & T. Ishida (eds.), *Digital Cities II: Computational and Sociological Approaches*, 10–25. Berlin: Springer.
- Whittaker, S. 2005. Supporting collaborative task management in e-mail. *Hum Comput Interact* 20: 49–88.
- Whittaker, S., V. Bellotti, and P. Moody. 2005. Introduction to this special issue on revisiting and reinventing e-mail. *Hum Comput Interact* 10: 1–9.
- Whittaker, S., E. Geelhoed, and E. Robinson. 1993. Shared workspaces: How do they work and when are they useful? *Int J Man Mach Stud* 39(5):813–842.
- Whittaker, S., and C. Sidner. 1996. E-mail overload: Exploring personal information management of e-mail. In *Proceeding of CHI '96*, 276–283. Vancouver, BC: ACM Press.
- Williams, E. 1977. Experimental comparisons of face-to-face and mediated communication: A review. *Psychol Bull* 84: 963–976.
- Wilson, S., J. Galliers, and J. Fone. 2006. Not all sharing is equal: The impact of a large display on small group collaborative work. In *Proceedings of CSCW 2006*, 25–28. New York: ACM.
- Wiltse, H., and J. Nichols. 2009. PlayByPlay: Collaborative web browsing for desktop and mobile devices. In *Proceedings of CHI 2009*, 1781–1790. New York: ACM.
- Winograd, T. 1988. A language/action perspective on the design of cooperative work. *Hum Comput Interact* 3: 3–30.
- Wong, A., and A. Young. 2009. *Network Infrastructure Security*. New York: Springer.
- Yang, H., and G. M. Olson. 2002. Exploring collaborative navigation: The effect of perspectives on group performance. In *Proceedings of CVE '02*, 135–142. New York: ACM Press.
- Zhao, D., and M. B. Rosson. 2009 How and why people Twitter: The role that micro-blogging plays in information communication at work. In *Proceedings of GROUP 2009*, 243–252. New York: ACM.
- Zheng, J., N. Bos, J. S. Olson, D. Gergle, and G. M. Olson. 2001. Trust without touch: Jump-start trust with social chat. Paper presented at the Conference on Human Factors in Computing Systems CHI-2001. Seattle, WA: ACM Press.

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- Aalto, L., N. Göthlin, J. Korhonen, and T. Ojala. 2004. Bluetooth and WAP push based location-aware mobile advertising system. In Proceedings of the 2nd International Conference on Mobile Systems, Applications, and Services, 49–58. New York: ACM.
- Abascal, J., and C. A. Nicolle, eds. 2001. Inclusive Design Guidelines for HCI. Abingdon, UK: Taylor & Francis.
- Adomavicius, G., and A. Tuzhilin. 2005. Toward the next generation of recommender systems: a survey of the state-of-the-art and possible extensions. *IEEE Trans Know Data Eng*
- Ahn, J., R. Farzan, and P. Brusilovsky. 2006. Social search in the context of social navigation. *J Korean Soc Inf Manag* 23(2): 147–165.
- Aizawa, A. 2003. An information-theoretic perspective of tf-idf measures. *Inf Process Manag* 39(1):45–65.
- Arikawa, M., S. Konomi, and K. Ohnishi. 2007. Navitime: Supporting pedestrian navigation in the real world. *IEEE Pervasive Comput* 6(3):21–29.
- Ashman, H. 2000. Electronic document addressing -dealing with change. *ACM Computing Surv* 32(3):201–212.
- Ashman, H., M. Antunovic, C. Donner, R. Frith, E. Rebelos, J.-F. Schmakeit, G. Smith, M. Truran. 2009. Are clickthroughs useful for image labelling? IEEE/WIC/ACM International Joint Conference on Web Intelligence and Intelligent Agent Technology 1: 191–197.
- Azuma, R., Y. Baillot, R. Behringer, S. Feiner, S. Julier, and B. MacIntyre. 2001. Recent advances in augmented reality. *IEEE Comput Graph Appl* 21(6):34–47.
- Baader, F., D. Calvanese, D. McGuinness, D. Nardi, and P. Patel-Schneider. 2007. The Description Logic Handbook, Cambridge University Press New York.
- Bar-Yossef, Z., A. Broder, R. Kumar, and A. Tomkins. 2004. Sic transit gloria telae: Towards an understanding of the web's decay. In Proc. WWW2004, 328–337. New York: ACM.
- Benford, S., A. Crabtree, M. Flintham, A. Drozd, R. Anastasi, M. Paxton, N. Tandavanitj, M. Adams, and J. Row-Farr. 2006. Can you see me now? *ACM Trans Comput Hum Interact* 13(1):100–133.
- Berners-Lee, T. 1998. *Cool URLs Don't Change*, <http://www.w3.org/Provider/Style/URI> (accessed October 10, 2011).
- Berners-Lee, T., H. Hendler, and O. Lassila. 2001. The semantic web. *Sci Am* 34–43.
- Bieber, M., F. Vitali, H. Ashman, V. Balasubramanian, and H. Oinas-Kukkonen. 1997. Fourth generation hypermedia: Some missing links for the World Wide Web. *Int J Hum Comput Stud* 47(1):31–65. Special Issue on HCI and the Web. Academic Press.
- Billups D., and M. Pazzani. 2007. Adaptive news access. In *The Adaptive Web*, Lecture Notes in Computer Science, LNCS, vol. 4321, ed. P. Brusilovsky, A. Kobsa, and W. Nejdl. Berlin, Heidelberg, New York: Springer-Verlag.
- Bosca, A., D. Bomino, and P. Pellegrino. 2005. OntoSphere: More than a 3D ontology visualization tool. In *Proceedings of SWAP, CEUR-Workshop Proceedings, ISSN 1613–0073*, Trento, Italy.
- Brailsford, D. 1999. Separable hyperstructure and delayed link binding. *ACM Comput Surv* 31(4es).
- Brailsford, T., C. Stewart, M. Zakaria, and A. Moore. 2002. Autonavigation, links and narrative in an adaptive web-based integrated learning environment. In *Eleventh International World Wide Web Conference*.
- Brin, S., and L. Page. 1998. The anatomy of a large-scale hyper-textual web search engine. In Proc. *Seventh international Conference on World Wide Web (WWW7)*, 107–17.
- Broil, W., I. Lindt, I. Herbst, J. Ohlenburg, A. Braun, and R. Wetzel. 2008. Toward next-gen mobile AR games. *IEEE Comput Graph Appl* 28(4):40–48.
- Browne, P., and A. Smeaton. 2004. *Video information retrieval using objects and ostensive relevance feedback*. In Proc. ACM symposium on Applied Computing, 1084–1090. New York: ACM.
- Brusilovsky, P. 1996. Methods and techniques of adaptive hypermedia. *User Model User Adapt Interact* 6: 87–129.
- Brusilovsky, P. 2001a. Adaptive hypermedia. *User Model User Adapt Interact* 11(1/2):87–110.
- Brusilovsky, P. 2001b. Adaptive educational hypermedia (invited talk). In *The 10th International PEG Conference*, 8–12.
- Brusilovsky, P. 2007. Adaptive Navigation Support. In *The Adaptive Web*, Lecture Notes in Computer Science, LNCS, vol. 4321, ed. P. Brusilovsky, A. Kobsa, and W. Nejdl. Berlin, Heidelberg, New York: Springer-Verlag.
- Brusilovsky, P., and M. Maybury. 2002. From adaptive hypermedia to the adaptive web. *Commun ACM* 45(5):30–34.
- Burke R. 2007. Hybrid web recommender systems. In *The Adaptive Web*, Lecture Notes in Computer Science, LNCS, vol. 4321, ed. P. Brusilovsky, A. Kobsa, and W. Nejdl. Berlin, Heidelberg, New York: Springer-Verlag.
- Burnett, G., S. Summerskill, and J. Porter. 2004. “On-the-move” destination entry for vehicle navigation systems -Unsafe by any means? *Behav Inf Technol* 23(4):265–272.
- Cailliau, R., and H. Ashman. 1999. A History of Hypertext in the Web In *ACM Computing Surveys Special Issue on Hypertext and Hypermedia*, 31(4es). New York: ACM.
- Card, S., G. Robertson, and J. Mackinlay. 1991. The information visualizer, an information workspace. In Proc. SIGCHI Conf. on Human Factors in Computing Systems (CHI '91), 181–186. New York: ACM.
- Carr, L., D. De Roure, W. Hall, and G. Hill. 1995. The distributed link Service: A tool for publishers, authors and readers. In *Proceedings of the 4th International WWW Conference*.
- Carroll, J., I. Dickinson, C. Dollin, D. Reynolds, A. Seaborne, and K. Wilkinson. 2004. Jena: Implementing the semantic web recommendations. In *International World Wide Web Conference on Alternate Track Papers and Posters*.
- Cawley, T., H. Ashman, G. Chase, M. Dalwood, S. Davis, and J. Verbyla. 1995. A link server for integrating the web with third-party applications. In *Proc. 1st Australasian World Wide Web Conf.*, Australia.
- Cawsey, A., F. Grasso, and C. Paris. 2007. Adaptive information for consumers of healthcare. In *The Adaptive Web*, Lecture Notes in Computer Science, LNCS, vol. 4321, 465–484, ed. P. Brusilovsky, A. Kobsa, and W. Nejdl. Berlin Heidelberg New York: Springer-Verlag.
- Conlan, O., and V. Wade. 2002. Multi-model, metadata-driven approach to adaptive hypermedia services for personalisation. In the Proceedings of the 2nd International Conference on Adaptive Hypermedia and Adaptive Web-Based Systems, AH2002, 100–111. Berlin: Springer, LNCS 2347.
- Conroy, C., R. Brennan, D. O'Sullivan, and D. Lewis. 2009. User evaluation study of a tagging approach to semantic mapping. In European Semantic Web Conference, LNCS 5554, 623–637. Berling: Springer.
- Dagger, D., V. Wade, and O. Conlan. 2005. Personalisation for all: making adaptive course composition easy. *Educ Technol Soc* 8(3):9–25.
- Davis, H. C. 1995. To Embed or not to Embed. *Commun ACM* 38(8): 108–109.

- Davis, H. C. 1998. Referential integrity of links in open hypermedia systems. In Proceedings of Hypertext '98, 207–216. New York: ACM.
- Davis, H., W. Hall, I. Heath, G. Hill, and R. Wilkins. 1992. Towards an integrated information environment with open hypermedia systems. In Proc. Second European Conference on Hypertext, 181–190. New York: ACM.
- Davis, H., S. Knight, and W. Hall. 1994. Light hypermedia link services: A study of third party application integration. In Proc. ECHT '94, 41–50. New York: ACM.
- De Bra, P., D. Smits, and N. Stash. 2006. The design of AHA!, In The Proceedings of the ACM Hypertext Conference, 133, Odense, Denmark. New York: ACM.
- Dimitrova, V., R. Denaux, G. Hart, C. Dolbear, I. Holt, and A. Cohn. 2008. Involving domain experts in authoring OWL ontologies. In Proc. ISWC 2008, LNCS 5318, 1–16. Berlin: Springer.
- Djurknic, G., and R. Richton. 2001. Geolocation and assisted GPS. Computer 34(3):123–125.
- Eason, K. 1984. Towards the experimental study of usability: Ergonomics of the user interface. Behav Inf Technol 3(2): 133–143.
- Fagerjord, A. 2005. Editing stretchfilm. In Proceedings of the Sixteenth ACM Conference on Hypertext and Hypermedia, 301. New York: ACM.
- Falconer S., and M. Storey. 2007. A cognitive support framework for ontology mapping. In Proc ISWC 2007, LNCS 4825, 114–127. Berlin: Springer.
- Fischer G., T. Mastaglio, B. Reeves, and J. Rieman. 1990. Minimalist explanations in knowledge-based systems. In Proceedings 23rd Annual Hawaiian International Conference on System Sciences, 309–317. Los Alamos, CA: IEEE Press.
- Fitzpatrick, L., and M. Dent. 1997. Automatic feedback using past queries: Social searching? In Proc. 20th Annual International Conf. on Res. and Dev. in Information Retrieval, 306–313. New York: ACM.
- Garfield, E. 1972. Citation analysis as a tool in journal evaluation. Science 178: 471–479.
- Goble, C., S. Harper, and R. Stevens. 2001. The travails of visually impaired web travelers. In Proceedings of Hypertext 2000, 1–10. New York: ACM.
- Gotow, J., K. Zienkiewicz, J. White, and D. Schmidt. 2010. Addressing challenges in delivering augmented reality applications to smartphones. In Proceedings of the Third International ICST Conference on MOBILE Wireless Middle WARE, Operating Systems, and Applications, Mobilware 2010, Chicago, IL, USA. Brussels: ICST.
- Goulding, J., T. Brailsford, and H. Ashman. 2010. Hyperorders and transclusion: Understanding dimensional hypertext. In Proceedings of the 21st ACM Conference on Hypertext and Hypermedia, 201–210. New York: ACM
- Groza, T., S. Handschuh, K. Moeller, G. Grimes, L. Sauermann, E. Minack, C. Mesnage, M. Jazayeri, G. Reif, and R. Gudjonsdottir. 2007. The NEPOMUK Project-On the way to the Social Semantic Desktop. In Proc. of I-Semantics'07, 201–11.
- Han, J. Y. 2005. Low-cost multi-touch sensing through frustrated total internal reflection. In Proceedings of the 18th Annual ACM Symposium on User Interface Software and Technology, Proc. UIST '05, 115–118. New York: ACM.
- Hansen, F., and K. Grønbæk. 2008. Social web applications in the city: A lightweight infrastructure for urban computing. In Proceedings of the Nineteenth ACM Conference on Hypertext and Hypermedia, 175–180. New York: ACM.
- Harman, D. 1992a. Relevance feedback revisited. In Proc. 15th Annual International ACM SIGIR Conference on Research and Development in Information Retrieval, 1–10. New York: ACM
- Harman, D. 1992b. Relevance feedback and other query modification techniques. In Information Retrieval, Data Structures and Algorithms, ed. W. B. Frakes and R. Baeza-Yates, 241–263. NJ: Prentice-Hall, Inc.
- Harter, A., Hopper, A., Steggles, P., Ward, A. and Webster, P., 2002. The Anatomy of a Context-Aware Application, Wireless Networks, 8 (2), 187–197.
- Hearst, M. 1997. Interfaces for searching the web. Sci Am 276(3): 68–72.
- Hendrix, M., and A. Cristea. 2007. A qualitative and quantitative evaluation of Adaptive authoring of Adaptive Hypermedia. In Proceedings of the First European Conference on Technology Enhanced Learning, EC-TEL 2007, 71–85. Crete, Greece: Springer LNCS (Doi): 10.1007/978-3-540-75195-3.
- Hollerer T., S. Feiner, T. Terauchi, G. Rashid, and D. Hallaway. 1999. Exploring MARS: developing indoor and outdoor user interfaces to a mobile augmented reality system. Comput Graph 23: 779–785.
- Hong, J., E. Suh, and S. Kim. 2009. Context-aware systems: A literature review and classification Expert Syst Appl 36(4):8509–8522.
- Hustadt, U., M. Motik, and U. Sattler. 2004. Reducing SHIQ-description logic to disjunctive datalog programs. In International Conference on Principles of Knowledge Representation and Reasoning, 52–162. Danvers, MA: AAAI Press.
- International Organisation for Standardisation. 1998. ISO 9241 Ergonomics requirements for work with visual display terminals (VDTs) - Part 11 Guidance on Usability.
- Jameson, A. 2006. Usability and the semantic web. In ESWC 2006, LNCS 4011, 3. Heidelberg, Germany: Springer.
- Jansen, B., A. Spink, and T. Saracevic. 2000. Real life, real users, and real needs: A study and analysis of user queries on the web. Inf Process Manag 36(2):207–227.
- Jul, S., and G. Furnas. 1997. Navigation in electronic worlds: A CHI 97 workshop. SIGCHI Bull 29(4):44–49.
- Kaasininen, E. 2003. User needs for location-aware mobile services. Pers Ubiquitous Comput 7(1):70–79.
- Kaplan, C., J. Fenwick, and J. Chen. 1993. Adaptive hypertext navigation based on user goals and context. User Model User Adapt Interact 3(3): 193–220.
- Kay, J. 2006. Scrutable adaption: Because we can and must. In the Proceedings of the 4th International Conference on Adaptive Hypermedia and Adaptive Web Systems, Springer LNCS, vol. 4018, 11–19. Dublin, Ireland. Berlin: Springer.
- Kim, H., and S. Hirtle. 1995. Spatial metaphors and disorientation in hypertext browsing. Behav Inf Technol 14(4):239–250.
- Kindberg, T., M. Chalmers, and E. Paulos. 2007. Guest Editors' Introduction: Urban Computing. IEEE Pervasive Comput 6(3):18–20.
- Kleinberg, J. M. 1999. Authoritative sources in a hyperlinked environment. J ACM 46(5):604–632.
- Kobayashi, M., and K. Takeda. 2000. Information retrieval on the web. ACM Comput Surv 32(2):144–173.
- Koenemann, J. 1996. Supporting interactive information retrieval through relevance feedback. In Conference Companion on Human Factors in Computing Systems, 49–50. New York: ACM.
- Kolbitsch, J. 2005. Fine-grained transclusions of multimedia documents in HTML. J Univers Comput Sci 11: 926–943.
- Krottmaier, H. 2002. Transcluded Documents: advantages of reusing document fragments. In Proceedings of the 6th International ICC/IFIP Conference on Electronic Publishing, 359–67.

- Lai, J., K. Cheng, P. Green, and O. Tsimhoni. 2002. On the road and on the web? Comprehension of synthetic and human speech while driving. In Proceedings of SIGCHI 2002, 206–212. New York: ACM.
- Lancaster, F., 1968. Information Retrieval Systems: Characteristics, Testing and Evaluation. New York: John Wiley and Sons, Inc.
- Lawrence, S., D. Pennock, G. Flake, R. Krovetz, F. Coetzee, E. Glover, F. Nielsen, A. Kruger, and C. Giles. 2001. Persistence of web references in scientific research. *IEEE Comput* 34(2):26–31.
- Lazar, J., K. Bessiere, I. Ceaparu, J. Robinson, and B. Shneiderman. 2003. Help! I'm lost: User frustration in web navigation. *IT and Society* 1(3): 18–26.
- Lee, F., D. Vogel, and M. Limayem, M. 2003. Virtual community informatics: a review and research agenda. *Journal of Information Technology Theory and Application (JITTA)* 5(1):47–61.
- Lee, S., and S. Zhai. 2009. The performance of touch screen soft buttons. In Proceedings of the 27th International Conference on Human Factors in Computing Systems, CHI '09, 309–318. New York: ACM.
- McCracken, D., and R. Wolfe. 2004. User-Centred Website Development -A Human-Computer Interaction Approach. Upper Saddle River, NJ: Pearson Prentice Hall.
- Meccawy, M., T. Brailsford, A. Moore, H. Ashman, and P. Blanchfield. 2008. WHURLE2.0: Adaptive Learning Meets Web 2.0. In *Proc. European Conf. on Technology-Enhanced Learning*, <http://www.ectel08.org/>.
- Michalski, R., R. Stepp, and E. Diday. 1983. Automatic construction of classifications: conceptual clustering versus numerical taxonomy. *IEEE Trans Pattern Anal Mach Intell* 5: 528–552.
- Moore, A., T. Brailsford, and C. Stewart. 2001. Personally tailored teaching in WHURLE using conditional transclusion. In Proceedings of the 12th ACM Conference on Hypertext and Hypermedia, 163–164. New York: ACM.
- Nelson, T. 1965. Complex information processing: a file structure for the complex, the changing and the indeterminate. In Proceedings of the 1965 20th national conference, ACM '65, 84–100. New York: ACM.
- Nelson, T. 1982. Literary Machines. Watertown, MA: Eastgate Systems Inc.
- Nielsen, J. 1998. *Fighting Linkrot*. <http://www.useit.com/alertbox/980614.html> (accessed July 5, 2010).
- Nielsen, J. 2010a. *iPhone Apps Need Low Starting Hurdles*. <http://www.useit.com/alertbox/mobile-apps-initial-use.html> (accessed July 5, 2010).
- Nielsen, J. 2010b. *iPad Usability: First Findings From User Testing*. <http://www.useit.com/alertbox/ipad.html> (accessed July 5, 2010).
- O'Keeffe, I., and V. Wade. 2009. Personalised web: Adaptability for web service composition and web content. In *User Modeling, Adaptation, and Personalization: 17th International Conference, UMAP 2009, Trento, Italy (LNCS 5535)*, ed. G.-J. Houben, G. McCalla, F. Pianesi, and M. Zancanaro, 480–486. Berlin: Springer-Verlag.
- Ontology Visualisation tab for Protege. <http://protegewiki.stanford.edu/wiki/OntoViz> (accessed October 10, 2011).
- Otter, M., and H. Johnson. 2000. Lost in hyperspace: metrics and mental models. *Interact Comput* 13: 1–40.
- Papagiannakis, G., G. Singh, and N. Magnenat-Thalmann. 2008. A survey of mobile and wireless technologies for augmented reality systems. *Computer Animat Virtual Worlds* 19(1):3–22.
- Patterson, C., R. Muntz, and C. Pancake. 2003. Challenges in location-aware computing. *IEEE Pervasive Comput* 2(2):80–89.
- Pinski, G., and F. Narin. 1976. Citation influence for journal aggregates of scientific publications: Theory, with application to the literature of physics. *Inf Proc Manag* 12: 297–312.
- Protégé. 2010. Ontology editing tool. <http://protege.stanford.edu/> (accessed August, 2010).
- Rao, B., and L. Minakakis. 2003. Evolution of mobile location-based services. *Commun ACM* 46(12):61–65.
- Rashid, O., W. Bamford, P. Coulton, R. Edwards, and J. Scheible. 2006. PAC-LAN: mixed-reality gaming with RFID-enabled mobile phones. *Comput Entertain* 4(4):4.
- Robertson, G., J. Mackinlay, and S. Card. 1991. Cone Trees: Animated 3D visualizations of hierarchical information. In *Proc. SIGCHI Conf. on Human Factors in Computing Systems, CHI '91*, 189–194. New York: ACM.
- Rolker, C., and P. Kramer. 1999. Quality of service transferred to information retrieval: The adaptive information retrieval system. In *Proc. Eighth International Conference on Information and Knowledge Management*, 399–404. New York: ACM.
- Ruthven, I. 2003. Re-examining the potential effectiveness of interactive query expansion. In *Proceedings of the 26th Annual International ACM SIGIR Conference on Research and Development in Information Retrieval, SIGIR '03*, 213–220. New York: ACM.
- Ruthven, I., and M. Lalmas. 2003. A survey on the use of relevance feedback for information access systems. *Knowl Eng Rev* 18(2):95–145.
- Salton, G., C. Yang, and C. Yu. 1975. A theory of term importance in automatic text analysis. *J Am Soc Inf Sci* 26(1):33–34.
- Schmalstieg, D., and D. Wagner. 2007. Experiences with handheld augmented reality. In *Proc. 6th IEEE and ACM International Symposium on Mixed and Augmented Reality*, 1–13. Los Alamos, CA: IEEE Computer Society.
- Schmalstieg, D., and D. Wagner. 2008. Mobile phones as a platform for augmented reality. In *Proc. IEEE VR 2008 Workshop on Software Engineering and Architectures for Realtime Interactive Systems*, 43–44. Washington, DC: IEEE Computer Society.
- Shadbolt, N., T. Berners-Lee, and W. Hall. 2006. The semantic web revisited. *IEEE Intell Syst* 21(3):96–101. ISSN 1541–1672.
- Shneiderman, B. 2000. The limits of speech recognition. *Commun ACM* 43(9):63–65.
- Sirin, E., B. Parsia, B. Grau, A. Kalyanpur, and Y. Katz. 2007. Pellet: A practical OWL-DL reasoner. *Web Semantics: Science, Services and Agents on the World Wide Web* 5(2):51–53.
- Sparck Jones, K. 1972. A statistical interpretation of term specificity and its application in retrieval. *J Doc* 28(1): 11–20.
- Spink, A., B. Jansen, and H. Ozmultu. 2000. Use of query reformulation and relevance feedback by Excite users. *Internet Research: Electronic Networking Applications and Policy* 10(4):317–328.
- Thomas, B., B. Close, J. Donoghue, J. Squires, P. Bondi, M. Morris, and W. PiekarSKI. 2000. *ARQuake: An outdoor/indoor augmented reality first person application*. In *Proc. 4th IEEE International Symposium on Wearable Computers*, 139. Washigton, DC: IEEE Computer Society.
- Truran, M., J. Goulding, and H. Ashman. 2005. Co-active intelligence for information retrieval. In *Proceedings of ACM Multimedia '05*, 547–550. New York: ACM.
- Varshney, U. 2001. Location management support for mobile commerce applications. In *Proc. 1st International Workshop on Mobile Commerce*, 1–6. New York: ACM.
- Verbyla, J., and H. Ashman. 1994. A user-configurable hyper-media-based interface via the functional model of the link. *Hypermedia* 6(3): 193–208.

- Virrantaus, K., J. Markkula, A. Garmash, V. Terziyan, J. Veijalainen, A. Katanosov, and H. Tirri. 2006. Developing GIS-supported location-based services. In Proc. Second International Conference on Web Information Systems Engineering, 66–75. Washington, DC: IEEE Computer Society.
- W3C, Examples. Semantic Web Case Studies and Use Cases. <http://www.w3.org/2001/sw/sweo/public/UseCases/> (accessed October 10, 2011).
- W3C, Linked Data-Connect Distributed Data across the Web. <http://linked data.org/> (accessed October 10, 2011).
- W3C, RDFa in XHTML:Syntax and Processing. <http://www.w3.org/TR/rdfa-syntax/> (accessed October 10, 2011).
- W3C, Semantic Web standards. <http://www.w3.org/TR/> (accessed October 10, 2011).
- Wade, V. 2009. Challenges for the multi-dimensional personalized web. In User Modeling, Adaptation, and Personalization: 17th International Conference, UMAP 2009, Trento, Italy, LNCS 5535, ed. G.-J. Houben, G. McCalla, F. Pianesi, and M. Zancanaro. Berlin: Springer-Verlag.
- Wagner, D., and D. Schmalstieg. 2009. Making augmented reality practical on mobile phones, part 2. *IEEE Comput Graph Appl* 29 (4): 6–9.
- Want, R., A. Hopper, V. Falcão, and J. Gibbons. 1992. The active badge location system. *ACM Trans Inf Syst* 10(1):91–102.
- Ward, M., R. Azuma, R. Bennett, S. Gottschalk, and H. Fuchs. 1992. A demonstrated optical tracker with scalable work area for head-mounted display systems. In Proc. Symposium on Interactive 3D Graphics, 43–52. New York: ACM.
- Wellner, P. 1991. The DigitalDesk calculator: Tangible manipulation on a desk top display. In *Proceedings of the 4th Annual ACM Symposium on User Interface Software and Technology UIST '91*, 27–33.
- Wen, J., J. Nie, and H. Zhang. 2001. Clustering user queries of a search engine. In Proc. 10th Intl Conf. on World Wide Web, 162–168. New York: ACM.
- Westerman, W., J. Elias, and A. Hedge. 2001. Multi-touch: A new tactile 2-D gesture interface for human–computer interaction. In *Proceedings of the Human Factors and Ergonomics Society 45th Annual Meeting*, 632–36.
- Wigdor, D., J. Fletcher, and G. Morrison. 2009. Designing user interfaces for multi-touch and gesture devices. In Proceedings of the 27th International Conference Extended Abstracts on Human factors in Computing systems, CHI '09, 2755–2758. New York: ACM.
- Wikipedia. 2010. Link Rot. http://en.wikipedia.org/wiki/Link_rot (accessed July 5, 2010).
- Wilde, E., and D. Lowe. 2002. XPath, XLink, XPointer, and XML: A Practical Guide to Web Hyperlinking and Transclusion. Boston, MA: Addison-Wesley Professional.
- Wing, M., A. Eklund, and L. Kellogg. 2005. Consumer-grade global positioning system (GPS) accuracy and reliability. *J For* 103: 169–173.
- WSMO. Web Services Modelling Ontology Technical Recommendations. <http://www.wsmo.org/TR/> (accessed October 10, 2011).
- Wu, Z., G. Eadon, S. Das, E. Chong, V. Kolovski, M. Annamalai, and J. Srinivasan. 2008. Implementing an inference engine for RDFS/OWL constructs and user-defined rules in Oracle. In International Conference on Data Engineering, 1239–1248. Washington, DC: IEEE Computer Society.
- XTM. 2001. XML Topic Maps. <http://www.topicmaps.org/xtm/> (accessed October 10, 2011).
- Zakaria, M., and T. Brailstorf. 2002. User modelling and adaptive educational hypermedia frameworks for education. *New Rev Hypermedia Multimed* 8: 83–97.
- Zhao, S., P. Dragicevic, M. Chignell, R. Balakrishnan, and P. Baudisch. 2007. Earpod: eyes-free menu selection using touch input and reactive audio feedback. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 1395–1404. New York: ACM.

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- Amalberti, R. 1999. Automation in aviation: A human factors perspective. In *Handbook of Aviation*, ed. D. Garland, J. Wise, and V. Hopkins, 173–192. Mahwah, NJ: Lawrence Erlbaum.
- Anderson, J. R. 1993. Rules of the Mind. Hillsdale, NJ: Lawrence Erlbaum.
- Anderson, J. R., D. Bothell, N. Byrne, S. Douglass, C. Lebiere, and Y. Qin. 2004. An integrated theory of the mind. *Psychol Rev* 111(4):1036–1060.
- Andes, R. C., and W. B. Rouse. 1992. Specification of adaptive aiding systems. *Inf Decis Technol* 18: 195–207.
- Annett, J., K. D. Duncan, R. B. Stammers, and M. J. Gray. 1971. Task Analysis. London, UK: HMSO.
- Annett, J., and N. Stanton. 2000. Task Analysis. London: Taylor & Francis.
- Baddeley, A. 1998. Human Memory: Theory and Practice. Boston, MA: Allyn and Bacon.
- Baddeley, A. 1999. Essentials of Human Memory. London: Taylor & Francis Group.
- Baecker, R., J. Grudin, W. Buxton, and S. Greenberg. 1995. Readings in Groupware and Computer-Supported Cooperative Work: Assisting Human-Human Collaboration. San Francisco, CA: Morgan Kaufmann.
- Bainbridge, L. 1983. Ironies of automation. *Automatica* 19: 775–779.
- Bar-Yam, Y. 2003. Dynamics of Complex Systems: Studies in Nonlinearity. Nashville, TN: Westview Press.
- Bar-Yam, Y. 2005. Making Things Work: Solving Complex Problems in a Complex World. Cambridge, MA: NECSI Knowledge Press.
- Beach, L. R., and T. Connolly. 2005. The Psychology of Decision Making: People in Organizations. 2nd ed. Thousand Oaks, CA: Sage Publications, Inc.
- Bennett, K. B., and J. M. Flach. 1992. Graphical displays: Implications for divided attention, focused attention, and problem solving. *Hum Factors* 34(5):513–533.
- Berner, E., C. Brooks, R. Miller, F. Masarie, and J. Jackson. 1989. Evaluation issues in the development of expert systems in medicine. *Eval Health Prof* 12: 270–281.
- Bickmore, T. 2010. Etiquette in motivational agents: Engaging users and developing relationships. In *Human-Computer Etiquette: Cultural Expectations and the Design Implications They Place on Computers and Technology*, ed. C. Hayes, and C. Miller, 205–229. Boca Raton, FL: Taylor & Francis.
- Billings, C. E. 1997. Aviation automation: The search for a human-centered approach. Hillsdale, NJ: Lawrence Erlbaum.

- Bisantz, A. M., E. Roth, and B. Brickman. 2003. Integrating cognitive analysis in a large-scale system design process. *Int J Hum Comput Stud* 58: 177–206.
- Bitner, K. 2002. *Use Case Modeling*. Harlow, England: Addison-Wesley.
- Bjork, R. A. 1999. Assessing our own competence: Heuristics and illusions. *Atten Perform* 17: 435–459.
- Blank, H. 1998. Memory states and memory tasks: An integrative framework for eyewitness memory and suggestibility. *Memory* 6(5):481–529.
- Blount, S., and R. P. Larrick. 2000. Framing the game: Examining frame choice in bargaining. *Organ Behav Hum Decis Process* 81(1):43–71.
- Bochman, A. 2004. A causal approach to nonmonotonic reasoning. *Artif Intell* 160(1–2):105–143.
- Bodker, K., F. Kensing, and J. Simonsen. 2004. *Participatory IT Design: Designing for Business and Workplace Realities*. Cambridge, MA: MIT Press.
- Bowers, C., E. Salas, and F. Jentsch, eds. 2006. *Creating High-Tech Teams: Practical Guidance on Work Performance and Technology*. Washington, DC: American Psychological Association.
- Brachman, R., and H. Levesque. 2004. *Knowledge Representation and Reasoning*. San Mateo, CA: Morgan Kaufmann.
- Bradfield, A., and G. Wells. 2005. Not the same old hindsight bias: Outcome information distorts a broad range of retrospective judgments. *Mem Cognit* 33(1):120–130.
- Brehm, S., S. M. Kassin, and S. Fein. 1999. *Social Psychology*. 4th ed. Boston, MA: Houghton Mifflin Company.
- Burns, C., A. Bizantz, and E. Roth. 2004. Lessons from a comparison of work domain models: Representational choices and their implications. *Hum Factors* 46: 711–727.
- Burns, C., and J. Hajdukiewicz. 2004. *Ecological Interface Design*. Boca Raton, FL: CRC Press.
- Burns, C., and K. Vicente. 2001. Model-based approaches for analyzing cognitive work: A comparison of abstraction hierarchy, multi-level flow modeling, and decision ladder modeling. *Int J Cognit Ergon* 5: 357–366.
- Byrne, M., and A. Kirlik. 2005. Using computational cognitive modeling to diagnose possible sources of aviation error. *Int J Aviat Psychol* 15(2):135–155.
- Caggiano, D., and R. Parasuraman. 2004. The role of memory representation in the vigilance decrement. *Psychon Bull Rev* 11(5):932–937.
- Caldwell, B. 2005. Multi-team dynamics and distributed expertise in mission operations. *Aviat Space Environ Med* 76(6):145–153.
- Card, S., T. P. Moran, and A. Newell. 1983. *The Psychology of Human-Computer Interaction*. Hillsdale, NJ: Lawrence Erlbaum.
- Carroll, J. M. 1995. *Scenario-Based Design: Envisioning Work and Technology in System Development*. New York: John Wiley & Sons.
- Carroll, J. M., D. C. Neale, P. L. Isenhour, and D. S. McCrickard. 2003. Notification and awareness: Synchronizing task-oriented collaborative activity. *Int J Hum Comput Stud* 58: 605–632.
- Cartwright, D., and A. Zander, eds. 1960. *Group Dynamics: Research and Theory*. 2nd ed. Evanston, IL: Row and Peterson.
- Cary, M., and R. Carlson. 2001. Distributing working memory resources during problem solving. *J Exp Psychol: Learn Mem Cogn* 27: 836–848.
- Chandrasekaran, B. 1988. Generic tasks as building blocks for knowledge based systems: The diagnosis and routine design examples. *Knowl Eng Rev* 3(3):183–210.
- Charness, N., P. Feltovich, R. Hoffman, and E. Ericsson. 2006. *The Cambridge Handbook of Expertise and Expert Performance*. New York: Cambridge University Press.
- Chi, M., R. Glaser, and M. Farr, eds. 1988. *The Nature of Expertise*. Hillsdale, NJ: Lawrence Erlbaum.
- Clancey, W. J. 1983. The epistemology of a rule-based expert system—a framework for explanation. *Artif Intell* 20: 215–251.
- Clancey, W. J. 1985. Heuristic classification. *Artif Intell* 27: 289–350.
- Clarke, K., G. Hardstone, M. Rouncefield, and I. Sommerville, eds. 2006. *Trust in Technology: A Socio-Technical Perspective*. New York: Springer.
- Cockburn, A. 2000. *Writing Effective Use Cases*. Harlow, England: Addison-Wesley.
- Crandall, B., G. Klein, and R. Hoffman. 2006. *Working Minds: A Practitioner's Guide to Cognitive Task Analysis*. Cambridge, MA: MIT Press.
- Croson, R., and J. Sundali. 2005. The gambler's fallacy and the hot hand: Empirical data from casinos. *J Risk Uncertain* 30(3):195–209.
- Dasgupta, P., P. Chakrabarti, and S. Desarkar. 2004. *Multiobjective Heuristic Search: An Introduction to Intelligent Search Methods for Multicriteria Optimization*. San Mateo, CA: Morgan Kauffman.
- Dechter, R. 2003. *Constraint Processing*. San Mateo, CA: Morgan Kaufmann.
- Diaper, D., and N. Stanton, eds. 2004. *The Handbook of Task Analysis for Human-Computer Interaction*. Mahwah, NJ: Lawrence Erlbaum.
- Dorneich, M. C., S. Mathan, S. Whitlow, P. M. Ververs, and C. C. Hayes. 2010. Etiquette considerations for adaptive systems that interrupt: Costs and benefits. In *Human-Computer Etiquette: Cultural Expectations and the Design Implications They Place on Computers and Technology*, ed. C. Hayes and C. Miller, 289–319. Boca Raton, FL: Taylor & Francis.
- Eckstein, M. P. 2004. Active vision: The psychology of looking and seeing. *Perception* 33(8):1021–1023.
- Elstein, A. S., L. S. Shulman, and S. A. Sprafka. 1978. *Medical Problem Solving: An Analysis of Clinical Reasoning*. Cambridge, MA: Harvard University Press.
- Endsley, M. 2003. *Designing for Situation Awareness*. London: Taylor & Francis.
- Endsley, M., and D. Garland. 2000. *Situation Awareness Analysis and Measurement*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Erkens, G., J. Andriessen, and N. Peters. 2003. Interaction and performance in computer-supported collaborative tasks. In *Cognition in a Digital World*, ed. H. Van Oostendorp, 225–251. Mahwah, NJ: Lawrence Erlbaum.
- Flach, J., P. Hancock, J. Caird, and K. Vicente, eds. 1995. *Global Perspectives on the Ecology of Human-Machine Systems*. Hillsdale, NJ: Lawrence Erlbaum.
- Fischer, G., A. C. Lemke, T. Mastaglio, and A. I. Morsch. 1991. The role of critiquing in cooperative problem solving. *ACM Trans Inf Syst* 9(3):123–151.
- Forsyth, D. 1998. *Group Dynamics*. Florence, KY: Wadsworth Publishing.
- Fraser, J. M., P. J. Smith, and J. W. Smith. 1992. A catalog of errors. *Int J Man Mach Syst* 37: 265–307.
- Freeman, F., P. Mikulka, and M. Scerbo. 2004. An evaluation of an adaptive automation system using a cognitive vigilance task. *Biol Psychol* 67(3):283–297.

- Garb, H. 2005. Clinical judgment and decision making. *Annu Rev Clin Psychol* 1(1):67–89.
- Geddes, N. D. 1989. *Understanding Human Operator's Intentions in Complex Systems*. Doctoral Dissertation, Georgia Institute of Technology, Atlanta, GA.
- Geddes, N. D. 1997a. Large scale models of cooperating and hostile intents. In *Proceeding of the 1997 IEEE Conference on Engineering of Computer Based Systems*. New York: IEEE.
- Geddes, N. D. 1997b. Associate Systems: A framework for human–machine cooperation. In *Design of computing systems: Social and ergonomic considerations. Advances in Human Factors/ Ergonomics*, ed. M. J. Smith, G. Salvendy, and R. J. Koubek, Vol. 21, 237–242. New York: Elsevier.
- Geddes, N. D., and C. S. Lizza. 1999. Shared plans and situations as a basis for collaborative decision making in air operations. *SAE World Aeronautics Conference*, SAE Paper 1999-01-5538.
- Gentner, D., and A. Stevens. 1983. Mental Models. Hillsdale, NJ: Lawrence Erlbaum.
- Ghallib, M., D. Nau, and P. Traverso. 2004. Automated Planning: Theory and Practice. San Mateo, CA: Morgan Kaufmann Publishers.
- Gilovich, T., D. Griffin, and D. Kahneman, eds. 2002. *Heuristics and Biases: The Psychology of Intuitive Judgment*. New York: Cambridge University Press.
- Gilovich, T., R. Vallone, and A. Tversky. 1985. The hot hand in basketball: On the misperception of random sequences. *Cogn Psychol* 17: 295–314.
- Gong, L. 2008. The boundary of racial prejudice: Comparing preferences for computer-synthesized black, white and robot characters. *Comput Hum Behav* 24(5):2074–2093.
- Gordon, A. 2004. The representation of planning strategies. *Artif Intell* 153(1/2):287–305.
- Gordon, S. E., and R. T. Gill. 1992. Knowledge acquisition with question probes and conceptual graph structures. In *Questions and Information Systems*, ed. T. Lauer, E. Peacock, and A. Graesser, 29–46. Hillsdale, NJ: Lawrence Erlbaum.
- Gordon, S. E., and R. T. Gill. 1997. Cognitive task analysis. In *Naturalistic Decision Making*, ed. C. Zsambok, and G. Klein, 131–140. Hillsdale, NJ: Lawrence Erlbaum.
- Grabowski, M., and S. Sanborn. 2003. Human performance and embedded intelligent technology in safety-critical systems. *Int J Hum Comput Stud* 58(6):637–670.
- Grier, R., J. Warm, and W. Dember. 2003. The vigilance decrement reflects limits in effortful attention, not mindlessness. *Hum Factors* 45(3):349–359.
- Griffith, T. L., J. E. Sawyer, and M. A. Neale. 2003. Virtualness and knowledge in teams: Managing the love triangle of organizations, individuals and information technology. *MIS Q* 27: 265–287.
- Grondin, S. 2005. Overloading temporal memory. *J Exp Psychol Hum Percept Perform* 31(5):869–879.
- Guerlain, S., P. J. Smith, J. H. Obradovich, S. Rudmann, P. Strohm, J. W. Smith, and J. Svirbely. 1996. Dealing with brittleness in the design of expert systems for immunohematology. *Immunohematology* 12: 101–107.
- Guerlain, S., P. J. Smith, J. H. Obradovich, S. Rudmann, P. Strohm, J. W. Smith, J. Svirbely, and L. Sachs. 1999. Interactive critiquing as a form of decision support: An empirical evaluation. *Hum Factors* 41: 72–89.
- Hammond, K. J. 1989. *Case-Based Planning: Viewing Planning as a Memory Task*. Boston, MA: Academic Press, Inc.
- Handberg, R. 1995. Expert testimony on eyewitness identification— A new pair of glasses for the jury. *Am Crim Law Rev* 32(4): 1013–1064.
- Handy, C. 1995. Trust and the virtual organization. *Harv Bus Rev* 73: 40–50.
- Harris, S., and J. Owens. 1986. Some critical factors that limit the effectiveness of machine intelligence technology in military systems applications. *J Comput Based Instr* 13: 30–34.
- Haselton, M. G., D. Nettle, and P. W. Andrews. 2005. The evolution of cognitive bias. In *The handbook of evolutionary psychology*, ed. D. M. Buss, 724–746. Hoboken, NJ: John Wiley & Sons.
- Hasling, D. W., W. J. Clancey, and G. Rennels. 1984. Strategic explanations for a diagnostic consultation system. *Int J Man Mach Syst* 20: 3–19.
- Hayes, C. C., and C. A. Miller, eds. 2010. Human computer etiquette: Should computers be polite? In *Human-Computer Etiquette: Cultural Expectations and the Design Implications They Place on Computers and Technology*, ed. C. Hayes, and C. Miller, 1–12. Boca Raton, FL: Taylor & Francis.
- Hayes, C. C., and U. Ravinder. 2003. Weasel: An automated planner that users can guide. In *Proceedings of the 2003 Conference on IEEE Systems, Man and Cybernetics*, October 5–8. Washington, DC. New York: IEEE.
- Hayes-Roth, B., and F. Hayes-Roth. 1979. A cognitive model of planning. *Cogn Sci* 3(4):275–310.
- Helander, M., T. Landauer, and P. Prabhu, eds. 1997. *Handbook of Human-Computer Interaction*. Amsterdam, Netherlands: Elsevier.
- Hertel, G., S. Geister, and U. Konradt. 2005. Managing virtual teams: A review of current empirical research. *Hum Resour Manage Rev* 15(1):69–95.
- Hester, R., and H. Garavan. 2005. Working memory and executive function: The influence of content and load on the control of attention. *Mem Cogn* 33(2):221–233.
- Hinds, P., and S. Kiesler, eds. 2002. *Distributed Work*. Cambridge, MA: MIT Press.
- Hinds, P. J., and M. Mortensen. 2005. Understanding conflict in geographically distributed teams: The moderating effects of shared identity, shared context, and spontaneous communication. *Organiz Sci* 16: 290–307.
- Hoc, J. -M. 2000. From human–machine interaction to human–machine cooperation. *Ergonomics* 43: 833–843.
- Hoc, J. M. 2001. Towards a cognitive approach to human–machine cooperation in dynamic situations. *International Journal of Human-Computer Studies* 54(4):509–540.
- Hollnagel, E. 2003. *Handbook of Cognitive Task Design*. Mahwah, NJ: Lawrence Erlbaum.
- Hollnagel, E., and D. Woods. 2005. *Joint Cognitive Systems: Foundations of Cognitive Systems Engineering*. Boca Raton, FL: Taylor & Francis.
- Horton, F., and D. Lewis, eds. 1991. *GreatInformationDisasters*. London, UK: Association for Information Management.
- Hutchins, E. 1990. The technology of team navigation. In *Intellectual Teamwork: Social and Technical Bases of Collaborative Work*, ed. J. Galegher, R. Kraut, and C. Egido. Hillsdale, NJ: Lawrence Erlbaum.
- Hutchins, E. 1995. *Cognition in the Wild*. Cambridge, MA: MIT Press.

- Jagacinski, R. J., and J. M. Flach. 2003. Control Theory for Humans: Quantitative Approaches to Modeling Performance. Hillsdale, NJ: Lawrence Erlbaum.
- Janis, I. 1982. Groupthink, 2nd ed. Boston, MA: Houghton Mifflin.
- Johnson, P., A. Duran, F. Hassebroek, J. Moller, M. Prietulla, P. Feltovich, and D. Swanson. 1981. Expertise and error in diagnostic reasoning. *Cogn Sci* 5: 235–283.
- Johnson, W. L., E. Shaw, A. Marshall, and C. LaBore. 2003. Evolution of User Interaction: the case of agent Adele. In International Conference on Intelligent User Interfaces, Proceedings of the 8th International Conference on Intelligent User Interfaces, 93–100. Miami, FL.
- Johnson, W. L., and N. Wang. 2010. The Role of Politeness in Interactive Educational Software for Language Tutoring. In Human-Computer Etiquette: Cultural Expectations and the Design Implications They Place on Computers and Technology, ed. C. Hayes, and C. Miller, 91–113. Boca Raton, FL: Taylor & Francis.
- Johnston, W. A., and V. J. Dark. 1986. Selective attention. *Annu Rev Psychol* 37: 43–75.
- Jonassen, D., Tessmer, M. and Hannum, W. 1999. Task Analysis Methods for Instructional Design. Mahwah NJ: Lawrence Erlbaum.
- Jonassen, D., M. Tessmer, and W. Hannum. 1999. Task Analysis Methods for Instructional Design. Mahwah, NJ: Lawrence Erlbaum.
- Jones, P., and J. Jacobs. 2000. Cooperative problem solving in human-machine systems: Theory, models and intelligent associate systems. *IEEE Trans Syst Man Cybern* 30(4):397–407.
- Jones, P. M., and C. M. Mitchell. 1995. Human-computer cooperative problem solving: Theory, design, and evaluation of an intelligent associate system. *IEEE Trans Syst Man Cybern* 25: 1039–1053.
- Jones, E., and R. Nisbett. 1971. The actor and the observer: Divergent perceptions of the causes of behavior. In *Attributions: Perceiving the Causes of Behavior*, ed. E. Jones, D. Kanouse, H. Kelley, R. Nisbett, S. Valins, and B. Weiner, 79–94. Morristown, NJ: General Learning Press.
- Jones, D. R., and D. A. Schkade. 1995. Choosing and translating between problem representations. *Organiz Behav Hum Decis Process* 61(2):214–223.
- Josephson, J., and S. Josephson. 1994. *Abductive Inference*, 31–38. New York: Cambridge University Press.
- Kahneman, D., and A. Tversky, eds. 2000. *Choices, Values and Frames*. New York: Cambridge University Press.
- Katz, N., D. Lazer, H. Arrow, and N. Contractor. 2004. Network theory and small groups. *Small Group Res* 35(3):307–332.
- Kieras, D. 2004. GOMS models for task analysis. In *The Handbook of Task Analysis for Human-Computer Interaction*, ed. D. Diaper, and N. Stanton, 83–116. Mahwah, NJ: Lawrence Erlbaum.
- Kieras, D., and D. Meyer. 1997. An overview of the EPIC architecture for cognition and performance with application to human-computer interaction. *Hum Comput Interact* 12: 391–438.
- Kirwan, B., and L. Ainsworth. 1992. *A Guide to Task Analysis*. London: Taylor & Francis.
- Klayman, J., and Y. Ha. 1987. Confirmation, disconfirmation, and information in hypothesis testing. *Psychol Rev* 94: 211–228.
- Klein, G. A. 1993. A recognition-primed decision (RPD) model of rapid decision making. In *Decision Making in Action: Models and Method*, ed. G. Klein, J. Oransanu, R. Calderwood, and C. Zsambok, 138–147. Norwood, NJ: Ablex.
- Klein, G. 2000. Cognitive task analysis of teams. In *Cognitive Task Analysis*, ed. J. M. Schraagen, S. Chipman, and V. Shalin, 417–430. Mahwah, NJ: Lawrence Erlbaum.
- Klein, G., R. Caulderwood, and D. MacGregor. 1989. Critical decision method for eliciting knowledge. *IEEE Trans Syst Man Cybern* 19: 462–472.
- Kleinmuntz, D. N., and D. A. Schkade. 1993. Information displays and decision processes. *Psychol Sci* 4(4):221–227.
- Koehler, J. J. 1996. The base rate fallacy reconsidered: Descriptive, normative, and methodological challenges. *Behav Brain Sci* 9(1):1–53.
- Kohler, W. 1992. *Gestalt Psychology: An Introduction to New Concepts in Modern Psychology*. New York: Liveright Publishing Corporation.
- Kolodner, J. 1993. *Case-Based Reasoning*. San Mateo, CA: Morgan Kaufmann Publishers.
- Kotovsky, K., J. R. Hayes, and H. A. Simon. 1985. Why are some problems hard? Evidence from Tower of Hanoi. *Cogn Psychol* 17: 248–294.
- Kulak, D., and E. Guiney. 2003. *Use Cases: Requirements in Context*. 2nd ed. Harlow, England: Addison-Wesley.
- Kushleyeva, Y., D. Salvucci, F. Lee, and C. Schunn. 2005. Deciding when to switch tasks in time-critical multitasking. *Cogn Syst Res* 6(1):41–49.
- Kutti, M. 1995. Activity theory as a potential framework for human-computer interaction research. In Nardi, B. (ed.) *Context and consciousness: Activity theory and human-computer interaction*. Cambridge MA: MIT Press.
- Laird, J. E., A. Newell, and P. S. Rosenbloom. 1987. SOAR: An architecture for general intelligence. *Artif Intell* 33: 1–64.
- Larkin, J. H., and H. A. Simon. 1987. Why a diagram is (sometimes) worth ten thousand words. *Cogn Sci* 11: 65–99.
- Larson, A. and C. Hayes, 2005. An assessment of WEASEL: A Decision support system to assist in military planning. Proceedings of the 2005 Annual Meeting of the Human Factors Society Orlando, 287–91.
- Larson, A. D. 2010. *The Impact of Computer Decision Support on Military Team Decision Making*. PhD Thesis, University of Minnesota, Minneapolis, MN, USA.
- Larson, A. D., and C. C. Hayes. 2005. An assessment of WEASEL: A decision support system to assist in military planning. In *Proceedings of the 2005 Annual Meeting of the Human Factors and Ergonomics Society*, 287–291. Santa Monica, CA: Human Factors and Ergonomics Society.
- Lee, J., and K. See. 2004. Trust in automation: Designing for appropriate reliance. *Hum Factors* 46(1):50–80.
- Lehner, P. E., and D. A. Zirk. 1987. Cognitive factors in user/expert/system interaction. *Hum Factors* 29(1):97–109.
- Levi, D. 2001. *Group Dynamics for Teams*. London, UK: SAGE Publications.
- Lewis, C., and C. Wharton. 1997. Cognitive walkthroughs. In *Handbook of Human-Computer Interaction*, 2nd ed., ed. M. Helander, T. Landauer, and P. Prabhu, 717–731. Amsterdam, Netherlands: Elsevier.
- Loftus, E. 1975. Leading questions and the eyewitness report. *Cogn Psychol* 7: 560–572.
- Logan, G. 2005. Attention, automaticity, and executive control. In *Experimental Cognitive Psychology and its Applications*, ed. A. F. Healy, 129–139. Washington, DC: American Psychological Association.

- Lowe, R. K. 2003. Animation and learning: Selective processing of information in dynamic graphics. *Learn Instr* 13(2):157–176.
- Luo, Y., P. Greenwood, and R. Parasuraman. 2001. Dynamics of the special scale of visual attention revealed by brain event-related potentials. *Cogn Brain Res* 12(3):371–381.
- Lurey, J. S., and M. S. Raisinghani. 2001. An empirical study of best practices in virtual teams. *Inf Manage* 38: 523–544.
- Mack, R. 1995. Scenarios as engines of design. In *Scenario-Based Design: Envisioning Work and Technology in System Development*, ed. J. M. Carroll, 361–386. New York: John Wiley & Sons.
- Mackworth, N. 1950. Researches on the measurement of human performance. Reprinted in *Selected papers on Human Factors in the Design and Use of Control Systems, 1961*, ed. H. W. Sinaiko. New York: Dover Publications.
- Madani, O., A. Condon, and S. Hanks. 2003. On the undecidability of probabilistic planning and related stochastic optimization problems. *Artif Intell* 147(1/2):5–34.
- Majercik, S., and M. Littman. 2003. Contingent planning under uncertainty via stochastic satisfiability. *Artif Intell* 147(1/2):119–162.
- Marsh, S., and M. Dibben. 2003. *Annu Rev Inf Sci Technol* 37: 465–498.
- McCauley, C. 1989. The nature of social influence in groupthink: Compliance and internalization. *J Pers Soc Psychol* 22: 250–260.
- Meister, D., and T. Enderwick. 2002. *Human Factors in System Design, Development and Testing*. Mahwah, NJ: Lawrence Erlbaum.
- Metzger, U., and R. Parasuraman. 2005. Automation in future air traffic management: Effects of decision aid reliability on controller performance and mental workload. *Hum Factors* 47(1):35–49.
- Michalewicz, Z., and D. Fogel. 2004. *How to Solve It: Modern Heuristics*. New York: Springer.
- Michie, D. 1986. *On Machine Intelligence*. 2nd ed. Chichester, West Sussex: Ellis Horwood Limited.
- Mikulka, P., M. Scerbo, and F. Freeman. 2002. Effects of a biocybernetic system on vigilance performance. *Hum Factors* 44(4):654–664.
- Miller, C., M. Pelican, and R. Goldman. 2000. “Tasking” interfaces to keep the operator in control. In *Proceedings of the 5th International Conference on Human Interaction with Complex Systems*. Urbana, IL.
- Miller, G. A., E. Galanter, and K. H. Pribram. 1960. *Plans and the Structure of Behavior*. New York: Henry Holt and Company.
- Miller, P. 1986. *Expert Critiquing Systems: Practice-Based Medical Consultation by Computer*. New York: Springer-Verlag.
- Mital, A., and A. Pennathur. 2004. Advanced technologies and humans in manufacturing workplaces: An interdependent relationship. *Int J Ind Ergon* 33(4):295–313.
- Mitchell, C. M., and R. A. Miller. 1986. A discrete control model of operator function: A methodology for information display design. *IEEE Trans Syst Man Cybern* 16: 343–357.
- Muir, B. 1987. Trust between humans and machines. *Int J Man Mach Stud* 27: 527–539.
- Muir, B., and N. Moray. 1996. Trust in automation 2: Experimental studies of trust and human intervention in a process control simulation. *Ergonomics* 39(3):429–460.
- Mumford, M., R. Schultz, and J. Van Doorn. 2001. Performance in planning: Processes, requirement, and errors. *Rev Gen Psychol* 5(3):213–240.
- Myers, D. 2004. *Psychology*. 7th ed. New York: Worth Publishers.
- Mynatt 1977: Mynatt, C., Doherty, M. and Tweney, R. 1977. Confirmation bias in a simulated research environment: An experimental study of scientific inference. *Quarterly Journal of Experimental Psychology* 30: 85–95.
- Mynatt, C., M. Doherty, and R. Tweney. 1977. Confirmation bias in a simulated research environment: An experimental study of scientific inference. *Q J Exp Psychol* 30: 85–95.
- Nakatsu, R. T., and I. Benbasat. 2003. Improving the explanatory power of knowledge-based systems: An investigation of content and interface-based enhancements. *IEEE Trans Syst Man Cybern Part A Syst Hum* 33(3):344–357.
- Nareyek, A., R. Fourer, and E. Freuder. 2005. Constraints and AI planning. *IEEE Intell Syst* 20(2):62–72.
- Nason, S., J. Laird, and C. Schunn. 2005. SOAR-RL: Integrating reinforcement learning with SOAR. *Cogn Syst Res* 6(1):51–59.
- Nass, C., J. Steuer, and E. Tauber. 1994. Computers are social actors. In *CHI '94, Human Factors in Computing Systems*. New York: Association for Computing Machinery.
- Nass, C., Y. Moon, and N. Green. 1997. Are Machines Gender-Neutral? Gender Stereotypic Responses to Computers. *J Appl Psychol* 27(10):864–876.
- Navon, D. 1978. The importance of being conservative. *British Journal of Mathematical and Statistical Psychology* 31: 33–48.
- Newell, A. 1990. *Unified Theories of Cognition*. Cambridge, MA: Harvard University Press.
- Newell, A., and H. Simon. 1972. *Human Problem Solving*. Englewood Cliffs, NJ: Prentice Hall, Inc.
- Nickerson, R. 1988. Counting, computing, and the representation of numbers. *Hum Factors* 30: 181–199.
- Norman, D. A. 1981. Categorization of action slips. *Psychol Rev* 88(1):1–15.
- Norman, D. A. 2002. *The Design of Everyday Things*. New York: Doubleday.
- Oliver, D., and J. Roos. 2005. Decision making in high-velocity environments. *Organiz Stud* 26(6):889–913.
- Olson, G. M., and J. S. Olson. 1997. Research on computer supported cooperative work. In *Handbook of Human-Computer Interaction*, ed. M. Helander, T. Landauer, and P. Prabhu, 1433–1456. Amsterdam, Netherlands: Elsevier.
- Olson, G., and J. Olson. 2003. Groupware and computer-supported cooperative work. In *Handbook of Human-Computer Interaction*, ed. A. Sears, and J. Jacko, 583–593. Mahwah, NJ: Lawrence Erlbaum.
- Orasanu, J., and E. Salas. 1993. Team decision making in complex environments. In *Decision Making in Action: Models and Methods*, ed. G. Klein, R., J. Orasanu, and Calderwood, 327–345. New Jersey: Ablex.
- Ormrod, J. 2003. *Human Learning*. 4th ed. Englewood Cliffs, NJ: Prentice Hall.
- Parasuraman, R. 2000. Designing automation for human use: Empirical studies and quantitative models. *Ergonomics* 43: 931–951.
- Parasuraman, R., and V. Riley. 1997. Humans and automation: Use, misuse, disuse and abuse. *Hum Factors* 39: 230–253.
- Parasuraman, R., T. B. Sheridan, and C. D. Wickens. 2000. A model for types and levels of human interaction with automation. *IEEE Trans Syst Man Cybern* 30(3):286–297.
- Pashler, H., J. C. Johnston, and E. Ruthruff. 2001. Attention and performance. *Annu Rev Psychol* 52: 629–651.
- Pearl, J. 1988. *Probabilistic Reasoning in Intelligent Systems: Networks of Plausible Inference*. San Mateo, CA: Morgan Kaufman.
- Pennington, N., and R. Hastie. 1992. Explaining the evidence: Tests of the story model for juror decision making. *J Pers Soc Psychol* 62: 189–206.
- Petroski, H. 1994. *Design Paradigms: Case Histories of Error and Judgment in Engineering*. New York: Cambridge University Press.

- Plous, S. 1993. *The Psychology of Judgment and Decision Making*. New York: McGraw-Hill.
- Poulton, E. C. 1989. *Bias in Quantifying Judgments*. Hillsdale, NJ: Lawrence Erlbaum.
- Preece, J., Y. Rogers, and H. Sharp. 2002. *Interaction Design*. New York: John Wiley & Sons.
- Preece, J., Y. Rogers, H. Sharp, and D. Benyon. 1994. *Human-Computer Interaction*. Reading, MA: Addison-Wesley.
- Pritchett, A., B. Vandor, and K. Edwards. 2002. Testing and implementing cockpit alerting systems. *Reliab Eng Syst Saf* 75(2):193–206.
- Psillos, S. 2002. Simply the best: A case for abduction. *Lect Notes Artif Intell* 2408: 605–625.
- Radvansky, G. 2005. *Human Memory*. Boston, MA: Allyn and Bacon.
- Rasmussen, J. 1983. Skills, rules and knowledge: Signals, signs, symbols and other distinctions in human performance models. *IEEE Trans Syst Man Cybern SMC-13*(3):257–266.
- Rasmussen, J., B. Brehner, and J. Leplat, eds. 1991. *Distributed Decision Making: Cognitive Models for Cooperative Work*. New York: John Wiley & Sons.
- Rasmussen, J., A. Pejtersen, and L. Goldstein. 1994. *Cognitive Systems Engineering*. New York: John Wiley & Sons.
- Ravinder, U. 2003. *Weasel: A Constraint-Based Tool for Generating Enemy Courses of Action*. Masters Thesis, University of Minnesota.
- Rayward-Smith, V., I. Osman, C. Reeves, and G. Smith, eds. 1996. *Modern Heuristic Search Methods*. New York: John Wiley & Sons.
- Reason, J. 1991. *Human Error*. New York: Cambridge Press.
- Reason, J. 1997. *Managing the Risks of Organizational Accidents*. Hampshire, UK: Ashgate.
- Reason, J. T. 1990. *Human Error*. New York: Cambridge University Press.
- Riegelsberger, J., M. Sasse, and J. McCarthy. 2005. The mechanics of trust: A framework for research and design. *Int J Hum Comput Stud* 62(3):381–422.
- Reising, D., and P. Sanderson. 2002. Work domain analysis and sensors I: Principles and simple example. *Int J Hum Comput Stud* 56(6):569–596.
- Riesbeck, C. K., and R. C. Schank. 1989. *Inside Case-Based Reasoning*. Hillsdale, NJ: Lawrence Erlbaum.
- Roth, E. M., K. B. Bennett, and D. D. Woods. 1987. Human interaction with an ‘intelligent’ machine. *Int J Man Mach Stud* 27: 479–525.
- Rouse, W. B. 1980. *Systems Engineering Models of Human Machine Interaction*. New York: Elsevier.
- Rubin, K. S., P. M. Jones, and C. M. Mitchell. 1988. OFMSpert: Interference of operator intentions in supervisory control using a blackboard structure. *IEEE Trans Syst Man Cybern* 18(4):618–637.
- Russell, S., and P. Norvig. 1995. *Artificial Intelligence: A Modern Approach*. Englewood Cliffs, NJ: Prentice-Hall, Inc.
- Sacerdoti, E. D. 1974. Planning in a hierarchy of abstraction spaces. *Artif Intell* 5(2):115–135.
- Salas, E., C. Bowers, and E. Edens, eds. 2001. *Improving Teamwork in Organizations: Applications of Resource Management Training*. Mahwah, NJ: Lawrence Erlbaum.
- Salas, E., and S. Fiore, eds. 2004. *Team Cognition: Understanding the Factors that Drive Process and Performance*. Washington, DC: American Psychological Association.
- Sarter, N., and D. Woods. 1993. *Cognitive Engineering in Aerospace Applications: Pilot Interaction with Cockpit Automation*. NASA Contractor Report 177617, NASA Ames Research Center, Moffett Field, CA.
- Schaeken, W., ed. 2005. *Mental Models Theory of Reasoning: Refinements and Extensions*. Mahwah, NJ: Lawrence Erlbaum.
- Schraagen, J. M., Chipman, S. and Shalin, V. (eds.). 2000. *Cognitive Task Analysis*. Mahwah NJ: Lawrence Erlbaum.
- Schraagen, J. M., S. Chipman, and V. Shalin. eds. 2000. *Cognitive Task Analysis*. Mahwah, NJ: Lawrence Erlbaum.
- Schroeder, R., and A. -S. Axelsson, eds. 2005. *Work and Plan in Shared Virtual Environments: Computer Supported Cooperative Work*. New York: Springer.
- Schuler, D., and A. Namioka, eds. 1993. *Participatory Design: Principles and Practices*. Mahwah, NJ: Lawrence Erlbaum.
- Scaife, M., and Y. Rogers. 1996. External cognition: How do graphical representations work? *Int J Hum Comput Stud* 45: 185–213.
- Scott, R., E. M. Roth, and S. E. Deutsch. 2005. Work-centered support systems: A human-centered approach to intelligent system design. *IEEE Intell Syst* 20: 73–81.
- Seamon, J. 2005. *Human Memory: Contemporary Readings*. Cambridge: Oxford University Press.
- Sewell, D. R., and N. D. Geddes. 1990. A plan and goal based method for computer-human system design. In *Human computer Interaction: INTERACT 90*, 283–288. New York.
- Shafer, G. 1996. *Probabilistic Expert Systems*. Philadelphia, PA: Society for Industrial and Applied Mathematics.
- Shafer, G., and J. Pearl, eds. 1990. *Readings in Uncertain Reasoning*. San Mateo, CA: Morgan Kaufmann.
- Shalin, V. L., N. D. Geddes, D. Bertram, M. A. Szczepkowski, and D. DuBois. 1997. Expertise in dynamic physical task domains. In *Expertise in Context: Human and Machine*, ed. P. Feltovich, K. Ford, and R. Hoffman, 194–217. Cambridge, MA: MIT Press.
- Shepherd, A. 2000. *Hierarchical Task Analysis*. London: Taylor & Francis.
- Sheridan, T. B. 1997. Supervisory control. In *Handbook of Human Factors*, 2nd ed., ed. G. Salvendy, 1295–1327. New York: John Wiley & Sons.
- Sheridan, T. 2002. *Humans and Automation: System Design and Research Issues*. Chichester, England: Wiley.
- Sheridan, T. B., and W. R. Ferrell. 1974. *Man-Machine Studies: Information, Control, and Decision Models of Human Performance*. Cambridge, MA: MIT Press.
- Shortliffe, E. 1990. Clinical decision support systems. In *Medical Informatics: Computer Applications in Health Care*, ed. E. Shortliffe, and L. Perreault, 466–500. New York: Addison-Wesley.
- Silverman, B. G. 1992. Survey of expert critiquing systems: Practical and theoretical frontiers. *Commun ACM* 35(4):106–128.
- Simmons, R. G. 1988. A Theory of debugging plans and Interpretations. In *Proceedings of the American Association for Artificial Intelligence (AAAI-98)*, 94–99. Minneapolis, MN. Menlo Park, CA: American Association for Artificial Intelligence Press.
- Skitka, L., K. Mosier, and M. Burdick. 1999. Does automation bias decision making? *Int J Hum Comput Syst* 51: 991–1006.
- Skitka, L., Mosier, K. and Burdick, M. 1999. Does automation bias decision making? *International Journal of Human-Computer Systems* 51: 991–1006.
- Smith, P. J., R. Beatty, A. Spencer, and C. Billings. 2003. Dealing with the challenges of distributed planning in a stochastic environment: Coordinated contingency planning. In *Proceedings of the 2003 Annual Conference on Digital Avionics Systems*. Reston, VA: American Institute of Aeronautics and Astronautics.
- Smith, P. J., C. Billings, R. Chapman, J. H. Obradovich, E. McCoy, and J. Orasanu. 2000. Alternative architectures for distributed cooperative problem-solving in the national airspace system. In *Proceedings of the 5th International Conference on Human Interaction with*

- Complex Systems, ed. M. Benedict. Urbana, IL.
- Smith, P. J., and N. Geddes. 2003. A cognitive systems engineering approach to the design of decision support systems. In *Handbook of Human-Computer Interaction*, ed. A. Sears, and J. Jacko, 656–675. Mahwah, NJ: Lawrence Erlbaum.
- Smith, P. J., W. Giffin, T. Rockwell, and M. Thomas. 1986. Modeling fault diagnosis as the activation and use of a frame system. *Hum Factors* 28(6):703–716.
- Smith, P. J., E. McCoy, and C. Layton. 1997. Brittleness in the design of cooperative problem-solving systems: The effects on user performance. *IEEE Trans Syst Man Cybern* 27(3):360–371.
- Smith, P. J., E. McCoy, and J. Orasanu. 2000. Distributed cooperative problem-solving in the air traffic management system. In *Naturalistic Decision Making*, ed. G. Klein, and E. Salas, 369–384. Mahwah, NJ: Lawrence Erlbaum.
- Smith, P. J., E. McCoy, and J. Orasanu. 2001. Distributed cooperative problem-solving in the air traffic management system. In *Naturalistic Decision Making*, ed. G. Klein, and E. Salas, 369–384. Mahwah, NJ: Lawrence Erlbaum.
- Smith, P. J., E. McCoy, J. Orasanu, C. Billings, R. Denning, M. Rodvold, T. Gee, and A. VanHorn. 1997. Control by permission: A case study of cooperative problem-solving in the interactions of airline dispatchers and ATCSCC. *Air Traffic Control Q* 4: 229–247.
- Smith, P. J., J. H. Obradovich, S. Guerlain, S. Rudmann, P. Strohm, J. Smith, J. Svirbely, and L. Sachs. 1998. Successful use of an expert system to teach diagnostic reasoning for antibody identification. In *Proceeding of the 4th International Conference on Intelligent Tutoring Systems*, 354–363. San Antonio, Texas. Berlin: Springer.
- Smith, P. J., and S. Rudmann. 2005. Clinical decision making and diagnosis: Implications for immunohematologic problem-solving. In *Serologic Problem-Solving: A Systematic Approach for Improved Practice*, ed. S. Rudmann, 1–16. Bethesda, MD: AABB Press.
- Smith, P. J., R. B. Stone, and A. Spencer. 2006. Design as a prediction task: Applying cognitive psychology to system development. In *Handbook of Industrial Ergonomics*, 2nd ed., ed. W. Marras and W. Karwowski. New York: Marcel Dekker, Inc.
- St. Amant, R., A. Freed, F. Ritter, and C. Schunn. 2005. Specifying ACT-R models of user interaction with a GOMS language. *Cogn Syst Res* 6(1):71–88.
- Sternberg, R. J., and J. Pretz. 2005. *Cognition and Intelligence: Identifying the Mechanisms of the Mind*. New York: Cambridge University Press.
- Strauch, B. 2004. *Investigating Human Error: Incidents, Accidents, and Complex Systems*. Hampshire, UK: Ashgate Publishing.
- Suchman, L. 1987. *Plans and Situated Actions: The Problem of Human-Machine Communication*. New York: Cambridge University Press.
- Sycara, K., and M. Lewis. 2004. Integrating intelligent agents into human teams. In *Team Cognition: Understanding the Factors that Drive Process and Performance*, ed. E. Salas, and S. Fiore, 203–231. Washington, DC: American Psychological Association.
- Tetlock, P. 1998. Social psychology and world politics. In *The Handbook of Social Psychology*, 4th ed., ed. D. Gilbert, S. Fiske, and G. Lindzey, Vol. 2, 868–912. New York: McGraw-Hill.
- Tetlock, P., R. Peterson, M. McQuire, S. Chang, and P. Feld. 1992. Assessing political group dynamics: A test of the groupthink model. *J Personal Soc Psychol* 63: 403–425.
- Tianfield, H., and R. W. Wang. 2004. Critic systems—Towards human–computer collaborative problem solving. *Artif Intell Rev* 22(4):271–295.
- Tobey, D. 2005. *Needs Assessment Basics*. Alexandria, VA: ASTD Press.
- Tufte, E. R. 1983. *The Visual Display of Quantitative Information*. Chesire, CT: Graphics Press.
- Tufte, E. R. 1990. *Envisioning Information*. Chesire, CT: Graphics Press.
- Tufte, E. R. 1997. *Visual Explanations*. Cheshire, CT: Graphics Press.
- Turban, E., J. Aronson, and T. -P. Liang. 2004. *Decision Support Systems and Intelligent Systems*. 7th ed. Englewood Cliffs, NJ: Prentice Hall.
- Tversky, A. 1972. Elimination by aspects: A theory of choice. *Psychol Rev* 79: 281–299.
- Tversky, A. 1982. *Judgment Under Uncertainty: Heuristics and Biases*. New York: Cambridge University Press.
- Tversky, A., and D. Kahneman. 1974. Judgment under uncertainty: Heuristics and biases. *Science* 185: 1124–1131.
- Vicente, K. J. 1991. Supporting Knowledge-Based Behavior Through Ecological Interface Design (EPRL-91-02). Urbana-Champaign, IL: Engineering Psychology Research Laboratory, Department of Mechanical Engineering, University of Illinois.
- Vicente, K. 1999. *Cognitive Work Analysis: Toward Safe, Productive, and Healthy Computer-Based Work*. Mahwah, NJ: Lawrence Erlbaum.
- Vicente, K. 2000. Work domain analysis and task analysis: A difference that matters. In *Cognitive Task Analysis*, ed. J. M. Schraagen, S. Chipman, and V. Shalin, 101–118. Mahwah, NJ: Lawrence Erlbaum.
- Vicente, K. J. 2002. Ecological interface design: Progress and challenges. *Hum Factors* 44(1):62–78.
- Vicente, K., and J. Rasmussen. 1990. The ecology of human–machine systems II: Mediating “direct perception” in complex work domains. *Ecol Psychol* 2: 207–249.
- Vicente, K., and J. Rasmussen. 1992. Ecological interface design: Theoretical foundations. *IEEE Trans Syst Man Cybern* 22: 589–606.
- Wang, N., W. L. Johnson, P. Rizzo, E. Shaw, and R. Mayer. 2005. Experimental evaluation of polite interaction tactics for pedagogical agents. In *Proceedings of the 10th International Conference on Intelligent User Interfaces*, 12–19. San Diego, CA.
- Wason, P. 1960. On the failure to eliminate hypotheses in a conceptual task. *Q J Exp Psychol* 12: 129–140.
- Watzman, S. 2003. Visual design principles for usable interfaces. In *Handbook of Human-Computer Interaction*, ed. A. Sears, and J. Jacko, 263–285. Mahwah, NJ: Lawrence Erlbaum.
- Wickens, C. D., J. Lee, Y. Liu, and S. G. Becker. 2004. *An Introduction to Human Factors Engineering*. 2nd ed. Upper Saddle River, NJ: Pearson/Prentice Hall.
- Wiegmann, D., and S. Shappell. 2003. *A Human Error Approach to Aviation Accident Analysis: The Human Factors Analysis and Classification System*. Hampshire, UK: Ashgate.
- Wiegmann, D., H. Zhang, T. Von Thaden, G. Sharma, and A. Gibbons. 2004. Safety culture: An integrative review. *Int J Aviat Psychol* 14(2):117–134.
- Wiener, E. L., and D. C. Nagel. 1988. *Human Factors in Aviation*. New York: Academic Press.
- Wilensky, R. (1983). *Planning and Understanding: A Computational Approach to Human Reasoning*. Reading MA: Addison Wesley.
- Williams, K. 2005. Computer-aided GOMS: A description and evaluation of a tool that integrates existing research for modeling human–computer interaction. *Int J Hum Comput Interact* 1(1):39–58.

- Witkin, B. R., and J. S. Altshuld. 1995. Planning and Conducting Needs Assessments. Thousand Oaks, CA: Sage Publications.
- Wogalter, M. S., and C. B. Mayhorn. 2005. Providing cognitive support with technology-based warning systems. *Ergonomics* 48(5):522–533.
- Wu, P., C. Miller, H. Funk, and V. Vikili. 2010. Computational Models of Etiquette and Culture. In *Human-Computer Etiquette: Cultural Expectations and the Design Implications They Place on Computers and Technology*, ed. C. Hayes, and C. Miller, 63–89. Boca Raton, FL: Taylor & Francis.
- Yantis, S. 1998. Control of visual attention. In *Attention*, ed. H. Pashler, 223–256. Hillsdale, NJ: Lawrence Erlbaum.
- Zhang, J. 1997. The nature of external representations in problem solving. *Cogn Sci* 21(2):179–217.
- Zhang, J., and D. A. Norman. 1994. Representations in distributed cognitive tasks. *Cogn Sci* 18: 87–122.
- Zhang, T., B. Zhu, and D. B. Kaber. 2010. Anthropomorphism and Social Robots: Setting Etiquette Expectations. In *Human-Computer Etiquette: Cultural Expectations and the Design Implications They Place on Computers and Technology*, ed. C. Hayes, and C. Miller, 231–259. Boca Raton, FL: Taylor & Francis.
- Zuboff, S. 1988. *In the Age of Smart Machines*. New York: Basic Books.

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- Ahrweiler, P., A. Pyka, and N. Gilbert. 2004. Simulating knowledge dynamics in innovation networks (skin). In *Industry and Labor Dynamics: The Agent-Based Computational Economics Approach*, ed. R. Leombruni and M. Richiardi. Singapore: World Scientific Press.
- Ang, C.S., P. Zaphiris, and S. Wilson. 2005. Social Interaction in Game Communities and Second Language Learning. Edinburgh, U.K.: The 19th British HCI Group Annual Conference.
- Antona, M., P. Bommel, F. Bousquet, and C. L. Page. 2002. Interactions and organization in ecosystem management: The use of multi-agent systems to simulate incentive environmental policies. Paper presented at the 3rd Workshop on Agent-Based Simulation. Ghent, Belgium.
- Archer, W., R. D. Garrison, T. Anderson, and L. Rourke. 2001. A framework for analyzing critical thinking in computer conferences. European Conference on Computer-Supported Collaborative Learning, Maastricht, The Netherlands.
- Aronsson, L. 2002. Operation of a Large Scale, General Purpose Wiki Website. Experience from susning.nu's first nine months in service. In *Proceedings of the 6th International ICCC/ IFIP Conference on Electronic Publishing*, ed. J. Á. Carvalho, A. Hübner, and A. A. Baptista, 27–37. Karlovy Vary, Czech Republic. Berlin: Verlag für Wissenschaft und Forschung.
- Barab, S. A., K. E. Hay, and L. C. Yamagata-Lynch. 2001. Constructing networks of action-relevant episodes: An in situ research methodology. *J Learn Sci* 10(1 & 2):63–112.
- Beidernikl, G., and D. Paier. 2003. Network analysis as a tool for assessing employment policy. In *Proceedings of the Evidence-Based Policies and Indicator Systems Conference 03*. London.
- Black, R. W. 2004. Anime-inspired affiliation: An ethnographic inquiry into the literacy and social practices of English language learners writing in the fan-fiction community. Paper presented at 2004 meeting of American Educational Research Association, San Diego, CA.
- Blomkvist, S. 2002. Persona—an overview, Uppsala University <http://www.it.uu.se/edu/course/homepage/hcinet/ht04/library/docs/Persona-overview.pdf> (accessed November 22, 2004).
- Borgatti, S. 2000. *What is Social Network Analysis*. Retrieved on November 9, 2010 from <http://www.analytictech.com/networks/whatis.htm>.
- Burge, E. L., and J. M. Roberts. 1993. Classrooms with a Difference: A Practical Guide to the Use of Conferencing Technologies. Ontario: University of Toronto Press.
- Burnett, G. 2000. Information exchange in virtual communities: A typology. *Inf Res Int Electron J* 5(4). Last retrieved on October 5, 2011 from <http://informationr.net/ir/5-4/paper82.html>.
- Carley, K., L. Ju-Sung, and D. Krackhardt. 2001. Destabilizing networks. *Connections* 24(3):31–34.
- Castranova, E. 2001. Virtual worlds: A first-hand account of market and society on the cyberian frontier. CESifo Working Paper Series No. 618. Center for Economic Studies and Ifo Institute for Economic Research, California State University, Fullerton.
- Choi, J. H., and J. Danowski. 2002. Cultural communities on the net—Global village or global metropolis? A network analysis of Usenet newsgroups. *J Comput Mediat Commun* 7: 3.
- Cook, D., and J. Ralston. 2003. Sharpening the Focus: Methodological issues in analyzing on-line conferences. *Technology, Pedagogy and Education*, 12:3, 361–376.
- Cooper, A. 1999. *The Inmates are Running the Asylum*. Indianapolis, IN: SAMS, a division of Macmillan Computer Publishing.
- Cyram. 2004. Netminer for Windows. <http://netminer.com>. Last accessed on October 5, 2011.
- December, J. 1997. Notes on defining of computer-mediated communication. *Comput Mediat Commun Mag* 3: 1.
- Dekker, A. H. 2002. A category-theoretic approach to social network analysis. In *Proceedings of Computing: The Australasian Theory Symposium (CATS)* Melbourne, Australia.
- Doran, J., M. Palmer, N. Gilbert, and P. Mellars. 1994. The eos project: Modelling upper paleolithic social change. In *Simulating Societies: The Computer Simulation of Social Phenomena*, ed. G. N. Gilbert and J. Doran. London: UCL Press.
- Ducheneaut, N., R. J. Moore, and E. Nickell. 2004. Designing for Sociability in Massively Multiplayer Games: An Examination of the “Third Places” of SWG, Other Players Conference, Denmark.
- Electronic Art. 2005. Ultima Online. <http://www.uo.com/> (accessed November 8, 2005).
- Engestrom, Y. 2001. Expansive learning at work: Toward an activity theoretical reconceptualisation. *J Educ Work* 14: 1.
- Epstein, J. 2002. Modelling civil violence: An agent-based computational approach. *Proc Natl Acad Sci U S A* 99(3):7243–8725.
- Epstein, J., and R. Axtell. 1997. *Growing Artificial Societies*. Boston, MA: MIT Press.
- Fahy, P. J. 2003. Indicators of support in online interaction. *Int Rev Res Open Distance Learn* 4: 1.
- Fahy, P. J., G. Crawford, and M. Ally. 2001. Patterns of interaction in a computer conference transcript. *Int Rev Res Open Distance Learn* 2: 1.
- Ferris, P. 1997. What is CMC? An overview of scholarly definitions. *Comput Mediat Commun Mag* 4: 1.

- Forther, R. S. 1993. International Communication: History, Conflict, and Control of the Global Metropolis. Belmont, CA: Wadsworth.
- Galotti, K. M., B. M. Clinchy, K. Ainsworth, B. Lavin, and A F Mansfield. 1999. A new way of assessing ways of knowing: The Attitudes Towards Thinking and Learning Survey (ATTLS). *Sex Roles* 40(9/10): 745–766.
- Garton, L., C. Haythorwaite, and B. Wellman. 1997. Studying on-line social networks. In *Doing Internet Research*, S. Jones. Thousand Oaks CA: Sage.
- Gilbert, N., and K. G. Troitzsch. 2005. Simulation for the Social Scientist. Berkshire, U.K.: Open University Press.
- Golder, S. A., and J. Donath. 2004. Social roles in electronic communities. Paper presented at the Association of Internet Researchers (AoIR) conference Internet Research 5.0, Brighton, England.
- Gunawardena, C., C. Lowe, and T. Anderson. 1997. Analysis of a global online debate and the development of an interaction analysis model for examining social construction of knowledge in computer conferencing. *J Educ Comput Res* 17(4):397–431.
- Hanneman, R. A. 2001. Introduction to Social Network Methods. <http://faculty.ucr.edu/~hanneman/SOC157/TEXT/TextIndex.html> (accessed November 9, 2004).
- Haythorwaite, C., and B. Wellman. 1998. Work, friendship, and media use for information exchange in a networked organisation. *J Am Soc Inf Sci Technol* 49(2):1101–1114.
- Henri, F. 1992. Computer conferencing and content analysis. In *Collaborative Learning Through Computer Conferencing: The Najaden Papers*, ed. A. R. Kaye, 117–136. Berlin, Germany: Springer-Verlag.
- Jager, W., R. Popping, and H. v. d. Sande. 2001. Clustering and fighting in two-party crowds: Simulating the approach-avoidance conflict. *J Artif Societies Soc Simul* 4(3). Last retrieved on October 5, 2011 from <http://jasss.soc.surrey.ac.uk/4/3/7.html>.
- Jones, S. 1995. Computer-mediated communication and community: Introduction. *Comput Mediat Commun Mag* 2: 3.
- Kelly, R. V. 2004. Massively Multiplayer Online Role-Playing Games: The People, the Addiction and the Playing Experience. NC: McFarland & Company.
- Klemm, P., M. Hurst, S. L. Dearholt, and S. R. Trone. 1999. Gender differences on internet cancer support groups. *Comput Nurs* 17(2):65–72.
- Kolbert, E. 2001. Pimps and Dragons: How an online world survived a social breakdown. *The New Yorker*, May 28, 2001. http://www.newyorker.com/fact/content/?010528fa_FACT (accessed February 15, 2005).
- Kollock, P. 1999. The economies of online cooperation: Gifts and public goods in cyberspace. In *Communities in Cyberspace*, ed. M. A. Smith & P. Kollock. London: Routledge.
- Korpela, M., H. A. Soriyan, and K. C. Olufokunbi. 2000. Activity analysis as a method for information systems development. *Scand J Inf Syst* 12: 191–210.
- Korzenny, F. 1978. A theory of electronic propinquity: Mediated communication in organizations. *Commun Res* 5: 3–23.
- Krebs, V. 2004. An Introduction to Social Network Analysis. <http://www.orgnet.com/sna.html> (accessed November 9, 2004).
- Kuo, J. 2004. Online video games in mental health. Paper presented at the annual meeting of the American Psychiatry Association, New York.
- Kypros-Net Inc. 2005. The World of Cyprus. <http://kypros.org>. Last accessed on October 5, 2011.
- Lamieri, M., and D. Ietri. 2004. Innovation creation and diffusion in a social network: An agent based approach. Last retrieved on October 5, 2011 from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=937255.
- Leont'ev, A. N. 1978. *Activity, Consciousness, and Personality*. Upper Saddle River, NJ: Prentice-Hall.
- López-Sánchez, M., X. Noria, J. A. Rodríguez-Aguilar, N. Gilbert, and S. Shuster. 2004. Simulation of digital content distribution using a multi-agent simulation approach. In *Recent Advances in Artificial Intelligence Research and Development*, ed. J. Vitria, P. Radeva, and I. Aguiló, 341–348. Amsterdam: IOS Press.
- Macy, M. W., and Y. Sato. 2002. Trust, cooperation, and market formation in the U.S. And Japan. Paper presented at the Proceedings of the National Academy of Sciences of the United States of America.
- Madden, M., and L. Rainie. 2003. Pew Internet & American Life Project Surveys. Washington, DC: Pew Internet & American Life Project.
- Mason, R. 1991. Analyzing computer conferencing interactions. *Comput Adult Educ Training* 2(3):161–173.
- MaxTsvetovat, and K. Carley. 2002. Knowing the enemy: A simulation of terrorist organizations and counter-terrorism strategies. Paper presented at the CASOS Conference 2002, Pittsburgh, PA.
- McLoughlin, C. 1996. A learning conversation: Dynamics, collaboration and learning in computer mediated communication. In *Proceedings of the Third International Interactive Multimedia Symposium*, ed. C. McBeath, and R. Atkinson, 267–273. Perth, Western Australia: Promaco Conventions.
- McLuhan, M. 1964. *Understanding Media: The Extension of Man*. New York: McGraw-Hill.
- Metcalf, B. 1992. Internet fogies to reminisce and argue at Interop Conference. *InfoWorld*.
- Metz, J. M. 1994. Computer-mediated communication: Literature review of a new context. *IPCT Electron J 21st Century* 2(2):31–49.
- Mwanza, D. 2002. Towards an Activity-Oriented Method for HCI Research and Practice. Open University. PhD. Milton Keynes, U.K.
- NCSsoft. 2005. Lineage. <http://www.lineage.com/> (accessed November 8, 2005).
- Niedner, S., G. Hertel, and S. Hermann. 2000. Motivation in open source projects: An empirical study among linux developers. (accessed April 24, 2008).
- NUA Internet Surveys. 2004. http://www.nua.ie/surveys/how_many_online/index.html (accessed October 20, 2004).
- Özman, M. 2007. Network formation and strategic firm behaviour to explore and exploit. *J Artif Societies Soc Simul* 11(1):7.
- Papert, S. 1980. *Mindstorms: Children, Computers, and Powerful Ideas*. New York: Basic Books.
- Pingdom. 2010. Internet 2009 in numbers. <http://royal.pingdom.com/2010/01/22/internet-2009-in-numbers/>. Last accessed on March 10, 2010.
- Preece, J. 2000. *Online Communities: Designing Usability, Supporting Sociability*. Chichester, UK: John Wiley and Sons.
- Preece, J., and D. Maloney-Krichmar. 2003. Online communities: Focusing on sociability and usability. In *Handbook of Human-Computer Interaction*, ed. J. Jacko, and A. Sears, 596–620. Mahwah, NJ: Lawrence Erlbaum Associates Inc. Publishers.
- Preece, J., Y. Rogers, and H. Sharp. 2002. *Interaction Design: Beyond Human-Computer Interaction*. New York: John Wiley & Sons.
- Raymond, E. 1999. *The Cathedral and the Bazaar: Musings on Linux and Open Source from an Accidental Revolutionary*. Sebastopol, CA: O'Reilly and Associates.
- Rheingold, H. 1993. *The Virtual Community: Homesteading on the Electronic Frontier*. Reading: Addison-Wesley.

- Rice, R. 1994. Network analysis and computer mediated communication systems. In *Advances in Social Network Analysis*, ed. S. W. J. Galaskiewicz. Newbury Park, CA: Sage.
- Rice, R. E., A. E. Grant, J. Schmitz, and J. Torobin. 1990. Individual and network influences on the adoption and perceived outcomes of electronic messaging. *Soc Netw* 12: 17–55.
- Savicki, V., D. Lingenfelter, and D. Kelley. 1996. Gender language style and group composition in internet discussion groups. *J Comput Mediated Commun* 2(3). <http://jcmc.indiana.edu/vol2/issue3/savicki.html>.
- SCOTCIT. 2003. Enabling large-scale institutional implementation of communications and information technology (ELICIT). Using Computer Mediated Conferencing. <http://www.elicit.scotcit.ac.uk/modules/cmc1/welcome.htm> (accessed November 2, 2004).
- Scott, J. 2000. *Social Network Analysis: A Handbook*. 2nd ed. London: Sage.
- Sony. 2005. Star Wars Galaxies. <http://starwarsgalaxies.station.sony.com/> (accessed November 8, 2005).
- Squire, K., and C. Steinkeuhler. In press. Generating CyberCulture/s: The case of star wars galaxies. In *Cyberlines: Languages and Cultures of the Internet*, ed. D. Gibbs and K. L. Krause, 2nd ed. Albert Park, Australia: James Nicholas Publishers.
- Suler, J. 2004. The Final Showdown Between In-Person and Cyberspace Relationships. <http://www1.rider.edu/~suler/psychcyber/showdown.html> (accessed November 3, 2004).
- Taylor, T. L. 2002. "Whose Game Is This Anyway?": Negotiating Corporate Ownership in a Virtual World." CGDC Conference Proceedings, 227–42. Tampere, Finland.
- Turner, T. C., M. A. Smith, D. Fisher, and H. T. Welser. 2005. Picturing usenet: Mapping computer-mediated collective action. *J Comput Mediated Commun* 10(4), Article 7.
- U.S Census Bureau. 2004. Global Population Profile 2002, <http://www.census.gov/ipc/www/wp02.html> (accessed October 20, 2004).
- Usability Net. 2003. UsabilityNet. <http://www.usabilitynet.org/> (accessed December 3, 2004).
- Vaknin, S. 2002. TrendSitors: Games People Play. Electronic Book Web. <http://12.108.175.91/ebookweb> (accessed February 23, 2002).
- Vygotsky, L. 1930. *Mind and Society*. Cambridge, MA: Harvard University Press.
- Waldrop, M. 1992. *Complexity: The Emerging Science at the Edge of Chaos*. New York: Simon and Schuster.
- Wallace, P. 1999. *The Psychology of the Internet*. Cambridge: Cambridge University Press.
- Wellman, B. 1982. Studying personal communities. In *Social Structure and Network Analysis*, ed. P. M. N. Lin. Beverly Hills, CA: Sage.
- Wellman, B. 1992. Which types of ties and networks give what kinds of social support? *Adv Group Processes* 9: 207–235.
- Wilhite, A. 2001. Bilateral trade and "small-world" networks. *Comp Econ* 18: 49–64.
- Wooldridge, M., and N. R. Jennings. 1995. Intelligent agents: Theory and practice. *Knowledge Eng Rev* 10(2):115–152.
- Yee, N. 2005. The Demographics and Derived Experiences of Users of Massively Multi-User Online Graphical Environments. The 55th Internal Communication Association Annual Conference, New York.
- Zaphiris, P., and G. Zacharia. 2001. Design Methodology of an Online Greek Language Course. Ext. Abstracts CHI 2001, Seattle, WA: ACM Press.
- Zaphiris, P., G. Zacharia, and M. Rajasekaran. 2003. Distributed constructionism through participatory design. In *E-Education Applications: Human Factors and Innovative Approaches*, ed. C. Ghaoui. London: Idea Group Publishing.
- Zhang, J., M. Ackerman, and L. Adamic. 2007a. Communitynetsimulator: Using simulations to study online community networks. Paper presented at the C&T2007, Lansing, MI.
- Zhang, J., M. Ackerman, and L. Adamic. 2007b. Expertise networks in online communities: Structure and algor. Paper presented at the WWW 2007, Banff Canada.
- Zhu, E. 1996. Meaning negotiation, knowledge construction, and mentoring in a distance learning course. In *Proceedings of Selected Research and Development Presentations at the 1996 National Convention of the Association for Educational Communications and Technology*. Indianapolis, IN. (ERIC Document Reproduction Service No. ED 397 849.)

Virtual Environments

- Acosta, E., and A. Liu. 2007. Real-time volumetric haptic and visual burrhole simulation. In *Proceedings of IEEE Virtual Reality Conference*, VR 2007, 247–250, Charlotte, NC. Los Alamitos, CA: IEEE Press.
- Akamatsu, M. 1994. Touch with a mouse. A mouse type interface device with tactile and force display. In *Proceedings of 3rd IEEE International Workshop on Robot and Human Communication*, 140–4. Held July 18–20, Nagoya, Japan. Los Alamitos, CA: IEEE Press.
- Algazi, V. R., R. O. Duda, D. M. Thompson, and C. Avendano. 2001. The CIPIC HRTF Database. In *Proceedings of the 2001 IEEE Workshop on Applications of Signal Processing to Audio and Electro-Acoustics*, 99–102, New Paltz, NY. Los Alamitos, CA: IEEE Press.
- Allbeck, J. M., and N. I. Badler. 2002. Embodied autonomous agents. In *Handbook of Virtual Environments: Design, Implementation, and Applications*, ed. K. M. Stanney, 313–332. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Johnston, M. R., K. Hale, and P. Axelsson. 2010. Results from empirical testing of the System for Tactile Reception of Advanced Patterns (STRAP). In *Proceedings of 54th Human Factors and Ergonomics Society Annual Meeting*, September 27–October 1, San Francisco, CA. Thousand Oaks, CA: Sage Publications.
- Anderson, J. R. 1987. Skill acquisition: Compilation of weak-method problem solutions. *Psychol Rev* 94: 192–210.
- Anderson, P., B.O. Rothbaum, and L.F. NS Hodges. 2003. Virtual reality exposure in the treatment of social anxiety. *Cognitive and Behavioral Practice* 10(3):240–247.
- Badiqué, E., M. Cavazza, G. Klinker, G. Mair, T. Sweeney, D. Thalmann, and N. N. Thalmann. 2002. Entertainment applications of virtual environments. In *Handbook of Virtual Environments: Design, Implementation, and Applications*, ed. K. M. Stanney, 1143–1166. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Ballal, J. A., D. Brock, J. Stroup, and H. Fouad. 2001. The effect of auditory rendering on perceived movement: Loudspeaker density and HRTF. In *Proceedings of the 2001 International Conference on Auditory Display*, 235–238. Held Jul 29-Aug 1, Espoo, Finland: Laboratory of Acoustics and Audio Signal Processing and the Telecommunications Software and Multimedia Laboratory, Helsinki University of Technology, Espoo, Finland.
- Barba, C., J. E. Deaton, T. Santarelli, B. Knerr, M. Singer, and J. Belanich. 2006. Virtual environment composable training for operational readiness (VECTOR). In *Proceedings of the 25th Army Science Conference*, 'Transformational Army Science and Technology—Charting

- the Future of S&T for the Soldier.' Held Nov 27–30, Orlando, FL: Tech Science Press.
- Basdogan, C., S. D. Laycock, A. M. Day, V. Patoglu, and R. B. Gillespie. 2008. 3-DoF haptic rendering. In *Haptic rendering*, ed. M. C. Lin, and M. Otaduy, 311–331. Wellesley, MA: A K Peters.
- Basdogan, C., and B. Loftin. 2008. Multimodal display systems: Haptic, olfactory, gustatory, and vestibular. In *The Handbook of Virtual Environment Training: Understanding, Predicting and Implementing Effective Training Solutions for Accelerated and Experiential Learning*, ed. D. Schmorow, J. Cohn, and D. Nicholson, Vol. 2, 116–135. Westport, CN: Praeger Security International.
- Begault, D. 1994. 3-D Sound for Virtual Reality and Multimedia. Boston: Academic Press.
- Biggs, S. J., and M. A. Srinivasan. 2002. Haptic interfaces. In *Handbook of Virtual Environments: Design, Implementation, and Applications*, ed. K. M. Stanney, 93–116. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Bordnick, P. S., A. Traylor, H. L. Copp, K. M. Graap, B. Carter, M. Ferrer, and A. P. Walton. 2008. Assessing reactivity to virtual reality alcohol based cues. *Addict Behav* 33: 743–756.
- Bordnick, P. S., A. C. Traylor, K. M. Graap, H. L. Copp, and J. Brooks. 2005. Virtual reality cue reactivity assessment: A case study in a teen smoker. *Appl Psychophysiol Biofeedback* 30(3): 187–193.
- Botella, C., A. García-Palacios, H. Villa, R. M. Baños, S. Quero, M. Alcañiz, et al. 2007. Virtual reality exposure in the treatment of panic disorder and agoraphobia: A controlled study. *Clin Psychol Psychother* 14: 164–175.
- Bowman, D., J. Gabbard, and D. A. Hix. 2002. Survey of usability evaluation in virtual environments: Classification and comparison of methods. *Presence: Teleoperators and Virtual Environ* 11(4):404–424.
- Brashers-Krug, T., R. Shadmehr, and E. Bizzi. 1996. Consolidation in human motor memory. *Nature* 382(6588):252–255.
- Brooks, B. M., and F. D. Rose. 2003. The use of virtual reality in memory rehabilitation: Current findings and future directions. *Neurorehabilitation* 18(2): 147–157.
- Brooks, B. M., F. D. Rose, E. A. Potter, S. Jayawardena, and A. Morling. 2004. Assessing stroke patients' prospective memory using virtual reality. *Brain Inj* 18(4):391–401.
- Brader, G., F. Steinicke, and K. H. Hinrichs. 2009. Arch-explore: A natural user interface for immersive architectural walkthroughs. In *Proceedings of IEEE Symposium on 3D User Interfaces (3DUI)*, 75–82, March 14–15, Lafayette, LA. Los Alamitos, CA: IEEE Press.
- Bryanton, C., J. Bossé, M. Brien, J. McLean, A. McCormick, and H. Sveistrup. 2006. Feasibility, motivation, and selective motor control: Virtual reality compared to conventional home exercise in children with cerebral palsy. *CyberPsychol Behav* 9: 123–128.
- Bullinger, H.-J., R. Breining, and M. Braun. 2001. Virtual reality for industrial engineering: Applications for immersive virtual environments. In *Handbook of Industrial Engineering: Technology and Operations Management*, 3rd ed., ed. G. Salvendy, 2496–2520. New York: Wiley.
- Bungert, C. 2007. HMD/headset/VR-helmet comparison chart. <http://www.stereo3d.com/hmd.htm> (accessed May 22, 2010).
- Burdea, G. C., and P. Coiffet. 2003. *Virtual Reality Technology* (2nd ed.). Hoboken, NJ: Wiley.
- Burigat, S., and L. Chittaro. 2007. Navigation in 3D virtual environments: Effects of user experience and location-pointing navigation aids. *Int J Hum Comput Stud* 65(11):945–958.
- Butler, R. A. 1987. An analysis of the monaural displacement of sound in space. *Percept Psychophys* 41: 1–7.
- Calvert, S. L. 2002. The social impact of virtual environment technology. In *Handbook of Virtual Environments: Design, Implementation, and Applications*, ed. K. M. Stanney, 663–680. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Calvert, S. L., and S. L. Tan. 1994. Impact of virtual reality on young adult's physiological arousal and aggressive thoughts: Interaction versus observation. *J Appl Dev Psychol* 15: 125–139.
- Carretta, T. R., and M. J. Ree. 1993. Basic attributes test (BAT): Psychometric equating of a computer-based test. *Int J Aviat Psychol* 3: 189–201.
- Carretta, T. R., and M. J. Ree. 1995. Air Force Officer Qualifying Test validity for predicting pilot training performance. *J Business Psychol* 9: 379–388.
- Carroll, M., S. Fuchs, A. Carpenter, K. Hale, R. G. Abbott, and A. Bolton. 2010. Development of an autodiagnostic adaptive precision trainer for decision making (ADAPT-DM). *Int Test Eval J* 31(2): 247–263.
- Carroll, M., S. Fuchs, K. Hale, B. Dargue, B. Buck. 2010. Advanced training evaluation system: Leveraging neuro-physiological measurement to individualize training. In *Proceedings of the Interservice/Industry Training, Simulation, and Education Conference (I/ITSEC) Annual Meeting*. Orlando, FL. Arlington, VA: NTSN.
- Carson, D. 2000a. Environmental storytelling, part 1: Creating immersive 3D worlds using lessons learned from the theme park industry. http://www.gamasutra.com/features/20000301/carson_pfv.htm (accessed May 24, 2010).
- Carson, D. 2000b. Environmental storytelling, part 2: Bringing theme park environment design techniques lessons to the virtual world. http://www.gamasutra.com/features/20000405/carson_pfv.htm (accessed May 24, 2010).
- CDC. 2010. CDC Virtual World Requirements and Best Practices. <http://www.cdc.gov/SocialMedia/Tools/guidelines/pdf/virtualworld.pdf> (accessed June 1, 2010).
- Chen, J. L., and K. M. Stanney. 1999. A theoretical model of way finding in virtual environments: Proposed strategies for navigational aiding. *Presence: Teleoperators Virtual Environ* 8(6):671–685.
- Chua, P. T., R. Crivella, B. Daly, N. Hu, R. Schaaf, D. Ventura, et al. 2003. Training for physical tasks in virtual environments: Tai Chi. In *Proceedings of IEEE Virtual Reality Conference 2003*, 87–97, March 22–26, 2003. Los Angeles, CA. Alamitos, CA: IEEE Press.
- Coelho, C. M., J. A. Santos, J. Silverio, and C. F. Silva. 2006. Virtual reality and acrophobia: One-year follow-up and case study. *Cyberpsychol Behav* 9: 336–341.
- Cohen, M. 1992. Integrating graphic and audio windows. *Presence: Teleoperators Virtual Environ* 1(4):468–481.
- Cohn, J., P. DiZio, and J. R. Lackner. 2000. Reaching during virtual rotation: Context-specific compensation for expected Coriolis forces. *J Neurophysiol* 83(6):3230–3240.
- Cote, S., and S. Bouchard. 2005. Documenting the efficacy of virtual reality exposure with psychophysiological and information processing measures. *Appl Psychophysiol Biofeedback* 30: 217–232.
- Cruz-Neira, C., D. J. Sandin, and T. A. DeFanti. 1993. Surround-screen projection-based virtual reality: The design and implementation of the CAVE. *ACM Comput Graph* 27(2): 135–142.
- Dahlquist, L. M., K. E. Weiss, E. F. Law, S. Soumitri, L. J. Herbert, S. B. Horn, K. Wohlheiter, and C. S. Ackerman. 2010. Effects of videogame distraction and a virtual reality type head-mounted display helmet on cold pressor pain in young elementary school-aged children. *J Pediatr Psychol* 35(6):617–625.
- Darken, R. P., and B. Peterson. 2002. Spatial orientation, wayfinding, and representation. In *Handbook of Virtual Environments: Design, Implementation, and Applications*, ed. K. M. Stanney, 493–518. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

- Deaton, J. E., C. Barba, T. Santarelli, L. Rosenzweig, V. Souders, C. McCollum, et al. 2005. Virtual environment cultural training for operational readiness (VECTOR). *Virtual Real* 8: 156–167.
- Deutsch, J. E., and A. Mirelman. 2007. Virtual reality-based approaches to enable walking for people poststroke. *Top Stroke Rehabil* 14: 45–53.
- DiZio, P., and J. R. Lackner. 1995. Motor adaptation to Coriolis force perturbations of reaching movements: Endpoint but not trajectory adaptation transfers to the non-exposed arm. *J Neurophysiol* 74(4): 1787–1792.
- Draper, M. H., J. D. Prothero, and E. S. Viirre. 1997. Physiological adaptations to virtual interfaces: Results of initial explorations. In *Proceedings of the Human Factors & Ergonomics Society 41st Annual Meeting*, 1393. Santa Monica, CA: Human Factors & Ergonomics Society.
- Durlach, B. N. I., and A. S. Mavor. 1995. *Virtual Reality: Scientific and Technological Challenges*. Washington, DC: National Academy Press.
- Eastgate, R. M., G. D. Griffiths, P. E. Waddingham, A. D. Moody, T. K. H. Butler, S. V. Cobb, et al. 2006. Modified virtual reality for treatment of amblyopia. *Eye* 20: 370–441.
- Emmelkamp, P. M. G., M. Bruynzeel, L. Drost, and C. A. P. G. van der Mast. 2001. Virtual reality treatment in acrophobia: A comparison with exposure in vivo. *Cyberpsychol Behav* 4(3):335–339.
- Erol, A., G. Bebis, M. Nicolescu, D. Boyle, and X. Twombly. 2007. Vision-based hand pose estimation: A review. *Comput Vis Image Underst* 108: 52–73.
- Ersner-Hershfield, H., J. Bailenson, and L. L. Carstensen. 2008. Feeling more connected to your future self: Using immersive virtual reality to increase retirement saving. In *Poster presented at the Association for Psychological Science Annual Convention*, Chicago, IL.
- Favalora, G. E. 2005. Volumetric 3D displays and application infrastructure. *Computer* 38(8):37–44.
- Figueroa, P., W. F. Bischof, P. Boulanger, and H. J. Hoover. 2005. Efficient comparison of platform alternatives in interactive virtual reality applications. *Int J Human-Computer Studies*, 62(1):73–103.
- Figueroa, P., Bischof, W. F., Boulanger, P., and Hoover, H. J. 2005. Efficient comparison of platform alternatives in interactive virtual reality applications. *Int J Human-Comp Stud* 62(1):73–103.
- Fouad, H. 2004. Ambient synthesis with random sound fields. In *Audio Anecdotes: Tools, Tips, and Techniques for Digital Audio*, ed. K. Greenebaum. Natick, MA: A K Peters.
- Fouad, H., and J. Ballas. 2000. An extensible toolkit for creating virtual sonic environments. In *Paperpresented at the International Conference on Auditory Displays*, ICAD 2000, Atlanta, GA.
- Fox, J., D. Arena, and J. N. Bailenson. 2009. Virtual reality: A survival guide for the social scientist. *J Media Psychol* 21(3):95–113.
- Fox, J., and J. N. Bailenson. 2009. Virtual self-modeling: The effects of vicarious reinforcement and identification on exercise behaviors. *Media Psychol* 12: 1–25.
- Fox, J., J. N. Bailenson, and J. Binney. 2009. Virtual experiences, physical behaviors: The effect of presence on imitation of an eating avatar. *Presence: Teleoperators Virtual Environ* 18(4): 294–303.
- Foxlin, E. 2002. Motion tracking requirements and technologies. In *Handbook of Virtual Environments: Design, Implementation, and Applications*, ed. K. M. Stanney, 163–210. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Fried, M. P., B. Sadoughi, M. J. Gibber, J. B. Jacobs, R. A. Lebowitz, D. A. Ross, et al. 2010. From virtual reality to the operating room: The endoscopic sinus surgery simulator experiment. *Otolaryngol Head Neck Surg* 142(2):202–207.
- Fuchs, S., M. Johnston, K. S. Hale, and P. Axelsson. 2008. Results from pilot testing of a system for tactile reception of advanced patterns (STRAP). In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*. Held September 22–26, New York, NY. Thousand Oaks, CA: Sage Publications.
- Gabbard, J. L., D. Hix, and J. E. Swan II. 1999. User-centered design and evaluation of virtual environments. *IEEE Comput Graph Appl* 19(6):51–59.
- Gold, J. I., Belmont, K. A., and D. A. Thomas. 2007. The neurobiology of virtual reality pain attenuation. *Cyberpsychol Behav* 10(4):536–544.
- Gopher, D., M. Weil, and M. Bareket. 1994 Transfer of skill from a computer game trainer to flight. *Human Factors*, 36(3), 387–405.
- Grantcharov, T. P., V. B. Kristiansen, J. Bendix, L. Bardram, J. Rosenberg, and P. Funch-Jensen. 2004. Randomized clinical trial of virtual reality simulation for laparoscopic skills training. *Br J Surg* 91(2): 146–150.
- Gregg, L., and N. Tarrier. 2007. Virtual reality in mental health: A review of the literature. *Soc Psychiatry Psychiatr Epidemiol* 42: 343–354.
- Gress, W., and B. Willkomm. 1996. Simulator-based test systems as a measure to improve the prognostic value of aircrew selection. *Selection and Training Advances in Aviation: Advisory Group for Aerospace Research and Development Conference Proceedings*, Prague, Czech Republic 588, 15–1–15–4.
- Gross, M., S. Wurmlin, M. Naef, E. Lamboray, C. Spagno, A. Kunz, E. Koller-Meier, et al. 2003. Blue-C: A spatially immersive display and 3D video portal for telepresence. *ACM Trans Graph* 22(3):819–827.
- Gutierrez-Maldonado, J., M. Ferrer-Garcia, A. Caqueo-Urizar, and A. Letosa-Porta. 2006. Assessment of emotional reactivity produced by exposure to virtual environments in patients with eating disorders. *Cyberpsychol Behav* 9(5):507–513.
- Gutierrez-Osuna, R. 2004. Olfactory interaction. In *Berkshire Encyclopedia of Human-Computer Interaction*, ed. W. S. Bainbridge, 507–511. Great Barrington, MA: Berkshire Publishing.
- Hale, K. S., and K. M. Stanney. 2004. Deriving haptic design guidelines from human physiological, psychophysical, and neurological foundation. *IEEE Comput Graph Appl* 24(2):33–39.
- Hale, K. S., K. M. Stanney, L. M. Milham, M. A. Bell-Carroll, and D. L. Jones. 2009. Multimodal sensory information requirements for enhancing situation awareness and training effectiveness. *Theor Issues Ergon Sci* 10(3):245–266.
- Harris, S. R., R. L. Kemmerling, and M. M. North. 2002. Brief virtual reality therapy for public speaking anxiety. *Cyberpsychol Behav* 5: 543–550.
- Hassinger, J. P., E. J. Dozois, J. D. Holubar, W. Pawlina, R. Pendlimari, J. L. Fidler, D. R. Holmes, and R. A. Robb. 2010. Virtual pelvic anatomy simulator improved medical student comprehension of pelvic anatomy. *FASEB J* 24:825.3.
- Hayward, V. 2008. A brief taxonomy of tactile illusions and demonstrations that can be done in a hardware store. *Brain Res Bull* 75(6):742–752.
- Hetherington, I. L. 2007. PocketSUMMIT: Small footprint continuous speech recognition. In *Proceedings of International Conference on Spoken Language Processing (Interspeech 2007—CSLP)*, 1465–1468. Held August 27–31, Antwerp, Belgium. Los Alamitos, CA: IEEE Press.

- Hettinger, L. J. 2002. Illusory self-motion in virtual environments. In *Handbook of Virtual Environments: Design, Implementation, and Applications*, ed. K. M. Stanney, 471–492. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Heylen, D., I. Van Es, A. Nijholt, and B. Van Dijk. 2008. Chapter 1: Controlling the gaze of conversational agents. <http://en.scientificcommons.org/43376669> (accessed June 2, 2010).
- Hill, R. W. Jr., J. Gratch, S. Marsella, J. Rickel, W. Swartout, and D. Traum. 2003. Virtual humans in the mission rehearsal exercise system. *Künstliche Intelligenz* 17: 5–12.
- Hix, D., and J. L. Gabbard. 2002. Usability engineering of virtual environments. In K. M. Stanney (Ed.), *Handbook of virtual environments: Design, implementation, and applications* pp. 681–699. Mahwah, NJ: Lawrence Erlbaum Associates.
- Hoffman, H. G., D. R. Patterson, E. Seibel, M. Soltani, L. Jewett-Leahy, and S. R. Sharar. 2008. Virtual reality pain control during burn wound debridement in the Hydrotank. *Clinical Journal of Pain* 24(4): 299–304.
- Holden, M. 2005. Virtual environments for motor rehabilitation: A review. *CyberPsychol Behav* 8(3): 187–211.
- Hollerbach, J. 2002. Locomotion interfaces. In *Handbook of Virtual Environments: Design, Implementation, and Applications*, ed. K. M. Stanney, 239–254. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Holmes, D. W., J. R. Williams, and P. Tilke. 2010. An events based algorithm for distributing concurrent tasks on multi-core architectures. *Comput Phys Commun* 181(2):341–354.
- Huggins-Daines, D., M. Kumar, A. Chan, A. W. Black, M. Ravishankar, and A. I. Rudnicky. 2006. PocketSphinx: a free real-time continuous speech recognition system for handheld devices. In *Proceedings of 31st International Conference on Acoustics, Speech, and Signal Processing (ICASSP 2006)*, 185–188. Held May 14–19, Toulouse, France. Los Alamitos, CA: IEEE Press.
- Isdale, J. 2000. Motion platform systems. VR News: April Tech Review. http://vr.isdale.com/vrTechReviews/MotionLinks_2000.html (accessed May 21, 2010).
- Isdale, J., C. Fencott, M. Heim, and L. Daly. 2002. Content design for virtual environments. In *Handbook of Virtual Environments: Design, Implementation, and Applications*, ed. K. M. Stanney, 519–532. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Jedrzejewski, M. 2004. Computation of Room Acoustics on Programmable Video Hardware. Master's thesis, Polish-Japanese Institute of Information Technology, Warsaw, Poland.
- Johnsen, K., R. Dickerson, A. Raij, B. Lok, J. Jackson, M. Shin, et al. 2005. Experiences in using immersive virtual characters to educate medical communication skills. In *Proceedings of 2005 IEEE Conference on Virtual Reality*, 179–186. Los Alimitos, CA: IEEE CS Press.
- Johnston, M., K. Stanney, K. Hale, and R. S. Kennedy. 2010. A framework for improving situation awareness of the UAS operator through integration of tactile cues. In *Proceedings of the 3rd Applied Human Factors and Ergonomics (AHFE) International Conference 2010*. July 17–20, Miami, FL. New York: CRC Press/Taylor and Francis.
- Jones, A., I. McDowall, H. Yamada, M. Bolas, and P. Debevec. 2007. Rendering an interactive 360° light field display. *ACM Trans Graph* 26(3, July): Article 40.
- Jones, D., K. Stanney, and H. Fouad. 2005. An optimized spatial audio system for virtual training simulations: Design and evaluation. In *Proceedings of the International Conference on Auditory Display*, Held July 6–9, 2005, Limerick, Ireland. Published by the International Community for Auditory Display (ICAD).
- Jones, L., C. A. Bowers, D. Washburn, A. Cortes, and R. Vijaya Satya. 2004. The effect of olfaction on immersion into virtual environments. In *Human Performance, Situation Awareness and Automation: Current Research and Trends*, ed. D. A. Vincenzi, M. Mouloua, and P. A. Hancock, Vol. 2, 282–285. Mahwah, NJ: Lawrence Erlbaum.
- Kalawsky, R. S. 1993. *The Science of Virtual Reality and Virtual Environments*. Wokingham, England: Addison-Wesley.
- Kallman, E. A. 1993. Ethical evaluation: A necessary element in virtual environment research. *Presence (Camb)* 2(2): 143–146.
- Karim, M. S., A. M. L. Karim, E. Ahmed, and M. Rokonuzzaman. 2003. Scene graph management for OpenGL based 3D graphics engine. In *Proceedings of the International Conference on Computer & Information Technology (ICCIT 2003)*, Vol. 1, 395–400. Los Alamitos, CA: IEEE Press.
- Katz, N., H. Ring, Y. Naveh, R. Kizony, U. Feintuch, and P. L. Weiss. 2005. Interactive virtual environment training for safe street crossing of right hemisphere stroke patients with Unilateral Spatial Neglect. *Disabil Rehabil* 29(2):177–181.
- Kaur, K. 1999. Designing virtual environments for usability. Unpublished doctoral dissertation, City University, London.
- Kennedy, R. S., J. M. Drexler, M. B. Jones, D. E. Compton, and J. M. Ordy. 2005. Quantifying human information processing (QHIP): Can practice effects alleviate bottlenecks? In *Quantifying Human Information Processing*, ed. D. K. McBride, and D. Schmorow, 63–122. Lanham, MD: Lexington Books.
- Kennedy, R. S., and J. E. Fowlkes. 1992. Simulator sickness is polygenic and polysymptomatic: Implications for research. *Int J Aviat Psychol* 2(1):23–38.
- Kennedy, R. S., and A. Graybiel. 1965. The Dial Test: A Standardized Procedure for the Experimental Production of Canal Sickness Symptomatology in a Rotating Environment (Rep. No. 113, NSAM 930). Pensacola, FL: Naval School of Aerospace Medicine.
- Kennedy, R. S., K. E. Kennedy, and K. M. Bartlett. 2002. Virtual environments and products liability. In *Handbook of Virtual Environments: Design, Implementation, and Applications*, ed. K. M. Stanney, 543–554. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Kennedy, R. S., N. E. Lane, K. S. Berbaum, and M. G. Lilienthal. 1993. Simulator sickness questionnaire: An enhanced method for quantifying simulator sickness. *Int J Aviat Psychol* 3(3):203–220.
- Kennedy, R. S., and K. M. Stanney. 1996. Virtual reality systems and products liability. *J Med Virtual Real* 1(2):60–64.
- Kennedy, R. S., K. M. Stanney, and W. P. Dunlap. 2000. Duration and exposure to virtual environments: Sickness curves during and across sessions. *Presence (Camb)* 9(5):466–475.
- Kennedy, R. S., K. M. Stanney, J. M. Ordy, and W. P. Dunlap. 1997. Virtual reality effects produced by head-mounted display (HMD) on human eye-hand coordination, postural equilibrium, and symptoms of cybersickness. *Soc Neurosci Abstr* 23: 772.
- Kessler, G. D. 2002. Virtual environment models. In *Handbook of Virtual Environments: Design, Implementation, and Applications*, ed. K. M. Stanney, 255–276. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Kitazaki, M., S. Onimaru, and T. Sato. 2010. Vection and action are incompatible. In *Proceedings of the 2nd IEEE VR 2010 Workshop on Perceptual Illusions in Virtual Environments (PIVE 2010)*, ed. F. Steinicke and P. Willemse, 22–23. March 21, 2010, Waltham, MA. http://pive.uni-muenster.de/paper/PIVE_proceedings2010.pdf (accessed May 31, 2010).
- Knerr, B. W., R. Breaux, S. L. Goldberg, and R. A. Thurman. 2002. National defense. In *Handbook of Virtual Environments: Design, Implementation, and Applications*, ed. K. M. Stanney, 857–872. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Koltko-Rivera, M. E. 2005. The potential societal impact of virtual reality. In *Advances in virtual environments technology: Musings on design, evaluation, and applications*, K. M. Stanney and M. Zyda. In G. Salvendy (Ed.), *HCI International 2005: 11th International*

- Conference on Human-Computer Interaction [CD-ROM, Volume 9, unpaginated]. Mahwah, NJ: Erlbaum.
- Konrad, J., and M. Halle. 2007. 3-D displays and signal processing— An answer to 3-D Ills?. *IEEE Signal Process Mag* 24(6):97–111.
- Kuntze, M. F., R. Stoermer, R. Mager, A. Roessler, F. Mueller-Spahn, and A. H. Bullinger 2001. Immersive virtual environments in cue exposure. *Cyberpsychol and Behav* 4(4):497–501.
- Lackner, J. R., and P. DiZio. 1994. Rapid adaptation to Coriolis force perturbations of arm trajectory. *J Neurophysiol* 72(1): 299–313.
- Laughlin, D., M. Roper, and K. Howell. 2007. NASA eEducation Roadmap: Research Challenges in the Design of Persistent Immersive Synthetic Environments for Education & Training. Washington, DC: Federation of American Scientists. <http://www.fas.org/programs/ltp/publications/NASA%20eEducation%20Roadmap.pdf> (accessed July 28, 2010).
- Lawson, B. D., S. A. Sides, and K. A. Hickinbotham. 2002. User requirements for perceiving body acceleration. In *Handbook of Virtual Environments: Design, Implementation, and Applications*, ed. K. M. Stanney, 135–161. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Leonetti, C., and J. N. Bailenson. 2010. High-Tech view: The use of immersive virtual environments injury trials. *Marquette Law Rev*, 93(3), 1073–1120.
- Maekawa, T., Y. Itoh, K. Takamoto, K. Tamada, T. Maeda, Y. Kitamura, and F. Kishino. 2009. Tearable: haptic display that presents a sense of tearing real paper. In *Virtual Reality Software and Technology*, Proceedings of the 16th ACM Symposium on Virtual Reality Software and Technology, 27–30. New York, NY: ACM.
- Majumder, A. 2003. A practical framework to achieve perceptually seamless multi-projector displays. Unpublished doctoral dissertation, University of North Carolina at Chapel Hill. http://www.cs.unc.edu/~welch/media/pdf/dissertation_majumder.pdf (accessed May 24, 2010).
- Majumder, A., H. Zhu, H. Towles, and G. Welch. 2000. Achieving Color Uniformity Across Multi-Projector Displays. In *Proceedings of IEEE Visualization 2000*, (October 8–13). Salt Lake City, UT: IEEE Computer Science Press.
- Mantovani, F., and G. Castelnovo. 2003. Sense of presence in virtual training: Enhancing skills acquisition and transfer of knowledge through learning experience in virtual environments. In *Being there: Concepts, Effects and Measurement*, ed. G. Riva, F. Davide, and W. A. IJsselsteijn, 167–181. Amsterdam, The Netherlands: IOS Press.
- Martinussen, M. 1996. Psychological measures as predictors of pilot performance: A meta-analysis. *J Aviat Psychol* 6: 1–20.
- Massimino, M., and T. Sheridan. 1993. Sensory substitution for force feedback in teleoperation. *Presence (Camb)* 2(4):344–352.
- McCauley, M. E., and T. J. Sharkey. 1992. Cybersickness: Perception of self-motion in virtual environments. *Presence: Teleoperators Virtual Environ* 1 (3):311–318.
- McCauley-Bell, P. R. 2002. Ergonomics in virtual environments. In *Handbook of Virtual Environments: Design, Implementation, and Applications*, ed. K. M. Stanney, 807–826. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- McQuaide, S. C., E. J. Seibel, J. P. Kelly, B. T. Schowengerdt, and T. A. Furness III. 2003. A retinal scanning display system that produces multiple focal planes with a deformable membrane mirror. *Displays* 24(2):65–72.
- Melzer, J. E., F. T. Brozoski, T. R. Letowski, T. H. Harding, and C. E. Rash. 2009. Guidelines for HMD design. In *Helmet-mounted Displays: Sensation, Perception, and Cognition Issues*, ed. C. E. Rash, M. Russo, T. Letowski, and E. Schmeisser, 805–848. Fort Rucker, AL: US Army Aeromedical Research Laboratory.
- Melzer, J. E., and C. E. Rash. 2009. The potential of an interactive HMD. In *Helmet-Mounted Displays: Sensation, Perception, and Cognition Issues*, ed. C. E. Rash, M. Russo, T. Letowski, and E. Schmeisser, 877–898. Fort Rucker, AL: U.S. Army Aeromedical Research Laboratory.
- Menzies, D. 2002. Scene management for modelled audio objects in interactive worlds. In *Proceedings of the 8th International Conference on Auditory Displays*, Kyoto, Japan: the International Community for Auditory Display (ICAD).
- Milham, L. M., K. Hale, K. Stanney, J. Cohn, R. Darken, and J. Sullivan, 2004. When is VE training effective? A framework and two case studies. Poster presented at The 48th Annual Human Factors and Ergonomics Society Meeting pp. 2592–2595. New Orleans: LA.
- Minamizawa, K., S. Kamuro, N. Kawakami, and S. Tachisuggest. 2008. A palm-worn haptic display for bimanual operations in virtual environments. In *EuroHaptics 2008*, ed. M. Ferre, 458–463. Berlin: Springer-Verlag.
- Moline, J. 1995. *Virtual Environments for Health Care. White Paper for the Advanced Technology Program (ATP)*. Retrieved September 15, 2006, from the National Institute of Standards and Technology website: <http://www.itl.nist.gov/iaui/ovrt/projects/health/vr-envir.htm>.
- Morris, C. S., and R. W. Tarr, 2002, March. Templates for selecting PC-based synthetic environments for application to human performance enhancement and training. In *Proceedings of IEEE Virtual Reality 2002 Conference*, 109–115, Orlando, FL.
- Mouba, J. 2009. Performance of source spatialization and source localization algorithms using conjoint models of interaural level and time cues. In *Proceedings of the 12th International Conference on Digital Audio Effects (DAFx-09)*. Held Sept 1–4, Como, Italy.
- Mulgund, S., J. Stokes, M. Turieo, and M. Devine. 2002. Human/Machine Interface Modalities for Soldier Systems Technologies (Final Report No. 71950–00). Cambridge, MA: TIAX, LLC.
- Murray, J. H. 1997. *Hamlet on the Holodeck: The Future of Narrative in Cyberspace*. New York: The Free Press.
- Nakatsu, R., M. Rauterberg, and P. Vorderer. 2005. A new framework for entertainment computing: From passive to active experience. In: *4th International Conference on Entertainment Computing (ICEC 2005) Proceedings*, ed. F. Kishino, Y. Kitamura, H. Kato, and N. Nagata, 1–12. Lecture Notes in Computer Science (LNCS 3711), Berlin, Heidelberg: Springer-Verlag.
- North, M. M., S. M. North, and J. R. Coble. 2002. Virtual reality therapy: An effective treatment for psychological disorders. In *Handbook of Virtual Environments: Design, Implementation, and Applications*, ed. K. M. Stanney, 1065–1078. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Optale, G., S. Capodieci, P. Pinelli, D. Zara, L. Gamberini, G. Riva. 2001. Music-enhanced immersive virtual reality in the rehabilitation of memory related cognitive processes and functional abilities: A case report. *Presence (Camb)* 10(4):450–462.
- Osgood, C. E. 1949. The similarity paradox in human learning: A resolution. *Psychol Rev* 56: 132–143
- Parsons, T. D., T. Bowerly, J. G. Buckwalter, and A. A. Rizzo. 2007. A controlled clinical comparison of attention performance in children with ADHD in a virtual reality classroom compared to standard neuropsychological methods. *Child Neuropsychol* 13(4):363–381.
- Parsons, T. D., and A. A. Rizzo. 2008. Affective outcomes of virtual reality exposure therapy for anxiety and specific phobias: A meta-analysis. *J Behav Ther Exp Psychiatry* 39: 250–261.
- Popescu, G. V., G. C. Burdea, and H. Trefftz. 2002. Multimodal interaction modeling. In *Handbook of Virtual Environments: Design, Implementation, and Applications*, ed. K. M. Stanney, 435–454. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Portillo-Rodríguez, O., C. A. Avizzano, M. Bergamasco, and G. Robles-De-La-Torre. 2006. Haptic rendering of sharp objects using lateral forces. In *Proceedings of the IEEE International Symposium on Robot and Human Interactive Communication (ROMANO6)*, 431–436. Held September 6–8, Hatfield, U.K. Los Alamitos, CA: IEEE Press.

- Povenmire, H. K., and S. N. Roscoe. 1973. Incremental transfer effectiveness of a ground-based general aviation trainer. *Human Factors*, 15(6):534–542.
- Powers, M. B., and P. M. G. Emmelkamp. 2008. Virtual reality exposure therapy for anxiety disorders: A meta-analysis. *J Anxiety Disord* 22: 561–569.
- Pulkki, V. 1997. Virtual sound source positioning using vector base amplitude panning. *J Audio Eng Soc* 45(6):456–466.
- Rautenberg, M. 2009. Entertainment computing, social transformation and the quantum field. In *Intelligent Technologies for Interactive Entertainment (INTELTAIN 2009) Proceedings*, ed. A. Nijholt, D. Reidsma, and H. Hondorp, 1–8, Lecture Notes of the Institute for Computer Sciences (LNICST 9). Berlin, Heidelberg: Springer-Verlag.
- Reeves, L. M., J. C. Lai, J. A. Larson, S. L. Oviatt, T. S. Balaji, S. Buisine, P. Collings, et al. 2004. Guidelines for multimodal user interface design. *Commun ACM* 47(1):57–59.
- Reger, G. M., and G. A. Gahm. 2008. Virtual reality exposure therapy for active duty soldiers. *J Clin Psychol* 64: 940–946.
- Riecke, B. E., A. Välijamäe, and J. Schulte-Pelkum. 2009. Moving sounds enhance the visually-induced self-motion illusion (circularvection) in virtual reality. *ACM Trans Appl Percept* 6(2), Article 7, 7:1–7:27.
- Rizzo, A., T. Bowery, J. Buckwalter, D. Klimchuk, R. Mitura, T. D. Parsons. 2006. A virtual reality scenario for all seasons: The virtual classroom. *CNS Spectr* 11(1):35–44.
- Rizzo, S., B. Rothbaum, and K. Graap. 2006. Chapter 9: Virtual reality applications for the treatment of combat-related PTSD. In *Combat Stress Injury Theory, Research, and Management*, ed. C. R. Figley, and W. P. Nash, 295–329. New York, NY: Routledge.
- Robles-De-La-Torre G., and V. Hayward. 2001. Force can overcome object geometry in the perception of shape through active touch. *Nature* 412(6845):445–448.
- Rolland, J. P., F. A. Biocca, T. Barlow, and A. Kancherla. 1995. Quantification of adaptation to virtual-eye location in see-thru head-mounted displays. In *IEEE Virtual Reality Annual International—Symposium '95*, 56–66. Los Alamitos, CA: IEEE Computer Society Press.
- Rolston, M. 2010. Your computer in 2020. In *Your Life in 2020*, ed. N. Perlroth. Forbes.com. <http://www.forbes.com/2010/04/08/3d-computers-2020-technology-data-companies-10-frog.html> (accessed May 25, 2010).
- Romoser, M. R. E., and D. L. Fisher. 2009. The effect of active versus passive training strategies on improving older driver's scanning in intersections. *Hum Factors* 51(5):652–668.
- Roscoe, S. N. 1982. *Aviation Psychology*. Ames, IA: Iowa State University Press.
- Rothbaum, B. O., L. Hodges, S. Smith, J. H. Lee, and L. Price. 2000. A controlled study of virtual reality exposure therapy for the fear of flying. *J Consult Clin Psychol* 68: 1020–1026.
- Rothbaum, B. O., L. Hodges, B. A. Watson, G. D. Kessler, and D. Opdyke. 1996. Virtual reality exposure therapy in the treatment of fear of flying A case report. *Behav Res Therapy* 34: 477–481.
- Roy, S., E. Klinger, P. Legeron, F. Lauer, I. Chemin, and P. Nugues. 2003. Definition of a VR-based protocol to treat social phobia. *Cyberpsychol Behav* 6: 411–420.
- Sadowski, W., and K. Stanney. 2002. Presence in virtual environments. In *Handbook of Virtual Environments: Design, Implementation, and Applications*, ed. K. M. Stanney, 791–806. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Sanders, P. 1997-September/October. Simulation Based Acquisition: An effective, affordable mechanism for fielding complex technologies. *Program Manager*, 72–7.
- Satava, R., and S. B. Jones. 2002. Medical applications of virtual environments. In K. M. Stanney, ed. *Handbook of virtual environments'. Design, implementation, and applications* 93–116. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Seeber, B. U., and H. Fastl. 2003. Subjective selection of nonindividual head-related transfer function. In *Proceeding of the 2003 International Conference on Auditory Display*, 259–262. Held July 6–9, Boston University, Boston, MA: International Community for Auditory Display (ICAD).
- Segal, D., and R. L. Fernandez. 2009. Teaching physician decision making in a technical age. *Virtual Mentor* 11(8):607–610.
- Serenko, A., and B. Detlor. 2004. Intelligent agents as innovations. *Artif Intell Soc* 18(4):364–381.
- Sheridan, T. B. 1993. My anxieties about virtual environments. *Presence: Teleoperators Virtual Environ* 2(2): 141–142.
- Shilling, R. D., and B. Shinn-Cunningham. 2002. Virtual auditory displays. In *Handbook of Virtual Environments: Design, Implementation, and Applications*, ed. K. M. Stanney, 65–92. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Siem, F. M., T. R. Carretta, and T. A. Mercatante. 1988. Personality, attitudes, and pilot training performance: Preliminary analysis (Tech. Report. N. AFHRL-TP-87-62). Brooks Air Force Base, TX: AFHRL, Manpower and Personnel Division.
- Slater, M., and Steed, A. 2000. A virtual presence counter. *Presence: Teleoperators Virtual Environ* 9(5):413–434.
- Spors, S., and J. Ahrens. 2010. Analysis and improvement of pre-equalization in 2.5-dimensional wave field synthesis. In *Proceedings of the 128th Audio Engineering Society (AES) Convention, P21—Multichannel and Spatial Audio: Part 2 Session (P21-3)*. Held May 25, London, U.K.: AES Publication.
- Stanney, K. M., D. A. Graeber, and R. S. Kennedy. 2005. Virtual environment usage protocols. In *Handbook of Standards and Guidelines in Ergonomics and Human Factors*, ed. W. Karwowski, 381–398. Mahwah, NJ: Lawrence Erlbaum.
- Stanney, K. M., and R. S. Kennedy. 1998. Aftereffects from virtual environment exposure: How long do they last? In *Proceedings of the 42nd Annual Human Factors and Ergonomics Society Meeting*, 1476–1480. Chicago, IL: Thousand Oaks, CA: Sage Publications.
- Stanney, K. M., and R. Kennedy. 2008. Simulator sickness. In *Human Factors in Simulation and Training*, ed. D. Vincenzi, J. A. Wise, M. Mouloua, and P. A. Hancock, 117–128. Mahwah, NJ: Lawrence Erlbaum Associates.
- Stanney, K. M., K. Kingdon, I. Nahmens, and R. S. Kennedy. 2003. What to expect from immersive virtual environment exposure: Influences of gender, body mass index, and past experience. *Hum Factors* 45(3):504–522.
- Stanney, K., C. Kokini, S. Fuchs, P. Axelsson, and C. Phillips. 2010. Auto-diagnostic adaptive precision training—human terrain (ADAPT-HT): A conceptual framework for cross-cultural skills training. In *Proceedings of the 3rd Applied Human Factors and Ergonomics (AHFE) International Conference 2010*. Held July 17–20, Miami, FL. Thousand Oaks, CA: Sage Publications.
- Stanney, K. M., M. Mollaghazemi, and L. Reeves. 2000. Development of MAUVE, the Multi-Criteria Assessment of Usability for Virtual Environments System (Final Report, Contract No. N61339-99-C-0098). Orlando, FL: Naval Air Warfare Center, Training Systems Division, 8/00.
- Stanney, K. M., R. Mourant, and R. S. Kennedy. 1998. Human factors issues in virtual environments: A review of the literature. *Presence: Teleoperators Virtual Environ* 7(4):327–351.
- Stanney, K. M., G. Salvendy, J. Deisigner, P. DiZio, S. Ellis, E. Ellison, et al. 1998. Aftereffects and sense of presence in virtual environments: Formulation of a research and development agenda (Report sponsored by the Life Sciences Division at NASA

- Headquarters). *Int J Hum Comput Interact* 10(2):135–187.
- Stanney, K., S. Samman, L. Reeves, K. Hale, W. Buff, C. Bowers, et al. 2004. A paradigm shift in interactive computing: Deriving multimodal design principles from behavioral and neurological foundations. *Int J Hum Comput Interact* 17(2):229–257.
- Stanney, K. M., D. D. Schmorow, M. Johnston, S. Fuchs, D. Jones, K. Hale, A. Ahmad, and P. Young. 2009. Augmented cognition: An overview. In *Reviews of Human Factors and Ergonomics*, ed. F. T. Durso, Vol. 5, 195–224. Santa Monica, CA: Human Factors and Ergonomics Society.
- Stanney, K. M., and M. Zyda. 2002. Virtual environments in the 21st century. In *Handbook of Virtual Environments: Design, Implementation, and Applications*, ed. K. M. Stanney, 1–14. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Steinicke, F., and P. Willemsen, ed. In *Proceedings of the 2nd IEEE VR 2010 Workshop on Perceptual Illusions in Virtual Environments (PIVE 2010)*. March 21, 2010, Waltham, MA. http://pive.uni-muenster.de/paper/PIVE_proceedings2010.pdf (accessed May 31, 2010). Los Alamitos, CA: IEEE Press.
- Sterling, G. C., L. E. Magee, and P. Wallace. 2000. Virtual reality training—A consideration for Australian helicopter training needs? In Paper presented at *Simulation Technology and Training (SimTecT2000)*, March 2000. Sydney, Australia: Simulation Industry Association of Australia.
- Stoffregen, T., B. G. Bardy, L. J. Smart, and R. Pagulayan, 2003. On the nature and evaluation of fidelity in virtual environments. In *Virtual and adaptive environments: Applications, implications, and human performance issues*. L. J. Hettinger and M. W. Haas, eds. 111–128, Mahwah, NJ: Lawrence Erlbaum Associates.
- Stone, R. 2002. Applications of virtual environments: An overview. In *Handbook of virtual environments: Design, implementation, and applications*. K. M. Stanney, ed. 827–856. Mahwah: NJ: Lawrence Erlbaum Associates.
- Storms, R. L. 2002. Auditory-visual cross-modality interaction and illusions. In *Handbook of Virtual Environments: Design, Implementation, and Applications*, ed. K. M. Stanney, 455–470. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Strickland, D., L. Hodges, M. North, and S. Weghorst. 1997. Overcoming phobias by virtual exposure. *Commun ACM* 40(8):34–39.
- Sullivan, A. 2004. DepthCube solid-state 3D volumetric display. In *Proceedings of the SPIE Stereoscopic Displays and Virtual Reality Systems*, Vol. 5291, 279–284. SPIE Press.
- Suma, E. A., S. Clark, S. L. Finkelstein, and Z. Wartell. 2010. Leveraging change blindness for walking in virtual environments. In *Proceedings of the 2nd IEEE VR 2010 Workshop on Perceptual Illusions in Virtual Environments (PIVE 2010)*, ed. F. Steinicke and P. Willemsen, 10. Held March 21, 2010, Waltham, MA. http://pive.uni-muenster.de/paper/PIVE_proceedings2010.pdf (accessed May 31, 2010). Los Alamitos, CA: IEEE Press.
- Swartz, K. O. 2003. Virtual environment usability assessment methods based on a framework of usability characteristics. Unpublished master's thesis. Virginia Polytechnic Institute and State University, Blacksburg.
- Tharp, V., M. Bums, and H. Moskowitz. 1981. Development and Field Test of Psychophysical Tests for DWI Arrest (Department of Transportation Final Report, ODT HS 805 864). Washington, DC: DOT.
- Thorndike, E. L., and R. S. Woodworth. 1901. The influence of improvement of one mental function upon the efficiency of the other functions. *Physiol Rev* 8(3):247–261.
- Tippett, W. J., J.-H. Lee, K. K. Zakzanis, S. E. Black, R. Mraz, and S. J. Graham. 2009. Visually navigating a virtual world with real-world impairments: A study of visually and spatially guided performance in individuals with mild cognitive impairments. *J Clin Exp Neuropsychol* 31(4):447–454.
- Turk, M. 2002. Gesture recognition. In *Handbook of Virtual Environments: Design, Implementation, and Applications*, ed. K. M. Stanney, 223–238. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Ultimate 3D Links. 2010. Commercial 3D software. <http://www.3dlinks.com/links.cfm?categoryid=1&subcategoryid=1#> (accessed May 25, 2010).
- Vertanen, K., and P. O. Kristensson. 2009. Parakeet: A continuous speech recognition system for mobile touch-screen devices. In *Proceedings of the 13th International Conference on Intelligent user Interfaces*, 237–246. February 9–11, Sanibel Island, FL: ACM.
- Vince, J. 2004. *Introduction to Virtual Reality*, 2nd ed. Berlin: Springer-Verlag.
- Washburn, D. A., and L. M. Jones. 2004. Could olfactory displays improve data visualization? *Comput Sci Eng* 6(6):80–83.
- Washburn, D. A., L. M. Jones, R. V. Satya, C. A. Bowers, and A. Cortes. 2003. Olfactory use in virtual environment training. *Model Simul* 2(3):19–25.
- Welch, R. B. 1978. *Perceptual Modification: Adapting to Altered Sensory Environments*. New York: Academic Press.
- Welch, R. B. 1997. The presence of aftereffects. In *Design of Computing Systems: Cognitive Considerations*, ed. G. Salvendy, M. Smith, and R. Koubek, 273–276. Amsterdam, The Netherlands: Elsevier Science Publishers, San Francisco, CA, August 24–29.
- Wiecha, J., R. Heyden, E. Stemthal, and M. Merialdi. 2010. Learning in a virtual world: Experience with using Second Life for medical education. *J Med Internet Res* 12(1):e1. <http://www.jmir.org/2010/1/e1/> (accessed May 20, 2010).
- Wickens, C. D., and J. G. Hollands. 2000. *Engineering psychology and human performance* (3rd ed). New Jersey: Prentice Hall.
- Witmer, B., and M. Singer. 1998. Measuring presence in virtual environments: A Presence Questionnaire. *Presence: Teleoperators Virtual Environ* 7(3):225–240.
- Yee, N., J. N. Bailenson, and N. Ducheneaut. 2009. The proteus effect: Implications of transformed digital self-representation on online and offline behavior. *Commun Res* 36(2):285–312.
- Yeh, S.-C., T. D. Parsons, M. McLaughlin, A. A. Rizzo. 2007. Virtual reality upper extremity motor training for post-stroke rehabilitation. *J Int Neuropsychol Soc* 13(Suppl S1):58.
- Zittel, R. C. 2001. Summer. The reality of simulation-based acquisition-And an example of U.S. military implementation. *Acquisition Review Quarterly*, 121–32.
- Zotkin, D. N., R. Duraiswami, E. Grassi, and N. A. Gumerov. 2006. Fast head related transfer function measurement via reciprocity. *J Acoust Soc Am* 120(4):2202–2215.

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- Ackerman, M., L. Cranor, and J. Reagle. 1999. Privacy in e-commerce: Examining user scenarios and privacy preferences. In Proceedings of the ACM Conference on Electronic Commerce, 1–8. Denver, CO: ACM.
- Ackerman, M., and S. Mainwaring. 2005. Privacy issues in human–computer interaction. In Security and Usability: Designing Secure Systems That People Can Use, ed. L. Cranor, and S. Garfinkel, 381–400. Sebastopol, CA: O'Reilly.
- Acquisti, A., and R. Gross. 2006. Imagined Communities: Awareness, Information Sharing, and Privacy on the Facebook. Springer eBook. Berlin: Springer.
- Adams, A., and A. Blanford. 2005. Bridging the gap between organizational and user perspectives of security in the clinical domain. *Int J Hum Comput Stud* 63(1–2): 175–202.
- Adams, A., and A. Sasse. 1999. Users are not the enemy: Why users compromise security mechanisms and how to take remedial measures. *Commun ACM* 42(12):40–46.
- Anderson, R. 1994. Why cryptosystems fail. *Communications of the ACM* 37(11):32–40.
- Anti-Phishing Working Group. 2005. APWG Phishing Archive, http://anti-phishing.org/phishing_archive.htm (accessed July 23, 2010).
- Ashbourn, J. 2000. Biometrics: Advanced Identity Verification. London: Springer Verlag.
- Associated Press. 2003. Pentagon Spy Office to Close. *Wired News*. <http://www.wired.com/news/print/0,1294,60588,00.html> (accessed September 25, 2003).
- Balfanz, D., G. Durfee, R. E. Grinter, D. Smetters, and P. Stewart. 2004a. Network-in-a-Box: How to set up a secure wireless network in under a minute. In Proceedings of the 13th USENIX Security Symposium, 207–222. Berkeley, CA: USENIX Association.
- Balfanz, D., G. Durfee, and D. K. Smetters. 2005. Making the impossible easy: Usable PKI. In Security and Usability: Designing Secure Systems That People Can Use, ed. L. Cranor, and S. Garfinkel, 319–334. Sebastopol, CA: O'Reilly.
- Balfanz, D., G. Durfee, D. K. Smetters, and R. E. Grinter. 2004b. In search of usable security: Five lessons from the field. *IEEE Secur Privacy* 2(5): 19–24.
- Beckles, B., V. Welch, and J. Basney. 2005. Mechanisms for increasing usability of grid security. *Int J Hum Comput Stud* 63(1–2):74–101.
- Begole, J., J. C. Tang, R. B. Smith, and N. Yankelovich. 2002. Work rhythms: Analyzing visualizations of awareness histories of distributed groups. In Proceedings of CSCW 2002, 334–343. New Orleans, LA: ACM Press.
- Bernaschi, M., E. Gabrelli, and L. Mancini. 2000. Operating system enhancements to prevent the misuse of system calls. In Proceedings of the 7th ACM conference on Computer and communications security, 174–183. New York: ACM Press.
- Bellotti, V. 1996. What you don't know can hurt you: Privacy in collaborative computing. In Proceedings of the HCI Conference on People and Computers XI, 241–261. London: Springer-Verlag.
- Bellotti, V., and A. Sellen. 1993. Designing for Privacy in Ubiquitous Computing Environments, In Proc European Conference on Computer-Supported Cooperative Work ECSCW'93, 77–92. Norwell, MA: Kluwer Academic Publishers.
- Bertino, E., C. Brodie, S. Calo, L. Cranor, C.-M. Karat, J. Karat et al. 2009. Analysis of privacy and security policies. *IBM J Res Dev* 53(2–3): 1–18.
- Bhattacherjee, A. 2002. Individual trust in online firms: Scale development and initial trust. *J Manage Inf Syst* 19(1):213–243.
- Briggs, P., B. Buford, A. De Angeli, and P. Lynch. 2002. Trust in online advice. *Soc Sci Comput Rev* 20(3):321–332.
- Briggs, P., B. Simpson, and A. De Angeli. 2004. Personalization and trust: A reciprocal relationship? In Designing Personalized User Experiences in e-Commerce, ed. C.-M. Karat, J. Blom, and J. Karat, 39–56. Dordrecht, Netherlands: Kluwer Academic Publishers.
- Brodie, C., D. George, C.-M. Karat, J. Karat, J. Lobo, M. Beigi, X. Wang, S. Calo, and D. Verma. 2008. The coalition policy management portal for policy authoring, verification, and deployment. In Proceedings of the IEEE Policy 2008 Conference, 247–249. New York: IEEE.
- Brodie, C., C.-M. Karat, and J. Karat. 2004. Personalizing interaction. In Designing Personalized User Experiences in e-Commerce, ed. C.-M. Karat, J. Blom, and J. Karat, 185–206. Dordrecht, Netherlands: Kluwer Academic Publishers.
- Brodie, C., C. Karat, and J. Karat. 2006. An empirical study of natural language parsing accuracy of privacy policy rules using the SPARCLE Policy Workbench. In Proceedings of the Symposium on Usable Privacy and Security. ACM Digital Library, submitted for publication. New York: ACM.
- Brostoff, S., and A. Sasse. 2000. Are passfaces more usable than passwords? (Eds.) In Proceedings of HCI 2000 Conference on People and Computers XIV—Usability or Else! 405–424. London: Springer.
- Buffett, S., M. W. Fleming, M. M. Richter, N. Scott, and B. Spencer. 2003. Determining Internet users' values for privacy information. In Proceedings of the Second Annual Conference on Privacy, Security, and Trust, 79–88. Toronto, Canada: National Research Council of Canada.
- Caloyannides, M. A. 2004. Speech privacy technophobes need not apply. *IEEE Secur Privacy* 2(5):86–87.
- Chaiken, S. 1980. Heuristic versus systematic information processing and the use of source versus message cues in persuasion. *J Pers Soc Psychol* 39: 752–766.
- Conti, G., M. Ahamad, and J. Stasko. 2005. Attacking information visualization system usability: Overloading and deceiving the human. In Proceedings of the Symposium on Usable Privacy and Security (SOUPS '05). New York: ACM Digital Library.
- Corritore, C., B. Kracher, and S. Wiedenbeck. 2003. Online trust: Concepts, evolving themes, a model. *Int J Hum Comput Stud* 58(6):737–758.
- Coventry, L. 2005. Usable biometrics. In Security and Usability: Designing Secure Systems That People Can Use, ed. L. Cranor, and S. Garfinkel, 175–198. Sebastopol, CA: O'Reilly.
- Cranor, L. 2002. Web Privacy with P3P. Sebastopol, CA: O'Reilly Media.
- Cranor, L. F. 2003. 'I didn't buy it for myself' privacy and e-commerce personalization. In Proceedings of the 2003 ACM Workshop On Privacy in Electronic Society, 111–117. New York: ACM.
- Cranor, L. 2004. 'I didn't buy it for myself' : Privacy e-commerce personalization. In Designing Personalized User Experiences in e-Commerce, ed. C.-M. Karat, J. Blom, and J. Karat, 57–74. Dordrecht, Netherlands: Kluwer Academic Publishers.
- Cranor, L. 2005. Privacy policies and privacy preferences. In Security and Usability: Designing Secure Systems That People Can Use, ed. L. Cranor, and S. Garfinkel, 447–472. Sebastopol, CA: O'Reilly.
- Culnan, M. 2000. Protecting privacy online: Is self-regulation working? *J Publ Policy Mark* 19(1):20–26.
- Dalberg, V., E. Angelvik, D. R. Elvekrok, and A. K. Fossberg. 2006. Cross-cultural collaboration in ICT procurement. In The Proceedings of the 2006 International Workshop on Global Software Development for the Practitioner, 51–59. ACM Press.

- Davis, D., F. Monroe, and M. Reiter. 2004. On user choice in graphical password schemes. In Proceedings of the 13th USENIX Security Symposium, 151–164. Berkeley, CA: USENIX Association.
- De Angeli, A., L. Coventry, G. Johnson, and K. Renaud. 2005. Is a picture really worth a thousand words? Exploring the feasibility of graphical authentication systems. *Int J Hum Comput Stud* 63(1-2):128–152.
- de Paula, R., X. Ding, P. Dourish, K. Nies, B. Pillet, D. Redmiles, J. Ren, J. Rode, and R. Silva Filho. 2005. Symposium On Usable Privacy and Security (SOUPS), Pittsburgh, PA, USA. New York, NY: ACM Digital Library.
- Dewan, P., and H. Shen. 1998. Controlling access in multiuser interfaces. *ACM Transactions on Computer-Human Interaction*, 5(1):34–62. New York, NY: ACM Press.
- Dey, A. K., and G. D. Abowd. 2000. CybreMinder: A context-aware system for supporting reminders. In Proceedings of the International Symposium on Handheld and Ubiquitous Computing, 172–186. Berlin: Springer.
- Dhamija, R., and A. Perrig. 2000. Déjà Vu: A user study using images for authentication. In Proceedings of the 9th conference on USENIX Security Symposium, 4–13. Berkeley, CA: USENIX Association.
- Dhamija, R., and J. D. Tygar. 2005. The battle against phishing: Dynamic security skins. In Proceedings of the Symposium on Usable Privacy and Security (SOUPS). New York: ACM Digital Library.
- Dingledine, R., and N. Matherwson. 2005. Anonymity loves company: Usability and the network effect. In *Security and Usability: Designing Secure Systems That People Can Use*, ed. L. Cranor, and S. Garfinkel, 547–560. Sebastopol, CA: O'Reilly.
- Dourish, P. 1993. Culture and control in a media space. In *ECSCW'93 Proceedings of the third conference on European Conference on Computer-Supported Cooperative Work*, 125–137. Norwell, MA: Kluwer Academic Publishers.
- Egelman, S., J. Tsai, L. Cranor, and A. Acquisti. 2009. Timing is everything? The effects of timing and placement of online privacy indicators. In Proceedings of the Conference on Human Factors in Computing Systems—CHI 2009. New York: ACM Press.
- Ellison, C., and B. Schneier. 2000. Ten risks of PKI: What you're not being told about public key infrastructure. *Computer Security Journal* XVI(1):1–7.
- Everitt, K., T. Bragin, J. Fogarty, and T. Kohno. 2009. Comprehensive study of frequency, interference, and training of multiple graphical passwords. In Proceedings of the Conference on Human Factors in Computing Systems—CHI 2009, 889–898. New York: ACM Press.
- Fogg, B. J. 2003. Prominence-interpretation theory: Explaining how people assess credibility online. In Proceedings of the Conference on Human Factors in Computing Systems -CHI 2003, Extended Abstracts on Human Factors in Computing Systems, 722–723. New York: ACM Press.
- Fogg, B. J., J. Marshall, O. Laraki, A. Osipovich, C. Varma, N. Fang, J. Paul et al. 2001. What makes websites credible? A report on a large quantitative study. In Proceedings of the Conference on Human Factors in Computing Systems -CHI 2001, 61–68. New York: ACM Press.
- Fogg, B. J., C. Soohoo, D. R. Danielson, L. Marable, J. Stanford, and E. R. Tauber. 2003. How do users evaluate the credibility of websites? A study with over 2,500 participants. In Proceedings of the 2003 Conference on Designing for User Experiences, 1–15. New York: ACM Press.
- Friedman, B., P. H. Kahn, and D. C. Howe. 2000. Trust online. *CommunACM* 43(12):34–40.
- Good, N., and A. Krekelberg. 2003. A study of Kazaa P2P file-sharing. In Proceedings of the Conference on Human Factors in Computing -Systems CHI 2003, 137–144. New York: ACM Press.
- Good, N., J. B. Schafer, J. Konstan, A. Borchers, B. Sarwar, J. Herlocker, and J. Riedl. 1999. Combining collaborative filtering with personal agents for better recommendations. In Proceedings of the AAAI, 439–446. Palo Alto: American Association for Artificial Intelligence.
- Goodall, J., A. Ozok, W. Lutters, P. Rheingens, and A. Komlodi. 2005. A user-centered approach to visualizing network traffic for intrusion detection. In *CHI '05 Extended Abstracts on Human Factors in Computing Systems*, 1403–1406. New York: ACM Press.
- Grabner-Krauter, S., E. A. Kaluscha, and M. Fladnitzer. 2006. Perspectives of online trust and similar constructs: A conceptual clarification. In *Proceedings of the 8th International Conference on Electronic Commerce: The new e-commerce: Innovations for Conquering Current Barriers, Obstacles, and Limitations to Conducting Successful Business on the Internet*, 235–243. New York: ACM.
- Greenberg, S., and D. Marwood. 1994. Real time groupware as a distributed system: Concurrency control and its effect on the interface. In *Proceedings of the 1994ACM conference on Computer supported cooperative work*, 207–217. New York: ACM.
- Gutmann, P. Plug-and-Play PKI: A PKI your mother can use. In Proceedings of the 12th USENIX Security Symposium, 45–58. Berkeley, CA: USENIX Association.
- Gutmann, P. 2003. Plug-and-play PKI: A PKI your mother can use. In Proceedings of the 12th conference on USENIX Security Symposium, 4–13. CA: USENIX Association Berkeley.
- Hagan, P. R. 2000. Personalization Versus Privacy. Cambridge, MA: Forrester.
- Harper, J., and S. Singleton. 2001. *With a Grain of Salt: What Consumer Privacy Surveys Don't Tell Us*. <http://ssm.com/abstract=299930> (accessed April 2, 2010).
- Hartmann, J., A. De Angeli, and A. Sutcliffe. 2008. Framing the user experience: Information biases on website quality judgement. In *The Proceeding of the 26th Annual SIGCHI Conference on HumanFactors in Computer Systems*, 855–864. New York: ACM.
- Henning, R. 1999. Security Service Level Agreements: Quantifiable Security for the Enterprise? *New Security Paradigm Workshop*, 54–60. Ontario, Canada: IEEE.
- Helft, M., and J. Wortham. 2010. Facebook bows to pressure over privacy. *The New York Times*, BI-6.
- Herbsleb, J. D., D. L. Atkins, D. G. Boyer, M. Handel, and T. A. Finholt. 2002. Introducing instant messaging and chat in the workplace. In *Proceeding of the Conference on Human Factors in Computing Systems -CHI 2002*, 171–178. New York: ACM Press.
- Hoffman, D. L., T. P. Novak, and M. Peralta. 1999. Building consumer trust online. *Commun ACM* 42(4):80–85.
- Hong, J. I., and J. Landay. 2004. An architecture for privacy-sensitive ubiquitous computing. In *Proceedings of Mobi Sys'04*, 177–189. New York: ACM Press.
- Hong, J. I., J. D. Ng, S. Lederer, and J. Landay. 2004. Privacy risk models for designing privacy-sensitive ubiquitous computing systems. In *Proceedings of the Conference on Designing Interactive Systems -DIS'04*. New York: ACM Press.
- Horstmann, T., and R. Bentley. 1997. Distributed authoring on the web with the BSCW shared workspace system. *ACM Stand View*, ACM Press 5(1):9–16.
- Iachello, G., and G. D. Abowd. 2008. From privacy methods to a privacy toolbox: Evaluation shows that heuristics are complementary. *ACM Trans Comput Hum Interact* 15(2): 1–30.

- IBM Secure Perspective. 2007. http://www-03.ibm.com/systems/i/advantages/security/rethink_security_policy.html (accessed December 3, 2010).
- Ingleseant, P., and A. Sasse. 2010. The true cost of unusable password policies: Password use in the wild. In Proceedings of the Conference on Human Factors in Computing Systems -CHI 2010. New York: ACM Press.
- Irvine, C., and T. Levin. 1999. Toward a Taxonomy and Costing Method for Security Services. In *Proceedings of the 15th Annual Computer Security Applications Conference (ACSAC '99)*, 183–5. IEEE.
- Irvine, C., and T. Levin. 2001. Quality of security service. Proceedings of the 2000 workshop on New security paradigms, ACM Press, 91–9.
- Jensen, C., and C. Potts. 2004. Privacy policies as decision-making tools: A usability evaluation of online privacy notices. In Proceedings of the Conference on Human Factors in Computing Systems -CHI 2004, 471–478. New York: ACM Press.
- Jensen, C., C. Potts, and C. Jensen. 2005. Privacy practices of Internet users: Self-reports versus observed behavior. *Int J Hum Comput Stud* 63: 203–227.
- Jøsang, A., and S. L. Presti. 2004. Analysing the relationship between risk and trust. In The Proceedings of the Second International Conference on Trust Management, ed. T. Dimitrakos, 135–145. UK: Oxford.
- Johnson, M., J. Karat, C.-M. Karat, and K. Grueneberg. 2010a. Optimizing a policy authoring framework for security and privacy policies. In Symposium on Usable Privacy and Security (SOUPS) 2010. Redmond, WA: ACM Digital Library.
- Johnson, M., J. Karat, C.-M. Karat, and K. Grueneberg. 2010b. Usable policy template authoring for iterative policy refinement. To be presented at IEEE Policy 2010. Fairfax, VA: IEEE.
- Just, M. 2004. Designing and evaluating challenge-question systems. *IEEE Secur Privacy* 2(5):32–39.
- Kahn, D. 1967. *The Codebreakers*. New York: Macmillan.
- Kandogan, E., and E. Haber. 2005. Security administration tools and practices. In *Security and Usability: Designing Secure Systems That People Can Use*, ed. L. Cranor, and S. Garfinkel, 357–378. Sebastopol, CA: O'Reilly.
- Karat, C.-M. 1989. Iterative usability testing of a security application. In *Proceedings of the Human Factors Society*, 272–277. Santa Monica, CA: HFES.
- Karat, C.-M. 1994. A business case approach to usability cost justification. In *Cost-Justifying Usability*, ed. R. Bias, and D. Mayhew, 45–70. New York: Academic Press.
- Karat, C.-M. 2005. A business case approach to usability cost justification for the web. In *Cost-Justifying Usability: An Update for the Internet Age*, ed. R. Bias, and D. Mayhew, 103–142. San Francisco, CA: Morgan Kaufman.
- Karat, C.-M., Brodie, and J. Karat. 2005. Usability design and evaluation for privacy and security solutions. In *Security and Usability: Designing Secure Systems That People Can Use*, ed. L. Cranor, and S. Garfinkel, 47–74. Sebastopol, CA: O'Reilly.
- Karat, C.-M., and J. Karat. 2010a. Case study 2: Personalization in e-commerce. In *Designing and Evaluating Usable Technology in Industrial Research -Three Case Studies*, 31–54. New York: Morgan and Claypool Publishers.
- Karat, C.-M., and J. Karat. 2010b. Case study 3: Security and privacy policy management technologies. In *Designing and Evaluating Usable Technology in Industrial Research -Three Case Studies*, 57–87. New York: Morgan and Claypool Publishers.
- Karat, C.-M., and J. Karat. 2010c. Designing and Evaluating Usable Technology in Industrial Research: Case Studies in Speech Recognition, Personalization in E-commerce, and Security and Privacy. Lectures in Human-Centered Informatics (Jack Carroll, Series Editor). NY: Morgan-Claypool.
- Karat, J., C.-M. Karat, E. Bertino, N. Li, Q. Ni, C. Brodie, J. Lobo et al. 2009. Policy framework for security and privacy management. *IBM J Res Dev* 53(2): 1–14.
- Karat, J., C.-M. Karat, and C. Brodie. 2004. Personalizing interaction. In *Designing Personalized User Experiences in e-Commerce*, ed. C.-M. Karat, J. Blom, and J. Karat, 7–18. Dordrecht, Netherlands: Kluwer Academic Publishers.
- Karat, J., C.-M. Karat, C. Brodie, and J. Feng. 2005. Privacy in information technology: Designing to enable privacy policy management in organizations. *Int J Hum Comput Stud* 63(1–2): 153–174.
- Karat, C.-M., J. Karat, C. Brodie, and J. Feng. 2006. Evaluating interfaces for privacy policy rule authoring. In *Proceedings of the Conference on Human Factors in Computing Systems -CHI 2006*, 83–92. New York: ACM Press.
- Karat, J., W. Sieck, T. Norman, C.-M. Karat, C. Brodie, L. Rasmussen, and K. Sycara. 2009. A framework for culturally adaptive policy management in ad hoc collaborative contexts. In *Proceedings of the ACM International Workshop on Intercultural Collaboration 2009*, 1–4. Palo Alto, CA: ACM.
- Kobsa, A. 2002. Personalized hypermedia and international privacy. *Communications of the ACM* 45(5):64–67.
- Kuhlen, R. 1998. Trust: A principle for ethics and economics in the global information society. Presented at The Second UNESCO Congress for Informational Ethics, Monte Carlo, Monaco.
- Kumaraguru, P., A. Acquisti, and L. F. Cranor. 2006. Trust modeling for online transactions: A phishing scenario. In *The Proceedings of the 2006 International Conference on Privacy, Security, and Trust: Bridge the Gap Between PST Technologies and Business Services*. Markham, ON. New York: ACM Digital Library.
- Kumaraguru, P., and L. Cranor. 2005. Privacy in India: Attitudes and awareness. In *Proceedings of the 2005 Workshop on Privacy Enhancing Technologies (PET2005)*, 243–258. Dubrovnik, Croatia. Berlin: Springer.
- Lederer, S., J. Mankoff, and A. K. Dey. 2003. Who wants to know what when? Privacy preference determinants in ubiquitous computing. In *Proceedings of the Conference on Human Factors in Computing Systems -CHI 2003*, 724–725. New York: ACM Press.
- Little, L., E. Silience, and P. Briggs. 2009. Ubiquitous systems and the family: Thoughts about the networked home. In *Symposium on Usable Privacy and Security (SOUPS) 2009*. Mountain View, CA: ACM Digital Library.
- Lumsden, J. 2009. Triggering trust: To what extent does the question influence the answer when evaluating the perceived importance of trust triggers. In *The Proceedings of the 2009 British Society Conference on Human-Computer Interaction*, 214–223. Swinton, UK: British Computer Society.
- Malin, B., and L. Sweeney. 2004. How (not) to protect genomic data privacy in a distributed network: Using trail re-identification to evaluation and design anonymity protection systems. *J Biomed Inf* 37(3): 179–192.
- Mandler, G. 1991. Your face is familiar but I can't remember your name: A review of Dual Process Theory, Relating Theory and Data. *J Exp Psychol Learn Memory Cognit* 11: 207–225.
- Mannan, M., and P. C. van Oorschot. 2008. Privacy-enhanced sharing of personal content on the web. In *The Proceedings of the 2008 Conference on the World Wide Web*, 487–496. New York: ACM.

- Mantei, M. M., R. M. Baecker, A. J. Sellen, W. A. S. Buxton, T. Milligan, and B. Wellman. 1991. Experiences in the use of a media space. In Proceedings of the Conference on Human Factors in Computing Systems -CHI'91, 203–208. New York: ACM Press.
- Marsh, S., and M. Dibben. 2003. The role of trust in information science and technology. In Annual Review of Information Science and Technology, ed. B. Cronin, Vol. 37, 465–498.
- Maxion, R., and R. Reeder. Improving user-interface dependability through mitigation of human error. *Int J Hum Comput Stud*, Volume 63, Issues 1–2, July 2005, 25–50.
- Meyer, S., and A. Rakotonirainy. 2003. A survey of research on context-aware homes. In Proceedings of the Australasian information security workshop conference on ACSW frontiers 2003, Vol. 21, 159–168. Darlinghurst, Australia: Australian Computer Society, Inc.
- Milberg, S. J., S. J. Burke, H. J. Smith, and E. A. Kallman. 1995. Values, personal information privacy, and regulatory approaches. *Commun ACM* 38(12): 65–74.
- Miller, R., and M. Wu. 2005. Fighting phishing at the user interface. In Security and Usability: Designing Secure Systems That People Can Use, ed. L. Cranor, and S. Garfinkel, 275–292. Sebastopol, CA: O'Reilly.
- Monrose, F., and M. Reiter. 2005. Graphical password systems. In Security and Usability: Designing Secure Systems That People Can Use, ed. L. Cranor, and S. Garfinkel, 157–174. Sebastopol, CA: O'Reilly.
- Ni, Q., E. Bertino, C. Brodie, C.-M. Karat, J. Karat, J. Lobo, and A. Trombetta. 2008. Privacy-aware role based access control. *ACM Trans Comput Logic* 16(8): 1–35.
- Office of the Federal Privacy Commissioner of Australia. 2000. Privacy and Business. Retrieved 2008, from <http://www.privacy.gov.au>.
- Opsahl, K. *Facebook's Eroding Privacy Policy: A Timeline*, <http://www.eff.org/deeplinks/2010/04/facebook-timeline> (accessed April 28, 2010).
- Palen, L., and P. Dourish. 2003. In Proceedings of the SIGCHI conference on Human factors in computing systems—CHI 2003, 129–136. New York: ACM Press.
- Palmer, J. W., J. P. Bailey, and S. Faraj. 2000. The role of intermediaries in the development of trust on the WWW: The use and prominence of trusted third parties and privacy statements. *J Comput Mediat Commun* 5(3). <http://jcmc.indiana.edu/vol5/issue3/palmer.html> (accessed September 12, 2010).
- Patrick, A., P. Briggs, and S. Marsh. 2005. Designing systems that people will trust. In Security and Usability: Designing Secure Systems That People Can Use, ed. L. Cranor, and S. Garfinkel, 75–100. Sebastopol, CA: O'Reilly.
- Peacock, A., X. Ke, and M. Wilkerson. 2005. Identifying users from their typing patterns. In Security and Usability: Designing Secure Systems That People Can Use, ed. L. Cranor, and S. Garfinkel, 199–220. Sebastopol, CA: O'Reilly.
- Pettersson, J. H., S. Fischer-Huebner, N. Danielsson, J. Nilsson, M. Bergmann, S. Clauss, T. Kriegelstein, and H. Krasemann. 2004. Making PRIME usable. In Proceedings of the Symposium on Usable Privacy and Security. New York: ACM Digital Library.
- Piazzalunga, U., P. Salvaneschi, and P. Coffetti. 2005. The usability of security devices. In Security and Usability: Designing Secure Systems That People Can Use, ed. L. Cranor and S. Garfinkel, 221–244. Sebastopol, CA: O'Reilly.
- Pirolli, P., E. Wollny, and B. Suh. 2009. So you know you're getting the best possible information: A tool that increases wikipedia credibility. In The Proceedings of the Twenty-Seventh Annual SIGCHI Conference on Human Factors in Computing Systems, 1505–1508. New York: ACM.
- Price, B. A., K. Adam, and B. Nuseibeh. 2005. Keeping ubiquitous computing to yourself: A practical model for user control of privacy. *Int J Hum Comput Stud* 63(1-2):228–253.
- PRIME. 2008. <https://www.prime-project.eu/> (accessed September 12, 2010).
- Quinones, P.-A., S. R. Fussell, L. Soibelman, and B. Akinci. 2009. Bridging the gap: Discovering mental models in globally collaborative contexts. In The Proceedings of the 2009 International Workshop on Intercultural Collaboration, 101–110. New York: ACM.
- Real User Corporation. 2002. *The Science behind Passfaces*. <http://www.realuser.com/published/ScienceBehindPassfaces.pdf> (accessed January 23, 2010).
- Reiter, M., and A. Rubin. 1998. Crowds: Anonymity for web transactions. *ACM Trans Inf Syst Secur* 1(1): 66–92.
- Renaud, K. 2005. Evaluating authentication mechanisms. In Security and Usability: Designing Secure Systems That People Can Use, ed. L. Cranor, and S. Garfinkel, 103–128. Sebastopol, CA: O'Reilly.
- Saltzer, J., and M. Schroeder. 1975. The protection of information in computer systems. *Proc IEEE* 63(9):1278–1308.
- Sasse, A., and I. Flechais. 2005. Usable security: Why do we need it? How do we get it? In Security and Usability: Designing Secure Systems That People Can Use, ed. L. Cranor, and S. Garfinkel, 13–30. Sebastopol, CA: O'Reilly.
- Schultz, C. D. 2006. A trust framework model for situational contexts. In The Proceedings of the 2006 International Conference on Privacy Security, and Trust: Bridge the Gap Between PST Technologies and Business Services, 50. New York: ACM.
- Schneirer, B., and Mudge. 1998. Cryptanalysis of Microsoft's point-to-point tunneling protocol (PPTP). In Proceedings of the 5th ACM conference on Computer and communications security, 132–141. New York: ACM Press.
- Senior, A., S. Pankanti, A. Hampapur, L. Brown, Y. Tian, and A. Ekin. 2003. Blinkering surveillance: Enabling video privacy through computer vision. *IBM Res Rep RC22886* (W0308–109), 1–9.
- Shankar, U., K. Talwar, J. Foster, and D. Wagner. 2001. Detecting format string vulnerabilities with type qualifiers. In Proceedings of the 10th conference on USENIX Security Symposium, 16–23. Berkeley, CA: USENIX Association Berkeley.
- Sillence, E., P. Briggs, L. Fishwick, and P. Harris. 2004. Trust and mistrust of online health sites. In Proceedings of the Conference on Human Factors in Computing Systems—CHI 2004, 663–670. New York: ACM Press.
- Smith, H. 1993. Privacy policies and practices: inside the organizational maze. In Communications of the ACM, 36(12):104–122. New York: ACM.
- Spiekermann, S., J. Grossklags, and B. Berendt. 2001. E-privacy in 2nd generation e-commerce: Privacy preferences versus actual behavior. In Proceedings of the ACM conference on Electronic Commerce, 38–47. New York: ACM.
- Strater, K., and H. R. Lipford. 2008. Strategies and struggles with privacy in an online social networking community. In The Proceedings of the 22nd British HCI Group Conference on HCI 2008: People and Computers XXII: Culture, Creativity, Interaction -Volume 1, 111–119. Swinton, UK: British Computer Society, Inc.
- Stutzman, F., and J. F. Karamer-Duffield. 2010. Only: Examining a privacy-enhancing behavior in facebook. In Proceedings of the 28th International Conference on Human Factors in Computing Systems, 1553–1562. New York: ACM.
- Suh, B., E. H. Chi, A. Kittur, and B. Pendleton. 2008. Lifting the veil: Improving accountability and social transparency in wikipedia with wikiDashboard. In The Proceedings of the Twenty-Sixth Annual SIGCHI Conference on Human Factors in Computing Systems, 1037–1040. New York: ACM.

- Sweeney, L. 2002. k-Anonymity: A model for protecting privacy. *Int J Uncertainty Fuzziness Knowl Based Syst* 10(5):557–570.
- Teltzrow, M., and A. Kobsa. 2004. Impacts of user privacy preferences on personalized systems. In *Designing Personalized User Experiences in e-Commerce*, ed. C.-M. Karat, J. Blom, and J. Karat. Dordrecht, Netherlands: Kluwer Academic Publishers.
- Thomsen, D., and M. Denz. 1997. Incremental Assurance for Multilevel Applications. In *Proc 13th Annual Computer Security Applications Conference*. IEEE.
- Thuraisingham, B. 2002. Data mining, national security, privacy and civil liberties. *ACM SIGKDD Explor Newsltt* 4(2):1–5.
- Turow, J. 2003. *Americans and Online Privacy: The System is broken*. Philadelphia: Annenberg Public Policy Center.
- Wagner, D., J. Foster, E. Brewer, and A. Aiken. 2000. A First Step Toward Automated Detection of Buffer Overrun Vulnerabilities. In *Proceedings of the Network and Distributed System Security Symposium*. New York: ACM Digital Library.
- Want, R., A. Hopper, V. Falcão, and J. Gibbons. 1992. The active badge location system. *ACM Trans Inf Syst* 10(1):91–102.
- Weiser, M. 1991. The computer for the twenty-first century. *Sci Am* 264:94–104.
- Welty, B., and I. Becerra-Fernandez. 2001. Managing trust and commitment in collaborative supply chain relationships. In *Communications of the ACM*, 44(6):67–73. New York: ACM.
- Wiedenbeck, S., J. Waters, J. Birget, A. Brodskiy, and N. Memon. 2005. PassPoints: Design and longitudinal evaluation of a graphical password system. *Int J Hum Comput Stud* 63(1–2): 102–127.
- Whitten, A., and D. Tygar. 1999. Why Johnny can't encrypt: A usability evaluation of PGP 5.0. In *Proceedings of the 8th USENIX Security Symposium*, 169–184. Berkeley, CA: USENIX.
- Yan, J., A. Blackwell, R. Anderson, and A. Grant. 2005. The memorability and security of passwords. In *Designing Secure Systems that People Can Use*, ed. L. Cranor and S. Garfinkel, 129–142. O'Reilly.
- Yee, K. P. 2002. User interaction design for the design of secure systems. Springer Lecture Notes in Computer Science, 2002, Volume 2513/2002, 278–90. Berlin: Springer.
- Yenisey, M., A. Ozok, and G. Salvendy. 2005. Perceived security determinants in e-commerce among Turkish university students. *Behav Inf Technol* 24(4):259–274.
- Zhang, J., and A. A. Ghorbani. 2004. Familiarity and trust: Measuring familiarity with a website. In *Proceedings of the Second Annual Conference on Privacy Security, and Trust*, 23–28. Toronto, Canada: National Research Council of Canada.
- Zurko, M., and R. Simon. 1996. User-centered security. In *NSPW96 New Security Paradigms Workshop V*. September 17–20, 27–33. Lake Arrowhead, CA, USA: ACM Press.

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- Acosta, D., V. Patkar, M. Keshtgar, and J. Fox. 2010. Challenges in delivering decision support systems: The MATE experience. In *Knowledge Representation for Healthcare. Data, Processes and Guidelines*, Vol. 5943, ed. D. Riano, A. T. Teije, S. Miksch, and M. Peleg, 124–140. Berlin/Heidelberg: Springer. Print. Lecture Notes in Computer Science.
- Adams, W. G., A. M. Mann, and H. Bauchner. 2003. Use of an electronic medical record improves the quality of urban pediatric primary care. *Pediatrics* 111: 626–632.
- Adnan, M., J. Warren, and M. Orr. 2009. Enhancing patient readability of discharge summaries with automatically generated hyperlinks. *Health Care Inf Rev Online* 13:21–27. http://www.hinz.org.nz/uploads/file/Journal_Dec09/Adnan_P21.pdf (accessed March 19, 2011).
- Adnan, M., J. Warren, M. Orr, A. Ewens, J. Scott, and S. Trubshaw. 2010. The quality of electronic discharge summaries for post-discharge care: Hospital panel assessment and IT to support improvement. *Health Care and Inf Rev Online* 14:8–17. http://www.hinz.org.nz/uploads/file/Journal_Dec10/Adnan_P8.pdf (accessed March 19, 2011).
- American Recovery and Reinvestment Act. 2009. [Recovery.gov.frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=111_cong_bills&docid=f:h1enr.pdf](http://recovery.gov/frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=111_cong_bills&docid=f:h1enr.pdf) (accessed March 2, 2011).
- Anderson, J., and E. Balas. 2006. Computerization of primary care in the United States. *Int J Health Inform Syst* 1: 1–23.
- Anvari, M., C. McKinley, and H. Stein. 2005. Establishment of the world's first telerobotic remote surgical service for provision of advanced laparoscopic surgery in a rural community. *Ann Surg* 241: 460–464.
- Bates, D. W., D. L. Boyle, and J. M. Teich. 1994. Impact of computerized physician order entry on physician time. In Paper presented at the Annual Symp Comput Appl Med Care. Bethesda, MD: AMIA.
- Bates, D. W., M. Cohen, L. L. Leape, M. Overhage, M. M. Shabot, and T. Sheridan. 2001. Reducing the frequency of errors in medicine using information technology. *JAMIA* 8(4):299–308.
- Bates, D. W., J. M. Teich, J. Lee, D. Seger, G. J. Kuperman, N. I. Ma'Luf, D. Boyle, and L. Leape. 1999. The impact of computerized physician order entry on medication error prevention. *J Am Med Inform Assoc* 6(4):313–321.
- Bekker, H. L., J. Hewison, and J. G. Thornton. 2003. Understanding why decision aids work: Linking process with outcome. *Patient Educ Couns* 50: 323–329.
- Benton Foundation. 1999. *Networking for Better Care: Health Care in the Information Age*. <http://www.benton.org/Library/health/> (accessed December 5, 2001).
- BlueCross BlueShield Association. 2008. Medical cost reference guide. <http://www.bcbs.com/blueresources/mrcg/> (accessed February 22, 2011).
- Blumenthal, D. 2009. The Federal Role in Promoting Health Information Technology. New York: The Commonwealth Fund Perspectives on Health Reform. <http://www.commonwealthfund.org/Content/Publications/Perspectives-on-Health-Reform-Briefs/2009/Jan/The-Federal-Role-in-Promoting-Health-Information-Technology.aspx> (accessed March 2, 2011).
- Boonstra, A., and M. Broekhuis. 2010. Barriers to the acceptance of electronic medical records by physicians from systematic review to taxonomy and interventions. *BMC Health Serv Res* 10(1):231. <http://www.biomedcentral.com/1472-6963/10/231> (accessed March 1, 2011).
- Booske, B. C., and F. Sainfort. 1998. Relationships between quantitative and qualitative measures of information use. *Int J Hum Comput Interact* 10(1):1–21.
- Boulos, K., I. Maramba, and S. Wheeler. 2006. Wikis, blogs and podcasts: a new generation of web-based tools for virtual collaborative clinical practice and education. *BMC Medical Education* 6(1):1–8.

- Branstetter, B. F. 2007. Basics of imaging informatics: Part 11. *Radiology* 243(3):656–667. doi:10.1148/radiol.2433060243.
- Carswell, C. M., and C. Ramzy. 1997. Graphing small data sets: Should we bother? *Behav Inf Technol* 16(2):61–70.
- Chassin, M. R., and R. W. Galvin, The National Roundtable on Health Care Quality. 1998. The urgent need to improve health care quality. *JAMIA* 280(11):1000–1005.
- Chaudhry, S. I., J. A. Mattera, J. P. Curtis, J. A. Spertus, J. Herrin, Z. Lin, and H. M. Krumholz. 2010. Telemonitoring in patients with heart failure. *N Engl J Med* 363(24):2301–2309. doi:10.1056/NEJMoa1010029
- Cheng, C. H., M. K. Goldstein, E. Geller, and R. E. Levitt. 2003. The Effects of CPOE on ICU workflow: An observational study. In AMIA Annual Symposium, 150–244. Washington, DC: AMIA.
- Cohen, S. B., K. D. Grote, W. E. Pietraszek, and F. Laflamme. 2010. Increasing consumerism in healthcare through intelligent information technology. *Am J Manag Care* 16, SP37–P43. http://www.ajmc.com/media/pdf/AJMC_10decHIT_CohenSP37to43.pdf (accessed March 14, 2011).
- Congressional Budget Office. 2007. *The Long-Term Outlook for Health Care Spending*. <http://www.cbo.gov/ftpdocs/87xx/doc8758/MainText.3.1.shtml> (accessed February 22, 2011).
- Cordero, L., L. Kuehn, R. R. Kumar, and H. S. Mekhjian. 2004. Impact of computerized physician order entry on clinical practice in a newborn intensive care unit. *J Perinatology* 24(2):88–93.
- Dahlberg, T. 1991. Effectiveness of report format and aggregation: An approach to matching task characteristics and the nature of formats. In *Acta Academie Oeconomiae Helsingiensis Series A*:76. Helsinki, Finland: Helsinki School of Economics and Business Administration.
- Davis, F. D., R. P. Bagozzi, and P. R. Warshaw. 1999. User acceptance of computer technology: A comparison of two theoretical models. *Manage Sci* 35: 982–1003.
- Edwards, P. J., K. P. Moloney, J. A. Jacko, and F. Sainfort. 2008. Evaluating usability of a commercial electronic health record: A case study. *Int J Hum Comput Stud* 66(10):701–758.
- Ereso, A. Q., P. Garcia, E. Tseng, G. Gauger, H. Kim, M. M. Dua, G. P. Victorino, and T. S. Guy. 2010. Live transference of surgical subspecialty skills using telerobotic proctoring to remote general surgeons. *J Am Coll Surg* 211(3):400–411. <http://www.journalacs.org/article/S1072-7515%2810%2900374-1/> abstract (accessed March 14, 2011).
- Eysenbach, L. et al. eds. 2005. Design and evaluation of consumer health information web sites. *Consumer Health Informatics* 34–60.
- Eysenbach, G. 2005. Design and evaluation of consumer health information web sites consumer health informatics. In Lewis, D., Eysenbach, G., Kukafka, R., Stavri, P. Z., Jimison, H. B., Hannah, K. J., Ball, M. J., Hannah, K. J., and Ball, M. J., eds., *Consumer Health Informatics, Health Informatics*, 34–60. New York: Springer.
- Felder, R. M. 1996. Matters of Style. *ASEE Prism* 6(4):18–23.
- Ferguson T. 1997. Health online and the empowered medical consumer. *Jt Comm J Qual Improv* 23(5):251–257. PubMed PMID: 9179717.
- Fox, S. 2006. Online Health Search 2006 | Pew Research Center's Internet & American Life Project. Pew Research Center's Internet & American Life Project. <http://www.pewinternet.org/Reports/2006/Online-Health-Search-2006.aspx> (accessed March 14, 2011).
- Gardner, R. M., and M. Shabot. 2001. Patient monitoring systems. In *Medical informatics: Computer applications in health care and biomedicine*, 2nd ed., ed. E. H. Shortliffe, L. E. Perreault, G. Wiederhold, and L. Fagan, 443–484. New York: Springer.
- Gibbons, M. C., R. F. Wilson, L. Samal, C. U. Lehmann, K. Dickersin, H. P. Lehmann, H. Aboumatar et al. 2009. *Impact of Consumer Health Informatics Applications*. Evidence Report/Technology Assessment No. 188. (Prepared by Johns Hopkins University Evidence-based Practice Center under contract No. HHSA 290-2007-10061-I). AHRQ Publication No. 09(10)-E019. Rockville, MD: Agency for Healthcare Research and Quality.
- Goldsmith, J. 2004. Technology and the boundaries of the hospital: Three emerging technologies. *Health Affairs* 23(6):149–156. doi:10.1377/hlthaff.23.6.149.
- Greenes, R. A., and J. F. Brinkley. 2001. Imaging systems. In *Medical informatics: Computer applications in health care and biomedicine*, 2nd ed., ed. E. H. Shortliffe, L. E. Perreault, G. Wiederhold, and L. Fagan, 485–538. New York: Springer.
- Gustafson, D. H., R. Hawkins, E. Boberg, S. Pingree, R. E. Serlin, F. Graziano, and C. L. Chan. 1999. Impact of a patient-centered, computer-based health information/support system. *Am J Prev Med* 16(1):1–9.
- Gustafson, D. H., R. Hawkins, S. Pingree, F. McTavish, N. K. Arora, J. Mendenhall, D. F. Cella et al. 2001. Effect of computer support on younger women with breast cancer. *J Gen Intern Med*. 16(7):435–445.
- Han, Y. Y., J. A. Carcillo, S. T. Venkataraman, R. S. B. Clark, R. S. Watson, T. C. Nguyen, H. Bayir, and R. A. Orr. 2005. Unexpected increased mortality after implementation of a commercially sold computerized physician order entry system. *Pediatrics* 116(6):1506–1512.
- Harris, J. 1995. Consumer health information demand and delivery: A preliminary assessment. In *Partnerships for Networked Health Information for the Public*. Rango Mirage, California. Summary Conference Report. Office of Disease Prevention and Health Promotion, U.S. Department of Health and Human Services, Washington, DC 20201.
- Health Edge - Watch. 2011. Cleveland Clinic. http://my.clevelandclinic.org/h.ealth_edge/vodcasts.aspx (accessed March 14, 2011).
- Hibbard, J. H., P. Slovic, and J. J. Jewett. 1997. Informing consumer decisions in health care: Implications from decision-making research. *Milbank Q* 75(3):395–414.
- Hoffman, C., D. P. Rice, and H. Y. Sung. 1996. Persons with chronic conditions: Their prevalence and costs. *JAMA* 276(18):1473–1479.
- Holden, R. J. 2010. Physicians' beliefs about using EMR and CPOE: In pursuit of a contextualized understanding of health IT use behavior. *Int J Med Inf* 79(2):71–80. doi: 10.1016/j.ijmedinf.2009.12.003.
- Huang, H. K. 2010. *PACS and Imaging Informatics Basic Principles and Applications*, 2nd ed. Hoboken, NJ: Wiley-Blackwell.
- Hughes, B., I. Joshi, H. Lemonde, and J. Wareham. 2009. Junior physician's use of web 2.0 for information seeking and medical education: A qualitative study. *Int J Med Inf* 78(10):645–655.
- Inglis, S. C., R. A. Clark, F. A. McAlister, J. Ball, C. Lewinter, D. Cullington, S. Stewart, and J. G. Cleland. 2010. Structured telephone support or telemonitoring programmes for patients with chronic heart failure. *Cochrane Database Syst Rev* 8:CD007228. Review. PubMed PMID: 20687083.
- Institute of Medicine. 2000. *To err is Human: Building a Safer Health System*. Washington, DC: National Academy Press.
- Institute of Medicine. 2001. *Crossing the quality chasm: A new health system for the 21st century*. Washington, DC: National Academy Press.
- Jacko, J. A. 2011. Narrow the gap in health literacy. *Nature* 470: 328.
- Jacko, J. A., A. Sears, and S. J. Sorensen. 2001. A framework for usability: Healthcare professionals and the Internet. *Ergonomics* 44(11):989–1007.

- Jadad, A. R., and A. Gagliardi. 1998. Rating health information on the Internet: Navigating to knowledge or to Babel? *JAMA* 279(8):611–614.
- Jarvenpaa, S. L., and G. W. Dickson. 1988. Graphics and managerial decision making: Research based guidelines. *Commun ACM* 31(6):764–774.
- John, D. R., and C. A. Cole. 1986. Age differences in information processing: Understanding deficits in young and elder consumers. *J Consum Res* 13(12):297–315.
- Johnson, M. M. S. 1990. Age differences in decision making: A process methodology for examining strategic information processing. *J Gerontology* 45(2):75–78.
- Johnson, E. J., J. W. Payne, and J. R. Bettman. 1988. Information displays and preference reversals. *Organ Behav Hum Decis Processes* 42: 1–21.
- Junglas, I., C. Abraham, and B. Ives. 2009. Mobile technology at the frontlines of patient care: Understanding fit and human drives in utilization decisions and performance. *Decis Support Syst* 46(3): 634–647. doi: 10.1016/j.dss.2008.11.012.
- Kadmon, G., E. Bron-Harlev, E. Nahum, O. Schiller, G. Haski, and T. Shonfeld. 2009. Computerized order entry with limited decision support to prevent prescription errors in a PICU. *Pediatrics* 124(3):935–940. doi:10.1542/peds.2008-2737.
- Kaelber, D. C., S. Shah, A. Vincent, E. Pan, J. Hook, D. Johnston, D. Bates, and B. Middleton. 2008. *The Value of Personal Health Records*. Center for Information Technology Leadership. Charleston: Mass.
- Karsh, B., J. W. Beasley, M. E. Hagenauer, and F. Sainfort. 2001. Do electronic medical records improve the quality of medical records? In *Systems, Social and Internationalization Design Aspects of Human-Computer-Interaction*, ed. M. J. Smith, and G. Salvendy, 908–912. Mahwah, NJ: Lawrence Erlbaum Associates.
- Keselman A., T. Tse, J. Crowell, A. Browne, L. Ngo, and Q. Zeng. 2007. Assessing consumer health vocabulary familiarity: An exploratory study. *J Med Internet Res* 9(1):e5. <http://www.jmir.org/2007/1/e5/> (accessed March 19, 2011).
- Kvedar, J. 2008. Community Healthcare Discussion Report. Center for Connected Health. www.connected-health.org/media/213517/obama%20transition%20team%20recommendations.pdf. Retrieved 4 November 2011.
- Koppel, R., J. P. Metlay, A. Cohen, B. Abaluck, A. R. Localio, S. E. Kimmel, and B. L. Strom. 2005. Role of computerized physician order entry systems in facilitating medication errors. *JAMA* 293(10):1197–1203.
- Krapichler, C., M. Haubner, A. Losch, D. Schuhmann, M. Seemann, and K. H. Englmeier. 1999. Physicians in virtual environments—Multimodal human-computer interaction. *Interact Comput* 11: 427–452.
- Krohn, R. 2008. Health information exchanges—what's working? *J Healthc Inf Manag* 22(3):7–8. PubMed PMID:19267023.
- Kumar, S., and C. Chandra. 2001. A healthy change. *IIE Solutions* 33(3):29–33.
- Kuperman, G. J., A. Bobb, T. H. Payne, A. J. Avery, T. K. Gandhi, G. Burns, D. C. Classen, and D. W. Bates. 2007. Medication-related clinical decision support in computerized provider order entry systems: A review. *J Am Med Inf Assoc* 14: 29–40.
- Legler, J. D., and R. Oates. 1993. Patients' reactions to physician use of a computerized medical record system during clinical encounters. *J Family Pract* 37(3):241–244.
- Lindberg, D. A. B., and B. L. Humphreys. 1998. Medicine and health on the Internet: The good, the bad, and the ugly. *JAMA* 280(15):1303–1304.
- Linzer, M., T. R. Konrad, J. Douglas, J. E. McMurray, D. E. Pathman, E. S. Williams, M. D. Schwartz et al. 2000. Managed care, time pressure, and physician job satisfaction: Results from the physician worklife study. *J Gen Int Med* 15(7):441–450.
- Llewellyn-Thomas, H. A., M. J. McGreal, and E. C. Thiel. 1995. Cancer patients' decision making and trial-entry preferences: The effects of "framing" information about short-term toxicity and long-term survival. *Med Decis Making* 15(1):4–12.
- Lyman, J. A., W. F. Cohn, M. Bloomrosen, and D. E. Detmer. 2010. Clinical decision support: Progress and opportunities. *JAMIA* 17(5):487–492.
- Mark, T. L., G. Johnson, B. Fortner, and K. Ryan. 2008. The benefits and challenges of using computer-assisted symptom assessments in oncology clinics: results of a qualitative assessment. *Technol Cancer Res Treat* 7(5):401–406.
- Masterson, L. 2008. Two phrases from AHIP: Consumerism and interactivity. *HealthLeaders Media for Healthcare Executives—HealthLeaders Media*. <http://healthplans.hcp.com/print/HEP-214109/Two-Phrases-from-AHIPConsumerism-and-Interactivity> (accessed February 18, 2011).
- Mekhjian, H. S., R. R. Kumar, L. Kuehn, T. D. Bentley, P. Teater, A. Thomas et al. 2002. Immediate benefits realized following implementation of physician order entry at an academic medical center. *JAMIA* 9(5):529–539.
- Mittman, R., and M. Cain. 1999. *The Future of the Internet in Health Care*. Oakland, CA: California Healthcare Foundation.
- Molenaar, S., M. A. G. Sprangers, F. C. E. Postma-Schuit, E. J. T. Rutgers, J. Noorlander, J. Hedriks, and H. De Haes. 2002. Feasibility and effects of decision aids. *Med Decis Making* 20(1):112–127.
- Murray, C. J. L., D. Phil, and J. Frenk. 2010. Ranking 37th—measuring the performance of the U.S. health care system. *Health policy and reform. N Engl J Med*. <http://healthpolicyandreform.nejm.org/?p=2610>. (accessed February 22, 2011).
- Murray, P. J., and M. A. Rizzolo. 1997. Reviewing and evaluating websites—some suggested guidelines. *Nursing Stand Online* 11(45). <http://www.nursing-standard.co.uk/vol11-45/olart.htm> (accessed July 30, 1997).
- Musen, M. A., Y. Shahar, and E. H. Shortliffe. 2006. Clinical decision-support systems. In *Biomedical Informatics*, 2nd ed., ed. E. H. Shortliffe and J. J. Cimino, 698–736. New York: Springer. http://dx.doi.org/10.1007/0-387-36278-9_20. (accessed February 22, 2011).
- Myers, I. B. 1987. *Introduction to Type*. Palo Alto, CA: Consulting Psychologists Press.
- National Alliance for Health Information Technology. 2008. Office of the National Coordinator for Health Information Technology. Defining Key Health Information Technology Terms. United States Department of Health and Human Services. www.hhs.gov/healthit/documents/m20080603/10_2_hit_terms.pdf (accessed March 19, 2011).
- National Research Council (U.S.). 2000. *Committee on Enhancing the Internet for Health and Biomedical Applications: Technical Requirements and Implementation Strategies. Networking Health: Prescriptions for the Internet*. Washington, DC: National Academy Press.
- Nugent, R. 2008. Chronic diseases in developing countries: Health and economic burdens. *N Y Acad Sci* 1136: 70–79.
- O'Connor, A. M. 1999. Consumer/patient decision support in the new millennium: Where should our research take us? *Can J Nursing Res* 30(4):257–261.
- O'Connor, A. M., A. Rostom, V. Fiset, J. Tetroe, V. Entwistle, H. A. Llewellyn-Thomas, M. Homes-Rovner, M. Barry, and J. Jones. 1999. Decision aids for patients facing health treatment or screening decisions: Systematic review. *Br Med J* 18: 731–734.

- O'Connor, A. M., D. Stacey, V. Entwistle, H. A. Llewellyn-Thomas, D. Rovner, M. Holmes-Rovner, V. Tait et al. 2003. *The Cochrane Database of Systematic Reviews: Decision Aids for People Facing Health Treatment or Screening Decisions*. The Cochrane Library. <http://gateway1.ovid.com:80/ovidweb.cgi>. (accessed March 14, 2011).
- Office of the National Coordinator for Health Information Technology. 2011. http://healthit.hhs.gov/portal/server.pt/community/healthit_hhs_gov__hitech_programs/1487 (accessed March 23, 2011).
- Orman, L. 1983. Information independent evaluation of information systems. *Inf Manage* 6: 309–316.
- Osheroff, J. A., J. M. Teich, B. Middleton, E. B. Steen, A. Wright, and D. E. Detmer. 2007. A roadmap for national action on clinical decision support. *J Am Med Inf Assoc* 14(2):141–145. doi:10.1197/jamia.M2334.
- Overhage, J. M., W. M. Tierney, X.-H. Zhou, and C. J. McDonald. 1997. A randomized trial of “corollary orders” to prevent errors of omission. *J Am Med Inform Assoc* 4(5):364–375.
- Patel, V. L., J. F. Arocha, and D. R. Kaufman. 2001. A primer on aspects of cognition for medical informatics. *JAMIA* 8(4):324–343.
- Patel, V. L., A. W. Kushniruk, S. Yang, and J. F. Yale. 2000. Impact of a computer-based patient record system on data collection, knowledge organization, and reasoning. *JAMIA* 7(6):569–585.
- Patrick, K., and S. Koss. 1995. Consumer health information “white paper”(draft). Consumer Health Education Subgroup. Committee on Applications and Technology. Information Infrastructure Task Force.
- Patrick, K., and S. Koss. 1995. Consumer health information “White Paper.” Consumer Health Information Subgroup, Health Information and Application Working Group, Committee on Applications and Technology, Information Infrastructure Task Force. Working Draft.
- Payne, J. W. 1976. Task complexity and contingent processing in decision making: An information search and protocol analysis. *Organ Behav Hum Perform* 16: 366–387.
- Pedersen, C. A., and K. F. Gumpert. 2008. ASHP national survey on informatics: assessment of the adoption and use of pharmacy informatics in U.S. hospitals, 2007. *Am J Health Syst Pharm* 65: 2244–2264.
- Potts, A. L., F. E. Barr, D. F. Gregory, L. Wright, and N. R. Patel. 2004. Computerized physician order entry and medication errors in a pediatric critical care unit. *Pediatrics* 113(1):59–63.
- Ralston, J. D., D. Carrell, R. Reid, M. Anderson, M. Moran, and J. Hereford. 2007. Patient web services integrated with a shared medical record: Patient use and satisfaction. *J Am Med Inform Assoc* 14(6):798–806.
- Robinson, T. N., K. Patrick, T. R. Eng, and D. Gustafson. 1998. An evidence-based approach to interactive health communication: A challenge to medicine in the information age. *Journal of the American Medical Association* 280(14):264–1269. doi:10.1001/jama.280.14.1264
- Riggio, J. M., R. Sorokin, E. D. Moxey, P. Mather, S. Gould, and G. C. Kane. 2009. Effectiveness of a clinical-decision-support system in improving compliance with cardiac-care quality measures and supporting resident training. *Acad Med* 84(12):1719–1726.
- Rosenberg, S. N., T. L. Shnaijen, A. A. Wegh, and I. A. Juster. 2008. Supporting the patient's role in guideline compliance: A controlled study. *Am J Manag Care* 14(11):737–744.
- Sainfort, F., and B. C. Booske. 1996. Role of information in consumer selection of health plans. *Health Care Financ Rev* 18(1):31–54.
- Schkade, D. A., and D. N. Kleinmuntz. 1994. Information displays and choice processes: Differential effects of organization, form, and sequence. *Organ Behav Hum Decis Processes* 57: 319–337.
- Schoen, C., K. Davis, R. Osborn, and R. Blendon. 2000. Commonwealth Fund 2000 International Health Policy Survey of Physicians' Perspectives on Quality. New York: Commonwealth Fund.
- Scott, G. C., and L. A. Lenert. 1998. Extending Contemporary Decision Support System Designs to Patient-Oriented Systems. Orlando, FL: Paper presented at the American Medical Informatics Association.
- Shackel, B. 1991. Usability—context, framework, definition, design and evaluation. In *Human Factors for Informatics Usability*, ed. B. Shackel, and S. Richardson, 376–380. Cambridge, UK: Cambridge University Press.
- Silberg, W. M., G. D. Lundberg, and R. A. Musacchio. 1997. Assessing, controlling, and assuring the quality of medical information on the Internet: Caveat lector et viewor—let the reader and viewer beware. *JAMA* 277(15):1244–1245.
- Shim, J. P., M. Warkentin, J. F. Courtney, D. J. Power, R. Sharda, and C. Carlsson. 2002. Past, present, and future of decision support technology. *Decis Support Syst* 33: 111–126.
- Shu, K., D. Boyle, C. D. Spurr, J. Horsky, H. Heiman, and P. O'Connor et al. 2001. Comparison of time spent writing orders on paper with computerized physician order entry. *Medinfo* 10(Pt 2):1207–1211.
- Slocum, J. W., and D. Hellriegel. 1983. A look at how manager's minds work. *Bus Horiz* 26: 58–68.
- Slovic, P. 1995. The construction of preference. *Am Psychologist* 50(5):364–371.
- Sneha, S., and U. Varshney. 2009. Enabling ubiquitous patient monitoring: Model, decision protocols, opportunities and challenges. *Decis Support Syst* 46(3):606–619. doi:10.1016/j.dss.2008.11.014.
- Sonnenberg, F. A. 1997. Health information on the Internet: Opportunities and pitfalls. *Arch Intern Med* 157: 151–152.
- Stacey, D., C. L. Bennett, M. J. Barry, N. F. Col, K. B. Eden, M. Holmes-Rovner, H. Llewellyn-Thomas, A. Lyddiatt, F. Légaré, and R. Thomson. 2011. Decision aids for people facing health treatment or screening decisions. *Cochrane Database of Systematic Reviews* 10(CD001431). doi:10.1002/14651858.CD001431.pub3
- The National Committee for Quality Assurance. 2011. Health plan report card. <http://reportcard.ncqa.org/plan/external/Plansearch.aspx> (accessed March 19, 2011).
- Todd, P., and I. Benbasat. 2001. An experimental investigation of the impact of computer based decision aids on decision making strategies. *Inf Syst Res* 2(2):87–115.
- Togo, D. F., and J. N. Hood. 1992. Quantitative information presentation and gender: An interaction effect. *J Gen Psychology* 119(2):161–167.
- Tu, H., and G. Cohen. 2008. Tracking Report No. 20. HSC Home Page. <http://hschange.org/CONTENT/1006/?PRINT=1>. Retreived 4 November 2011.
- Turisco, F., and J. Case. 2001. Wireless and Mobile Computing. Oakland, CA: California Healthcare Foundation.
- United States Department of Health and Human Services. 2011. Breaches Affecting 500 or More Individuals. <http://www.hhs.gov/ocr/privacy/hipaa/administrative/breachnotificationrule/breachtool.html> (accessed March 14, 2011).
- United States Department of Health and Human Services, Office of the National Coordinator for Health Information Technology, HIT Policy Committee: Request for Comment Regarding the Stage 2 Definition of Meaningful Use of Electronic Health Records (EHRs). 2011. http://healthit.hhs.gov/portal/server.pt/gateway/PTARGS_0_0_5383_1472_17094_43/ http://wci-pubcontent/publish/onc/public_communities/u_z/wg_month_pages/mu_jan_portlet/files/nr_mu_rfc_v_4_2011_01_05.pdf (accessed

- March 23, 2011).
- Wagner, E. H., B. T. Austin, and M. Von Korff. 1996. Organizing care for patients with chronic illness. *Milbank Q* 74(4):511–542.
- Wager, K. A., F. W. Lee, A. W. White, D. M. Ward, and S. M. Ornstein. 2000. Impact of an electronic medical record system on community-based primary care practices. *J Am Board Family Pract* 13: 338–348.
- Ward, R., C. Stevens, P. Brentnall, and J. Briddon, 2008. The attitudes of health care staff to information technology: A comprehensive review of the research literature. *Health Information & Libraries Journal* 25(2):81–97. doi:10.1111/j.1471–1842.2008.00777.x
- Weingart, S. N., B. Simchowitz, L. Shiman, D. Brouillard, A. Cyriluk, R. B. Davis, T. Isaac et al. 2009. Clinicians' assessments of electronic medication safety alerts in ambulatory care. *Arch Intern Med* 169(17):1627–1632.
- Williams, A., D. Herman, J. Moriarty, T. Beebe, S. Bruggeman, E. Klavetter et al. 2008. HIPAA Costs and patient perceptions of privacy safeguards at mayo clinic. *Joint Commission J Qual Patient Saf* 34(1):27–35.
- <http://www.ingentaconnect.com/content/jcaho/jcjqs/2008/00000034/00000001/art00005> (accessed March 14, 2011).
- Workgroup on Electronic Data Interchange. 2000. HIPAA: Changing the health care landscape. *Oncol Issues* 15(4):21–23.
- World Health Organization. 2000. The World Health Report 2000: Health systems: improving performance. <http://www.who.int/whr/2000/index.htm> (accessed April 11, 2002).
- Wyatt, J. C. 1997. Commentary: Measuring quality and impact of the World Wide Web. *Br Med J* 314(7098):1879–1881.
- Zeng-Treitler, Q., S. Goryachev, H. Kim, A. Keselman, and D. Rosendale. 2007. Making texts in electronic health records comprehensible to consumers: A prototype translator. *AMIA Annu Symp Proc* 846–50. Annual Symposium Proceedings/ AMIA Symposium.

Why We Play

- 4ourty2wo. 2005. The beast. <http://www.42entertainment.com/beast.html> (accessed November 29, 2011).
- Bartle, R. 2003a. *A Self of Sense*. <http://www.mud.co.uk/richard/selfware.htm> (accessed December 29, 2005).
- Bartle, R. 2003b. Designing Virtual Worlds. New Riders Games. Berkeley, CA: Peach Pit Press.
- Boorstin, J. 1990. Making Movies Work. Beverly Hills, CA: Silman-James Press.
- Brave, S., and C. Nass. 2002. A. Emotion in human-computer interaction. In *The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications*, ed. J. Jacto and A. Sears, 81–96. Mahwah, NJ: Lawrence Erlbaum Associates.
- Clore, G. C., and K. Gasper. 2000. Feeling is believing: Some affective influences on belief. In *Emotions and Beliefs: How Feelings Influence Thoughts*, ed. N. H. Frijda, A. S. R. Manstead, and S. Bem, 10–44. Paris/Cambridge: Editions de la Mason des Sciences de l'Homme and Cambridge University Press (jointly published).
- Csikszentmihalyi, M. 1990. *Flow: The Psychology of Optimal Experience*. New York: Harper & Row.
- Damasio, A. 1994. *Descartes' Error: Emotion, Reason, and The Human Brain*. New York: Quill Penguin Putnam.
- Ekman, P. 2003. *Emotions Revealed*. New York: Times Books Henry Hold and Company, LLC.
- Fabricant, R. 2005. HRV monitor: Creating a guided user experience on handheld devices. In *Proceedings of DUX 2005*. San Francisco, USA.
- Gee, J. 2003. *What Video Games Have to Teach us About Learning and Literacy*. New York: Palgrave Macmillan.
- Hassenzahl, M., A. Burmester, M., and K. Lehner. 2000. Hedonic and ergonomic quality aspects determine a software's appeal. In *Proceedings Association for Computing Machinery (ACM) Special Interest Group on Computer-Human Interaction Conference (CHI)*, 201–208. The Hague, the Netherlands. New York: ACM.
- Hazlett, H. 2003. Measurement of user frustration: A biologic approach. In *Proceedings Association for Computing Machinery (ACM) Special Interest Group on Computer-Human Interaction Conference (CHI)*, 734–5, April, 2003.
- Hjelm, I. 2003. BrainBall research + design: The making of Brainball. *Interactions* 10(1):26–34.
- Hulse, C. 2003. Threats and responses: Plans and criticisms; Pentagon prepares a futures market on terror attacks. *The New York Times*. Retrieved November 29, 2011, from <http://www.nytimes.com/2003/07/29/us/threats-responses-plans-criticisms-pentagon-prepares-futures-market-terror.html?pagewanted=all&src=pm>.
- Jordan, P. W. 2000. *Designing Pleasurable Products: An Introduction to the New Human Factors*. London: Taylor & Francis.
- Kim, A. J. 2000. *Community Building on the Web*. Berkeley, CA: Peach Pit Press.
- Lazzaro, N. 2004a. Why we play games. *User Exp Mag* 8.
- Lazzaro, N. 2004b. Why we play games: Four keys to more emotion in player experiences. In *Proceedings of the Game Developers Conference*. San Jose, California, USA. www.xeodesign.com/whyweplaygames.html (accessed December 28, 2005).
- Lazzaro, N. 2005a. *Design survey of game designers*. Unpublished manuscript.
- Lazzaro, N. 2005b. *Diner dash and the people factor* from www.xeodesign.com/whyweplaygames.html (accessed March 2, 2005).
- Lazzaro, N., and K. Keefer. 2004. What's My Method? A game show on games. In *Proceedings Association for Computing Machinery (ACM) Special Interest Group on Computer-Human Interaction Conference (CHI)*, 1093–4. Vienna, Austria.
- LeBlanc, M., R. Hunicke, and R. Zubek. 2004. MDA: A formal approach to game design and game research. <http://www.cs.northwestern.edu/~hunicke/pubs/MDA.pdf> (accessed March 2, 2005).
- Malone, T. 1981. Heuristics for designing enjoyable user interfaces: Lessons from computer games. In *Proceedings Association for Computing Machinery (ACM) Special Interest Group on Computer Human Conference (CHI)* 63–8.
- Mandryk, R. 2004. Objectively evaluating entertainment technology. In *Proceedings Association for Computing Machinery (ACM) Special Interest Group on Computer-Human Interaction Conference (CHI)*, 1057–8. Doctoral Consortium, Vienna, Austria.
- Norman, D. A. 2004. *Emotional Design: Why We Love (or hate) EveryDay Things*. New York: Basic Books.
- Papert, S. 2005. *Hard Fun*. <http://www.papert.org/articles/HardFun.html> (accessed December 29, 2005).
- Piaget, J. 1962. *Play, Dreams, and Imitation in Childhood*. New York: Norton.
- Servan-Schreiber, E., J. Wolfers, D. M. Pennock, and B. Galebach. 2004. Prediction markets: Does money matter? *Electronic Markets* 14(3):243–251. Retrieved November 29, 2011, from <http://bpp.wharton.upenn.edu/jwolfers/Papers/DoesMoneyMatter.pdf>
- Sykes, J., and S. Brown. 2003. Affective gaming: Measuring emotion through the gamepad. In *Proceedings Association for Computing Machinery (ACM) Special Interest Group on Computer-Human Interaction Conference (CHI)*, 732–733. New York: ACM.

- Tiger, L. 1992. *The Pursuit of Pleasure*, 52–60. Boston, MA: Little, Brown & Company.
- Thorson, E., and M. Friesstad. 1985. The effects of emotion on episode memory for television commercials. In *Advances in Consumer Psychology*, ed. P. Cafferata and A. Tybor, 131–136. Lexington, MA: Lexington.
- von Ahn, L., and L. Dabbish. 2004. Labeling images with a computer game. In *Proceedings Association for Computing Machinery (ACM) Special Interest Group on Computer-Human Interaction. Conference (CHI)*, 319–326. Vienna, Austria, New York: ACM Press.
- Wright, P., J. McCarthy, and L. Meekison. 2003. Making sense of experience. In *Funology: From Usability to Enjoyment*, ed. M. A. Blythe, K. Overbeeke, A. F. Monk, and P. C. Wright, 43–53. Dordrecht, the Netherlands: Kluwer Academic.
- Weber, R., L. Ritterfeld, and K. Mathiak. 2006. Does playing violent video games induce aggression? Empirical evidence of a functional magnetic resonance imaging study. *Media Psychology* 8(1):39–60.
- For more articles on emotion and game research, see <http://www.xeodesign.com/whyweplaygames>.
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Motor Vehicle-Driver Interfaces

- Alliance of Automobile Manufacturers. 2006. Statement of Principles on Human-Machine Interfaces (HMI) for In-Vehicle Information and Communication Systems (version 3). Washington, DC: Alliance of Automobile Manufacturers. <http://www.umich.edu/driving/guidelines/guidelines.html> (accessed April 3, 2007).
- Barón, A., and P. Green. 2006. Safety and Usability of Speech Interfaces for In-Vehicle Tasks while Driving: A Brief Literature Review. Technical Report UMTRI-2006-5. Ann Arbor, MI: University of Michigan Transportation Research Institute.
- Bass, F. 1969. A new product growth model for consumer durables. *Manag Sci* 15(5):215–222.
- Bass, F. 2004. Comments on “A new product growth for model consumer durables.” *Manag Sci* 50(12 Suppl): 1833–1840.
- Bayly, M., K. L. Young, and M. A. Regan. 2008. Sources of distraction inside the vehicle and their effects on driving performance. In *Driver Distraction: Theory, Effects, and Mitigation*, eds. M. A. Regan, J. D. Lee, and K. Young, 192–210. Boca Raton, FL: CRC Press.
- Bertand, M., S. Djankov, R. Hanna, and S. Mullainathan. 2008. Corruption in driving licensing process in Dehli. *Econ Polit Wkly* (February):71–6. <http://www.povertyactionlab.org/sites/default/files/publications/155%20%28b%29%20Corruption%20in%20Drivers%20Licence.pdf> (accessed May 31, 2010).
- Biever, W. J. 1999. Auditory based supplemental information processing demand effects on driving performance. Unpublished master's thesis, Virginia Polytechnic Institute and State University, Blacksburg.
- Blanco, M. 1999. Effects of in-vehicle information systems (IVIS) tasks on the information processing demands of a commercial vehicle operations (CVO) driver. Unpublished master's thesis, Virginia Polytechnic Institute and State University, Blacksburg.
- Caird, J. K., C. T. Scialfa, G. Ho, and A. Smiley. 2006. A metaanalysis of driving performance and crash risk associated with the use of cellular telephones while driving. In *Proceedings of the Third International Driving Symposium on Human factors in Driver Assessment, Training and Vehicle Design*. Iowa City, IA: University of Iowa.
- Campbell, J.L., C. Carney, and B. H. Kantowitz. 1997. Human Factors Design Guidelines for Advanced Traveler Information Systems (ATIS) and Commercial Vehicle Operations (CVO). Technical Report FHWA-RD-98-057. Washington, DC: U.S. Department of Transportation, Federal Highway Administration.
- Card, S. K., T. P. Moran, and A. Newell. 1980. The keystroke-level model for user performance time with interactive systems. *Commun ACM* 7: 396–410.
- Card, S. K., T. P. Moran, and A. Newell. 1983. *The Psychology of Human-Computer Interaction*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Chang, J. C., A. Lien, B. Lathrop, and H. Hees. 2009. Usability evaluation of a Volkswagen group in-vehicle speech system. In *Proceedings of the First International Conference on Automotive User Interfaces and Interactive Vehicular Applications (AutomotiveUI2009)*. Essen, Germany.
- Chisholm, S. L., J. K. Caird, and J. Lockhart. 2008. The effects of practice with MP3 players on driving performance. *Accid Anal Prev* 40(2):704–713.
- Collet, C., A. Guillot, and C. Petit. 2010a. Phoning while driving I: A review of epidemiological, psychological, behavioural and physiological studies. *Ergonomics* 53(5):589–601.
- Collet, C., A. Guillot, and C. Petit. 2010b. Phoning while driving II: A review of driving conditions influence. *Ergonomics* 53(5):602–616.
- Commission of the European Communities. 2007. European Statement of Principles on the Design of Human Machine Interaction. Brussels, Belgium, http://eur-lex.europa.eu/LexUriServ/site/en/oj/2007/l_032/l_03220070206en02000241.pdf (accessed May 28, 2010).
- Crandall, D., M. Bains, P. Chapman, and G. Underwood. 2005. Regulating conversation during driving: A problem for mobile phones? *Transp Res Part F: Traffic Psychol Behav* 8: 197–211.
- Dingus, T. A., and S. G. Klauer. 2008. The Relative Risks of Secondary Task Induced Driver Distraction. SAE paper 2008-21-0001. Warrendale, PA: Society of Automotive Engineers.
- Drews, F. A., M. Pasupathi, and D. L. Strayer. 2004. Passenger and cell-phone conversations in simulated driving. In *Proceedings of the Human Factors and Ergonomics Society 48th Annual Meeting*, 2210–2212. Santa Monica, CA: Human Factors and Ergonomics Society.
- Driving Assessment. 2005. *Proceedings of the Third International Symposium on Human Factors in Driver Assessment, Training and Vehicle Design*. Iowa City, IA: University of Iowa, <http://ppc.uiowa.edu/driving-assessment/2005/final/index.htm> (accessed April 3, 2007).
- Eby, D. W., and L. P. Kostyniuk. 2004. Distracted Driving Scenarios: A Synthesis of Literature, 2001 Crashworthiness Data System (CDS) Data, and Expert Feedback. SAVE-IT project Technical Report, Task 1. Washington, DC: U.S. Department of Transportation. http://www.volpe.dot.gov/hf/roadway/saveit/docs/dec04/finalrep_1.pdf (accessed April 3, 2007).
- Eoh, H., P. A. Green, J. Schweitzer, and E. Hegedus. 2006. Driving Performance Analysis of the ACAS FOT: Data and Recommendations for a Driving Workload Manager. Technical Report UMTRI-2006-18. Ann Arbor, MI: University of Michigan Transportation Research Institute.
- Farber, E., M. Blanco, J. P. Foley, R. Curry, J. Greenberg, and C. Serafin. 2000. Surrogate measures of visual demand while driving. In *Proceedings of the IEA/HFES 2000 Congress [CD-ROM]*. Santa Monica, CA: Human Factors and Ergonomics Society.
- Farmer, C. M., K. A. Brautman, and A. K. Lund. 2010. Cell Phone Use While Driving and Attributable Crash Risk. Arlington, VA: Insurance Institute for Highway Safety.

- Frost and Sullivan. 2009. Analysis of North American market of Advanced Driver Assistance Systems-ACC, LDW, BSD, Night Vision and Park Assist Systems. Document N6450-18. Palo Alto, CA: Frost and Sullivan.
- Gallagher, J. P. 2001. An assessment of the attention demand associated with the processing of information for in-vehicle information systems (IVIS). Unpublished master's thesis, Virginia Polytechnic Institute and State University, Blacksburg.
- Garay-Vega, L., A. K. Pradhan, G. Weinberg, B. Schmidt-Nielsen, B. Harsham, Y. Shen, G. Divekar, M. Romoser, M. Knodler, and D. L. Fisher. 2010. Evaluation of different speech and touch interfaces to in-vehicle music retrieval systems. *Accid Anal Prev* 42(3):913–920.
- General Motors Corporation. 2005. Automotive Collision Avoidance System Field Operational Test (ACAS FOT) final program report. DOT HS 809 886. Washington, DC: U.S. Department of Transportation, National Highway Traffic Safety Administration.
- Go, E., A. Morton, J. Famewo, and H. Angel. 2006. Final Report: Evaluation of Industry Safety Principles for In-Vehicle Information and Communication Systems. Ottawa, Canada: Transport Canada.
- Gould, J. D., and C. Lewis. 1985. Designing for usability: Key principles and what designers think. *Commun ACM* 28(3):300-311.
- Green, P. 1995a. Automotive techniques. In *Research Techniques in Human Engineering*, ed. J. Weimer, 2nd ed., 165–208. New York: Prentice-Hall.
- Green, P. 1995b. Measures and Methods Used to Assess the Safety and Usability of Driver Information Systems. Technical Report FHWA-RD-94-088. McLean, VA: U.S. Department of Transportation, Federal Highway Administration.
- Green, P. 1995c. Suggested Procedures and Acceptance Limits for Assessing the Safety and Ease of Use of Driver Information Systems. Technical Report FHWA-RD-94-089. McLean, VA: U.S. Department of Transportation, Federal Highway Administration.
- Green, P. 1999a. Estimating compliance with the 15-second rule for driver-interface usability and safety. In *Proceedings of the Human Factors and Ergonomics Society 43rd Annual Meeting [CD-ROM]*. Santa Monica, CA: Human Factors and Ergonomics Society.
- Green, P. 1999b. Navigation System Data Entry: Estimation of Task Times. Technical Report UMTRI-99-17. Ann Arbor, MI: University of Michigan, Transportation Research Institute.
- Green, P. 1999c. The 15-second rule for driver information systems. In *ITS America Ninth Annual Meeting Conference Proceedings [CD-ROM]*. Washington, DC: Intelligent Transportation Society of America.
- Green, P. 1999d. Visual and Task Demands of Driver Information Systems. Technical Report UMTRI-98-16. Ann Arbor, MI: University of Michigan Transportation Research Institute.
- Green, P. 2000a. The human interface for ITS display and control systems: developing international standards to promote safety and usability. Paper presented at the International Workshop on ITS Human Interface, Utsu, Japan.
- Green, P. 2000b. Crashes induced by driver information systems and what can be done to reduce them. SAE paper 2000-01-C008. In *Convergence 2000 Conference Proceedings*, 27–36. Warrendale, PA: Society of Automotive Engineers.
- Green, P. 2001a. Safeguards for on-board wireless communications. Paper presented at the Second Annual Plastics in Automotive Safety Conference, Troy, Michigan.
- Green, P. 2001b. Synopsis of Driver Interface Standards and Guidelines for Telematics as of mid-2001. Technical Report UMTRI-2001-23. Ann Arbor, MI: University of Michigan, Transportation Research Institute.
- Green, P. 2001c. Variations in task performance between younger and older drivers: UMTRI research on telematics. Paper presented at the Association for the Advancement of Automotive Medicine Conference on Aging and Driving, Southfield, MI.
- Green, P. 2004. Driver distraction, telematics design, and workload managers: safety issues and solutions. SAE paper 2004-21-0022. In *Proceedings of the 2004 International Congress on Transportation Electronics*, 165–180. Warrendale, PA: Society of Automotive Engineers.
- Green, P. 2005. How driving simulator data quality can be improved. In *Proceedings of the Driving Simulation Conference North America 2005 [CD-ROM]*. November, 2005, Orlando, FL. <http://www.umich.edu/~driving/publications.html> (accessed April 3, 2007).
- Green, P. 2008a. Driver interface safety and usability standards: An overview. In *Driver Distraction: Theory, Effects, and Mitigation*, Chap 24, eds. M. A. Regan, J. D. Lee, and K. L. Young, 445–464. Boca Raton, FL: CRC Press.
- Green, P. 2008b. Driver interface/HMI standards to minimize driver distraction/Overload. SAE paper 2008-21-2002. In *Convergence 2008 Conference Proceedings*, Detroit, MI. Warrendale, PA: Society of Automotic Engineers.
- Green, P., C. Nowakowski, K. Mayer, and O. Tsimhoni. 2003. Audio-visual system design recommendations from experience with the UMTRI driving simulator. In *Proceedings of the Driving Simulator Conference North America 2003 [CD-ROM]*. Dearborn, MI. <http://www.umich.edu/~driving/publications.html> (accessed April 3, 2007).
- Green, P., J. George, and R. Jacob. 2003. What Constitutes a Typical Cell Phone Call. Technical Report UMTRI-2003-38. Ann Arbor, MI: The University of Michigan Transportation Research Institute.
- Green, P., M. Flynn, G. Vanderhagen, J. Ziomek, E. Ullman, and K. Mayer. 2001. Automotive Industry of Trends in Electronics: Year 2000 Survey of Senior Executives. Technical Report UMTRI-2001-15. Ann Arbor, MI, University of Michigan, Transportation Research Institute.
- Green, P., W. Levison, G. Paelke, and C. Serafin. 1995. Preliminary Human Factors Guidelines for Driver Information Systems. Technical Report FHWA-RD-94-087. McLean, VA: U.S. Department of Transportation, Federal Highway Administration.
- Hankey, J. M., T. A. Dingus, R. J. Hanowski, W. W. Wierwille, and C. Andrews. 2000a. In-vehicle Information Systems Behavioral Model and Design Support Final Report. Technical Report FHWA-RD-00-135. McLean, VA: U.S. Department of Transportation, Federal Highway Administration. <http://www.tfhrc.gov/humanfac/00-135.pdf> (accessed April 3, 2007).
- Hankey, J. M., T. A. Dingus, R. J. Hanowski, W. W. Wierwille, and C. Andrews. 2000b. In-vehicle Information Systems Behavioral Model and Design Support: IVIS Demand Prototype Software User's Manual. Technical Report FHWA-RD-00-136. McLean, VA: U.S. Department of Transportation, Federal Highway Administration. <http://www.tfhrc.gov/humanfac/00-136.pdf> (accessed April 3, 2007).
- Highway Loss Data Institute. 2009. Hand-held Cell Phone Laws and Collision Claim Frequencies. Arlington, VA: Highway Loss Data Institute.
- Highway Statistics. 2008. *Distribution of Licensed Drivers-2008 by Sex and Percentage in Each Age Group and Relation to Population*. U.S. Department of Transportation, Federal Highway Administration. <http://www.fhwa.dot.gov/policyinFormation/statistics/2008/dl20.cfm> (accessed June 1, 2010).
- Hoedemaeker, M., S. N. de Ridder, and W. H. Janssen. 2002. Review of European Human Factors Research on Adaptive Interface Technologies for Automobiles. TNO report TM-02-C031. Soesterberg, The Netherlands: TNO Institute for Perception.
- Horrey, W. J., and C. D. Wickens. 2006. Examining the impact of cell phone conversations on driving using meta-analytic techniques. *Hum Fact* 48(1):196–205.
- Hu, P. S., and T. R. Reuscher. 2004. Summary of Travel Trends: 2001 National Household Travel Survey. Washington, DC: U.S. Department of Transportation. <http://nhts.ornl.gov/2001/pub/STT.pdf> (accessed April 3, 2007).

- Insurance Institute for Highway Safety (IIHS). 2006. US Driver Licensing Procedures for Older Drivers. Arlington, VA. http://www.iihs.org/laws/state_laws/older_drivers.html (accessed April 3, 2007).
- International Organization of Standardization. 2001. Road Vehicles— Measurement of Driver Visual Behaviour with Respect to Transport Information and Control Systems—Part 2: Equipment and Procedures. ISO Technical Specification 15007–2: 2001. Geneva, Switzerland: International Organization of Standardization.
- International Organization of Standardization. 2002a. Road Vehicles—Ergonomic Aspects of Transport Information and Control Systems—Dialogue Management Principles and Compliance Procedures. ISO Standard ISO 15005: 2002. Geneva, Switzerland: International Organization of Standardization.
- International Organization of Standardization. 2002b. Road Vehicles—Measurement of Driver Visual Behaviour with Respect to Transport Information and Control Systems— Part 1: Definitions and Parameters. ISO Standard 15007–1: 2002. Geneva, Switzerland: International Organization of Standardization.
- International Organization of Standardization. 2003a. How are ISO Standards Developed? Geneva, Switzerland. <http://www.iso.ch/iso/en/stdsdevelopment/whowhenhow/how.html> (accessed April 3, 2007).
- International Organization of Standardization. 2003b. Road Vehicles—Ergonomic Aspects of Transport Information and Control Systems—Procedure for Assessing Suitability for Use While Driving. ISO Standard 17287:2003. Geneva, Switzerland: International Organization of Standardization.
- International Organization of Standardization. 2004a. Road Vehicles—Ergonomic Aspects of Transport Information and Control Systems (TICS)—Procedures for Determining Priority of On-Board Messages Presented to Drivers. ISO Trial Standard 16951:2004. Geneva, Switzerland: International Organization of Standardization.
- International Organization of Standardization. 2004b. Road Vehicles—Ergonomic Aspects of Transport Information and Control Systems—Specifications and Compliance Procedures for In-Vehicle Auditory Presentation. ISO Standard 15006:2004. Geneva, Switzerland: International Organization of Standardization.
- International Organization of Standardization. 2005. Road Vehicles—Ergonomic Aspects of In-Vehicle Presentation for Transport Information and Controls Systems—Warning Systems. ISO Technical Report 16352:2005. Geneva, Switzerland: International Organization of Standardization.
- International Organization of Standardization. 2007a. List of Technical Committees: TC 22/SC 13 Ergonomics Applicable To Road Vehicles. Geneva, Switzerland. <http://www.iso.org/iso/en/CatalogueListPage.CatalogueList?COMMID=869&scopelist=PROGRAMME> (accessed April 4, 2007).
- International Organization of Standardization. 2007b. Road Vehicles—Ergonomic Aspects of Transport Information and Control Systems—Occlusion Method to Assess Visual Distraction Due to the Use of In-Vehicle Information and Communication Systems. ISO Draft Standard 16673. Geneva, Switzerland: International Organization of Standardization.
- International Organization of Standardization. 2009. Road Vehicles—Ergonomic Aspects of Transport Information and Control Systems—Specifications and Compliance Procedures for In-Vehicle Visual Presentation. ISO Standard 15008:2009. Geneva, Switzerland: International Organization of Standardization.
- International Organization of Standardization. 2010. Road Vehicles—Ergonomic Aspects of Transport Information and Control Systems—Simulated Lane Change Test to Assess In-Vehicle Secondary Task Demand. ISO Proof Draft Standard 26022. Geneva, Switzerland: International Organization of Standardization.
- Jamson, S., M. Wardman, R. Batley, and O. Carsten. 2008. Developing a driving safety index using a Delphi state preference experiment. *Accid Anal Prev* 40: 435–442.
- Japan Automobile Manufacturers Association. 2004. JAMA Guideline for In-Vehicle Display Systems, version 3.0. Tokyo, Japan: Japan Automobile Manufacturers Association. http://www.jama.or.jp/safe/guideline/pdf/jama_guideline_v30_en.pdf (accessed April 3, 2007).
- Johansson, E., J. Engstrom, C. Cherri, E. Nodari, A. Toffetti, R. Schindhelm, et al. 2004. Review of Existing Techniques and Metrics for IVIS and ADAS Assessment. AIDE deliverable 2.2.1. Brussels, Belgium: European Union.
- Kayl, K. 2000. *The Networked Car: Where the Rubber Meets the Road*. <http://sun.systemnews.com/artides/32/1/ja/2746> (accessed April 5, 2007).
- Koushki, P. A., S. Y. Ali, and O. I. Al-Saleh. 1999. Driving and using mobile phones: Impacts on road accidents. *Transp Res Rec* 1694: 27–33.
- Lai, F. C. H. 2005. Driver attentional demand to dual task performance. Unpublished doctoral dissertation, University of Leeds, Institute for Transport Studies, United Kingdom.
- LeBlanc, D., R. Goodsell, Z. Bareket, M. R. Hagan, M. L. Buonarosa, J. Devonshire, S. E. Bogard, R. D. Ervin, C. B. Winkler, J. R. Sayer. 2006. Road Departure Crash Warning System Field Operational Test: Methodology and Results, Volume 1: Technical Report. Technical Report UMTRI-2006-9-1. Ann Arbor, MI: University of Michigan Transportation Research Institute.
- Lee, J., J. Forlizzi, and S. E. Hudson. 2008. Iterative design of MOVE: A situationally appropriate vehicle navigation system. *Int J Hum Comput Stud* 66: 198–215.
- Mahajan, V., E. Muller, and F. M. Bass. 1990. New product diffusion model in Marketing: A review and directions in research. *J Mark* 54: 1–26.
- Manes, D., P. Green, and D. Hunter. 1998. Prediction of Destination Entry and Retrieval Times Using Keystroke-Lev el Models. Technical Report UMTRI-96-37. Ann Arbor, MI: University of Michigan, Transportation Research Institute.
- Mayhew, D. R., H. M. Simpson, and A. Pak. 2003. Changes in collision rates among novice drivers during the first months of driving. *Accid Anal Prev* 35(5):683–691.
- McCatt, A. T., L. A. Hellinga, and K. A. Bratiman. 2006. Cell phones and driving: Review of research. *Traffic Injury Prevention* 7: 89–106.
- McEvoy, S. P., M. R. Stevenson, A. T. McCatt, M. Woodward, C. Haworth, P. Palamara, et al. 2005. Role of mobile phones in motor vehicle crashes resulting in hospital attendance: A case-crossover study. *Br Med J* 1–5. <http://bmj.bmjjournals.com/cgi/content/abstract/bmj.38537.397512.55vl> (accessed April 3, 2007).
- McEvoy, S. P., M. R. Stevenson, and M. Woodward. 2007. The contribution of passengers versus mobile phone use to motor vehicle crashes resulting in hospital attendance by the driver. *Accid Anal Prev* 39: 1170–1176.
- Michon, J. A., ed. 1993. Generic Intelligent Driver Support. London: Taylor & Francis.
- Nowakowski, C., and P. Green. 2000. *Prediction of Menu Selection Times Parked and While Driving Using the SAE J2365 Method*. Technical Report 2000-49. Ann Arbor, MI, University of Michigan, Transportation Research Institute.
- Nowakowski, C., D. Friedman, and P. Green. 2001. Cell phone ring suppression and HUD caller ID: Effectiveness in reducing momentary driver distraction under varying workload levels. Technical report 2001-29. Ann Arbor, MI: University of Michigan, Transportation Research

- Institute. <http://www.umich.edu/driving/publications.html>(accessed April 3,2007).
- Nowakowski, C., Y. Utsui, and P. Green. 2000. *Navigation System Evaluation: The Effects of Driver Workload and Input Devices on Destination Entry Time and Driving Performance and their Implications to the SAE Recommended Practice*. Technical Report UMTRI-2000-20. Ann Arbor, MI, University of Michigan, Transportation Research Institute.
- Olson, J. R., and E. Nilsen. 1987–1988. Analysis of the cognition involved in spreadsheet software interaction. *Hum Comput Interact* 3: 309–349.
- Owens, J. M., S. B. McLaughlin, and J. Sudweeks. 2010. On-Road Comparison of Driving Performance Measures When Using Handheld and Voice-Control Interfaces for Mobile Phones and Portable Music Players. SAE paper 2010-01-1036. Warrendale, PA: Society of Automotive Engineers.
- Peacock, B., and W. Karwowski. 1993. *Automotive Ergonomics*. London: Taylor & Francis.
- Pettitt, M. 2008. Visual demand evaluation methods for in-vehicle interfaces. Unpublished PhD dissertation. Nottingham, England: University of Nottingham.
- Pettitt, M., G. Burnette, and A. Stevens. 2007. An extended keystroke level model (KLM) for predicting the visual demand of in-vehicle information systems. In CHI 2007 Proceedings, 1515–1524. San Jose, CA, New York: ACM.
- Piechulla, W., C. Mayser, H. Gehrke, and W. König. 2003. Reducing Drivers' mental workload by means of an adaptive man-machine interface. *Transp Res Part F Traffic Psychol Behav* 6: 233–248.
- Ranney, T. A. 2008. Driver Distraction: A Review of the Current State-of Knowledge. Technical Report DOT HS 810 787. Washington, DC: U.S. Department of Transportation, National Highway Traffic Safety Administration.
- Redelmeier, D. A., and R. J. Tibshirani. 1997. Association between cellular-telephone calls and motor vehicle collisions. *N Engl J Med* 336: 453–458.
- Redelmeier, D. A., and R. J. Tibshirani. 2001. Car phones and car crashes: some popular misconceptions. *Can Med Assoc J* 164(11): 1581–1582.
- Regan, M. A., J. D. Lee, and K. Young. eds. 2008. *Driver Distraction: Theory, Effects, and Mitigation*. Boca Raton, FL: CRC Press.
- Ribbens, W. B., and D. E. Cole. 1989. University of Michigan Automotive electronics Delphi. Ann Arbor, MI: Office for the Study of Automotive Transportation, University of Michigan, Transportation Research Institute.
- Richardson, B., and P. Green. 2000. Trends in North American Intelligent Transportation Systems: A year 2000 Appraisal. Technical Report UMTRI-2000-9. Ann Arbor, MI, University of Michigan, Transportation Research Institute.
- Roskam, A. J., K. A. Brookhuis, D. deWaard, O. M. J. Carsten, L. Read, S. Jamson, et al. 2002. Development of Experimental Protocol. HASTE Deliverable 1. Brussels, Belgium: European Commission.
- Ross, T., K. Midtland, M. Fuchs, A. Pauzie, A. Engert, B. Duncan, et al. 1996. *HARDIE Design Guidelines Handbook: Human Factors Guidelines for Information Presentation by ATT Systems*. Luxembourg: Commission of the European Communities.
- Salvucci, D. D. 2009. Rapid prototyping and evaluation of in-vehicle interfaces. *ACM Trans Comput Hum Interact* 16(2):9:1–33.
- Salvucci, D. D., D. Markley, M. Zuber, D. P. Brumby. 2007. iPod distraction: Effects of portable music-player use on driver performance. In CHI Proceedings, San Jose, California. New York: ACM.
- Salvucci, D. D., M. Zuber, E. Beregovaya, and D. Markley. 2005. Distract-R: Rapid prototyping and evaluation of in-vehicle interaces. In CHI 2005 Proceedings. New York: Association for Computing Machinery.
- Schindhelm, R., C. Gelau, A. Keinath, K. Bengler, H. Kussmann, P. Kompfner, et al. 2004. *Report on the Review of Available Guidelines and Standards*. AIDE deliverable 4.3.1. Brussels, Belgium: European Commission. http://www.aide-eu.org/pdf/sp4_deliv/aide_d4-3-1.pdf (accessed April 4, 2007).
- Schweitzer, J., and P. A. Green. 2007. Task Acceptability and Workload of Driving Urban Roads, Highways, and Expressways: Ratings from Video Clips. Technical Report UMTRI-2006–2006. Ann Arbor, MI: University of Michigan Transportation Research Institute.
- Shutko, J., K. Mayer, E. Laansoo, and L. Tijerina. 2009. Driver Workload Effects of Cell Phone, Music Player, and Text Messaging Tasks with the Sync-Voice Interface versus the Devices 'Handheld Visual-Manual Interfaces. SAE paper 2009-01-0768, Warrendale, PA: Society of Automotive Engineers.
- Sloss, D., and P. Green. 2000. National Automotive Center 21st Century Truck (21T) Dual Use Safety Focus. SAE Paper 2000-01-3426. Warrendale, PA: Society of Automotive Engineers (published in National Automotive Center Technical Review, Warren, MI, U.S. Army Tank-Automotive and Armaments Command, National Automotive Center, 63–70).
- Society of Automotive Engineers. 2002. Calculation of the Time to Complete In-Vehicle Navigation and Route Guidance Tasks. SAE recommended practice J2365. Warrendale, PA: Society of Automotive Engineers.
- Society of Automotive Engineers. 2004a. Navigation and Route Guidance Function Accessibility While Driving. SAE recommended practice 2364. Warrendale, PA: Society of Automotive Engineers.
- Society of Automotive Engineers. 2004b. Rationale Document for SAE J2364. SAE information report J2678. Warrendale, PA: Society of Automotive Engineers.
- Society of Automotive Engineers. 2010a. Definitions of Driving Performance Measures and Statistics. SAE recommended practice J2409, draft. Warrendale, PA: Society of Automotive Engineers.
- Society of Automotive Engineers. 2010b. *SAE Handbook 2010*. Warrendale, PA: Society of Automotive Engineers.
- Steinfeld, A., and H.-S. Tan. 2000. Development of a driver assist interface for snowplows using iterative design. *Transp Hum Factors* 2(3):247–264.
- Steinfeld, A., D. Manes, P. Green, and D. Hunter. 1996. Destination Entry and Retrieval with the Ali-Scout Navigation System. Technical Report UMTRI-96-30, also released as EECS-ITS LAB FT97-077. Ann Arbor, MI: University of Michigan, Transportation Research Institute.
- Stevens, A., A. Quimby, A. Board, T. Kersloot, and P. Burns. 2004. *Design Guidelines for Safety of In-Vehicle Information Systems*. Crowthorne, UK: TRL Limited.
- Stutts, J. C., D. W. Reinfurt, L. Staplin, and E. A. Rodgman. 2001. The Role of Driver Distraction in Traffic Crashes. Washington, DC: AAA Foundation for Traffic Safety. <http://www.aaafts.org/pdf/distraction.pdf> (accessed April 3, 2007).
- Teo, L., and B. E. John. 2008. Towards predicting user interaction with CogTool-Explorer. In Proceedings of the Human Factors and Ergonomics Society 52nd Annual Meeting, New York, Sept 22–26, 2008. Santa Monica, CA: Human Factors and Ergonomics Society.
- Tijerina, L., L. Angell, A. Austria, A. Tan, and D. Kochhar. 2003. Driver Workload Metrics Literature Review. Washington, DC, U.S. Department of Transportation, National Highway Traffic Safety Administration.

- Tsimhoni, O., D. Smith, and P. Green. 2004. Address entry while driving: Speech recognition versus a touch-screen keyboard. *Hum Factors* 46(6):600–610.
- U.S. Department of Transportation. 2008. National Motor Vehicle Crash Causation Survey. Technical Report DOT HS 811 059. Washington, DC: U.S. Department of Transportation, National Highway Traffic Safety Administration.
- U.S. Department of Transportation. 2009a. 2008 Traffic Safety Annual Assessment—Highlights. Technical Report DOT HS 811 172. Washington, DC: U.S. Department of Transportation. www.nrd.nhtsa.dot.gov/pubs/811172.pdf (accessed May 30, 2010).
- U.S. Department of Transportation. 2009b. Driver Electronic Device Use in 2008. Technical Report DOT HS 811 184. Washington, DC: U.S. Department of Transportation. www.nrd.nhtsa.dot.gov/Pubs/811184.pdf (accessed April 3, 2007).
- Underwood, S. E. 1989. Summary of Preliminary Results from a Delphi Survey on Intelligent Vehicle-Highway Systems. Technical Report. Ann Arbor, MI: University of Michigan.
- Underwood, S. E. 1992. Delphi Forecast and Analysis of Intelligent Vehicle-Highway Systems Through 1991: Delphi II. Ann Arbor, Program in Intelligent Vehicle-Highway Systems. IVHS Technical Report-92-17. Ann Arbor, MI: University of Michigan.
- Underwood, S. E., D. Chen, and R. D. Ervin. 1991. Future of intelligent vehicle-highway systems: A Delphi forecast of markets and socio-technological determinants. *Transp Res Rec No. (1305)*:291–304.
- Violanti, J. M., and J. R. Marshall. 1996. Cellular phones and traffic accidents: An epidemiological approach. *Accid Anal Prev* 28: 265–270.
- Wang, J. S., R. R. Knipling, and M. J. Goodman. 1996. The role of driver inattention in crashes: New statistics from the 1995 crashworthiness data system. In *Association for the Advancement of Automotive Medicine 40th Annual Conference Proceedings*, 311–92. Des Plaines, IL: Association for the Advancement of Automotive Medicine.
- Wards Automotive Group. 2009. World Motor Vehicle Data 2009. Southfield, MI: Wards Automotive Group.
- Wejnert, B. 2002. Integrating models of diffusion of innovations: A conceptual framework. *Annu Rev Sociol (Annu Rev)* 28: 297–306.
- Wierwille, W. 1995. Development of an initial model relating driver in-vehicle visual demands to accident rate. In *Proceedings of the Third Annual Mid-Atlantic Human Factors Conference*, 1–7. Blacksburg, VA: Virginia Polytechnic Institute and State University.
- World Health Organization. 2009. Global Status Report on Road Safety. Geneva, Switzerland: World Health Organization.
- Young, R., B. Aryal, M. Muresan, Z. Ding, S. Oja, and N. Simpson. 2005. Road-to-Lab: Validation of the static load test for predicting on-road driving performance while using advanced in-vehicle information and communication devices. In *Driving Assessment 2005: Proceedings of the Third International Symposium on Human Factors in Driver Assessment, Training and Vehicle Design*, 240–254. Iowa City, IA: University of Iowa. <http://ppc.uiowa.edu/driving-assessment/2005/final/index.htm> (accessed April 3, 2007).
- Young, K., M. Regan, and M. Hammer. 2003. Driver Distraction: A Review of the Literature. Report 206. Melbourne, VIC Australia: Monash University.

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- Abbott, T. S., G. C. Mowen, L. H. Person Jr., G. L. Keyser Jr., K. R. Yenni, and J. F. Garren Jr. 1980. Flight investigation of cockpit-displayed traffic information utilizing coded symbology in an advanced operational environment (NASA Technical Paper 1684). Hampton, VA: NASA Langley Research Center.
- Acharya, R., P. Joseph, N. Kannathal, C. M. Lim, and J. S. Suri. 2006. Heart rate variability: A review. *Med Biol Eng Comput* 44: 1031–1051.
- Allen, R. B. 1983. Cognitive factors in the use of menus and trees: An experiment. *IEEE J Sel Areas Commun* 1(2):333–336.
- Arthur, W. C., and M. P. McLaughlin. 1998. User Request Evaluation Tool (URET): Interfacility Conflict Probe Performance Assessment. McLean, VA: MITRE.
- Bailey, N. R., M. W. Scerbo, F. G. Freeman, P. J. Mikulka, and L. A. Scott. 2006. Comparison of a brain-based adaptive system and a manual adaptable system for invoking automation. *Hum Factors* 48: 693–709.
- Bainbridge, L. 1983. Ironies of automation. *Automatica* 19(6):775–780.
- Bannon, L. J. 2000. Understanding common information spaces in CSCW. Paper presented at the Workshop on Cooperative Organisation of Common Information Spaces, Delft.
- Barco Orthogon. 2003. Osyris. Retreived January 27, 2005, from http://www.barco.com/barcoview/downloads/BVW_Osyris_new_6p.pdf.
- Bartlett, F. C. 1943. Instrument controls and displays - Efficient human manipulation (No. 565). London: UK Medical Research Council.
- Bejczy, A. K., and G. Paine. 1977. Displays for supervisory control of manipulators. Paper presented at the 13th Annual Conference on Manual Control. Cambridge, MA.
- Bentley, R., J. A. Hughes, D. Randall, T. Rodden, P. Sawyer, D. Shapiro et al. 1992. Ethnographically-informed systems design for air traffic control. Paper presented at the Computer Supported Cooperative Work, Toronto, Canada.
- Beringer, D. B., R. C. Willeges, and S. N. Roscoe. 1975. The transition of experienced pilots to a frequency-separated aircraft altitude display. *Hum Factors* 17: 401–414.
- Berndtsson, J., and M. Normark. 2000. The CATCH project— A field study of air traffic control in Copenhagen (No. CTI Working Paper no. 57): Technical University of Denmark.
- Beyer, H., and K. Holtzblatt. 1998. Contextual Design: Defining Customer Centred System. San Francisco, CA: Morgan Kaufman.
- Billings, C. E. 1995. Situation awareness measurement and analysis: A commentary. Paper presented at the Proceedings of the International Conference on Experimental Analysis and Measurement of Situation Awareness, Daytona Beach, FL.
- Billings, C. E. 1997. Aviation Automation: The Search for a Human-Centered Approach. Mahwah, NJ: Lawrence Erlbaum.
- Breznitz, S. 1984. Cry Wolf: The Psychology of False Alarms. Mahwah, NJ: Lawrence Erlbaum.
- Brudnicki, D. J., and A. L. McFarland. 1997. User Request Evaluation Tool (URET) Conflict Probe Performance and Benefits Assessment. (No. MP97W0000112). McLean, VA: MITRE.
- Bryan, L. A., J. W. Stonecipher, and K. Aron. 1954. 180-degree turn experiment. *Univ Ill Bull* 54(11): 1–52.
- Chapanis, A. 1959. Research Techniques in Human Engineering. Baltimore, MD: The Johns Hopkins Press.
- Civil Aeronautics Board. 1953. Civil Air Regulations Part 4b, 4b.611 (b)C.F.R.
- Civil Aeronautics Board. 1957. Civil Air Regulations Part 4b, Amendment 4b-7 C.F.R.

- Cohen, E., and R. L. Follert. 1970. Accuracy of interpolation between scale graduations. *Hum Factors* 31(5):481–483.
- Cole, E. L., J. L. Milton, and B. B. McIntosh. 1954. Routine Maneuvers Under Day and Night Conditions, Using An Experimental Panel, Eye Fixations of Aircraft Pilots ix (No. Technical Report 53–220). Wright-Patterson AFB, OH: USAF WADC.
- Conrad R. 1951. Speed and load stress in sensory-motor skill. *Br J Ind Med* 8: 1–7.
- Cooper, G. E. 1977. A Survey of the Status of and Philosophies Relating to Cockpit Warning Systems (No. NASA-CR-152071). Moffett Field, CA: NASA Ames Research Center.
- Cotton, B. 2003. For spacious skies—the twenty-first century promise of free flight. Paper presented at the AIAA International Air and Space Symposium and Exhibition: The Next 100 Years, Dayton, OH.
- Craik, K. 1943. The Nature of Explanation. Cambridge, UK: Cambridge University Press.
- Crane, P. M. 1992. Theories of Expertise as Models for Understanding Situation Awareness (No. ADP006943). Williams, AZ: The Armstrong Lab.
- Dashevsky, S. G. 1964. Check-reading accuracy as a function of pointer alignment, patterning, and viewing angle. *J Appl Psychol* 48: 344–347.
- Davenport, W. W. 1978. Gyro! The Life and Times of Lawrence Sperry. New York: Charles Scribner.
- Dearden, A., M. Harrison, and P. Wright. 1998. Allocation of function: scenarios, context and the economics of effort. *Int J Hum Comput Stud* 52(2):289–318.
- de Brito, G. 2002. Towards a model for the study of written procedure following in dynamic environments. *Reliab Eng Saf Sci* 75: 233–244.
- Degani, A., and E. Weiner. 1990. Human Factors of Flight-Deck Checklists: The Normal Checklist. (No. 177549). Moffett Field, CA: NASA Ames Research Center.
- Degani, A., and E. Weiner. 1993. Cockpit checklists: Concepts, design, and use. *Hum Factors* 35(2):28–43.
- Degani, A., and E. L. Weiner. 1997. Procedures in complex systems: The airline cockpit. *IEEE Trans Syst Man Cybern* 27: 302–312.
- Dien, Y. 1998. Safety and application of procedures, or how do they have to use operating procedures in nuclear power plants? *Saf Sci* 29: 179–187.
- Djokic, J., B. Lorenz, and H. Fricke. 2010. Air traffic control complexity as workload driver. *Transp Res Part C Emerg Technol* 18(6):930–936.
- Dorris, A. L., T. Connolly, T. L. Sadosky, and M. Burroughs. 1977. More information or more data? Some experimental findings. Paper presented at the Human Factors Society 21st Annual Meeting, Santa Monica, CA.
- Elkin, E. H. 1959. Effect of Scale Shape, Exposure Time and Display Complexity on Scale Reading Efficiency (No. TR 58–472). Wright-Patterson AFB, OH: USAF WADC.
- Endsley, M. R. 1988. Design and evaluation for situation awareness enhancement. Paper presented at the Human Factors Society 32nd Annual Meeting, Santa Monica, CA.
- Endsley, M. R., and D. G. Garland. 2000. Pilot situation awareness training in general aviation. Paper presented at the 44th Annual Meeting of the Human Factors and Ergonomics Society, Santa Monica, CA.
- Endsley, M. R., and M. D. Rodgers. 1996. Attention distribution and situation awareness in air traffic control. Paper presented at the 40th Annual Meeting of the Human Factors and Ergonomics Society, Philadelphia, PA.
- Eriksen, C. W., and B. A. Eriksen. 1974. Effects of noise letter upon the identification of a target letter in a nonsearch task. *Percept Psychophys* 16: 143–149.
- Erzberger, H. 2004a. Transforming the NAS: The Next Generation Air Traffic Control System (No. TP-2004-212828). Moffett Field, CA: NASA Ames Research Center.
- Erzberger, H. 2004b. Transforming the NAS: The next generation air traffic control system. Paper presented at the 24th International Congress of the Aeronautical Sciences, Yokohama, Japan.
- Erzberger, H., and W. Nedell. 1989. Design of Automated System for Management of Arrival Traffic. Moffett Field, CA: NASA Ames Research Center.
- Erzberger, H., and R. A. Paielli. 2002. Concept for next generation air traffic control system. *Air Traffic Control Q* 10(4):355–378.
- Farber, E., and M. Paley. 1993. Using freeway traffic data to estimate the effectiveness of rear-end collision countermeasures. Paper presented at the Third Annual IVHS America Meeting, Washington, DC.
- Ferrell, W. R., and T. B. Sheridan. 1967. Supervisory control of remote manipulation. *IEEE Spectr* 4(10):81–88.
- Fitts, P. 1951a. Engineering psychology in equipment design. In *Handbook of Experimental Psychology*, ed. S. S. Stevens, 1287–1340. New York: Wiley.
- Fitts, P. 1951b. Human Engineering for an Effective Air-Navigation and Traffic-Control System. Washington, DC: National Research Council Committee on Aviation Psychology.
- Fitts, P., R. E. Jones, and J. L. Milton. 1950. Eye movements of aircraft pilots during instrument-landing approaches. *Aeronaut Eng Rev* 9(2): 1–6.
- Flach, J. M. 1995. Situation awareness: Proceed with caution. *Hum Factors* 37: 149–157.
- Fogel, L. 1959. A new concept: The kinalog display system. *Hum Factors* 1(1):30–37.
- Fracker, M. L. 1991. Measures of Situation Awareness: Review and Future Directions (No. AL-TR-1991-0128). Wright-Patterson AFB, OH: USAF Armstrong Laboratory.
- Francis, G. 2000. Designing multifunction displays: An optimization approach. *Int J Cogn Ergon* 4(2): 107–124.
- Gentner, D., and A. L. Stevens, eds. 1983. Mental Models. Hillsdale, NJ: Lawrence Erlbaum.
- Gerovitch, S. 2003. Interview with Sheridan. Retrieved November 4 2011, from <http://web.mit.edu/slava/space/interview/interview-sheridan.htm>.
- Gilbert, G. A. 1973. Historical development of the air traffic control system. *IEEE Trans Commun* 21:364–375.
- Gosling, G. D. 2002. Analysis of factors affecting the occurrence and severity of air traffic control operational errors. Paper presented at the 2002 Transportation Research Board Annual Meeting, Washington, DC.
- Graeber, R. C., and M. M. Moodi. 1998. Understanding flight crew adherence to procedures: The Procedural Event Analysis Tool (PEAT). Paper presented at the Flight Safety Foundation/ International Federation of Airworthiness International Air Safety Seminar, Cape Town, South Africa.
- Green, P. 1984. Driver Understanding of Fuel and Engine Gauges (No. Technical Paper Series 840314). Warrendale, PA: Society of Automotive Engineers.

- Hacker, E. W. 1984. Learning from the Past: A Fighter Pilot's Obligation. <http://www.globalsecurity.org/military/library/report/1984/HEW.htm> (accessed July 29, 2005).
- Hanson, R. H., D. G. Payne, R. J. Shively, and B. H. Kantowitz. 1981. Process control simulation research in monitoring analog and digital displays. Paper presented at the The Human Factors Society 25th Annual Meeting, Rochester, NY.
- Harper, R., and J. Hughes. 1991. What a F-ing system! Send 'em all to the same place and then expect us to stop 'em hitting: Making technology work in air traffic control. In *Technology in Working Order: Studies of Work, Interaction, and Technology*, ed. G. Burton, 127–144. Cambridge, UK: Rank Xerox Cambridge EuroPARC.
- Heglin, H. J. 1973. NAVSHIPS Display Illumination Design Guide: Human Factors (No. NELC/TD223). San Diego, CA: Naval Electronics Laboratory Center.
- Hersey, M. D. 1923. Aeronautic Instruments. Section I: General Classification of Instruments and Problems Including Bibliography. (No. 125). Langley, VA: NASA.
- Hodge, M. H., and S. R. Reid. 1971. The influence of similarity between relevant and irrelevant information upon a complex identification task. *Percept Psychophys* 10: 193–196.
- Hughes, J. A., D. Randall, and D. Shapiro. 1992. Faltering from ethnography to design. Paper presented at the ACM Conference on Computer Supported Cooperative Work, Toronto, ON.
- Iwasaki, S. 1996. Speeded digit identification under impaired perceptual awareness. Paper presented at the Toward a Science of Consciousness 1996 Conference, Tucson, AZ.
- Johnson-Laird, P. N. 1983. *Mental Models: Towards a Cognitive Science of Language, Inference, and Consciousness*. Cambridge: Harvard University Press.
- Jones, D. G., and M. R. Endsley. 2000. Can real-time probes provide a valid measure of situation awareness? Paper presented at the Human Performance, Situation Awareness and Automation: User Centered Design for the New Millennium Conference, Savannah, GA.
- Kerns, K. 1991. Data-link communications between controllers and pilots: A review and synthesis of the simulation literature. *Int J Aviat Psychol* 1: 181–204.
- Knorr, D. 2003. Free Flight Program Performance Metrics to Date: December 2003. Washington, DC: Federal Aviation Administration.
- Kopardekar, P., K. Bilimoria, and B. Sridhar. 2007. Airspace configuration concepts for the next generation air transportation system. *Air Traffic Control Q* 16: 313–336.
- Kuchar, J. K. 1996. Methodology for alerting-system performance evaluation. *J Guid Control Dyn* 19: 438–444.
- Kuchar, J. K., and A. Drumm. 2007. The traffic alert and collision avoidance system. *Lincoln Lab J* 16: 277–296.
- Lagu, A., and S. J. Landry. 2011. Roadmap for the next generation of dynamic function allocation theories and strategies. *Hum Factors Ergon Manuf* 21(1):14–28.
- Landry, S., T. Farley, and T. Hoang. 2005. Expanding the use of time-based metering: Multi-Center Traffic Management Advisor. Paper presented at the 6th USA/Europe ATM 2005 R&D Seminar, Baltimore, MD.
- Latorella, K. A. 1998. Effects of modality on interrupted flight deck performance: Implications for data link. Paper presented at the Human Factors and Ergonomics Society 42nd Annual Meeting, Santa Monica, CA.
- Lee, K. K., and T. J. Davis. 1996. The development of the final approach spacing tool (FAST): A cooperative controller-engineer design approach. *J Control Eng Pract* 4: 1161–1168.
- Lee, K. K., and B. D. Sanford. 1998. Human factors Assessment: The Passive Final Approach Spacing Tool (pFAST) Operations Evaluation. Moffett Field, CA: NASA Ames Research Center.
- Levy, J. L., D. C. Foyle, and R. S. McCann. 1998. Performance benefits with scene-linked HUD symbology: An attentional phenomenon? Paper presented at the The 42nd Annual Meeting of the Human Factors and Ergonomics Society, Santa Monica, CA.
- Ljundberg, M., and A. Lucas. 1992. The OASIS Air Traffic Management System (No. 28). Melbourne, Australia: Australian Artificial Intelligence Institute.
- MacKay, W. E. 1999. Is paper safer? The role of paper flight strips in air traffic control. *ACM Trans Comput Hum Interact* 6: 311–340.
- McGreevy, M. W., and S. R. Ellis. 1986. The effect of perspective geometry on judged direction in spatial information instruments. *Hum Factors* 28: 439–456.
- McRuer, D., and D. Graham. 1965. Human pilot dynamics in compensatory systems (No. AAFFDL-TR-65-15): USAF.
- Mendel, M. B., and T. B. Sheridan. 1986. Optimal Combination of Information from Multiple Sources. Arlington, VA: Office of Naval Research.
- Midkiff, A., and R. J. Hansman. 1993. Identification of important 'party line' information elements and implications for situational awareness in the data-link environment. *Air Traffic Control Q* 1(1):5–30.
- Miller, C. A., and R. Parasuraman. 2007. Designing for flexible interaction between humans and automation: Delegation interfaces for supervisory control. *Hum Factors* 49: 57–75.
- Monty, R. A. 1973. Keeping track of sequential events: Implications for the design of displays. *Ergonomics* 16: 443–454.
- Mountford, S. J., and B. Somberg, B. 1981. Potential uses of two types of stereographic display systems in the airborne fire control environment. In *Proceedings of the Human Factors Society*, vol. 25, 235–239. Santa Monica, CA: The Human Factors and Ergonomics Society.
- Murphy, M. R., L. A. McGee, E. A. Paler, C. H. Pault, and T. E. Wempe. 1978. Simulator evaluation of three situation and guidance displays for V/STOL aircraft zero-zero landing approaches. *IEEE Trans Syst Man Cybern* 8: 18–29.
- NavCanada. 2003. SASS: Sequencing and Scheduling System. Retreived November 4, 2011, from <http://www.navcanada.ca/contentdefinitionsfiles/TechnologySolutions/products/StandAlone/sass/SASSen.pdf>.
- Norman, D. A. 1993. *Things That Make Us Smart*. Reading, MA: Addison-Wesley.
- Ockerman, J. J., and A. R. Pritchett. 2004. Improving performance on procedural tasks through presentation of locational procedure context: An empirical evaluation. *Behav Inf Technol* 23(1): 11–20.
- Olmos, O., C. D. Wickens, and A. Chudy. 1997. Tactical displays for combat awareness: An examination of dimensionality and frame of reference concepts, and the application of cognitive engineering. Paper presented at the 9th International Symposium on Aviation Psychology, Columbus, OH.
- Parasuraman, R., and M. Byrne. 2003. Automation and human performance in aviation. In *Principles of Aviation Psychology*, ed. P. Tsang, and M. Vidulich, 311–356. Mahwah, NJ: Lawrence Erlbaum.
- Parasuraman, R., M. Mouloua, R. Molloy, and B. Hilburn. 1993. Adaptive function allocation reduces performance costs of static automation. Paper presented at the Proceedings of the Seventh International Symposium on Aviation Psychology, Columbus, OH.

- Parasuraman, R., and V. Riley. 1997. Humans and automation: Use, misuse, disuse, abuse. *Hum Factors* 39: 230–253.
- Parasuraman, R., T. B. Sheridan, and C. D. Wickens. 2000. A model for types and levels of human interaction with automation. *IEEE Trans Syst Man Cybern* 30: 286–297.
- Parker, D., and R. Lawton. 2000. Judging the use of clinical protocol by fellow professionals. *Soc Sci* 51: 669–677.
- Prevot, T., S. Sheldon, J. Mercer, P. Kopardekar, E. Palmer, and V. Battiste. 2003. ATM concept integrating trajectory-orientation and airborne separation assistance in the presence of time-based traffic flow management. Paper presented at the 22nd Digital Avionics System Conference, Indianapolis, IN.
- Pritchett, A. R. 2001. Reviewing the role of cockpit alerting systems. *Hum Factors Aerosp Saf* 1(1):5–38.
- Pritchett, A. R., R. J. Hansman, and E. N. Johnson. 1995. Use of testable responses for performance-based measurement of situation awareness. In *Experimental Analysis and Measurement of Situation Awareness*, ed. M. R. Endsley, and D. J. Garland, 201–210. Daytona Beach, FL: Embry-Riddle Press.
- Pulat, B. M., and M. A. Ayoub. 1979. A computer-aided instrument panel design procedure. *Proc Hum Factors Soc* 23: 191–192.
- Plylyshyn, Z. 2003. Mental imagery: In search of a theory. *Trends Cogn Sci* 7(3): 113–118.
- Rani, P., J. Sims, R. Brackin, and N. Sarkar. 2002. Online stress detection using psychophysiological signals for implicit human-robot cooperation. *Robotica* 20: 673–685.
- Regal, D. M., W. H. Rogers, and G. P. Boucek. 1988. *Situational Awareness in the Commercial Flight Deck: Definition, Measurement, and Enhancement* (No. Technical Paper 881508). Warrendale, PA: Society of Automotive Engineers.
- Robinson III, J. E., T. J. Davis, and D. R. Isaacson. 1997. Fuzzy reasoning-based sequencing of arrival aircraft in the terminal area. Paper presented at the AIAA Guidance, Navigation, and Control Conference, New Orleans, LA.
- Roscoe, S. N. 1968. Airborne displays for flight and navigation. *Hum Factors* 10(4):321–332.
- Roscoe, S. N. 1997. Horizon control reversals and the graveyard spiral. *CSEIAC Gatewa* 7(3): 1–4.
- Roscoe, S. N., L. Corl, and R. S. Jensen. 1981. Flight display dynamics revisited. *Hum Factors* 23(3):341–353.
- Sabeh, R., W. R. Jorve, and J. M. Vanderplas. 1958. *Shape Coding of Aircraft Instrument Zone Markings* (No. Technical Note 57–260). Wright-Patterson AFB: USAF WADC.
- Sanders, and E. J. McCormick. 1993. Human Factors in Engineering and Design. New York: McGraw-Hill.
- Sarter, N. B., and D. D. Woods. 1991. Situation awareness: A critical but ill-defined phenomenon. *Int J Aviat Psychol* 1(1):45–57.
- Scallen, S. F., P. A. Hancock, and J. A. Dudley. 1996. Pilot performance and preference for short cycles of automation in adaptive function allocation. *Appl Ergon* 26(6):397–403.
- Schmidt, K., and L. Bannon. 1992. Taking CSCW seriously: Supporting articulation work. *Comput Support Coop Work* 1(1):7–40.
- Schneiderman, B. 1998. Designing the User Interface. Cambridge, MA: Addison-Wesley.
- Seidler, K., and C. D. Wickens. 1992. Distance and organization in multifunction displays. *Hum Factors* 34: 555–569.
- Selcon, S. J., and R. M. Taylor. 1989. Evaluation of the situational awareness rating technique (SART) as a tool for aircrew systems design. Paper presented at the NATO AGARD conference on situational awareness in aerospace operations, Springfield, VA.
- Sheridan, T. B. 1992. Telerobotics, Automation, and Human Supervisory Control. Cambridge: The MIT Press.
- Sheridan, T. B. 1998. Allocating functions rationally between humans and machines. *Ergon Des* 6(3):20–25.
- Simmonds, G. R., M. Galer, and A. Baines. 1981. Ergonomics of Electronic Displays. Warrendale, PA: Society of Automotive Engineers.
- Smith, K., and P. A. Hancock. 1995. Situation awareness is adaptive, externally directed consciousness. *Hum Factors* 37(1): 137–148.
- Sokkappa, B. G. 1989. Impact of Metering Methods on Airport Throughput. (Report No. MP-89W000222) (No. MP-89W000222). McLean, VA: MITRE Corporation.
- Sridhar, B., S. R. Grabbe, K. Sheth, and K. Bilimoria. 2007. Initial study of tube networks for flexible airspace utilization. Paper presented at the Guidance, Navigation, and Control Conference 2007, Hilton Head, SC.
- Starr, S. L., and J. R. Griesemer. 1989. Institutional ecology, “translations,” and boundary objects: Amateurs and professionals in Berkeley’s Museum of Vertebrate Zoology. *Soc Stud Sci* 19: 387–420.
- Suchman, L. 1987. Plans and Situated Actions: The Problem of Human-Machine Communication. Cambridge, UK: Cambridge University Press.
- Swenson, H., T. Hoang, S. Engelland, D. Vincent, T. Sanders, B. Sanford et al. 1997. Design and Operational Evaluation of the Traffic Management Advisor at the Fort Worth Air Route Traffic Control Center. Paper presented at the 1st USA/Europe Air Traffic Management R&D Seminar, Saclay, France.
- Taylor, R. M. 1989. Situational awareness rating technique (SART): The development of a tool for aircrew systems design. Paper presented at the NATO AGARD conference on situational awareness in aerospace operations, Springfield, VA.
- Tipper, S. P., and J. Driver. 1988. Negative priming between pictures and words in a selective attention task: Evidence for semantic processing of ignored stimuli. *Mem Cogn* 16(1):64–70.
- Vandevenne, H. F., and J. W. Andrews. 1993. Effects of metering precision and terminal controllability on runway throughput. *Air Traffic Control Q* 1: 277–297.
- VanRullen, and C. Koch. 2003. Competition and selection during visual processing of natural scenes and objects. *J Vis* 3(1):75–85.
- VanRullen, and S. J. Thorpe. 2001. The time course of visual processing: From early perception to decision-making. *J Cogn Neurosci* 13(4):454–461.
- Veitengruber, J. E. 1977. Design criteria for aircraft warning, caution, and advisory alerting systems. *J Aircr* 15(9):574–581.
- Ververs, M. P., and C. D. Wickens. 1998. Head-up displays: Effects of clutter, symbology, intensity, and display location on pilot performance. *Int J Aviat Psychol* 8: 377–403.
- Vicente, K. J., and J. Rasmussen. 1992. Ecological interface design: Theoretical foundations. *IEEE Trans Syst Man Cyberne SMC-22*:589–606.
- Vidulich, M. A. 1992. Measuring situation awareness. Paper presented at the The Human Factors Society 36th Annual Meeting, Atlanta, GA.
- Wegerbauer, C. 2005. The Access 5 project—Enabling direct route UAS operations in the U.S. National Airspace System. *Unmanned Veh Mag* 10: 3.
- Well, A. 1971. The influence of irrelevant information on speeded classification tasks. *Percept Psychophys* 13: 79–84.
- Whitehurst, H. O. 1982. Screening designs used to estimate the relative effects of display factors on dial reading. *Hum Factors* 24(3):301–310.

- Whitfield, D., and A. Jackson. 1983. The air traffic controller's picture as an example of a mental model. Paper presented at the IFAC Conference on Analysis, Design, and Evaluation of Man-Machine Systems, Baden-Baden, Germany.
- Wickens, C. D. 2003. Aviation displays. In *Principles and Practice of Aviation Psychology*, ed. P. Tsang, and M. Vidulich, 147–199. Mahwah, NJ: Lawrence Erlbaum.
- Wickens, C. D., and C. M. Carswell. 1995. The proximity compatibility principle: Its psychological foundation and its relevance to display design. *Hum Factors* 37(3):473–494.
- Wickens, C. D., S. Fadden, D. Merwin, and P. M. Ververs. 1998. Cognitive factors in aviation display design. Paper presented at the 17th Digital Avionics Systems Conference, Bellevue, WA.
- Wickens, C. D., A. S. Mavor, R. Parasuraman, and J. P. McGee. 1998. *The Future of Air Traffic Control: Human Operators and Automation*. Washington, DC: National Academy Press.
- Wickens, C. D., S. Miller, and M. Tham. 1996. The implications of data-link for representing pilot request information on 2D and 3D air traffic control displays. *Int J Ind Ergon* 18: 283–293.
- Wickens, C. D., and T. Prevett. 1995. Exploring the dimensions of egocentricity in aircraft navigation displays. *J Exp Psychol Appl* 1(2): 110–135.
- Wickens, C. D., S. Rice, D. Keller, S. Hutchins, J. Hughes, and K. Clayton. 2009. False alerts in air traffic control conflict alerting system: Is there a "cry wolf" effect? *Hum Factors* 51: 446–462.
- Wiener, E. L., and R. E. Curry. 1980. Flight-deck automation: Promises and problems. *Ergonomics* 23(10):995–1011.
- Wilson, G. F., and C. A. Russell. 2007. Performance enhancement in an uninhabited air vehicle task using psychophysio logically determined adaptive aiding. *Hum Factors* 49: 1005–1018.
- Wittgenstein, L. 1922. *Tractatus Logico-Philosophicus*. London: Routledge & Kegan Paul.
- Woods, D. D. 1984. Visual momentum: A concept to improve the cognitive coupling of person and computer. *Int J Man Mach Stud* 21: 229–244.
- Wright, P., A. Dearden, and B. Fields. 1998. Function allocation: A perspective from studies of work practice. *Int J Hum Comput Stud* 52(2):335–355.
- Zhang, J., and D. A. Norman. 1994. Representations in distributed cognitive tasks. *Cogn Sci* 18: 87–122.

User-Centered Design in Games

- Age of Empires II: Age of Kings. 1999. Computer Software. Redmond, WA: Microsoft Corporation.
- Alpine Racer. 1995. Computer Software. Tokyo, Japan: Namco.
- Amaya, G., J. Davis, D. Gunn, C. Harrison, R. Pagulayan, B. Phillips, and D. Wixon. 2008. Games user research (GUR): Our experience with and evolution of four methods. In *Game Usability: Advice from the Experts for Advancing the Player Experience*, ed. K. Isbister, N. Schaffer, 35–64. Burlington, MA: Morgan Kaufmann Publishers.
- Animal Crossing. 2002. Computer Software. Redmond, WA: Nintendo of America.
- Banjo Kazooie. 2000. Computer Software. Redmond, WA: Nintendo of America.
- Bradburn, N. M., and S. Sudman. 1988. *Polls and Surveys: Understanding What they Tell Us*. San Francisco, CA: Jossey-Bass.
- Brute Force. 2003. Computer Software. Redmond, WA: Microsoft Game Studios.
- Business Week. 2006. *A Brief History of Game Console Warfare*. http://images.businessweek.com/ss/06/10/game_consoles/source/7.htm (accessed March 22, 2008).
- Cassell, J., and H. Jenkins. 2000. Chess for girls? Feminism and computer games. In *From Barbie to Mortal Kombat: Gender and Computer Games*, ed. J. Cassell, and H. Jenkins, 2–45. Cambridge, MA: The MIT Press.
- Chalk, A. 2007. Halo 3 Sets New First-Day Sales Record. <http://www.escapistmagazine.com/news/view/77341-Halo-3-Sets-New-First-Day-Sales-Record>. (accessed June 23, 2010).
- Combat Flight Simulator. 1998. Computer Software. Redmond, WA: Microsoft Corporation.
- Couper, M. P. 2000. Web surveys: A review of issues and approaches. *Public Opin Q* 64: 464–494.
- Crackdown 2. 2010. Computer Software. Redmond, WA: Microsoft Game Studios.
- Crash Bandicoot: The Wrath of Cortex. 2001. Computer Software. Los Angeles, CA: Universal Interactive Studios.
- Crawford, C. 1982. *The Art of Computer Game Design*. Berkeley, CA: Osborne/McGraw-Hill.
- Csikszentmihalyi, M. 1990. *Flow-The Psychology of Optimal Experience*. New York: Harper & Rowe.
- Dance Dance Revolution. 1998. Computer Software. Tokyo, Japan: Konami.
- Davis, J. P., K. Steury, and R. J. Pagulayan. 2005. A survey method for assessing perceptions of a game: The consumer playtest in game design. *Game Stud Int J Comput Game Res* 5(1). http://www.gamestudies.org/0501/davis_steyr_pagulayan/ (accessed November 22, 2005).
- Desurvire, H., M. Caplan, and J. Toth. 2004. Using heuristics to improve the playability of games. In *CHI 2004: Conference on Human Factors in Computing Systems*. Vienna, Austria: ACM's Special Interest Group on Computer-Human Interaction.
- Diddy Kong Racing. 1997. Computer Software. Redmond, WA: Nintendo of America.
- Domjan, M. 2010. *The Principles of Learning and Behavior*. Belmont, CA: Wadsworth.
- Dumas, J. S., and J. C. Redish. 1999. *A Practical Guide to Usability Testing*, Rev. ed., Portland, OR: Intellect Books.
- Entertainment Software Association (ESA). 2009. *2009 Sales, Demographics and Usage Data: Essential Facts About the Computer and Video Game Industry*. Washington, DC: Entertainment Software Association.
- Facebook. 2010. Facebook's Farmville Application Page. Facebook:<http://www.facebook.com/apps/application.php?id=102452128776> (accessed April 25, 2010).
- Final Fantasy X. 2001. Computer Software. Tokyo, Japan: Square Co., Ltd.
- Flight Simulator X. 2006. Computer Software. Redmond, WA: Microsoft Game Studios.
- Forza Motorsport 4. 2011. Computer Software. Redmond, WA: Microsoft Studios.
- Game Boy. 1989. Computer Hardware. Redmond, WA: Nintendo of America.

- Game Boy Color. 1998. Computer Hardware. Redmond, WA: Nintendo of America.
- Gameboy Advance. 2001. Computer Hardware. Redmond, WA: Nintendo of America.
- Gardner, J. 2009. *Futurology: FarmVille on Facebook*. London Today:<http://www.thisislondon.co.uk/lifestyle/article-23749479-futurology-farmville-on-facebook.do> (accessed October 11, 2009).
- Gears of War. 2006. Computer Software. Redmond, WA: Microsoft Game Studios.
- Greenbaum, T. L. 1988. The Practical Handbook and Guide to Focus Group Research. Lexington, MA: D.C. Heath and Company.
- Guitar Hero. 2005. Computer Software. Santa Monica, CA: Activision.
- Halo 2. 2004. Computer Software. Redmond, WA: Microsoft Game Studios.
- Halo: Combat Evolved. 2001. Computer Software. Redmond, WA: Microsoft Corporation.
- Harvest Moon. 2003. Computer Software. Redmond, WA: Nintendo of America.
- Hyman, P. 2005. State of the industry: Mobile games. *Game Developer Mag* 12(14):11–16.
- IDG Entertainment. 2005. IDG Entertainment Casual Games Market Report. Oakland, CA: IDG Entertainment.
- International Game Developers Association. 2005. IDGA 2005 mobile games whitepaper. Presented at the Game Developers Conference 2005 by the Mobile Games SIG, San Francisco.
- Internet Backgammon, Windows X.P. 2001. Computer Software. Redmond, WA: Microsoft Corporation.
- Jablonsky, S., and D. DeVries. 1972. Operant conditioning principles extrapolated to the theory of management. *Organ Behav Hum Perform* 7: 340–358.
- Janis, I. L. 1972. Victims of Groupthink. Boston, MA: Houghton Mifflin Company.
- Jordan, P. W. 2000. Designing Pleasurable Products: An Introduction to the New Human Factors. Philadelphia, PA: Taylor & Francis.
- Kent, S. L. 2000. The First Quarter: A 25-year History of Video Games. Bothell, WA: BWD Press.
- Kim, J., D. Gunn, E. Schuh, B. Phillips, R. Pagulayan, and D. Wixon. 2008. Tracking real-time user experience (TRUE): A comprehensive instrumentation solution for complex systems. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. Florence, Italy: ACM.
- Krueger, R. A. 1994. Focus Groups: A Practical Guide for Applied Research. Thousand Oaks, CA: Sage.
- Labaw, P. 1981. Advanced Questionnaire Design. Cambridge, MA: Abt Books Inc.
- Lepper, M. R., and T. W. Malone. 1987. Intrinsic motivation and instructional effectiveness in computer-based education. In *Aptitude, Learning and Instruction III: Conative and Affective Process Analyses*, ed. R. E. Snow, and M. J. Farr, 223–253. Hillsdale, NJ: Erlbaum.
- Lepper, M., D. Greene, and R. Nisbett. 1973. Undermining children's intrinsic interest with extrinsic rewards. *J Pers Soc Psychol* 28: 129–137.
- Levine, K. 2001. New opportunities for storytelling. Paper presented at the Electronic Entertainment Exposition. Los Angeles, CA.
- Madden NFL 06. 2005. Computer Software. Redwood City, CA: Electronic Arts Inc.
- Malone, T. W. 1981. Towards a theory of intrinsic motivation. *Cogn Sci* 4: 333–369.
- Maximejohnson. 2010. Tetris atteint les 100 millions de téléchargements payants (et une petite histoire du jeu). maximejohnson: <http://www.maximejohnson.com/techno/2010/01/tetris-atteint-les-100-millions-de-telechargements-payants-et-une-petite-histoire-du-jeu/> (accessed May 24, 2010)
- Mazur, J. 2006. Learning and Behavior, 6th ed., Upper Saddle River, NJ: Prentice Hall.
- MechCommander 2. 2001. Computer Software. Redmond, WA: Microsoft Corporation.
- MechWarrior 4: Vengeance. 2000. Computer Software. Redmond, WA: Microsoft Corporation.
- Medlock, M. C., D. Wixon, M. McGee, and D. Welsh. 2005. The rapid iterative test and evaluation method: Better products in less time. In *Cost Justifying Usability*, ed. G. Bias, and D. Mayhew, 489–517. San Francisco, CA: Morgan Kaufmann.
- Medlock, M. C., D. Wixon, M. Terrano, and R. Romero. 2002. Using the RITE Method to Improve Products: A Definition and a Case Study. Orlando, FL: Usability Professionals Association.
- Microsoft. 2007. Global Entertainment Phenomenon "Halo 3" Records More Than \$300 Million in First-Week Sales Worldwide. Microsoft Newscenter: <http://www.microsoft.com/presspass/press/2007/oct07/10-04Halo3FirstWeekPR.mspx> (accessed June 15, 2010).
- Moore, K., and J. Rutter. 2004. Understanding consumers' understanding of mobile entertainment. In *Proceedings of Mobile Entertainment: User-centred Perspectives*, ed. Moore, and Rutter, 49–65. University of Manchester: CRIC.
- MPAA. 2009. Theatrical Market Statistics. Washington, DC: MPAA.
- MTV Music Generator. 1999. Computer Software. Warwickshire, UK: The Codemasters Software Company Limited.
- NFL2K. 1999. Computer Software. San Francisco, CA: Sega of America, Inc.
- Nielsen, J. 1993. Usability Engineering. San Francisco, CA: Morgan Kaufmann.
- Nielsen, J., and T. K. Landauer. 1993. A mathematical model of the finding of usability problems. In *Proceedings of ACM INTERCHF'93 Conference*, 206–213. Amsterdam: ACM.
- Nielsenwire. 2009. iPhone Users Watch More Video... and are Older than You Think: http://blog.nielsen.com/nielsenwire/online_mobile/iphone-users-watch-more-video-and-are-older-than-you-think/ (accessed June 15, 2009)
- Nintendo. 2005. 2005 Annual Report. <http://www.nintendo.com/corp/report/NintendoAnnualReport2005.pdf> (accessed March 22, 2008).
- Nintendo D.S. 2004. Computer Hardware. Redmond, WA: Nintendo of America.
- Nintendo Wii. 2006. Computer Hardware. Redmond, WA: Nintendo of America.
- Norman, D. 2005. Emotional Design. Cambridge, MA: Basic Books.
- Oddworld: Munch's Odyssey. 2001. Computer Software. Redmond, WA: Microsoft Corporation.
- Pagulayan, R. J., and K. Steury. 2004. Beyond usability in games. *Interactions* 11(5):70–71.
- Pagulayan, R. J., D. V. Gunn, and R. L. Romero. 2006. A gameplay-centered design framework for human factors in games. In *2nd Edition of International Encyclopedia of Ergonomics and Human Factors*, ed. W. Karwowski, 1314–1319. London, England: Taylor & Francis.
- Pagulayan, R. J., K. Steury, B. Fulton, and R. L. Romero. 2003. Designing for fun: User-Testing case studies. In *Funology: From Usability to Enjoyment*, ed. M. Blythe, A. Monk, K. Overbeeke, and P. Wright, 137–150. Netherlands: Kluwer Academic.
- Payne, S. L. 1979. The Art of Asking Questions. Princeton, NJ: Princeton University.
- Playstation Move. 2010. Computer Hardware. Tokyo, Japan: Sony Computer Entertainment.
- Pokemon Crystal. 2000. Computer Software. Tokyo, Japan: Nintendo Japan.

- Preece, J., Y. Rogers, H. Sharp, D. Benyon, S. Holland, and T. Carey. 1996. Human-Computer Interaction. Reading, MA: Addison-Wesley.
- Project Natal. 2010. Computer Hardware. Redmond, WA: Microsoft.
- RalliSport Challenge. 2003. Computer Software. Redmond, WA: Microsoft Game Studios.
- Ratchet and Clank Future: A Crack in Time. 2009. Computer Software. Tokyo, Japan: Sony Computer Entertainment.
- Resident Evil 4. 2005. Computer Software. Osaka, Japan: Capcom.
- Rise of Nations: Rise of Legends. 2006. Computer Software. Redmond, WA: Microsoft Game Studios.
- Rock Band. 2007. Computer Software. Redwood City, CA: Electronic Arts.
- Root, R. W., and S. Draper. 1983. Questionnaires as a software evaluation tool. Paper presented at the ACM CHI, Boston, MA.
- Saints Row 2. 2008. Computer Software. Agoura Hills, CA: THQ.
- Salas, E., and D. Maurino. 2010. Human Factors in Aviation, 2nd ed., Burlington, MA: Elsevier.
- Schuh, E., D. Gunn, B. Phillips, R. Pagulayan, J. Kim, and D. Wixon. 2008. TRUE instrumentation: Tracking real-time user experience in games. In Game Usability: Advice from the Experts for Advancing the Player Experience, ed. K. Isbister, and N. Schaffer, 237–265. Burlington, MA: Morgan Kaufmann Publishers.
- Second Life. 2003. Computer Software. San Francisco, CA: Linden Research, Inc.
- Shippy, D., and M. Phipps. 2009. The Race for a New Game Machine. New York: Kensington Publishing Corp.
- Sidel, P. H., and G. E. Mayhew. 2003. *The Emergence of Context: A Survey of MobileNet User Behaviour*. www.mocobe.com/pdf/EmergenceofContext1.pdf (accessed June 15, 2010)
- Singstar. 2004. Computer Software. Tokyo, Japan: Sony Computer Entertainment.
- Sudman, S., N. M. Bradburn, and N. Schwarz. 1996. Thinking about Answers: The Application of Cognitive Processes to Survey Methodology. San Francisco, CA: Jossey-Bass.
- Super Mario Bros Wii. 2009. Computer Software. Redmond, WA: Nintendo of America.
- The Legend of Zelda: The Wind Waker. 2003. Computer Software. Redmond, WA: Nintendo of America.
- Thompson, C. 2007. Halo 3: How Microsoft Labs Invented a New Science of Play. *Wired* 15: 140–147.
- Tom Clancy's Splinter Cell: Conviction. 2010. Computer Software. Paris, France: Ubisoft.
- Tomb Raider: Underworld. 2008. Computer Software. London, England: Eidos.
- Toy Soldiers. 2010. Computer Software. Redmond, WA: Microsoft Game Studios.
- Toy Soldiers: Match Defense. 2010. Computer Software. Redmond, WA: Microsoft Game Studios.
- Wickens, C. D., and J. G. Hollands. 2000. Engineering Psychology and Human Performance, 3rd ed., Upper Saddle River, NJ: Prentice Hall.
- Wii Sports Resort. 2008. Computer Software. Redmond, WA: Nintendo of America.
- Yuen, M. 2005. The tipping point: The convergence of wireless and console/PC game design. *Game Developer Magazine*, September 1.

Older Adults and Information Technology

- AARP. 2002. Staying Ahead of the Curve: The AARP Work and Career Study. Washington, DC: AARP.
- Adams, N., D. Stubbs, and V. Woods. 2005. Psychological barriers to Internet usage among older adults in the UK. *Inf Health Internet Med* 30: 3–17.
- Adler, R. 2002. The age wave meets the technology wave: Broadband and older Americans. <http://www.senionet.org/downloads/broadband.pdf> (accessed August 25, 2010).
- Administration on Aging. 2009. *A Profile of Older Americans*. http://www.aoa.gov/aoaroot/aging_statistics/Profile/2009/docs/2009profile_508.pdf (accessed July 15, 2010).
- Baltes, P. B., and J. Smith. 1999. Multilevel and systemic analyses of old age: Theoretical and empirical evidence for a fourth age. In *Handbook of Theories of Aging*, ed. V. L. Bengtson, and K. W. Schaie, 153–173. New York: Springer.
- Barth, M. C., W. McNaught, and P. Rizzi. 1993. Corporations and the aging workforce. In *Building the Competitive Workforce*, ed. P. H. Mirvis, 156–200. New York: Wiley.
- Beach, S., R. Schulz, J. Downs, J. Matthews, B. Barron, and K. Seelman. 2009. Disability, age, and information privacy attitudes in quality of life technology applications: Results from a national web study. *ACM Transact Accessible Comput* (2): 1–21.
- Berkman, L. F. 1995. The role of social isolations in health promotion. *Psychosomatic Med* 57: 245–254.
- Birren, J. E., and K. W. Schaie. 2001. *Handbook of the Psychology and Aging*. San Diego, CA: Academic Press.
- Cantor, N., and C. Sanderson. 1999. Life task participation and well-being: The importance of taking part in daily life. In *Well-being: The Foundation of Hedonic Psychology*, ed. D. Kahneman, E. Diener, and N. Schwartz, 230–243. New York: Russell Sage Foundation.
- Charness, N., and W. R. Boot. 2009. Aging and information technology use: Potential and pitfalls. *Curr Directions Psychol Sci* 18: 253–258.
- Charness, N., E. A. Bosman, and R. G. Elliot. 1995. Senior-friendly input devices: Is the pen mightier than the mouse? In Paper Presented at the 103 Annual Convention of the American Psychological Association Meeting, New York.
- Charness, N., S. J. Czaja, and J. Sharit. 2007. Age and technology for work. In *Aging and Work in the 21st Century*, ed. K. S. Shultz, and G. A. Adams, 225–249. Mahwah, NJ: Erlbaum.
- Charness, N., M. C. Fox, and A. L. Mitchum. 2010. Lifespan cognition and information technology. In *Handbook of Lifespan Psychology*, ed. K. Fingerman, C. Berg, T. Antonucci, and J. Smith, New York: Springer.
- Charness, N., and P. Holley. 2001. Minimizing computer performance deficits via input devices and training. In Presentation Prepared for the Workshop on Aging and Disabilities in the Information Age. Baltimore, MD, John Hopkins University.
- Charness, N., C. E. Schumann, and G. A. Boritz. 1992. Training older adults in word processing: Effects of age, training technique and computer anxiety. *Int J Aging Technol* 5: 79–106.
- Cline, R. J. W., and K. H. Hayes. 2001. Consumer health information seeking on the Internet: The state of the art. *Health Educ Res* 16: 671–692.

- Clinical Geriatrics. 1999. Trend watch: Chronic illness and the aging U.S. population. *Clin Geriatrics* 7(8):77.
- Cobb, S. 1976. Social support as a moderator of life stress. *Psychosomatic Med* 38: 300–314.
- Cody, M. J., D. Dunn, S. Hoppin, and P. Wendt. 1999. Silver surfers: Training and evaluating Internet use among older adult learners. *Commun Educ* 48: 269–286.
- Czaja, S. J., N. Charness, A. D. Fisk, C. Hertzog, S. N. Nair, W. Rogers, and J. Sharit. 2006. Factors predicting the use of technology: Findings from the center for research and education on aging and technology enhancement (CREATE). *Psychol Aging* 21: 333–352.
- Czaja, S. J., J. H. Guerrier, S. N. Nair, and T. K. Laudauer. 1993. Computer communication as an aid to independence for older adults. *Behav Inf Technol* 12: 197–207.
- Czaja, S. J., K. Hammond, J. Blascovich, and H. Swede. 1986. Age-related differences in learning to use a text-editing system. *Behav Inf Technol* 8: 309–319.
- Czaja, S. J., K. Hammond, and J. B. Joyce. 1989. Word processing training for older adults. Final report submitted to the National Institute on Aging (Grant # 5 R4 AGO4647–03).
- Czaja, S. J., and C. C. Lee. 2007. Information technology and older adults. In *The Human Computer-Interaction Handbook*, 2nd ed., ed. J. A. Jacko and A. Sears, 777–792. New York: Lawrence Erlbaum Associates.
- Czaja, S. J., and M. Rubert. 2002. Telecommunications technology as an aid to family caregivers of persons with dementia. *Psychosomatic Med* 64: 469–476.
- Czaja, S. J., and J. Sharit. 1993. Age differences in the performance of computer-based work as a function of pacing and task complexity. *Psychol Aging* 8: 59–67.
- Czaja, S. J., and J. Sharit. 1998a. Ability-performance relationships as a function of age and task experience for a data entry task. *J Exp Psychol Appl* 4: 332–351.
- Czaja, S. J., and J. Sharit. 1998b. Age differences in attitudes towards computers: The influence of task characteristics. *J Gerontol Psychol Sci Social Sci* 53B:329–410.
- Czaja, S. J., and J. Sharit. 2003. Practically relevant research: Capturing real-world tasks, environments, and outcomes. *Gerontologists* 43: 9–18.
- Czaja, S. J., and J. Sharit. 2009. *Aging and Work: Assessment and implications for the future*. Johns Hopkins University Press.
- Czaja, S. J., J. Sharit, M. A. Hernandez, S. N. Nair, and D. Loewenstein. 2010. Variability among older adults in Internet health information-seeking performance. *Gerontechnology* 9: 46–55.
- Czaja, S. J., J. Sharit, and S. N. Nair. 2008. Usability of the medicare health web site. *JAMA* 300(7):790–791.
- Czaja, S. J., J. Sharit, S. Nair, and M. Rubert. 1998. Understanding sources of user variability in computer-based data entry performance. *Behav Inf Technol* 19: 282–293.
- Czaja, S. J., J. Sharit, D. Ownby, D. Roth, and S. N. Nair. 2001. Examining age differences in performance of a complex information search and retrieval task. *Psychol Aging* 16:564–579.
- Damianakis, T., M. Crete-Nishihata, K. L. Smith, R. M. Baeker, and E. Marziali. 2010. The psychosocial impacts of multi-media biographies on persons with cognitive impairments. *Gerontologist* 50: 23–35.
- Demiris, G., M. J. Rantz, M. A. Aud, K. D. Marek, H. W. Tyres, M. Skubic, and A. A. Hussam. 2004. Older adults' attitude towards and perceptions of 'smart home' technologies: A pilot study. *Med Inf Internet Med* 29: 87–94.
- Dickinson A., and P. Gregor. 2006. Computer has no demonstrated impact on the well-being of older adults. *Int J Hum Comput Stud* 64: 744–753.
- Dyck, J. L., and J. A. Smither. 1994. Age differences in computer anxiety: The role of computer experience, gender and education. *J Educ Comput Res* 10: 239–248.
- Dykstra, P. 1995. Loneliness among the never and formerly married: The importance of supportive friendships and a desire for independence. *J Gerontol Psychol Sci Social Sci* 50B:S321–9.
- Edwards, J. E., V. G. Wadley, R. S. Myers, D. K. Roenker, G. M. Cissel, and K. Ball. 2002. Transfer of a speed of processing intervention to near and far cognitive functions. *Gerontol* 48: 329–340.
- El-Attar, T. E., J. Gray, S. Nair, R. Ownby, and S. J. Czaja. 2005. Older adults and internet health information seeking. In *Proceedings of the 49th Annual Meeting of the Human Factors and Ergonomics Society*, 163–166. Santa Monica, CA: Human Factors and Ergonomics Society.
- Elias, P. K., M. F. Elias, M. A. Robbins, and P. Gage. 1987. Acquisition of word-processing skills by younger, middle-aged, and older adults. *Psychol Aging* 2: 340–348.
- Ellaway, A., S. Wood, and S. MacIntyre. 1999. Some to talk to? The role of loneliness as a factor in the frequency of GP consultations. *Br J Gen Pract* 49: 363–637.
- Ellis, E. R., and A. J. Allaire. 1999. Modeling computer interest in older adults: The role of age, education, computer knowledge, and computer anxiety. *Hum Factors* 41: 345–355.
- Ellis, P., and I. Hickie. 2001. What causes mental illness. In *Foundations of Clinical Psychiatry*, ed. S. Bloch, and B. Singh, 43–62. Melbourne: Melbourne University Press.
- Ellis, L. B. M., H. Joo, and C. R. Gross. 1991. Use of a computer-based health risk appraisal by older adults. *J Family Pract* 33: 390–394.
- Family Caregiver Alliance. 2010. Caregiving: A universal occupation. http://www.caregiver.org/caregiver/jsp/content_node.jsp?nodeid=2313 (accessed September 5, 2010).
- Federal Interagency Forum on Aging-Related Statistics. 2010. *Older Americans 2010: Key Indicators of Well-being*. Washington, DC: U.S. Government Printing Office.
- Ferguson, T. 1998. Digital doctoring: Opportunities and challenges in electronic-patient communication. *J Am Med Assoc* 280: 1261–1262.
- Fisk, A. D., W. A. Rogers, N. Charness, S. J. Czaja, and J. Sharit. 2009. Designing for older adults: Principles and creative human factors approaches, 2nd ed. Boca Raton, FL: CRC Press.
- Fox, S. 2010. *Health Pew Internet & American Life Project*, <http://www.pewinternet.org/topics/health.aspx> (accessed August 30, 2010).
- Fox, S., and K. Purcell. 2010. Chron disease and the Internet. *Pew Internet Am Life Project* <http://www.pewinternet.org/Reports/2010/Chronic-Disease.aspx> (accessed August 30, 2010).
- Freudenthal, D. 1997. *Learning to use Interactive Devices: Age Differences in the Reasoning Process*. Master's thesis, Eindhoven University of Technology.
- Gallienne, R. L., S. M. Moore, and P. F. Brennan. 1993. Alzheimer's caregivers: Psychosocial support via computer networks. *J Gerontol Nursing* 12: 1–22.

- Gist, M., B. Rosen, and C. Schwoerer. 1988. The influence of training method and trainee age on the acquisition of computer skills. *Pers Psychol* 41: 255–265.
- Guilleard, C., M. Hyde, and P. Higgs. 2007. The impact of age, place, aging in place, and attachment to place on the wellbeing of the over 50s in England. *Res Aging* 29: 590–605.
- Günther, V. K., P. Schäfer, B. J. Holzner, and G. W. Kemmler. 2003. Long-term improvement in cognitive performance through computer-assisted cognitive training: A pilot study in a residential home for older people. *Aging Ment Health* 7(3): 200–206.
- Jacobs, J. M., R. Hammerman-Rozenberg, A. Cohen, J. Stressman. 2006. Chronic back pain among the elderly: Prevalence, associations, and predictors. *Spine* 31:E203–7.
- Jay, G. M., and S. L. Willis. 1992. Influence of direct computer experience on older adults attitude towards computer. *J Gerontol Psychol Sci* 47: 250–257.
- Klusmann, V., A. Evers, R. Schwarzer, P. Schlattmann, F. M. Reischies, I. Heuser, and F. C. Dimeo. 2010. Complex mental and physical activity in older women and cognitive performance: A 6-month randomized controlled trial. *J Gerontol Series A* 65A:680–688.
- Lee, C. C., S. J. Czaja, and J. Sharit. 2009. Training older workers for technology-based employment. *Educ Gerontology* 35: 15–31.
- Madden, M. 2010. Older adults and social media. Pew Internet & American Life Project. <http://pewinternet.org/Reports/2010/Older-Adults-and-Social-Media.aspx> (accessed August 30, 2010).
- Mayhorn, C. B., A. J. Stronge, A. C. McLaughlin, and W. A. Rogers. 2004. Older adults, computer training, and the systems approach: A formula for success. *Educ Gerontol* 30: 185–204.
- McKay, S. M., and B. E. Maki. 2010. Attitudes of older adults towards shooter video games: An initial study to select an acceptable game for training visual processing. *Gerontechnology* (9):5–17.
- Mead, S. E., R. A. Sit, B. A. Jamieson, G. K. Rousseau, and W. A. Rogers. 1996. On-line library catalog: Age-related differences in performance for novice users. Paper presented at the Annual Meeting of the American Psychological Association, Toronto, Canada.
- Mead, S. E., V. A. Spaulding, R. A. Sit, B. Meyer, and N. Walker. 1997. Effects of age and training on World Wide Web navigation strategies. In *Proceedings of the Human Factors and Ergonomics Society 41st Annual Meeting*, 152–156. Santa Monica, CA: Human Factors and Ergonomics Society.
- Mitzner, T. L., J. B. Boron, C. B. Fausset, A. E. Adams, N. Charness, S. J. Czaja, K. Dijkstra, A. D. Fisk, W. A. Rogers, and J. Sharit. 2010. Older adults talk technology: Technology use and attitude. *Comput Hum Behav* 26: 1710–1721.
- Morrell, R. W., C. B. Mayhorn, and J. Bennett. 2000. A survey of World Wide Web in middle-aged and older adults. *Hum Factors* 42(2): 175–185.
- Morrell, R. W., C. B. Mayhorn, and K. V. Echt. 2004. Why older adults use or do not use the Internet. In *Gerontechnology: Research and Practice in Technology and Aging*, ed. D. C. Burdkick, and K. Kwon, 86–96. New York: Springer.
- Morrell, R. W., D. C. Park, C. B. Mayhorn, and K. V. Echt. 1995. Older adults and electronic communication networks: Learning to use ELDERCOMM. Paper presented at the 103 Annual Convention of the American Psychological Association. New York, New York.
- Murata, A., and H. Iwase. 2005. Usability of touch-panel interfaces for older adults. *Hum Factors* 47(4):767–776.
- Nair, S. N. 1989. *A Capability-Demand Analysis of Grocery Shopping Problems Encountered by Older Adults*. A thesis design submitted to the department of Industrial Engineering, State University of New York at Buffalo in partial fulfillment for the requirements for Master of Science.
- Nair, S. N., C. C. Lee, and S. J. Czaja. 2005. Older adults and attitudes toward computers: Have they changed with recent advances in technology? In *Proceedings of the 49th Annual Meeting of the Human Factors and Ergonomics Society*, 154–157. Santa Monica, CA: Human Factors and Ergonomics Society.
- National Alliance for Caregiving and AARP. 2009. Caregiving in the U.S. 2009. http://www.aarp.org/relationships/caregiving/info-12-2009/caregiving_09.html (accessed August 15, 2010).
- National Center for Health Statistics. 2005. Health, United States, 2005 with Chartbook on Trends in the Health of Americans. Washington, DC. Hyattsville, Maryland: US Government Printing Office.
- National Research Council. 2004. Technology for adaptive aging. Steering committee for the workshop on technology for adaptive aging. In *Board on Behavioral, Cognitive, and Sensory Sciences, Division of Behavioral and Social Sciences and Education*, ed. R. W. Pew and S. B. Van Hemel. Washington, DC: The National Academies Press.
- Pak, R., J. Sharit, S. J. Czaja, W. A. Rogers, and A. D. Fisk. 2008. The role of spatial abilities and age in performance in an auditory computer navigation task. *Comput Hum Behav* 24:3045–3051. PMID: 18997876.
- Park, D. C. 1992. Applied cognitive aging research. In *The Handbook of Aging and Cognition*, ed. F. I. M. Crail, and T. A. Salthouse, 449–494. New Jersey: Laurence Erlbaum Associates Pub.
- Pew Internet & American Life Project. 2000. The online health care evolution: How the web helps Americans take better care of themselves. http://www.pewinternet.org/pdfs/PIP_Health_Report.pdf (accessed August 30, 2010).
- Pew Internet & American Life Project. 2004. *Older Americans and the Internet*. http://www.pewinternet.org/pdfs/PIP_Seniors_Online_2004.pdf (accessed August 30, 2010).
- Potter, E. E. 2003. Telecommuting: The future of work, corporate culture, and American society. *J Labor Res* XXIV:73–84.
- Preece, J., and D. Maloney-Krichmar. 2003. Online communities: Focusing on sociability and usability. In *The Human Computer-Interaction Handbook*, ed. J. A. Jacko, and A. Sears, 596–620. Mahwah, NJ: Lawrence Erlbaum Assoc.
- Riviere, C. N., and N. V. Thakor. 1996. Effects of age and disability on tracking tasks with a computer mouse: Accuracy and linearity. *J Rehabil Res Dev* 33(1):6–15.
- Robinson, T. N., P. K. Eng, and D. Gustafson. 1998. An evidence-based approach to interactive health communication: A challenge to medicine in the information age. *J Am Med Assoc* 280: 1264–1269.
- Schieber, F., J. L. Fozard, S. Gordon-Salant, and J. W. Weiffenbach. 1991. Optimizing sensation and perception in older adults. *Int J Ind Ergonom* 7: 133–162.
- Schulz, R., L. S. Noelker, K. Rockwood, and R. L. Sprott. 2006. *The Encyclopedia of Aging*. Vol 1, New York: Springer.
- Sharit, J., S. J. Czaja, M. Hernandez, Y. Yang, D. Perdomo, J. Lewis, C.C. Lee, and S. N. Nair. 2004. An evaluation of performance by older persons on a simulated telecommuting task. *J Gerontol Psychol Sci* 59B, No.6, P305–16.
- Sharit, J., S. J. Czaja, S. N. Nair, and C. C. Lee. 2003. The effects of age and environmental support in using telephone voice menu systems. *Hum Factors* 45: 234–251.
- Sharit, J., M. Hernandez, S. J. Czaja, and S. N. Nair. 2009. The employability of older workers as teleworkers: an appraisal of issues and an empirical study. *Hum Factors Ergon Man* 19: 457–477.

- Sharit, J., M. Hernandez, S. J. Czaja, and P. Pirolli. 2008. Investigating the roles of knowledge and cognitive abilities in older adult information seeking on the web. *ACM Trans Comput Hum Interact* 15(3): 1–25.
- Siegers, K., M. P. J. van Boxtel, and J. Jolles. 2009. The efficiency of using everyday technological devices by older adults: The role of cognitive functioning. *Ageing Soc* 29: 309–325.
- Smith, A. 2010. Home Broadband 2010 Pew Internet & American Life Project Surveys. <http://pewinternet.org/~media//Files/Reports/2010/Home%20broadband%202010.pdf> (acces sed August 30, 2010).
- Smith, N. W., J. Sharit, and S. J. Czaja. 1999. Aging, motor control, and performance of computer mouse tasks. *Hum Factors* 41(3):389–396.
- Stoltz-Loike, M., R. W. Morrell, and J. D. Loike. 2005. Can e-leaming be used as an effective training method for people over age 50? A pilot study. *Gerontechnol* 4(2): 101–113.
- Taha, J., S. J. Czaja, and J. Sharit. 2009. Use of and satisfaction with sources of health information among older Internet users and non-users. *Gerontologist* 49:663–673. PMID: 19741112.
- Tun, P. A., and M. E. Lachman. 2010. The association between computer use and cognition across adulthood: Use it so you won't lose it? *Psychol Aging* 25: 560–568.
- U.S. Bureau of Labor Statistics. 2010. Occupations with the largest job growth. <http://www.bls.gov/oco/cgs035.htm>.
- U.S. General Accounting Office. 2003. *Older Workers: Policies of other Nations to Increase Labor Force Participation*. <http://www.gao.gov/new.items/d03307.pdf>.
- Walker, N., J. Millians, and A. Worden. 1996. Mouse accelerations and performance of older computer users. In *Proceedings of Human Factors and Ergonomics Society 40th Annual Meeting*, 151–154. Santa Monica, CA: Human Factors and Ergonomics Society.
- Westerman, S. J., D. R. Davies, A. I. Glendon, R. B. Stammer, and G. Matthews. 1995. Age and cognitive ability as predictors of computerized information retrieval. *Behav Inf Technol* 14: 313–326.
- White, H., E. McConnell, L. G. Branch, R. Sloane, C. Pieper, and T. L. Box. 2002. A randomized controlled trial of the psychosocial impact of providing Internet training and access to older adults. *Aging Men Health* 6(3):213–222.
- Willis, S. 2004. Technology and learning in current and future older cohorts. In *Technology for Adaptive Aging*, Board on Behavioral, Cognitive, and Sensory Sciences, Division of Behavioral and Social Sciences and Education, ed. R. W. Pew, and S. B. Van Hemel, 209–229. Washington, DC: The National Academies Press.
- Zandri, E., and N. Charness. 1989. Training older and younger adults to use software. *Educ Gerontol* 15: 615–631.

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- Alborzi, H., A. Druin, J. Montemayor, M. Platner, J. Porteous, L. Sherman, A. Boltman et al. 2000. Designing StoryRooms: Interactive storytelling spaces for children. In *Proceedings of the Symposium on Designing Interactive Systems: Processes, Practices, Methods, and Techniques*, 95–104. Brooklyn, NY.
- AlphaBaby. 2009. About AlphaBaby. <http://alphababy.sourceforge.net/> (accessed May 18, 2010).
- Als, B. S., J. J. Jensen, and M. B. Skov. 2005. Comparison of think-aloud and constructive interaction in usability testing with children. In *Proceedings of the 2005 Conference on Interaction Design and Children*. Boulder, CO.
- Amershi, S., M. R. Morris, N. Moraveji, R. Balakrishnan, and K. Toyama. 2010. Multiple mouse text entry for single-display groupware. In *Proceedings of the 2010 ACM Conference on Computer Supported Cooperative Work*, 169–178. Savannah, GA: ACM.
- Andersen, A., and C. Rowland. 2007. Improving the outcomes of students with cognitive and learning disabilities: Phase I development for a web accessibility tool. In *Proceedings of the 9th International ACM SIGACCESS Conference on Computers and Accessibility*, 221–222. Tempe, AZ: ACM.
- Antle, A. N., M. Droumeva, and D. Ha. 2009. Hands on what?: Comparing children's mouse-based and tangible-based interaction. In *Proceedings of the 8th International Conference on Interaction Design and Children*, 80–88. Como, Italy: ACM.
- Baauw, E., and P. Markopoulos. 2004. A comparison of think-aloud and post-task interview for usability testing with children. In *Proceedings of the 2004 Conference on Interaction Design and Children*, 115–116. College Park, MD.
- Bälter, O., O. Engwall, A. M. Öster, and H. Kjellström. 2005. Wizard-of-Oz test of ARTUR: A computer-based speech training system with articulation correction. In *Proceedings of the 7th International ACM SIGACCESS Conference on Computers and Accessibility*, 43. Baltimore, MD: ACM.
- BBC. 1997. *Teletubbies Press Release*.
- Bederson, B., J. Hollan, A. Druin, J. Stewart, D. Rogers, and D. Proft. 1996. Local tools: An alternative to tool palettes. In *Proceedings of the ACM Symposium on User Interface Software and Technology*, 169–170. Seattle, WA.
- Berkovitz, J. 1994. Graphical interfaces for young children in a software-based mathematics curriculum. In *Proceedings of the ACM Conference on Human Factors in Computing Systems: Celebrating Interdependence*, 247–248. Boston, MA.
- Bernard, M., M. Mills, T. Frank, and J. McKnown. 2001. *Which Fonts Do Children Prefer to Read Online?* (Winter 2001), [Web Newsletter]. Software Usability Research Laboratory (SURL).
- Bers, M. U., J. Gonzalez-Heydrich, and D. R. DeMaso. 2001. Identity construction environments: Supporting a virtual therapeutic community of pediatric patients undergoing dialysis. In *Proceedings of the SIGCHI conference on Human Factors in Computing Systems*, 380–387. Seattle, WA: ACM.
- Brashears, H., V. Henderson, K. Park, H. Hamilton, S. Lee, and T. Starner. 2006. American sign language recognition in game development for deaf children. In *Proceedings of the 8th International ACM SIGACCESS Conference on Computers and Accessibility*, 79–86. Portland, OR: ACM.
- Bruckman, A. 1997. *MOOSE Crossing: Construction, Community, and Learning in a Networked Virtual World for Kids*. Unpublished PhD, MIT.
- Bruckman, A. 1998. Community Support for constructionist learning. *Comput Support Coop Work* 7: 47–86.
- Bruckman, A. 2000. Situated support for learning: Storm's weekend with rachael. *J Learn Sci* 9(3):329–372.
- Buechley, L., M. Eisenberg, J. Catchen, and A. Crockett. 2008. The LilyPad Arduino: Using computational textiles to investigate engagement, aesthetics, and diversity in computer science education. In *Proceeding of the Twenty-Sixth Annual SIGCHI Conference on Human Factors in Computing Systems*, 423–432. Florence, Italy.

- Byrne, M. D., J. R. Anderson, S. Douglass, and M. Matessa. 1999. Eye tracking the visual search of click-down menus. In Proceedings of the ACM Conference on Human Factors in Computing Systems: The CHI is the Limit, 402–409. Pittsburgh, PA.
- Calvert, K. 1992. Children in the House: The Material Culture of Early Childhood, 1600–1900. Boston: Northeastern University Press.
- Clements, D. H. 1986. Effects of logo and CAI environments on cognition and creativity. *J Educ Psychol* 78(4):309–318.
- Clements, D. H., and D. F. Gullo. 1984. Effects of computer programming on young children's cognition. *J Educ Psychol* 76(6):1051–1058.
- Cooper, S., W. Dann, and R. Pausch. 2000. Alice: A 3-D tool for introductory programming concepts. *J Comput Sci Coll* 15(5):107–116.
- Cypher, A., and D. C. Smith. 1995. End user programming of simulations. In Proceedings of the ACM Conference on Human Factors in Computing Systems, 27–34. Denver, CO.
- Davenport, A., and A. Wood. 1997. *TeleTubbies FAQ*, [Website]. BBC Education. <http://www.bbc.co.uk/cbeebies/teletubbies/grownups/faq.shtml>.
- Dindler, C., E. Eriksson, O. S. Iversen, M. Ludvigsel, and A. Lykke-Olesen. 2005. Mission from Mars: A method for exploring user requirements for children in a narrative space. In Proceedings of the 2005 Conference on Interaction Design and Children. Boulder, CO.
- diSessa, A. A., and H. Abelson. 1986. Boxer: A reconstructible computational medium. *Commun ACM* 29(9):859–868.
- Donker, A., and P. Markopoulos. 2002. A comparison of think-aloud, questionnaires and interviews for testing usability with children. In *Proceedings of HCI 2002*, 305–16.
- Donker, A., and P. Reitsma. 2004. Usability testing with young children. In Proceedings of the Conference on Interaction Design and Children, 43–48. College Park, MD.
- Dourish, P. 2001. Where the Action Is: The Foundations of Embodied Interaction. Cambridge, MA: MIT Press.
- Druin, A. 1999. Cooperative inquiry: Developing new technologies for children with children. In Proceedings of the ACM Conference on Human Factors in Computing Systems: The CHI is the Limit, 592–599. Pittsburgh, PA.
- Druin, A. 2002. The role of children in the design of new technology. *Behav Inf Technol* 21(1):1–25.
- Druin, A., B. Bederson, J. P. Hourcade, L. Sherman, G. Revelle, M. Platner, and S. Weng. 2001. Designing a digital library for young children: An intergenerational partnership. In Proceedings of the Joint Conference on Digital Libraries. Roanoke, VA.
- Druin, A., E. Foss, L. Hatley, E. Golub, M. L. Guha, J. Fails, and H. Hutchinson. 2009. How children search the internet with keyword interfaces. In Proceedings of the 8th International Conference on Interaction Design and Children, 89–96. Como, Italy: ACM.
- Edwards, H., and R. Benedyk. 2007. A comparison of usability evaluation methods for child participants in a school setting. In Proceedings of the 6th International Conference on Interaction Design and Children, 9–16. Aalborg, Denmark: ACM.
- Eisenberg, M., A. Nishioka, and M. E. Schreiner. 1997. Helping users think in three dimensions: Steps toward incorporating spatial cognition in user modeling. Proceedings of the International Conference on Intelligent User Interfaces, 113–120. Orlando, FL.
- Electronic Privacy Information Center. 2001. Filters and Freedom 2.0: Free Speech Perspectives on Internet Content Control. Washington, DC: Electronic Privacy Information Center.
- Elliott, J., A. Bruckman, E. Edwards, and C. Jensen. 2000. Uneven achievement in a constructionist learning environment. In Proceedings of the International Conference on the Learning Sciences, 157–163. Ann Arbor, MI.
- Ellis, J. B., and A. S. Bruckman. 2001. Designing palaver tree online: Supporting social roles in a community of oral history. In Proceedings of CHI: Conference on Human Factors in Computing Systems, 474–481. Seattle, WA.
- Erickson, T. 1990. Working with interface metaphors. In *The Art of Human-Computer Interface Design*, ed. B. Laurel, 65–73. Reading, MA: Addison Wesley Publishing Company Inc.
- Ericsson, K. A., and H. Simon. 1993. Protocol Analysis: Verbal Reports as Data. Cambridge, MA: MIT Press.
- Fell, H., C. Cress, J. MacAuslan, and L. Ferrier. 2004. visiBabble for reinforcement of early vocalization. In Proceedings of the 6th International ACM SIGACCESS Conference on Computers and Accessibility, 161–168. Atlanta, GA: ACM.
- Feng, J., J. Lazar, L. Kumin, and A. Ozok. 2010. Computer usage by children with down syndrome: Challenges and future research. *ACM Trans Access Comput* 2(3):1–44.
- Gay, L. R., and P. Airasian. 2000. Education Research: Competencies for Analysis and Application, 6th ed. Upper Saddle River, NJ: Merrill.
- Gennari, R., and O. Mich. 2008. Designing and assessing an intelligent e-tool for deaf children. In Proceedings of the 13th International Conference on Intelligent User Interfaces, 325–328. Gran Canaria, Spain: ACM.
- Gilutz, S., and J. Nielsen. 2002. Usability of websites for children: 70 design guidelines based on usability studies with kids. Nielsen Norman Group Report.
- Goldman-Segall, R. 1996. Looking through layers: Reflecting upon digital video ethnography. *JCT Interdiscip J Curriculum Stud* 13(1).
- Guha, M. L., A. Druin, G. Chipman, J. A. Fails, S. Simms, and A. Farber. 2005. Working with young children as technology design partners. *Commun ACM* 48(1):39–42.
- Guha, M. L., A. Druin, and J. A. Fails. 2008. Designing with and for children with special needs: An inclusionary model. In Proceedings of the 7th International Conference on Interaction Design and Children, 61–64. Chicago, IL: ACM.
- Guzdial, M. 1994. Software-realized scaffolding to facilitate programming for science learning. *Interact Learn Environ* 4(1):1–44.
- Guzdial, M., and K. Rose, ed. 2001. Squeak: Open Personal Computing and Multimedia: Prentice Hall.
- Halgren, S., T. Fernandes, and D. Thomas. 1995. Amazing Animation™: Movie making for kids design briefing. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 519–525. Denver, CO.
- Hanna, L., K. Risden, and K. Alexander. 1997. Guidelines for usability testing with children. *Interactions* 4(5):9–14.
- Harada, S., J. A. Landay, J. Malkin, X. Li, and J. A. Bilmes. 2006. The vocal joystick: Evaluation of voice-based cursor control techniques. In Proceedings of the 8th International ACM SIGACCESS Conference on Computers and Accessibility, 197–204. Portland, OR: ACM.
- Harada, S., J. O. Wobbrock, and J. A. Landay. 2007. Voicedraw: A hands-free voice-driven drawing application for people with motor impairments. In Proceedings of the 9th International ACM SIGACCESS Conference on Computers and Accessibility, 27–34. Tempe, AZ: ACM.
- Henderson, V., S. Lee, H. Brashear, H. Hamilton, T. Starner, and S. Hamilton. 2005. Development of an American Sign Language game for deaf children. In *Proceedings of the 2005 Conference on Interaction Design and Children*, 79.
- Hickey, D. T., A. C. H. Kindfield, P. Horwitz, and M. A. Christie. 2000. Integrating instruction, assessment, and evaluation in a technology-based genetics environment: The GenScope follow-up study. In Proceedings of the International Conference of the Learning Sciences, 6–13. Ann Arbor, MI.

- Holdaway, D. 1979. *The Foundations of Literacy*. New York: Ashton Scholastic.
- Hornof, A. J. 2008. Working with children with severe motor impairments as design partners. In *Proceedings of the 7th International Conference on Interaction Design and Children*, 69–72. Chicago, IL: ACM.
- Hornof, A. J., and A. Cavender. 2005. EyeDraw: Enabling children with severe motor impairments to draw with their eyes. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 170.
- Hourcade, J. P. 2002. *It's Too Small! Implications of Children's Developing Motor Skills on Graphical User Interfaces* (No. CS-TR-4425): University of Maryland Computer Science Department.
- Hourcade, J. P., K. B. Perry, and A. Sharma. 2008. PointAssist: Helping four year olds point with ease. In *Proceedings of the 7th International Conference on Interaction Design and Children*, 202–9.
- Hoysniemi, J., P. Hamalainen, and L. Turkki. 2003. Using peer tutoring in evaluating the usability of a physically interactive computer game with children. *Interact Comput* 15: 203–225.
- Hutchinson, H., W. Mackay, B. Westerlund, B. B. Bederson, A. Druin, C. Plaisant et al. 2003. Technology probes: Inspiring design for and with families. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. Fort Lauderdale, FL.
- Inkpen, K. 1997. Three important research agendas for educational multimedia: Learning, children and gender. In *Proceedings of Educational Multimedia '97*, 521–526. Calgary, AB.
- Inkpen, K. 2001. Drag-and-drop versus point-and-click: Mouse interaction styles for children. *ACM Trans Comput Hum Interact* 8(1):1–33.
- Inkpen, K., S. Gribble, K. S. Booth, and M. Klawe. 1995. Give and take: Children collaborating on one computer. In *Proceedings of the ACM Conference on Human Factors in Computing Systems*, 258–259. Denver, CO.
- Ishii, H., and B. Ullmer. 1997. Tangible bits: Towards seamless interfaces between people, bits and atoms. In *Proceedings of the SIGCHI Conference on Human Factor in Computing Systems*, 234–241. New York: ACM.
- Iversen, O. S. 2002. Designing with children: The video camera as an instrument of provocation. In *Proceedings of the Conference on Interaction Design and Children*. Eindhoven, The Netherlands.
- Iversen, O. S., K. J. Kortbek, K. R. Nielsen, and L. Aagaard. 2007. Stepstone: An interactive floor application for hearing impaired children with a cochlear implant. In *Proceedings of the 6th International Conference on Interaction Design and Children*, 124.
- Jensen, J. J., and M. B. Skov. 2005. A review of research methods in children's technology design. In *Proceedings of the Conference on Interaction Design and Children*. Boulder, CO.
- Joiner, R., D. Messer, P. Light, and K. Littleton. 1998. It is best to point for young children: A comparison of children's pointing and dragging. *Comput Hum Behav* 14(3):513–529.
- Jones, T. 1992. Recognition of animated icons by elementary-aged children. *Assoc Learn Technol J* 1(1):40–46.
- Kail, R. 1991. Developmental changes in speed of processing during childhood and adolescence. *Psychol Bull* 109: 490–501.
- Kay, A. 1972. A personal computer for children of all ages. In *Proceedings of the ACM National Conference*. Boston, MA.
- Kemp, J. A. M., and T. van Gelderen. 1996. Co-discovery exploration: An informal method for the iterative design of consumer products. In *Usability Evaluation in Industry*, ed. P. W. Jordan, B. Thomas, B. A. Weerdmeester, and I. L. McClelland, 139–146. London: Taylor & Francis Ltd.
- Kolodner, J., and M. Guzdial. 1996. Effects with and of cscl: Tracking learning in a new paradigm. In *CSCL: Theory and Practice*, ed. T. Koschmann. Mahwah, NJ: Lawrence Erlbaum Associates.
- Koschmann, T., ed. 1996. *CSCL: Theory and Practice*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Lamberty, K. K., and J. Kolodner. 2005. Camera talk: Making the camera a partial participant. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 839–848. Portland, OR.
- Lenhart, A. 2007. Cyberbullying. In *Pew Internet & American Life Project*. <http://pewinternet.org/Reports/2007/Cyberbullying.aspx> (accessed November 1, 2011).
- Leo, G. D., and G. Leroy. 2008. Smartphones to facilitate communication and improve social skills of children with severe autism spectrum disorder: Special education teachers as proxies. In *Proceedings of the 7th International Conference on Interaction Design and Children*, 45–48. Chicago, IL: ACM.
- Li, Q. 2006. Cyberbullying in schools: A research of gender differences. *Sch Psychol Int* 27(2):157.
- Li, Q. 2007. New bottle but old wine: A research of cyberbullying in schools. *Comput Hum Behav* 23(4):1777–1791. doi:10.1016/j.chb.2005.10.005.
- MacFarlane, S., G. Sim, and M. Horton. 2005. Assessing usability and fun in educational software. In *Proceedings of the Conference on Interaction Design and Children*. Boulder, CO.
- Markopoulos, P., and M. Bekker. 2002. How to compare usability testing methods with children participants. In *Proceedings of the Conference on Interaction Design and Children*, 153–158. Eindhoven, The Netherlands.
- Martin, F., and M. Resnick. 1993. LEGO/Logo and electronic bricks: Creating a scienceland for children. In *Advanced Educational Technologies for Mathematics and Science*, ed. D. L. Ferguson, 61–90. Berlin, Heidelberg: Springer-Verlag.
- Mayberry, R. 2007. When timing is everything: Age of first-language acquisition effects on second-language learning. *Appl Psycholinguist* 28(3).
- McElligott, J., and L. van Leeuwen. 2004. Designing sound tools and toys for blind and visually impaired children. In *Proceedings of the Conference on Interaction Design and Children*, 65–72. College Park, MD.
- Merryman, J., A. Tartaro, M. Arie, and J. Cassell. 2008. Designing virtual peers for assessment and intervention for children with autism. In *Proceedings of the 7th International Conference on Interaction Design and Children*, 81–84. Chicago, IL: ACM.
- Miller, C. 1998. Designing for kids: Infusions of life, kisses of death. In *Proceedings of the Proceedings of the Game Developers Conference*. Long Beach, CA.
- Miller, L. T., and P. A. Vernon. 1997. Developmental changes in speed of information processing in young children. *Dev Psychol* 33(4):549–554.
- Moeller, M. P. 2000. Early intervention and language development in children who are deaf and hard of hearing. *Pediatrics* 106(3):e43.
- Newman, D., P. Griffin, and M. Cole. 1989. *The Construction Zone: Working for Cognitive Change in School*. Cambridge, England: Cambridge University Press.
- Nielsen, J. 1993. *Usability Engineering*. London: Academic Press.
- Nix, D., P. Fairweather, and B. Adams. 1998. Speech recognition, children, and reading. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 245–246. Los Angeles, CA.

- O'Hare, E. A., and M. F. McTear. 1999. Speech recognition in the secondary school classroom: An exploratory study. *Comput Educ* 3(8):27–45.
- Oosterholt, R., M. Kusano, and G. D. Vries. 1996. Interaction design and human factors support in the development of a personal communicator for children. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 450–457. Vancouver, Canada.
- Ortega-Tudela, J. M., and C. J. Gomez-Ariza. 2006. Computer-assisted teaching and mathematical learning in Down Syndrome children. *J Comput Assist Learn* 22(4):298–307.
- Papert, S. 1972. *On Making a Theorum for a Child*. Paper presented at the ACM National Conference, Boston, MA.
- Papert, S. 1980. *Mindstorms: Children, Computers, and Powerful Ideas*. New York: Basic Books.
- Papert, S. 1987. Computer criticism vs. technocentric thinking. *Educ Res* 16(1):22–30.
- Papert, S. 1992. *The Children's Machine*. NewYork: BasicBooks.
- Patomäki, S., R. Raisamo, J. Salo, V. Pasto, and A. Hippula. 2004. Experiences on haptic interfaces for visually impaired young children. In *Proceedings of the 6th International Conference on Multimodal Interfaces*, 281–8.
- Pea, R. 1984. On the cognitive effects of learning computer programming. *New Ideas Psychol* 2(2):137–168.
- Pea, R. 1987. The aims of software criticism: Reply to Professor Papert. *Educ Res* 16: 4–8.
- Piaget, J. 1970. *Science of Education and the Psychology of the Child*. New York: Orion Press.
- Piper, A. M., E. O'Brien, M. R. Morris, and T. Winograd. 2006. SIDES: A cooperative tabletop computer game for social skills development. In *Proceedings of the 2006 20th Anniversary Conference on Computer Supported Cooperative Work*, 10.
- Price, S., Y. Rogers, M. Scaife, D. Stanton, and H. Neale. 2003. Using 'tangibles' to promote novel forms of playful learning. *Interact Comput* 15(2):169–185.
- Putnam, C., and L. Chong. 2008. Software and technologies designed for people with autism: What do users want? In *Proceedings of the 10th International ACM SIGACCESS Conference on Computers and Accessibility*, 3–10. Halifax, NS: ACM.
- Reprenning, A., and L. E. Fahlen. 1993. Agentsheets: A tool for building domain-oriented visual programming environments. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 142–143. Amsterdam, The Netherlands.
- Resnick, M. 1994. *Turtles, Termites, and Traffic Jams: Explorations in Massively Parallel Microworlds*. Cambridge, MA: MIT Press.
- Resnick, M., A. Bruckman, and F. Martin. 1996. Pianos not stereos: Creating computational construction kits. *Interactions* 3(5):40–50.
- Resnick, M., J. Maloney, A. M. Hernández, N. Rusk, E. Eastmond, K. Brennan, A. Millner et al. 2009. Scratch: Programming for everyone. *Commun ACM* 52(11):60–67.
- Resnick, M., and N. Rusk. 1996. The computer clubhouse: Preparing for life in a digital world. *IBM Syst J* 35(3–4):431–440.
- Resnick, M., and B. Silverman. 2005. Some reflections on designing construction kits for kids. In *Proceedings of the Conference on Interaction Design and Children*. Boulder, CO.
- Revelle, G., and E. Reardon. 2009. Designing and testing mobile interfaces for children. In *Proceedings of the 8th International Conference on Interaction Design and Children*, 329–332. Como, Italy: ACM.
- Rogers, Y., S. Price, G. Fitzpatrick, R. Fleck, E. Harris, H. Smith, C. Randell, H. Muller, C. O'Malley, and D. Stanton. Ambient wood: Designing new forms of digital augmentation for learning outdoors. In *Proceedings of the 2004 Conference on Interaction Design and Children: Building a Community*, 3–10. New York: ACM.
- Rubin, J. 1994. *Handbook of Usability Testing*. New York: John Wiley and Sons, Inc.
- Rusk, N., M. Resnick, R. Berg, and M. Pezalla-Granlund. 2008. New pathways into robotics: Strategies for broadening participation. *J Sci Educ Technol* 17(1):59–69.
- Sánchez, J., and M. Sáenz. 2005. Developing mathematics skills through audio interfaces. In *Proceedings of 11th International Conference on Human-Computer Interaction, HCI*, 22–7.
- Sánchez, J., M. Sáenz, and M. Ripoll. 2009. Usability of a multimodal videogame to improve navigation skills for blind children. In *Proceedings of the 11th International ACM SIGACCESS Conference on Computers and Accessibility*, 35–42. Pittsburgh, PA: ACM.
- Scaife, M., and Y. Rogers. 1999. Kids as informants: Telling us what we didn't know or confirming what we knew already? In *The Design of Children's Technology*, ed. A. Druin, 27–50. San Francisco, CA: Morgan Kaufmann Publishers, Inc.
- Scaife, M., Y. Rogers, F. Aldrich, and M. Davies. 1997. Designing for or designing with? Informant design for interactive learning environments. In *Proceedings of the SIGCHI Conference on Human factors in Computing Systems*. Atlanta, GA.
- Scardamalia, M., and C. Bereiter. 1994. Computer support for knowledge-building communities. *J Learn Sci* 3(3):265–283.
- Schneider, K. G. 1996. Children and information visualization technologies. *Interactions* 3(5):68–73.
- Schneider, K. G. 1997. *The Internet Filter Assessment Project (TIFAP)*, [Website]. <http://www.bluehighways.com/tifap/learn.htm>.
- Schuler, D., and A. Namioka, ed. 1993. *Participatory Design: Principles and Practices*. Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.
- Skinner, B. F. 1968. *The Technology of Teaching*. New York: Appleton-Century-Crofts.
- Soloway, E., M. Guzdial, and K. E. Hay. 1994. Learner-centered design: The challenge for HCI in the 21st century. *Interactions* 1(1):36–48.
- Soloway, E., S. L. Jackson, J. Klein, C. Quintana, J. Reed, J. Spitulnik, S. J. Stratford et al. 1996. Learning theory in practice: Case studies of learner-centered design. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. Vancouver, Canada.
- Songer, N. B. 1996. Exploring learning opportunities in coordinated network-enhanced classrooms: A case of kids as global scientists. *J Learn Sci* 5(4):297–327.
- Stewart, J., E. M. Raybourn, B. Bederson, and A. Druin. 1998. When two hands are better than one: Enhancing collaboration using single display groupware. In *Proceedings of the ACM Conference on Human Factors in Computing Systems*. Los Angeles, CA.
- Stiehl, W. D., J. K. Lee, C. Breazeal, M. Nalin, A. Morandi, and A. Sanna. 2009. The huggable: A platform for research in robotic companions for pediatric care. In *Proceedings of the 8th International Conference on Interaction Design and Children*, 317–320. Como, Italy: ACM.
- Strommen, E. 1994. Children's use of mouse-based interfaces to control virtual travel. In *Proceedings of the ACM Conference on Human Factors in Computing Systems: Celebrating Interdependence*. Boston, MA.
- Strommen, E. 1998. When the interface is a talking dinosaur: Learning across media with actimates barney. In *Proceedings of the ACM Conference on Human Factors in Computing Systems*. Los Angeles, CA.

- Strommen, E., and K. Alexander. 1999. Emotional interfaces for interactive aardvarks: Designing affect into social interfaces for children. In Proceedings of the ACM Conference on Human Factors in Computing Systems: The CHI is the limit. Pittsburgh, PA.
- Tarrin, N., G. Petit, and D. Chêne. 2006. Network force-feedback applications for hospitalized children in sterile room. In Proceedings of the 2006 Conference on Interaction Design and Children, 157–160. Tampere, Finland: ACM.
- Taylor, R. P., ed. 1980. The Computer In the School, Tutor, Tool, Tutee. New York: Teachers College Press.
- Thomas, J. R. 1980. Acquisition of motor skills: Information processing differences between children and adults. *Res Q Exerc Sport* 51(1):158–173.
- Tinker, R. 1993. Thinking About Science. Concord, MA: The Concord Consortium.
- United Nations. 2006. Convention on the rights of persons with disabilities. <http://www.un.org/disabilities/convention/facts.shtml> (accessed May 18, 2010).
- U.S. Department of Education, National Center for Education Statistics. 2011. *Digest of Education Statistics* (NCES 2011–015), Chapter 2.
- van Kesteren, I. E., M. M. Bekker, A. P. O. S. Vermeeren, and P. A. Lloyd. 2003. Assessing usability evaluation methods on their effectiveness to elicit verbal comment from children subjects. In Proceedings of the Conference on Interaction Design and Children. Preston, UK.
- Walker, D. F. 1987. Logo needs research: A response to Professor Papert's paper. *Educ Res* 9–11.
- Walker, B. N., M. T. Godfrey, J. E. Orlosky, C. Bruce, and J. Sanford. 2006. Aquarium sonification: Soundscapes for accessible dynamic informal learning environments. In *Proceedings of the 12th International Conference on Auditory Display*, 238–41.
- Westeyn, T. L., J. A. Kientz, T. E. Starner, and G. D. Abowd. 2008. Designing toys with automatic play characterization for supporting the assessment of a child's development. In Proceedings of the 7th International Conference on Interaction Design and Children, 89–92. Chicago, IL: ACM.
- Winograd, T. 1996. Profile: Kid pix. In *Bringing Design to Software*, ed. T. Winograd, 58–61. New York: ACM Press.

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- Alm, N. 1994. Ethical issues in AAC research. In *Methodological Issues in Research in Augmentative and Alternative Communication: Proceedings of the Third ISAAC Research Symposium*, ed. J. Brodin, and E. B. Ajessibm, 98–104. Sweden: University Press.
- Alm, N., J. L. Amott, and A. F. Newell. 1992. Prediction and conversational momentum in an augmentative communication system. *Commun ACM* 35(5):46–57.
- Alm, N., R. Dye, G. Gowans, J. Campbell, A. Astell, and M. Ellis. 2006. A communication support system for older people with dementia. *IEEE Comput* 40(5):35–41.
- Alm, N., A. Morrison, and J. L. Amott. 1995. A communication system based on scripts, plans and goals for enabling non-speaking people to conduct telephone conversations. In *Proceedings of the IEEE Conference on Systems, Man & Cybernetics*, 2408–2412. Vancouver, Canada.
- Andreasen, P. N., A. Waller, and P. Gregor. 1998. BlissWord—full access to blissymbols for all users. In *Proceedings of the 8th Biennial Conference of ISAAC*, 167–168. Dublin, Ireland: ISAAC.
- Arch, A. 2008. WAI-AGE Literature Review and Analysis: Observations and Conclusions [Editor's DRAFT—21 August 2008] <http://www.w3.org/WAI/WAI-AGE/conclude.html>.
- Bäckman, L., B. J. Small, Å. Wahlin, and M. Larsson. 2000. Cognitive functioning in very old age. In *The Handbook of Aging and Cognition*, ed. F. I. M. Craik, and T. A. Salthouse, 499–558. New Jersey, NJ: Lawrence Erlbaum Associates.
- Balandin, S., and P. Raghavendra. 1999. Challenging oppression: Augmented communicators' involvement in AAC research. In *Augmentative and Alternative Communication, New Directions in Research and Practice*, ed. F. T. Loncke, J. Clibbens, H. H. Arvidson, and L. L. Lloyd, 262–277. London: Whurr.
- Beirmann, A. W. 1997. More than Screen Deep—Towards an Every-Citizen Interface to the National Information Infrastructure. Computer Science and Telecommunications Board, National Research Council. Washington, DC: National Academy Press.
- Beukelman, D. R., and P. Mirenda. 1998. *Augmentative and Alternative Communication Management of Severe Communication Disorders in Children and Adults*, 2nd ed.. Baltimore, MD: Brookes.
- Black, R., J. Reddington, E. Reiter, N. Tintarev, and A. Waller. 2010. Using NLG and sensors to support personal narrative for children with complex communication needs. In *First Workshop on Speech and Language Processing for Assistive Technologies (SLPAT)*, Human Language Technologies: The 11th Annual Conference of the North American Chapter of the Association for Computational Linguistics, Los Angeles. Association of Comp Linguistics.
- Blunsden, S., B. Richards, T. Bartindale, D. Dan Jackson, P. Patrick Olivier, J. Boger, A. Mihailidis, and J. Hoey. 2009. Design and prototype of a device to engage cognitively disabled older adults in visual artwork. In *Proceedings of the ACM 2nd International Conference on PErvasive Technologies Related to Assistive Environments*. Corfu, Greece: ACM.
- British Dyslexia Association. 2006. <http://www.bdaydyslexia.org.uk/facq.html#q1> (accessed 2010).
- Carmichael, A. R. 1999. *Style Guide for the Design of Interactive Television Services for Elderly Viewers*. Winchester: Independent Television Commission.
- Carmichael, A., A. F. Newell, and M. Morgan. 2007. The efficacy of narrative video for raising awareness in ICT designers about older users' requirements. *Interact Comput* 19: 587–596.
- Carmichael, A., A. Newell, M. Morgan, A. Dickinson, and O. Mival. 2005. Using theatre and film to represent user requirements. In *Proceedings INCLUDE '05*. London: Royal College of Art. ISBN (CD rom) 1–905000–10–3.
- Chamess, N., and E. A. Bosman. 1994. Age-related changes in perceptual and psychomotor performance: Implications for engineering design. *Exp Aging Res* 20(1):45–61.
- Chin, J., and W. Fu. 2010. Interactive effects of age and interface differences on search strategies and performance. In *Proceedings of the 28th International Conference on Human Factors in Computing Systems* (Atlanta, Georgia, USA, April 10–15, 2010). CHI '10, 403–412. New York: ACM.
- Clare, L., R. T. Woods, E. D. Moniz Cook, M. Qrell, and A. Spector. 2003. Cognitive rehabilitation and cognitive training for early-stage Alzheimer's disease and vascular dementia. *The Cochrane Database of Systematic Reviews*: CD003260. Cochrane Library, Issue 4.

- Cohen, G. 2000. Two new intergenerational interventions for Alzheimer's disease patients and their families. *Am J Alzheimers Dis* 15(3): 137–142.
- Coyne, K. P., and J. Nielsen. 2002. Web Usability for Senior Citizens—Design Guidelines Based on Usability Studies with People Age 65 and Older. 126. Nielsen Norman Group. An overview is available at <http://www.useit.com/alertbox/seniors.html>. (accessed 2010).
- Critchley, M. 1964. *Developmental Dyslexia*. London: Heinemann.
- Czaja, S. J., N. Charness, A. D. Fisk, C. Hertzog, S. N. Nair, and W. Rogers. 2006. Factors predicting the use of technology: Findings from the center for research and education on aging and technology enhancement (CREATE). *Psychol Aging* 21(2):333–352.
- Czaja, S. J., J. Sharit, M. A. Hernandez, S. N. Nair, and D. Loewenstein. 2010. Variability among older adults in Internet health information-seeking performance. *Gerontechnology* 9(1):46–55.
- Detterman, D. K., L. T. Gabriel, and J. M. Ruthsatz. 2000. Intelligence and mental retardation. In *Handbook of Intelligence*, ed. R. J. Sternberg, 141–158. Cambridge, MA: Cambridge University Press.
- Dickinson, A., R. Eisma, A. Syme, and P. Gregor. 2002. UTOPIA: Usable technology for older people: Inclusive and appropriate. *Proc. BCS HCI 2002* 38–9.
- Dunne, A. 2006. *Electronic Products, Aesthetic Experience, and Critical Design*. Boston, MA: MIT Press.
- Dyslexia Research Institute. 2010. <http://www.dyslexia-add.org/> (accessed July 7, 2010).
- Elkind, J. 1998. Computer reading machines for poor readers. *Perspectives* 24(2):4–6.
- Fairweather, P. G. 2008. How older and younger adults differ in their approach to problem solving on a complex website. In Proceedings of the 10th International ACM SIGACCESS Conference on Computers and Accessibility (Halifax, Nova Scotia, Canada, October 13–15, 2008). Assets '08, 67–72. New York: ACM.
- Feil, N. 1993. *The Validation Breakthrough*. Maryland: Health Professions Press.
- Fillit, H. M., R. N. Butler, A. W. O'Connell, M. S. Albert, J. E. Birren, C. W. Cotman, W. T. Greenough et al. 2002. Achieving and maintaining cognitive vitality with aging. *Mayo Clin Proc* 77: 681–696.
- Frayling, C. 2003. Interviewed on Desert Island Disks, BBC Radio 4, Nov 2nd.
- Freeman, J., A. Miotto, J. Lessiter, A. De Gloria, F. Bellotti, M. Mangarone, N. Hofshi et al. 2009. Defining a framework to support cognitive training for older people via interactive digital television. IBC2009. U.K.: Independent Broadcasting Company.
- Freudenthal, A. 1999. *The Design of Home Appliances for Young and Old Consumers*. Delft: Delft University Press.
- Gill, J., and T. Shipley. 1999. *Telephones, What Features Do People Need*. London: Royal National Institute for the Deaf.
- Gould, S. J. 1997. *The Mismeasure of Man*, 2nd ed., Harmondsworth: Penguin.
- Gregor, P., and A. F. Newell. 1999. The application of computing technology to interpersonal communication at the university of Dundee's department of applied computing. *Technol Disabil* 10: 107–113.
- Gregor, P., A. F. Newell, and M. Zajicek. 2002. Designing for dynamic diversity—interfaces older people. In Proceedings of the 5th International ACM SIGCAPH Conference on Assistive Technologies (ASSETS '02), 151–156. New York: ACM.
- Hanson, V. L. 2009. Age and web access: the next generation. In Proceedings of the 2009 International Cross-Disciplinary Conference on Web Accessibility (W4A) (Madrid, Spain, April 20–21, 2009). W4A '09, 7–15. New York: ACM.
- Hanson, V. L., J. Brezin, S. Crayne, S. Keates, R. Kjeldsen, J. T. Richards, C. Swart, and S. Trewin. 2005. Improving Web accessibility through an enhanced open-source browser. *IBM Syst J* 44(3):573–588.
- Hanson, V. L., J. T. Richards, S. Harper, and S. Trewin. 2009. Web accessibility. In *The Universal Access Handbook*, ed. C. Stephanidis. Boca Raton, FL: CRC Press.
- Hocking, C. 1999. Function or feelings: factors in abandonment of assistive devices. *Technol Disabil* 11: 3–11.
- Hoey, J., P. Poupart, A. von Bertoldi, T. Craig, C. Boutilier, and A. Mihailidis. 2010a. Automated handwashing assistance for persons with dementia using video and a partially observable markov decision process. *Comput Vis Image Underst* 114(5).
- Hoey, J., K. Zutis, V. Leuty, and A. Mihailidis. 2010b. A Tool to promote prolonged engagement in art therapy: Design and development from art therapist requirements. In Proceedings of the 12th International ACM SIGACCESS Conference on Computers and Accessibility, 211–218. Orlando, FL.
- Hoey, J., J. N. Boger, K. Fenton, T. Craig, and A. Mihailidis. 2010c. Using actors to develop technologies for older adults with dementia: A pilot study. *Gerontechnology* 9(4).
- Hoey, J., T. Ploetz, D. Jackson, P. Olivier, A. Monk, and C. Pham. 2011. Rapid specification and automated generation of prompting systems to assist people with dementia. *Pervasive and Mobile Computing* 7(3).
- Holt, B. J., and R. W. Morrell. 2002. Guidelines for web site design for older adults: The ultimate influence of cognitive factors. In *Older Adults, Health Information, and the World Wide Web*, ed. R. W. Morrell, 109–129. Hillsdale, NJ: Erlbaum.
- Kan, P., R. Huq, J. Hoey, R. Goetschalckx, and A. Mihailidis. 2011. The development of an adaptive upper-limb stroke rehabilitation robotic system. *Journal of NeuroEngineering and Rehabilitation* 8(33).
- Kaluger, G., and C. L. Kolson. 1987. *Reading and Learning Disabilities*, 2nd ed., Columbus, OH: Bell & Howell Company.
- Kaufman, A. S. 2000. Tests of intelligence. In *Handbook of Intelligence*, ed. R. J. Sternberg, 445–476. Cambridge, MA: Cambridge University Press.
- Kurniawan, S. H. 2009. Age-related differences in the interface design process. In *The Universal Access Handbook*, ed. C. Stephanidis, Chap 8, 1–12. Boca Raton, FL: CRC Press.
- Lewis, J. 2001. Vision for Britain: The NHS, the Optical Industry and Spectacle Design 1946–1986. MA dissertation Royal College of Art, London, U.K.
- Lohman, D. F. 2000. Complex information processing and intelligence. In *Handbook of Intelligence*, ed. R. J. Sternberg, 285–340. Cambridge, MA: Cambridge University Press.
- Mandler, J. M. 1984. *Stories, Scripts and Scenes: Aspects of Schema-Theory*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Mandler, J. M., and R. E. Parker. 1976. Memory for descriptive and spatial information in complex pictures. *J Exp Psychol Hum Learn Mem* 2:38–48.
- Marquis-Faulkes, F., S. J. McKenna, P. Gregor, and A. F. Newell. 2003. Scenario-based drama as a tool for investigating user requirements with application to home monitoring for elderly-people. In *Human-Centred Computing: Vol. 3. Cognitive, Social and Ergonomic Aspects*, ed. D. Harris, V. Duffy, M. Smith, and C. Stephanidis, 512–516. Mahwah, NJ: Lawrence Erlbaum.
- Marquis-Faulkes, F., S. J. McKenna, P. Gregor, and A. F. Newell. 2005. Gathering the requirements for a fall monitor using drama and video with older people. *Technol Disabil* 17(4):227–236.

- McKinlay, A. 1991. Using a social approach in the development of a communication aid to achieve perceived communicative competence. In Proceedings of the 14th Annual Conference of the Rehabilitation Engineers Society of North America, ed. J. Presperin, 204–206. Washington, DC: The RESNA Press.
- Mellish, C., and X. Sun. 2005. Natural language directed inference in the presentation of ontologies. In *Proceedings of the 10th European Workshop on Natural Language Generation*, 118–24.
- Microsoft. 1994. Word Developers Kit. Redmond, WA: Microsoft Press.
- Microsoft. 1995. Word for Windows 95. Redmond, WA: Microsoft Corporation.
- Mihailidis, A., J. Boger, M. Candido, and J. Hoey. 2008. The COACH prompting system to assist older adults with dementia through handwashing: An efficacy study. *BMC Geriatr* 8(28). doi: 10.1186/1471-2318-8-28.
- Mihailidis, A., S. Blunsden, J. N. Boger, B. Richards, K. Zutis, L. Young, and J. Hoey. 2010. Towards the development of a technology for art therapy and dementia: Definition of needs and design constraints. *The Arts in Psychotherapy* 37(4).
- Morgan, M., V. Hanson, C. Martin, J. Hughes, and A. F. Newell. 2008b. “Accessibility challenges—a game show investigating the accessibility of computer systems for disabled people.” In CHI ’08 Extended Abstracts on Human Factors in Computing Systems. Florence, Italy: ACM.
- Morgan, M., M. McGee-Lennon, N. Hine, J. Arnott, J. Martin, M. J. Clark, and M. Wolters. 2008b. “Requirements gathering with diverse user groups and stakeholders.” In CHI 2008 Proceedings, 2597–2600. Florence, Italy: ACM.
- Morgan, M., and A. Newell. 2007. Interface between two disciplines, the development of theatre as a research tool. In Lecture Notes in Computer Science 4550, 184–193. Springer.
- Morrell, R. W., S. R. Dailey, C. Feldman, C. G. Mayhorn, and K. V. Echt. 2002. Older Adults and Information Technology: A Compendium of Scientific Research and Web Site Accessibility Guidelines. Bethesda, MD: National Institute on Aging. For a summary, see also “Making your web site senior friendly: A checklist.” <http://www.nlm.nih.gov/pubs/checklist.pdf> (accessed 2010).
- National Center for Learning Disabilities. 2007. <http://www.ncld.org/content/view/447/391/> (accessed December 20, 2007).
- Newell, A. F. 1995. Extra-ordinary human computer operation. In *Extra-Ordinary Human-Computer Interaction*, ed. A. D. N. Edwards, 3–18. Cambridge, MA: Cambridge University Press.
- Newell, A. F. 2009. “Educational videos: Examining the issues older people have in using modern technology,” *Interfaces* 80 Autumn. 18–9.
- Newell, A. F., J. L. Arnott, L. Booth, and W. Beattie. 1992. Effect of the PAL word prediction system on the quality and quantity of text generation. *Augment Altern Commun* 8:304–311.
- Newell, A. F., and L. Booth. 1991. The use of lexical and spelling aids with dyslexics. In *Computers & Literacy Skills*, ed. C. Singleton, 35–44. Hull: University of Hull.
- Newell, A. F., L. Booth, and W. Beattie. 1991. Predictive text entry with PAL and children with learning difficulties. *Br J Educ Technol* 22: 23–40.
- Newell, A. F., and A. Y. Cairns. 1993. Designing for extra-ordinary users. *Ergon Des Hum Factors Ergon Soc* 10–16.
- Newell, A. F., A. Carmichael, M. Morgan, and A. Dickinson. 2006a. The use of theatre in requirements gathering and usability studies. *Interact Comput* 18: 996–1011.
- Newell, A. F., and P. Gregor. 1997. Human computer interfaces for people with disabilities. In *Handbook of Human-Computer Interaction*, ed. M. Helander, T. K. Landauer, and P. Prabhu, 813–824. Amsterdam: Elsevier.
- Newell, A. F., and P. Gregor. 2000. User sensitive inclusive design—in search of a new paradigm. In *Proceedings of the ACM Conference on Universal Usability*, 39–44. Washington, DC.
- Newell, A. F., and M. Morgan. 2006. “The use of theatre in HCI research.” In “Engage” 20th Annual BCS HCI Conference. UK: University of London. ACM.
- Newell, A. F., and M. Morgan. 2008a. “An intelligent future”—interactive theatrical presentations addressing the issues of ambient intelligence and older people. In *Collaboration with MM Training. Vision in Action—Accessibility to Next Generation Networks*, COST219ter Conference. Brussels: COST 219.
- Newell, A. F., and M. Morgan. 2008b. “An interactive theatre presentation: Intelligible Transport information systems—a user perspective” in collaboration with MM Training. In “Access and the City” Conference, Dublin City Council, the Centre for Excellence in Universal Design, and the National Disability Authority. Dublin, Ireland: Centre for Excellence in Universal Design.
- Newell, A. F., and M. Morgan. 2008c. “An intelligent future”—interactive theatrical presentations addressing the issues of ambient intelligence and older people. In *Collaboration with MM Training, eInclusion Ministerial Conference*, Vienna.
- Newell, A. F., M. E. Morgan, P. Gregor, and A. Carmichael. 2006b. CHI 2006. In Experience Report in CHI 2006 Extended Abstracts on Human Factors in Computing Systems Montreal, 111–117. Quebec, Canada: ACM.
- Nielsen, J. 1993. *Usability Engineering*. London: Academic Press.
- Ogozalec, V. Z. 1997. A comparison of the use of text and multimedia interfaces to provide information to the elderly. In *Proceedings of CHI ’97*, 65–71. Atlanta, Georgia, New York: ACM Press.
- Orpwood, R., C. Gibbs, T. Adlam, R. Faulkner, and D. Neegagawatte. 2005. *The Design of Smart Houses for People with Dementia: User Interface Aspects*, Vol. 4, 156–164. Universal Access in the Information Society.
- Park, D. C. 1992. Applied cognitive aging research. In *The Handbook of Aging and Cognition*, ed. F. I. M. Craik, and T. A. Salthouse, 449–493. Hillsdale, NJ: Erlbaum.
- Pirkl, J. J. 1994. *Transgenerational Design, Products for an Aging Population*. New York: Van Nostrand Reinhold.
- Preece, J. 1994. *A Guide to Usability—Human Factors in Computing*. London: Addison Wesley & Open University.
- Pullin, G. 2009a. *Design Meets Disability*. Cambridge, MA: The MIT Press.
- Pullin, G. 2009b. An introduction to universal design. *Dwell* 10(4): 102–108.
- Rabbitt, P. M. A. 1993. Does it all go together when it goes? The nineteenth bartlett memorial lecture. *Q J Exp Psychol* 46A(3):385–434.
- Rau, M. T. 1993. *Coping with Communication Challenges in Alzheimer’s Disease*. California: Singular Publishing Group Inc.
- Reiter, E., and R. Dale. 2000. *Building Natural-Language Generation Systems*. Cambridge, U.K.: Cambridge University Press.
- Reiter, E., R. Turner, N. Alm, R. Black, M. Dempster, and A. Waller. 2009. Using NLG to help language-impaired users tell stories and participate in social dialogues. In *Proceedings of the 12th European Workshop on Natural Language Generation*, 1–8. Athens, Greece: Association for Computer Linguistics.
- Rice, M., A. F. Newell, and M. Morgan. 2007. Forum theatre as a requirement gathering methodology in the design of a home telecommunication system for older adults. *Behav Inf Technol* 26(4):323–332.

- Riley, P. 2010. Unpublished PhD Thesis. Dundee, Scotland, UK: University of Dundee.
- Riley, P. J., N. Alm, and A. F. Newell. 2009. An interactive tool to support musical creativity in people with dementia. *J Comput Hum Behav* 25: 599–608.
- Salthouse, T. 1985. *A Theory of Cognitive Aging*. Amsterdam: North Holland.
- Salthouse, T. A. 1991. *Theoretical Perspectives on Cognitive Aging*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Salthouse, T. 2006. Mental exercise and mental aging: evaluating the validity of the ‘use it or lose it’ hypothesis. *Perspect Psychol Sci* 1: 68–87.
- Sayago, S., L. Camacho, and J. Blat. 2009. Evaluation of techniques defined in WCAG 2.0 with older people. In *Proceedings of the 2009 International Cross-Disciplinary Conference on Web Accessibility (W4a)* (Madrid, Spain, April 20–21, 2009). W4A ’09, 79–82. New York: ACM.
- Schank, R., and R. Abelson. 1977. *Scripts, Plans, Goals, and Understanding*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Schooler, C., and M. Mulatu. 2001. The reciprocal effects of leisure time activities and intellectual functioning in older people: A longitudinal analysis. *Psychol Aging* 16(3):466–482.
- Shaywitz, S. E., B. A. Shaywitz, K. R. Pugh, R. K. Fulbright, R. T. Constable, W. E. Mencl, D. P. Shankweiler et al. 1998. Functional disruption in the organization of the brain for reading in dyslexia. *Proc Natl Acad Sci U S A* 95(5):2636–2641.
- Sheridan, C. 1992. *Failure-Free Activities for the Alzheimer’s Patient*. London: Macmillan Press.
- Shneiderman, B. 1992. *Designing the User Interface: Strategies for Effective Human-Computer Interaction*. Reading, MA: Addison-Wesley.
- Sleeman, K. D. 1998. Disability’s new paradigm, implications for assistive technology and universal design. In *Improving the Quality of Life for the European Citizen: Vol. 4 Assistive Technology Research Series*, ed. I. Placencia Porrero and E. Ballabio, xx–xxiv. Amsterdam: IOS Press.
- Smith, G., P. Housen, K. Yaffe, R. Ruff, R. Kennison, H. Mahncke, and E. Zelinski. 2009. A cognitive training program designed based on principles of brain plasticity: Results from the improvement in memory with plasticity-based adaptive cognitive training study. *J Am Geriatr Soc* 57(4):594–603.
- Stephanidis, C. ed. 2001. *User Interfaces for All*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Sternberg, R. J. 2000. The concept of intelligence. In *Handbook of Intelligence*, ed. R. J. Sternberg, 3–15. Cambridge, MA: Cambridge University Press.
- Todman, J., L. Elder, and N. Alm. 1995. Evaluation of the content of computer-aided conversations. *Augment Altern Commun* 11(4):229–234.
- Topo, P., O. Mäki, K. Saarikalle, N. Clarke, E. Begley, S. Cahill, J. Arenlind et al. 2004. Assessment of a music-based multimedia program for people with dementia. *Dementia* 3: 331–350.
- Vanderheiden, P. B., P. W. Demasco, K. F. McCoy, and C. A. Pennington. 1996. A preliminary study into schema-based access and organization of re-usable text in AAC. In *Proceedings of the RESNA ’96 Conference*, 59–61. Salt Lake City, Utah, Arlington, VA: RESMA Press.
- Verhaeghen, P., A. Marcoen, and L. Goossens. 1992. Improving memory performance in the aged through mnemonic training: A meta-analytic study. *Psychol Aging* 7: 242–251.
- Waller, A. 1992. Providing Narratives in an Augmentative Communication System. Unpublished doctoral dissertation. Dundee, Scotland, UK: University of Dundee.
- Waller, A. 2006. “Communication access to conversational narrative.” *Top Lang Disord* 26(3):221–239.
- Waller, A., R. Black, D. O’Mara, H. Pain, G. Ritchie, and R. Manurung. 2009. “Evaluating the STANDUP pun generating software with children with cerebral palsy.” *ACM Trans Access Comput* 1(3):27.
- Waller, A., F. Dennis, J. Brodie, and A. Y. Cairns. 1997. “Evaluating the use of TalksBac, a predictive communication device for non-fluent aphasic adults.” *Int J Lang Commun Disord* 33: 45–70.
- Web design for dyslexic users. 2009. <http://www.dyslexia.com/qaweb.htm> (accessed July, 2010).
- Willows, D. M., R. S. Kruk, and E. Corcos. 1993. *Visual Processes in Reading and Reading Disabilities*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Wilson, A. 2003. *Communicating with pictures and symbols*. CALL Centre Publications (Augmentative and Alternative Communication in Practice: Scotland). Edinburgh: University of Edinburgh. ISBN 1-898042-25-X.
- Wilson, B. A. 1997. Cognitive Rehabilitation: How it is and how it might be. *J Int Neuropsychol Soc* 3:487–496. Cambridge University Press.
- Woods, B., and N. Watson. 2004. A glimpse at the social and technological history of wheelchairs. *Int J Ther Rehabil* 11(9):407–410.
- Zajicek, M. 2003. Patterns for encapsulating speech interface design solutions for older adults. In *Proceedings of the 2003 Conference on Universal Usability* (Vancouver, British Columbia, Canada, November 10–11, 2003). CUU ’03, 54–60. New York: ACM.
- Zajicek, M. 2007. Web 2.0: Hype or happiness? In *Proceedings W4A ’07*, 35–39. New York: ACM.

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- Age-Related Eye Disease Study Research Group. 2001. A randomized, placebo-controlled, clinical trial of high-dose supplementation with vitamins C and E, beta carotene, and zinc for age-related macular degeneration and vision loss (AREDS Report No. 8). *Arch ophthalmol* 119: 1417–1436.
- Albacete, P. L., S. K. Chang, and G. Polese. 1994. Iconic language design for people with significant speech and multiple impairments. In *Paper Presented at the First Annual International ACM/SIGCAPH Conference on Assistive Technologies (ASSETS ’94)*. Marina del Rey, CA.
- Applegate, W. B., S. T. Miller, J. T. Elam, J. M. Freeman, T. O. Wood, and T. C. Geltlefinger. 1987. Impact of cataract surgery with lens implantation on vision and physical function in elderly patients. *Jama* 257: 1064–1066.
- Arditi, A. 2002. Web accessibility and low vision. *Aging Vis* 14(2):2–3.
- Arditi, A. 2003. Low vision web browsing and allocation of screen space resources. *Invest Ophthalmol Vis Sci* 44(5):2767.

- Arditi, A. 2004. Adjustable typography: An approach to enhancing low vision text accessibility. *Ergonomics* 47(5):469–482.
- Arditi, A., and J. Lu. 2008. Accessible web browser interface design for users with low vision. *Hum Fact Ergon Soc Annu Meet Proc* 52(6):576–580. <http://www.ingentaconnect.com/content/hfes/hfproc/2008/00000052/00000006/art00014> (accessed March 19, 2011).
- Assistive Technologies for Independent Aging: Opportunities and Challenges. 2004. In Hearing Before the Special Committee on Aging, 108th Cong., 2nd Sess., Vol. 145 (Statement of the American Foundation for the Blind).
- Baca, J. 1998. Comparing effects of navigational interface modalities on speaker prosodics. In *Paper Presented at the Third Annual International ACM/SIGCAPH Conference on Assistive Technologies (ASSETS '98)*. Marina del Rey, CA.
- Barreto, A. B., J. A. Jacko, and P. Hugh. 2007. Impact of spatial auditory feedback on the efficiency of iconic human-computer interfaces under conditions of visual impairment. *Comput Human Behav* 23(3): 1211–1231. doi:DOI: 10.1016/j.chb.2004.12.001
- Becker, S., and D. Lundman. 1998. Improving access to computers for blind and visually impaired persons: The development of a test method for usability. In Paper Presented at the Telemeatics for the Integration of Disabled and Elderly People (TIDE) 1998 Conference. Helsinki, Finland.
- Blattner, M., D. Sumikawa, and R. Greenberg. 1989. Earcons and icons: Their structure and common design principles. *Hum Comput Interact* 4(1): 11–44.
- Brenner, M. H., B. Curbow, J. C. Javitt, M. W. Legro, and A. Sommer. 1993. Vision change and quality of life in the elderly: Response to cataract surgery and treatment of other chronic ocular conditions. *Arch Ophthalmol* 111(5):680–685.
- Bressler, S., B. Munoz, S. Solomon, S. West, and Eye Evaluation (SEE) Study Team. 2008. Racial differences in the prevalence of age-related macular degeneration: The Salisbury Eye Evaluation (SEE) project. *Arch Ophthalmol* 126(2):241–245. <http://www.ncbi.nlm.nih.gov/pubmed/18268216> (accessed March 20, 2011).
- Brewster, S. A., P. C. Wright, and A. D. N. Edwards. 1994. The design and evaluation of an auditory-enhanced scrollbar. In Paper Presented at the ACM Conference on Human Factors in Computing Systems (CHI). Boston, MA.
- Bühler, C., H. Heck, and R. Wallbruch. 1994. A uniform control interface for various electronic aids. In Paper Presented at the 4th International Conference on Computers for Handicapped Persons. Vienna, Austria.
- Chang, S.-K., ed. 1990. Principles of Visual Programming Systems. Upper Saddle River, NJ: Prentice-Hall, Inc.
- Chignell, M., and J. Waterworth. 1997. Multimedia. In *Handbook of Human Factors and Ergonomic*, ed. G. Salvendy, 1808–1861. New York, NY: John Wiley & Sons.
- Coeckelbergh, T. R. M., F. W. Cornelissen, W. H. Brouwer, and A. C. Kooijam. 2002. The effect of visual field defects on eye movement and practical fitness to drive. *Vision Res* 42: 669–677.
- Colenbrander, A. 1977. Dimensions of visual performance. *Trans Am Acad Ophthalmol Otolaryngol* 83(2):332–337.
- Craven, J. 2003. Access to electronic resources by visually impaired people. *Inf Res* 8(4). Paper no. 156. <http://informationr.net/ir/8-4/paper156.html>. Accessed March 1, 2011.
- Crispien, K., W. Würz, and G. Weber. 1994. Using spatial audio for the enhanced presentation of synthesised speech within screen-readers for blind computer users. In Paper Presented at the 4th International Conference on Computers for Handicapped Persons. Vienna, Austria.
- Cunningham, C., and N. Coombs. 1997. Information Access and Adaptive Technology. Phoenix, AZ: American Council on Education and The Oryx Press.
- Danis, C., and J. Karat. 1995. Technology-driven design of speech recognition systems. In Paper Presented at the Conference on Designing Interactive Systems: Processes, Practices, Methods, & Techniques. Ann Arbor, MI.
- Darvishi, A., V. Guggiana, E. Munteanu, H. Schauer, M. Motavalli, and M. Rauterberg. 1994. Synthesizing nonspeech sound to support blind and visually impaired computer users. In Paper Presented at the ICCHP. Vienna, Austria.
- Darvishi, A., E. Munteanu, V. Guggiana, H. Schauer, M. Motavalli, and M. Rauterberg. 1994. Automatic impact sound generation for using in nonvisual interfaces. In *Paper Presented at the First Annual International ACM/SIGCAPH Conference on Assistive Technologies (ASSETS '94)*. Marina del Rey, CA.
- De Bra, P., G.-J. Houben, and H. Wu. 1999. AHAM: A Dexter-based -reference model for adaptive hypermedia. In *Paper Presented at the tenth ACM Conference on Hypertext and Hypermedia: Returning to our Diverse Roots: Returning to our Diverse Roots*. Darmstadt, Germany.
- Diabetic Retinopathy Study Research Group. 1979. Four risk factors for severe visual loss in diabetic retinopathy: DRS Report 3. *Arch Ophthalmol* 97:654–655.
- Diabetic Retinopathy Study Research Group. 1981. Photocoagulation treatment of proliferative diabetic retinopathy: Clinical application of diabetic retinopathy study (DRS) findings (DRS Report 8). *Arch Ophthalmol* 88: 583–600.
- Dix, A., J. Finlay, G. Abowd, and R. Beale. 1998. Human-Computer Interaction, 2nd ed. New York, NY: Prentice Hall.
- Donderi, D. C., and S. B. Murphy. 1983. Predicting activity and satisfaction following cataract surgery. *J Behav Med* 6: 313–328.
- Early Treatment Diabetic Retinopathy Study Research Group. 1995. Focal photocoagulation treatment of diabetic macular edema (ETDRS Report 19). *Arch Ophthalmol* 113: 1144–1155.
- Edwards, P. J., L. Barnard, V. K. Emery, J. Yi, K. P. Moloney, T. Kongnakorn et al. 2004. Strategic design for users with diabetic retinopathy: Factors influencing performance in a menu-selection task. In Proceedings of the Sixth International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS '04), 118–125. Atlanta, GA. New York: ACM.
- Edwards, P. J., L. Barnard, V. K. Emery, J. Yi, K. P. Moloney, T. Kongnakorn et al. 2005. Understanding users with diabetic retinopathy: Factors that affect performance in a menu selection task. *Behav Inf Technol* 24(3): 175–186.
- Edwards, W. K., and E. D. Mynatt. 1994. An architecture for transforming graphical interfaces. In *Paper Presented at the ACM Conference on User Interface Software and Technology (UIST '94)*. Marina del Rey, CA.
- Edwards, W. K., E. D. Mynatt, and K. Stockton. 1994. Providing access to graphical interfaces, not graphical screens. In *Paper Presented at the ACM Conference on Assistive and Enabling Technology (ASSETS, '94)*. Marina del Rey, CA.
- Emery, V. K., P. J. Edwards, J. A. Jacko, K. P. Moloney, L. Barnard, T. Kongnakorn et al. 2003. Toward achieving universal usability for older adults through multimodal feedback. In Proceedings of the 2003 ACM Conference on Universal Usability, 46–53. Vancouver, BC. New York: ACM.
- Emiliani, P. L. 2001. Special needs and enabling technologies: An evolving approach to accessibility. In *User Interfaces for All—Concepts, Methods and Tools*, ed. C. Stephanidis, 97–113. Mahwah, NJ: Lawrence Erlbaum Associates.
- Fletcher, D. C., ed. 1999. Low Vision Rehabilitation: Caring for the Whole Person. Hong Kong: Oxford University Press.

- Fletcher, D. C., R. Schuchard, C. Livingstone, W. Crane, and S. Hu. 1994. Scanning laser ophthalmoscope macular perimetry and applications for low vision rehabilitation clinicians. *Ophthalmol Clin North Am* 7: 257–265.
- Fortuin, F. T., and S. Omata. 2004. Designing universal user interfaces—The application of universal design rules to eliminate information barriers for the visually impaired and the elderly. <http://www.visionconnection.org> (accessed May 19, 2004).
- Fraser, J., and C. Gutwin. 2000. A framework of assistive pointers for low vision users. In Paper Presented at the ACM Conference on Assistive Technologies. Arlington, VA.
- Fricke, J., and H. Baehring. 1994. Displaying laterally moving tactile information. In Paper Presented at the 4th International Conference on Computers for Handicapped Persons (ICCHP '94). Vienna, Austria.
- Friedlander, C. 1997. Speech facilities for the reading disabled. *Commun ACM* 40(3): 24–25.
- Gaver, W. 1989. The SonicFinder: An interface that uses auditory icons. *Hum Comput Interact* 4(1):67–94.
- Gerber, E., and C. Kirchner. 2001. Who's surfing? Internet access and computer use by visually impaired youths and adults. *J Vis Impair Blind* 95(3):176–181.
- Gillan, D. J. 1998. The psychology of multimedia: Principles of perception and cognition. In Paper Presented at the 1998 ACM Conference on Human Factors in Computing Systems (CHI '98). Los Angeles, CA.
- Gragoudas, E. S., A. P. Adamis, E. T. Cunningham Jr., M. Feinsod, and D. R. Guyer. 2004. Pegaptanib for neovascular age-related macular degeneration. *New England Journal of Medicine* 351: 2805–2816.
- Harper, S., C. Goble, and R. Stevens. 2001. Web mobility guidelines for visually impaired surfers. *J Res Pract Inf Technol* 33(1):30–41.
- Huang, X., A. Acero, J. Adcock, H.-W. Hon, J. Goldsmith, J. Liu et al. 1996. Whistler: A trainable text-to-speech system. In Paper Presented at the Fourth International Conference of Spoken Language Processing (ICSLP '96). Philadelphia, PA.
- Huang, X., A. Acero, F. Alleva, M.-Y. Hwang, L. Jiang, and M. Mahajan. 1995. Microsoft Windows highly intelligent speech recognizer: Whisper. In Paper Presented at the International Conference on Acoustics, Speech, and Signal Processing. Detroit, MI.
- Ismail, N., and H. Zaman. 2010. Search engine module in voice recognition browser to facilitate the visually impaired in virtual learning (MGSYS VISI-VL). *World Acad Sci Eng Technol* 71: 606–610.
- Jacko, J. A. 1999. The importance of clinical diagnoses in the prediction of performance on computer-based tasks for low vision users. In Proceedings of the 9th International Conference on Human-Computer Interaction, 787–791. Munich.
- Jacko, J. A., L. Barnard, T. Kongnakorn, K. P. Moloney, P. J. Edwards, V. K. Emery et al. 2004. Isolating the effects of visual impairment: Exploring the effect of AMD on the utility of multimodal feedback. *CHI Lett* 6(1):311–318.
- Jacko, J. A., A. B. Barreto, I. U. Scott, J. Y. M. Chu, H. S. Vitense, F. T. Conway et al. 2002. Macular degeneration and visual icon use: Deriving guidelines for improved access. *Univers Access Inf Soc* 1: 197–296.
- Jacko, J. A., A. B. Barreto, I. U. Scott, R. H. Rosa Jr., and C. J. Pappas. 2000. Using electroencephalogram to investigate stages of visual search in visually impaired computer users: Preattentive and focal attention. *Int J Hum Comput Interact* 12(1): 135–150.
- Jacko, J. A., M. A. Dixon, R. H. Rosa, I. U. Scott, and C. J. Pappas. 1999a. Linking visual capabilities of partially sighted computer users to psychomotor task performance. In Proceedings of the 9th International Conference on Human-Computer Interaction, 975–979. Munich, Germany, August 22–27. New York: ACM.
- Jacko, J. A., M. A. Dixon, R. H. Rosa Jr., I. U. Scott, and C. J. Pappas. 1999b. Visual profiles: A critical component of universal access. In ACM Conference on Human Factors in Computing Systems (CHI '99), 330–337. Pittsburgh, PA. New York: ACM.
- Jacko, J. A., V. K. Emery, P. J. Edwards, M. Ashok, L. Barnard, T. Kongnakorn et al. 2004. The effects of multimodal feedback on older adults' task performance given varying levels of computer experience. *Behav Inf Technol* 23(4):247–264.
- Jacko, J. A., K. P. Moloney, T. Kongnakorn, L. Barnard, P. J. Edwards, V. K. Emery et al. 2005. Multimodal feedback as a solution to ocular disease-based user performance decrements in the absence of functional visual loss. *Int J Hum Comput Interact* 18(2):183–218.
- Jacko, J. A., R. H. Rosa, I. U. Scott, C. J. Pappas, and M. A. Dixon. 2000. Visual impairment: The use of visual profiles in evaluations of icon use in computer-based tasks. *Int J Hum Comput Interact* 12(1): 151–165.
- Jacko, J. A., I. U. Scott, A. B. Barreto, H. S. Bautsch, J. Y. M. Chu, and W. B. Fain. 2001. Iconic visual search strategies: A comparison of computer users with AMD versus computer users with normal vision. In Paper Presented at the 9th International Conference on Human-Computer Interaction. New Orleans, LA.
- Jacko, J. A., I. U. Scott, F. Sainfort, K. P. Moloney, T. Kongnakorn, B. S. Zorich et al. 2003. Effects of multimodal feedback on the performance of older adults with normal and impaired vision. *Lect Notes Comput Sci (LNCS)* 2615: 3–22.
- Jacko, J. A., and A. Sears. 1998. Designing interfaces for an overlooked user group: Considering the visual profiles of partially sighted users. In Paper Presented at the ACM Conference on Assistive Technologies. Marina del Rey, CA.
- Jacko, J. A., and H. S. Vitense. 2001. A review and reappraisal of information technologies within a conceptual framework for individuals with disabilities. *Univers Access Inf Soc (UAIS)* 1: 56–76.
- Jacko, J. A., H. S. Vitense, and I. U. Scott. 2003. Perceptual impairments and computing technologies. In Human-Computer Interaction Handbook, ed. J. A. Jacko, and A. Sears, 504–522. Mahwah, NJ: Lawrence Erlbaum Associates.
- Javitt, J. C., M. H. Brenner, B. Curbow, M. W. Legro, and D. A. Street. 1993. Outcomes of cataract surgery. Improvement in visual acuity and subjective visual function after surgery in the first, second, and both eyes. *Arch Ophthalmol* 111(5):686–691.
- Karshmer, A. I., P. Brawner, and G. Reiswig. 1994. An experimental sound-based hierarchical menu navigation system for visually handicapped use of graphical user interfaces. In Proceedings of the First Annual ACM Conference on Assistive Technologies, 123–128. Marina del Rey, CA. New York: ACM.
- Karshmer, A. I., B. Ogden, P. Brawner, K. Kaugars, and G. Reiswig. 1994. Adapting graphical user interfaces for use by visually handicapped computer users: Current results and continuing research. In Paper Presented at the 4th International Conference on Computers for Handicapped Persons (ICCHP '94). Vienna, Austria.
- Kawai, S., H. Aida, and T. Saito. 1996. Designing interface toolkit with dynamic selectable modality. In Paper Presented at the Second Annual ACM Conference on Assistive Technologies. Vancouver, Canada.
- Klein, R., B. Klein, M. Knudtsen, T. Wong, M. Cotch, K. Liu et al. 2006. Prevalence of age-related macular degeneration in 4 racial/ethnic groups in the multi-ethnic study of atherosclerosis. *Ophthalmology* 113(3):373–380. <http://www.ncbi.nlm.nih.gov/pubmed/16513455> (accessed March 20, 2011).
- Kline, R. L., and E. P. Glinert. 1995. Improving GUI accessibility for people with low vision. In Paper Presented at the SIGCHI Conference on Human Factors in Computing Systems. Denver, CO.
- Kline, D. W., and C. T. Scialfa. 1997. Sensory and perceptual functioning: Basic research and human factor implications. In *Handbook of Human Factors and the Older Adult*, ed. A. D. Fisk, and W. A. Rogers, 27–54. San Diego, CA: Academic Press.

- Kuber, R., W. Yu, and M. S. O'Modhrain. 2010. Tactile web browsing for blind users. In *Haptic and Audio Interaction Design: 5th International Workshop, HAID 2010, Copenhagen, Denmark, September 16–17, 2010; Proceedings*, ed. R. Nordahl, S. Serafin, F. Fontana, and S. Brewster, Vol. 6306/2010, 75–84. Berlin: Springer. Print. Lecture Notes in Computer Science.
- Kurze, M. 1998. TGuide: A guidance system for tactile image exploration. In Paper Presented at the Third Annual International ACM/SIGCAPH Conference on Assistive Technologies (ASSETS '98). Marina Del Rey, CA.
- LaPlante, M. P. 1988. Prevalence of conditions causing need for assistance in activities of daily living. In *Data on disability from the National Health Interview Survey, 1983–1985*, ed. M. P. LaPlante, 3. Washington, DC: National Institute on Disability and Rehabilitation Research.
- Law, C. M., J. S. Yi, Y. S. Choi, and J. A. Jacko. 2008a. A systematic examination of universal design resources: Part 1, heuristic evaluation. *Univers Access Inf Soc* 7(1-2):31–54.
- Law, C. M., J. S. Yi, Y. S. Choi, and J. A. Jacko. 2008b. A systematic examination of universal design resources: Part 2, analysis of the development process. *Univers Access Inf Soc* 7(1-2):55–77.
- Lazar, J., A. Allen, J. Kleinman, and C. Malarkey. 2010. What frustrates screen reader users on the web: A study of 100 blind users. *Int J Hum Comput Interact* 22(3):247–269. http://triton.towson.edu/~jlazar/IJHCI_blind_user_frustration.pdf (accessed March 21, 2011).
- Lee, H.-W., G. E. Legge, and A. Ortiz. 2003. Is word recognition different in central and peripheral vision? *Vision Res* 43: 2837–2846.
- Leonard, V. K., P. J. Edwards, and J. A. Jacko. 2005. Informing accessible design through self-reported quality of visual health. In *Proceedings of the Human Factors and Ergonomics Society 49th Annual Meeting*, 994–998. Orlando, FL: New York: ACM.
- Leonard, V. K., J. A. Jacko, and J. J. Pizzimenti. 2005. An exploratory investigation of handheld computer interaction for older adults with visual impairments. In *Proceedings of the 7th International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS 2005)*, 12–19. Baltimore, MD: New York: ACM.
- Mccoy, K. F., P. Demasco, C. A. Pennington, and A. L. Badman. 1997. Some interface issues in developing intelligent communication aids for people with disabilities. In Paper Presented at the 1997 International Conference on Intelligent User Interfaces (IUI '97). Orlando, FL.
- McMillan, W. W., and L. Wisniewski. 1994. A rule-based system that suggests computer adaptations for users with special needs. In Paper Presented at the First Annual International ACM/SIGCAPH Conference on Assistive Technologies (ASSETS '94). Marina del Rey, CA.
- Mehr, E. B., and A. N. Freid. 1975. Low Vision Care. Chicago: Professional Press.
- Mereu, S. W., and R. Kazman. 1996. Audio enhanced 3D interfaces for visually impaired users. In Paper Presented at the 1996 ACM Conference on Human Factors in Computing Systems (CHI '96). Vancouver, Canada.
- Mitzner, T., D. Touron, W. Rogers, and C. Hertzog. 2010. Checking it twice: Age-related differences in double checking during visual search. In *Human Factors and Ergonomics Society Annual Meeting Proceedings, Perception & Performance*, Vol. 5, 1326–1330. <http://www.ingentaconnect.com/content/hfes/hfproc/2010/00000054/00000018/art00005> (accessed March 19, 2011).
- Moloney, K. P., B. Shi, V. K. Leonard, J. A. Jacko, B. Vidakovic, and F. Sainfort. 2006. Leveraging data complexity: Pupillary behavior of older adults with visual impairment during HCI. *Trans Comput Hum Interact (TOCHI)*.
- Murphy, E., R. Kuber, G. McAllister, P. Strain, and W. Yu. 2008. An empirical investigation into the difficulties experienced by visually impaired internet users. *Univers Access Inf Soc* 7(1):79–91.
- Mynatt, E. D., and G. Weber. 1994. Nonvisual presentation of graphical user interfaces: Contrasting two approaches. In Paper Presented at the 1994 ACM Conference on Human Factors in Computing Systems (CHI '94). Boston, MA.
- Nguyen, N. X., M. Weismann, and S. Trauzettel-Klosinski. 2009. Improvement of reading speed after providing of low vision aids in patients with age-related macular degeneration. *Acta Ophthalmologica* 87(8):849–853. doi: 10.1111/j.1755-3768.2008.01423.x.
- Nilsson, U. L. 1990. Visual rehabilitation of patients with and without educational training in the use of optical aids and residual vision: A prospective study of patients with advanced age-related macular degeneration. *Clin Vision Sci* 6: 3–10.
- Nilsson, U. L., and S. E. G. Nilsson. 1986. Rehabilitation of the visually handicapped with advanced macular degeneration. *Doc Ophthalmol* 62(4):345–367.
- Oakley, I., M. R. McGee, S. A. Brewster, and O. Gray. 2000. Putting the feel in 'look and feel'. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems Hague*, 415–422. The Netherlands: New York: ACM.
- Orr, A. L. 1998. Issues in Aging and Vision. New York: American Foundation for the Blind.
- Oviatt, S. L. 1999. Mutual disambiguation of recognition errors in a multimodel architecture. In Paper Presented at the SIGCHI Conference on Human Factors in Computing Systems: The CHI is the Limit (CHI '99). Pittsburgh, PA.
- Oviatt, S. L., and P. Cohen. 2000. Multimodal interfaces that process what comes naturally. *Commun ACM* 43(3):45–53.
- Oviatt, S., Cohen, P., Suhm, B., Bers, J., Wu, I., Holzman, T., Winograd, T., Vergo, J., Duncan, L., Landay, J., Larson, J., and Ferro, D. 2002. Designing the user interface for multimodal speech and gesture applications: state-of-the-art systems and research directions from 2000 and beyond. In *Human-Computer Interaction in the New Millennium*, ed. J. M. Carroll, 419–456. Reading, MA: Addison-Wesley.
- Paciello, M. G. 1996. Designing for people with disabilities. *Interactions* 3(1): 15–16.
- Parrish, R. K. I., S. J. Gedde, I. U. Scott, W. J. Feuer, J. C. Schiffman, C. M. Mangione et al. 1997. Visual function and quality of life among patients with glaucoma. *Arch Ophthalmol* 115(11): 1447–1455.
- Paternó, F., and C. Mancini. 1998. Developing adaptable hypermedia. In Paper Presented at the 4th International Conference on Intelligent User Interfaces (IUI '99). Los Angeles, CA.
- Petrie, H., S. Morley, and G. Weber. 1995. Tactile-based direct manipulation in GUIs for blind users. In Paper Presented at the Conference Companion on Human Factors in Computing Systems (CHI '95). Denver, CO.
- Pilar da Silva, D., R. Van Durm, E. Duval, and H. Olivière. 1998. Adaptive navigational facilities in educational hypermedia. In Paper Presented at the Ninth ACM Conference on Hypertext and Hypermedia: Links, Objects, Time and Space—Structure in Hypermedia Systems (HyperText '98). Pittsburgh, PA.
- Rajput, N., S. Agarwal, A. Kumar, and A. A. Nanavati. 2008. An alternative information web for visually impaired users in developing countries. *IBM Research Report, RI08010*, 1–9. [http://domino.research.ibm.com/library/cyberdig.nsf/papers/E1642C08F06FA89C85257491003E16D0/\\$File/IBMresearchReport.pdf](http://domino.research.ibm.com/library/cyberdig.nsf/papers/E1642C08F06FA89C85257491003E16D0/$File/IBMresearchReport.pdf) (accessed March 20, 2011).
- Rampp, D. L. 1979. Hearing and learning disabilities. In *Hearing and Hearing Impairment*, ed. L. J. Bradford, and W. G. Hardy, 381–389. New York: Grune & Stratton.
- Ramstein, C. 1996. Combining hepatic and Braille technologies: Design issues and pilot study. In Paper Presented at the Second Annual International ACM/SIGCAPH Conference on Assistive Technologies (ASSETS '96). Vancouver, Canada.

- Reeves, B., and C. Nass. 2000. Perceptual user interfaces: Perceptual bandwidth. *Commun ACM* 43(3):65–70.
- Rosenberg, R., E. Faye, M. Fischer, and D. Budicks. 1989. Role of prism relocation in improving visual performance of patients with macular dysfunction. *Optom Vis Sci* 66(11):747–750.
- Rovner, B. W., R. J. Casten, M. T. Hegel, R. W. Massof, B. E. Leiby, and W. S. Tasman. 2011. Improving function in age-related macular degeneration: Design and methods of a randomized clinical trial. *Contemp Clin Trials* 32(2): 196–203. doi: 10.1016/j.cct.2010.10.008
- Roy, D., and A. Pentland. 1998. A phoneme probability display for individuals with hearing disabilities. In Paper Presented at the Third Annual International ACM/SIGCAPI Conference on Assistive Technologies (ASSETS '98). Marina del Rey, CA.
- Ryder, J. W., and K. Ghose. 1999. Multi-sensory browser and editor model. In Paper Presented at the 1999 ACM Symposium on Applied Computing. San Antonio, TX.
- Schank, R. C. 1972. Conceptual dependency: A theory of natural language understanding. *Cogn Psychol* 3(4):532–631.
- Schieber, F. 1994. Recent Developments in Vision, Aging and Driving: 1988–1994. Report No. UMTRI-94-26. Ann Arbor, MI: University of Michigan, Transportaion Research Institute.
- Schumacher, E. H., J. A. Jacko, S. A. Primo, K. L. Main, K. P. Moloney, E. N. Kinzel, J. Ginn. 2008. Reorganization of visual processing is related to eccentric viewing in patients with Macular Degeneration. *Restor Neuro Neurosci* 26(4–5):391–402.
- Scott, I. U., W. J. Feuer, and J. A. Jacko. 2002a. Impact of graphic user interface screen features on computer task accuracy and speed in a cohort of patients with age-related macular degeneration. *Am J Ophthalmol* 134(6):857–862.
- Scott, I. U., W. J. Feuer, and J. A. Jacko. 2002b. Impact of visual function on computer task accuracy and reaction time in a cohort of patients with age-related macular degeneration. *Am J Ophthalmol* 133(3):350–357.
- Scott, I. U., J. A. Jacko, F. Sainfort, V. K. Leonard, T. Kongnakorn, and K. P. Moloney. 2006. The impact of auditory and haptic feedback on computer task performance in patients with Age-related Macular Degeneration and control subjects with no known ocular disease. *Retina* 26(7): 803–810.
- Scott, I. U., O. D. Schein, W. J. Feuer, M. F. Folstein, and K. Bandeen-Roche. 2001. Emotional distress in patients with retinal disease. *Am J Ophthalmol* 131(5):584–589.
- Scott, I. U., O. D. Schein, S. West, K. Bandeen-Roche, C. Enger, and M. F. Folstein. 1994. Functional status and quality of life measurement among ophthalmic patients. *Arch Ophthalmol* 112(3):329–335.
- Scott, I. U., W. E. Smiddy, W. Feuer, and A. Merikansky. 1998. Vitreoretinal surgery outcomes: Results of a patient satisfaction/functional status survey. *Ophthalmology* 105(5):795–803.
- Scott, I. U., W. E. Smiddy, J. Schiffman, W. J. Feuer, and C. J. Pappas. 1999. Quality of life of low-vision patients and the impact of low-vision services. *Am J Ophthalmol* 128(1):54–62.
- Sennette, C., M. Buzzi, M. Buzzi, and B. Leporini. 2009. Enhancing wikipedia editing with WAI-ARIA. In *HCI and Usability for e-Inclusion*, Volume 5889 of Lecture Notes in Computer Science, ed. A. Holzinger, and K. Miesenberger. Chapter 11, 159–177. Berlin, Heidelberg: Springer Berlin/Heidelberg.
- Silva, L., and O. R. P. Bellon. 2002. A novel application to aid low vision computer users. *Lect Notes Comput Sci* 2398: 455–462.
- Simoneit, T. 2011. A world wide web that talks - technology review. *Technology Review: The Authority on the Future of Technology*. http://www.technologyreview.com/prINTER_FRIENDLY_article.aspx?id (accessed March 21, 2011).
- Sloan, L. L. 1968. Reading aids for the partially sighted: Factors which determine success or failure. *Arch Ophthalmol* 80(1):35–38.
- Steinberg, E. P., J. M. Tielsch, O. D. Schein, J. C. Javitt, P. Sharkey, S. D. Cassard et al. 1994. National study of cataract surgery outcomes: Variation in 4-month postoperative outcomes as reflected in multiple outcome measures. *Ophthalmology* 101(6):1131–1140.
- Stelmack, J. A., X. C. Tang, D. J. Reda, S. Rinne, R. M. Mancil, R. W. Massof, and for the LOVIT Study Group. 2008. Outcomes of the veterans affairs low vision intervention trial (LOVIT). *Arch Ophthalmol* 126(5):608–617. doi:10.1001/archopht.126.5.608
- Stephanidis, C. 2001a. The concept of unified user interfaces. In *User Interfaces for All: Concepts, Methods, and Tools*, ed. C. Stephanidis, 371–388. Mahwah, NJ: Lawrence Erlbaum Associates.
- Stephanidis, C., ed. 2001b. *User Interfaces for All: Concepts, Methods, and Tools*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Stephanidis, C., C. Karagiannidis, and A. Koumpis. 1997. Decision making in intelligent user interfaces. In Paper Presented at the 2nd International Conference on Intelligent User Interfaces (IUI '97). Orlando, FL.
- Stephanidis, C., G. Salvendy, D. Akoumianakis, A. Arnold, N. Bevan, D. Dardailler et al. 1999. Toward an information society for all: HCI challenges and R&D recommendations. *Int J Hum Comput Interact* 11(1):1–28.
- Stephanidis, C., G. Salvendy, D. Akoumianakis, N. Bevan, J. Brewer, P. L. Emiliani et al. 1998. Toward an information society for all: An international research and development agenda. *Int J Hum Comput Interact* 10(2): 107–134.
- Thatcher, J. 1994. Screen reader/2: Access to OS/2 and the graphical user interface. In *Paper Presented at the First Annual ACM Conference on Assistive Technologies (ASSETS '94)*. Marina del Rey, CA.
- The Eye Diseases Prevalence Research Group. 2004a. Causes and prevalence of visual impairment among adults in the United States. *Arch Ophthalmol* 122: 477–485.
- The Eye Diseases Prevalence Research Group. 2004b. Prevalence of age-related macular degeneration in the United States. *Arch Ophthalmol* 122: 564–572.
- The Eye Diseases Prevalence Research Group. 2004c. The prevalence of diabetic retinopathy among adults in the United States. *Arch Ophthalmol* 122: 552–563.
- Turk, M., and G. Robertson. 2000. Perceptual user interfaces. *Commun ACM* 43(3):32–34.
- Vanderheiden, G. C. 1998. Universal design and assistive technology in communication and information technologies: Alternatives or complements? *Assistive Technology* 10(1):29–36.
- Vitense, H. S., J. A. Jacko, and V. K. Emery. 2002. Foundations for improved interaction by individuals with visual impairments through multimodal feedback. *Univers Access Inf Soc (UAIS)* 2(1):76–87.
- Vitense, H. S., J. A. Jacko, and V. K. Emery. 2003. Multimodal feedback: An assessment of performance and mental workload. *Ergonomics* 46(1-3):58–87.
- Waterworth, J. A., and M. H. Chignell. 1997. Multimedia interaction. In *Handbook of Human-Computer Interaction*, ed. M. Helander, T. K. Landauer, and P. Prabhu, 915–946. New York, NY: Elsevier Science.
- Whittaker, S. G. 1998. Choosing assistive devices when computer users have impaired vision. In Paper Presented at the Center on Disabilities, Technology, and Persons with Disabilities Conference. Northridge, CA.
- Yankelovich, N., G.-A. Levow, and M. Marx. 1995. Designing SpeechActs: Issues in speech user interfaces. In Paper Presented at the SIGCHI Conference on Human Factors in Computing Systems. Denver, CO.

Yu, W., R. Ramloll, and S. Brewster. 2000. Haptic graphs for blind computer users. In Paper Presented at the First Workshop on Haptic Human-Computer Interaction. Glasgow, Scotland.

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- Adkins, N., and J. Ozanne. 2005. The low literate consumer. *J Consum Res* 32: 93–105.
- Bekerian, D., and J. Dennett. 1993. The cognitive interview technique: Reviving the issues. *Appl Cogn Psychol* 7: 275–297.
- Benard, M. (n.d.). Criteria for Optimal Web Design. <http://psychology.wichita.edu/optimalweb/structure.html> (accessed January 13, 2006).
- Benton Foundation. 1999. *Networking for Better Care: Health Care in the Information Age*. <http://www.Benton.org/library/health/> (accessed December 28, 2003).
- Beveridge, M., and V. Griffiths. 1987. The effects of pictures on the reading processes of less able readers: A miscue analysis approach. *J Res Read* 10: 29–42.
- Birru, M., V. Monaco, L. Charles, H. Drew, V. Njie, T. Bierria, E. Detlefsen, and R. Steinman. 2004. Internet usage by low-literacy adults seeking health information: An observational analysis. *J Med Internet Res* 6(3). <http://www.jmir.org/2004/3/e25/> (accessed December 12, 2005).
- Bogner, M. 1999. How do I work this thing? Cognitive issues in home medical equipment use and maintenance. In *Processing of Medical Information in Aging Patients: A Cognitive and Human Factors Perspective*. ed. R. Morrell, K. Shifren, and D. Park, 245–256. New York: Psychology Press.
- Bohman, P., and S. Anderson. 2005. A conceptual framework for accessibility tools to benefit users with cognitive disabilities. In *Proceedings of the W4A at WWW2005*, 85–89. New York: ACM.
- Brez, S., and M. Taylor. 1997. Assessing literacy for patient teaching: Perspectives of adults with low literacy skills. *J Adv Nurs* 25: 1040–1047.
- Britt, M., and G. Gabrys. 2002. Implications of document-level literacy skills for website design. *Behav Res Methods Instrum Comput* 34(2): 170–176.
- Brown, C. 1992. Assistive technology computers and persons with disabilities. *Commun ACM* 35(5):36–45.
- Brown, D., and J. Lawton. 2001. Design guidelines and issues for website design and use by people with a learning disability. Centre for Educational Technology Interoperability Standards. <http://www.cetis.ac.uk/members/accessibility/links/disabilities/cogdis> (accessed March 28, 2007).
- Cain, M. M., R. Mittman, J. Sarasohn-Kahn, and J. Wayne. 2000. *Health E-People: The Online Consumer Experience*. Oakland, CA: Institute for the Future, California Health Care Foundation.
- Carmien, S., M. Dawe, G. Fischer, A. Gorman, A. Kintsch, and J. Sullivan. 2005. Socio-technical environments supporting people with cognitive disabilities using public transportation. *ACM Trans Hum Comput Interact* 12(2): 233–267.
- Carmien, S., and G. Fischer. 2008. Design, adoption, and assessment of a socio-technical environment supporting independence for persons with cognitive disabilities. In *Proceedings of CHI*, 597–606. New York: ACM.
- Camey, R., and J. Levin. 2002. Pictorial illustrations still improve students' learning from text. *Educ Psychol Rev* 14(1):5–26.
- Carroll, J. 1972. *The American Heritage Word Frequency Book*. New York: Houghton Mifflin.
- Carvin, A., J. Hill, and S. Smothers. 2004. *E-GovernmentforAll: Ensuring Equitable Access to Online Government Services*. New York: The EDC Center for Media & Community and the NYS Forum.
- Cashen, M., P. Dykes, and B. Gerber. 2004. e-health technology and Internet resources: Barriers for vulnerable populations. *J Cardiovasc Nurs* 19(3):209–214.
- Cole, E., and P. Dehdashti. 1998. Computer-based cognitive prosthetics: Assistive technology for the treatment of cognitive disabilities. In *Proceedings of the Third International ACM Conference on Assistive Technologies*, 11–18. Arrington, VA: ACM.
- Collins, V., S. Dickson, D. Simmons, and E. Kameenui. 1998. *Metacognition and its Relations to Reading Comprehension: A Synthesis of the Research*. National Center to Improve the Tools of Educators. Washington, DC: University of Washington.
- Corley, M., and J. Taymans. 2002. Adults with Learning Disabilities: A Review of the Literature. <http://www.ncsall.net/?id1575> (accessed December 30, 2005).
- Craven, J., and H. Booth. 2006. Putting awareness into practice: Practical steps for conducting usability tests. *Libr Rev* 55(3): 179–194.
- Croft, D. R., and M. W. Peterson. 2002. An evaluation of the quality and contents of asthma education on the World Wide Web. *Chest* 121(4):1301–1307.
- Cromley, J. 2005. Metacognition. Cognitive Strategy Instruction, and Reading in Adult Literacy. <http://www.ncsall.net/index.php?id5773> (accessed January 17, 2006).
- Daneman, M., and P. Carpenter. 1980. Individual differences in working memory and reading. *J Verbal Learn Verbal Behav* 19: 450–466.
- Danielson, D. 2002. Web navigation and the behavioral effects of constantly visible site maps. *Interact Comput* 14(5):601–618.
- Dawe, M. 2007. "Let me show you what i want": Engaging individuals with cognitive disabilities and their families in design. In *Proceedings of Computer Human Interaction Conference*, 2177–2182. New York: ACM.
- Dickinson, A., R. Eisma, and P. Gregor. 2003. Challenging Interfaces/Redesigning Users. In *CUU 2003*, 61–68. British Columbia, Canada. New York: ACM.
- Doak, C., L. Doak, G. Friedell, and C. Meade. 1998. Improving comprehension for cancer patients with low literacy skills: strategies for clinicians. *CA Cancer J Clin* 48: 151–162.
- Doak, C., L. Doak, and J. Root. 1996. *Teaching Patients with Low Literacy Skills*. Philadelphia, PA: J.B. Lippincott Company.
- Dropout Rates in the United States. 2001. National Center for Educational Statistics. http://nces.ed.gov/pubs2002/drop-outpub_2001/11 (accessed December 10, 2003).
- Epstein, A., R. Maley, and J. Suri. 2006. A tutorial on emerging medical device technology in the distributed diagnosis and home healthcare (D2H2) W+Environment. In *Workshop, 28th Annual International Conference IEEE Engineering in Medicine and Biology Society (EMBS)* August 30-September 3. New York: IEEE. <http://embc2006.nijit.edu/ws10php> (accessed June 10, 2010).
- Flavell, J. 1979. Metacognition and cognitive monitoring: A new area of cognitive-developmental inquiry. *Am Psychol* 34(10):906–911.

- Friedman, M., and D. Bryen. 2007. Web accessibility design recommendations for people with cognitive disabilities. *Technol Disabil* 19: 205–212.
- Gerber, P. 1998. *Characteristics of Adults with Specific Learning Disabilities*. http://www.idonline.org/ld_indepth/adult/characteristics.html (accessed December 28, 2003).
- Gerber, B., I. Brodsky, K. Lawless, L. Smolin, A. Arozullah, E. Smith, M. Berbaum, P. Heckerling, and A. Eiser. 2005. Implementation and evaluation of a low literacy diabetes education computer multimedia application. *Diabet Care* 28(7): 1574–1580.
- Graber, M. A., D. M. D'Alessandro, and J. Johnson-West. 2002. Reading level of privacy policies on Internet websites. *J Fam Pract* 51(7):642–645.
- Gribbons, W. 1992. The functionally illiterate: Handicapped by design. In Proceedings of the International Professional Communications Conference, 302–307. New York: IEEE.
- Hahn, E., D. Cella, D. Dobrez, G. Shiromoto, S. Marcus, M. Vohra, H. Chang, and K. Webster. 2004. The talking touchscreen: A new approach to outcomes assessment in low literacy. *Psychooncology* 13: 86–95.
- Henriksen, K., A. Joseph, and T. Zayas-Caban. 2009. The human factors of home health care: A conceptual model for examining safety and quality concerns. *J Pat Saf* 5(4):229–236.
- Houts, P., C. Doak, L. Doak, and M. Loscalzo. 2006. The role of pictures in improving health communication: A review of research on attention, comprehension, recall, and adherence. *Patient Educ Couns* 61: 173–190.
- Houts, P., J. Witmer, M. Egeleth, M. Loscalzo, and J. Zabora. 2001. Using pictographs to enhance recall of spoken medical instructions. *Patient Educ Couns* 43: 231–242.
- Huenerfauth, M. 2002. Design approaches for developing user interfaces accessible to illiterate users. In American Association of Artificial Intelligence Conference (AAAI 2002), Intelligent and Situation-Aware Media and Presentations Workshop. Paper presented in Edmonton, Alberta, Canada. Palo Alto, CA: Association for the Advancement of Artificial Intelligence.
- Huenerfauth, M., L. Feng, and N. Elhadad. 2009. Comparing evaluation techniques for text readability software for adults with intellectual disabilities. In Proceedings of ASSETS '09, 3–10. New York: ACM.
- Hussey, L. 1994. Minimizing the effects of low literacy on medication knowledge and compliance among the elderly. *Clin Nurs Res* 3(2): 132–145.
- Jiwnani, K. 2001. *Designing for Users with Learning Disabilities*. <http://www.otal.umd.edu/uupractice/cognition/> (accessed December 28, 2005).
- Kaphingst, K., C. Zanfini, and K. Emmons. 2006. Accessibility of web sites containing colorectal cancer information to adults with limited literacy. *Cancer Causes Control* 17: 147–151.
- Karande, S., S. Sawant, M. Kulkarni, P. Galvankar, and R. Sholapurwala. 2005. Comparison of cognitive abilities between groups of children with specific learning disability having average, bright normal and superior nonverbal intelligence. *Indian J Med Sci* 59(3):95–103.
- Kickbusch, I. 2001. Health literacy: Addressing the health and education divide. *Health Promot Int* 16(3):289–297.
- Kirsch, I., A. Jungeblut, L. Jenkins, and A. Kolstad. 1993a. Adult Illiteracy in America: A First Look at the Results of the National Literacy Survey, Washington, DC: Department of Education, Center for Educational Statistics.
- Kirsch, I., A. Jungeblut, L. Jenkins, and A. Kolstad. 1993b. *Executive Summary of Adult Literacy in America: A First Look at the Results of the National Literacy Survey*, <http://www.nces.ed.gov/naal/resources/execsumm.asp> (accessed October 27, 2003).
- Kodagoda, N., and B. L. Wong. 2008. Effects of low & high literacy on user performance in information search and retrieval. In Proceedings of the 22nd British HCI Group Annual Conference on HCI 2008: People and Computers XXII: Culture, Creativity, Interaction—Vol 1. British Computer, 173–181. London, UK.
- Kolatch, E. 2000. *Designing for Users with Cognitive Disabilities*. <http://www.otal.umd.edu/uuguide/erica/> (December 28, 2005).
- Kruger, J., and D. Dunning. 1999. Unskilled and unaware of it: How difficulties in recognizing one's own incompetence lead to inflated self-assessments. *J Personal Soc Psychol* 77(6): 1121–1135.
- Larsen, S. 1995. What is "quality" in the use of technology for children with learning disabilities? *Learn Disabil Quarter* 18(2): 118–130.
- Larson, K., and M. Czerwinski. 1998. Web page design: Implications of memory, structure and scent for information retrieval. In Proceedings of CHI '98, 25–32. USA: ACM.
- Lee, J. 1999. Test anxiety and working memory. *J Exp Educ* 67: 218–240. Retrieved December 4, 2005, from ProQuest database.
- Lepisto, A., and S. Ovaska. 2004. Usability evaluation involving participants with cognitive disabilities. In Proceedings of Nordi CHI, 416–420. New York: ACM.
- Lewis, C. 2006. HCI and cognitive disabilities. *Interactions* 13(3): 14–15.
- Lewis, C. 2007. Simplicity in cognitive assistive technology: A framework and agenda for research. *Univers Access Inf Soc* 5: 351–361.
- Lewis, C. 2010. ICT and people with cognitive disabilities. *Interactions* 9(2):4–6.
- Lobach, D., J. Arbanas, D. Mishra, M. Campbell, and B. Wildemuth. 2004. Adapting the Human-Computer Interface for Reading Literacy and Computer Skill to Facilitate Collection of Information Directly from Patients. MEDINFO 2004, 1143–1146. Amsterdam, The Netherlands: IOS Press.
- McDonald, S., and R. Stevenson. 1996. Disorientation in hypertext: The effects of three text structures on navigation performance. *Appl Ergon* 27: 61–68.
- McDonald, S., and R. Stevenson. 1998. Effects of text structure and prior knowledge of the learner on navigation in hypertext. *Hum Factors* 40(1): 18–27.
- McGrenere, J., D. Davies, L. Findlater, P. Graf, M. Klawe, K. Moffatt, B. Purves, and S. Yang. 2003. Insights from the aphasia project: Designing technology for and with people who have aphasia. In CUU 2003, 112–118. Arlington, VA: ACM.
- McGrenere, J., J. Sullivan, and R. Baekcker. 2006. Designing technology for people with cognitive impairments. In Proceedings of CHI, 1635–1638. New York: ACM.
- Mellard, D., E. Fall, and K. Woods. 2010. A path analysis of reading comprehension for adults with low literacy. *J Learn Disabil* 43(2):154–165.
- Milne, R., I. Clare, and R. Bull. 1999. Using cognitive the interview with adults with mild learning disabilities. *Psychol Crime Law* 5: 81–89.
- Mirchandani, N. 2003. *Web Accessibility for People with Cognitive Disabilities: Universal Design Principles at Work*. http://www.ncddr.org/du/researchexchange/v08n03/8_access.html (accessed December 28, 2005).
- Mokhtari, K., and C. Reichard. 2002. Assessing students' metacognitive awareness of reading strategies. *J Educ Psychol* 94(2):249–259.
- Moon, R., T. Cheng, K. Patel, and P. Scheidt. 1998. Parental literacy level and understanding of medical information. *Pediatrics* 102(2). Retrieved from Medline, e25.

- Myatt, A., I. Essa, and W. Rogers. 2000. Increasing the opportunities for aging in place. In Proceedings of the ACM Conference on Universal Usability, 65–71. New York: ACM Press.
- National Assessment of Adult Literacy (NAAL). 2003. A First Look at the Literacy of Americas Adults in the 21st Century. Washington, DC: National Center for Educational Statistics, U.S. Department of Education, Institute of Educational Sciences, NCES 2006–470.
- National Dyslexia Association (n.d.). What is Dyslexia? <http://www.interdys.org> (accessed November 10, 2003).
- Newell, A., A. Carmichael, P. Gregor, and N. Alm. 2003. Information technology for cognitive support. In *The Human Computer Interaction Handbook*, ed. J. Jacko and A. Sears, 464–481. Mahwah, NJ: Lawrence Erlbaum Associates.
- Newell, A., and P. Gregor. 2000. User sensitive inclusive design: In search of a new paradigm. In *CUU 2000*, 39–44. Arlington, VA: ACM.
- Nielsen, J. 2005. Lower-Literacy Users. <http://www.useit.com/alert-box/20050314.html> (accessed December 9, 2005). Freemont, CA: Nielsen Norman Group.
- Ozanne, J., N. Adkins, and J. Sandlin. 2005. Shopping for power: How adult literacy learners negotiate the marketplace. *Adult Educ Quarter* 55(4):251–268.
- Palmer, S. 2000. Phonological recoding deficit in working memory of dyslexic teenagers. *J Res Read* 23(1):28–40.
- Patterson, M. 2008. Learning disability prevalence and adult education program characteristics. *Learn Disabil Res Pract* 23(1):50–59.
- Petrie, H., G. Weber, and W. Fisher. 2005. Personalization, interaction, and navigation in rich multimedia documents for print-disabled users. *IBM Syst J* 44(3):629–635.
- Poissant, H. 1994. Assessing and understand the cognitive and metacognitive perspectives of adults who are poor readers. Center for the Study of Reading. Urbana, IL. Technical Report No. 594.
- Quintana, C., J. Krajcik, and E. Soloway. 2002. A case study to distill structural scaffolding guidelines for scaffolded software environments. In *CHI 2002*, 81–88. Minneapolis, MN: ACM.
- Quintana, C., M. Zhang, and J. Krajcik. 2005. A framework for supporting metacognitive aspects of online inquiry through software-based scaffolding. *Educ Psychol* 40(4):235–414.
- Ransby, M., and H. L. Swanson. 2003. Reading comprehension skills of young adults with childhood diagnoses of dyslexia. *J Learn Disabil* 36(6):538–555.
- Romen, D., and D. Svanaes. 2008. Evaluating website accessibility: Validating the WAI guidelines through usability testing with disabled users. In *Proceedings of NordiCHI*, 535–538. New York: ACM.
- Rowland, C. 2004. *Cognitive Disabilities Part 2: Conceptualizing Design Considerations*. <http://www.webaim.org/techniques/articles/conceptualize/?templatetype53> (accessed December 28, 2005).
- Rudd, R. E., B. A. Moeykens, and T. C. Colton. 1999. *Health and Literacy: A Review of Medical and Public Health Literature*. New York: Josey-Bass.
- Sabatini, J. 2002. Efficiency in word reading of adults: Ability group comparisons. *Scientific Studies of Reading* 6: 267–298.
- Sanchez, C., and J. Wiley. 2009. To scroll or not to scroll: Scrolling, working memory capacity, and comprehending complex texts. *Hum Factors* 51: 730–738.
- Sevilla, J., G. Herrera, B. Martinez, and F. Alcantud. 2007. Web accessibility for individuals with cognitive deficits: A comparative study between an existing commercial web and its cognitively accessible equivalent. *ACM Trans Hum Comput Interact* 14(3):12–25.
- Shaw, E., W. Johnson, and R. Ganeshan. 1999. Pedagogical agents on the web. In *Proceedings of Autonomous Agents*, 283–290. Seattle, WA: New York: ACM.
- Shaywitz, S. 1998. Current concepts: Dyslexia. *New England J Med* 338: 307–312.
- Sherwani, J., S. Palijo, S. Mirza, T. Ahmed, N. Ali, and R. Rosenfeld. 2009. Speech vs. touchtone: Telephony interfaces for information access by low literate users. In *Proceedings IEEE/ACM International Conference on Information and Communication Technologies and Development*, 1–11. New York: IEEE.
- Shneiderman, B. 2000. Universal usability. *Commun ACM* 43(5):84–91.
- Shneiderman, B. 2003. Promoting universal usability with multilayer interface design. In *CUU 2003*, 1–8. British Columbia, Canada: Vancouver.
- Shneiderman, B. 2007. Web science: A provocative invitation to computer science. *Commun ACM* 50(6):25–27.
- Sitbon, L., and P. Bellot. 2008. How to cope with questions typed by dyslexic users. In *Proceedings of the Second Workshop on Analytics for Noisy Unstructured Text Data*. (Singapore, July 24, 2008), 1–8. New York, NY: ACM.
- Small, J., P. Schallau, K. Brown, and R. Appleyard. 2005. Web accessibility for people with cognitive disabilities. In *Proceedings of CHI*, 1793–1796. New York: ACM.
- Showling, M., N. Defty, and N. Goulandris. 1996. A longitudinal study of reading development in dyslexic children. *J Educ Psychol* 88(4): 653–669.
- Stanovich, K., and R. West. 1989. Exposure to print and orthographic processing. *Read Res Quarter* 24: 402–433.
- Stewart, R., V. Narendra, and A. Schmetzke. 2005. Accessibility and usability of online library databases. *Library Hi Tech* 23(2):265–286.
- Stone, R., and J. Wiener. 2001. Who will Care For Us? Addressing the Long-Term Care Workforce Crisis, 1–44. The Urban Institute and American Association of Homes and Services for the Aging. Washington, DC: The Urban Institute.
- Sum, A. 1999. Literacy in the Labor Force. Washington, DC: National Center for Education Statistics, U.S. Department of Education.
- Summers, K., and M. Summers. (n.d.). *Reading and Navigational Strategies of Web users with Low Literacy Skills*. http://iat.ubalt.edu/summers/papers/Summers_ASIST2005.pdf (accessed May 12, 2010).
- Sutcliffe, A., S. Fickas, M. Sohlberg, and L. Ehlhardt. 2003. Investigating the usability of assistive user interfaces. *Interact Comput* 15: 577–602.
- Swanson, H. L. 1993. Working memory in learning disability subgroups. *J Exp Child Psychol* 56: 87–114.
- Swanson, H. L., C. Howard, and L. Saez. 2006. Do different components of working memory underlie different subgroups of reading disabilities? *J Learn Disabil* 39(3):252–269.
- TRACE Center. 1994. *A Brief Introduction to Disabilities*. Madison, WI: University of Wisconsin. <http://trace.wisc.edu/docs/population/populat.htm> (accessed November 23, 2003).
- U.S. Department of Commerce. 2002. *A Nation Online: How Americans are Expanding Their Use of the Internet*. Economics and Statistics Administration, National Telecommunications and Information Administration. Washington, DC: NTIA.
- Utt, M. 2010. Usability testing by people with disabilities. *Interactions* 9(2):18–19.

- Van Der Geest, T. 2006. Conducting usability studies with users who are elderly or have disabilities. *Tech Commun* 53(1):23–31.
- van Gelderen, A., R. Schoonen, K. de Gloppe, J. Hulstijn, A. Simis, P. Snellings, and M. Stevenson. 2004. Linguistic knowledge, processing speed, and metacognitive knowledge in first and second language reading comprehension: A component analysis. *J Educ Psychol* 96(1):19–30.
- Vellutino, F., D. Scanlon, E. Sipay, S. Small, R. Chen, A. Pratt, and M. Denckla. 1996. Cognitive profiles of difficult to remediate and readily remediated poor readers: Early intervention as a vehicle for distinguishing between cognitive and experimental deficits as basic causes of specific reading disability. *J Educ Psychol* 88(4):601–638.
- Viswanathan, M., J. Rosa, and J. Harris. 2005. Decision making and coping of functionally illiterate consumers and some implications for marketing management. *J Mark* 69: 15–31.
- W3C. 1999. *Web Content Accessibility Guidelines 1.0 [Electronic-Edition]*, <http://www.w3.org/TR/WAI-WebContent/> (accessed April 3, 2007).
- Weiner, J., A. Aquirre, K. Ravenell, K. Kovath, L. McDevit, J. Murphy, D. Asch, and J. Shea. 2004. Designing an illustrated patient satisfaction instrument for low literacy populations. *Am J Manag Care* 10(11):853–859.
- West, D. 2003. State and Federal E-Government in the United States. Center for Public Policy. 1–29. Providence, RI: Brown University.
- Wilder, A., and J. Williams. 2001. Students with severe learning disabilities can learn higher order comprehension skill. *J Educ Psychol* 93(2):268–278.
- Williams, S., and E. Reiter. 2008. Generating readable texts for readers with low basic skills. *Nat Lang Eng* 14(4):495–525.
- Wolf, M., T. Davis, H. Tilson, P. Bass, and R. Parker. 2006. Misunderstanding of prescription drug warnings labels among patients with low literacy. *Am J Syst Pharm* 63: 1048–1055.
- Zarcadoolas, C., M. Blanco, J. Boyer, and A. Pleasant. 2002. Unweaving the web: An exploratory study of low-literate adults' navigation skills on the World Wide Web. *J Health Commun* 17: 309–324.

Computing Technologies for Deaf and Hard of Hearing Users

- Aronson, J. 2000. Sound and Fury [Motion picture]. United States: New Video Group.
- Bain, K., S. Basson, A. Faisman, and D. Kanevsky. 2005. Accessibility, transcription, and access everywhere. *IBM Syst J* 44(3): 589–605.
- Bain, K., S. Basson, and M. Wald. 2002. Speech recognition in university classrooms: Liberated learning project. In Proceedings of the 5th International ACM SIGCAH Conference on Assistive Technologies (ASSETS'02), 192–196. New York: ACM.
- Brady, S., and D. Shankweiler. 1991. Phonological Processes in Literacy: A Tribute to Isabelle Y. Liberman. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Braffort, A. 1996. A gesture recognition architecture for sign language. In Proceedings of the 2nd International ACM SIGCAH Conference on Assistive Technologies (ASSETS'96), 102–9, Vancouver, British Columbia, Canada. New York: ACM.
- Brashears, H., T. Starner, P. Lukowicz, and H. Junker. 2003. Using multiple sensors for mobile sign language recognition. In Proceedings of the 7th IEEE International Symposium on Wearable Computers, 45–52, White Plains, NY. Washington, DC: IEEE Computer Society.
- Brewer, J., and D. Dardailler. 1999. Web content accessibility guidelines 1.0. University of Wisconsin-Madison, Trace Research and Development Center. <http://www.w3.org/TR/WAI-WEBCONTENT/> (accessed December 7, 2005).
- CapTel. (n.d.). Introducing the captioned Telephone. <http://www.captionedtelephone.com/aboutcaptel.phtml> (accessed December 7, 2005).
- Caption First. (n.d.). Overview of our services. <http://www.captionfirst.com/overview.htm> (accessed January 20, 2006).
- Chorost, M. 2005. Rebuilt: How Becoming Part Computer Made Me More Human. New York, NY: Houghton Mifflin Company.
- Closed Captioning Web. (n.d.) Closed captioning web: Software links. <http://www.captions.org/softlinks.cfm> (accessed December 7, 2005).
- Conrad, R. 1979. The Deaf Schoolchild. London: Harper & Row.
- Cox, S., M. Lincoln, J. Tryggvason, M. Nakisa, M. Wells, M. Tutt, and S. Abbott. 2002. TESSA, a system to aid communication with deaf people. In Proceedings of the 5th International ACM SIGCAH Conference on Assistive Technologies (ASSETS'02), 205–212. New York: ACM.
- Emmorey, K., and H. Lane. 2000. The Signs of Language Revisited: An Anthology to Honor Ursula Bellugi and Edward Klima. Mahwah, NJ: Lawrence Erlbaum Associates.
- Erard, M. 2005. The birth of a language. *New Sci* 188(2522):46–49.
- Fang, G., W. Gao, and D. Zhao. 2003. Large vocabulary sign language recognition based on hierarchical decision trees. In Proceedings of the 5th International Conference on Multimodal Interfaces, 125–131. New York: ACM.
- Fay, E. A. 1883. The glossograph. *Am Ann Deaf* 28: 67–69.
- Frishberg, N., S. Corazza, L. Day, S. Wilcox, and R. Schulmeister. 1993. Sign language interfaces. In Proceedings of the ACM SIGCHI Conference on Human Factors in Computing Systems, 194–197. New York: ACM.
- Gallaudet Research Institute. 2003. Literacy and deaf students. <http://gri.gallaudet.edu/Literacy/> (accessed December 7, 2005).
- Gallaudet University. (n.d.). Sample web page with embedded real media video. http://academic.gallaudet.edu/pages/iced2000/real/stellaluna_smil.html (accessed January 20, 2006).
- Hanson, V. L. 1989. Phonology and reading: Evidence from profoundly deaf readers. In Phonology and Reading Disability: Solving the Reading Puzzle, ed. D. Shankweiler, and I. Y. Liberman, 69–89. Ann Arbor, MI: University of Michigan Press.
- Hanson, V. L., and C. A. Padden. 1989. The use of interactive video for bilingual ASL/English instruction of deaf children. *Am Ann Deaf* 134: 209–213.
- Hanson, V. L., and C. A. Padden. 1990. Bilingual ASL/English instruction of deaf children. In Cognition, Education, and Multimedia: Exploring Ideas in High-Technology, ed. D. Nix, and R. Spiro, 49–63. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Hernandez-Rebollar, J. L. 2005. Gesture-drive American Sign Language phraselator. In Proceedings of the 7th International ACM Conference on Multimodal Interfaces (ICMI'05), 288–292. New York: ACM Press.
- Hernandez-Rebollar, J. L., R. W. Lindeman, and N. Kyriakopoulos. 2002. A multi class pattern recognition system for practical fingerspelling translation. In Proceedings of the 4th IEEE International Conference on Multimodal Interfaces (ICMI'05), 185–190. Washington, DC: IEEE Computer Society.

- Huenerfauth, M. 2005. Representing coordination and noncoordination in an American Sign Language animation. In *Proceedings of the 7th International ACM SIGACCESS Conference on Assistive Technologies (ASSETS '05)*, 44–51. New York: ACM Press.
- Hyde, M., and D. Power. 2006. Some ethical dimensions of cochlear implantation for deaf children and their families. *J Deaf Stud Deaf Educ* 11(1): 102–111.
- iCommunicator. (n.d.). iCommunicator. <http://www.myicomunicator.com/> (accessed January 4, 2006).
- Kadous, M. W. 1996. Machine recognition of Auslan signs using Powergloves: Towards large-lexicon recognition of sign languages. In *Proceedings of WIGLS, The Workshop on the Integration of Gestures in Language and Speech, Wilmington Delaware*, ed. L. Messing, 165–74.
- Karpouzis, K., G. Caridakis, S.-E. Fotinea, and E. Efthimiou. 2007. Educational resources and implementation of a greek sign language synthesis architecture. *Computers & Education* 49(1):54–74. doi:10.1016/j.compedu.2005.06.004.
- Kennaway, R. 2002. Synthetic animation of deaf signing gestures. In *Gesture and Sign Language in Human-Computer Interaction: International Gesture Workshop (GW 2001, LNAI 2298)*, 146–57.
- King, C. 2000. *Online Learning at Gallaudet University*. Gallaudet University.
- http://academic.gallaudet.edu/pages/iced2000/iced2000_GUonlinelearning.PDF (accessed January 20, 2006).
- Klima, E. S., and U. Bellugi. 1979. *The Signs of Language*. Cambridge, MA: Harvard University Press.
- Lamberton, J. 2005. Jason Lamberton's video blog. <http://video.google.com/videoplay?docid=56012463606293405795&q=5gallaudet1university> (accessed January 20, 2006).
- Lane, H. 1984. *When the Mind Hears: A History of the Deaf*. New York: Random House.
- Lane, H. 1992. *The Mask of Benevolence: Disabling the Deaf Community*. New York: Alfred A. Knopf.
- Lane, H., R. Hoffmeister, and B. Bahan. 1996. *A Journey into the Deaf-world*. San Diego, CA: Dawn Sign Press.
- Laurent Clerc National Deaf Education Center, Gallaudet University. (n.d.). Shared reading project: Chapter by chapter—The Thinking Reader. <http://clerccenter.gallaudet.edu/Literacy/programs/chapter.html> (accessed January 20, 2006).
- Lazzaro, J. J. 1993. *Adaptive Technologies for Learning and Work Environments*. Chicago, IL: American Library Association.
- Lee, S., V. Henderson, H. Hamilton, T. Starner, H. Brashears, and S. Hamilton. 2005. A gesture-based American Sign Language game for deaf children. In *Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI '05)*, 1589–1592. New York: ACM Press.
- Lichtenstein, E. H. 1998. The relationships between reading processes and English skills of deaf college students. *J Deaf Stud Deaf Educ* 3(2):80–134.
- McGarr, N. S. 1987. Communication skills of hearing-impaired children in schools for the deaf. *ASHA Monogr* (26):91–107.
- McGarr, N. S., and A. Lofqvist. 1988. Laryngeal kinematics in voiceless obstruents produced by hearing-impaired speakers. *J Speech Hear Res* 31(2):234–239.
- Mitchell, R. E. 2005. Can you tell me how many deaf people there are in the United States? Gallaudet Research Institute, Graduate School and Professional Programs. <http://gri.gallaudet.edu/Demographics/deaf-US.php> (accessed December 7, 2005).
- Mitchell, R. E. 2006. How many deaf people are there in the United States? Estimates from the survey of income and program participation. *J Deaf Stud Deaf Educ* 11(1): 112–119.
- National Institutes of Health, National Institute on Deafness and Other Communication Disorders. 2002. *Captions for Deaf and Hard of Hearing Viewers*. NIH Publication No. 00–4834. <http://www.nidcd.nih.gov/health/hearing/caption.asp#edit> (accessed December 7, 2005).
- National Institutes of Health, National Institute on Deafness and Other Communication Disorders. 2004. *Statistics About Hearing Disorders, Ear Infections, and Deafness*. <http://www.nidcd.nih.gov/health/statistics/hearing.asp> (accessed December 7, 2005).
- Newport, E. 1990. Maturational constraints on language learning. *Cogn Sci* 14: 11–28.
- Padden, C. A., and V. L. Hanson. 2000. Search for the missing link: The development of skilled reading in deaf children. In *The Signs of Language Revisited: An Anthology to Honor Ursula Bellugi and Edward Klima*, ed. K. Emmorey, and H. Lane, 435–447. Mahwah, NJ: Lawrence Erlbaum Associates.
- Padden, C., and T. Humphries. 1988. *Deaf in America: Voices from a Culture*. Cambridge, MA: Harvard University Press.
- Padden, C., and T. Humphries. 2005. *Inside Deaf Culture*. Cambridge, MA: Harvard University Press.
- Padden, C., and C. Ramsey. 2000. American Sign Language and reading ability in deaf children. In *Language Acquisition by Eye*, ed. C. Chamberlain, J. Morford, and R. Mayberry, 165–189. Mahwah, NJ: Lawrence Erlbaum Associates.
- Road runner video mail. (n.d.). http://vmail.vibephone.com/vm/vm_player?vmfile=54dbc51d033b4cdbac583bf8ec3ef9cd3&v mpid=51007 (accessed January 20, 2006).
- Robson, G. 2001. Can realtime captioning be done using realtime voice recognition systems? <http://www.robson.org/capfaq/online.html#VoiceRecognition> (accessed December 7, 2005).
- Signtel Inc. (n.d.). Signtel. <http://www.signtelinc.com/main.htm> (accessed December 7, 2005).
- Sims, E. 2004. *Using Emerging Visualization Technologies to Provide Sign Language Access to the Web*. <http://www.w3.org/WAI/RD/2003/12/Visualization/VCom3D.html> (accessed January 20, 2006).
- Steinfeld, A. 2001. The case for real time captioning in classrooms. <http://www.cartinfo.org/steinfeld.html> (accessed December 7, 2005).
- Stinson, M., and R. Stuckless. 1998. Recent developments in speech-to-print transcription systems for deaf students. In *Issues Unresolved: New Perspectives on Language and Deaf Education*, ed. A. Weisel, 126–132. Washington, DC: Gallaudet University Press.
- U.S. General Services Administration, Office of Governmentwide Policy, IT Accessibility & Workforce Division. (n.d.). *Section 508*. <http://section508.gov/> (accessed January 20, 2006).
- Vanderheiden, G. C. 1994. Application software design guidelines: Increasing the accessibility of application software for people with disabilities and older users. University of Wisconsin-Madison, Trace Research and Development Center. http://trace.wisc.edu/docs/software_guidelines/software.htm (accessed January 20, 2006).
- Viable Technologies. (n.d.). Frequently asked Questions. <http://www.viabletechnologies.com/faq.php> (accessed December 7, 2005).
- Vibe video mail. (n.d.). <http://www.vibephone.com/vsg/htdocs/products/video-mail/index.jsp> (accessed January 20, 2006).
- Vogler, C., and D. Metaxas. 2001. Framework for recognizing the simultaneous aspects of American Sign Language. *Comput Vis Image Underst* 81:358–384. doi:10.1006/cviu.2000.0895. <http://www.idealibrary.com>
- Wang, C., W. Gao, and J. Ma. 2002. A real-time large vocabulary recognition system for Chinese Sign Language. In *International Gesture Workshop, Springer Lecture Notes in Artificial Intelligence*, ed. I. Wachsmuth, and T. Sowa, Vol. 2298, 86–95. New York, NY: Springer-Verlag.

User Experience Requirements Analysis within the Usability Engineering Lifecycle

- Baird, J. 2010. *The Principles of Beautiful Web Design*. Canada: SitePoint, Pty., Ltd.
- Eisenberg, E., and J. Eisenberg. 2005. *Call to Action: Secret Formulas to Improve Online Results*. Austin, TX: Wizard Academy Press.
- Goldstein, N. J., S. J. Martin, and R. B. Cialdini. 2008. *Yes! 50 Scientifically Proven Ways to be Persuasive*. New York: Free Press.
- Mayhew, D. J. 1999. *The Usability Engineering Lifecycle*. San Francisco, CA: Morgan Kaufmann Publishers.
- McIntosh, M. 2011. Locate Several Decision-Makers Within Each Target Business to Improve B2B Relationships. <http://www.buzzle.com/articles/locate-several-decision-makers-within-each-target-business-to-improve-b2b-relationships.html> (accessed January 18, 2011).
- Nielsen, J., and H. Loranger. 2006. *Prioritizing Web Usability*. Berkeley, CA: New Riders Press.
- Pruitt, J., and T. Adlin. 2006. *The Persona Lifecycle: Keeping People in Mind Throughout Product Design*. San Francisco, CA: Morgan Kaufmann Publishers/Elsevier.
- Quenk, N. L. 2009. *Essentials of Myers-Briggs Type Indicator Assessment*. Hoboken, NJ: John Wiley & Sons.
- Tidwell, J. 2010. *Designing Interfaces*. Sebastopol, CA: O'Reilly Media.

Task Analysis

- Ann, E. 2004. Cultural differences affecting user research methods in China. In *Understanding Your Users*, ed. C. Courage, and K. Baxter, 196–207. San Francisco, CA: Morgan Kaufmann.
- Butler, M. B. 1996. Getting to know your users: Usability roundtables at Lotus Development. *Interactions* 3(1):23–30.
- Butler, M. B., and M. Tahir. 1996. Bringing the users' work to us: Usability roundtables of Lotus development. In *Field Methods Casebook for Software Design*, ed. D. Wixon and J. Ramey, 249–267. New York: Wiley.
- Chavan, A. 2005. Another culture, another method. In *From the Proceedings of the Human Computer Interaction International Conference*. Las Vegas, NV. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Cloud Computing Wikipedia. 2010. http://en.wikipedia.org/wiki/Cloud_computing.
- Cooper, A. 1999. *The Inmates Are Running The Asylum*. New York: Macmillian.
- Courage, C., and B. Baxter. 2004. *Understanding Your Users*. San Francisco, CA: Morgan Kaufmann.
- Courage, C., G. Redish, D. Wixon. 2007. Task analysis. In *The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications*, (Human Factors and Ergonomics), Second ed., ed. A. Sears and J. Jacko, 927–948. Mahwah, NJ: Lawrence Erlbaum Associates.
- Dray, S., and D. Mrazek. 1996. A day in the life of a family: An international ethnographic study. In *Field Methods Casebook for Software Design*, ed. D. Wixon, and J. Ramey, 145–156. New York: Wiley.
- Dray, S., and D. Siegel. 2005. Sunday in Shanghai, Monday in Madrid? In *Usability and Internationalization of Information Technology*, ed. N. Aykin, 189–212. Mahwah, NJ: Lawrence Erlbaum Associates.
- Flanagan, J. C. 1954. The critical incident technique. *Psychol Bull* 51(4):327–358.
- Foucault, B. 2005. Contextualizing cultures for the commercial world: Techniques for presenting field research in business environments. In *Proceeding of the HCII Conference*. Las Vegas, NV.
- Foucault, B., R. Russell, and G. Bell. 2004. Techniques for researching and redesigning global products in an unstable world. A case study. In *Proceedings of CHI2004 Conference on Human Factors in Computing Systems*. New York: ACM Press.
- Gray, W. D., B. E. John, and M. E. Atwood. 1993. Project Ernestine: Validating a GOMS analysis for predicting and explaining real-world performance. *Hum Comput Interact* 8: 237–309.
- Hackos, J. T., and J. C. Redish. 1998. *User and Task Analysis for Interface Design*. New York: Wiley.
- Kirwan, B., and L. K. Ainsworth. 1992. *A Guide to Task Analysis*. London: Taylor & Francis.
- Kujala, S., M. Kauppinen, and S. Rekola. 2001. Bridging the gap between user needs and user requirements. In *Proceedings of PC-HCI 2001 Conference*, Patras, Greece.
- Lee, W. O., and N. Mikkelson. 2000. Incorporating user archetypes into scenario-based design. In *Proceedings of the Ninth Annual Conference UPA 2000*. Chicago, CA: Usability Professionals' Association. www.upassoc.org.
- Lovejoy, T., and N. Steele. 2005. Incorporating international field research into software product design. In *From the Proceedings of the Human Computer Interaction International Conference*. Las Vegas, NV. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Miles, M. B., and A. M. Huberman. 1994. *Qualitative Data Analysis: An Expanded Source Book*. New York: Sage.
- Mulder, S., and Z. Yaar. 2007. *The User is Always Right*. Berkeley, CA: New Riders.
- Norman, D. 1988. *The Design of Everyday Things*. New York: Doubleday. (Originally published as *The Psychology of Everyday Things*: hard cover published by Basic Books).
- Pruitt, J., and T. Adlin. 2005. *The Persona Lifecycle*. San Francisco, CA: Morgan Kaufmann, an imprint of Elsevier.
- Pruitt, J., and T. Adlin. 2010. *The Essential Personal Lifecycle*, (Abridged Edition of the 2005 Book). Burlington, MA: Morgan Kaufmann, an imprint of Elsevier.
- Quesenberry, W., and K. Brooks. 2010. *Storytelling for User Experience*. Brooklyn, NY: Rosenfeld Media.
- Redish, J., and D. Wixon. 2003. Task analysis. In *The Human-Computer Interaction Handbook*, ed. J. Jacko, and A. Sears, 922–940. Mahwah, NJ: Lawrence Erlbaum Associates.
- Siegel, D., and S. Dray. 2005. Making the business case of international user centered design. In *Cost-Justifying Usability: An Update for the Internet Age*, ed. R. Bias and D. Mayhew. San Francisco, CA: Morgan Kaufmann.
- Simpson, K. T. 1998. The UI war room and design prism: A user interface design approach from multiple perspectives. In *User Interface Design: Bridging the Gap from User Requirements to Design*, ed. L. Wood, 245–274. Boca Raton, FL: CRC Press.
- Wixon, D. 1995. Qualitative research methods in design and development. *Interactions* 2: 19–24.
- Young, I. 2008. *Mental Models: Aligning Design Strategy with Human Behavior*. Brooklyn, NY: Rosenfeld Media.

Contextual Design

- H. Beyer, and K. Holtzblatt. *Contextual Design: Defining Customer-Centered Systems*. San Francisco, CA: Morgan Kaufmann Publishers Inc., 1997.
- K. Holtzblatt, J. Wendell, and S. Wood. *Rapid Contextual Design: A How-to Guide to Key Techniques for User-Centered Design*. San Francisco, CA: Morgan Kaufmann Publishers, 2005.
- M. Gaultieri, Best Practices in User Experience (UX) Design. Forrester Research. Cambridge, MA, September 4, 2009.
- Morgan, D. "Covert Agile—Development at the Speed of... Government?" in Proceedings of the Agile 2009 Conference (Agile 2009), pp. 79–83. Chicago, IL: IEEE Conference Publishing Services, 2009.
- A. Cooper. *The Inmates Are Running the Asylum: Why High Tech Products Drive Us Crazy and How to Restore the Sanity*. Indiana, IN: Sams Publishing, 1997.
- H. Manning. *The Power of Design Personas*. Forrester Research. Cambridge, MA, 2003.
- H. Beyer. "Calling down the lightning." *IEEE Software* 11, no. 5 (1994): 106.
- C. Snyder. *Paper Prototyping: The Fast and Easy Way to Design and Refine User Interfaces*. San Francisco, CA: Morgan Kaufmann Publishers, 2003.
- K. Schwaber, and M. Beedle. *Agile Software Development with Scrum*. Upper Saddle River, NJ: Prentice Hall, 2001.
- Beck, K. *eXtreme Programming Explained: Embrace Change*, second edition. Boston, MA: Addison-Wesley, 2004.

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- Ackerman, M. S., and C. A. Halverson. 2000. Reexamining organizational memory. *Commun ACM* 43(1):58–64.
- Adolph, S., W. Hall, and P. Kruchten. 2008. A methodological leg to stand on: Lessons learned using grounded theory to study software development. In Proceedings of Conference on the Center for Advanced Studies on Collaborative Research 2008, Toronto, ON, Canada. New York: ACM.
- AlKaissi, A. A. E. (n.d.). Grounded theory. An-Najah National University <http://www.najah.edu/file/Essays/english/Aidah%20Kaisi/19.pdf>.
- Allen, G. 2003. A critique of using grounded theory as a research method. *Electron J Bus Res Methods* 2(1): 1–10.
- Asimakopoulos, S., R. Fildes, and A. Dix. 2009. Forecasting software visualizations: An explorative study. In Proceedings of British Conference on HCI, 269–277. Cambridge, UK. New York: ACM
- Awbrey, J., and S. Awbrey. 1995. Interpretation as Action: The Risk of Inquiry. *Inquiry Crit Thinking Across Disciplines* 15: 40–52.
- Barr, P., J. Noble, R. Biddle, and R. Khaled. 2006. From pushing buttons to play and progress: Value and interaction in fable. In Proceedings of Australian User Interface Conference 2006, 61–68. Hobart, Australia. New York: ACM
- Bazerman, C. 1997. Discursively structured activities. *Mind Culture Act* 4(4):296–308.
- Becker, P. H. 1993. Common pitfalls in published grounded theory. *Qual Health Res* 3(2): 254–256.
- Bertram, D., A. Voida, S. Greenberg, and R. Walker. 2010. Communication, collaboration, and bugs: The social nature of issue tracking in small, collocated teams. In Proceedings of CSCW 2010. Savannah, GA. New York: ACM.
- Blaikie, N. W. H. 2000. *Designing Social Research: The Logic of Anticipation*. Cambridge, UK: Polity.
- Blumer, H. 1954. What is wrong with social theory? *Am Soc Rev* 18: 3–10.
- Blythe, M., and P. Cairns. 2009. Critical methods and user generated content: The iPhone on YouTube. In Proceedings of CHI 2009, 1467–1476. Boston, MA. New York: ACM.
- Bowen, G. A. 2006. Grounded theory and sensitizing concepts. *Int J Qual Methods* 5(3): 12–23.
- Bowers, B., and L. Schatzman. 2009. Dimensional analysis. In *Developing Grounded Theory: The Second Generation*, ed. J. M. Morse, P. N. Stern, J. Corbin, B. Bowers, K. Charmaz, and A. E. Clarke. Walnut Creek, CA: Left Coast Press.
- Bryant, A. 2002. Regrounding grounded theory. *J Inf Technol Theory Appl* 4: 25–42.
- Bryant, A. 2003. Doing grounded theory constructively. A reply to Barney Glaser. *Forum Qual Sozialforschung/Forum Qual Soc Res* 3(3).
- Bryant, A., and K. Charmaz, eds. 2007. *The Sage Handbook of Grounded Theory*. Thousand Oaks, CA: Sage.
- Charmaz, K. 2003. Grounded theory: Objectivist and constructivist methods. In *Strategies of qualitative inquiry* 2nd Edn, ed. N. Denzin and Y. Lincoln 249–291. Thousand Oaks, California: Sage Publications.
- Charmaz, K. 2006a. *Constructing Grounded Theory: A Practical Guide through Qualitative Analysis*. Thousand Oaks, CA: Sage.
- Charmaz, K. 2006b. Grounded theory. In *Encyclopedia of Sociology*, ed. G. Ritzer. Cambridge, MA: Blackwell.
- Charmaz, K. 2008. Grounded theory in the 21st century: Applications for advancing social justice. In *Strategies of Qualitative Research*, ed. N. K. Denzin and Y. S. Lincoln, 3rd ed., 203–241. Thousand Oaks, CA: Sage.
- Charmaz, K. 2009. Shifting the grounds: Constructivist grounded theory methods. In *Developing Grounded Theory: The Second Generation*, ed. J. M. Morse, P. N. Stern, J. Corbin, B. Bowers, K. Charmaz, and A. E. Clarke. Walnut Creek, CA: Left Coast Press.
- Chiovitti, R. F., and N. Piran. 2003. Rigour and grounded theory research. *J Adv Nurs* 44(4):427–435.
- Clarke, A. E. 2005. *Situational Analysis: Grounded Theory After the Postmodern Turn*. Thousand Oaks, CA: Sage.
- Clarke, A. E. 2009. From grounded theory to situational analysis: What's new? Why? How? In *Developing Grounded Theory: The Second Generation*, ed. J. M. Morse, P. N. Stern, J. Corbin, B. Bowers, K. Charmaz, and A. E. Clarke. Walnut Creek, CA: Left Coast Press.
- Corbin, J., and A. L. Strauss. 2008. *Basics of Qualitative Research*. 3rd ed. Thousand Oaks, CA: Sage.
- Corbin, J. 2009. The Straussian perspective. In *Developing Grounded Theory: The Second Generation*, ed. J. M. Morse, P. N. Stern, J. Corbin, B. Bowers, K. Charmaz, and A. E. Clarke. Walnut Creek, CA: Left Coast Press.
- Cutliffe, J. R. 2005. Adapt or adopt: Developing and transgressing the methodological boundaries of grounded theory. *J Adv Nurs* 51(4):421–428.
- Dagenais, B., H. Ossher, R. K. E. Bellamy, M. P. Robillard, and J. P. deVries. 2010. Moving into a new project landscape. In Proceedings of Conference on Software Engineering 2010, 275–284. Cape Town, South Africa. IEEE.
- Dalsgaard, T., M. B. Skov, M. Stougaard, and B. Thomassen. 2006. Mediated intimacy in families: Understanding the relation between children and parents. In Proceedings of Conference on Interface Design and Children 2006, 145–152. Tampere, Finland. New York: ACM.

- Dewey, J. 1986. Logic: The theory of inquiry. In John Dewey: The Later Works, 1925–53. (Vol. 12: 1938), ed. J. A. Boydston. Carbondale, IL: Southern Illinois University Press.
- Dey, I. 1993. Qualitative Data Analysis: A User-Friendly Guide for Social Scientists. London: Routledge.
- Dick, B. 2005. *Grounded Theory: A Thumbnail Sketch*. Resource papers in action research, <http://www.scu.edu.au/schools/gcm/ar/arp/grounded.html>.
- Dodig-Crnkovic, G. 2002. Scientific methods in computer science. In Proceedings of Conference for Promotion of Research in IT, 446–460. Skovde, Sweden: Scientific Research Publishing.
- Eiter, T., and G. Gottlob. 1995. The complexity of logic-based abduction. *J ACM* 42(1):3–42.
- Faisal, S., B. Craft, P. Cairns, and A. Blandford. 2008. Internalization, qualitative methods, and evaluation. In Proceedings of BELIV 2008. Florence, IT. New York: ACM.
- Ferreira, J., J. Noble, and R. Biddle. 2007. Up-front interaction design in agile development. In Proceedings of Conference on Agile Processes in Software Engineering and Extreme Programming 2007, 9–16. Como, IT. Springer.
- Fincher, S., and J. Tenenberg. 2007. Warren's question. In Proceedings of Workshop on Computer Education Research, 51–60. Atlanta, GA. New York: ACM.
- Floyd, C. 1987. Outline of a paradigm change in software engineering. In Computers and Democracy: A Scandinavian Challenge, ed. G. Bjerknes, P. Ehn, and M. Kyng. Brookfield, VT: Gower.
- Gasson, S. 2004. Rigor in grounded theory research: An interpretive perspective on generating theory from qualitative field studies. In The Handbook of Information Systems Research, ed. M. Whitman and A. B. Woszczynski. Hershey, PA: Idea Group.
- Ge, X., Y. Dong, and K. Huang. 2006. Shared knowledge construction process in an open-source software development community: An investigation of the Gallery community. In Proceedings of Conference on Learning Sciences 2006, 189–195. Bloomington, IN: International Society of the Learning Sciences.
- Glaser, B. G. 1978. Theoretical Sensitivity. Mill Valley, CA: Sociology Press.
- Glaser, B. G. 1992. Basics of Grounded Theory Analysis: Emergence vs Forcing. Mill Valley, CA: Sociology Press.
- Glaser, B. G. 1998. Doing Grounded Theory: Issues and Discussions. Mill Valley, CA: Sociology Press.
- Glaser, B. G. 2003. The Grounded Theory Perspective II: Description's Remodeling of Grounded Theory Methodology. Mill Valley, CA: Sociology Press.
- Glaser, B. G. 2004. Remodeling grounded theory. *Forum Qual Soc Res Soz* 5(2).
- Glaser, B. G., and A. L. Strauss. 1965. Awareness of Dying. Chicago, IL: Aldine.
- Glaser, B. G., and A. L. Strauss. 1967. The Discovery of Grounded Theory. Chicago, IL: Aldine.
- Glaser, B. G., and A. L. Strauss. 1968. A Time for Dying. Chicago, IL: Aldine.
- Goede, R., and C. de Villiers. 2003. The applicability of grounded theory as research methodology in studies on the use of methodologies in IS practices. In Proceedings of the 2003 Annual Research Conference of the South African Institute of Computer Scientists and Information Technologists on Enablement Through Technology 2003. South Africa: South African Institute for Computer Scientists and Information Technologists.
- Goulding, C. 1998. Grounded theory: The missing methodology on the interpretivist agenda. *Qual Market Res* 1(1):50–57.
- Greenberg, S., and H. Thimbleby. 1992. The weak science of human-computer interaction. In CHI '92 Research Symposium on Human Computer Interaction. Monterey, California. New York: ACM.
- Haig, B. D. 2005. Grounded theory as scientific method. In Philosophy of Education Yearbook 2005. Philosophy of Education Society. University of Illinois.
- Heath, H., and Cowley, S. 2004. Developing a grounded theory approach: A comparison of Glaser and Strauss. *International Journal of Nursing Studies* 41: 141–150.
- Hollan, J., E. Hutchins, and D. Kirsh. 2000. Distributed cognition: Toward a new foundation for human-computer interaction. *Trans Comput Hum Interact* 7(2): 174–196.
- Hood, J. C. 2007. Orthodoxy vs. power: The defining traits of grounded theory. In The Sage Handbook of Grounded Theory, ed. A. Bryant, and K. Charmaz, 191–213. Thousand Oaks, CA: Sage.
- Jaccard, J., and J. Jacoby. 2010. Theory Construction and Model-Building Skills: A Practical Guide for Social Scientists. New York: Guilford.
- Jantunen, S., and K. Smolander. 2006. Towards global market-driven software development processes: An industrial case study. In Proceedings of Workshop on Global Software Development for the Practitioner, 94–100. Shanghai, China. New York: ACM.
- Jin, J., and L. A. Dabbish. 2009. Self-interruption on the computer: A typology of discretionary task interleaving. In Proceedings of CHI 2009, 1799–1808. Boston, MA. New York: ACM.
- Kane, S. K., C. Javant, J. O. Wobbrock, and R. E. Ladner. 2009. Freedom to roam: A study of mobile device adoption and accessibility for people with visual and motor disabilities. In Proceedings of ASSETS 2009, 115–122. Pittsburgh, PA. New York: ACM.
- Kaptelinin, V., B. Nardi, S. Bødker, J. Carroll, J. Hollan, E. Hutchins, and T. Winograd. 2003. Post-cognitivist HCI: Second-wave theories. In CHI 2003 Extended Abstracts. Fort Lauderdale, FL: ACM.
- Kaufman, S. R. 1986. The Ageless Self: Sources of Meaning in Late Life. Madison, WI: University of Wisconsin Press.
- Kelle, U. 2005. "Emergence" vs. "forcing" of empirical data? A crucial problem of "grounded theory" reconsidered. *Forum Qual Soc Res* 6(2): 191–213.
- Kelle, U. 2007. The development of categories: Different approaches in grounded theory. In The Sage Handbook of Grounded Theory, ed. A. Bryant, and K. Charmaz, 191–213. Thousand Oaks, CA: Sage.
- Kierkegaard, B., and P. Borlund. 2008. Characteristics of information needs for television broadcasts of scholars and students in media studies. In Proceedings of Symposium of Information Interaction in Context 2008, 116–122. London, UK. New York: ACM.
- Lee, G., W. DeLone, and J. A. Espinosa. 2006. Ambidextrous coping strategies in globally distributed software development projects. *Commun ACM* 49(10):35–40.
- Lempert, L. B. 2007. Asking questions of the data: Memo writing in the grounded theory tradition. In The Sage Handbook of Grounded Theory, ed. A. Bryant, and K. Charmaz, 245–264. Thousand Oaks, CA: Sage.
- Locke, K. 2001. Grounded Theory in Management Research. Thousand Oaks, CA: Sage.
- Mackay, W. E., and A.-L. Fayard. 1997. HCI, natural science and design: A framework for triangulation across disciplines. In Proceedings of DIS'97, 223–234. Amsterdam, The Netherlands: ACM.

- Mamykina, L., A. D. Miller, E. D. Mynatt, and D. Greenblatt. 2010. Constructing identities through storytelling in diabetes management. In Proceedings of CHI 2010, 1203–1212. Atlanta, GA. New York: ACM.
- Matavire, R., and I. Brown. 2008. Investigating the uses of “grounded theory” in information systems research. In Proceedings of SAICSIT 2008, 139–147. Wilderness. South Africa. New York: ACM.
- Menzies, T. 1996. Applications of abduction: Knowledge-level modeling. *Int J Hum Comput Stud* 45(3):305–335.
- Morgan, L., and P. Finnegan. 2010. Open innovation in secondary software firms: An exploration of managers’ perceptions of open source software. *ACM SIGMIS Database* 41 (1):79–95.
- Morse, J. M., P. N. Stern, J. Corbin, B. Bowers, K. Charmaz, and A. E. Clarke. 2009. Developing Grounded Theory: The Second Generation. Walnut Creek, CA: Left Coast Press.
- Muller, M. J. 2010. Grounded theory method. Tutorial at HCIC 2010. Slides <http://www.slideshare.net/traincroft>.
- Muller, M. J., D. R. Millen, and J. Feinberg. 2009. Information curators in an enterprise file-sharing service. In Proceedings of ECSCW 2009, Springer, Vienna, Austria. Springer.
- Nørgaard, M., and K. Hornbæk. 2006. What do usability evaluators do in practice? An explorative study of think-aloud testing. In Proceedings of DIS 2006, 209–218. University Park, PA. New York: ACM.
- Patokorpi, E. 2009. What could abductive reasoning contribute to human computer interaction? A technology domestication view. *PsychNology J* 7(1): 113–131.
- Peirce, C. S. 1865/1982. On the logic of science. In *Writings of Charles S. Peirce: A Chronological Edition*, ed. Peirce Edition Project, Vol. 1, 1857–1866. Bloomington, IN: Indiana University Press.
- Popper, K. 1968. *The Logic of Scientific Discovery*. 2nd ed. New York: Harper Torchbook.
- Pryor, J. 2005. *A Grounded Theory of Nursing’s Contribution to Inpatient Rehabilitation*. PhD thesis. School of Nursing, Deakin University.
- Reichertz, J. 2007. Abduction: The logic of discovery of grounded theory. In *The Sage Handbook of Grounded Theory*, ed. A. Bryant, and K. Charmaz, 214–228. Thousand Oaks, CA: Sage.
- Sanderson, P. M. 2003. Cognitive work analysis. In *HCI Models, Theories, and Frameworks: Toward a Multidisciplinary Science*, ed. J. M. Carroll, 225–264. San Francisco, CA: Morgan Kaufman.
- Sarker, S., F. Lau, and S. Sahey. 2001. Using an adapted grounded theory approach for inductive theory building about virtual team development. *Data Base Adv Inf Syst* 32(1):38–56.
- Sarker, S. 2006. Knowledge transfer and collaboration in distributed U.S-Thai teams. *Journal of Computer Mediated Communications* 10(4).
- Savago, S., and J. Blat. 2009. About the relevance of accessibility barriers in the everyday interactions of older people with the web. In Proceedings of Cross-Disciplinary Conference on Web Accessibility 2009, 104–113. Madrid, Spain. New York: ACM.
- Schulte, C., and M. Knobelsdorf. 2007. Attitudes towards computer science-computing experiences as a starting point and barrier to computer science. In Proceedings of Workshop on Computing Education Research 2007, 27–35. Atlanta, GA. New York: ACM.
- Seale, C. 1999. *The Quality of Qualitative Research*. London, UK: Sage.
- Sease, R., and D. W. McDonald. 2009. Musical fingerprints: Collaboration around home media collections. In Proceedings of GROUP 2009, 331–340. Sanibel Island, FL. New York: ACM.
- Simmons, O. E. 1994. Grounded therapy. In *More Grounded Theory Methodology: A Reader*, ed. B. Glaser, 4–37. Mill Valley, CA: Sociology Press.
- Skodal-Wilson, H., and S. Ambler-Hutchinson. 1996. Methodological mistakes in grounded theory. *Nurs Res* 45(2):122–124.
- Sousa, C. A. A., and P. H. J. Hendriks. 2006. The diving bell and the butterfly: The need for grounded theory in developing a knowledge based view of organizations. *Organ Res Methods* 9(3):315–338.
- Star, S. L. 2007. Living grounded theory. In *The Sage Handbook of Grounded Theory*, ed. A. Bryant and K. Charmaz. Thousand Oaks, CA: Sage.
- Stern, P. N. 1994. Eroding grounded theory. In *Critical Issues in Qualitative Research Methods*, ed. J. Morse. Thousand Oaks, CA: Sage.
- Stern, P. N. 2007. Properties for growing grounded theory. In *The Sage Handbook of Grounded Theory*, ed. A. Bryant and K. Charmaz. Thousand Oaks, CA: Sage.
- Stern, P. N. 2009. Glaserian grounded theory. In *Developing Grounded Theory: The Second Generation*, ed. J. M. Morse, P. N. Stern, J. Corbin, B. Bowers, K. Charmaz, and A. E. Clarke. Walnut Creek, CA: Left Coast Press.
- Strauss, A. L. 1987. *Qualitative Analysis for Social Scientists*. New York: Cambridge.
- Strauss, A. L. 1993. *Continual Permutations of Action*. New York: Aldine.
- Strauss, A. L., and J. Corbin. 1990. *Basics of Qualitative Research*. Thousand Oaks, CA: Sage.
- Strauss, A. L., and J. Corbin. 1998. *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. 2nd ed. Thousand Oaks, CA: Sage.
- Strauss, A. L., and B. G. Glaser. 1970. *Anguish*. Mill Valley, CA: Sociology Press.
- Suddaby, R. 2006. From the editors: What grounded theory is not. *Acad Manage J* 49(4):633–642.
- Swallow, D., M. Blythe, and P. Wright. 2005. Grounding experience: Relating theory and method to evaluate the user experience of smartphones. In Proceedings of EACE 2005. Chania, Greece. University of Athens.
- Taiapale, O., and K. Smolander. 2006. Improving software testing by observing practice. In Proceedings of Symposium on Empirical Software Engineering, 262–271. Rio de Janeiro, Brazil. IEEE.
- Thom-Santelli, J., D. Cosley, and G. Gay. 2006. What’s mine is mine: Territoriality in collaborative authoring. In Proceedings of CHI 2009. Boston, MA. New York: ACM.
- Thom-Santelli, J., M. J. Muller, and D. R. Millen. 2008. Social tagging roles: Publishers, evangelists, leaders.’ In Proceedings of CHI 2008. Florence, IT.
- Umarji, M., and C. Seaman. 2008. Why do programmers avoid metrics? In Proceedings of Symposium on Empirical Software Engineering and Measurement 2008, 236–247. Kaiserslautern, DE. New York: ACM.
- Umarji, M., and C. Seaman. 2009. Gauging acceptance of software metrics: Comparing perspectives of managers and developers. In Proceedings of Empirical Software Engineering and Measurement 2009, 236–247. Kaiserslautern, DE: Fraunhofer-Gesellschaft.
- van Niekerk, J. C., and J. D. Roode. 2009. Glaserian and Straussian grounded theory: Similar or completely different? In *Proceedings of SAICSIT 2009*.

- Vasconcelos, A. C. 2007. The use of grounded theory and of arenas/ social worlds theory in discourse studies: A case study on the discursive adaptation of information systems. *Electron J Bus Res Methods* 5(2):125–136.
- Whitworth, E., and R. Biddle. 2007. Motivation and cohesion in agile teams. In *Proceedings of Conference on Agile Processes in Software Engineering and Extreme Programming 2007*, 62–69. Como, IT: New York: ACM.
- Williams, L., L. Layman, K. M. Slaten, S. B. Berenson, and C. Seaman. 2007. On the Impact of a Collaborative Pedagogy on African American Millennial Students in Software Engineering. In *Proceedings of Conference on Software Engineering 2007*, 677–84.
- Yu, C. H. 1994. Is there a logic of exploratory data analysis? In *Annual Meeting of American Educational Research Association*. New Orleans, LA: American Educational Research Association. New York: ACM.
- Zaltman, G., and R. Coulter. 1995. Seeing the voice of the customer: Metaphor-based advertising research. *J Adv Res* 83: 35–51.

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- Agar, M. 1996. *The Professional Stranger*. 2nd ed. San Diego, CA: Academic Press.
- Anderson, K., and T. Lovejoy. 2005. *Proceedings of EPIC 2005*. Berkeley: University of California Press.
- Anderson, R. J. 1994. Representations and requirements: The value of ethnography in system design. *Hum Comput Interact* 9: 151–182.
- Appadurai, A., ed. 1988. *The Social Life of Things: Commodities in Cultural Perspective*. Cambridge: Cambridge University Press.
- Babbie, E. 1990. *Survey Research Methods*. 2nd ed. Belmont, CA: Wadsworth Publishing Company.
- Bell, G. 2004. Insights into Asia: 19 Cities, 7 Countries, 2 Years—What people Really Want from Technology. *Technology® Intel Magazine*. Intel Corp.
- Bentley, R., J. A. Hughes, D. Randall, T. Rodden, P. Sawyer, D. Shapiro, and I. Sommerville. 1992. Ethnographically-informed system design for air- traffic control. In *Proceedings of Computer Supported Cooperative Work*, 123–129. New York: ACM Press.
- Bernard, H. R. 1995. *Research Methods in Anthropology: Qualitative and Quantitative Approaches*. 2nd ed. London: Altamira Press.
- Berry, M., and M. Hamilton. 2006. Mobile computing, visual diaries, learning and communication: Changes to the communicative ecology of design students through mobile computing. In *Proceedings of the 8th Australian Conference on Computing Education*. Darlinghurst, Australia: Australian Computer Society.
- Beyer, H., and K. Holtzblatt. 1998. *Contextual Design: Defining Customer-Centered Systems*. San Francisco, CA: Morgan Kaufmann Publishers.
- Bitner, M. J., A. L. Ostrom, and F. N. Morgan. 2008. Service blueprinting: A practical technique for service innovation. *Calif Manage Rev* 50: 3.
- Blomberg, J. 1987. Social interaction and office communication: Effects on user's evaluation of new technologies. In *Technology and the Transformation of White Collar Work*, ed. R. Kraut, 195–210. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Blomberg, J. 1988. The variable impact of computer technologies on the organization of work activities. In *Computer-Supported Cooperative Work: A Book of Readings*, ed. I. Greif, 771–782. San Mateo, CA: Morgan Kaufmann.
- Blomberg, J. 1995. Ethnography: Aligning field studies of work and system design. In *Perspectives on HCI: Diverse Approaches*, ed. A. F. Monk, and N. Gilbert, 175–197. London: Academic Press LTD.
- Blomberg, J. 2008a. On participation and service innovation. In *(Re-) Searching a Digital Bauhaus*, ed. T. Binder, J. Löwgren, and L. Malmborg, 121–144. London: Springer.
- Blomberg, J. 2008b. Negotiating meaning of shared information in service system encounters. *Eur Manag J* 23: 213–222.
- Blomberg, J., J. Giacomi, A. Mosher, and P. Swenton-Wall. 1991. Ethnographic field methods and their relation to design. In *Participatory Design: Perspectives on Systems Design*, ed. D. Schuler, and A. Namioka, 123–155. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Blomberg, J., L. Suchman, and R. Trigg. 1996. Reflections on a work-oriented design project. *Hum Comput Interact* 11: 237–265.
- Blomberg, J., and R. Trigg. 2000. Co-constructing the relevance of work practice for CSCW Design: A case study of translation and mediation. *Occasional Papers from the Work Practice Laboratory*. Blekinge Inst Technol 1: 1–23.
- Bowers, J., G. Button, and W. Sharrock. 1995. Workflow from within and without: Technology and cooperative work on the print industry shopfloor. In *Proceedings of the Fourth Conference on European Conference on Computer-Supported*. Stockholm, Sweden. 51–66. Dordrecht: Kluwer Academic Publishers.
- Briggs, C. 1983. *Learning How to Ask: A Sociolinguistic Appraisal of the Role of the Interview in Social Science Research*. Cambridge, U.K.: Cambridge University Press.
- Brun-Cotton, F., and P. Wall. 1995. Using video to re-present the user. *Commun ACM* 38: 61–71.
- Button, G., and R. Harper. 1996. The relevance of 'work-practice' for design. *Comput Support Coop Work* 5: 263–280.
- Buur, J., and S. Bødker. 2000. From usability lab to "design collabo-ratorium": Reframing usability practice. In *Proceedings of the 3rd Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques*. Brooklyn, NY: ACM.
- Carroll, J. M. 2000. *Making Use: Scenario-Based Design of Human-Computer Interactions*. Cambridge, MA: MIT Press.
- Carter, S., and J. Mankoff. 2005. When participants do the capturing: The role of media in diary studies. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. 899–908. Portland, Oregon: ACM.
- Cefkin, M., ed. 2009. *Ethnographers at Work: New Social Science Research In and of Industry*. New York: Berghahn Books.
- Clifford, J. 1988. *The Predicament of Culture: Twentieth-Century Ethnography, Literature, and Art*. Cambridge, MA: Harvard University Press.
- Clifford, J., and G. Marcus, eds. 1986. *Writing Culture: The Poetics and Politics of Ethnography*. Berkeley: University of California Press.
- Cohen, K. 2005. Who we talk about when we talk about users. In *Proceedings of EPIC*, 9–30. Arlington, VA: American Anthropological Association.
- Coleman, S., and P. von Hellermann, eds. 2011. *Multi-Sited Ethnography: Problems and Possibilities in Translocation of Research Methods*. New York: Routledge.
- Comaroff, J., and J. Comaroff. 1992. *Studies in the Ethnographic Imagination*. Boulder, CO: Westview Press.
- Corral-Verduga, V. 1997. Dual 'realities' of conservation behavior: Self reports vs. observations of re-use and recycling behavior. *J Environ Psychol* 17:135–145.

- Crabtree, A. 1998. Ethnography in participatory design. In *Proceedings of the Participatory Design Conference*, 93–105. Seattle, WA: Palo Alto, CA: CPSR.
- Crabtree, A. 2000. Ethnomethodologically informed ethnography and information system design. *J Am Soc Inf Sci* 51: 666–682.
- D'Andrade, R. G. 1995. *The Development of Cognitive Anthropology*. Cambridge, U.K.: Cambridge University Press.
- Dittrich, Y., A. Ekelin, P. Elovaara, S. Eriksén, and C. Hansson. 2003. Making e-Government happen Everyday co-development of services, citizenship and technology. In *Proceedings of the 36th Annual Hawaii International Conference on System Sciences (HICSS'03) - Track 5*.
- Dourish, P. 2001. Process descriptions as organizational accounting devices: The dual use of workflow technologies. In *Proceedings of the 2001 International ACM SIGGROUP Conference on Supporting Group Work*, 52–60. Boulder, CO.
- Engeström, Y. 2000. From individual action to collective activity and back: Developmental work research as an interventionist methodology. In *Workplace Studies: Recovering Work Practice and Informing System Design*, ed. P. Luff, J. Hindmarsh, and C. Heath, 150–166. Cambridge, U.K.: Cambridge University Press.
- Falzon, M. 2009. *Multi-Sited Ethnography: Theory, Praxis and Locality in Contemporary Research*. Aldershot: Ashgate Pub.
- Fluehr-Lobban, C., ed. 1991. *Ethics and the Profession of Anthropology: Dialogue for a New Era*. Philadelphia: University of Pennsylvania Press.
- Foucault, B. E., R. S. Russell, and G. Bell. 2004. Techniques for researching and designing global products in an unstable world: A case study. In *CHI'04 Extended Abstracts on Human Factors in Computing Systems*. New York: ACM.
- Gallant, L. M. 2006. An ethnography of communication approach to mobile product testing. *Pers Ubiquitous Comput* 10(5):325–332.
- Gentner, D., and A. Stevens. 1983. *Mental Models*. New York: Lawrence Erlbaum Associates.
- Gillham, R. 2005. Diary studies as a tool for efficient cross-cultural design. In *Proceedings of International Workshop on Internationalisation of Products and Services (IWIPS)*, 57–65. Amsterdam, The Netherlands.
- Green, E. C. 2001. Can qualitative research produce reliable quantitative findings? *Field Methods* 13: 1–19.
- Green, S., P. Harvey, and H. Knox. 2005. Scales of place and networks: An ethnography of the imperative to connect through information and communication technologies. *Hum Organiz* 46: 805–826.
- Grief, I., ed. 1988. *Computer-Supported Cooperative Work: A Book of Readings*. San Mateo, CA: Morgan Kaufmann.
- Grudin, J., and R. E. Grintner. 1995. Ethnography and design. *Comput Support Coop Work* 3: 55–59.
- Gubrium, J. F., and J. A. Holstein, eds. 2002. *Handbook of Interview Research: Context and Method*. Thousand Oaks, CA: Sage Publication.
- Guest, G. 2000. Using Guttman scaling to rank wealth: Integrating quantitative and qualitative data. *Field Methods* 12: 346–357.
- Hannerz, U. 2003. Being there...and there...and there! *Ethnography* 4: 201–216.
- Harding, S. 1986. *The Science Question in Feminism*. Ithaca, NY: Cornell University Press.
- Heritage, J. 1984. *Garfinkel and Ethnomethodology*. Cambridge, MA: Polity Press.
- Horst, H., and D. Miller. 2005. From kinship to link-up: Cell phones and social networking in Jamaica. *Hum Organiz* 46: 755–778.
- Hughes, J. A., D. Randall, and D. Shapiro. 1993. From ethnographic record to system design: Some experiences from the field. *Comput Support Coop Work* 1: 123–147.
- Hughes, J., V. King, T. Rodden, and H. Anderson. 1994. Moving out of the control room: Ethnography in systems design. In *Proc. CSCW'94*, 429–438. Chapel Hill, NC: ACM Press.
- Hughes, J. A., T. Rodden, and H. Anderson. 1995. The role of ethnography in interactive system design. *ACM Interact* 2: 56–65.
- Hutchins, E. 1995. *Cognition in the Wild*. Cambridge, MA: MIT Press.
- Johnson, J. C. 1990. Selecting ethnographic informants. Newbury Park, CA: Sage.
- Johnson, J. C., and D. C. Griffith. 1998. Visual data: Collection, analysis, and representation. In *Using Methods in the Field: A Practical Introduction and Casebook*, ed. V. DeMunck, and E. Sobo, 211–228. Walnut Creek, CA: Altamira.
- Johnson, J. C., M. Ironsmith, A. L. Whitcher, G. M. Poteat, and C. Snow. 1997. The development of social networks in preschool children. *Early Educ Dev* 8: 389–406.
- Johnson-Laird, P. N. 1983, 1996. *Mental Models*. Cambridge: Harvard University Press.
- Jones, M., and F. Samalionis. 2008. From small ideas to radical service innovation. *Des Manage Rev* 19: 20–27.
- Jordan, B., and L. Suchman. 1990. Interactional troubles in face-to-face survey interviews. *J Am Stat Assoc* 85(409):232–253.
- Kantner, L. 2001. Assessing website usability from server log files. In *Design by People, for People: Essays on Usability*, ed. R. Branaghan, 245–262. Chicago, IL: Usability Professionals Association.
- Kantner, L., D. H. Sova, and S. Rosenbaum. 2003. Alternative methods for field usability research. In *Proceedings SIGDOC Annual International Conference on Documentation*, 68–72. San Francisco, CA.
- Karasti, H. 2001. Bridging work practice and system design— integrating systemic analysis, appreciative intervention, and practitioner participation. *Comput Support Coop Work Int* 10: 167–198.
- Kensing, F., and J. Blomberg. 1998. Participatory design: Issues and concerns. *Comput Support Coop Work* 7: 163–165.
- Kensing, F., J. Simonsen, and K. Bødker. 1999. MUST—a method for participatory design. *Hum Comput Interact* 13: 167–198.
- Kieliszewski, C. A., J. H. Bailey, and J. Blomberg. 2010. A service practice approach: People, activities and information in highly collaborative knowledge-based service systems. In *Handbook of Service Science*, ed. P. P. Maglio, C. A. Kieliszewski, and J. C. Spohrer. U.S.: Springer.
- Kimbell, L. 2009. The turn to service design. In *Design and Creativity Policy, Management and Practice*, ed. G. Julier, and L. Moor, 157–173. Oxford: Berg.
- Kimbell, L., and V. P. Seidel. 2008. Designing for Services— Multidisciplinary Perspectives: Proceedings from the Exploratory Project on Designing for Services in Science and Technology-based Enterprises, Saïd Business School. <http://www.scribd.com/doc/72888892/Designing-for-Services-Multidisciplinary-Perspectives>. Accessed November 30, 2011.
- Koskinen, I., K. Battarbee, and T. Mattelmäki. 2005. *Emphatic Design: User Experience in Product Design*. Helsinki: IT Press.
- Latour, B. 1987. *Science in Action: How to Follow Scientists and Engineers Through Society*. Cambridge, MA: Harvard University Press.
- Latour, B., and S. Woolgar. 1986. *Laboratory Life: The Construction of Scientific Facts*. Princeton, NJ: Princeton University Press.
- Lave, J. 1988. *Cognition and Practice*. Cambridge, U.K.: Cambridge University Press.
- Leonard, D., and J. F. Rayport. 1997. Sparking innovation through empathic design. *Harv Bus Rev* 75: 102–113.

- Long-Tae, P., B. Jong-Wook, and J. Woon-Ki Hong. 2001. Management of service level agreements for multimedia Internet service using a utility model. *Commun Mag IEEE* 39: 100–106.
- Mager, B., and O. King. 2009. Methods and processes of service design. *Touchpoint* 1: 20–28.
- Malone, T. 1983. How do people organize their desks? Implications for the design of office information systems. *ACM Trans Inf Syst* 1: 99–112.
- Marcus, G. E. 1995. Ethnography in/of the world system: The emergence of multi-sited ethnography. *Annu Rev Anthropol* 24: 95–117.
- Marcus, G., and M. Fischer. 1986. Anthropology as Cultural Critique: An Experimental Moment in the Human Sciences. Chicago: University of Chicago Press.
- Marilly, E., O. Martinot, S. Betge-Brezetz, and G. Delegue. 2002. Requirements for service level agreement management. In *IEEE Workshop on IP Operations and Management*, 57–62.
- Mason, B., and B. Dicks. 1999. "The digital ethnographer," *Cybersociology* 6, http://www.cybersociology.com/files/6_1_virtualethnographer.html. Accessed November 30, 2011.
- Masten, D., and T. Plowman. 2003. Digital ethnography: The next wave in understanding the consumer experience. *Des Manage* J 14: 75–84.
- Moore, R. J. 2004. Managing troubles in answering survey questions: Respondents' uses of projective reporting. *Soc Psychol Q* 67: 50–69.
- Murthy, D. 2008. Digital ethnography: An examination of the use of new technologies for social research. *Sociology* 42: 837–855.
- Nader, L. 1974. Up the anthropologist—perspectives gained from studying up. In *Reinventing Anthropology*, ed. D. Hymes, 284–311. New York: Vintage.
- Nardi, B. 1992. The use of scenarios in design. *SIGCHI Bull* 24:13–14.
- Nardi, B. 1996. Context and Consciousness: Activity Theory and Human-Computer Interaction. Cambridge, MA: MIT Press.
- Nardi, B., and J. Miller. 1990. An ethnographic study of distributed problem solving in spreadsheet development. In *Proceedings of Computer Supported Cooperative Work*, 197–208. New York: ACM Press.
- Nardi, B. A., D. J. Schiano, and M. Gumbrecht. 2004. Blogging as social activity, or, would you let 900 million people read your diary? In *Proceedings of the 2004 ACM Conference on Computer Supported Cooperative Work*. New York: ACM.
- Newman, S. E. 1998. Here, there, and nowhere at All: Distribution, negotiation, and virtuality in postmodern engineering and ethnography. *Knowl Soc* 11: 235–267.
- Nielsen, J., and T. K. Landauer. 1993. A mathematical model of the finding of usability problems. In *Proceedings of ACM INTERCHI'93 Conference*, 206–213. Amsterdam, The Netherlands: ACM Press.
- Norman, D. 1983. Some observations on mental models. In *Mental Models*, ed. D. Gentner and A. Stevens. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Palen, L., and M. Salzman. 2002. Voice-mail diary studies for naturalistic data capture under mobile conditions. In *Proceedings of Computer Supported Cooperative Work (CSCW)*, 87–95. New Orleans, Louisiana.
- Perkins, R. 2001. Remote usability evaluation over the Internet. In *Design by People, for People: Essays on Usability*, ed. R. Branaghan, 153–162. Bloomingdale, IL: Usability Professionals Association.
- Pickering, A., ed. 1980. Science as Practice and Culture. Chicago: University of Chicago Press.
- Pine, J., and J. Gilmore. 1999. The Experience Economy: Work is Theater and Every Business a Stage. Cambridge, MA: Harvard Business School Press.
- Polanyi, M. 1966. The Tacit Dimension. London: Routledge & Kegan Paul.
- Pruitt, J., and T. Adlin. 2006. The Persona Lifecycle: Keeping People in Mind Throughout Product Design. San Francisco, CA: Morgan Kaufmann Pub.
- Pruitt, J., and J. Grudin. 2003. Personas: Practice and theory. In *Proceedings of Designing for User Experience*, 1–15. New York: ACM Press.
- Randall, D., M. Rouncefield, and J. Hughes, J. 1995. Chalk and cheese: BPR and ethnomethodologically informed ethnography on CSCW. In *Proceedings E-CSCW*, 325–340. Stockholm, Sweden: ACM Press.
- Rathje, W. L., and C. C. Murphy. 1991. Rubbish! The Archaeology of Garbage. New York: HarperCollins.
- Rheingold, H. 2000. Virtual Community: Homesteading on the Electronic Frontier. Cambridge, MA: MIT Press.
- Rich, M., S. Lamola, C. Amory, and L. Schneider. 2000. Asthma in life context: Video intervention/prevention assessment (VIA). *Pediatrics* 105: 469–477.
- Robinson, R. E. 1994. The origin of cool things. In *Proceedings of the American Center for Design Conference on Design that Packs a Wallop: Understanding the Power of Strategic Design*, 5–10. New York: American Center for Design.
- Robinson, R. E., and J. P. Hackett. 1997. Creating the conditions of creativity. *Des Manage* J 8: 10–16.
- Rodden, T., and H. Anderson. 1994. Moving out from the control room: Ethnography in system design. In *Proceedings of the Conference on Computer Supported Cooperative Work*, ed. R. Furuta, and C. Neuwirth, 429–439. New York: ACM Press.
- Rogers, E. M. 2003. Diffusion of innovations (5th ed.). New York, NY: Free Press.
- Rogers, Y., and V. Bellotti. 1997. How can ethnography help? *Interactions* 4: 58–63.
- Romney, A. K., W. H. Batchelder, and S. C. Weller. 1986. Culture as consensus: A theory of culture and informant accuracy. *Am Anthropol* 88: 313–338.
- Sachs, P. 1995. Transforming work: Collaboration, learning, and design. *Commun ACM* 38: 36–44.
- Said, E. 1978. Orientalism. New York: Pantheon.
- Salant, P., and D. A. Dillman. 1994. How to Conduct Your Own Survey. New York: Wiley and Sons, Inc.
- Schmidt, K., and L. Bannon. 1992. Taking CSCW seriously: Supporting articulation work. *Comput Support Coop Work* 1: 7–40.
- Schuler, D., and A. Namioka, eds. 1993. Participatory Design: Principles and Practices. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Scola-Streckenbach, S. 2008. Experience-based Information: The role of Web-based Patient Networks in Consumer Health Information Services. *J Consum Health Internet* 12: 216–236.
- Scott, J. P. 2000. Social Network Analysis: A Handbook. 2nd ed. London: Sage Publication.
- Shapiro, D. 1994. The limits of ethnography: Combining social sciences for CSCW. In *Proceeding of Computer Supported Cooperative Work*, 417–428. New York: ACM Press.

- Shostack, G. L. 1984. Designing services that deliver. *Harv Bus Rev* 62: 133–139.
- Shostack, G. L. 1987. Service positioning through structural change. *J Mark* 59: 34–43.
- Shostack, G. L. 1993. How to design a service. *Eur J Mark* 16: 49–63.
- Smith, D. 1987. *The Everyday World as Problematic: A Feminist Sociology*. Boston, MA: Northwestern University Press.
- Sonderegger, P., H. Manning, C. Charron, and S. Roshan. 2000. Scenario design. In *Forrester Report*, December 2000.
- Squires, S., and B. Byrne, eds. 2002. *Creating Breakthrough Ideas: The Collaboration of Anthropologists and Designers in the Product Development Industry*. Westport, CT: Bergin & Garvey.
- Suchman, L. 1983. Office procedures as practical action: Models of work and system design. *ACM Trans Office Inf Syst* 1: 320–328.
- Suchman, L. 1999. Embodied practices of engineering work [Special issue]. *Mind Cult Act* 7: 4–18.
- Suchman, L., J. Blomberg, and R. Trigg. 1999. Reconstructing technologies as social practice. *Am Sci* 87: 392–408.
- Suchman, L., and R. Trigg. 1991. Understanding practice: Video as a medium for reflection and design. In *Design at Work: Cooperative Design of Computer Systems*, ed. J. Greenbaum, and M. Kyng, 65–89. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Suchman, L., R. Trigg, and J. Blomberg. 2002. Working artifacts: Ethnomethods of the prototype. *Br J Sociol* 53:163–179.
- Thomke, S. 2003. R&D comes to services. *Harvard Business Review*, April, 71–9.
- Trigg, R., J. Blomberg, and L. Suchman. 1999. Moving document collections online: The evolution of a shared repository. In *Proceeding of the European Conference on Computer-Supported Cooperative Work*, 331–350. Copenhagen, Norwell, MA: Kluwer Academic Publishers.
- Wasson, C. 2000. Ethnography in the field of design. *Hum Organiz* 59: 377–388.
- Weller, S. C., and A. K. Romney. 1988. *Systematic data collection*. Newbury Park, CA: Sage.
- Whiting, B., and J. Whiting. 1970. Methods for observing and recording behavior. In *Handbook of Method in Cultural Anthropology*, ed. R. Naroll, and R. Cohen, 282–315. New York: Columbia University Press.
- Whyte, W. F. 1960. Interviewing in field research. In *Human Organization Research*, ed. R. Adams, and J. Preiss, 299–314. Homewood, IL: Dorsey.
- Whyte, W. F. 1984. *Learning From the Field: A Guide From Experience*. Newbury Park, CA: Sage.
- Wilson, S. M., and L. C. Peterson. 2002. The anthropology of online communities. *Annu Rev Anthropol* 31: 449–467.
- Wolf, M. 1992. A Thrice-Told Tale: Feminism, Postmodernism, and Ethnographic Responsibility. Stanford, CA: Stanford University Press.
- Xun, J., and J. Reynolds. 2010. Applying netnography to market research: The case of the online forum. *J Targeting Meas Anal Marke* 181: 17–31.
- Yanagisako, S., and C. Delaney, eds. 1995. *Naturalizing Power: Essays in Feminist Cultural Analysis*. New York: Routledge.
- Zhao, D., and M. Rosson. 2009. How and why people Twitter: The role that micro-blogging plays in informal communication at work. May 2009. In *Proceedings of the ACM 2009 Conference on Supporting Group Work*. New York: ACM Publishing.
- Zimmerman, D. H., and D. L. Wieder. 1977. The diary: Diary-interview method. *Urban Life* 5: 479–487.

Putting Personas to Work

- Adlin, T., and J. Pruitt. 2010. *The Essential Persona Lifecycle: Your Guide to Building and Using Personas*. Burlington, MA: Morgan Kaufmann Press.
- Antle, A. N. 2006. Child-personas: Fact or fiction? In *Proceedings of DIS06: Designing Interactive Systems: Processes, Practices, Methods, & Techniques* 2006, 22–30. New York: ACM.
- Blomquist, Å., and M. Arvola. 2002. "Personas in Action: Ethnography in an interaction design team." In *Proceedings of the Second Nordic Conference on Human-Computer Interaction, NordiCHI*. Aarhus, Denmark. New York: ACM Press.
- Carroll, J., ed. 1995. *Scenario-Based Design: Envisioning Work and Technology in System Development*. New York: Wiley.
- Carroll, J. 2000a. Five reasons for scenario-based design. *Interact Comput* 13: 43–60.
- Carroll, J. 2000b. *Making use: Scenario-Based Design of Human-Computer Interactions*. Cambridge, MA: MIT Press.
- Chang, Y., Y. Lim, and E. Stolterman. 2008. Personas: From theory to practices. In *Proceedings of NordiCHI 2008: Using Bridges*, 439–442. Lund, Sweden: ACM.
- Chapman, C. N., and R. P. Milham. 2006. The personas' new clothes: Methodological and practical arguments against a popular method. In *Proceedings of the Human Factors and Ergonomics Society (HFES) 50th Annual Conference*, 634–636. San Francisco, CA: Human Factors and Ergonomics Society.
- Chapman, C. N., E. Love, R. P. Milham, P. Elrif, and J. L. Alford. 2008. Quantitative evaluation of personas as information. In *Proceedings of the Human Factors and Ergonomics Society 52nd Annual Meeting*, 1107–1111, New York. San Francisco, CA: Human Factors and Ergonomics Society.
- Constantine, L., and L. Lockwood. 2001. Personas. *For Use Newsletter*, August 15. <http://www.foruse.com/newsletter/foruse15.htm>.
- Constantine, L., and L. Lockwood. 2002. Modeling: Persona Popularity and Role Relationships. *For Use Newsletter*, October 26. <http://www.foruse.com/newsletter/foruse26.htm>.
- Cooper, A. 1999. *The Inmates are Running the Asylum*. Indianapolis, IN: Macmillan.
- Cooper, A., and R. Reimann. 2003. *About Face 2.0: The Essentials of Interaction Design*. Wiley Publishing, Inc.
- Dantin, U. 2005. Application of personas in user interface design for educational software. In *Proceedings of Australasian Computing Education Conference-ACE*, 239–247. Darlinghurst, Australia: Australian Computer Society, Inc.
- Dharwada, P. 2006. *Use of Personas for User Interface Design: Results of Field and Experimental Studies*. PhD Thesis, Clemson University.
- Dharwada, P., J. S. Greenstein, A. K. Gramopadhye, and S. J. Davis. 2007. A case study on use of personas in design and development of an audit management system. In *Human Factors and Ergonomics Society Annual Meeting Proceedings (September 2007)*, 469–73.
- Dreyfuss, H. 1955. *Designing for People*. Republished 2003, New York: Allworth Press.
- Freed, J. 2004. *Ahead of the Game: Best Buy Revamps its Stores to be Ready for the Challenge from a New Line of Electronics Retailers*. Associated Press. http://www.projo.com/business/content/projo_20040520_best20x.201cc9.html.
- Grudin, J. 1990. Constraints in product development organizations. In *Proceedings of Participatory Design Conference*, 14–21.

- Grudin, J. 1993. Obstacles to participatory design in large product development organizations. In *Participatory Design: Principles and Practices*, ed. D. Schuler, and A. Namioka, 99–119. Mahwah, NJ: Erlbaum.
- Grudin, J., and J. Pruitt. 2002. Personas, participatory design, and product development: An infrastructure for engagement. In *Proceedings of PDC 2002*, 144–161. Boston, MA: PDC.
- Haikara, J. 2007. Usability in agile software development: Extending the interaction design process with personas approach. In *Extreme Programming-XP Universe*, LNCS 4536, ed. G. Concias et al., 153–156. Berlin: Springer-Verlag.
- Hill, V., and V. Bartek. 2007. Telling the user's story. In *Proceedings of CHIMIT'07*, Cambridge, MA. New York: ACM.
- Hourihan, M. 2002. Taking the "you" out of user: My experience using Personas. Boxes and arrows. <http://boxesandarrows.com/archives/002330.php>.
- Jacobson, I. 1995. "The use-case construct in object-oriented software engineering". In *Scenario-Based Design*, ed. J. M. Carroll. New York: Wiley.
- Jacobson, I., M. Christerson, P. Jonsson, and G. Övergaard. 1992. *Object-Oriented Software Engineering: A Use Case Driven Approach*. Reading, MA: Addison-Wesley.
- Junior, P., and L. Filgueiras. 2005. User modeling with personas. In *CLIHC '05: Proceedings of the 2005 Latin American Conference on Human-Computer Interaction* (2005), 277–282. New York: ACM.
- Khalayli, N., S. Nyhus, K. Hamnes, and T. Terum. 2007. Persona based rapid usability kick-off. In *Proceedings of CHI 2007*, San Jose, California. New York: ACM.
- Kujala, S., and M. Kauppinen. 2004. Identifying and selecting users for user-centered design. In *Proceedings of NordiCHI'04*, Tampere, Finland. New York: ACM.
- Levinson, M. 2003. Website redesign: How to Play to Your Audience. CIO.com <http://www.cio.com/archive/111503/play.html>.
- Long, F. 2009. Real or imaginary: The effectiveness of using personas in product design. In *Irish Ergonomics Review, Proceedings of the IES Conference 2009*, 1–10. Dublin.
- Markensten, E., and H. Artman. 2004. Procuring usable systems using unemployed personas. In *Proceedings of NordiCHI'04*, Tampere, Finland. New York: ACM.
- McGinn, J., and N. Kotamraju. 2008. Data-driven persona development. In *Proceedings of CHI 2008*, Florence, Italy. New York: ACM.
- McQuaid, H. L., A. Goel, and M. McManus. 2003. When you can't talk to customers: Using storyboards and narratives to elicit empathy for users. In *Proceedings of the 2003 International Conference on Designing Pleasurable Products and Interfaces*, 2003, Pittsburgh, PA. New York: ACM.
- Mello, S. 2003. *Customer-Centric Product Definition: The Key to Great Product Development*. Boston, MA: PDC Professional Publishing.
- Maskiewicz, T., and K. Kozar. 2006. The use of the delphi method to determine the benefits of the personas method - an approach to systems design. In *Proceedings of SIGCHI 2006*. Paper 7.
- Maskiewicz, T., T. Sumner, and K. Kozar. 2008. A latent semantic analysis methodology for the identification and creation of personas. In *Proceedings of CHI 2008*, Florence, Italy. New York: ACM.
- Moore, G. A. 1991. *Crossing the Chasm: Marketing and Selling High-Tech Products to Mainstream Customers*. New York: Harper Collins Publishers. (Revised in 2002).
- Mulder, S., and Z. Yaar. 2007. *The User Is Always Right: A Practical Guide to Creating and Using Personas for the Web*. Berkeley, CA: New Riders.
- Nielsen, J. 1993. *Usability Engineering*. Boston, MA: Academic Press.
- Nieters, J. E., S. Ivaturi, and I. Ahmed. 2007. Making personas memorable. In *Proceedings of CHI 2007*, San Jose, California. New York: ACM.
- Panke, S., B. Gaiser, and B. Werner. 2007. Evaluation as Impetus for Innovations in E-learning—Applying Personas to the Design of Community Functions. *MERLOT J Online Learn Teach* (3) 2.
- Pruitt, J., and T. Adlin. 2006. *The Persona Lifecycle: Keeping People in Mind Throughout Product Design*. Burlington, MA: Morgan Kaufmann Press.
- Rönkkö, K., M. Hellman, B. Kilander, and Y. Dittrich. 2004. "Personas is not applicable: Local remedies interpreted in a wider context." In *Proceedings of the Participatory Design Conference 2004*, 27–31 Toronto, Canada. New York: ACM.
- Siegel, D. A. 2010. The mystique of numbers: Belief in quantitative approaches to segmentation and persona development. In *Proceedings of CHI 2010*, Atlanta, GA. New York: ACM.
- Sinha, R. 2003. Persona development for information-rich domains. In *Proceedings of CHI 2003*. New York: ACM Press.
- Sissors, J. 1966. What is a market. *J Mark* 30: 17–21.
- Shyba, L., and J. Tam. 2005. Developing character personas and scenarios: Vital steps in theatrical performance and HCI goal-directed design. In *Proceedings of C&C'05*, London, United Kingdom. New York: ACM.
- Star, S. L., and J. R. Griesemer. 1989. Institutional ecology, 'translations,' and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907–1939. *Social Studies of Science* 19: 387–420.
- Triantafyllakos, G., G. Palaigeorgiou, and I. A. Tsoukalas. 2009. Design alter egos: Constructing and employing fictional characters in collaborative design sessions. In *Proceedings of the 23rd British HCI Group Annual Conference on People and Computers: Celebrating People and Technology*. Swinton, UK: British Computer Society.
- Tychsen, A., and A. Canossa. 2008. Defining personas in games using metrics. In *Proceedings of Future Play 2008*, 73–80, Toronto, Ontario, Canada. New York: ACM.
- Upshaw, L. 1995. *Building Brand Identity: A Strategy for Success in a Hostile Marketplace*. New York: John Wiley & Sons.
- Weinstein, A. 1998. *Defining your Market: Winning Strategies for High-Tech, Industrial, and Service Firms*. New York: Haworth Press.

Prototyping Tools and Techniques

- Apple Computer. 1996. Programmer's Guide to MacApp. Cupertino, CA: Apple Computer, Inc.
- Beaudouin-Lafon, M. 2000. Instrumental interaction: An interaction model for designing post-WIMP user interfaces. In Proceedings ACM Human Factors in Computing Systems, CHI '2000. 446–453. The Hague, Netherlands.
- Beaudouin-Lafon, M. 2001. Novel interaction techniques for overlapping Windows. In Proceedings of ACM Symposium on User Interface Software and Technology, UIST 2001, Orlando, Florida. *CHI Letters* 3(2): 153–41.
- Beaudouin-Lafon, M. 2004. Designing interaction, not interfaces. In Proceedings of the Working Conference on Advanced Visual Interfaces, AVI '04, 15–22. Gallipoli, Italy.
- Beaudouin-Lafon, M., and M. Lassen. 2000. The architecture and implementation of a post-WIMP graphical application. In Proceedings of ACM Symposium on User Interface Software and Technology, UIST 2000, San Diego, CA. *CHI Lett* 2(2):181–90.
- Beaudouin-Lafon, M., and W. Mackay. 2000. Reification, polymorphism and reuse: Three principles for designing visual interfaces. In Proceedings Conference on Advanced Visual Interfaces, AVI 2000, 102–109. Palermo, Italy.
- Beck, K. 2000. Extreme Programming Explained. New York: Addison-Wesley.
- Bederson, B. B., and J. Hollan. 1994. Pad++: A zooming graphical interface for exploring alternate interface physics. In *Proceedings of ACM Symposium on User Interface Software and Technology, UIST '94*, 17–26. Marina del Rey.
- Bederson, B. B., and J. Meyer. 1998. Implementing a zooming interface: Experience building Pad++. *Softw Pract Exp* 28(10): 1101–1135.
- Bederson, B. B., J. Meyer, and L. Good. 2000. Jazz: An extensible zoomable user interface graphics toolkit in Java. In Proceedings of ACM Symposium on User Interface Software and Technology, UIST 2000, San Diego, CA. *CHI Lett* 2(2): 171–80.
- Berger, N. 2006. The excel story. *Interactions* 13(1): 14–17.
- Bier, E., M. Stone, K. Pier, W. Buxton, and T. De Rose. 1993. Toolglass and magic lenses: The see-through interface. In Proceedings ACM SIGGRAPH, 73–80. Anaheim, CA.
- Bødker, S. 1999. Scenarios in user-centered design: Setting the stage for reflection and action. In Proceedings of the 32nd Annual Hawaii International Conference on System Sciences, HICSS-32, Vol 3, article 3053, 11. Wailea, HI: IEEE Computer Society.
- Bødker, S., P. Ehn, J. Knudsen, M. Kyng, and K. Madsen. 1988. Computer support for cooperative design. In Proceedings of the CSCW '88 ACM Conference on Computer-Supported Cooperative Work, 377–393. Portland, OR.
- Boehm, B. 1988. A spiral model of software development and enhancement. *IEEE Comput* 21(5):61–72.
- Boucher, A., and W. Gaver. 2006. Developing the drift table. *Interactions* 13(1):24–27.
- Chapanis, A. 1982. Man/Computer research at Johns Hopkins. In *Information Technology and Psychology: Prospects for the Future*, ed. R. A. Kasschau, R. Lachman, and K. R. Laughery, 238–249. New York, NY: Praeger Publishers, Third Houston Symposium.
- Chapuis, O., and N. Roussel. 2005. Metisse is not a 3D desktop! In Proceedings of the 18th Annual ACM Symposium on User Interface Software and Technology, UIST '05, 13–22. Seattle, WA.
- Collaros, P. A., and L. R. Anderson. 1969. Effect of perceived expertness upon creativity of members of brainstorming groups. *J Appl Psychol* 53: 159–163.
- de Vreede, G. J., R. Briggs, R. van Duin, and B. Enserink. 2000. Athletics in electronic brainstorming: Asynchronous brainstorming in very large groups. In Proceedings of the 33rd Annual Hawaii International Conference on System Sciences, HICSS-33, Vol 1, article 1042, 11. Wailea, HI: IEEE Computer Society.
- Dey, A. K., R. Hamid, C. Beckmann, I. Li, and D. Hsu. 2004. A CAPpella: Programming by demonstration of context-aware applications. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '04, 33–40. Vienna, Austria.
- Diehl, M., and W. Stroebe. 1987. Productivity loss in brainstorming groups: Towards the solution of a riddle. *J Personal Soc Psychol*, 53(3):497–509. Washington, DC: American Psychology Association.
- Dijkstra-Erikson, E., W. E. Mackay, and J. Arnowitz. 2001. Trialogue on design of. *ACM/Interact* 109–17.
- Dourish, P. 1997. Accounting for system behaviour: Representation, reflection and resourceful action. In *Computers and Design in Context*, ed. M. Kyng, and L. Mathiassen, 145–170. Cambridge, MA: MIT Press.
- Eckstein, R., M. Loy, and D. Wood. 1998. Java Swing. Cambridge, MA: O'Reilly.
- Fekete, J. D. 2004. The InfoVis toolkit. In Proceedings of the 10th IEEE Symposium on Information Visualization, InfoVis '04, 167–174. Austin, Texas: IEEE Press.
- Frishberg, N. 2006. Prototyping with junk. *Interactions* 13(1):21–23.
- Gamma, E., R. Helm, R. Johnson, and J. Vlissides. 1995. Design patterns, elements of reusable object-oriented software. Reading, MA: Addison-Wesley.
- Gaver, W., J. Bowers, A. Boucher, H. Gellerson, S. Pennington, A. Schmidt, A. Steed, N. Villar, and B. Walker. (2004). The Drift Table: Designing for ludic engagement. Proc. CHI '04 Design Expo. New York: ACM Press.
- Good, M. D., J. A. Whiteside, D. R. Wixon, and S. J. Jones. 1984. Building a user-derived interface. *Commun ACM* 27(10): 1032–1043. New York: ACM.
- Goodman, D. 1987. The Complete Hypercard Handbook. New York: Bantam Books.
- Greenbaum, J., and M. Kyng, eds. 1991. Design at Work: Cooperative Design of Computer Systems. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Greenberg, S., and C. Fritchett. 2001. Phidgets: Easy development of physical interfaces through physical widgets. In Proceedings of the 14th Annual ACM Symposium on User interface Software and Technology, UIST '01, 209–218. Orlando, FL.
- Holmquist, L. E., A. Schmidt, and B. Ullmer. 2004. Tangible interfaces in perspective. *Pers Ubiquitous Comput* 8(5):291–293. Heidelberg: Springer.
- Hong, J. I., and J. A. Landay. 2000. SATIN: A toolkit for informal ink-based applications. In Proceedings of the 13th Annual ACM Symposium on User interface Software and Technology, UIST '00, 63–72. San Diego, CA.
- Houde, S., and C. Hill 1997. What do prototypes prototype? In *Handbook of Human Computer Interaction*, 2nd ed., ed. M. G. Helander, T. K. Landauer, and P. V. Pradhu, 367–381. North-Holland.
- Hudson, S. E., J. Mankoff, and I. Smith. 2005. Extensible input handling in the subArctic toolkit. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '05, 381–390. Portland, Oregon.
- Kelley, J. F. 1983. An empirical methodology for writing user-friendly natural language computer applications. In Proceedings of CHI '83 Conference on Human Factors in Computing Systems, 193–196. Boston, MA.

- Klemmer, S. R., J. Li, J. Lin, and J. A. Landay. 2004. Papier-mache: Toolkit support for tangible input. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '04, 399–406. Vienne, Austria.
- Krasner, E. G., and S. T. Pope. 1988. A cookbook for using the model-view-controller user interface paradigm in small-talk-80. *J Object-Oriented Program*, 21-A9.
- Kurtenbach, G., G. Fitzmaurice, T. Baudel, and W. Buxton. 1993. The design of a GUI paradigm based on tablets, two-hands, and transparency. In Proceedings of ACM Human Factors in Computing Systems, CHI '97, 35–42. Atlanta, GA.
- Landay, J., and B. A. Myers. 2001. Sketching interfaces: Toward more human interface design. *IEEE Comput* 34(3):56–64.
- Li, Y., J. I. Hong, and J. A. Landay. 2004. Topiary: A tool for prototyping location-enhanced applications. In Proceedings of the 17th Annual ACM Symposium on User Interface Software and Technology, UIST '04, 217–226. Santa Fe, NM.
- Li, Y., and J. A. Landay. 2005. Informal prototyping of continuous graphical interactions by demonstration. In Proceedings of the 18th Annual ACM Symposium on User Interface Software and Technology, UIST '05, 221–230. Seattle, WA.
- Lin, J., M. W. Newman, J. I. Hong, and J. A. Landay. 2000. DENIM: Finding a tighter fit between tools and practice for website design. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '00, 510–517. Hague, Netherlands.
- Linton, M. A., J. M. Vlissides, and P. R. Calder. 1989. Composing user interfaces with InterViews. *IEEE Comput* 22(2):8–22.
- Mackay, W. E. 1988. Video prototyping: A technique for developing hypermedia systems. In *Conference Companion of ACM CHI '88, Conference on Human Factors in Computing*. Washington DC. <http://www.iri.fr/~mackay/publications.html> (accessed April 2, 2007).
- Mackay, W. E. 1995. Ethics, lies and videotape. In Proceedings ACM Human Factors in Computing Systems, CHI '95, 138–145. Denver, CO.
- Mackay, W. E. 2000. Video techniques for participatory design: Observation, brainstorming & prototyping. In Tutorial Notes, CHI 2000, Human Factors in Computing Systems. Hague, Netherlands. <http://www.iri.fr/~mackay/publications.html> (accessed April 2, 2007).
- Mackay, W. E. 2002. Using video to support interaction design, DVD tutorial, INRIA and ACM/SIGCHI. <http://stream.cc.gt.atl.ga.us/hccvideos/viddesign.php> (accessed April 2, 2007).
- Mackay, W. E., and A. L. Fayard. 1997. HCI, natural science and design: A framework for triangulation across disciplines. In Proceedings of ACM DIS '97, Designing Interactive Systems, 223–234. Pays-Bas, Amsterdam.
- Mackay, W. E., and D. Pagani. 1994. Video mosaic: Laying out time in a physical space. In Proceedings of ACM Multimedia '94, 165–172. San Francisco, CA.
- Mackay, W. E., A. L. Fayard, L. Frobert, and L. Médini. 1998. Reinventing the familiar: Exploring an augmented reality design space for air traffic Control. In Proceedings of ACM CHI '98 Human Factors in computing Systems, 558–565. Los Angeles, CA.
- Mackay, W. E., A. Ratzer, and P. Janecek. 2000. Video artifacts for design: Bridging the gap between abstraction and detail. In Proceedings ACM Conference on Designing Interactive Systems, DIS 2000, 72–82. New York.
- MacIntyre, B., M. Gandy, S. Dow, and J. D. Bolter. 2005. DART: A toolkit for rapid design exploration of augmented reality experiences. *ACM Trans Graph* 24(3):932.
- Muller, M. J. 1991. PICTIVE: An exploration in participatory design. In Proceedigs of ACM CHI '91 Human Factors in Computing Systems, 225–231. New Orleans, LA.
- Myers, B. A., D. A. Giuse, R. B. Dannenberg, B. Vander Zander, D. S. Kosbie, E. Pervin, A. Mickish, and P. Marchal. 1990. Garnet: Comprehensive support for graphical, highly-interactive user interfaces. *IEEE Comput* 23(11):71–85.
- Myers, B. A., R. G. McDaniel, R. C. Miller, A. S. Ferency, A. Faulring, B. D. Kyle, A. Mickish, A. Klimovitski, and P. Doane. 1997. The Amulet environment. *IEEE Trans Softw Eng* 23(6):347–365.
- Myers, B. A., and M. B. Rosson. 1992. Survey on user interface programming. In ACM Conference on Human Factors in Computing Systems, CHI '92, 195–202. Monterey, CA.
- NeXT Corporation. 1991. NeXT Interface Builder Reference Manual. Redwood City, CA: NeXT Corporation.
- Norman, D. A., and S. W. Draper, eds. 1986. User Centered System Design. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Osborn, A. 1957. Applied Imagination: Principles and Procedures of Creative Thinking. Rev. ed. New York: Scribner's.
- Ousterhout, J. K. 1994. Tcl and the Tk Toolkit. Reading, MA: Addison Wesley.
- Perkins, R., D. S. Keller, and F. Ludolph. 1997. Inventing the Lisa user interface. *ACM Interact* 4(1):40–53.
- Rettig, M. 1994. Prototyping for tiny fingers. *Commun ACM* 37(4):21–27.
- Raskin, J. 2000. The Humane Interface. New York: Addison-Wesley.
- Roseman, M., and S. Greenberg. 1996. Building real-time group-ware with GroupKit, a groupware toolkit. *ACM Trans Comput Hum Interact* 3(1):66–106.
- Roseman, M., and S. Greenberg. 1999. Groupware toolkits for synchronous work. In Computer-Supported Co-operative Work: Trends in Software Series, ed. M. Beaudouin-Lafon, 135–168. Chichester: Wiley.
- Schroeder, W., K. Martin, and B. Lorenzen. 1997. The Visualization Toolkit. Upper Saddle River, NJ: Prentice Hall.
- Snyder, C. 2003. Paper Prototyping: The Fast and Easy Way to Design and Refine User Interfaces. San Francisco, CA: Morgan Kaufmann.
- Strass, P. 1993. IRIS inventor, a 3D graphics toolkit. In Proceedings ACM Conference on Object-Oriented Programming, Systems, Languages and Applications, OOPSLA '93, 192–200. Washington, DC.
- Vlissides, J. M., and M. A. Linton. 1990. Unidraw: A framework for building domain-specific graphical editors. *ACM Trans Inf Syst* 8(3):237–268.
- Weiser, M. 1991. The computer for the 21st century. *Sci Am* 265(3):94–104.
- Wellner, P., W. E. Mackay, and R. Gold, eds. 1993. Special Issue on Computer-Augmented Environments. *Commun ACM*. New York: ACM.

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- Abraham, G., and M. E. Atwood. 2009. Patterns or claims: Do they help in communicating design advice?. In Proceedings of the 21st Annual Conference of the Australian Computer-Human Interaction Special Interest Group: Design: Open 24/7 (Melbourne, Australia, November 23–27, 2009). OZCHI '09, Vol. 411, 25–32. New York: ACM. DOI=<http://doi.acm.org/10.1145/1738826.1738831>.
- Ackoff, R. L. 1979. Resurrecting the future of operations research, *J Oper Res Soc* 30(3):189–199.
- Alexander, I. F., and N. Maiden. 2004. Scenarios, Stories, Use Cases through the Systems Development Life-Cycle. London: Wiley.
- Antón, A., W. M. McCracken, and C. Potts. 1994. Goal decomposition and scenario analysis in business process reengineering. In Proceedings of CAiSE'94: Sixth Conference on Advanced Information Systems Engineering, Utrecht, The Netherlands: Springer-Verlag.
- Beck, K. 1999. Extreme Programming Explained: Embrace Change. Reading, MA: Addison-Wesley.
- Beck, K., and W. Cunningham. 1989. A laboratory for teaching object-oriented thinking. In Proceedings of Object-Oriented Systems, Languages and Applications: OOPSLA '89, ed. N. Meyrowitz, 1–6. New York: ACM.
- Bertelsen, O. W., and S. Bødker. 2003. Activity theory. In *HCI Models, Theories, and Frameworks: Toward a Multidisciplinary Science*, ed. J. M. Carroll, 291–324. San Francisco, CA: Morgan Kaufmann.
- Beyer, H., and K. Holtzblatt. 1998. Contextual Design: A Customer-Centered Approach to System Design. San Francisco, CA: Morgan Kaufmann.
- Beyer, H., and K. Holtzblatt. 1998. Contextual Design: Defining Customer-Centered Systems. San Francisco, CA: Morgan Kaufmann.
- Blandford, A., and S. Attfield. 2010. Interacting with Information. San Francisco, CA: Morgan and Claypool Publishers.
- Bødker, S. 1991. Through the Interface: A Human Activity Approach to User Interface Design. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Brooks, F. 1995. The Mythical Man-Month: Essays on Software Engineering. Reading, MA: Addison-Wesley. (Anniversary Edition, originally 1975).
- Campbell, R. L. 1992. Will the real scenario please stand up?. *SIGCHI Bull* 24(2):6–8.
- Carroll, J. M. eds. 1995. Scenario-Based Design: Envisioning Work and Technology in System Development. New York: John Wiley and Sons.
- Carroll, J. M. 1997. Scenario-based design. In *Handbook of Human-Computer Interaction*, Second ed., ed. M. Helander and T. K. Landauer, 383–406. Amsterdam: North Holland.
- Carroll, J. M. 2000. Making Use: Scenario-Based Design of Human-Computer Interactions. Cambridge, Massachusetts: MIT Press.
- Carroll, J. M., and C. Carrithers. 1983. Blocking errors in a learning environment. In Psychonomic Society 24th Annual Meeting (San Diego, CA, November 17), Abstract in Proceedings, 356. New York: Springer.
- Carroll, J. M., G. Chin, M. B. Rosson, and D. C. Neale. 2000. The development of cooperation: Five years of participatory design in the Virtual School. In Proceedings of DIS 2000: Designing Interactive Systems, 239–251. Brooklyn, NY: ACM.
- Carroll, J. M., J. Karat, S. A. Alpert, M. van Deusen, and M. B. Rosson. 1994. Demonstrating raison d' etre: Multimedia design history and rationale. In CHI'94 Conference Companion, ed. C. Plaisant, 29–30. New York: ACM.
- Carroll, J. M., R. L. Mack, and W. A. Kellogg. 1988. Interface metaphors and user interface design. In *Handbook of Human-Computer Interaction*, ed. M. Helander, 67–85. Amsterdam: North Holland.
- Carroll, J. M., and M. B. Rosson. 1985. Usability specifications as a tool in iterative development. In *Advances in Human-Computer Interaction*, ed. H. R. Hartson, 1–28. Norwood, NJ: Ablex.
- Carroll, J. M., and M. B. Rosson. 1990. Human-computer interaction scenarios as a design representation. In Proceedings of the 23rd Annual Hawaii International Conference on Systems Sciences (Kailua-Kona, HI, January 2–5), 555–561. Los Alamitos, CA: IEEE Computer society Press.
- Carroll, J. M., and M. B. Rosson. 1991. Deliberated evolution: Stalking the view matcher in design space. *Hum Comput Interact* 6: 281–318.
- Carroll, J. M., and M. B. Rosson. 1992. Getting around the task-artifact cycle: How to make claims and design by scenario. *ACM Trans Inf Syst* 10: 181–212.
- Carroll, J. M., and M. B. Rosson. 2003. Design rationale as theory. In *HCI Models, Theories, and Frameworks: Toward an Interdisciplinary Science*, ed. J. M. Carroll, 431–461. San Francisco, CA: Morgan Kaufmann.
- Carroll, J. M., and M. B. Rosson. 2005a. Case studies as minimalist information designs. In Proceedings of HICSS 38: Hawaii International Conference on Systems Science, Hilton Waikoloa Village: IEEE Digital Library.
- Carroll, J. M., and M. B. Rosson. 2005b. A case library for usability engineering: Development, experiences, and outcomes. *ACM J Educ Res Comput* 5(1): Article 3, 1–22.
- Carroll, J. M., and M. B. Rosson. 2005c. Toward even more authentic case-based learning. *Educ Technol* 45(6):5–11.
- Carroll, J. M., M. B. Rosson, G. Chin, and J. Koenemann. 1998. Requirements development in scenario-based design. *IEEE Trans Softw Eng* 24(12): 1156–1170.
- Carroll, J. M., J. A. Singer, R. K. E. Bellamy, and S. R. Alpert. 1990. A view matcher for learning smalltalk. In Proceedings of CHI90: Human Factors in Computing Systems (Seattle, WA, April 1–5), 431–437. New York: ACM.
- Carroll, J. M., and J. C. Thomas. 1982. Metaphors and the cognitive representation of computing systems. *IEEE Trans Syst Man Cybern* 12(2):107–116.
- Checkland, P. B. 1981. Systems Thinking, Systems Practice. Chichester: John Wiley.
- Chewar, C. M., E. Bachetti, D. S. McCrickard, and J. Booker. 2005. Automating a design reuse facility with critical parameters: Lessons learned in developing the LINK-UP system. In Computer-Aided Design of User Interfaces IV, ed. R. Jacob, Q. Limbourg, and J. Vanderdonckt, 235–246. Norwell, MA: Kluwer Academic Publishers.
- Chewar, C. M., and D. S. McCrickard. 2003. Educating novice developers of notification systems: Targeting user-goals with a conceptual framework. In Proceedings of ED-MEDIA '03, 2759–2766. Chesapeake, VA: AACE.
- Chin, G., M. B. Rosson, and J. M. Carroll. 1997. Participatory analysis: Shared development of requirements from scenarios. In Proceedings of Human Factors in Computing Systems, CHI'97 Conference, 162–169. New York: ACM.
- Constantine, L. L., and L. A. D. Lockwood. 1999. Software for Use: A Practical Guide to the Models and Methods of Usage-Centered Design. Reading, Massachusetts: Addison-Wesley.
- Cooper, A. 1999. The Inmates are Running the Asylum: Why High Tech Products Drive Us Crazy and How to Restore the Sanity. Indianapolis, IN: SAMS Press.

- Cooper, A., and R. Reimann. 2003. *About Face 2.0*. Indianapolis, IN: Wiley Publishing.
- Cross, N. 2001. Design cognition: Results from protocol and other empirical studies of design activity. In *Design Knowing and Learning: Cognition in Design Education*, ed. C. Eastman, M. McCracken and W. Newstetter, 79–103. Amsterdam: Elsevier.
- Dubberly, H., and D. Mitsch. 1992. Knowledge navigator. In *CHI'92 Special Video Program: Conference on Human Factors in Computing Systems* (Monterey, CA, May 3–7), ed. B. A. Myers, New York: ACM SIGCHI.
- Erickson, T. 1990. Working with interface metaphors. In *The Art of Human-Computer Interface Design*, ed. B. Laurel, 65–73. Reading, MA: Addison-Wesley.
- Erickson, T. 1995. Notes on design practice: Stories and prototypes as catalysts for communication. In *Scenario-Based Design: Envisioning Work and Technology in System Development*, ed. J. M. Carroll, 37–58. New York: John Wiley and Sons.
- Freud, S. 1900. *The Interpretation of Dreams*, Standard Edition, Vol. IV, Hogarth, London.
- Good, M., T. M. Spine, J. Whiteside, and P. George. 1986. User-derived impact analysis as a tool for usability engineering. In *Proceedings of Human Factors in Computing Systems: CHI '86*, ed. M. Mantei, and P. Oberton, 241–246. New York: ACM.
- Gray, W. D., B. E. John, and M. E. Atwood. 1992. The precis of Project Ernestine, or an overview of a validation of GOMS. In *Proceedings of Human Factors in Computing Systems: CHI '92*, ed. P. Bauersfeld, J. Bennett, and G. Lynch, 307–312. New York: ACM.
- Gregoriades, A., and A. Sutcliffe. 2005. Scenario-based assessment of nonfunctional requirements. *IEEE Transact Softw Eng* 31(5):392–409.
- Haviland, S. E., and H. H. Clark. 1974. What's new? Acquiring new information as a process in comprehension. *J Verbal Learn Verbal Behav* 13: 512–521.
- Haynes, S. R., S. Purao, and A. L. Skattebo. 2004. Situating evaluation in scenarios of use. In *Proceedings of CSCW 2004*, 92–101. New York: ACM.
- Haynes, S. R., S. Purao, and A. L. Skattebo. 2009. Scenario-based methods for evaluating collaborative systems. *Comput Support Coop Work* 18(4):331–356. DOI= <http://dx.doi.org/10.1007/s10606-009-9095-x>.
- Haynes, S. R., L. Spence, and L. Lenze. 2009. Scenario-based assessment of learning experiences. In *Proceedings of the 39th IEEE international Conference on Frontiers in Education Conference* (San Antonio, Texas, USA, October 18–21, 2009). 870–876. Piscataway, NJ: IEEE Press.
- Holbrook, H. 1990. A scenario-based methodology for conducting requirements elicitation. *ACM SIGSOFT Softw Eng Notes* 15(1):95–103.
- Hsia, P., J. Samuel, J. Gao, D. Kung, Y. Toyoshima, and C. Chen. 1994. Formal approach to scenario analysis. *IEEE Softw* 11(2):33–41.
- Jacobson, I. 1995. The use-case construct in object-oriented software engineering. In *Scenario-Based Design: Envisioning Work and Technology in System Development*, ed. J. M. Carroll, 309–336. New York: John Wiley & Sons.
- Jacobson, I., G. Booch, and J. Rumbaugh. 1998. *The Unified Software Development Process*. Reading, MA: Addison-Wesley.
- Jacobson, I., M. Christersson, P. Jonsson, and G. Övergaard. 1992. *Object-Oriented Software Engineering—A Use-Case Driven Approach*. Reading, MA: Addison-Wesley.
- Jarke, M., X. T. Bui, and J. M. Carroll. 1998. Scenario management: An interdisciplinary approach. *Requir Eng* 3(3–4):155–173.
- Kahn, H. 1962. *Thinking about the Unthinkable*. New York: Horizon Press.
- Kahneman, D., and A. Tversky. 1972. Subjective probability: A judgement of representativeness. *Cogn Psychol* 3: 430–454.
- Kaindl, H. 1997. A practical approach to combining requirements definition and object-oriented analysis. *Ann Softw Eng* 3: 319–343.
- Kaindl, H. 2000. A design process based on a model combining scenarios with goals and functions. *IEEE Trans Syst Man Cybern* 30(5):537–551.
- Karat, J. 1995. Scenario use in the design of a speech recognition system. In *Scenario-Based Design: Envisioning Work and Technology in System Development*, ed. J. M. Carroll, 109–133. New York: John Wiley & Sons.
- Karat, J., and J. B. Bennett. 1991. Using scenarios in design meetings—a case study example. In *Taking Design Seriously: Practical Techniques for Human-Computer Interaction Design*, ed. J. Karat, 63–94. Boston, MA: Academic Press.
- Kieras, D. 1997. A guide to GOMS model usability evaluation using NGOMSL. In *Handbook of Human-Computer Interaction*, Second ed., ed. M. G. Helander, T. K. Landauer, and P. V. Pradhu, 733–766. Amsterdam: North-Holland.
- Kraut, R., R. Fish, R. Root, and B. Chalfonte. 1993. Informal communication in organizations: Form, function, and technology. In *Proceedings of CSCW'93: Conference on Computer-Supported Cooperative Work*. New York: ACM.
- Kuutti, K. 1995. Work processes: Scenarios as a preliminary vocabulary. In *Scenario-Based Design: Envisioning Work and Technology in System Development*, ed. J. M. Carroll, 19–36. New York: John Wiley & Sons.
- Kuutti, K., and T. Arvonen. 1992. Identifying potential CSCW applications by means of activity theory concepts: A case example. In *Proceedings of Computer-Supported Cooperative Work: CSCW '92*, ed. J. Turner, and R. Kraut, 233–240. New York: ACM.
- Kyng, M. 1995. Creating contexts for design. In *Scenario-Based Design: Envisioning Work and Technology in System Development*, ed. J. M. Carroll, 85–107. New York: John Wiley & Sons.
- Lee, J. C., D. S. McCrickard, and K. T. Stevens. 2009. Examining the foundations of agile usability with extreme scenario-based design. In *Proceedings of the 2009 Agile Conference* (August 24–28, 2009), 3–10. Washington, DC: AGILE. IEEE Computer Society. DOI= <http://dx.doi.org/10.1109/AGILE.2009.30>.
- Lévi-Strauss, C. 1967. *Structural Anthropology*. Garden City, NY: Anchor Books.
- MacLean, A., R. M. Young, and T. P. Moran. 1989. Design rationale: The argument behind the artifact. In *Proceedings of Human Factors in Computing Systems: CHI '89*, 247–252. New York: ACM.
- Madsen, K. H. 1994. A guide to metaphorical design. *Commun ACM* 37(12):57–62.
- Maiden, N., C. Ncube, S. Kamali, N. Seyff, and P. Grunbacher. 2007. Exploring scenario forms and ways of use to discover requirements on airports that minimize environmental impact. In *15th IEEE International Requirements Engineering Conference (RE 2007)*, 29–38. Washington, DC: IEEE Computer Society Press.
- McCall, R. 2010. Critical conversations: Feedback as a stimulus to creativity in software design. *Hum Technol Interdiscip J Hum ICT Environ* 6(1): 11–37.
- McKerlie, D., and A. MacLean. 1994. Reasoning with design rationale: Practical experience with design space analysis. *Des Stud* 15: 214–226.
- Medin, D. L., and M. M. Schaffer. 1978. A context theory of classification learning. *Psychol Rev* 85: 207–238.
- Moran, T., and J. M. Carroll. eds. 1996. *Design Rationale: Concepts, Techniques, and Use*. Hillsdale, NJ: Lawrence Erlbaum Associates.

- Muller, M. 1991. PICTIVE—An exploration in participatory design. In *Proceedings of Human Factors in Computing Systems: CHI '91*, 225–231. New York: ACM.
- Muller, M. K. 1992. Retrospective on a year of participatory design using the PICTIVE technique. In *Proceedings of Human Factors of Computing Systems: CHI '92*, ed. A. Janda, 455–462. New York: ACM.
- Muller, M. J., L. G. Tudor, D. M. Wildman, E. A. White, R. A. Root, T. Dayton, R. Carr, B. Diekmann, and E. Dykstra-Erickson. 1995. Bifocal tools for scenarios and representations in participatory activities with users. In *Scenario-Based Design: Envisioning Work and Technology in System Development*, ed. J. M. Carroll, 135–163. New York: John Wiley & Sons.
- Mylopoulos, J., L. Chung, and B. Nixon. 1992. Representing and using nonfunctional requirements: A process-oriented approach. *IEEE Transact Softw Eng* 18(6):483–497.
- Nardi, B. A. ed. 1996. *Context and Consciousness: Activity Theory and Human-Computer Interaction*. Cambridge, MA: MIT Press.
- Nielsen, J. 1995. Scenarios in discount usability engineering. In *Scenario-Based Design: Envisioning Work and Technology in System Development*, ed. J. M. Carroll, 59–83. New York: John Wiley & Sons.
- Nielsen, J., and R. L. Mack. 1994. *Usability Inspection Methods*. New York: John Wiley & Sons.
- Norman, D. A. 1986. Cognitive engineering. In *User Centered System Design*, ed. D. A. Norman, and S. D. Draper, 31–61. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Norman, D. A. 1988. *The Psychology of Everyday Things*. New York: Basic Books.
- Norman, D. A. 2005. Human-centered design considered harmful. *Interactions* 12(4):14–18.
- Orr, J. 1986. Narratives at work: Story telling as cooperative diagnostic activity. In *Proceedings of CSCW '96*, 62–72. New York: ACM.
- Payne, C., C. F. Allgood, C. M. Chewar, C. Holbrook, and D. S. McCrickard. 2003. Generalizing interface design knowledge: Lessons learned from developing a claims library. In *Proceedings of IRI '03*, 362–369. New York: IEEE.
- Polson, P. G., C. Lewis, J. Rieman, and C. Wharton. 1992. Cognitive walkthroughs: A method for theory-based evaluation of user interfaces. *Int J Man Mach Stud* 36: 741–773.
- Pommeranz, A., W. Brinkman, P. Wiggers, J. Broekens, and C. M. Jonker. 2009. Design guidelines for negotiation support systems: An expert perspective using scenarios. In *European Conference on Cognitive Ergonomics: Designing Beyond the Product—Understanding Activity and User Experience in Ubiquitous Environments* (Helsinki, Finland, September 30–October 02, 2009). ed. L. Norros, H. Koskinen, L. Salo, and P. Savioja, 1–8. Finland: European Conference on Cognitive Ergonomics. VTT Technical Research Centre of Finland, VTT.
- Potts, C. 1995. Using schematic scenarios to understand user needs. In *Proceedings of ACM Symposium on Designing Interactive Systems: DIS'95*: (Ann Arbor, Michigan), 247–256. New York: ACM Press.
- Propp, V. 1958. *Morphology of the Folktale*. Mouton: The Hague (originally published in 1928).
- Rogers, Y. 2009. The changing face of human-computer interaction in the age of ubiquitous computing. In *Proceedings of the 5th Symposium of the Workgroup Human-Computer interaction and Usability Engineering of the Austrian Computer Society on HCI and Usability For E-Inclusion* (Linz, Austria, November 09–10, 2009), Lecture Notes in Computer Science, ed. A. Holzinger and K. Miesenberger, Vol. 5889, 1–19. Berlin, Heidelberg: Springer-Verlag. DOI= http://dx.doi.org/10.1007/978-3-642-10308-7_1.
- Rosch, E., C. B. Mervis, W. Gray, D. Johnson, and P. Boyes-Braem. 1976. Basic objects in natural categories. *Cogn Psychol* 7: 573–605.
- Rosson, M. B. 1999. Integrating development of task and object models. *Commun ACM* 42(1):49–56.
- Rosson, M. B., and J. M. Carroll. 1993. Extending the task-artifact framework. In *Advances in Human-Computer Interaction*, ed. R. Hartson, and D. Hix, Vol. 4, 31–57. New York: Ablex.
- Rosson, M. B., and J. M. Carroll. 1995. Narrowing the gap between specification and implementation in object-oriented development. In *Scenario-Based Design: Envisioning Work and Technology in System Development*, ed. J. M. Carroll, 247–278. New York: John Wiley & Sons.
- Rosson, M. B., and J. M. Carroll. 1996. The reuse of uses in Smalltalk programming. *ACM Trans Comput Hum Interact* 3(3):219–253.
- Rosson, M. B., and J. M. Carroll. 2000a. Nonfunctional requirements in scenario-based development. In *Proceedings of OZCHI 2000*, 232–239. North Ryde, NSW, Australia: CSIRO Mathematical and Information Sciences.
- Rosson, M. B., and J. M. Carroll. 2000b. Scenarios, objects, and points-of-view in user interface design. In *Object Modeling and User Interface Design*, ed. M. van Harmelen. London: Addison-Wesley Longman.
- Rosson, M. B., and J. M. Carroll. 2002. *Usability Engineering: Scenario-Based Development of Human-Computer Interaction*. San Francisco, CA: Morgan Kaufmann.
- Rosson, M. B., and E. Gold. 1989. Problem-solution mapping in object-oriented design. In *Proceedings of OOPSLA'89: Conference on Object-Oriented Programming Systems, Languages, and Applications*, ed. N. Meyrowitz, 7–10. New York: ACM.
- Rosson, M. B., S. Maass, and W. A. Kellogg. 1988. The designer as user: Building requirements for design tools from design practice. *Commun ACM* 31: 1288–1298.
- Rubin, K., and A. Goldberg. 1992. Object behavior analysis. *Commun ACM* 35(9):48–62.
- Schön, D. A. 1967. *Technology and Change: The New Heraclitus*. New York: Pergamon Press.
- Schön, D. A. 1983. *The Reflective Practitioner: How Professionals Think in Action*. New York: Basic Books.
- Schön, D. A. 1987. *Educating the Reflective Practitioner*. San Francisco, CA: Jossey-Bass.
- Scriven, M. 1967. The methodology of evaluation. In *Perspectives of Curriculum Evaluation*, ed. R. Tyler, R. Gagne, and M. Scriven, 39–83. Chicago: Rand McNally.
- Sommerville, I. 1992. *Software Engineering*. Fourth ed. Reading, MA: Addison-Wesley.
- Sutcliffe, A. 2002. *The Domain Theory: Patterns for Knowledge and Software Reuse*. Hillsdale, NJ: Erlbaum Associates.
- Sutcliffe, A. 2010. Juxtaposing design representations for creativity. *Hum Technol Interdiscip J Hum ICT Environ* 6(1):38–54.
- Sutcliffe, A. G., and S. Minocha. 1998. Scenario-based analysis of non-functional requirements. In *Proceedings of RESQ 2000*. Namur, Belgium: Namur University Press.
- Swanson, E., K. Sato, and J. Gregory. 2009. Exploring cultural context using the contextual scenario framework. In *Proceedings of the 3rd International Conference on Internationalization, Design and Global Development: Held As Part of HCI International 2009* (San Diego, CA, July 19–24, 2009), Lecture Notes In Computer Science, ed. N. Aykin, Vol. 5623, 117–126. Springer-Verlag, Berlin: Heidelberg. DOI= http://dx.doi.org/10.1007/978-3-642-02767-3_13.
- Theng, Y. L., D. H. Goh, E. Lim, Z. Liu, N. L. Pang, P. B. Wong, and L. Chua. 2002. Intergenerational Partnerships in the Design of a Digital Library of Geography Examination Resources. In *Proceedings of the 5th International Conference on Asian Digital Libraries: Digital Libraries: People, Knowledge, and Technology* (December 11–14, 2002), Lecture Notes In Computer Science, ed. E. Lim, S. Foo, C. S. Khoo, H. Chen, E.A. Fox, S. R. Urs, and C. Thanos, Vol. 2555, 427–439. London: Springer-Verlag.

- Tideman, M., M. C. van der Voor, and B. van Arem. 2010. A new scenario based approach for designing driver support systems applied to the design of a lane change support system. *Transp Res Part C Emerg Technol* 18(2):247–258.
- Turner, P., and S. Turner. 2011. Is stereotyping inevitable when designing with personas? *Design Studies* 11(3):30–44.
- Tversky, A., and D. Kahneman. 1974. Judgements under uncertainty: Heuristics and biases. *Science* 185: 1124–1131.
- Vasara, K. 2003. *Introducing Personas in a Software Development Project*. Masters thesis submitted to Helsinki University of Technology. Department of Computer Science & Engineering, Helsinki, Finland.
- Verplank, W. L. 1988. Graphic challenges in designing object-oriented user interfaces. In *Handbook of Human-Computer Interaction*, ed. M. Helander, 365–376. Amsterdam: North-Holland.
- Virzi, R. A., J. L. Sokolov, and D. Karis. 1996. Usability problem identification using both low-and high-fidelity prototypes. In *Proceedings of Human Factors in Computing Systems: CHI '96*, 236–243. New York: ACM.
- Wasserman, A. I., and D. T. Shewmake. 1982. Rap Prototyping Interact Inf Syst ACM Softw Eng Notes 7(5):171–180.
- Weidenhaupt, K., K. Pohl, M. Jarke, and P. Haumer. 1998. Scenarios in system development: Current practice. *IEEE Softw* 15/2:34–45.
- Wertheimer, M. 1938. Laws of organization in perceptual forms. A Sourcebook of Gestalt Psychology, ed. W. D. Ellis. London: Paul, Trench, Trubner.
- Wirths-Brock, R. 1995. Designing objects and their interactions: A brief look at responsibility-driven design. In *Scenario-Based Design: Envisioning Work and Technology in System Development*, ed. J. M. Carroll, 337–360. New York: John Wiley & Sons.
- Wirths-Brock, R., and Wilkerson, B. 1989. Object-oriented design: A responsibility-driven approach. In *Object-Oriented Programming: Systems, Languages and Applications, Proceedings of OOPSLA'89*, 71–76. New York: ACM.
- Wirths-Brock, R., B. Wilkerson, and L. Wiener. 1990. *Designing Object-Oriented Software*. Englewood Cliffs, NJ: Prentice Hall.
- Young, R. M., and P. B. Barnard. 1987. The use of scenarios in human-computer interaction research: Turbocharging the tortoise of cumulative science. In *Proceedings of CHI+GI'87: Conference on Human Factors in Computing Systems and Graphics Interface* (Toronto, Canada, April 5–9), 291–296. New York: ACM.
- Zhao, D., and M. B. Rosson. 2009. How and why people twitter: The role that micro-blogging plays in informal communication at work. In *Proceedings of GROUP 2009*, 243–252. New York: ACM.

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- Adlin, T., J. Pruitt, K. Goodwin, C. Hynes, K. McGrane, A. Rosenstein, and M. J. Muller. 2006. Putting personas to work, n *CHI 2006 Adjunct Proceedings*, 13–16. Montréal, QU, CA: ACM.
- Anderson, W. L., and W. T. Crocca. 1993. Engineering practice and codevelopment of product prototypes. *Commun ACM* 36(6):49–56.
- Antle, A. 2003. Case study: The design of CBC4Kids' StoryBuilder. In *Proceedings of IDC 2003*, 59–68. New York: ACM.
- Anzaldúa, G. 1999. *La frontera/Borderlands*. San Francisco, CA: Aunt Lute Books.
- Aune, M. 1996. The computer in everyday life: Patterns of domestication of a new technology. In *Making Technology Our Own: Domesticating Technology into Everyday Life*, ed. M. Lie, and K. H. Sorensen, 91–120. Oslo: Scandinavian University Press.
- Bachmann-Medick, D. 1996. Cultural misunderstanding in translation: Multicultural coexistence and multicultural conceptions of world literature. *Erfurt Electronic Studies in English* 7. http://webdoc.gwdg.de/edoc/ia/eese/artic96/bachmann/7_96.html.
- Badke-Schaub, P. 2004. Strategies of experts in engineering design: Between innovation and routine behavior. *Des Res* 4(2).
- Balka, E. 1995. Political frameworks for system design: Participatory design in non-profit women's organizations in Canada and the United States. In *Workshop Proceedings: Political Frameworks of System Design From a Cross-Cultural Perspective*, ed. J. Gaertner and I. Wagner.
- Beck, E. E. 1996. P for political? Some challenges to PD towards 2000. In *PDC'96 Proceedings of the Participatory Design Conference*, 117–125. Cambridge, MA: CPSR.
- Beck, E. E. 2001. On Participatory Design in Scandinavian Ecomputing Research. University of Oslo. Oslo, Norway. Research Report 294.
- Beeson, I., and C. Miskelly. 1998. Discovery and design in a community story. In *Proceedings of PDC 98*, 147–156. Seattle, WA: CPSR.
- Beeson, I., and C. Miskelly. 2000. Dialogue and dissent in stories of community. In *Proceedings of PDC 2000*, 1–10. New York: CPSR.
- Béguin, P. 2003. Design as a mutual learning process between users and designers. *Interact Comput* 15(5):709–730.
- Bertelsen, O. W. 1996. The festival checklist: Design as the transformation of artifacts. In *Proceedings of PDC 96*, 93–102. Cambridge, MA: CPSR.
- Best, M. L., T. N. Smyth, D. Serrano-Baquero, and J. Etherton. 2009. Designing for and with diaspora: A case study of work for the truth and reconciliation commission of liberia. In *CHI 2009 Adjunct Proceedings*, 2903–2917. Boston, MA.
- Beyer, H., and K. Holtzblatt. 1998. *Contextual Design: Defining Customer-Centered Systems*. San Francisco, CA: Morgan Kaufmann.
- Bhabha, H. K. 1994. *The Location of Culture*. London: Routledge.
- Bidwell, N., and D. Hardy. 2009. Dilemmas in situating participation in rural ways of saying. In *Proceedings of OZCHI 2009*, 145–152. Melbourne, Australia: ACM.
- Bidwell, N. J., T. Reitmäier, G. Marsden, and S. Hansen. 2010. Designing with mobile digital storytelling in Africa. In *Proceedings of CHI 2010*, 1593–1602. Atlanta, GA: ACM.
- Binder, T. 1999. Setting the scene for improvised video scenarios. In *Adjunct Proceedings of CHI 99*. Pittsburgh, PA: ACM.
- Bjerknes, G., and T. Bratteteig. 1987. Florence in wonderland. In *Computers and Democracy-a Scandinavian Challenge* Avebury, ed. G. Bjerknes, P. Ehn, and M. Kyng, 279–295. Aldershot, FC.
- Bjerknes, G., and T. Bratteteig. 1995. User participation and democracy: A discussion of Scandinavian research on system development. *Scand J Inf Syst* 7(1):73–98.
- Bjerknes, G., P. Ehn, and M. Kyng, eds. 1987. *Computers and Democracy: A Scandinavian Challenge*. Brookfield, VT: Gower.
- Björgvinsson, E., and P. A. Hillgren. 2004. On the spot experiments within healthcare. In *Proceedings of PDC 2004*, 93–101. Toronto, ON: CPSR.
- Blomberg, J., J. Giacomi, A. Mosher, and P. Swenton-Wall. 1993. Ethnographic field methods and their relation to design. In *Participatory Design: Principles and Practices*, ed. D. chuler and A. Namioka. Hillsdale, NJ: Erlbaum.

- Boal, A. 1974/1992. Games for Actors and Non-Actors (A. Jackson, Trans.). London: Routledge.
- Bolton, R., eds. 1989. The Contest of Meaning: Critical Histories of Photography. Cambridge, MA: MIT Press.
- Braa, K. 1996. Influencing qualities of information systems—future challenges for participatory design. In Proceedings of PDC 96, 15–24. Cambridge, MA: CPSR.
- Brandt, E., and C. Grunnet. 2000. Evoking the future: Drama and props in user centered design. In Proceedings of PDC 2000, 11–20. New York: CPSR.
- Brandt, E., and J. Messeter. 2004. Facilitating collaboration through design games. In Proceedings of PDC 2004, 121–130. Toronto, ON: CPSR.
- Brereton, M. 2009. Designing from somewhere: A located, relational and transformative view of design. In (Re)searching the Digital Bauhaus, ed. T. Binder, J. Lowgren, and L. Malmborg, 100–119. London: Springer.
- Briefs, U., C. Ciborra, and L. Schneider. 1983. System Design for, with, and by the Users. Amsterdam: North-Holland.
- Bruyne, E., de, and A. de Jong. 2008. The Workplace Game: Exploring End Users' New Behaviour. Keynote AKFEI08 conference, Las Vegas, NV.
- Bunch, C. 1987. Passionate Politics, Essays 1968–1986: Feminist Theory in Action. New York: St. Martin's Press.
- Buur, J., T. Binder, and E. Brandt. 2000. Taking video beyond "hard data" in user centred design. In Proceedings of PDC 2000, 1–10. New York: CPSR.
- Buzan, T., and B. Buzan. 1996. The Mind Map Book: How to Use Radiant Thinking to Maximize Your Brain's Untapped Potential. New York: Plume.
- Bødker, S. 1990. Through the Interface: A Human Activity Approach to User Interface Design. Hillsdale, NJ: Erlbaum.
- Bødker, S., and J. Buur. 2000. From usability lab to "design collaboratorium": Reframing usability practice. In Proceedings of DIS'00. New York: ACM.
- Bødker, S., and J. Buur. 2002. The design collaboratorium—A place for usability design. *Trans Comput Hum Interact* 9(2): 152–169.
- Bødker, S., P. Ehn, M. Kyng, J. Kammergaard, and Y. Sundblad. 1987. A UTOPIAN experience: On design of powerful computer-based tools for skilled graphic workers. In Computers and Democracy: A Scandinavian Challenge, ed. G. Bjerknes, P. Ehn, and M. Kyng, Brookfield, VT: Gower.
- Bødker, S., and K. Grønbæk. 1991. Design in action: From prototyping by demonstration to cooperative prototyping. In Design at Work: Cooperative Design of Computer Systems, ed. J. Greenbaum and M. Kyng. Hillsdale, NJ: Erlbaum.
- Bødker, S., K. Grønbæk, and M. Kyng. 1993. Cooperative design: Techniques and experiences from the Scandinavian scene. In Participatory Design: Principles and Practices, ed. D. Schuler and A. Namioka. Hillsdale, NJ: Erlbaum.
- Bødker, K., F. Kensing, and J. Simonsen. 2004. Participatory IT Design: Designing for Business and Workplace Realities. Cambridge, MA: MIT Press.
- Bødker, S., J. L. Knudsen, M. Kyng, P. Ehn, and K. H. Madsen. 1988. Computer support for cooperative design. In CSCW'88: Proceedings of the Conference on Computer Supported Cooperative Work. Portland, OR: ACM.
- Cáceres, M.S. 2007, *Standardising widgets: Improving the development, distribution and deployment, accessibility, security, metadata, internationalisation, and device-independence of client-side web applications*. PhD thesis, 8/29/2007, Queensland University of Technology, Brisbane, Australia, <http://datadriven.com.au/thesis/confirmation/confirmation.pdf>, Verified November 28, 2011.
- Cameron, M. 1998. Design for safety: Working with residents to enhance community livability. In Proceedings of PDC 98. Seattle, WA: CPSR.
- Carmien, S., R. DePaula, A. Gorman, and A. Kintsch. 2003. Increasing workplace independence for people with cognitive disabilities by leveraging distributed cognition among caregivers and clients. In Proceedings of GROUP'03, 95–104. Sanibel Island, FL: ACM.
- Carrillo, R. 2000. Intersections of official script and learners' script in third space: A case study on latino families in an after-school computer program. In Proceedings of Fourth International Conference of the Learning Sciences, 312–313. Mahwah, NJ: Erlbaum.
- Carroll, J., eds. 1995. Scenario-Based Design for Human–Computer Interaction. New York: Wiley.
- Carroll, J. M. 2000. Making Use: Scenario-Based Design of Human–Computer Interactions. Cambridge, MA: MIT Press.
- Carter, S., and J. Mankoff. 2005. When participants do the capturing: The role of media in diary studies. In Proceedings of CHI 2005. Portland, OR: ACM.
- Chandler, J., A. I. Davidson, and H. Harootunian, eds. 1994. Questions of Evidence: Proof, Practice, and Persuasion Across the Disciplines. Chicago, IL: University of Chicago Press.
- Checkland, P. 1981. Systems Thinking, Systems Practice. New York: Wiley.
- Chin, G., K. Schuchardt, J. Myers, and D. Gracio. 2000. Participatory workflow analysis: Unveiling scientific research processes with physical scientists. In Proceedings of PDC 2000. New York: CPSR.
- Clement, A., P. Kolm, and I. Wagner, eds. 1994. NetWORKing: Connecting Workers in and Between Organizations. IFIP Transactions A-38. Amsterdam: North-Holland.
- Clement, A., and P. Van den Besselaar. 1993. A retrospective look at PD projects. *Commun ACM* 36(6):29–37.
- Cohene, T., R. Baecker, and E. Marziali. 2005. Designing interactive life story multimedia for a family affected by Alzheimer's disease: A case study. CHI 2005 Extended Abstracts, 1300–1303. Portland, OR: ACM.
- Cook, J., and A. Light. 2006. New patterns of power and participation? Designing ICT for informal and community learning. *E-Learning* 3(1):51–61.
- Cooper, A., R. Reimann, and D. Cronin. 2007. About Face 3: The Essentials of Interaction Design. New York, NY: Wiley.
- Corburn, J. 2003. Bringing local knowledge into environmental decision making: Improving urban planning for communities at risk. *J Plann Educ Res* 22: 120–133.
- Costabile, M. F., D. Fogli, P. Mussio, and A. Piccinno. 2006. Enduser development: The software sharing workshop approach. In End-User Development, ed. H. Lieberman, F. Paterno, and V. Wulf, 183–205. Dordrecht, NE: Springer.
- Costabile, M. F., D. Fogli, P. Mussio, and A. Piccinno. 2007. Visual interactive systems for end-user development: A model-based design methodology. *IEEE Transn SMC Part A* 37(6):1029–1046.
- Cotton, L. J., A. D. Vollrath, L. Kirk, L. Foggatt, L. Mark. Lengnick-Hall, and R. Kenneth. Jennings. 1988. Employee Participation: Diverse forms and different Outcomes. *Academy of Management Review* 13(1):8–22.
- Crabtree, A. 1998. Ethnography in participatory design. In Proceedings of PDC 98. Seattle, WA: CPSR.

- Cross, N. 2001. Designerly ways of knowing: Design discipline versus design science. *Des Issues* 17(3):49–55.
- Dandavate, U., D. Steiner, and C. William. 2000. Working anywhere: Co-design through participation. In *Proceedings of CoDesigning 2000*. London: Springer.
- Davies, R., S. Marcella, J. McGrenere, and B. Purves. 2004. The ethnographically informed participatory design of a PDA to support communication. In *Proceedings of ASSETS'04*. Atlanta, GA: ACM.
- Davis, J. 2010. Participatory design for sustainable campus living. In *CHI 2010 Adjunct Proceedings*, 3877–3882. Atlanta, GA: ACM.
- de Jong, A., M. Kouprie, and E. De Bruyne. 2009. Effects of the workplace game: A case study into anticipating future behavior of office workers. In *Ergonomics and Health Aspects HCII 2009*, ed. B. T. Karsh. Berlin, Heidelberg: Springer Verlag.
- Demirbilek, O., and H. Demirkhan. 2004. Universal product design involving elderly users: A participatory design model. *Appl Ergon* 35: 361–370.
- Dewulf, G., and J. Van Meel. 2003. Democracy in design? In *Workplace Strategies and Facilities Management*, ed. R. Best, C. Langston, and G. de Valence, 281–291. Oxford, U.K.: Butterworth Heinemann.
- Dewulf, G., and J. Van Meel. 2002. User participation and the role of information and communications technology. *J Corp Real Estate* 4(3):237–247.
- Dingawaney, A., and C. Maier. 1994. *Between Languages and Cultures: Translation and Cross-Cultural Texts*. Pittsburgh, PA: University of Pittsburgh Press.
- DiSalvo, C., A. Light, T. Hirsch, L. Goodman, and K. Hill. 2010. HCI, communities and politics. In *CHI 2010 Adjunct Proceedings*, 3151–3154. Atlanta, GA: ACM.
- Docherty, P., K. Fuchs-Kittowski, P. Kolm, and L. Matthiessen. 1987. *System Design for Human Development and Productivity: Participation and Beyond*. Amsterdam: North-Holland.
- Dray, S. M. 1992. Understanding and supporting successful group work in software design: Lessons from IDS [Position paper]. In *Understanding and Supporting Successful Group Work in Software Design, Workshop at CSCW '92 conference*, ed. J. Karat and J. Bennett. Toronto, ON: ACM.
- Druin, A. 1999. Cooperative inquiry: Developing new technologies for children with children. In *Proceedings of CHI 99*. Pittsburgh, PA: ACM.
- Druin, A. 2002. The role of children in the design of new technology. *Behav Inf Technol* 21(1): 1–25.
- Druin, A. 2005. What children can teach us: Developing digital libraries for children. *Libr Q* 75(1):20–41.
- Druin, A., H. Alborzi, A. Boltman, S. Cobb, J. Montemayor, H. Neale, M. Platner et al. 2000. *Participatory design with children: Techniques, challenges, and successes*. In *Proceedings of PDC 2000*. New York: CPSR.
- Druin, A., B. B. Bederson, A. Rose, and A. Weeks. 2009. From New Zealand to Mongolia: Co-designing and deploying a digital library for the world's children. *Chil Youth Environ Spec Issue Child Technol Environ* 19(1):34–57.
- Dykstra, E. A., and R. P. Carasik. 1991. Structure and support in cooperative environments: The amsterdam conversation environment. *Int J Man Mach Stud* 34: 419–434.
- Ehn, P. 1988. *Work-Oriented Design of Computer Artifacts*. Falköping, Sweden: Arbetslivcentrum/Almqvist and Wiksell International.
- Ehn, P. 1993. Scandinavian design: On participation and skills. In *Usability: Turning Technologies into Tools*, ed. P. S. Adler and T. A. Winograd. New York: Oxford University Press.
- Ehn, P., and M. Kyng. 1987. The collective resource approach to systems design. In *Computers and Democracy: A Scandinavian Challenge*, ed. G. Bjerknes, P. Ehn, and M. Kyng. Brookfield, VT: Gower.
- Ehn, P., and M. Kyng. 1991. Cardboard computers: Mocking-it-up or hands-on the future. In *Design at Work: Cooperative Design of Computer Systems*, ed. J. Greenbaum and M. Kyng. Hillsdale, NJ: Erlbaum.
- Ehn, P., and Å. Sanberg. 1979. Management Control and Wage Earner Power. *Foretagsstyrning och Lontagarmakt*. Falkoping: Prisma.
- Ehn, P., and D. Sjögren. 1986. Typographers and carpenters as designers. In *Proceedings of Skill-Based Automation*. Karlsruhe, Germany.
- Ehn, P., and D. Sjögren. 1991. From system descriptions to scripts for action. In *Design at Work: Cooperative Design of Computer Systems*, ed. J. Greenbaum and M. Kyng. Hillsdale, NJ: Erlbaum.
- Enquist, H., and K. Tollmar. 2008. The memory stone—a personal ICT device in health care. In *Proceedings of NordiCHI 2008*, 103–112. Lund, Sweden.
- Erickson, T. 1996. Design as story-telling. *Interactions* 3(4):30–35.
- Evanoff, R. 2000. The concept of "third cultures" in intercultural ethics. *Eubios J Asian Int Bioeth* 10: 126–129.
- Fails, J., A. Druin, and M. L. Guha. 2010. Mobile collaboration: Collaboratively reading and creating children's stories on mobile devices. In *Proceedings of Interaction Design and Children (IDC'2010)*. Barcelona, Spain: ACM.
- Fanderclai, T. 1995. MUDs in education: New environments, new pedagogies. *Comput Mediat Commun* 2(1): 8.
- Fanderclai, T. 1996. Like magic, only real. In *Wired Women: Gender and New Realities in Cyberspace*, ed. L. Cherny and E. R. Weise. Seattle, WA: Seal Press.
- Floyd, C. 1987. Outline of a paradigm change in software engineering. In *Computers and Democracy: A Scandinavian Challenge*, ed. G. Bjerknes, P. Ehn, and M. Kyng. Brookfield, VT: Gower.
- Floyd, C. 1993. STEPS—A methodical approach to PD. *Commun ACM* 36(6):83.
- Floyd, C., W. M. Mehl, F. M. Reisin, G. Schmidt, and G. Wolf. 1989. Out of scandinavia: Alternative approaches to software design and system development. *Hum Comput Interact* 4(4):253–350.
- Fowles, R. A. 2000. Symmetry in design participation in the built environment: Experiences and insights from education and practice. In *Proceedings of CoDesigning 2000*. London: Springer.
- Füller, J., M. Bartl, H. Ernst, and H. Muhlbacher. 2006. Community based innovation: How to integrate members of virtual communities into new product development. *Electron Commer Res* 6(1):57–73.
- Garrety, K., and R. Badham. 1998. The Four-Dimensional Politics of Technology, or Postmodernising Participatory Design. Presented at *Cultural Politics of Technology workshop*. Trondheim: Centre for Technology and Society.
- Garzotto, F. 2008. Broadening children's involvement as design partners: From technology to "experience". In *Proceedings of the Seventh International Conference on Interaction Design and Children*, 186–193. ACM.
- Gasson, S. 1995. User involvement in decision-making in information systems development. In *Proceedings of 18th IRIS*. Gjern Denmark: IRIS Association.

- Gärtner, J., and I. Wagner. 1995. Political Frameworks of Systems Design from a Cross-Cultural Perspective. IFIP WG.9.1 Workshop. Aarhus: IFIP.
- Gjersvik, R., and V. Hepsø. 1998. Using models of work practice as reflective and communicative devices: Two cases from the Norwegian offshore industry. In Proceedings of PDC 98. Seattle, WA: CPSR.
- Greenbaum, J. 1991. Toward participatory design: The head and the heart revisited. In Women, Work and Computerization: Understanding and Overcoming Bias in Work and Education, ed. I. V. Ericksson, B. A. Kitchenham, and K. J. Tijdens, 33–39. Amsterdam: Elsevier Science Publishers (North Holland).
- Greenbaum, J. 1993. A design of one's own: Towards participatory design in the United States. In Participatory Design: Principles and Practices, ed. D. Schuler and A. Namioka. Hillsdale, NJ: Erlbaum.
- Greenbaum, J. 1996. Post modern times: Participation beyond the workplace. In Proceedings of PDC 96. Cambridge, MA: CPSR.
- Greenbaum, J., and M. Kyng. 1991. Design at Work: Cooperative Design of Computer Systems. Hillsdale, NJ: Erlbaum.
- Gregory, J. 2003. Scandinavian approaches to participatory design. *Int J Eng Educ* 19(1):62–74.
- Grenfell, M. 1998. Border-Crossing: Cultural Hybridity and the Rural and Small Schools Practicum. Australian Association for Research in Education conference. Adelaide, Australia.
- Gruen, D. 2000. Storyboarding for Design: An Overview of the Process. Cambridge, MA: Lotus Research.
<http://www.research.ibm.com/cambridge>, under "Papers." Accessed November 28, 2011.
- Gruen, D. 2001. Stories in Design Tutorial. IBM Make It Easy Conference. Indianapolis, IN: IBM Press.
- Guha, M. L., and A. Druin. 2008. Designing with and for children of special needs: An inclusionary model. In Interaction Design and Children (IDC'08) Workshop. Chicago, IL: ACM.
- Gumm, D. C., M. Janneck, M. Finck. 2006. Distributed participatory design—a case study. In NordiCHI Workshop on Distributed Participatory Design. Oslo, Norway: ACM.
- Grønbæk, K. 1989. Extending the boundaries of prototyping—Toward cooperative prototyping. In Proceedings of 12th IRIS. Aarhus: IRIS Association.
- Halskov, K., and P. Dalsgård. 2006. Inspiration card workshops. In Proceedings of DIS 2006, University Park, PA: ACM.
- Haraway, D. 1991. Situated knowledges. In Simians, Cyborgs, and Women: The Reinvention of Nature, ed. D. Haraway. New York, NY: Routledge.
- Harding, S. 1991. Whose Science? Whose Knowledge? Thinking from Women's Lives. Ithaca, NY: Cornell University Press.
- Hartsock, N. 1983. The feminist standpoint. In Discovering Reality, ed. S. Harding, and M. B. Hintikka, 283–310. Holland, Boston, London: D. Riedel Publishing Company.
- Henderson, A., and M. Kyng. 1991. There's no place like home: Continuing design in use. In Design at Work: Cooperative Design of Computer Systems, ed. J. Greenbaum and M. Kyng. Hillsdale, NJ: Erlbaum.
- Heß, J., S. Offenburg, and W. Pipek. 2008. Community driven development as participation?: Involving user communities in a software design process, 31–40. In Proc. PDC 2008. Indiana University, Indianapolis, IN.
- Hirsch, T. 2009. Communities real and imagined: Designing a communications system for zimbabwean activities. In Proceedings of Communities and Technologies 2009. University Park, PA: ACM.
- Holmström, J. 1995. The power of knowledge and the knowledge of power: On the systems designer as a translator of rationalities. In Proceedings of the 18th IRIS. Göteborg: IRIS Association.
- Horgan, T., M. L. Joroff, W. L. Porter, and D. A. Schön. 1998. Excellence by Design—Transforming Workplace and Work Practice. New York: Wiley.
- Hornecker, E. 2010. Creative idea exploration within the structure of a guiding framework: The card brainstorming game. In Proceedings of TIE 2010, 101–108. Cambridge, MA: ACM.
- Hornof, A. 2008. Working with children with severe motor impairments as design partners. In Proceedings of the Seventh International Conference on Interaction Design and Children, 69–72. ACM.
- Howard, S., J. Carroll, J. Murphy, and J. Peck. 2002. Using 'endowed props' in scenario-based design. In Proceedings of NORCHI 2002. Aarhus: ACM.
- Hulkko, S., T. Mattelmäki, K. Virtanen, and T. Keinonen. 2004. Mobile probes. In Proceedings of NORCHI 2004. Tampere: ACM.
- Hultcrantz, J., and A. Ibrahim. 2002. Contextual workshops: User participation in the evaluation of future concepts. In Proceedings of PDC 2002. Malmö: CPSR.
- Iacucci, G., C. Iacucci, and K. Kuutti. 2002. Imaging and experiencing in design—the role of performances. In Proceedings of NORCHI 2002, 167–176. Aarhus: ACM.
- Iacucci, G., and K. Kuutti. 2002. Everyday life as a stage in creating and performing scenarios for wireless devices. *Pers Ubiquitous Comput* 6: 299–306.
- Irestig, M., and T. Timpka. 2002. Dynamic interactive scenario creation: A method for extending participatory design to large system development projects. In Proceedings of PDC 2002. Malmö: CPSR.
- Isomursu, M., K. Kuutti, and S. Väinämö. 2004. Experience clip: Method for user participation and evaluation of mobile concepts. In Proceedings of PDC 2004. Toronto, ON: CPSR.
- Iversen, O. S., and J. Buur. 2002. Design is a game: Developing design competence in a game setting. In Proceedings of PDC 2002. Malmö: CPSR.
- Janneck, M., and D. Gumm. 2008. Bridging different use contexts in distributed participatory design. Position paper at workshop *Distributed Participatory Design*, held in conjunction with CHI 2008, Florence, IT.
- Johansson, M., P. Fröst, E. Brandt, T. Binder, and J. Messeter. 2002. Partner engaged design: New challenges for workplace design. In Proceedings of PDC 2002. Malmö: CPSR.
- Jones, C., L. McIver, L. Gibson, and P. Gregor. 2003. Experiences obtained from designing with children. In Proceedings of Interaction Design and Children 2003: Small Users—Big Ideas, 69–74. New York: ACM.
- Jungk, R., and N. Mullert. 1987. Future Workshops: How to Create a Desirable Future. London: Institute of Social Invention.
- Jönsson, B., and unnamed colleagues. (n.d.). *Elderly People and Design*. Lund, Sweden: Lund Institute of Technology.
- Kaindl, H., L. Constantine, J. Karat, and M. J. Muller. 2001. Methods and modeling: Fiction or useful reality? (panel). In CHI 2001 Extended Abstracts. Seattle, WA: ACM.
- Kam, M., D. Ramachandran, A. Raghavan, J. Chiu, U. Sahni, and J. Canny. 2006. Practical considerations for participatory design with rural school children in underdeveloped regions: Early reflections from the field. In Proceedings of Interaction Design and Children 2006,

- 25–32. New York: ACM.
- Kankainen, T., V. Kantola, K. Mehto, and S. Tiitta. 2005. Interactive drama and user centered product concept design. In Proceedings of Designing for User eXperience (DUX 2005). San Francisco, CA, (unpaged electronic document). ACM.
- Kantola, V., S. Tiitta, K. Mehto, and T. Kankainen. 2007. Using dramaturgical methods to gain more dynamic user understanding in user-centered design. In Proceedings of Creativity and Cognition Conference, 712–714. Washington, DC. ACM.
- Kappelman, L. 1995. Measuring user involvement: A diffusion of innovation perspective. The DATABASE Adv Inf Syst 26(2&3):65–86.
- Karasti, H., K. S. Baker, and G. C. Bowker. 2002. Ecological storytelling and collaborative scientific activities. SIGGROUP Bull 23(2):29–30.
- Karttunen, F. 1994. Between Worlds: Interpreters, Guides, and Survivors. New Brunswick, NJ: Rutgers University Press.
- Kensing, F., and J. Blomberg. 1998a. Participatory design: Issues and concerns. Comput Support Coop Work 7: 167–185.
- Kensing, F., and J. Blomberg, eds. 1998b. Comput Support Coop Work special issue on participatory design, 7(3–4): 163–165.
- Kensing, F., and K. H. Madsen. 1991. Generating visions: Future workshops and metaphorical design. In Design at Work: Cooperative Design of Computer Systems, ed. J. Greenbaum and M. Kyng. Hillsdale, NJ: Erlbaum.
- Kensing, F., and A. Munk-Madsen. 1993. PD: Structure in the toolbox. Commun ACM 36(6):78–85.
- Kensing, F., J. Simonsen, and K. Bødker. 1996. MUST—A method for participatory design. In Proceedings of PDC 96. Cambridge, MA: CPSR.
- Klein, J. T. 1996. Crossing Boundaries: Knowledge, Disciplinarieties, and Interdisciplinarieties. Charlottesville, NC: University Press of Virginia.
- Klær, A., and K. H. Madsen. 1995. Participatory analysis of flexibility. Commun ACM 38(5):53–60.
- Krabbel, A., and I. Wetzel. 1998. The customization process for organizational package information systems: A challenge for participatory design. In Proceedings of PDC 98. Seattle, WA: CPSR.
- Kujala, S. 2003. User involvement: A review of the benefits and challenges. Behav Inf Technol 22(1): 1–16.
- Kuutti, K., G. Iacucci, and C. Iacucci. 2002. Acting to know: Improving creativity in the design of mobile services by using performances. In Proceedings of C&C 02. Loughborough: ACM.
- Kwok, J. Y.-C. 2004. The weight of space: Participatory design research for configuring habitable space for new arrival women in Hong Kong. In Proceedings of PDC 2004. Toronto, ON: CPSR.
- Kyng, M. 1998. Users and computers: A contextual approach to design of computer artifacts. Scand J Inf Syst 10(1,2):7–44.
- Kyng, M., and L. Mathiassen. 1982. Systems development and trade union activities. In Information Society, for Richer, for Poorer, ed. N. Bjørn-Andersen. Amsterdam: North Holland.
- Kyng, M., and L. Matthiessen, eds. 1997. Computers in Design and Context. Cambridge, MA: MIT Press.
- Lafrenière, D. 1996. CUTA: A simple, practical, and low-cost approach to task analysis. Interactions 3(5):35–39.
- Lanza, G. F. 1983. The design process: Frames, metaphors, and games. In Systems Design for, with, and by the Users, ed. U. Briefs, C. Ciborra, and L. Schneider. Amsterdam: North-Holland.
- Large, A., L. Bowler, J. Beheshti, and V. Nesset. 2007. Creating web portals with children as designers: Bonded design and the zone of proximal development. McGill J Educ 42(1):61–82.
- Levinger, D. 1998. *Participatory Design History*, <http://cpsr.org/preBSITE/conferences/pdc98/history.html/view>.
- Light, A., and R. Luckin. 2008. *Designing for Social Justice: People, Technology, and Learning*. Futurelab. www.learningdirectorsnetwork.com/refdocs/Designing_for_Social_Justice.pdf.
- Lim, Y.-K., E. Stolterman, and J. Teneberg. 2008. The anatomy of prototypes Prototypes as filters, prototypes as manifestations of design ideas. ACM Trans Comput Hum Interact 15(2):7:1–7:27.
- Lohmann, S., S. Dietzold, P. Heim, and N. Heino. 2009. A web platform for social requirements engineering. Software Engineering (Workshops), 309–315. Bonn: Köllen.
- Lohmann, S., J. Ziegler, and P. Heim. 2008. Involving end users in distributed requirements engineering. In Engineering Interactive Systems, ed. P. Forbrig, and F. Paterno, 21–28. Berlin, DE: Springer.
- Louridas, P. 1999. Design as bricolage: Anthropology meets design thinking. Des Stud 20(6):517–535.
- Luck, R. 2000. Does “inclusive design” require an inclusive design process? In Proceedings of CoDesigning 2000. London: Springer.
- Luck, R. 2003. Dialogue in participatory design. Des Stud 24(6):523–535.
- Lyotard, J.-F. 1984. The Post-Modern Condition: A Report on Knowledge. Minneapolis, MN: University of Minnesota Press.
- Maarleveld, M., L. Volker, and D. J. M. van der Voordt. 2009. Measuring employee satisfaction in new offices—The WODI toolkit. J Facil Manag 7(3):181–197.
- MacLean, A., K. Carter, L. Lovstrand, and T. Moran. 1990. User-tailorable systems: Pressing the issues with buttons. In Proceedings of CHI '90. Seattle, WA: ACM.
- Madsen, K. H. 1999. *Commun ACM* special issue on usability in Scandinavia and the US. 42(5).
- Madsen, K. H., and P. Aiken. 1993. Experiences using cooperative interactive storyboard prototyping. Commun ACM 36(6):57–64.
- Maher, M. L., S. J. Simoff, and G. C. Gabriel. 2000. Participatory design and communication in virtual environments. In Proceedings of PDC 2000. New York: CPSR.
- Massimi, M. 2006. A context-aware mobile phone for remembering names and faces. Position paper for CHI 2006 workshop. In Designing Technology for People with Cognitive Impairments. Montréal, Canada. ACM.
- Massimi, M. 2007. Participatory Design of Mobile Phone Software for Seniors. Master's thesis. Toronto, Ontario, Canada: University of Toronto.
- Massimi, M., and R. Baeker. 2006. Participatory design process with older users. In Proceedings of Ubicomp 2006 Workshop on Future Networked Interactive Media Systems and Services for the New-Senior Communities. ACM.
- Massimi, M., R. Baeker, and M. Wu. 2007. Using participatory activities with seniors to critique, build, and evaluate mobile phones. In Proceedings of ASSETS 2007, 155–162. Tempe, AZ. ACM.
- Mattelmäki, T., and K. Batarbee. 2002. Empathy probes. In Proceedings of PDC 2002. Malmö: CPSR.
- Mazzone, E., J. Read, and R. Beale. 2008. Design with and for disaffected teenagers. In Proceedings: NordiCHI 2008, 290–297. New York: ACM.
- McLagan, P., and C. Nel. 1995. The Age of Participation: New Governance for the Workplace and the World. San Francisco, CA: Berrett-Koehler.

- McPhail, B., T. Costantino, D. Bruckmann, R. Barclay, and A. Clement. 1998. CAVEAT exemplar: Participatory design in a non-profit volunteer organization. *Comput Support Coop Work* 7: 223–241.
- Merkel, C. B., L. Xiao, U. Farooq, C. H. Ganoe, R. Lee, J. M. Carroll, and M. B. Rosson. 2004. Participatory design in community computing contexts: Tales from the field. In *Proceedings of PDC 2004*. Toronto, ON: CPSR.
- Miller, D. S., M. J. Muller, and J. G. Smith. 1995. TelePICTIVE: Computer-supported collaborative GUI design for designers with diverse expertise. In *Groupware for Real Time Drawing: A Designer's Guide*, ed. S. Greenberg, S. Haynes, and R. Rada. New York: McGraw-Hill.
- Moffatt, K., J. McGrenere, B. Purves, and M. Klawe. 2004. The participatory design of a sound an image enhanced daily planner for people with aphasia. In *Proceedings of CHI 2004*. Portland, OR: ACM.
- Monk, A., and S. Howard. 1998. The rich picture: A tool for reasoning about work context. *Interactions* 2: 21–30.
- Moore, J. M. 2003. Communicating requirements using end-user GUI constructions with argumentation. In *Proceedings of IEEE Conference on Automated Software Engineering*, 360–363. Montréal, Canada: IEEE.
- Muller, M. J. 1992. Retrospective on a year of participatory design using the PICTIVE technique. In *Proc. CHI 1992*, 455–462. New York: ACM.
- Muller, M. J., eds. 1994. *CPSR Newsletter* 12(3). Participatory design issue.
<http://cpsr.org/prevsite/publications/newsletters/old/1990s/Summer1994.txt/>.
- Muller, M. J. 1997a. Ethnocritical heuristics for reflecting on work with users and other interested parties. In *Computers in Context and Design*, ed. M. Kyng and L. Matthiessen. Cambridge, MA: MIT Press.
- Muller, M. J. 1997b. Translation in HCI: Formal representations for work analysis and collaboration. In *Proceedings of CHI 97*. Atlanta, GA: ACM.
- Muller, M. J. 1999a. *Catalogue of Scenario-Based Methods and Methodologies*. Lotus Research Technical Report 99–06.
<http://www.research.ibm.com/cambridge>, under "Papers." Accessed November 28, 2011.
- Muller, M. J. 1999b. *Translation in HCI: Toward a Research Agenda*. Lotus Research Technical Report 99–05.
<http://www.research.ibm.com/cambridge>, under "Papers." Accessed November 28, 2011.
- Muller, M. J. 2001. Layered participatory analysis: New development in the CARD technique. In *Proceedings of CHI 2001*. Seattle, WA: ACM.
- Muller, M. J., J. L. Blomberg, K. Carter, E. A. Dykstra, J. Greenbaum, and K. Halskov Madsen. 1991. Panel: Participatory design in Britain and North America: Responses to the "Scandinavian challenge." In *Proceedings of CHI'91*. New Orleans, LA: ACM.
- Muller, M. J., R. Carr, C. A. Ashworth, B. Diekmann, C. Wharton, C. Eickstaedt, and J. Clonts. 1995a. Telephone operators as knowledge workers: Consultants who meet customer needs. In *Proceedings of CHI'95*. Denver, CO: ACM.
- Muller, M. J., J. D. Hallewell Haslwanter, and T. Dayton. 1997. Participatory practices in the software lifecycle. In *Handbook of Human–Computer Interaction*, ed. M. Helander, T. Landauer, and P. Prabhu. Amsterdam: Elsevier.
- Muller, M. J., and S. Kuhn, eds. 1993. *Commun ACM* special issue on participatory design 36(6).
- Muller, M. J., L. G. Tudor, D. M. Wildman, E. A. White, R. W. Root, T. Dayton, R. Carr, B. Diekmann, and E. A. Dykstra-Erickson. 1995b. Bifocal tools for scenarios and representations in participatory activities with users. In *Scenario-Based Design for Human–Computer Interaction*, ed. J. Carroll. New York: Wiley.
- Muller, M. J., E. A. White, and D. M. Wildman. 1993. Taxonomy of PD practices: A brief practitioner's guide. *Commun ACM* 36(6):26–28.
- Muller, M. J., D. M. Wildman, and E. A. White. 1994. Participatory design through games and other group exercises. In *Tutorial at CHI '94 Conference*. Boston, ACM.
- Mumford, E. 1983. Designing Human Systems for New Technology: The ETHICS Method. Manchester, U.K.: Manchester Business School.
- Mumford, E., and D. Henshall. 1979/1983. Designing Participatively: A Participative Approach to Computer Systems Design. Sandbach, U.K.: Manchester Business School.
- Mørch, A. I., B. K. Engen, and H. R. H. Åsand. 2004. The workplace as a learning laboratory: The winding road to e-learning in a Norwegian service company. In *Proceedings of PDC 2004*. Toronto, ON: CPSR.
- Naghsh, A. M., K. Danielsson, G. Fischer, T. Bratteteig, J. Blomberg, and J. A. Nocera. 2008. Distributed participatory design. In *CHI 2008 Extended Abstracts*, 3953–3956. Florence, IT: ACM.
- Nielsen, J., and M. Bødker. 2009. Collaborating with users: Cultural and (i)literacy challenges. In *Proceedings of OZCHI 2009*, 325–328. Melbourne, Australia: IEEE.
- Nisonen, E. 1994. Women's safety audit guide: An action plan and a grass roots community development tool. *CPSR Newsletter* 12(3), Summer, 1994. <http://www.cpsr.org/publications/newsletters/issues/1994/Summer1994/nisonen.html>.
- Noble, A., and C. Robinson. 2000. For the love of the people: Participatory design in a community context. In *Proceedings of CoDesigning 2000*. London: Springer.
- Nordichi. 2006. <http://www.nordichi.org>. Accessed November 28, 2011.
- Noro, K., and A. S. Imada, ds. 1991. *Participatory Ergonomics*. London: Taylor & Francis.
- Nygaard, K. 1975. Kunnskaps-strategi for fagbevegelsen (Knowledge strategy for trade unions). *Nordisk Forum* 6 10(2): 15–27.
- Nygaard, K., and P. Sørgaard. 1987. The perspective concept in informatics. In *Computers and Democracy: A Scandinavian Challenge*, ed. G. Bjerknes, P. Ehn, and M. Kyng. Brookfield, VT: Gower.
- O'Connor, C., G. Fitzpatrick, M. Buchannon-Dick, and J. McKeown. 2006. Exploratory prototypes for video: Interpreting PD for a complexly disabled participant. *Proceedings of NORDICHI 2006*, 232–241. Oslo, <http://www.sciweavers.org/conference/nordichi-2006>.
- Olsson, E. 2004. What active users and designers contribute in the design process. *Interact Comput* 16(2):377–401.
- Orr, J., and N. C. Crowfoot. 992. Design by anecdote—The use of ethnography to guide the application of technology to practice. In *PDC '92: Proceedings of the Participatory Design Conference*. Cambridge, MA: CPSR.
- Önder, D., and V. Der. 2007. A criteria for increasing quality in housing area: User participation. In *Proceedings of ENHR 2007*. Rotterdam.
- Patton, J. W. 2000. Picturing commutes: Informant photography and urban design. In *Proceedings of PDC 2000*. New York: CPSR.
- Pecknold, K. 2009. Dialogue through design: Visual communication across cultures. In *Proceedings of Creativity and Cognition*, 239–244. Berkeley, CA: ACM.
- Pedell, S. 2004. Picture scenarios: An extended scenario-based method for mobile appliance design. In *Proceedings of OZCHI'04*.
- Pedersen, J., and J. Buur. 2000. Games and moves: Towards innovative codesign with users. In *Proceedings of CoDesigning 2000*. London: Springer.

- Peeters, M. A. G., H. F. J. M. von Tuijl, and I. M. M. Reyman. 2008. *Small Group Res* 4(39):438–467.
- Pew, R. W., and A. Mavor. 2007. *Human-System Integration in the System Development Process: A New Look*. Washington, DC: National Academies Press.
- Rashid, A., D. Meder, J. Wiesenberger, and A. Behm. 2006. Visual requirement specification in end-user participation. In *Proceedings of International Workshop on Multimedia Requirements Engineering*. Washington, DC: IEEE.
- Reid, F. J. M., and S. E. Reed. 2000. Interaction and entrainment in collaborative design meetings. In *Proceedings of CoDesigning 2000*. London: Springer.
- Rettig, M. 1994. Prototyping for tiny fingers. *Commun ACM* 37(4):21–27.
- Reyman, I. M. M. J., J. M. Whyte, and C. H. Dorst. 2005. Users, designers and dilemmas of expertise. In *Proceedings of Include 2005*, London: Royal College of Art.
- Robertson, T. 1996. Participatory design and participative practices in small companies. In *Proceedings of PDC 96*. Cambridge, MA: CPSR.
- Robertson, T. 1998. Shoppers and tailors: Participative practices in small Australian design companies. *Comput Support Coop Work* 7(3–4):205–221.
- Robertson, J. 2002. Experiences of designing with children and teachers in the StoryStation project. In *Proceedings of Interaction Design and Children 2003: Small Users—Big Ideas*, 29–41. ACM.
- Saarinen, T., and M. Sääksjarvi. 1990. The missing concepts of user participation: An empirical assessment of user participation and information system success. *Scandinavian Journal of Information Systems* 2(1):25–42.
- Salvador, T., and K. Howells. 1998. Focus troupe: Using drama to create common context for new product concept end-user evaluations". In *Proceedings of CHI '98*. Los Angeles: ACM.
- Salvador, T., and S. Sato. 1998. Focus troupe: Mini-workshop on using drama to create common context for new product concept end-user evaluations. In *Proceedings of PDC '98*. Seattle, WA: CPSR.
- Salvador, T., and S. Sato. 1999. Methods tools: Playacting and focus troupes: Theater techniques for creating quick, intense, immersive, and engaging focus group sessions." *Interactions* 6(5):35–41.
- Sanders, E. B.-N. 2000. Generative tools for co-designing. In *Proceedings of CoDesigning 2000*. London: Springer.
- Sanders, E. N. 2006. Scaffolds for building everyday creativity. In *Design for Effective Communications: Creating Contexts for Clarity and Meaning*, ed. J. Frascara. New York: Allworth Press.
- Sanders, E. B.-N., and R. J. Branaghan. 1998. Participatory expression through image collaging: A learning-by-doing experience. In *Proceedings of PDC 98*. Seattle, WA: CPSR.
- Sanders, E. B.-N., and E. H. Nutter. 1994. Velcro-modeling and projective expression: Participatory design methods for product development. In *PDC '94: Proceedings of the Participatory Design Conference*. Chapel Hill, NC: CPSR.
- Schuler, D., and A. Namioka, eds. 1993. *Participatory Design: Principles and Practices*. Hillsdale, NJ: Erlbaum.
- Scrivener, S. A. R., L. J. Ball, and A. Woodcock. 2000. *Collaborative Design: Proceedings of Co-Designing 2000*. London, U.K.: Springer.
- Segall, P., and L. Snelling. 1996. Achieving worker participation in technological change: The case of the flashing cursor. In *Proceedings of PDC 96*. Cambridge, MA: CPSR.
- Segalowitz, M., and M. Brereton. 2009. An examination of the knowledge barriers in participatory design and the prospects for embedded research. In *Proceedings of OZCHI 2009*, 337–340. Melbourne, Australia: IEEE.
- Shallwani, S., and S. Mohammed. 2007. *Community-Based Participatory Research: A Training Manual for Community-Based Researchers*. Aga Khan University Human Development Programme.
- Shilton, K., N. Ramanathan, S. Reddy, V. Samanta, J. Burke, D. Estrin, M. Hansen, and M. Srivastava. 2008. Participatory design of sensing networks: Strengths and challenges. In *Proceedings of PDC 2008*, 282–285. Bloomington, IN. Indianapolis, IN: Indiana University.
- Silverstone, R., and L. Haddon. 1998. Design and the domestication of information and communication. In *Communication by Design: The Politics of Information and Communication Technologies*, ed. R. Mansell, and R. Silverstone, 44–74. Oxford, U.K.: Oxford University Press.
- Slater, J. 1998. Professional misinterpretation: What is participatory design? In *Proceedings of PDC 98*. Seattle, WA: CPSR.
- Spencer, L. J. 1989. *Winning Through Participation: Meeting the Challenge of Corporate Chance with the Technology of Participation*. Dubuque, IA: Kendall/Hunt.
- Stappers, P. J., H. van Rijn, S. C. Kirtemaker, A. E. Hennick, and F. Sleeswijk Visser. 2009. Designing for other people's strengths and motivations: Three cases using context, visions, and experiential prototypes. *Adv Eng Inf* 23(2):174–183.
- Star, S. L., and J. R. Griesemer. 1989. Institutional ecology, "translations," and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907–39. *Soc Stud Sci* 19: 387–420.
- Suchman, L., ed. 1995. Representations of work [Special issue]. *Commun ACM* 38(9).
- Suchman, L. 2002. Located accountabilities in technology production. *Scand J Inf Syst* 14(2):91–105.
- Suchman, L., and R. Trigg. 1991. Understanding practice: Video as a medium for reflection and design. In *Design at Work: Cooperative Design of Computer Systems*, ed. J. Greenbaum and M. Kyng. Hillsdale, NJ: Erlbaum.
- Svanæs, D., and G. Seland. 2004. Putting the users center stage: Role playing and low-fi prototyping enable end users to design mobile systems. In *Proceedings of CHI 2004*. Vienna, Austria: ACM.
- Taxén, G. 2004. Introducing participatory design in museums. In *Proceedings of the Eighth Conference on Participatory Design: Artful Integration: Interweaving Media, Materials and Practices*, 204–213. New York: ACM.
- Taylor, N., and K. Cheyerst. 2009. Social interaction around a rural community photo display. *Int J Hum Comput Stud* 67(12): 1037–1047.
- Thackara, J. 2000. Edge effects: The design challenge of pervasive interface. Plenary presentation at CHI 2000.
- Titlestad, O. H., K. Staring, and J. Braa. 2009. Distributed development to enable user participation: Multilevel design in the HISp network. *Scand J Inf Syst* 21(1):27–50.
- Triantafyllakos, G., G. Palaiogeorgiou, and I. A. Tsoukalas. 2010. Fictional characters in participatory design sessions: Introducing the "design alter egos" technique. *Interact Comput* 22(3): 165–175.
- Trigg, R. H. 2000. From sandbox to "fundbox": Weaving participatory design into the fabric of a busy non-profit. In *Proceedings of PDC 2000*. New York: CPSR.
- Tscheligi, M., S. Houde, A. Marcus, K. Mullet, M. J. Muller, and R. Kolli. 1995. Creative prototyping tools: What interaction designers really need to produce advanced user interface concepts. In *CHI'95 Conference Companion*. Denver, CO: ACM.

- Tschudy, M. W., E. A. Dykstra-Erickson, and M. S. Holloway. 1996. PictureCARD: A storytelling tool for task analysis. In PDC'96 Proceedings of the Participatory Design Conference. Cambridge, MA: CPSR.
- Tudor, L. G., M. J. Muller, T. Dayton, and R. W. Root. 1993. A participatory design technique for high-level task analysis, critique, and redesign: The CARD method. In Proceedings of the HFES'93. Seattle, WA: Human Factors and Ergonomics Society.
- Törpel, B., and M. Poschen. 2002. Improving infrastructures by transforming narratives. In Proceedings of PDC 2002. Malmö: CPSR.
- Vaajakallio, K., and T. Mattelmäki. 2007. Collaborative design exploration: Envisioning future practices with make tools. In Proceedings of Designing Pleasurable Products and Interfaces, 223–238. Helsinki, Finland: ACM.
- Van den Besselaar, P., A. Clement, and P. Jaervinen. 1991. Information System, Work and Organization Design. Amsterdam: North-Holland.
- van den Besselaar, P., J. Greenbaum, and P. Mambrey. 1996. Unemployment by design: Participatory design and the changing structure of the workforce in the information society. In Proceedings of PDC 96. Cambridge, MA: CPSR.
- von Hippel, E. 2002. Horizontal *Innovation Networks—By and For Users*. MIT Sloan School of Management Working Paper No 4366–02 (web.mit.edu/evhippel/www/papers/UserInnovNetworksMgtSci.pdf).
- Wakkary, R., and K. Tanenbaum. 2009. A sustainable identity: The creativity of an everyday designer. In Proceedings of CHI 2009, 365–374. Boston, MA: New York: ACM.
- Wang, C., M. A. Burris, and X. Y. Ping. 1996. Chinese village women as visual anthropologists: A participatory approach to reaching policymakers. *Soc Sci Med* 42(10): 1391–1440.
- Warr, A. 2006. Situated and distributed design. In NordiCHI Workshop on Distributed Participatory Design. Oslo, Norway: ACM.
- Warr, A., and E. O'Neill. 2005. Understanding design as a social creative process. In Proceedings of Conference on Creativity and Cognition, 12–15. London, United Kingdom: ACM.
- Winner, L. 1994. Political artifacts in Scandinavia: An american perspective. *Scand J Inf Syst* 6(2):85–94.
- Winters, N., and Y. Mor. 2008. IDR: A participatory methodology for interdisciplinary design in technology enhanced learning. *Comput Educ* 50(2):579–600.
- Wixon, D., and J. Ramey, eds. 1996. Field Methods Casebook for Software Design. New York: Wiley.
- Wu, M., R. Baecker, and B. Richards. 2005. Participatory design of an orientation aid for amnesics. In Proceedings of CHI 2005. Portland, OR: ACM.
- Wu, M., B. Richard, and R. Baecker. 2004. Participatory design with individuals who have amnesia. In Proceedings of PDC 2004. Toronto, ON: CPSR.
- Xie, B., A. Druin, J. Fails, S. Massey, E. Golub, S. Franckel, and K. Schneider. (In press). Connecting generations: Developing co-design methods for older adults and children. *Behav Inf Technol*.
- Yamauchi, Y. 2009. Power of peripheral designers: How users learn to design. In Proceedings of 4th International Conference on Design Science Research in Information Systems and Technology. Philadelphia, PA, (unpaged electronic edition): ACM.
- Yu, Y., and Z. Liu. 2006. Integrated scenario-based design method for inclusive online teaching system. In Proceedings of International Conference on Computational Intelligence for Modeling Control and Automation. Sydney, Australia: IEEE.

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- Calvary, G., J. Coutaz, and D. Thevenin. 2001. A unifying reference framework for the development of plastic user interfaces. In Proceedings of EHCI2001 Conference, 173–192. Berlin: Springer LNCS 2254.
- Clerckx, T., C. Vandervelpen, K. Luyten, and K. Coninx. 2008. A task-driven user-interface architecture for ambient intelligent environments. In Proceedings of the IUI 2008 Conference, 309–311. New York: ACM.
- Cockton, G. 1993. Spaces and distances—Software architecture and abstraction and their relation to adaptation. In Adaptive User Interfaces—Principles and Practice, 79–108. Amsterdam: Elsevier Science.
- Collignon, B., J. Vanderdonckt, and G. Calvary. 2008. Model-driven engineering of multi-target plastic user interfaces. In Proceedings of the Fourth International Conference on Autonomic and Autonomous Systems, ICAS '08, ed. D. Greenwood, M. Grottko, H. Lutfiyaa and M. Popescu, 16–21. March 2008, Gosier, Guadeloupe. Los Alamitos, CA: IEEE Computer Society. 2008, ISBN 978-0-7695-3093-2.
- Hartson, H. R., A. C. Siochi, and D. Hix. 1990. The UAN: A user-oriented representation for direct manipulation interface design. *ACM Trans Inf Syst* 8(3): 181–203.
- Hill, R. 1986. Supporting concurrency, communication and synchronisation in human-computer interaction—The Sassafras UIMS. *ACM Trans Graph* 5(3):289–320.
- Hoare, C. A. R. 1978. Communicating sequential processes. *Commun ACM* 21(8):666–677.
- Johnson, P., H. Johnson, P. Waddington, and A. Shouls. 1988. Task-related knowledge structures: Analysis, modeling, and applications. In People and Computers: From Research to Implementation—Proceedings of HCI '88, ed. D. M. Jones, and R. Winder, 35–62. Cambridge, MA: Cambridge University Press.
- Kiczales, G., J. Lamping, A. Mendhekar, C. Maeda, C. Lopes, J. M. Loingtier, and J. Irwin. 1997. Aspect-oriented programming. In Proceedings of the European Conference on Object-Oriented Programming, 1241:220–242. Berlin: Springer LNCS.
- Kobsa, A., and W. Pohl. 1995. The user modelling shell system BGP-MS. *User Modell User-Adapted Interact* 4(2):59–106.
- Marcus, A. 1996. Icon design and symbol design issues for graphical interfaces. In International User Interfaces, ed. E. Del Galdo, and J. Nielsen, 257–270. New York: John Wiley and Sons.
- Mens, T., and T. Tourwe. 2004. A survey of software refactoring. *IEEE Trans Softw Eng* 30(2):126–139.
- Opdyke, W. 1992. *Refactoring: A Program Restructuring Aid in Designing Object-Oriented Application Frameworks*. Ph.D. thesis, University of Illinois at Urbana-Champaign.
- Saldarini, R. 1989. Analysis and design of business information systems. In Structured Systems Analysis, 22–23. New York: MacMillan Publishing.
- Savidis, A. 2004. Dynamic software assembly for automatic Deployment-Oriented adaptation. *Elsevier Electron Notes Theor Comput Sci (ENTCS)* 127(3):207–217.

- Savidis, A., C. Stephanidis, and D. Akoumianakis. 1997. Unifying toolkit programming layers: A multi-purpose toolkit integration module. In Proceedings of the 4th Eurographics Workshop on Design, Specification and Verification of Interactive Systems (DSV-IS '97), Granada, Spain, June 4–6, ed. M. D. Harrison and J. C. Torres, 177–192. Berlin: Springer-Verlag.
- Savidis, A., and C. Stephanidis. 2004. Unified user interface design: Designing universally accessible interactions. *Int J Interact Comput* 16: 243–270.
- Savidis, A., and C. Stephanidis. 2005. Distributed interface bits: Dynamic dialogue composition from ambient computing resources. *ACM-Springer J Pers Ubiquitous Comput* 9(3): 142–168.
- Savidis, A., and C. Stephanidis. 2010. Software refactoring process for adaptive user-interface composition. In Proceedings of the ACM SIGCHI Symposium on Engineering Interactive Computing Systems (EICS 2010), 19–23 June 2010, Berlin, Germany, 19–28. New York: ACM Press.
- Stephanidis, C., A. Paramythios, M. Sfyrakis, and A. Savidis. 2001. A case study in unified user interface development: The AVANTI Web Browser. In User Interfaces for All, ed. C. Stephanidis, 525–568. Mahwah, NJ: Lawrence Erlbaum Associates.
- Wen, Z., M. Zhou, and V. Aggarwal. 2007. Context-aware adaptive information retrieval for investigative tasks. In IUI 2008, 122–131. New York: ACM.
- Wirfs-Brock, R., and A. Mc Kean. 2003. Object Design: Roles, Responsibilities, and Collaborations. Boston, MA: Addison-Wesley.

Usability + Persuasiveness + Graphic Design = eCommerce User Experience

- Bias, R., and D. J. Mayhew. 2005. Cost Justifying Usability—An Update for the Internet Age. San Francisco, CA: Morgan Kaufmann Publishers, Inc.
- Rohn, J. 2005. Cost justifying usability in vendor companies. In Cost Justifying Usability—An Update for the Internet Age, ed. R. Bias and D. J. Mayhew, 185–214. San Francisco, CA: Morgan Kaufmann Publishers, Inc.

Human–Computer Interaction and Software Engineering for User Interface Plasticity

- Balakrishnan, R., and P. Baudisch. 2009. Special issue on ubiquitous multi-display environments. *Hum Comput Interact* 24 (1–2): 1–8. Philadelphia, PA: Taylor & Francis.
- Balme, L., A. Demeure, N. Barralon, J. Coutaz, and G. Calvary. 2004. CAMELEON-RT: A software architecture reference model for distributed, migratable, and plastic user interfaces, lecture notes in computer science. In Ambient Intelligence: Second European Symposium, EUSAIR 2004, Vol. 3295, ed. P. Markopoulos, B. Eggen, E. Aarts et al., 291–302. Eindhoven, the Netherlands: Springer-Verlag Heidelberg, ISBN: 3-540-23721-6.
- Bass, L., R. Faneuf, R. Little, N. Mayer, B. Pellegrino, S. Reed, R. Seacord, S. Sheppard, and M. Szczur. 1992. Arch, a metamodel for the runtime architecture of an interactive system. The UIMS developers workshop. *SIGCHI Bull* 24(1):32–37. ACM Publ.
- Berti, S., and F. Paternò. 2005. Migratory multimodal interfaces in multidevice environments. In Proceedings International Conference on Multimodal Interfaces (ICMI 05), 92–99. New York: ACM.
- Bézivin, J. 2004. In search of a basic principle for model driven engineering. *European Journal of the Informatics Professional* 5(2):21–24.
- Bézivin, J., G. Dupé, F. Jouault, G. Pitette, and J. Rougui. 2003. First experiments with the ATL transformation language: Transforming XSLT into Xquery. In 2nd OOPSLA Workshop on Generative Techniques in the context of Model Driven Architecture, Anaheim, CA, USA. <http://www.softmetaware.com/oopsla2003/mda-workshop.html>.
- Blumendorf, M., G. Leehmann, and S. Albayrak. 2010. Bridging models and systems at runtime to build adaptive user interfaces. In Proc. of the 2010 ACM SIGCHI Symposium on Engineering Interactive Computing Systems, EICS 2010, 9–18. New York: ACM.
- Bolt, R. 1980. Put that there": Voice and gesture at the graphics interface. In Proc. of the 7th International Conf. on Computer Graphics and Interactive Techniques, 262–270. New York: ACM.
- Bouillon, L., and J. Vanderdonckt. 2002. Retargeting web pages to other computing platforms. In Proceedings of IEEE 9th Working Conference on Reverse Engineering WCRE'2002 (Richmond, 29 October–1 November 2002), 339–348. Los Alamitos, CA: IEEE Computer Society Press.
- Bourguin, G., A. Lewandowski, and J.-C. Tarby. 2007. Defining task oriented component. In Proc. TAMODIA 2007, Lecture Notes in Computer Science 4849. 170–183. Berlin: Springer.
- Calvary, G., J. Coutaz, D. Thevenin, Q. Limbourg, N. Souchon, L. Bouillon, and J. Vanderdonckt. 2003. A unifying reference framework for multi-target user interfaces. *Interact Comput* 15(3):289–308. Elsevier Science B.V.
- Canfora, G., M. Di Penta, P. Lombardi, and M. L. Villani. 2009. Dynamic composition of web applications in human centered processes. In PESOS '09 Proceedings of the 2009 ICSE Workshop on Principles of Engineering Service Oriented Systems, 50–57. Washington, DC: IEEE Computer Society.
- Clerckx, T., C. Vandervelzen, and K. Coninx. 2007. Task-based design and runtime support for multimodal user interface distribution. In Proc. of Engineering Interactive Systems, Lecture Notes in Computer Science, LNCS 4940, 89–105. Berlin: Springer.
- Cockton, G. 2004. From quality in use to value in the world. In ACM Proceedings CHI 2004, Late Breaking Results, 1287–1290. New York: ACM.
- Cockton, G. 2005. A development framework for value-centred design. In ACM Proceedings CHI 2005. Late Breaking Results, 1292–5. New York: ACM.
- Coninx, K., K. Luyten, C. Vandervelzen, J. Van den Bergh, and B. Creemers. 2003. Dygimes: Dynamically generating interfaces for mobile computing devices and embedded Systems. In Proceedings of the 5th International Symposium, Mobile HCI, Lecture Notes in Computer Science, LNCS 2795, 256–270. Berlin: Springer.
- Coutaz, J. 1987. PAC, an implementation model for dialog design. In Proceedings of Interact'87, 431–436. Stuttgart North-Holland: Amsterdam.

- Coutaz, J. 2006. Meta user interfaces for ambient spaces. In Proc. TAMODIA 2006, 5th International Workshop on Task Models and Diagrams for User Interface Design TAMODIA'2006. Lecture Notes in Computer Science, LNCS 4385, Berlin: Springer.
- Coutaz, J., J. Crowley, S. Dobson, and D. Garlan. 2005. Context is key. *Commun ACM* 48(3):49–53. ACM Publ.
- Coutaz, J., L. Nigay, D. Salber, A. Blandford, J. May, and R. Young. 1995. Four easy pieces for assessing the usability of multimodal interaction: The CARE properties. In Proceedings of the INTERACT95, 115–120. Chapman&Hall Publ.
- Coyette, A., S. Faulkner, M. Kolp, Q. Limbourg, and J. Vanderdonckt. 2004. SketchiXML: Towards a multi-agent design tool for sketching user interfaces based on USIXML. In Proceedings of the 3rd Annual Conference on Task Models and Diagrams, TAMODIA 2004. Prague, Czech Republic. New York: ACM.
- Demeure, A., G. Calvary, K. Koninx. 2008. A software architecture style and an interactors toolkit for plastic user interfaces. In Proceeding of the 15th International Workshop DSV-IS 2008, LNCS, 225–237. Berlin: Springer.
- Dey, A. K. 2001. Understanding and using context. *J Pers Ubiquitous Comput* 5:4–7. Springer London.
- Dourish, P. 2001. Where the Action Is: The Foundation of Embodied Interaction. Cambridge, MA: MIT Press.
- Duarte, C., and L. Carriço. 2006. A conceptual framework for developing adaptive multimodal applications. In Proc. of the 11th International Conference on Intelligent User Interfaces, IUI'06, 132–139. New York: ACM.
- Elrad, T., R. Filman, and A. Bader. 2001. Aspect oriented programming. Special issue. *Commun ACM* 44(10):28–95.
- Favre, J. M. 2004a. *Foundations of Model (Driven) (Reverse) Engineering*. Dagstuhl Seminar on Language Engineering for Model Driven Development, DROPS. Internationales Begegnungs-und Forschungszentrum für Informatik (IBFI), Schloss Dagstuhl, Germany <http://drops.dagstuhl.de/portals/04101>.
- Favre, J. M. 2004b. Foundations of the Meta-Pyramids: Languages and Meta-Models. DROPS. Internationales Begegnungs-und Forschungszentrum für Informatik (IBFI), Schloss Dagstuhl, Germany <http://drops.dagstuhl.de/portals/04101>.
- Ferry, N., G. Hourdin, S. Lavirotte, G. Rey, J.-Y. Tigli, and M. Riveill. 2009. Models at runtime: Service for device composition and adaptation. In *4th International Workshop Models@run.time, Models 2009 (MRT'09)* http://sunsite.informatik.rwth-aachen.de/Publications/CEUR-WS/Vol-509/MRT09_proceedings.pdf#page=55.
- Gajos, K., J. Wobbrock, and D. Weld. 2008. Improving the performance of motor-impaired users with automatically-generated, ability-based interfaces. In CHI '08: Proceeding of the Twenty-Sixth Annual SIGCHI Conference on Human Factors in Computing Systems, 1257–1266. New York: ACM.
- Gaver, W., J. Bowers, A. Boucher, S. Pennington, and N. Villar. 2006. The History tablecloth: Illuminating domestic activity. In Proceedings of the 6th Conference on Designing Interactive Systems, 199–208. New York: ACM.
- Han, R., V. Perret, and M. Naghshineh. 2000. WebSplitter: A unified XML framework for multi-device collaborative web browsing. In ACM Conference on Computer Supported Cooperative Work (CSCW 2000), 221–230. New York: ACM.
- Harrison, C., T. Desney, and D. Morris. 2010. Skinput: Appropriating the body as an input surface. In Proceedings of CHI'10, the 28th International Conference on Human Factors in Computing Systems, 453–462. New York: ACM.
- Hartson, R., A. Siochi, and D. Hix. 1990. The UAN: A user-oriented representation for direct manipulation interface designs. *ACM Trans Inf Syst (TOIS)* 8(3):181–203.
- Hayes, P. J., P. Szekely, and R. A. Lerner. 1985. Design alternatives for user interface management systems based on experience with COUSIN. In Proceedings of the ACM Conference on Human Factors in Computing Systems CHI'85, 169–175. San Francisco, CA. New York: ACM.
- Kieffer, S., A. Coyette, and J. Vanderdonckt. 2010. User interface design by sketching: A complexity analysis of widget representations. In Proc. of the 2010 New York: ACM SIGCHI Symposium on Engineering Interactive Computing Systems, 57–66. New York: ACM.
- Krasner, G. E., and S.T. Pope. 1988. A cookbook for using the model-view-controller user interface paradigm in smalltalk-80. *J Object Oriented Program (JOOP)* 1(3):26–49.
- Kurtev, I., J. Bézivin, and M. Aksit. 2002. Technological spaces: An initial appraisal. In *International Conference on Cooperative Information Systems (CoopIS), DOA'2002 Federated Conferences, Industrial Track*, 30 Oct–1 Nov 2002, Irvine, CA. 1–6. <http://eprints.eemcs.utwente.nl/10206/>.
- Limbourg, Q. 2004. Multi-Path Development of User Interfaces. Belgium: PhD of University of Louvain La Neuve.
- Limbourg, Q., J. Vanderdonckt, B. Michotte, L. Bouillon, and V. Lopez-Jaquero. 2004. UsiXML: A language supporting multi-path development of user interfaces. In Proceedings of 9th IFIP Working Conference on Engineering for Human-Computer Interaction Jointly with 11th Int. Workshop on Design, Specification, and Verification of Interactive Systems, EHCI-DSVIS'2004, Lecture Notes in Computer Science, LNCS 3425. Hamburg, Germany. Berlin: Springer.
- Mens, T., K. Czamecki, and P. Van Gorp. 2005. A taxonomy of model transformations. In *Dagstuhl Seminar Proceedings 04101*. <http://drops.dagstuhl.de/opus/vol1texte/2005/11> Internationales Begegnungs-und Forschungszentrum für Informatik (IBFI), Schloss Dagstuhl, Germany.
- Merrill, D., J. Kalanithi, and P. Maes. 2007. Siftables: Towards sensor network user interfaces. In Proceedings of the 1st International Conference on Tangible and Embedded Interaction, TEI 2007. New York: ACM.
- Mistry, P., and P. Maes. 2009. SixthSense—A wearable gestural interface. In Proc. SIGGRAPH Asia 2009. Yokohama, Japan: Emerging Technologies.
- Mori, G., F. Paternò, and C. Santoro. 2002. CTTE: Support for developing and analyzing task models for interactive system design. *IEEE Trans Softw Eng* 28(8):797–813.
- Mori, G., F. Paternò, and C. Santoro. 2004. Design and development of multidevice user interfaces through multiple logical descriptions. *IEEE Trans Softw Eng* 30(8):507–520.
- Myers, B. 1990. Creating user interfaces using programming by example, visual programming, and constraints. *ACM Trans Program Lang Syst (TOPLAS)* 12(2): 143–177. ACM Publ.
- Myers, B. 2001. Using handhelds and PCs together. *Commun ACM* 44(11):34–41.
- Myers, B., S. Y. Park, Y. Nakano, G. Mueller, and A. Ko. 2008. How designers design and program interactive behaviors. In Proc. IEEE Symposium on Visual Languages and Human Centric Computing (VL/HCC), 177–184. IEEE Computer Society Press.
- Nielsen, J. 1993. Usability Engineering. London: Academic Press.
- Oreizy, P., M. Gorlick, R. Taylor, D. Heimbigner, G. Johnson, N. Medvidovic, A. Quilici, D. Rosenblum, and A. Wolf. 1999. An architecture-based approach to self-adaptive software. *IEEE Intell Syst* 14(3):54–62.
- Paganelli, L., and F. Paternò. 2003. A tool for creating design models from website code. *Int J Softw Eng Knowl Eng* 13(2): 169–189. World Scientific Publishing.

- Paternò, F. 1999. Model-Based Design and Evaluation of Interactive Applications. Berlin: Springer Verlag.
- Paternò, F. 2003. Concur task trees: An engineered notation for task models. In *The Handbook of Task Analysis for Human-Computer Interaction*, Chap. 24, ed. D. Diaper, and N. Stanton, 483–503. Mahwah, NJ: Lawrence Erlbaum Associates.
- Phanariou, C. 2000. UIML: a Device-Independent User Interface Markup Language. PhD Thesis, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, September 2000.
- Pietschmann, S., M. Voigt, and K. MeiBner. 2009. Dynamic composition of service-oriented web user interfaces. In Proc. of the 4th International Conf. on Internet and Web Applications and Services, ICIW 2009, 217–222. IEEE Computer Society Press.
- Ponnekanti, S., B. Lee, A. Fox, P. Hanrahan, and T. Winograd. 2001. Icrafter: A service framework for ubiquitous computing environments. In Proceedings Ubicomp 2001, ed. G. Abowd, B. Brumitt, and S. Shafer, 57–75, LNCS 2201, Berlin: Springer.
- Puerta, A., and J. Eisenstein. 2001. XIML: A common representation for interaction data. In Proceedings IUI01, 214–215. New York: ACM.
- Reignier, P., O. Brdiczka, D. Vaufreydaz, J. L. Crolwey, and J. Maisonnasse. 2007. Context aware environments: From specification to implementation. *Expert Syst J Knowl Eng* 5(24):304–320.
- Reignier, P., O. Brdiczka, D. Vaufreydaz, J. L. Crowley, and J. Maisonnasse. 2007. Contexte-aware environments: From specification to implementation. *Expert Syst J Knowl Eng* 24(5):305–320.
- Rekimoto, J. 1997. Pick and drop: A direct manipulation technique for multiple computer environments. In Proceedings of UIST97, 31–39. New York: ACM Press.
- Rey, G. 2005. *Le Contexte en Interaction Homme-Machine: Le Contexteur*. PhD Thesis. France: Université Joseph Fourier.
- Rosson, M. B., and J. Carroll. 2002. Usability Engineering Scenario-Based Development of Human Computer Interaction. Burlington, MA: Morgan Kaufmann.
- Savidis, A., and C. Stephanidis. 2010. Software refactoring process for adaptive user interface composition. In Proc. of the 2010 ACM SIGCHI Symposium on Engineering Interactive Computing Systems, EICS 2010, 19–28. New York: ACM.
- Schulert, A. J., G. T. Rogers, and J. A. Hamilton. 1985. ADM-A dialogue manager. In Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI'85), 177–183. San Francisco, CA. New York: ACM.
- Shackel, B. 1984. The concept of usability. In *Visual Display Terminals: Usability Issues and Health Concerns*, ed. J. Bennett et al. Englewood Cliffs, NJ: Prentice-Hall, ISBN 0-13-942482-2.
- Smith, D. C. 1993. Pygmalion: An executable electronic blackboard. In “Watch What I Do”, A. Cypher, Chap 1. Cambridge, MA: MIT Press.
- Sottet, J.-S. 2008. Méga-IHM: Malléabilité des Interfaces Homme-Machine Dirigée par les Modèles. PhD Thesis, Université Joseph Fourier, Grenoble.
- Sottet, J.-S., G. Calvary, J. Coutaz, and J.-M. Favre. 2007. A model-driven engineering approach for the usability of user interfaces. In Proc. Engineering Interactive Systems (EIS2007), ed. J. Gulliksen et al., 140–157. LNCS 4940. Berlin: Springer.
- Sottet, J.-S., G. Calvary, and J.-M. Favre. 2006. *Models at Runtime for Sustaining user Interface Plasticity*. Int Models@run.time workshop, in conjunction with MODELS/UML.
- Stephanidis, C., and A. Savidis. 2001. Universal access in the information society: Methods, tools, and interaction technologies. *J Univers Access Inf Soc UAIS* 1(1):40–55.
- Streitz, N., J. Geibler, T. Holmer, S. Konomi, C. Müller-Tomfelde, W. Reischl, P. Rexroth, P. Seitz, and R. Steinmetz. 1999. i-LAND: An interactive landscape for creativity and innovation. In Proceedings of the ACM Conference on Human Factors in Computer Human Interaction (CHI99), 120–127. New York: ACM.
- Taleb, M., A. Seffah, and A. Abran. 2009. Interactive systems engineering: A pattern-oriented and model-driven architecture. In *Software Engineering Research and Practice*, 636–642. CSREA Press.
- Thevenin, D., and J. Coutaz. 1999. Plasticity of user interfaces: Framework and research agenda. In Proceedings Interact99, ed. A. Sasse, and C. Johnson, 110–117. Edinburgh: IFIP IOS Press.
- Vanderdonckt, J., and P. Berquin. 1999. Towards a very large model-based approach for user interface development. In Proc. of 1st Int. Workshop on User Interfaces to Data Intensive Systems UIDIS'99 (Edinburg, 5-6 September 1999), ed. N. W. Paton, and T. Griffiths, 76–85. Los Alamitos, CA: IEEE Computer Society Press.
- Vanderdonckt, J., and F. Bodard. 1993. Encapsulating knowledge for intelligent automatic interaction objects selection. In Proceedings of the Joint ACM Conference on Human Factors in Computing Systems CHI and IFIP Conference on Human Computer Interaction INTERACT. Amsterdam, the Netherlands: ACM Press.
- Van Lamsweerde, A. 2009. *Requirements Engineering: From System Goals to UML Models to Software Specifications*. 2009.
- Winograd, T. 2001. Architectures for context. *Hum Comput Interact Spec Issue Context-Aware Comput* 16(2–4):401–420. Lawrence Erlbaum Associates.
- Yu, J., B. Benatallah, R. Saint-Paul, F. Casati, F. M. Daniel, and M. Matera. 2007. A framework for rapid integration of presentation components. In WWW'07 Proc. of the 16th International Conf. on World Wide Web, 923–932. New York: ACM.

Usability Testing

- Aboraya, A., E. Rankin, C. France, A. El-Missiry, and C. John. 2006. The reliability of psychiatric diagnosis revisited: The clinician's guide to improve the reliability of psychiatric diagnosis. *Psychiatry* 3(1):41–50.
- Albert, W., and D. Tedesco. 2010. Reliability of self-reported awareness measures based on eye tracking. *J Usability Stud* 5(2):50–64.
- Albert, W., T. Tullis, and D. Tedesco. 2010. Beyond the Usability Lab: Conducting Large-Scale Online User Experience Studies. Burlington, MA: Morgan Kaufmann Publishers.
- Als, B., J. Jensen, and M. Skov. 2005. Comparison of think-aloud and constructive interaction in usability testing with children. In Proceedings of the Conference on Interaction Design and Children, 9–16. (Boulder, CO), New York: The Association for Computing Machinery.
- Andre, T., R. Williges, and H. Hartson. 2003. The effectiveness of usability evaluation methods: Determining the appropriate criteria. In Proceedings of the Human Factors and Ergonomics Society, 43rd Annual Meeting, 1090–1094. (Denver, CO), Santa Monica, CA: The Human Factors and Ergonomics Society.
- Bailey, R. W., R. W. Allan, and P. Raiello. 1992. Usability testing vs. heuristic evaluation: A head-to-head comparison. In Proceedings of the Human Factors Society, 36th Annual Meeting, 409–413. (Atlanta, GA), Santa Monica, CA: The Human Factors Society.

- Betiol, A. H., and W. Cybis. 2005. Usability testing of mobile devices: A comparison of three approaches. In Proceedings of the Tenth IFIP TC13 International Conference on Human-Computer Interaction, 470–481. (Rome, Italy), The IFIP Technical Committee on Human-Computer Interaction.
- Birru, M. S., V. M. Monaco, L. Charles, H. Drew, V. Njie, T. Bierria, E. Detlefsen, and R. A. Steinman. 2004. Internet usage by low-literacy adults seeking health information: An observational analysis. *J Med Internet Res* 6(3):e25. www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1550604 (accessed November 29, 2011).
- Bojko, A. 2005. Eye tracking in user experience testing: How to make the most of it. In Proceedings of the Usability Professionals' Association Annual Meeting, 1–9. (Montreal, Canada), Bloomingdale, IL: The Usability Professionals' Association.
- Bojko, A. 2009. Informative or misleading? Heatmaps deconstructed. In Human-Computer Interaction, ed. J. Jacko, 30–39. Heidelberg, Germany: Springer-Verlag.
- Boren, M., and J. Ramey. 2000. Thinking aloud: Reconciling theory and practice. *IEEE Trans Prof Commun* 43(3):261–278.
- Branaghan, R. 1997. Ten tips for selecting usability test participants. *Common Ground* 7: 3–6.
- Burmeister, O. K. 2001. Usability testing: Revisiting informed consent procedures for testing Internet sites. In Second Australian Institute Conference on Computer Ethics, 3–9. (Sydney, Australia), Darlinghurst, Australia: The Australian Computer Society, Inc.
- Castillo, J. C., H. R. Hartson, and D. Hix. 1998. Remote usability evaluation: Can users report their own critical incidents? In Proceedings of Human Factors in Computing Systems, 253–354. (Los Angeles, CA), New York: The Association for Computing Machinery.
- Catani, M. B. 2003. Observation methodologies for usability tests of handheld devices. In Proceedings of The Usability Professionals' Association Annual Meeting, 1–6. (Scottsdale, AZ), Bloomingdale, IL: The Usability Professionals' Association.
- Chisnell, D., A. Lee, and J. Redish. 2005. *Recruiting and Working with Older Participants*. American Association of Retired Persons. www.aarp.org/olderviswired/owww-features/Articles/a2004-03-03-recruiting-participants.html (accessed October 13, 2005).
- Coyne, K. P. 2005. Conducting simple usability studies with users with disabilities. In Proceedings of HCI International, 890–893. (Las Vegas, NV), Mahwah, NJ: Lawrence Erlbaum Associates.
- Desurvire, H. W., J. M. Kondziela, and M. E. Atwood. 1992. What is gained and lost when using evaluation methods other than empirical testing. In People and Computers VII, ed. A. Monk, D. Diaper, and M. D. Harrison, 89–102. Cambridge, MA: Cambridge University Press.
- Douglass, R., and K. Hylton. 2010. Get it RITE. *User Exp* 9: 12–13.
- Duh, H. B.-L., G. C. B. Tan, and V. H. Chen. 2006. Usability evaluation for mobile device: A comparison of laboratory and field tests. In Proceedings of the 8th Conference on Human-Computer Interaction with Mobile Devices and Services, 181–186. (Helsinki, Finland), New York: The Association for Computing Machinery.
- Dumas, J. 1998. Usability testing methods: Using test participants as their own controls. *Common Ground* 8: 3–5.
- Dumas, J. 2001. Usability testing methods: Think aloud protocols. In Design by People for People: Essays on Usability, ed. R. Branaghan, 119–130. Chicago, IL: Usability Professionals' Association.
- Dumas, J. 2003. Usability evaluation from your desktop. *Assn Inf Syst (AIS) SIGCHI Newsletter* 2(2):7–8.
- Dumas, J. 2007. The great leap forward: The birth of the usability profession (1988–1993). *J Usability Stud* 2(2):54–60.
- Dumas, J., and J. Fox. 2007. Usability testing: Current practice and future directions. In *The Human-Computer Interaction Handbook*, ed. J. Jacko and A. Sears 2nd ed., 1129–1149. Mahwah, NJ: Lawrence Erlbaum, Associates.
- Dumas, J., and B. Loring. 2008. Moderating Usability Tests: Principles and Practices for Interacting. San Francisco, CA: Morgan Kaufman.
- Dumas, J., and G. Redish. 1993. *A Practical Guide to Usability Testing* (1st ed.). London: Intellect Books.
- Dumas, J., and G. Redish. 1999. *A Practical Guide to Usability Testing* (Rev. ed.). London: Intellect Books.
- Ebling, M., and B. John. 2000. On the contributions of different empirical data in usability testing. In Proceedings of Designing Interactive Systems, 289–296. (Brooklyn, NY), New York: The Association for Computing Machinery.
- Eger, N., L. J. Ball, R. Stevens, and J. Dodd. 2007. Cueing retrospective verbal reports in usability testing through eye-movement replay. In People and Computers XXI—HCI ... but not as we know it: Proceedings of HCI 2007, ed. L. J. Ball, M. A. Sasse, C. Sas, T. C. Ormerod, A. Dix, P. Bagnall, and T. McEwan. Swindon: The British Computer Society.
- Ellis, K., M. Quigley, and M. Power. 2008. Experiences in ethical usability testing with children. *J Inf Technol Res* 1(3): 1–13.
- Ericsson, K. A., and H. A. Simon. 1993. *Protocol Analysis: Verbal Reports as Data*. Cambridge, MA: MIT Press.
- Evers, V. 2004. Cross-cultural applicability of user evaluation methods. A case study amongst Japanese, North-American, English and Dutch users. In Proceedings of Human Factors in Computing Systems, 740–741. (New Orleans, LA), New York: The Association for Computing Machinery.
- Faulkner, L. 2003. Beyond the five-user assumption: Benefits of increased sample sizes in usability testing. *Behav Res Methods Instrum Comput* 35(3):379–383.
- Frishberg, N. 2010. Agile and UX. *User Exp* 9: 4.
- Frøkjær, E., M. Hertzum, and K. Hornbæk. 2000. Measuring usability: Are effectiveness, efficiency, and satisfaction really correlated? In Proceedings of Human Factors in Computing Systems, 345–352. (Fort Lauderdale, FL), New York: The Association for Computing Machinery.
- Frøkjær, E., and K. Hornbæk. 2005. Cooperative usability testing: Complementing usability tests with user-supported interpretation sessions. In Proceedings of Human Factors in Computing Systems, 1383–1386. (Denver, CO), New York: The Association for Computing Machinery.
- Goldberg, J. H., and A. M. Wichansky. 2002. Eye tracking in usability evaluation: A practitioner's guide. In *The Mind's Eyes: Cognitive and Applied Aspects of Eye Movements*, ed. J. Hyönä, R. Radach, and H. Deubel, 493–516. Oxford: Elsevier Science.
- Gray, W., and M. Salzman. 1998. Damaged merchandise? A review of experiments that compare usability methods. *Hum Comput Interact* 13: 203–335.
- Grossnickle, M. M. 2004. How many users with disabilities should you include when conducting a usability test for accessibility? Idea Market presented at *The Usability Professionals' Association Annual Meeting* www.upassoc.org/usability_resources/conference/2004/im_martinson.html (accessed September 13, 2005).
- Hammersley, M., and P. Atkinson. 1995. *Ethnography: Principles in Practice*. London: Routledge.
- Hancock, P., A. Pepe, and L. Murphy. 2005. Hedonomics: The power of positive and pleasurable ergonomics. *Ergon Des* 13(1):8–14.
- Hanna, L., K. Risden, and K. J. Alexander. 1997. Guidelines for usability testing with children. *Interactions* 4: 9–14.
- Hartson, H. R., J. C. Castillo, J. Kelso, and W. Neale. 1996. Remote evaluation: The network as an extension of the usability laboratory. In Proceedings of Human Factors in Computing Systems, 228–235. (Vancouver, Canada), New York: The Association for Computing Machinery.

- Henry, S. L. 2007. Just ask. www.uiaccess.com/accessucd/index.html (accessed February 12, 2010).
- Hertzum, M., and N. E. Jacobsen. 2001. The evaluator effect: A chilling fact about usability evaluation methods. *Int J Hum Comput Interact* 13(4):421–443.
- Hornbæk, K., and E. Law. 2007. Meta-analysis of correlations among usability measures. In *Proceedings of Human Factors in Computing Systems*, 617–626. (San Jose, CA), New York: The Association for Computing Machinery.
- House, E. 1990. An ethics of qualitative field studies. In *The Paradigm Dialog*, ed. E. Gaba, 158–201. Newbury Park, CA: Sage.
- Information Technology Technical Assistance and Training Center (ITTATC), Georgia Institute of Technology. 2004. *Planning Usability Testing for Accessibility*. www.ittatc.org/technical/access-ucd/ut_plan.php (accessed September 13, 2005).
- Jacobsen, N., M. Hertzum, and B. E. John. 1998. The evaluator effect in usability studies: Problem detection and severity judgments. In *Proceedings of the Human Factors and Ergonomics Society*, 42nd Annual Meeting, 1336–1340. (Chicago, IL), Santa Monica, CA: The Human Factors and Ergonomics Society.
- Jordan, P. 2002. The personalities of products. In *Pleasure with Products*, ed. W. Green, and P. Jordan, 19–48. London: Taylor & Francis.
- Kaikkaner, A., A. Kekalainen, M. Canker, T. Kalliot, and A. Kankainen. 2005. Usability testing of mobile applications: A comparison between laboratory and field studies. *J Usability Stud* 1: 4–16.
- Karat, J. 2003. Beyond task completion: Evaluation of affective components of use. In *The Human-Computer Interaction Handbook*, ed. J. Jacko and A. Sears, 1152–1164. Mahwah, NJ: Lawrence Erlbaum, Assoc.
- Kjeldskov, J., and J. Stage. 2004. New techniques for usability evaluation of mobile systems. *Int J Hum Comput Stud* 60(5–6):599–620.
- Krahmer, E., and N. Ummelen. 2004. Thinking about thinking aloud: A comparison of two verbal protocols for usability testing. *IEEE Trans Prof Commun* 47(2):105–117.
- Krug, S. 2010. *Rocket Surgery Made Easy*. Berkeley, CA: New Riders.
- Law, C., and G. Vanderheiden. 2000. Reducing sample sizes when user testing with people who have and who are simulating disabilities: Experiences with blindness and public information kiosks. In *Proceedings of the IEA 2000/ HFES 2000 Congress*, 26, 157–160. (San Diego, CA), Santa Monica, CA: The Human Factors and Ergonomics Society.
- Lepistö, A., and S. Ovaska. 2004. Usability evaluation involving participants with cognitive disabilities. In *Proceedings of NordiCHI*, 305–308. (Tempere, Finland), New York: The Association for Computing Machinery.
- Lesaigne, E. M., and D. W. Biers. 2000. Effect of type of information on real-time usability evaluation: Implications for remote usability testing. In *Proceedings of the IEA 2000/HFES 2000 Congress*, 37, 585–588. (San Diego, CA), Santa Monica, CA: The Human Factors and Ergonomics Society.
- Lewis, J. 1994. Sample size for usability studies: Additional considerations. *Hum Fact* 36: 368–378.
- Lewis, J. 2001. Evaluation of procedures of adjusting problem discovery rates estimates from small samples. *Int J Hum Comput Interact* 71(1):57–78.
- Lindgaard, G., and J. Chatrattichart. 2007. Usability testing: What have we overlooked? In *Proceedings of Human Factors in Computing Systems*, 1415–1424. (San Jose, CA), New York: The Association for Computing Machinery.
- Lu, C., T. Rauch, and L. Miller. 2010. Agile teams: Best practices for agile development. *User Exp* 9: 6–10.
- Luef, B., and W. Cunningham. 2001. *The Wiki Way: Quick Collaboration on the Web*. Reading, MA: Addison-Wesley, Inc.
- Macklin, R. 1982. The problem of adequate disclosure in social science research. In *Ethical Issues in Social Science Research*, ed. T. Beauchamp, R. Faden, R. Wallace, and L. Walters, 193–214. Baltimore, MD: Johns Hopkins.
- Medlock, M., D. Wixon, M. McGee, and D. Welsh. 2005. The rapid iterative test and evaluation method: Better products in less time. In *Cost-Justifying Usability: An Update for the Information Age*, 489–517. New York: Morgan Kaufman Publishers.
- Millett, L. I., B. Friedman, and E. Felten. 2001. Cookies and web browser design: Toward realizing informed consent online. In *Proceedings of Human Factors in Computing Systems*, 46–52. (Seattle, WA), New York: The Association for Computing Machinery.
- Molich, R., N. Bevan, I. Curson, S. Butler, E. Kindlund, D. Miller, and J. Kirakowski. 1998. Comparative evaluation of usability tests. In *Proceedings of the Usability Professionals' Association Annual Meeting*. Bloomingdale, IL: The Usability Professionals' Association.
- Molich, R., and J. Dumas. 2008. Comparative usability evaluation (CUE-4). *Behav Inf Technol* 27(3):263–281.
- Molich, R., R. Meghan, K. Ede, and B. Karyukin. 2004. Comparative usability evaluation. *Behav Inf Technol* 23: 65–74.
- Murphy, E., R. Dingwall, D. Greatbatch, S. Parker, and P. Watson. 1998. Qualitative research methods in health technology assessment: A review of the literature. *Health Technol Assess* 2(16): 1–272.
- Murphy, L., K. Stanney, and P. Hancock. 2003. The effect of affect: The hedonic evaluation of human-computer interaction. In *Proceedings of the Human Factors and Ergonomics Society* 47th Annual Meeting, 764–767. Santa Monica, CA: The Human Factors and Ergonomics Society.
- Nielsen, J. 1992. Finding usability problems through heuristic evaluation. In *Proceedings of Human Factors in Computing Systems*, 373–380. (Monterey, CA), New York: The Association for Computing Machinery.
- Nielsen, J. 1996. *International Usability Testing*. www.useit.com/papers/intemational_usetest.html (accessed September 13, 2005).
- Nielsen. 2000. *Why you Only Need to Test with 5 Users*. www.useit.com/alertbox/20000319.html (accessed February 22, 2009).
- Nielsen, J., T. Clemmensen, and C. Yssing. 2002. Getting access to what goes on in people's heads: Reflections on the think-aloud technique. In *Proceedings of NordiCHI*, 101–110. (Aarhus, Denmark), New York: The Association for Computing Machinery.
- Norgaard, M., and K. Hornbaek. 2006. What do usability evaluators do in practice? An explorative study of think-aloud testing. In *Proceedings of Designing Interactive Systems*, 209–218. (University Park, PA), New York: The Association for Computing Machinery.
- Olmsted-Hawala, E., S. Hawala, E. Murphy, and K. Ashenfelter. 2010. Think-aloud protocols: A comparison of three think-aloud protocols for use in testing data-dissemination web sites for usability. In *Proceedings of Human Factors in Computing Systems*, 2381–2390. (Atlanta, GA), New York: The Association for Computing Machinery.
- Pagulayan, R., K. Keeker, D. Wixon, R. Romero, and T. Fuller. 2003. User-centered design in games. In *The Human-Computer Interaction Handbook*, ed. J. Jacko and A. Sears, 883–906. Mahwah, NJ: Lawrence Erlbaum, Assoc.
- Patel, M., and C. A. Paulsen. 2002. Strategies for recruiting children for usability tests. In *Proceedings of the Usability Professionals' Association Annual Meeting*, 1–4. (Orlando, FL), Bloomingdale, IL: The Usability Professionals' Association.
- Petrie, H., F. Hamilton, N. King, and P. Pavan. 2006. Remote usability evaluations with disabled people. In *Proceedings of Human Factors in Computing Systems*, 1133–1141. (Montreal, Canada), New York: The Association for Computing Machinery.
- Pool, A., and L. J. Ball. 2005. Eye tracking in human-computer interaction and usability research: Current status and future prospects. In *Encyclopedia of a Human-Computer Interaction*, ed. C. Ghaoui, 211–219. Hershey, PA: Idea Group.

- Pruitt, J., and T. Adlin. 2005. *The Persona Lifecycle: Keeping People in Mind Throughout Product Design*. San Francisco, CA: Morgan Kaufman.
- Quesenberry, W. 2004. "Balancing the 5Es: Usability." *Cutter IT J* 17(2):4–11.
- Quesenberry, W. 2005. The five dimensions of usability. In *Content and Complexity: Information Design in Technical Communication*, ed. M. Albers, B. Mazur, 81–102. Mahwah, NJ: Lawrence Erlbaum & Associates.
- Redish, J. 2007. Expanding usability testing to evaluate complex systems. *J Usability Stud* 2: 102–111.
- Redish, J. C., and J. Scholtz. 2007. Evaluating complex information systems for domain experts. Paper presented at HCI and Information Design to Communicate Complex Information, 1–23. Memphis, TN: University of Memphis.
- Rosenbaum, S., J. Rohn, and J. Humburg. 2000. A toolkit for strategic usability: Results from workshops, panels, and surveys. In *Proceedings of Human Factors in Computing Systems*, 337–344. (The Hague, Netherlands), New York: The Association for Computing Machinery.
- Rubin, J. 1994. *Handbook of Usability Testing*. New York: John Wiley & Sons, Inc.
- Sauro, J., and J. Dumas. 2009. Comparison of three one-question, post-task usability questionnaires. In *Proceedings of Human Factors in Computing Systems*, 1599–1608. (Boston, MA), New York: The Association for Computing Machinery.
- Sauro, J., and J. Lewis. 2009. Correlations among prototypical usability metrics: Evidence for the construct of usability. In *Proceedings of Human Factors in Computing Systems*, 1609–1618. (Boston, MA), New York: The Association for Computing Machinery.
- Sawyer, P., A. Flanders, and D. Wixon. 1996. Making a difference—the impact of inspection. In *Proceedings of Human Factors in Computing Systems*, 378–382. (Vancouver, British Columbia, Canada), New York: The Association for Computing Machinery.
- Schnipke, S. K., and M. W. Todd. 2000. Trials and tribulations of using an eye-tracking system. In *Proceedings of Human Factors in Computing Systems*, 185–186. (The Hague, Netherlands), New York: The Association for Computing Machinery.
- Schusteritsch, R., C. Y. Wei, and M. LaRosa. 2007. Towards the perfect infrastructure for usability testing on mobile devices. In *Proceedings of Human Factors in Computing Systems*, 1839–1844. (San Jose, CA), New York: The Association for Computing Machinery.
- Shanteau, J. 2001. What does it mean when experts disagree? In *Linking Expertise and Naturalistic Decision Making*, ed. E. Salas, and G. Klein, 229–244. Mahwah, NJ: Lawrence Erlbaum Associates.
- Sears, A. 1997. Heuristic walkthroughs: Finding the problems without the noise. *Int J Hum Comput Interact* 9: 213–234.
- Spolsky, J. 2000. *The Joel Test: 12 Steps to Better Code*. www.joelonsoftware.com/articles/fog0000000043.html (accessed November 29, 2011).
- Strain, P., A. D. Shaikh, and R. Boardman. 2007. Thinking but not seeing: Think-aloud for non-sighted users. In *Proceedings of Human Factors in Computing Systems*, 1851–1856. (San Jose, CA), New York: The Association for Computing Machinery.
- Swierenga, S. J., and T. Guy. 2003. Session logistics for usability testing of users with disabilities. In *Proceedings of the Usability Professionals' Association Annual Meeting*, 1–6. (Scottsdale, AZ), Bloomingdale, IL: The Usability Professionals' Association.
- Teague, R., and H. Whitney. 2002. What's love got to do with it? *User Exp* 1: 6–13.
- Tedesco, D., M. McNulty, and T. Tullis. 2005. Usability testing with older adults. In *Proceedings of the Usability Professionals' Association Annual Meeting*, 1–8. (Montreal, Canada), Bloomingdale, IL: The Usability Professionals' Association.
- Tedesco, D., and T. Tullis. 2006. A comparison of methods for eliciting post-task subjective ratings in usability testing. In *Proceedings of the Usability Professionals Association Annual Meeting*, 1–9. (Broomfield, Colorado), Bloomingdale, IL: The Usability Professionals' Association.
- Thompson, K., E. Rozanski, and A. Haake. 2004. Here, there, anywhere: Remote usability testing that works. In *Proceedings of SIGITE*, 132–137. (Salt Lake City, UT), New York: The Association for Computing Machinery.
- Tullis, T., S. Flieschman, M. McNulty, C. Cianchette, and M. Bergel. 2002. An empirical comparison of lab and remote usability testing of web sites. In *Proceedings of the Usability Professionals' Association Annual Meeting*, 1–5. (Orlando, FL), Bloomingdale, IL: The Usability Professionals' Association.
- Tullis, T., and J. Stetson. 2004. A comparison of questionnaires for assessing website usability. In *Proceedings of the Usability Professionals' Association Annual Meeting*, 1–12. (Minneapolis, MN), Bloomingdale, IL: The Usability Professionals' Association.
- Turner, C., J. R. Lewis, and J. Nielsen. 2006. Determining usability test sample size. In *International Encyclopedia of Ergonomics and Human Factors*, ed. W. Karwowski, 3084–3088. Boca Raton, FL: CRC Press.
- U.S. Department of Health and Human Services. 2008. *Office for Human Research Protections (OHRP): OHRP Informed Consent Frequently Asked Questions*. www.answers.hhs.gov/ohrp/categories/1566 (accessed February 25, 2010).
- van den Haak, M. J., M. D. T. de Jong, and P. J. Schellens. 2003. Retrospective vs. concurrent think aloud protocols: Testing the usability of an online library catalogue. *Behav Inf Technol* 22(5):339–351.
- Vatrapu, R., and M. A. Pérez-Quiñones. 2004. *Culture and International Usability Testing: The Effects of Culture in Structured Interviews*. Technical Report cs.HC/0405045. Computing Research Repository (CoRR). <http://arxiv.org/pdf/cs/0405045v1.pdf> (accessed October 4, 2005).
- Virzi, R. A. 1990. Streamlining the design process: Running fewer subjects. In *Proceedings of the Human Factors Society*, 34th Annual Meeting, 291–294. (Orlando, FL), Santa Monica, CA: The Human Factors and Ergonomics Society.
- Virzi, R. A. 1992. Refining the test phase of usability evaluation: How many subjects is enough? *Hum Fact* 34: 457–468.
- Virzi, R. A., J. F. Sorce, and L. B. Herbert. 1993. A comparison of three usability evaluation methods: Heuristic, think-aloud, and performance testing. In *Proceedings of the Human Factors and Ergonomics Society*, 37th Annual Meeting, 309–313. (Seattle, WA), Santa Monica, CA: The Human Factors and Ergonomics Society.
- West, R., and K. R. Lehman. 2006. Automated summative usability studies: An empirical evaluation. In *Proceedings of Human Factors in Computing Systems*, 631–639. (Montreal, Canada), New York: The Association for Computing Machinery.
- Wilson, C. E., and K. P. Coyne. 2001. Tracking usability issues: To bug or not to bug? *Interactions* 8: 15–19.
- Wolfson, C. A., R. W. Bailey, J. Nall, and S. Koyani. 2008. Contextual card sorting (or FirstClick testing): A new methodology for validating information architectures. In *Proceedings of the Usability Professionals' Association Annual Meeting*, 1–6. (Baltimore, MD), Bloomingdale, IL: The Usability Professionals' Association.

Usability for Engaged Users

- Allen, M., J. McGrenere, and B. Purves. 2008. The field evaluation of a mobile digital image communication application designed for people with aphasia. *ACM Trans Access Comput* V1(1), Article 5: 1–26.
- Barnum, C. 2011. *Usability Testing Essentials: Ready, Set... Test!* Burlington, MA: Morgan Kaufmann.
- Beers, R., and P. Whitney. 2006. From ethnographic insight to user-centered design tools. In *Ethnographic Praxis in Industry Conference Proceedings*, 144–154. Arlington, VA: American Anthropological Association.
- Beyer, H., and K. Holtzblatt. 1998. *Contextual Design: Defining Customer Centered Systems*. San Francisco, CA: Morgan Kaufmann.
- Blomberg, J., and M. Burrell. 2011. An ethnographic approach to design. In *The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications*, 3rd ed, ed. J. Jacko. New York: Taylor & Francis Group.
- Coursaris, C., and D. Kim. 2007. A research agenda for mobile usability. In *Proceedings CHI 2007*, 2345–2350. New York: ACM.
- Diggins, T., and P. Tolmie. 2003. The ‘adequate’ design of ethnographic outputs for practice: Some explorations of the characteristics of design resources. *Pers Ubiquitous Comput* 7(3): 147–158.
- Dray, S., and D. Siegel. 2009. Understanding users in context: An in-depth introduction to fieldwork in user-centered design. In *Human-Computer Interaction—INTERACT 2009, 12th IFIP TC 13 Conference Proceedings, Part II*, ed. T. Gross, J. Gulliksen, P. Kotzé, L. Oestreicher, P. Palanque, R. Prates, and M. Winkler, 950–951. New York: Springer.
- Dray, S., D. Siegel, E. Feldman, and M. Potenza. 2002. Why do version 1.0 and not release it?: Conducting field trials of the tablet PC. *Interactions* 9(2): 11–16.
- Duh, H. B., G. C. B. Tan, and V. H. Chen. 2006. Usability evaluation for mobile devices: A comparison of lab and field tests. In *Proceedings of the 8th Conference on Human–Computer Interaction with Mobile Devices and Services—Mobile HCI 2006*, eds. M. Nieminen, and M. Röykkee, September 12–15, 181–186. Helsinki, Finland, New York: ACM.
- Goodman, J., S. A. Brewster, and P. D. Gray. 2004. Using field experiments to evaluate mobile guides. In *Proceedings HCI in Mobile Guides 2004*. New York: Springer. http://www.dcs.gla.ac.uk/~stephen/papers/MobileGuides04_Goodman.pdf (accessed November 18, 2010).
- Hartson, R. H., T. S. Andre, and R. C. Williges. 2003. Criteria for evaluating usability evaluation methods. *Int J Hum Comput Interact* 15(1): 145–181.
- Holtzblatt, K. 2011. Contextual design. In *The Human–Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications*, 3rd ed, ed. J. Jacko, Chapter 43. New York: Taylor & Francis Group.
- ISO 9241-11.1998. *Ergonomic Requirements for Office Work with Visual Display Terminals (VDT)s—Part 11 Guidance on Usability*. AM International Organization for Standards.
- Jones, R. 2006. Experience models: Where ethnography and design meet. In *Proceedings Ethnographic Praxis in Industry Conference*, 81–93. Arlington, VA: American Anthropological Association.
- Kaikkonen, A., T. Kallio, A. Kekäläinen, A. Kankainen, and M. Cankar. 2005. Usability testing of mobile applications: A comparison between lab and field testing. *J Usability Stud* 1(1):4–16.
- McDonald, S., K. Monahan, and G. Cockton. 2006. Modified contextual design as a field evaluation method. In *Proceedings of the 4th Nordic Conference on Human–Computer Interaction: Changing Roles*, NordiCHI '06, vol. 189, ed. A. Mørch, K. Morgan, T. Bratteteig, G. Ghosh, and D. Svanaes, 437–440. New York: ACM Press.
- Medlock, M. C., D. Wixon, M. McGee, and D. Welsh. 2005. The rapid iterative test and evaluation method: Better products in less time. In *Cost Justifying Usability: An Update for the Internet Age*, ed. G. Bias, and D. Mayhew, 489–517. San Francisco, CA: Morgan Kaufmann.
- Nielsen, C. M., M. Overgard, M. B. Pedersen, J. Stage, and S. Stenild. 2006. It's worth the hassle! The added value of evaluating the usability of mobile systems in the field. In *Proceedings of the 4th Nordic Conference on Human–Computer Interaction: Changing Roles*, ed. A. Mørch, K. Morgan, T. Bratteteig, G. Ghosh, and D. Svanaes, 272–280. New York: ACM Press.
- Salvador, T., G. Bell, and K. Anderson. 1999. Design ethnography. *Des Manag J* 10(4):35–41.
- Siegel, D., and S. Dray. 2005. Avoiding the next schism: Ethnography and usability. *Interactions* 12(2):58–61.
- Snyder, C. 2003. *Paper Prototyping: The Fast and Easy Way to Design and Refine User Interfaces*. San Francisco, CA: Morgan Kaufman.

Survey Design and Implementation in HCI

- Aiken, L. R., and A. Lewis. 1996. *Rating Scales and Checklists: Evaluating Behavior, Personality, and Attitude*, 1st ed. New York: John Wiley & Sons.
- Badre, A. 2002. *Shaping Web Usability: Interaction Design in Context*. Boston, MA: Addison Wesley Professional.
- Baecker, R., J. Grudin, W. Buxton, and S. Greenberg. 1995. A historical and intellectual perspective. In *Readings in human-computer interaction: Toward the year 2000*, 2nd ed., ed. R. M. Baecker, J. Grudin, W. A. S. Buxton, and S. Greenberg, 35–47. San Francisco, CA: Morgan Kaufmann Publishers, Inc.
- Baker, R. 1998. The CASIC future. In *Computer Assisted Survey Information Collection*, 1st ed., ed. M. P. Couper, 583–604. New York: John Wiley & Sons.
- Belson, W. 1981. *The Design and Understanding of Survey Questions*. Aldershot, England: Gower.
- Card, S. 1996. Pioneers and settlers: Methods used in successful user interface design. In *Human-Computer Interface Design: Success Stories, Emerging Methods, and Real-world Context*, ed. M. Rudisill et al., 122–169. San Francisco, CA: Morgan Kaufmann Publishers.
- Carini, R. M., J. H. Hayek, G. D. Kuh, J. M. Kennedy, and J. A. Ouimet. 2003. College student responses to web and paper surveys: Does mode matter? *Res High Educ* 44: 1–19.
- Cochran, W. 1977. *Sampling Techniques*. 3rd ed. New York: John Wiley & Sons.
- Cole, S. T. 2005. Comparing mail and web-based survey distribution methods: Results of surveys to leisure travel retailers. *J Travel Res* 43(4):422–430.
- Converse, J. M., and S. Presser. 1986. *Survey questions: Handcrafting the standardized questionnaire*. Newbury Park, CA: Sage Publications, Inc.
- Couper, M. P., M. W. Tourangeau, F. Conrad, and S. Crawford (2004). What they see is what we get: Response options for web surveys. *Soc Sci Comput Rev* 22(1): 111–127.

- Couper, M. P., M. W. Traugott, and M. J. Lamias. 2001. Web survey design and administration. *Public Opin* 65: 230–253.
- Cronbach, L. J. 1990. *Essentials of Psychological Testing*. New York: Harper & Row Publishing.
- Dillman, D. 1991. The design and administration of mail surveys. *Annu Rev Sociol* 17: 225–249.
- Dillman, D. 1999. Mail and other self-administered surveys in the 21st century. *The Gallup Research Journal, Winter/Spring 1999* 121–40.
- Dillman, D. 2000. *Mail and Internet surveys: The Tailored Design Method*. New York: John Wiley and Sons, Inc.
- Gendall, P. 1998. A framework for questionnaire design: Labaw revisited. *Mark Bull* 9: 28–39.
- Hackman, R. J., and G. R. Oldham. 1980. Development of job diagnostic survey. *J Appl Psychol* 60(2):159–170.
- Jenkins, C. R., and D. A. Dillman. 1997. Towards a theory of selfadministered questionnaire design. In *Survey Measurement and Process Quality*, ed. L. Lyberg, P. Biemer, M. Collins, E. deLeeuw, C. Dippo, N. Schwarz, and D. Trewin, 165–196. New York: John Wiley & Sons.
- Kiernan, N. E., M. Oyler, M. A. Oyler, and C. Gilles. 2005. Is a web survey as effective as a mail survey? A field experiment among computer users. *Am Eval* 26(2):245–252.
- Krosnick, J. A. 1999. Survey research. *Annu Rev Psychol* 50: 537–567.
- Litwin, M. 1995. *How to Measure Survey Reliability and Validity*. Thousand Oaks, CA: Sage Publications.
- Lund, E., and I. T. Gram. 1998. Response rate according to title and length of questionnaire. *Scand J Public Health* 26(2): 154–160.
- Medsker, G. J., and M. A. Campion. 1997. Job and team design. In *Handbook of Human Factors and Ergonomics*, 3rd ed., ed. G. Salvendy, 450–489. New York: Wiley.
- Miller, K. 1996. The Influence of Difference Techniques on Response Rates and Nonresponse Error in Mail Surveys. Unpublished Master's thesis, Western Washington University, Ballingham, WA.
- Myers, B. 1996. *A Quick History of Human Computer Interaction*. Carnegie Mellon University School of Computer Science Technical Report. CMU-S-96-163 and Human Computer Interaction Institute Technical Report. CMU-HCII-96-103, August, 1996.
- Myers, B., J. Hollan, and I. Cruz. 1996. Strategic directions in human computer interaction. *ACM Comput Surv* 28(4):794–809.
- Nielsen, J. 1989. Coordinating user interface for consistency. *SIGCHI Bull* 20: 63–65.
- Nielsen, J. 1993. *Usability Engineering*. London, UK: Academic Press.
- Nua Internet Surveys. 2005. nua.com (accessed September 15, 2005).
- Ozok, A. A., and G. Salvendy. 2000. Measuring consistency of web page design and its effects on performance and satisfaction. *Ergonomics* 43(4):443–460.
- Ozok, A. A., and G. Salvendy. 2001. How consistent is your web design? *Behav Inf Technol* 20(6):433–447.
- Ozok, A. A., and J. Wei. 2004. User perspectives of mobile and electronic commerce with a usability emphasis. *Proceedings of the ISOneWorld 2004 Conference*, Las Vegas, NE, Article 71.
- Sanchez, M. E. 1992. Effect of questionnaire design on the quality of survey data. *Public Opin* 56: 206–217.
- Schleyer, T. K. L., and J. Forrest. 2000. Methods for the design and administration of web-based surveys. *J Am Med Inf Assoc* 7(4):416–425.
- Shneiderman, B. 1992. *Designing the User Interface: Strategies for Effective Human-Computer Interaction*. New York: Addison-Wesley.
- Stone, D. H. 1993. Design a questionnaire. *Br Med* 301(6914): 1264–1266.
- Thiemann, S., and H. C. Kraemer. 1987. *How Many Subjects?: Statistical Power Analysis in Research*. Newbury Park, CA: Sage Publishing.
- U.S. Census Bureau. 2005. Computer and Internet use in the United States: 2003. *Annual Report Special Studies* 23–108.
- Zhang, Y. 2000. Using the Internet for survey research: A case study. *J Am Soc Inf Sci* 51(1):57–68.

Inspection-Based Evaluations

- Andre, T. S., H. R. Hartson, S. M. Belz, and F. A. McCreary. 2001. The user action framework: A reliable foundation for usability engineering support tools. *Int J Hum Comput Stud* 54(1): 107–136.
- Bastien, J. M. C., and D. L. Scapin. 1995. "Evaluating a user interface with ergonomic criteria." *Int J Hum Comput Interact* 7(2): 105–121.
- Bias, R. G. 1994. The pluralistic usability walkthrough: Coordinated empathies. In *Usability Inspection Methods*, ed. J. Nielsen and R. L. Mack. New York: John Wiley and Sons.
- Capra, M., and T. Smith-Jackson. 2005. Developing Guidelines for Describing Usability Problems (No. ACE/HCI-2005-002). Blacksburg, VA: Virginia Tech, Assessment and Cognitive Ergonomics Laboratory & Human–Computer Interaction Laboratory.
- Cockton, G. 2005. A development framework for value-centred design. In *CHI'05 Extended Abstracts on Human Factors in Computing Systems*, ed. G. C. van der Veer, and C. Gale, 1292–2195. New York: ACM Press.
- Cockton, G., and D. Lavery. 1999. A framework for usability problem extraction. In *Proceedings of Interact '99*, ed. M. A. Sasse, and C. Johnson, 344–352. Amsterdam, The Netherlands: IOS Press.
- Cockton, G., and A. Woolrych. 2001. Understanding inspection methods: Lessons from an assessment of heuristic evaluation. In *People and Computers XV: Interaction without Frontiers*, eds. A. Blandford, and J. Vanderdonckt, 171–191. London: Springer-Verlag.
- Cockton, G., and A. Woolrych. 2002. Sale must end: Should discount methods be cleared off HCI's shelves? *Interactions* 9(5): 13–18.
- Cockton, G., and A. Woolrych. 2009. *Comparing UEMs: Strategies and Implementation*. Final report of COST-294 working group 2. <http://141.115.28.2/cost294/upload/533.pdf>. (Accessed November 30, 2011).
- Cockton, G., A. Woolrych, L. Hall, and M. Hindmarch. 2003. Changing analysts' tunes: The surprising impact of a new instrument for usability inspection method assessment. In *People and Computers XVII: Designing for Society*, eds. P. Palanque, P. Johnson, and E. O'Neill, 145–162. London: Springer-Verlag. John Long Award for Best Paper.
- Cockton, G., A. Woolrych, and M. Hindmarch. 2004. Reconditioned merchandise: Extended structured report formats in usability inspection. In *CHI '04 Extended Abstracts on Human Factors in Computing Systems*, ed. E. Dykstra-Erickson, and M. Tscheligi, 1433–1436. New York: ACM Press.
- Connell, I. W., and N. V. Hammond. 1999. Comparing usability evaluation principles with heuristics: Problem instances vs. problem types. In *IFIP INTERACT '99: Human–Computer Interaction*, eds. M. A. Sasse and C. Johnson, 621–629. Amsterdam, The Netherlands: IOS Press.

- Cook, T. D., and D. T. Campbell. 1979. Quasi-Experimentation: Design and Analysis Issues for Field Settings. Chicago: Rand McNally.
- Cuomo, D. L., and C. D. Bowen. 1992. Stages of user activity model as a basis for user-system interface evaluations. In Proceedings of the Human Factors Society 36th Annual Meeting, Human Factors Society, 1254–1258. Santa Monica, CA: Human Factors Society.
- Cuomo, D. L., and C. D. Bowen. 1994. Understanding usability issues addressed by three user-system interface evaluation techniques. *Interact Comput* 6(1):86–108.
- Frøkjær, E., and K. Hornbæk. 2002. Metaphors of human thinking in HCI: Habit, stream of thought, awareness, utterance, and knowing. In Proceedings of HF2002/OzCHI 2002 (CD-Rom), eds. R. Kuchinsky, L. Johnson, and F. Vetere. Australia: CHISIG.
- Frøkjær, E., and K. Hornbæk. 2008. Metaphors of human thinking for usability inspection and design. *ACM Trans Comput Hum Interact* 14(4): 1–33.
- Furniss, D. 2008. Beyond Problem Identification: Valuing Methods in a 'System of Usability Practice.' London: University College London.
- Følstad, A. 2007. Work-domain experts as evaluators: Usability inspection of domain-specific work-support systems. *Int J Hum Comput Interact* 22(3):217–245.
- Gray, W. D., and M. Salzman. 1998. Damaged merchandise? A review of experiments that compare usability evaluation methods. *Hum Comput Interact* 13(3):203–261.
- Green, T. R. G. 1991. Describing information artifacts with cognitive dimensions and structure maps. In Proceedings of the HCI'91 Conference on People and Computers VI, eds. D. Diaper, and N. Hammond, 297–315. Cambridge, UK: Cambridge University Press.
- Green, T. R. G., and D. Benyon. 1995. Displays as data structures: Entity-relationship models of information artifacts. In Proceedings of INTERACT'95: IFIP TC13 Fifth International Conference on Human–Computer Interaction, eds. K. Nordby, P. Helmersen, D. Gilmore, and S. Arnesen, 55–60. London: Chapman & Hall.
- Green, T. R. G., and D. Benyon. 1996. The skull beneath the skin: Entity-relationship models of information artefacts. *Int J Hum Comput Stud* 44(6):801–828.
- Green, T. R. G., and M. Petre. 1996. Usability analysis of visual programming environments: A 'cognitive dimensions' framework. *J Visual Lang Comput* 7(2):131–174.
- Hartson, H. R., T. S. Andre, and R. C. Williges. 2001. Criteria for evaluating usability evaluation methods. *Int J Hum Comput Interact* 13(4):373–410.
- Hertzum, M., and N. E. Jacobsen. 2001. The evaluator effect: A chilling fact about usability evaluation methods. *Int J Hum Comput Interact* 13(1):421–443.
- Hornbæk, K., and E. Frøkjær. 2002. Evaluating user interfaces with metaphors of human thinking. In Proceedings of User Interfaces For All, Paris, France, October 23–25, also in Springer Lecture Notes in Computer Science, Vol. 2615, 486–507. Berlin: Springer.
- Hornbæk, K., and E. Frøkjær. 2004. Usability inspection by metaphors of human thinking compared to heuristic evaluation. *Int J Hum Comput Interact* 17(3):357–374.
- Hornbæk, K., and E. Frøkjær. 2006. What kinds of usability-problem description are useful to developers? In Human Factors and Ergonomic Society's Annual Meeting, 2523–2527. Santa Monica, CA: Human Factors Society.
- Hornbæk, K., and E. Frøkjær. 2008a. Comparison of techniques for matching of usability problem descriptions. *Interact Comput* 20(6):505–514.
- Hornbæk, K., and E. Frøkjær. 2008b. Making use of business goals in usability evaluation: An experiment with novice evaluators. In Proceeding of the Twenty-Sixth Annual SIGCHI Conference on Human Factors in Computing Systems, 903–912. New York: ACM Press.
- Howarth, J., T. S. Andre, and R. Hartson. 2007. A structured process for transforming usability data into usability information. *J Usability Stud* 3(1):7–23.
- Hvannberg, E. T., E. L.-C. Law, and M. K. Larusdottir. 2007. Heuristic evaluation: Comparing ways of finding and reporting usability problems. *Interact Comput* 19(2):225–240.
- Jacobsen, N. E., M. Hertzum, and B. E. John. 1998. The evaluator effect in usability tests. In Human Factors in Computing Systems CHI'98 Summary, eds. C.-M. Karat, and A. Lund, 255–256. New York: ACM Press.
- Jeffries, R. 1994. Usability problem reports: Helping evaluators communicate effectively with developers. In Usability Inspection Methods, eds. J. Nielsen, and R. L. Mack, 273–294. New York: John Wiley and Sons.
- Jeffries, R., J. R. Miller, C. Wharton, and K. M. Uyeda. 1991. User interface evaluation in the real world: A comparison of four techniques. In Proc. CHI'91 Conf. on Human Factors in Computing Systems, eds. S. P. Robertson, G. M. Olson, and J. S. Olson, 119–124. New York: ACM.
- John, B. E., and S. J. Marks. 1997. Tracking the effectiveness of usability evaluation methods. *Behav Inf Technol* 16(4/5):188–202.
- John, B. E., and H. Packer. 1995. Learning and using the cognitive walkthrough method: A case study approach. In Proceedings of ACM CHI'95 Conference on Human Factors in Computing Systems, eds. I. Katz, R. Mack, and L. Marks, 429–436. New York: ACM Press.
- Lavery, D., and G. Cockton. 1996. Iterative development of early usability evaluation methods for software visualisations. In Proceedings of the 6th Workshop of Empirical Studies of Programmers, eds. W. D. Gray, and D. A. Boehm-Davis, 275–276. Ablex. Glasgow, UK: Glasgow University.
- Lavery, D., G. Cockton, and M. Atkinson. 1996a. Heuristic Evaluation: Usability Evaluation Materials. Technical Report TR-1996-15, Department of Computing Science. Glasgow, UK: University of Glasgow.
- Lavery, D., G. Cockton, and M. Atkinson. 1996b. Cognitive Dimensions: Usability Evaluation Materials. Technical Report TR-1996-17, Department of Computing Science. Glasgow, UK: University of Glasgow.
- Lavery, D., G. Cockton, and M. P. Atkinson. 1997. Comparison of evaluation methods using structured usability problem reports. *Behav Inf Technol* 16(4):246–266.
- Lewis, C., P. Polson, C. Wharton, and J. Rieman. 1990. Testing a walkthrough methodology for theory-based design of walk-up—and-use interfaces. In Proc. CHI'90 Conf. on Human Factors in Computing Systems, eds. J. Carrasco, and J. Whiteside, 235–242. New York: ACM Press.
- Lewis, C., and C. Wharton. 1997. Cognitive walkthroughs. In Handbook of Human–Computer Interaction, 2nd ed., eds. M. Helander, T. K. Landauer, and P. Prabhu, 717–732. New York: Elsevier.
- Lindgaard, G., and J. Chatratichart. 2007. Usability testing: What have we overlooked? In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 1415–1424. New York: ACM Press.
- Mankoff, J., A. K. Dey, G. Hsieh, J. Kientz, M. Ames, and S. Lederer. 2003. Heuristic evaluation of ambient displays. *CHI Letters*, CHI 2003. ACM Conf Hum Fact Comput Syst 5(1):169–176.

- Manning, H. 2002. Reflections: Must the sale end? *Interactions* 9(6):56. ACM.
- Medlock, M., D. Wixon, M. McGee, and D. Welsh. 2005. The rapid iterative test and evaluation method: Better products in less time. In *Cost-Justifying Usability: An Update for the Information Age*, eds. R. Bias and D. Mayhew, 489–517. Morgan Kaufman.
- Molich, R., M. R. Ede, K. Kaasgaard, and B. Karyukin. 2004. Comparative usability evaluation. *Behav Inf Technol* 23(1):65–74.
- Molich, R., and J. Nielsen. 1990. Improving a human-computer dialogue. *Commun ACM* 33(3):338–348.
- Muller, M. J., A. McClard, B. Bell, S. Dooley, L. Meiskey, J. A. Meskill, R. Sparks, and D. Tellam. 1995. Validating an extension to participatory heuristic evaluation: Quality of work and quality of life. In *Proc. ACM CHI'95 Conference on Human Factors in Computing Systems (Conference Companion)*, eds. I. Katz, R. Mack, and L. Marks, 115–116. New York: ACM Press.
- Nielsen, J. 1992. Finding usability problems through heuristic evaluation. In *Proc. ACM CHI'92 Conf.*, eds. P. Bauersfeld, J. Bennett, and G. Lynch, 373–380. New York: ACM press.
- Nielsen, J. 1993. *Usability Engineering*. San Francisco: Morgan Kaufmann.
- Nielsen, J. 1994a. Enhancing the explanatory power of usability heuristics. In *Proc. CHI'94 Conference on Human Factors in Computing Systems*, eds. B. Adelson, S. Dumais, and J. Olson, 152–158. New York: ACM Press.
- Nielsen, J. 1994b. Heuristic evaluation. In *Usability Inspection Methods*, eds. J. Nielsen, and R. L. Mack, 25–62. New York: John Wiley & Sons.
- Nielsen, J., and T. K. Landauer. 1993. A mathematical model of the finding of usability problems. In *Proc. INTERCHI'93 Conf. on Human Factors in Computing Systems*, eds. S. Ashlund, K. Mullet, A. Henderson, E. Hollnagel, and T. White, 206–213. New York: ACM Press.
- Nielsen, J., and R. Molich. 1990. Heuristic evaluation of user interfaces. In *Proceedings of ACM CHI'90 Conference on Human Factors in Computing Systems*, eds. J. Carrasco, and J. Whiteside, 249–256. New York: ACM Press.
- Norman, D. A. 1986. Cognitive engineering. In *User Centered System Design: New Perspectives on Human-Computer Interaction*, eds. D. A. Norman, and S. W. Draper, 31–61. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Nørgaard, M., and K. Hornbæk. 2006. What do usability evaluators do in practice? An explorative study of think-aloud testing. In *ACM Conference on Designing Interactive Systems*, 209–218. New York: ACM Press.
- Polson, P. G., and C. H. Lewis. 1990. Theory-based design for easily learned interfaces. *Hum Comput Interact* 5(2–3):191–220.
- Polson, P. G., C. Lewis, J. Rieman, and C. Wharton. 1992. Cognitive walkthroughs: A method for theory-based evaluation of user interfaces. *Int J Man Mach Stud* 36(5):741–773.
- Rieman, J., S. Davies, D. C. Hair, M. Esemplare, P. Polson, and C. Lewis. 1991. An automated cognitive walkthrough. In *Proc. ACM CHI'91 Conf. on Human Factors in Computing Systems*, eds. S. P. Robertson, G. M. Olson, and J. S. Olson, 427–428. New York: ACM Press.
- Rosenbaum, S. 2008. The future of usability evaluations: Increasing impact on value. In *Maturing Usability: Quality in Software, Interaction and Value*, eds. E. L. C. Law, E. Hvannberg, and G. Cockton, 344–378. London: Springer.
- Rosenbaum, S., J. A. Rohn, and J. Humburg. 2000. A toolkit for strategic usability: Results from workshops, panels, and surveys. In *Proceedings of ACM CHI 2000 Conference on Human Factors in Computing Systems*, eds. R. Little, and L. Nigay, 337–344. New York: ACM Press.
- Rowley, D. E., and D. G. Rhoades. 1992. The cognitive jogthrough: A fast-paced user interface evaluation procedure. In *Proceedings of ACM CHI'92 Conference on Human Factors in Computing Systems*, eds. P. Bauersfeld, J. Bennett, and G. Lynch, 389–395. New York: ACM Press.
- Scapin, D. L. 1990. Organizing human factors knowledge for the evaluation and design of interfaces. *Int J Hum Comput Interact* 2(3):203–229.
- Scapin, D. L., and J. M. C. Bastien. 1997. Ergonomic criteria for evaluating the ergonomic quality of interactive systems. *Behav Inf Technol* 16(4/5):220–231.
- Sears, A. 1997. Heuristic walkthroughs: Finding the problems without the noise. *Int J Hum Comput Interact* 9(3):213–234.
- Sears, A., and D. Hess. 1999. Cognitive walkthroughs: Understanding the effect of task description detail on evaluator performance. *Int J Hum Comput Interact* 11(3):185–200.
- Somervell, J., and D. S. McCrickard. 2005. Better discount evaluation: Illustrating how critical parameters support heuristic creation. *Interact Comput* 17(5):592–612.
- Spencer, R. 2000. The streamlined cognitive walkthrough method, working around social constraints encountered in a software development company. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 353–359. New York: ACM.
- Spool, J., and W. Shroeder. 2001. Testing web sites: Five users is nowhere near enough. In *CHI '01 Extended Abstracts on Human Factors in Computing Systems*, 285–286. New York: ACM.
- Suchman, L. 1987. *Plans and Situated Actions: The Problem of Human-Machine Communication*. New York: Cambridge University Press.
- Sy, D. 2007. Adapting usability investigations for agile user-centered design. *J Usability Stud* 2(3):112–132.
- Theofanos, M., and W. Quesenberry. 2005. Towards the design of effective formative test reports. *J Usability Stud* 1(1):27–45.
- Uldall-Espersen, T., E. Frøkjær, and K. Hornbæk. 2008. Tracing impact in a usability improvement process. *Interact Comput* 20(1):48–63.
- Venturi, T., J. Troost, and T. Jokela. 2006. People, organizations, and processes: An inquiry into the adoption of user-centered design in industry. *International Journal of Human-Computer Interaction*, 21(2):219–238.
- Wharton, C., J. Rieman, C. Lewis, and P. Polson. 1994. The cognitive walkthrough: A practitioner's guide. In *Usability Inspection Methods*, eds. J. Nielsen, and R. L. Mack, 105–140. New York: John Wiley & Sons.
- Wixon, D. 2003. Evaluating usability methods: Why the current literature fails the practitioner. *Interactions* 10(4):28–34.
- Woolrych, A. 2001. *Assessing the Scope and Accuracy of the Usability Inspection Method Heuristic Evaluation*, MPhil, University of - Sunderland. <http://osiris.sunderland.ac.uk/csoawo/down-loadable%20documents.htm> (accessed 21/12/05).
- Woolrych, A., and G. Cockton. 2000. Assessing heuristic evaluation: Mind the quality, not just percentages. In *Proceedings of British HCI Group HCI 2000 Conference*, Vol. 2, eds. S. Turner and P. Turner, 35–36. London: British Computer Society.
- Woolrych, A., and G. Cockton. 2002. Testing a conjecture based on the DR-AR model of usability inspection method effectiveness. In *People and Computers XVI: Memorable yet Invisible*, Vol. 2, eds. H. Sharp, P. Chalk, J. LePeuple, and J. Rosbottom, 30–33. London: British Computer Society.
- Woolrych, A., G. Cockton, and M. Hindmarch. 2004. Falsification testing for usability inspection method assessment. In *Proceedings of HCI 2004*, Vol. 2, eds. A. Dearden, and L. Watts, 137–140. Bristol, UK: Research Press International.
- Woolrych, A., G. Cockton, and M. Hindmarch. 2005. Knowledge resources in usability inspection. In *Proceedings of HCI 2005*, Vol. 2, eds. L. Mackinnon, O. Bertelsen and N. Bryan-Kinns, 15–20.

- Woolrych, A., K. Hornbæk, E. Frøkjær, and G. Cockton. 2012. Ingredients and meals rather than recipes: A proposal for research that does not treat usability evaluation methods as indivisible wholes. *International Journal of Human-Computer Interaction* 27(10):940–970.
- Young, R. M., and T. Simon. 1987. Planning in the context of human–computer interaction. In *People and Computers III*, eds. D. Diaper, and R. Winder, 363–370. Cambridge, UK: Cambridge University Press.

Model-Based Evaluation

- Anderson, J. R. 1983. *The Architecture of Cognition*. Cambridge, MA: Harvard University Press.
- Annett, J., K. D. Duncan, R. B. Stammers, and M. J. Gray. 1971. *Task Analysis*. London: Her Majesty's Stationery Office.
- Baumeister, L. K., B. E. John, and M. D. Byrne. 2000. A comparison of tools for building GOMS models. In *Proceedings of CHI 2000*. New York: ACM.
- Beckett, D. 1984. *Stephenson's Britain*. North Pomfret, Vermont: David and Charles, Inc.
- Beevis, D., R. Bost, B. Doering, E. Nordo, F. Oberman, J.-P. Papin, I. H. Schuffel, and D. Streets. 1992. *Analysis Techniques for Man-Machine System Design*. (Report AC/243(P8)TR/7). Brussels, Belgium: Defense Research Group, NATO HQ.
- Bhavnani, S. K., and B. E. John. 1996. Exploring the unrealized potential of computer-aided drafting. In *Proceedings of the CHI '96 Conference on Human Factors in Computing Systems*. New York: ACM.
- Bolton, M. L., and E. J. Bass. 2009. A method for the formal verification of human-interactive systems. In *Proceeding of the Human Factors and Ergonomics Society 53rd Annual Meeting*. 764–768. Santa Monica, CA: Human Factors and Ergonomics Society.
- Bovair, S., D. E. Kieras, and P. G. Polson. 1990. The acquisition and performance of text editing skill: A cognitive complexity analysis. *Hum Comput Interact* 5: 1–48.
- Buchanan, R. A. 1989. *The Engineers: A History of the Engineering Profession in Britain 1750-1914*. London: Jessica Kingsley Publishers.
- Butler, K. E., J. Zhang, C. Esposito, A. Bahrami, R. Hebron, and D. Kieras. 2007. Work-centered design: A case study of a mixed-initiative scheduler. In *Proceedings of CHI 2007*. San Jose, California, New York: ACM.
- Card, S. K., T. P. Moran, and A. Newell. 1980. The keystroke-level model for user performance time with interactive systems. *Commun ACM* 23(7):396–410.
- Card, S., T. Moran, and A. Newell. 1983. *The Psychology of Human-Computer Interaction*. Hillsdale, New Jersey: Erlbaum.
- Chubb, G. P. 1981. SAINT, a digital simulation language for the study of manned systems. In *Manned System Design*, eds. J. Moraal, and K. F. Kraas, 153–179. New York: Plenum.
- Diaper, D., and N. A. Stanton, eds. 2004. *The Handbook of Task Analysis for Human-Computer Interaction*. Mahwah, New Jersey: Lawrence Erlbaum Associates.
- Elkind, J. I., S. K. Card, J. Hochberg, and B. M. Huey, eds. 1989. *Human Performance Models for Computer-Aided Engineering*. Committee on Human Factors, National Research Council. Washington: National Academy Press.
- Glenn, F. A., A. L. Zaklad, and R. J. Wherry. 1982. Human operator simulation in the cognitive domain. In *Proceedings of the Human Factors Society*, 964–969. Santa Monica, CA: Human Factors and Ergonomics Society.
- Gordon, J. E. 1978. *Structures: Or Why Things Don't Fall Down*. New York: Plenum.
- Gray, W. D., and D. A. Boehm-Davis. 2000. Milliseconds matter: An introduction to microstrategies and to their use in describing and predicting interactive behavior. *J Exp Psychol Appl* 6(4):322–335.
- Gray, W. D., B. E. John, and M. E. Atwood. 1993. Project Ernestine: A validation of GOMS for prediction and explanation of real-world task performance. *Hum Comput Interact* 8(3):237–309.
- Harris, R. M., H. P. Iavecchia, and A. C. Bittner. 1988. Everything you always wanted to know about HOS micromodels but were afraid to ask. In *Proceedings of the Human Factors Society*, 1051–1055. Santa Monica, CA: Human Factors and Ergonomics Society.
- Harris, R., H. P. Iavecchia, and A. O. Dick. 1989. The human operator simulator (HOS-IV). In *Applications of Human Performance Models to System Design*, eds. G. R. McMillan, D. Beevis, E. Salas, M. H. Strub, R. Sutton, and L. Van Breda, 275–280. New York: Plenum Press.
- Hornof, A. J., Y. Zhang, T. Halverson. 2010. Knowing where and when to look in a time-critical multimodal dual task. In *Proceedings of ACM CHI 2010: Conference on Human Factors in Computing Systems*, 2103–2112. New York: ACM.
- Howes, A., R. L. Lewis, and A. Vera. 2009. Rational adaptation under task and processing constraints: Implications for testing theories of cognition and action. *Psychol Rev* 116(4):717–751.
- John, B. E. 2010. Reducing the variability between novice modelers: Results of a tool for human performance modeling produced through human-centered design. In *Proceedings of the 19th Annual Conference on Behavior Representation in Modeling and Simulation (BRIMS)*. Orlando, FL: SISO, Inc.
- John, B. E., and D. E. Kieras. 1996a. Using GOMS for user interface design and evaluation: Which technique? *ACM Trans Comput Hum Interact* 3: 287–319.
- John, B. E., and D. E. Kieras. 1996b. The GOMS family of user interface analysis techniques: Comparison and contrast. *ACM Trans Comput Hum Interact* 3: 320–351.
- John, B., K. Prevas, D. Salvucci, and K. Koedinger. 2004. Predictive human performance modeling made easy. In *Proceedings of CHI 2004*. New York: ACM.
- John, B., A. Vera, M. Matessa, M. Freed, and R. Remington. 2002. Automating CPM-GOMS. In *Proceedings of CHI 2002*. New York: ACM.
- Kieras, D. E. 1988. Towards a practical GOMS model methodology for user interface design. In *Handbook of Human–Computer Interaction*, ed. M. Helander, 135–158. Amsterdam: North–Holland Elsevier.
- Kieras, D. E. 1997. A Guide to GOMS model usability evaluation using NGOMSL. In *Handbook of Human-Computer Interaction*. eds. M. Helander, T. Landauer, and P. Prabhu, Second ed. 733–766. Amsterdam: North-Holland.
- Kieras, D. E. 2004. Task analysis and the design of functionality. In *The Computer Science and Engineering Handbook*. ed. A. Tucker, 2nd ed. 46-1–46-25. Boca Raton, FL: CRC Inc.
- Kieras, D. E. 2005a. *A Guide to GOMS Model Usability Evaluation using GOMSL and GLEAN4*. Document available at <http://www.eecs.umich.edu/~kieras/> (accessed November 30, 2011).

- Kieras, D. 2005b. Fidelity issues in cognitive architectures for HCI modeling: Be careful what you wish for. Paper presented at the 11th International Conference on Human Computer Interaction (HCII 2005). Las Vegas, July 22–27. Proceedings published as CD-ROM.
- Kieras, D. 2009. Why EPIC was wrong about motor feature programming. In 9th International Conference on Cognitive Modeling—ICCM 2009, eds. A. Howes, D. Peebles, and R. Cooper. Manchester, U.K. Available online at <http://sideshow.psyc.bbk.ac.uk/rcooper/iccm2009/proceedings/> (Retrieved November 30, 2011).
- Kieras, D. E., and D. E. Meyer. 2000. The role of cognitive task analysis in the application of predictive models of human performance. In *Cognitive Task Analysis*, eds. J. M. C. Schraagen, S. E. Chipman, and V. L. Shalin, 237–260. Mahwah, NJ: Lawrence Erlbaum.
- Kieras, D. E., and P. G. Polson. 1985. An approach to the formal analysis of user complexity. *Int J Man Mach Stud* 22: 365–394.
- Kieras, D. E., and T. P. Santoro. 2004. Computational GOMS modeling of a complex team task: Lessons learned. In *Proceedings of CHI 2004: Human Factors in Computing Systems*. New York: ACM, Inc.
- Kieras, D. E., S. D. Wood, K. Abotel, and A. Hornof. 1995. GLEAN: A computer-based tool for rapid GOMS model usability evaluation of user interface designs. In *Proceeding of UIST*, 91–100. Pittsburgh, PA, New York: ACM.
- Kieras, D. E., S. D. Wood, and D. E. Meyer. 1997. Predictive engineering models based on the EPIC architecture for a multimodal high-performance human-computer interaction task. *ACM Trans Comput Hum Interact* 4: 230–275.
- Kirwan, B., and L. K. Ainsworth. 1992. *A Guide to Task Analysis*. London: Taylor & Francis.
- Landauer, T. 1995. *The Trouble with Computers: Usefulness, Usability, and Productivity*. Cambridge, MA: MIT Press.
- Lane, N. E., M. I. Strieb, F. A. Glenn, and R. J. Wherry. 1981. The human operator simulator: An overview. In *Manned System Design*, eds. J. Moraal, and K. F. Kraas, 121–152. New York: Plenum.
- Larkin, J. H. 1989. Display based problem solving. In *Complex Information Processing: The Impact of Herbert A. Simon*, eds. D. Klahr and K. Kotovsky. Hillsdale, NJ: Erlbaum.
- Laughery, K. R. 1989. Micro SAINT—A tool for modeling human performance in systems. In *Applications of Human Performance Models to System Design*, eds. G. R. McMillan, D. Beevis, E. Salas, M. H. Strub, R. Sutton, and L. Van Breda, 219–230. New York: Plenum Press. See also the web site of Micro Analysis and Design, Inc., <http://www.maad.com>.
- McMillan, G. R., D. Beevis, E. Salas, M. H. Strub, R. Sutton, and L. Van Breda. 1989. *Applications of Human Performance Models to System Design*. New York: Plenum Press.
- Merritt, F. S., M. K. Loftin, and J. T. Ricketts. 1996. *Standard Handbook for Civil Engineers*. New York: McGraw-Hill.
- Newell, A. *Unified Theories of Cognition*. 1990. Cambridge, MA: Harvard University Press.
- Norman, D. A. 1986. *Cognitive Engineering*. In *User Centered System Design*, eds. D. A. Norman and S. W. Draper. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Petrosky, H. 1985. *To Engineer is Human: The Role of Failure in Successful Design*. New York: St. Martin's Press.
- Pew, R. W., S. Baron, C. E. Feehrer, and D. C. Miller. 1977. Critical Review and Analysis of Performance Models Applicable to Man-Machine Systems Operation. Technical Report No. 3446, Cambridge, MA: Bolt, Beranek and Newman, Inc.
- Polson, P. G. 1987. A quantitative model of human-computer interaction. In *Interfacing Thought: Cognitive Aspects of Human-Computer Interaction*, ed. J. M. Carroll. Cambridge, MA: Bradford, MIT Press.
- Pugsley, A. ed. 1976. *The Works of Isambard Kingdom Brunel: An Engineering Appreciation*. London and Bristol: The Institution of Civil Engineers and The University of Bristol.
- St. Amant, R., T. E. Horton, and F. E. Ritter. 2007. Model-based evaluation of expert cell phone menu interaction. *ACM Trans Hum Comput Interact* 14(1):1–24.
- St. Amant, R., and M. O. Riedl. 2001. A perception/action substrate for cognitive modeling in HCI. *Int J Hum Comput Stud* 55(1): 15–39.
- Strieb, M. I., and R. J. Wherry. 1979. An Introduction to the Human Operator Simulator. Technical Report 1400.02-D, Willow Grove, PA: Analytics Inc.
- Vera, A. H., A. Howes, M. McCurdy, and R. L. Lewis. 2004. A constraint satisfaction approach to predicting skilled interactive cognition. In *Proceedings of the CHI 2004*, 121–128. New York: ACM.
- Wherry, R. J. 1976. The human operator simulator—HOS. In *Monitoring Behavior and Supervisory Control*, eds. T. B. Sheridan and G. Johannsen. New York: Plenum Press.
- Whiteside, J., S. Jones, P. S. Levy, and D. Wixon. 1985. User performance with command, menu, and iconic interfaces. In *Proceedings of CHI '85*. New York: ACM.
- Wood, S. D. 2000. Extending GOMS to Human Error and Applying it to Error-Tolerant Design. Doctoral dissertation. Ann Arbor, MI: University of Michigan.
- Zachary, W., T. Santarelli, J. Ryder, and J. Stokes. 2000. Developing a Multi-Tasking Cognitive Agent Using the COGNET/IGEN Integrative Architecture. Technical Report No. 001004.9915, Lower Gwynedd, PA: CHI Systems, Inc. See also the web site for CHI Systems, Inc., <http://www.chiinc.com/>.

Spreadsheet Tool for Simple Cost-Benefit Analyses of User Experience Engineering

- Bias, R. G., and D. J. Mayhew. 2005. *Cost Justifying Usability—An Update for the Internet Age*. San Francisco, CA: Morgan Kaufmann Publishers.
- Fireclick. 2010. <http://index.fireclick.com/>. Last accessed 2010.
- GVU. 1999. http://www.gvu.gatech.edu/user_surveys. Atlanta, GA: Georgia Institute of Technology. (No longer online, last accessed 2005.)
- Mayhew, D. J. 1999. *The Usability Engineering Lifecycle*. San Francisco, CA: Morgan Kaufmann Publishers.
- Mayhew, D. J. 2011. Deborah J. Mayhew & Associates website, Downloads page. <http://drdeb.vineyard.net/index.php?loc=12&nloc=1>. Last accessed November 28, 2011.
- Payscale website. 2011. Career planning page. http://www.payscale.com/research/US/Country=United_States/Salary. Last accessed November 28, 2011.
- Sonderegger, P. 1998. *The Age of Net Pragmatism*. Cambridge, MA: Forrester Research.

- Souza, R. K. 2000. The Best of Retail Site Design. Cambridge, MA: Forrester Research.
- Souza, R. K. 2001. Get ROI From Design. Cambridge, MA: Forrester Research.
- UPA website. 2009. Resources, salary surveys page.
http://usabilityprofessionals.org/usability_resources/surveys/2009salarysurvey_PUBLIC.pdf. Last accessed November 28, 2011.

Technology Transfer

- Buderi, R. 2000. Engines of Tomorrow: How the World's Best Companies are Using their Research Labs to Win the Future. New York: Simon & Schuster.
- Butler, K. 1990. Collaboration for technology transfer—or “How do so many promising ideas get lost?” In Proceedings of the CHI '90 Conference on Human Factors in Computing Systems, 349–351. New York: ACM.
- Card, S. K., T. P. Moran, and A. Newell. 1983. The Psychology of Human-Computer Interaction. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Chesbrough, H. 2003. Open Innovation. Boston, MA: Harvard Business School Press.
- Foley, J. 1996. Technology transfer from university to industry. *Commun ACM* 39(9):30–31.
- Friedman, T. 2005. The World is Flat. New York: Farrar, Straus, and Giroux.
- Hiltzik, M. 1999. Dealers of Lightning. New York: Harper Collins Publishers.
- Isaacs, E. A., and J. C. Tang. 1996. Technology transfer: So much research, so few good products. In Proceedings of the CHI '96 Conference on Human Factors in Computing Systems, (2), 155–156. New York: ACM.
- Lesko, J., P. Nicolai, and M. Steve. 1998. Technology Exchange in the Information Age. Columbus, OH: Battelle Press.
- Manning, G. K., ed. 1974. Technology Transfer: Successes and Failures. San Francisco, CA: San Francisco Press.
- Mock, J. E., D. C. Kenkeremath, and F. T. Janis. 1993. Moving R&D to the Marketplace: A Guidebook for Technology Transfer Managers. Falls Church, VA: Technology Prospects, Inc.
- National Research Council. 2003. Innovation in Information Technology. Washington, DC: National Academies Press.
- Singh, G. 1993. From research prototypes to usable, useful systems: Lessons learned in the trenches. In Proceedings of the ACM Symposium on User Interface Software and Technology, 139–143. New York: ACM.
- Speser, P. 2006. The Art & Science of Technology Transfer. Hoboken, NJ: John Wiley & Sons.
- Steinberg, L. 1998. Winning with Integrity. New York: Villard Books.

Augmenting Cognition in HCI

- Barker, R. A., R. E. Edwards, K. R. O'Neill, and R. J. Tollar. 2004. DARPA Improving Warfighter Information Intake Under Stress—Augmented Cognition Concept Validation Experiment (CVE) Analysis Report for the Boeing Team (Contract NBCH030031). Arlington, VA: Defense Advanced Research Projects Agency.
- Berka, C., D. J. Levendowski, M. N. Lumicao, A. Yau, G. Davis, V. T. Zivkovic, R. E. Olmstead, P. D. Tremoulet, and P. L. Craven. 2007. EEG correlates of task engagement and mental workload in vigilance, learning, and memory tasks. *Aviat Space Environ Med* 78(5):B231–244.
- Bradley, M. M., B. Moulder, and J. P. Lang. 2005. When good things go bad: The reflex physiology of defense. *Psychol Sci* 16: 468–473.
- Cacioppo, J. T., G. G. Berntson, J. F. Sheridan, and M. K. McClintock. 2000. Multilevel integrative analyses of human behavior: Social neuroscience and the complementing nature of social and biological approaches. *Psychol Bull* 126: 829–843.
- Carroll, M., S. Fuchs, A. Carpenter, K. Hale, R. G. Abbott, and A. Bolton. 2010. Development of an autodiagnostic adaptive precision trainer for decision making (ADAPT-DM). *Int Test Eval J* 31(2): 247–263.
- Ciesielski, K. T., and C. N. French. 1989. Event-related potentials before and after training: Chronometry and lateralization of visual N1 and N2. *Biol Psychol* 28(3):227–238.
- Craven, P. L., P. D. Tremoulet, J. H. Barton, S. J. Tourville, and Y. Dahan-Marks. 2009. Evaluating training with cognitive state sensing technology. In Augmented Cognition, HCII 2009, LNAI 5638, ed. D. D. Schmorow, et al., 585–594. Springer-Verlag Berlin Heidelberg: Germany.
- Critchley, H. D. 2002. Electrodermal responses: What happens in the brain. *Neuroscientist* 8(2): 132–142.
- Deeny, S. P., C. H. Hillman, C. M. Janelle, and B. D. Hatfield. 2003. Cortico-cortical communication and superior performance in skilled marksmen: An EEG coherence analysis. *J Sport Exerc Psychol* 25: 188–204.
- de Greef, T., H. Lafeber, H. van Oostendorp, and J. Lindenberg. 2009. Eye movement as indicators of mental workload to trigger adaptive automation. In Augmented Cognition, HCII 2009, LNAI 5638, ed. D. D. Schmorow, et al., 219–228. Springer-Verlag Berlin Heidelberg: Germany.
- Dickson, B. T. 2005. The cognitive cockpit—A testbed for augmented cognition. In CD Proceedings of the First International Conference on Augmented Cognition, 11:479–488. Las Vegas, NV: Nevada.
- Diethé, T. 2005. The future of augmentation managers. In Foundations of Augmented Cognition, ed. D. D. Schmorow, 631–640. Mahwah, NJ: Erlbaum.
- Di Nocera, F., M. Terenzi and M. Camilli. 2006. Another look at scanpath: distance to nearest neighbor as a measure of mental workload. In D. de Waard, K. Brookhuis and A. Toffetti. Developments in Human Factors in Transportation, Design, and Evaluation (pp. 1–9). Maastricht, the Netherlands: Shaker Publishing.
- Dorneich, M. C., P. M. Ververs, S. Mathan, and D. S. Whitlow. 2006. Evaluation of a tactile navigation cueing system triggered by a real-time assessment of cognitive state. In Proceedings of the Human Factors and Ergonomics Society 50th Annual Meeting, 2600–2604. Santa Monica, CA: Human Factors and Ergonomics Society.
- Dorneich, M. C., S. D. Whitlow, S. Mathan, J. Carciovini, and M. P. Ververs. 2005. The communications scheduler: A task scheduling mitigation for a closed loop adaptive system. In Foundations of Augmented Cognition, ed. D. D. Schmorow, 132–141. Mahwah, NJ:

Erlbaum.

- Dorneich, M., S. Whitlow, P. M. Ververs, J. Carciofini, and J. Creaser. 2005. Closing the loop of an adaptive system with cognitive state. In Proceedings of the 48th Annual Meeting of the Human Factors and Ergonomics Society. Santa Monica, CA: Human Factors and Ergonomics Society, pp. 590–594.
- DuRousseau, D. R. 2004. Multimodal Cognitive Assessment System (Final Tech. Rep. DAAH01-03-C-R232). Arlington, VA: Defense Advanced Research Projects Agency.
- Duta, M., C. Alford, S. Wilon, and L. Tarassenko. 2004. Neural network analysis of the mastoid EEG for the assessment of vigilance. *Int J Hum Comput Interact* 17(2):171–195.
- Fidopiastis, C. M., J. Drexler, D. Barber, K. Cosenzo, M. Barnes, J. Y. C. Chen, and D. Nicholson. 2009. Impact of automation and task load on unmanned system operator's eye movement patterns. In *Augmented Cognition, HCII 2009, LNAI 5638*, ed. D. D. Schmorow, et al., 229–238. Springer-Verlag Berlin Heidelberg: Germany.
- Floyer-Lea, A., and P. M. Matthews. 2004. Changing brain networks for visuomotor control with increased movement automaticity. *J Neurophysiol* 92(4):2405–2412.
- Freeman, F. G., P. J. Mikulka, L. J. Prinzel, and W. M. Scerbo. 1999. Evaluation of an adaptive automation system using three EEG indices with a visual tracking system. *Biol Psychol* 50: 61–76.
- Fuchs, S., K. S. Hale, C. Berka, and J. Juhnke. 2008. Enhancing situation awareness with an augmented cognition system. In *Augmented Cognition: A Practitioner's Guide*, ed. K. M. Stanney and D. Schmorow, 112–143. Santa Monica, CA: HFES.
- Fuchs, S., K. S. Hale, K. M. Stanney, J. Juhnke, and D. Schmorow. 2007. Enhancing mitigation in augmented cognition. *J Cogn Eng Decis Mak* 1: 309–326.
- Fukuda, T. and M. Yamada. 1986. Quantitative evaluation of eye movements as judged by sight-line displacements. *SMPTE Mot. Imag J* (95)12:1230–1241.
- Gratton, G., A. F. Kramer, and M. Fabiani. 2008. Brain sensors and measures. In *Augmented Cognition: A Practitioner's Guide*, ed. D. D. Schmorow, and K. M. Stanney, 1–26. Santa Monica, CA: Human Factors and Ergonomics Society.
- Gunter, T. C., and A. D. Friederici. 1999. Concerning the automaticity of syntactic processing. *Psychophysiology* 36(1):126–137.
- Hale, K. S., S. Fuchs, P. Axelsson, A. Baskin, and D. Jones. 2007. Determining gaze parameters to guide EEG/ERP evaluation of imagery analysis. In *Foundations of Augmented Cognition*, ed. D. D. Schmorow, D. M. Nicholson, J. M. Drexler and L. M. Reeves, 4th ed., 33–40. Arlington, VA: Strategic Analysis Inc.
- Hale, K. S., S. Fuchs, P. Axelsson, C. Berka, and A. J. Cowell. 2008. Using physiological measures to discriminate signal detection outcome during imagery analysis. *Proc Hum Fact Ergon Soc Annu Meet* 52(3): 182–186.
- Harmon-Jones, E., and S. J. Beer. 2009. Methods in Social Neuroscience. New York: Guilford Press.
- Healey, J. A. 2000. *Wearable and Automotive System for Affect Recognition from Physiology*. Unpublished Ph.D. thesis, Massachusetts Institute of Technology. Cambridge, MA.
- Hoover, A., and E. Muth. 2004. A real-time index of vagal activity. *Int J Hum Comput Interact* 17(2): 197–210.
- Iqbal, S. T., X. S. Zheng, and B. P. Bailey. 2004. Task-evoked pupillary response to mental workload in human-computer interaction. *Proc ACM Conf Hum Fact Comput Syst* 1477–80. <http://interruptions.net/literature/Iqbal-CHI04-p1477-iqbal.pdf>
- Izzetoglu, K., S. Bunce, B. Onaral, K. Pourrezaei, and B. Chance. 2003. Functional optical brain imaging using near-infrared during cognitive tasks. *Int J Hum Comput Interact* 17(2): 211–227.
- Izzetoglu, M., K. Izzetoglu, S. Bunce, H. Ayaz, A. Devaraj, and B. Onaral, et al. 2005. Functional near-infrared neuroimaging. *IEEE Trans Neural Syst Rehabil Eng* 13: 153–159.
- Jang, D. P., I. Y. Kim, S. W. Nam, B. K. Wiederhold, M. D. Wiederhold, and I. S. Kim. 2002. Analysis of physiological response to two virtual environments: Driving and flying simulation. *Cyberpsychol Behav* 5(1): 11–18.
- Jung, T. -P., S. Makeig, M. Stensmo, and T. J. Sejnowski. 1997. Estimating alertness from the EEG power spectrum. *IEEE Transactions on Biomedical Engineering* 44(1):60–69.
- Kaber, D. B., C. M. Perry, N. Segall, and M. A. Sheik-Nainar. 2007. Workload state classification with automation during simulated air traffic control. *Int Aviat Psychol* 17: 371–390.
- Kahneman, D., J. Beatty, and I. Pollack. 1967. Perceptual deficit during a mental task. *Science* 157: 218–219.
- Kass, S. J., M. Doyle, A. K. Raj, F. Andrasik, and J. Higgins. 2003. Intelligent adaptive automation for safer work environments. In *Occupational Health and Safety: Encompassing Personality, Emotion, Teams, and Automation*, ed. J. C. Wallace and G. Chen (Co-Chairs), Symposium conducted at the Society for Industrial and Organizational Psychology 18th Annual Conference, April. Orlando, FL.
- Kerick, S. E., L. W. Douglass, and B. D. Hatfield. 2004. Cerebral cortical adaptations associated with visuomotor practice. *Med Sci Sports Exerc* 36: 118–129.
- King, L. A. 2009. Visual navigation patterns and cognitive load. In *Augmented Cognition, HCII 2009, LNAI 5638*, ed. D. D. Schmorow, et al., 254–259. Springer-Verlag Berlin Heidelberg: Germany.
- Kirsh, D. 2000. A few thoughts on cognitive overload. *Intellectica* 30: 19–51.
- Kobus, D. A., C. M. Brown, J. G. Morrison, G. Kollmorgen, and R. Cornwall. 2005. *DARPA Improving Warfighter Information Intake under Stress—Augmented Cognition Phase II: The Concept Validation Experiment (CVE)*. DARPA/IPTO technical report submitted to CDR Dylan Schmorow.
- Kollmorgen, L. S. 2007. Introduction: A case for operational approach in advanced research projects—the augmented cognition story. *Aviat Space Environ Med (Spec Suppl)* 78(5), B1–B3.
- Kramer, A. F. 1991. Physiological metrics of mental workload: A review of recent progress. In *Multiple Task Performance*, ed. D. L. Damos, 279–328. Washington, DC: Taylor & Francis.
- Kruse, A. A., and J. J. Schulman. 2006. Neurotechnology for Intelligence Analysts. In *Foundations of Augmented Cognition*, ed. D. D. Schmorow, K. M. Stanney, and L. M. Reeves, 2nd ed., 27–31. Arlington, VA: Strategic Analysis, Inc.
- Lee, C. K., S. Yoo, Y. J. Park, N. Kim, K. Jeong, and B. Lee. 2005. Using neural network to recognize human emotions from heart rate variability and skin resistance. In *Proceedings of the 2005 IEEE Engineering in Medicine and Biology 27th Annual Conference*, 5523–5525. Los Alamitos, CA: IEEE Computer Society.
- Licklider, J. C. R. 1960. Man-computer symbiosis. *IRE Trans Hum Factors Electron* 1:4–11.
- Luu, D., D. M. Tucker, and R. Stripling. 2007. Neural mechanisms for learning actions in context. *Brain Res* 1179: 89–105.
- Mandryk, R. L. 2005. *Modeling User Emotion in Interactive Play Environments: A Fuzzy Physiological Approach*. Unpublished Ph.D. thesis, Simon Fraser University. Burnaby, BC.

- Mathan, S., and S. Whitlow, et al. 2006. Neurophysiologically driven image triage: a pilot study. Conference on Human Factors in Computing Systems, Montréal, Québec. Canada ACM Press New York, NY.
- Morrison, J. G., D. A. Kobus, and M. C. Brown. 2006. *Volume I: DARPA Improving Warfighter Information Intake under Stress—Augmented Cognition*. Phase II Concept Validation (Tech. Rep. 1940). San Diego, CA: Pacific Science and Engineering Group. <http://handle.dtic.mil/100.2/ADA457526> (accessed June 30, 2009).
- Nakayama, M., K. Takahashi, and Y. Shimizu. 2002. The Act of task difficulty and eye-movement frequency for the 'oculo-motor indices.' *Proc Symp Eye Track Research Appl* 37–42.
- Parra, L. C., C. D. Spence, A. D. Gerson, and P. Sajda. 2005. Recipes for the linear analysis of EEG. *Neuroimage* 28: 326–341.
- Partala, T. and V. Surakka. 2003. Pupil size variation as an indication of affective processing. *Int J Hum Comput Stud* 59: 185–198.
- Peres, M., P. F. Van De Moortele, C. Pierard, S. Lehericy, P. Satabin, and D. Le Bihan, et al. 2000. Functional magnetic resonance imaging of mental strategy in a simulated aviation performance task. *J Aviat Space Environ Med* 71(12): 1218–1231.
- Pleydell-Pearce, K., B. Dickson, and S. Whitecross. 2000. Cognition monitor: A system for real time pilot state assessment. In *Contemporary Ergonomics 2000*, ed. P. T. McCabe, M. A. Hanson, and S. A. Robertson, 65–69. London: Taylor & Francis.
- Pleydell-Pearce, C. W., S. E. Whitecross, and B. T. Dickson. 2003. Multivariate analysis of EEG: Predicting cognition on the basis of frequency decomposition, inter-electrode correlation, coherence, cross phase, and cross power. In *Abstract Proceedings of the 36th Annual Hawaii International Conference on System Sciences (Track 5, CD-ROM)*. Los Alamitos, CA: IEEE Computer Society.
- Pojman, N., A. Behneman, N. Kintz, R. Johnson, G. Chung, S. M. Nagashima, P. Espinosa, and C. Berka. 2009. Characterizing the psychophysiological profile of expert and novice marksmen. In *Augmented Cognition, HCII 2009, LNAI 5638*, ed. D. D. Schmorow, et al., 524–532. Springer-Verlag Berlin Heidelberg: Germany.
- Pope, A. T., E. H. Bogart, and D. S. Bartolome. 1995. Biocybemetic-system validates index of operator engagement in automated task. *Biol Psychol* 40: 187–195.
- Prinzel III, L. J., F. C. Freeman, M. W. Scerbo, P. J. Mikulka, and A. T. Pope. 2000. A closed-loop system for examining psychophysiological measures for adaptive task allocation. *Int J Aviat Psychol* 10: 393–410.
- Raj, A. K., J. F. Perry, L. J. Abraham, and A. H. Rupert. 2003. Tactile interfaces for decision making support under high workload conditions. In *Proceedings of Aerospace Medical Association 74th Annual Scientific Meeting*. San Antonio, TX.
- Reaz, M. B. I., M. S. Hussain, and F. Mohd-Yasin. 2006. Techniques of EMG signal analysis: Detection, processing, classification and applications. *Biol Proced Online* 1(8): 11–35.
- Reeves, L. M., D. D. Schmorow, and K. M. Stanney. 2007a. Augmented cognition and cognitive state assessment technology—near-term, mid-term, and long-term research objectives. In *Foundations of Augmented Cognition, Third International Conference 2007, LNAI 4565*, ed. D. D. Schmorow, and L. M. Reeves, 220–228. Springer-Verlag Berlin Heidelberg: Germany.
- Reeves, L. M., P. Young, D. D. Schmorow, and K. M. Stanney. 2007b. Near-term, mid-term, and long-term research objectives for augmented cognition: (a) Robust controller technology and (b) mitigation strategies. In *Foundations of Augmented Cognition*, ed. D. D. Schmorow, K. M. Stanney, and L. M. Reeves, 2nd ed. Arlington, VA: Strategic Analysis, Inc.
- Sajda, P., A. Gerson, and L. Parra. 2003. Spatial signatures of visual object recognition events learned from single-trial analysis of EEG. In *Proceedings of IEEE Engineering in Medicine and Biology Annual Meeting*, 2087–2090. Cancun, Mexico: IEEE.
- Scerbo, M. W. 2001. Adaptive automation. In *International Encyclopedia of Ergonomics and Human factors*, ed. W. Karwowski, 1077–1079. London: Taylor & Francis.
- Schmorow, D. D., and A. Kruse. 2002. Improving human performance through advanced cognitive system technology. In *CD Proceedings of the Interservice/Industry Training, Simulation & Education Annual Conference (I/ITSEC'02)*. Orlando, FL National Training and Simulation Association (NTSA).
- Schmorow, D. D., and A. A. Kruse. 2004. Augmented cognition. In *Berkshire Encyclopedia of Human-Computer Interaction*, ed. W. S. Bainbridge, 54–59. Great Barrington, MA: Berkshire Publishing Group.
- Schmorow, D. D., and A. Kruse. 2005. Session overview: Foundations of augmented cognition. In *Foundations of Augmented Cognition*, ed. D. D. Schmorow, 441–445. Mahwah, NJ: Lawrence Erlbaum Associates.
- Schmorow, D. D., and L. M. Reeves. 2007. Introduction: 21st century human-system computing: augmented cognition for improved human performance. *Aviat Space Environ Med (Spec Suppl)* 78(5): B7–B11.
- Schmorow, D., K. M. Stanney, G. Wilson, and P. Young. 2005. Augmented cognition in human-system interaction. In *Handbook of Human Factors and Ergonomics*, ed. G. Salvendy, 3rd ed. New York: John Wiley.
- Schnell, T., M. Keller, and T. Macuda. 2008. Sensor integration to characterize operator state. In *Augmented Cognition: A Practitioner's Guide*, ed. D. D. Schmorow, and K. M. Stanney, 41–74. Santa Monica, CA: Human Factors and Ergonomics Society.
- Schnell, T., R. Cornwall, M. Walwanis, and J. Grubb. 2009. The quality of training effectiveness assessment (QTEA) tool applied to the naval aviation training context. In *Augmented Cognition, HCII 2009, LNAI 5638*, ed. N. D. D. Schmorow, et al., 640–649. Springer-Verlag Berlin Heidelberg: Germany.
- Smith, E. E., and J. Jonides. 1998. Neuroimaging analyses of human working memory. *Proc Natl Acad Sci* 95(20): 12061–12068.
- Smith, M. E., L. K. McEvoy, and A. Gevins. 1999. Neurophysiological indices of strategy development and skill acquisition. *Cogn Brain Res* 7(3):389–404.
- Smith, M. E., A. Gevins, H. Brown, A. Karnik, and R. Du. 2001. Monitoring task loading with multivariate EEG measures during complex forms of human-computer interaction. *Hum Factors* 43: 366–380.
- Stanney, K. M., and L. Reeves. 2005. *Mitigation Strategies and Performance Effects*. White paper outbrief from a working session at Improving Warfighter Information Intake Under Stress, AugCog PI Meeting, March 2–4, 2005. Chantilly, VA.
- Stanney, K. M., D. D. Schmorow, M. Johnston, S. Fuchs, D. Jones, K. S. Hale, A. Ahmad, and P. Young. 2009. Augmented cognition: An overview. In *Reviews of Human Factors and Ergonomics*, ed. F. T. Durso, 5:195–224. Santa Monica, CA: Human Factors and Ergonomics Society.
- Sukaviriya, P., and J. D. Foley. 1990. Coupling a UI-framework with automatic generation of context-sensitive animated help. In *Proceedings of the 3rd Annual ACM SIGGRAPH Symposium on User Interface Software and Technology*, 152–166. New York: ACM Press.
- Sun, Y., H. Wang, Y. Yang, J. Zhang, and J. W. Smith. 1994. *Probabilistic Judgment by a Coarser Scale: Behavioral and ERP Evidence*. www.cogsci.northwestern.edu/cogsci2004/papers/paper187.pdf (accessed December 5, 2005).
- Tremoulet, P., P. Barton, P. Craven, C. Corrado, G. Mayer, and K. Stibler, et al. 2005. DARPA Improving Warfighter Information Intake Under Stress—Augmented Cognition Phase 3 Concept Validation Experiment (CVE) Analysis Report for the Lockheed-Martin ATL team

- (Prepared Under Contract No. NBCH030032). Arlington, VA: Defense Advanced Research Projects Agency/Information Processing Techniques Office.
- Tucker, D. M., and P. Luu. 2009. Operational brain dynamics: data fusion technology for neurophysiological, behavioral, and scenario context information in operational environments. In *Augmented Cognition, HCII 2009*, LNAI 5638, ed. D. D. Schmorrow, et al., 98–104. Springer-Verlag Berlin Heidelberg, Germany.
- Vinayagamoorthy, V., A. Brogni, M. Gillies, M. Slater, and A. Steed. 2004. An investigation of presence response across variations in visual realism. In *Presence 2004: 7th Annual International Presence Workshop*, 148–55. http://www.temple.edu/ispr/prev_conferences/proceedings/2004/index.html (accessed June 30, 2009).
- Vogel, E. K., and S. J. Luck. 2000. The visual N1 component as an index of a discrimination process. *Psychophysiology* 37: 190–203.
- Whitlow, S. D., and P. M. Ververs. 2005. Scheduling communications with an adaptive system driven by real-time assessment of cognitive state. In *Proceedings of the 11th International Conference on Human-Computer Interaction*. Las Vegas, NV: Lawrence Erlbaum Associates, Inc.
- Wickens, C. D. 2002. Multiple resources and performance prediction. *Theor Issues Ergon Sci* 3: 159–177.
- Wilson, C. R. 1992. Applied use of cardiac and respiration measures: Practical considerations and precautions. *Biol Psychol* 34: 163–178.
- Wilson, G. F., and C. A. Russell. 2006. Psychophysiological versus task determined adaptive aiding accomplishment. In *Foundations of Augmented Cognition*, ed. D. D. Schmorrow, K. M. Stanney, and L. M. Reeves, 2nd ed., 201–207. Arlington, VA: Strategic Analysis, Inc.
- Wilson, G. F., and R. E. Schlegel, eds. 2004. Operator Functional State Assessment (NATO RTO Publication RTO-TR-HFM-104). Neuilly sur Seine, France: NATO Research and Technology Organization.
- Wilson, G. F., J. D. Lambert, and C. A. Russell. 2000. Performance enhancement with real-time physiologically controlled adaptive aiding. In *Proceedings of the Human Factors and Ergonomics Society 44th Annual Meeting*, 361–364. Santa Monica, CA: Human Factors and Ergonomics Society.
- Yamaguchi, S., S. Yamagata, and S. Kobayashi. 2000. Cerebral asymmetry of the “top-down” allocation of attention to global and local features. *The Journal of Neuroscience* 20, RC72 1 of 5. <http://www.liing.uni-potsdam.de/~saddy/web%20papers/Yamaguchi%20assymetry%20and%20attention.pdf>. (accessed June 5, 2011).
- ## Social Networks and Social Media
- About Meebo meebo. 2011. *Meebo—Together is Better*. <http://www.meebo.com/about/> (accessed June 9, 2011).
- Albanesius, C. 2010. Foursquare updates privacy settings—news & opinion—PCMag.com. In *Technology Product Reviews, News, Prices & Downloads—PC Mag.com—PC Magazine*. <http://www.pcmag.com/article2/0,2817,2367964,00.asp> (accessed June 8, 2011).
- Anyclip, LTD. 2011. AnyClip to Kickoff Foursquare Scavenger Hunt During NYC Internet Week. *Marketwire à Newswire service for online press release distribution, social media releases, social media monitoring, online newsrooms, news release analytics and reporting*. <http://www.marketwire.com/press-release/anyclip-to-kickoff-foursquare-scavenger-hunt-duringnyc-internet-week-1524476.htm> (accessed June 9, 2011).
- Apple—iTunes stores your content and pushes it to your devices. 2011. *Apple*, <http://www.apple.com/icloud/what-is.html> (accessed June 7, 2011).
- Associated Press. 2011. California Woman Sues Internet Dating Site After Sex Assault—FoxNews.com. *FoxNews.com—Breaking News—Latest News—Current News*. <http://www.foxnews.com/us/2011/04/14/california-woman-sues-internet-dating-site-sex-assault/> (accessed June 9, 2011).
- Beckerman, L., and J. Nocero. 2003. High-tech student hate mail. *Educ Dig* 68(6):37–40.
- Burke, M., C. Marlow, and T. Lento. 2010. Social network activity and social well-being Social media users. In *Proceedings of the 2010 ACM Conference on Human Factors in Computing Systems*, 1909–1912. New York: ACM.
- Chou, W. Y., Y. Hunt, A. Folkers, and E. Augustson. 2011. Cancer survivorship in the age of YouTube and social media: a narrative analysis. *J Med Inter Res* 13(1):e7.
- Christakis, D. A., and M. A. Moreno. 2009. Trapped in the net: Will Internet addiction become a 21st century epidemic? *Arch Pediatr Adolesc Med* 163: 959–960.
- Colineau, N., and C. Paris. 2010. Talking about your health to strangers: understanding the use of online social networks by patients. *MYPERMM New Review of Hypermedia and Multimedia* 16 (1/2): 141–160.
- Edwards, E. 2010. Twitter: Without a doubt, the best way to get fired. *JOLT Home—North Carolina Journal of Law and Technology*. <http://www.ncjolt.org/blog/2010/01/14/twitter-without-doubt-best-way-get-fired> (accessed April 2, 2011).
- Elgg. 2011. <http://elgg.org> (accessed June 9, 2011).
- El Abaddi, A., L. Backstrom, S. Chakrabarti, A. Jaimes, J. Leskovec, and A. Tomkins. 2011. *Proceedings of the 2011 International Conference on the World Wide Web*, 2:327–328. New York: ACM.
- Espinoza, J. 2009. Online dating sites flirt with record growth—forbes. com. *Forbes* com http://www.forbes.com/2009/01/06/online-dating-industry-face-markets-cx_je_0105_autofacescan01.html (accessed June 8, 2011).
- Fasick, K., and C. Lisi. 2011. Weiner says he has no plans to resign following sexting scandal. *New York Post*. Retrieved June 30, 2011, from http://www.nypost.com/p/news/local/weiner_says_scandal_has_no_plans_RE26B787X2Xp2K4Le8qleK.
- Fisher, M. 2011. Gottfried's QuackerQuashed, fired for tweets. *The Faster Times*. thefastertimes.com/entertainmentnews/2011/03/16/gottfrieds-quacker-quashed-fired-for-tweets/ (accessed April 1, 2011).
- Forti, J. 2011. CNBC Tech Check Blog—Forti: Why Apple's iCloud Announcement Matters—CNBC.com Technology News—CNBC. *Stock Market News, Business News, Financial, Earnings, World Market News and Information—CNBC*. <http://www.cnbc.com/id/43294274> (accessed June 7, 2011).
- Friedman, P. W., B. L. Winnick, C. P. Friedman, and P. C. Mickelson. 2002. Development of a MeSH-based index of faculty research interests. *Proc Am Med Inform Assoc Symp* 265–269. Bethesda, MD: AMIA.
- Garton, L., C. Haythorne et al. 1997. Studying online social networks. *J Comput Mediat Commun* 3(1):0–10.
- Gewin V. 2010. Collaboration: Social networking seeks critical mass. *Nature* 15(468):993–994.
- Goble, C., O. Corcho, P. Alper, and D. De Roure. 2006. e-Sciene and the semantic web: A symbiotic relationship. *Proc Discov Sci Lect Notes Artif Intell* 1–12.

- Grudin, J., and E. S. Poole. 2010. Wikis at work: Success factors and challenges for sustainability of enterprise wikis. In ACM Press: Proceedings of WikiSym '10. Gdansk, Poland. New York: ACM.
- Hampton, K., and B. Wellman. 2003. Neighboring in netville: how the Internet supports community and social capital in a wired suburb. *City Community* 2(4): 277–311.
- Hancock, J., and C. Toma. 2009. Putting your best face forward: The accuracy of online dating photographs. *J Commun* 59:367–386. <http://faculty.unlv.edu/drums/pioneer/files/JOUR%20435%20635/photosonlinedating.pdf> (accessed June 9, 2011).
- Harvard Catalyst Profiles. 2011. *People and Collaboration*. <http://connects.catalyst.harvard.edu/PROFILES/search> (accessed on April 4, 2011).
- Hinrichs, U., D. Fisher, and N. H. Riche. 2010. ResearchWave: an ambient visualization for providing awareness of research activities. In DIS '10: Proceeding of 8th ACM Conference on Designing Interactive Systems, 31–34. New York: ACM.
- Kane, Y. I. 2011. New App Aims to Erase Swingers' Online Tracks—Digits—WSJ. WSJ Blogs—WSJ. <http://blogs.wsj.com/digits/2011/05/03/new-app-aims-to-erase-swingers-online-tracks/> (accessed June 8, 2011).
- Kellman, L. 2011. Top Democratic women dodge tough call on Weiner—Politics—Wire—TheSunNews.com. *TheSunNews.com—MyrtleBeachNews, Golf, Hotels, Homes, Jobs, Cars.N.p.*, 9 Web. <http://www.thesunnews.com/2011/06/09/2211049/weiner-abides-despite-new-photo.html> (accessed 9 June 2011).
- Kontos, E. Z., K. M. Emmons, E. Puleo, and K. Viswanath. 2010. Communication inequalities and public health implications of adult social networking site use in the United States. *J Health Commun* 15 Suppl (3):216–235.
- Labi, N. 2007. An IM Infatuation Turned to Romance. Then the Truth Came Out. *Wired*. <http://www.wired.com/images/press/pdf/flirting.pdf> (accessed June 9, 2011).
- Lampinen, A. 2010. Practices of balancing privacy and publicness in social network services. Poster session II—doctoral colloquium. GROUP '10: Int Conf Support Group Work 11-06:343–344.
- Lehtinen, V., J. Näsänen, and R. Sarvas. 2009. A Little Silly and Empty-Headed—Older Adults' Understandings of Social Networking Sites in the 23rd BCS conference on Human Computer Interaction. Cambridge, UK.
- Lenhart, A. 2007. Cyberbullying and Online Teens. Pew Research Center's Internet & American Life Project. <http://www.pewinternet.org/Reports/2007/Cyberbullying.aspx> (accessed April 3, 2011).
- Li, Q. 2010. Cyberbullying in high schools: A study of students' behaviors and beliefs about this new phenomenon. *J Aggress Maltreat Trauma* 19(4):372–392.
- Madden, M., and A. Lenhart. 2006. Most online Americans who are single and looking for dates have used the Internet to pursue their romantic interests and millions more Americans know people who have tried and succeeded at online dating. *Pew Inter Am Life Proj*. <http://www.pewinternet.org/Reports/2006/Online-Dating/01-Summary-of-Findings.aspx> (accessed June 8, 2011).
- Madden, M., and A. Lenhart. 2006. Summary of Findings I Pew Internet & American Life Project. Pew Research Center's Internet & American Life Project. Retrieved November 29, 2011, from <http://www.pewinternet.org/Reports/2006/Online-Dating/01-Summary-of-Findings.aspx>.
- Madrigal, A. 2011. Should employers be allowed to ask for your Facebook login? In *The Atlantic*. <http://www.theatlantic.com/technology/archive/2011/02/should-employers-be-allowed-to-ask-for-your-facebook-login/71480/> (accessed April 3, 2011).
- Mangla, I. 2009. Fired for Facebook: Don't let it happen to you. *CNN Money*. <http://moremoney.blogs.money.cnn.com/2009/04/21/fired-for-facebook-dont-let-it-happen-to-you/> (accessed April 2, 2011).
- Massachusetts Institute of Technology. 2011. *The Third Revolution: The Convergence of the Life Sciences, Physical Sciences, and Engineering*. <http://web.mit.edu/dc/Policy/MIT%20White%20Paper%20on%20Convergence.pdf> (accessed March 24, 2011).
- Metz, C. 2007. Web 3.0. PCMag.com. In *Technology Product Reviews, News, Prices & Downloads*. PCMag.com. PC Magazine. <http://www.pcmag.com/article2/0,2817,2102852,00.asp> (accessed June 9, 2011).
- Nielsen Company. 2010. Global Audience Spends Two Hours More a Month on Social Networks than Last Year. In *Nielsen Wire*. blog.nielsen.com/nielsenwire/global/global-audience-spends-two-hours-more-a-month-on-social-networks-than-last-year/print/ (accessed April 2, 2011).
- O'Keefe, G. S., K. Clarke-Pearson, and C. O. Communications. 2011. Clinical Report. The impact of social media on children, adolescents, and families. *Pediatrics*, Retrieved from <http://pediatrics.aappublications.org/content/early/2011/03/28/peds.2011-0054.abstract>.
- Porter, A. L., and I. Rafols. 2009. Is science becoming more interdisciplinary? Measuring and mapping six research fields over time. *Scientometrics* 80(3):710–745.
- Preece, J., and B. Shneiderman. 2009. The reader-to-leader framework: motivating technology-mediated social participation. *AIS Trans Hum Comput Interact* 1(1): 13–32. <http://aisel.ais-net.org/thci/vol1/iss1/5>
- Richtel, M., and M. Helft. 2011. Facebook users who are under age raise concerns. In *The New York Times*. B1. <http://www.nytimes.com/2011/03/12/technology/internet/12underage.html> (accessed April 2, 2011).
- Sainfort, F., J. A. Jacko, M. McClellan, K. P. Moloney, and V. K. Leonard. 2011. E-health in health care. 2nd ed. In *The Handbook of Human Factors in Web Design*, ed. K.-P. L. Vu and R. W. Proctor, 608–609. Boca Raton, FL: CRC Press.
- Sautter, J. M., R. M. Tippett, and S. P. Morgan. 2010. The social demography of Internet dating in the united states. *Soc Sci Q* 91: 554–575.
- Schleyer T., H. Spallek, B. S. Butler, S. Subramanian, D. Weiss, M. L. Poythress, P. Rattanathikun, and G. Mueller. 2008. Facebook for scientists: requirements and services for optimizing how scientific collaborations are established. *J Med Internet Res* 10(3):e24.
- Seong, S. W., S. Hangal, C. Brigham, D. Sengupta, G. Bayer, and J. Seo, et al. 2009. *A Distributed Social Networking Infrastructure with Personal Cloud Butlers*. http://gbayer.com/stanford/prpl/www2009_submission_872.pdf (accessed June 7, 2011).
- Sillanpaa, N., S. Alli, and T. Overmark. 2010. Easy-to-use network service. ICCHP 2010. LNCS 6179: 544–549.
- Silverstein, E. 2011. Match.com proposes closer partnership with meetic dating site. In *Smarter News, Analysis & Research Communities*. <http://www.tmcnet.com/topics/articles/180811-matchcom-proposes-closer-partnership-with-meetic-datingsite.htm> (accessed June 8, 2011).
- Spitzberg, B. H., and G. Hoobler. 2002. Cyberstalking and the technologies of interpersonal terrorism. *New Media Society* 4: 71–92.
- Stewart, T. 2009. Facebook entry that earned 'Lindsay' her P45. London Evening Standard. Retrieved November 29, 2011, from <http://www.thisislondon.co.uk/standard/article-23732446-facebook-entry-that-earned-lindsay-her-p45.do>.
- Strickland, J. 2008a. Is there a Web 1.0? HowStuffWorks.com. <http://computer.howstuffworks.com/web-10.htm> (accessed June 9, 2011).

- Strickland, J. 2008b. How Web 3.0 Will Work. HowStuffWorks.com. <http://computer.howstuffworks.com/web-30.htm> (accessed June 9, 2011).
- Toma, C. 2010. Affirming the self through online profiles: beneficial effects of social networking sites using your social network. Proc ACM CHI 2010 Conf Hum Factors Comput Syst. 1: 1749–1752.
- Toma, C., J. T. Hancock, and N. Ellison. 2008. Separating fact from fiction: An examination of deceptive selfpresentation in online dating profiles. Pers Soc Psychol Bull 34: 1023–1036.
- Tulsiani, B., M. Best, and D. Card. 2008. US Paid Content Forecast, 2008 to 2013. Jupiter Research. http://www.forrester.com/rb/Research/us_paid_content_forecast,_2008_to_2013/q/id/53215/t/2. (accessed June 8, 2011).
- VIVO. 2011. VIVO: enabling national networking of scientists. <http://vivoweb.org/> (accessed April 4, 2011).
- W3Techs. 2011. Usage statistics and market share of content management systems for websites. W3Techs—World Wide Web Technology Surveys. http://w3techs.com/technologies/overview/content_management/all (accessed April 3, 2011).
- Wagner, C., and A. Majchrzak. 2007. Enabling customer-centricity using wikis and the wiki way. J Manag Inf Syst 23(3): 17–43.
- Wang, H., and B. Wellman. 2010. Social connectivity in America: changes in adult friendship network size from 2002 to 2007. Am Behav Sci 53(8): 1148–1169.
- Wang, X., L. Tang, H. Gao, and H. Liu. 2010. Discovering overlapping groups in social media. In Proceedings of the 10th IEEE International Conference on Data Mining (ICDM 2010). Sydney, Australia. Los Alamitos, CA: CPS.
- Weber, G. M., W. Barnett, M. Conlon, D. Eichmann, W. Kibbe, H. Falk-Krzesinski, M. Halaas, et al. 2011. Distributed Interoperable Research Experts Collaboration Tool (DIRECT). J Am Med Inform Assoc.
- Wells, R. 2010. 41.6% of the US Population has a Facebook Account. Social media news, strategy, tools, and techniques: Social Media Today. <http://socialmediatoday.com/index.php?q=roywells1/158020/416-us-population-has-facebook-account> (accessed April 3, 2011).
- Wright, A. 2008. Searching the Deep Web. CACM 51(10):14–15.
- Ybarra, M. L., and K. J. Mitchell. 2004. Youth engaging in online harassment: Associations with caregiver-child relationships, Internet use, and personal characteristics. J Adolesc 27: 319–336.

Human–Computer Interaction for Development

- Alexander, C. 1977. A Pattern Language: Towns, Buildings, Constructions. New York: Oxford University Press.
- Anokwa, Y., T. Smyth, D. Ramachandran, J. Sherwani, Y. Schwartzman, R. Luk, M. Ho, N. Moraveji, and B. DeRenzi. 2009. Stories from the Field: Reflections on HCI4D Experiences. Inf Technol Int Dev 5(4). <http://itidjournal.org/itid/article/view/427/195> (accessed November 30, 2011).
- Avgerou, C., and G. Walsham. 2000. Introduction: IT in Developing Countries. In Information Technology in Context: Studies from the Perspective of Developing Countries, ed. C. Avgerou and G. Walsham. Aldershot: Ashgate Publishing Ltd.
- Azim Premji Foundation. 2004. The Social Context of Elementary Education in Rural India. Bengaluru, India: Azim Premji Foundation.
- Bantebya Kyomuhendo, G. 2009. The mobile payphone business: A vehicle for rural women's empowerment in Uganda. In African Women and ICTs: Investigating Technology, Gender and Empowerment, ed. I. Buskens and A. Webb. Zed Books & IDRC. http://www.idrc.ca/en/ev-137013-201-1-DO_TOPIC.html (accessed September 26, 2010).
- Beretta, A., and A. Davies. 1985. Evaluation of the Bangalore Project. ELT Journal 39(2): 121–212.
- Best, M. L., T. N. Smyth, D. Serrano-Baquero, and J. Etherton. 2009. Designing for and with diaspora: A case study of work for the truth and reconciliation commission of Liberia. In *Extended abstracts on Human factors in computing systems*, 2903–18.
- Best, M. L., Serrano-Baquero, D., Abbasi, H., Pon, C. L., Roberts, D. L., and Smyth, T. N. 2008. Design of Video-Sharing Kiosks for Liberian Post-Conflict Reconciliation. Unpublished paper presented at CHI 2008, HCI4D Workshop. San Jose, CA.
- Björk, S., and J. Holopainen. 2005. Patterns in Game Design. Hingham, MA: Charles River Media.
- Braa, J., T. Ola Hodne, and S. Johan. 2004. Participatory health information systems development in Cuba: The challenge of addressing multiple levels in a centralized setting. In PDC 2004 - Proceedings of the Eighth Conference on Participatory Design, ed. A. Clement and P. Van den Besselaar, 53–64. Toronto, Ontario, Canada. <http://delivery.acm.org/10.1145/1020000/1011877/p53-braa.pdf?key1=1011877&key2=7878144821&coll=GUIDE&dl=GUIDE&CFID=104403073&CFTOKEN=50873688> (Behind login in ACM Digital Library; accessed September 26, 2010).
- Buié, E., S. Dray, K. Instone, J. Jain, G. Lindgaard, and A. Lund. 2010a. How to bring HCI research and practice closer together. Workshop presented at CHI 2010, Atlanta, GA, and included in *Proceedings of the 28th of the International Conference Extended Abstracts on Human Factors in Computing Systems*, New York, NY: ACM.
- Buié, E., S. Dray, K. Instone, J. Jain, G. Lindgaard, and A. Lund. 2010b. A researcher-practitioner interaction. "Special Interest Group" presented at CHI 2010, Atlanta, GA, and included in *Proceedings of the 28th of the International Conference Extended Abstracts on Human Factors in Computing Systems*, New York, NY: ACM.
- Carrasco, E., C. McClellan, and J. Ro. 2007. Foreign debt: Forgiveness and repudiation. In *The E-Book on International Finance & Development*, ed. E. Carrasco. Published online and available at: <http://www.uiowa.edu/ifdebook/ebook2/contents/part4-1.shtml> (accessed September 26, 2010).
- Chambers, R. 1994. The Origin and Practice of PRA. World Dev 22(7):953–969.
- Cheng, K. G., F. Ernesto, K. N. Truong. 2008. Participant and Interviewer attitudes toward handheld computers in the context of HIV/AIDS programs in Sub-Saharan Africa. In The Proceedings of CHI 2008: The ACM Conference on Human Factors in Computing Systems, 763–766. Florence, Italy. <http://khaitruong.com/publications/CHI-2008c.pdf> (accessed September 26, 2010).
- Dearden, A., and H. Rizvi. 2008a. Adapting participatory and agile software methods to participatory rural development. In PDC '08: Experiences and Challenges, Proceedings of the Participatory Design Conference, 221–225. Bloomington, IN: Indiana University Press.
- Dearden, A., and H. Rizvi. 2008b. Participatory design and participatory development: A comparative review. In PDC '08: Experiences and Challenges, Proceedings of the Participatory Design Conference, 81–91. Bloomington, IN: Indiana University Press.
- Dearden, A., and H. Rizvi. 2009. A deeply embedded sociotechnical strategy for designing ICT for development. J SocioTechnol Knowl Dev 1(4):52–70.
- Department for International Development. 1999. Sustainable Livelihoods Guidance Sheets. London. <http://www.nssd.net/references/SustLiveli/DFIDapproach.htm> (accessed September 26, 2010).

- Dray, S. 2009. Engaged scholars, thoughtful practitioners: The interdependence of academics and practitioners in user-centered design and usability. *J Usability Stud* 5(1): 1–7. http://www.upassoc.org/upa_publications/jus/2009november/JUS_Dray_Nov2009.pdf (accessed September 26, 2010).
- Ellis, R. 2003. Task-Based Language Teaching and Learning. New York: Oxford University Press.
- Fals-Borda, O. 1987. The application of participatory action-research in Latin America. *Int Sociol* 2(4):329–347.
- Faust, D., and R. Nagar. 2001. English Medium Education, Social Fracturing, and the Politics of Development in Postcolonial India. *Economic and Political Weekly* 2878–83.
- Foucault, B. E., R. S. Russell, and G. Bell. 2004. Techniques for researching and designing global products in an unstable world: a case study. In *Proceedings of the 23rd International Conference Extended Abstracts on Human Factors in Computing Systems*, New York: ACM.
- Fullerton, T. 2008. Game Design Workshop: A Playcentric Approach to Creating Innovative Games. 2nd Edition. Burlington, MA: Elsevier Inc.
- Gandhi, R., R. Veeraraghavan, K. Toyama, and V. Ramprasad. 2007. Digital green: Participatory video for agricultural extension. Presented at ICTD '09 and published in *Information Technologies and International Development*, 5(1): 1–15. Available at: <http://itidjournal.org/itid/article/view/322/145> (accessed November 30, 2011).
- Gaver, W. 2007. Cultural commentators: Non-native interpretations as resources for polyphonic assessment. *Int J Hum Comput Stud* 65(4): 292–305.
- Haq, M. 1995. Reflections on Human Development. New York: Oxford University Press.
- Heeks, R. 2005. e-Government as a Carrier of Context. *J Public Pol* 25: 51–74.
- Heeks, R. 2009. The ICT4D 2.0 Manifesto: Where Next for ICTs and International Development? Published online and available at: http://www.sed.manchester.ac.uk/idpm/research/publications/wp/di/documents/di_wp42.pdf (accessed September 26, 2010).
- Ho, M., T. Smyth, M. Kam, and A. Dearden. 2009. Human-computer interaction for development: The past, present, and future. *Inf Technol Int Dev* 5(4): 1–18. <http://itidjournal.org/itid/article/view/420/188> (accessed September 26, 2010).
- Humphrey, J. 2009. Policy implications of trends in agribusiness value chains. *The European Journal of Development Research* 18(4):572–592.
- International Development Research Centre. 2005. *Participatory Research and Development: A Sourcebook*. Vol. 1. Ottawa, Canada: Author. <http://www.idrc.ca> (accessed September, 26 2010).
- Jalava, J., and M. Pohjola. Economic growth in the New Economy: Evidence from advanced economies. *Information Economics and Policy* 14(2):189–210.
- Kam, M., A. Kumar, S. Jain, A. Mathur, and J. Canny. 2009b. Improving literacy in rural India: Cellphone games in an after-school program. In *Proceedings of the Information and Communication Technologies and Development 2009 International Conference* (ICTD 2009), April 17–19 2009. Doha, Quatar, 139–49. Available at: <http://www.scribd.com/doc/14234869/ICTD-2009-Proceedings>.
- Kam, M., A. Mathur, A. Kumar, and J. Canny. 2009. Designing digital games for rural children: A study of traditional village games in india. In *Proceedings of the 27th International Conference Extended Abstracts on Human Factors in Computing Systems*. New York: ACM. Available at: <http://www.cs.cmu.edu/~mattkam/publications/CHI2009.pdf> (accessed November 30, 2011).
- Kam, M., D. Ramachandran, V. Devanathan, A. Tewari, and J. Canny. 2007. Localized iterative design for language learning in underdeveloped regions: The PACE framework. *Proceedings of the 25th International Conference Extended Abstracts on Human Factors in Computing Systems*, New York, NY: ACM.
- Kam, M., V. Rudraraju, A. Tewari, and J. Canny. 2007b. Mobile gaming with children in rural india: Contextual factors in the use of game design patterns. In *Proceedings of 3rd Digital Games Research Association International Conference* (DiGRA '07), September 24–28, 2007. Tokyo, Japan. Available at: <http://www.digra.org/dl/db/07312.25032.pdf> (accessed November 30, 2011).
- Kasturiaracchi, A., T. Eriksson, S. Rodrigues, and A. Kubota. 2009. Planning, monitoring and evaluating for development results. In *Handbook on Planning, Monitoring and Evaluating for Development Results*. 5–17. New York: United Nations Development Programme, <http://stone.undp.org/undpweb/eo/evalnet/Handbook2/documents/english/pme-handbook.pdf> (accessed September 26, 2010).
- Kishwar, M. P. 2005. Deprivations's Real Language. In *The Indian Express*. <http://www.indianexpress.com/printerFriendly/12662.html> (accessed September 26, 2010).
- Kleine, D., and T. Unwin. 2009. Technological revolution, evolution and new dependencies: What's new about ICT4D? *Third World Q* 30(5): 1045–1067.
- Kraemer, K. L., and J. Dedrick. 2001. Information technology and productivity: Results and policy implications of crosscountry studies. In *Information Technology, Productivity, and Economic Growth*, ed. M. Pohjola, 257–279. Oxford, UK: Oxford University Press.
- Light, A., and T. Anderson. 2009. Research Project as Boundary Object: negotiating the conceptual design of a tool for International Development. In *Proc ECSCW 2009*, Vienna, Austria.
- Long, W., and P. Brecke. 2003. War and Reconciliation: Reason and Emotion in Conflict Resolution. Cambridge, MA: MIT Press.
- Luk, R., M. Zaharia, M. Ho, B. Levine, and P. M. Aoki. 2009. ICTD for Healthcare in Ghana: Two Parallel Case Studies. In *Proceedings of the 3rd International Conference on Information and Communication Technologies and Development*, ICTD '09, 118–128. Piscataway, NJ. New York: IEEE Press.
- Marker, P., K. McNamara, and L. Wallace. 2002. The Significance of Information and Communication Technologies for Reducing Poverty. London: Department for International Development. http://www.oecd.org/dac/ictcd/docs/matrixdocs/GBR_paper1.pdf (accessed September 26, 2010).
- Marsden, G., A. Maunder, and M. Parker. 2008. People are people, but technology is not technology. *Phil Trans R Soc A* 366(1881): 3795–3804. Available at: <http://people.cs.uct.ac.za/~gaz/papers/RSTA20080119.pdf> (accessed November 30, 2011).
- Medhi, I., A. Sagar, and K. Toyama. 2006. Text-Free User Interfaces for Illiterate and Semi-Literate Users. Berkeley, CA: IEEE/ACM International Conference on Information and Communication Technologies and Development.
- Medhi, I., A. Sagar, and K. Toyama. 2008. Text-free user interfaces for illiterate and semi-literate users. *Inf Technol Int Dev* 4(1):37–50.
- Munshi, K., and M. Rosenzweig. 2006. Traditional institutions meet the modern world: Caste, gender, and schooling choice in a globalizing economy. *Am Econ Rev* 96(4): 1225–1252.
- NSF. 2011. Grant Proposal Guide. National Science Foundation. Available at: http://www.nsf.gov/pubs/policydocs/pappguide/nsf11001/gpg_1.jsp (accessed November 30, 2011).
- Nunan, D. 2004. Task-Based Language Teaching. New York: Cambridge University Press.
- Oxford University. 2010. *Department of International Development*. <http://www.qeh.ox.ac.uk/> (accessed September 26, 2010).

- Parikh, T., and E. Lazowska. 2006. Designing an architecture for delivering mobile information services to the rural developing world. In International World Wide Web Conference: Proceedings of the 15th International Conference on World Wide Web, 791–800. Edinburgh, Scotland, NY: ACM Press.
- Polak, P. 2009. Out of Poverty: What Works When Traditional Approaches Fail. San Francisco, CA: Berrett-Koehler Publishers, Inc.
- Polak, P. 2010. *The Death of Appropriate Technology*. Blog post. <http://blog.paulpolak.com/?p=376> (accessed September 26, 2010).
- Prabhu, N. S. 1987. Second Language Pedagogy. Oxford, U.K.: Oxford University Press.
- Prahalad, C. 2009. *The Fortune at the Bottom of the Pyramid: Eradicating Poverty through Profits*. Revised and Updated. Wharton School of Publishing/Pearson Education.
- Ramachandran, D., J. Canny, P. D. Das, and E. Cutrell. 2010a. Mobile-izing health workers in rural india. In Proceedings of CHI 2010, Human Factors in Computing Systems, 1889–1898. Atlanta, GA: ACM Press. <http://research.microsoft.com/en-us/um/people/cutrell/CHI2010-RamachandranEtal-Mobile-izingHealth.pdf> (accessed September 26, 2010).
- Ramachandran, D., V. Goswami, and J. Canny. 2010b. Research and reality: Using mobile messages to promote maternal health in rural india. In Proceedings of ICTD 2010, International Conference on Information and Communication Technologies and Development. London: Royal Holloway University of London Press.
- Ropers, N. 2004. From resolution to transformation: The role of dialogue projects. In Berghof Handbook for Conflict Transformation, eds. D. Körppen, B. Schmelzle, and O. Wils. Berlin, Germany: Berghof Research Center for Constructive Conflict Management.
- Sambasivan, N., E. Cutrell, and K. Toyama. 2010. ViralVCD: Tracing information-diffusion paths with low cost media in developing communities. In Conference on Human Factors in Computing Systems: Proceedings of ACM Conference on Human Factors in Computing Systems. 2607–2610. New York: ACM Press.
- Sambasivan, N., N. Rangaswamy, E. Cutrell, and B. Nardi. 2009. Ubicomp4D: Interaction and infrastructure for international development: The case of urban indian slums. In UbiComp: Proceedings of the 11th International Conference on Ubiquitous Computing. 155–164. New York: ACM Press.
- Sambasivan, N., N. Rangaswamy, K. Toyama, and B. Nardi. 2009a. Encountering development ethnographically. *Interactions* 16(6):20–23.
- Sambasivan, N., N. Rangaswamy, K. Toyama, and B. Nardi. 2009b. Encountering development ethnographically. *Interactions* 16(6):20–23. http://www.ics.uci.edu/~nsambasi/ACMInteractions09_EncounteringDevEthno.pdf (accessed September 26, 2010).
- Schwarzer, R., and M. Jerusalem. 1995. Generalized self-efficacy scale. In Measures in Health Psychology: A User's Portfolio. Causal and Control Beliefs, ed. J. Weinman, S. Wright, and Johnston, 35–37. Windsor, U. K.: NFER-NELSON.
- Sen, A. 1999. Development as Freedom. Oxford, U.K.: Oxford University Press.
- Silverstone, R., and L. Haddon. 1996. Design and the domestication of information and communication technologies: Technical change and everyday life. In *Communication by Design: The Politics of Information and Communication Technologies*, ed. R. Mansell and R. Silverstone. New York: Oxford University Press.
- Skehan, P. 1998. Task-based instruction. *Annual Review of Applied Linguistics* 18: 268–286.
- Smyth, T., J. Etherton, and M. L. Best. 2010. MOSES: Exploring new ground in media and post-conflict reconciliation. In CHI. Atlanta, GA. <http://mikeb.inta.gatech.edu/uploads/papers/pap0922-smyth.pdf> (accessed September 26, 2010).
- Spicker, P. no date. *British Social Policy*. 1601–948. Published online and available at: <http://www2.rgu.ac.uk/publicpolicy/introduction/historyf.htm> (accessed September 26, 2010).
- Sukumaran, A., S. Ramlal, E. Ophir, V. RamNaresh Kumar, G. Mishra, V. Evers, V. Balaji, and C. Nass. 2009. Intermediated technology interaction in rural contexts. In Proceedings of the 27th International Conference on Human Factors in Computing Systems Extended Abstracts (CHI EA '09), 3817–3822. New York: ACM.
- The National Science Foundation Proposal Award Policies and Procedures Guide. 2009. Effective January 4, 2010. NSF 10–1, OMB Control Number 3145-0058. http://www.nsf.gov/pubs/policydocs/pappguide/nsf10_1/gpgprint.pdf (accessed September 26, 2010).
- Truman, H. S. 1949. *Inaugural Address*. <http://www.vlib.us/amdocs/texts/41trum1.htm> (accessed November 30, 2011).
- United Nations Asian and Pacific Training Centre for Information and Communication Technology for Development (APCICT). 2010. *Briefing Note: ICT Project Management in Theory and Practice*, <http://www.unapcict.org/news/aboutus/programmes/research/BriefingNote-7-web.pdf> (accessed September 26, 2010).
- United Nations Development Programme. 2010. *Millennium Development Goals*. <http://www.undp.org/mdg/> (accessed September 26, 2010).
- United Nations Environment Programme. *TUNZA Network*. <http://www.unep.org/tunza/youth/> (accessed September 26, 2010).
- Vodafone Group. 2005. Africa: The impact of mobile phones. Moving the debate forward (Vodafone Policy Papers Series No. 2). Available at http://www.vodafone.com/content/dam/vodafone/about/public_policy/policy_papers/public_policy_series_2.pdf (accessed November 30, 2011).
- World Bank. 2004. Monitoring & evaluation. Some tools, methods & approaches. Operations Evaluation Department. New York, NY: World Bank. http://www.worldbank.org/ieg/ecd/me_tools_and_approaches.html (accessed September 26, 2010).
- World Economic Forum, Financing for Development Initiative. 2005. Building on the monterrey consensus: The growing role for public-private partnerships in mobilizing resources for development. In *United Nations High-level Plenary Meeting On Financing for Development*. http://www.weforum.org/pdf/un_final_report.pdf (accessed September 12, 2010).