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<th>Hall B</th>
<th>Ballroom 201</th>
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<th>A105 – A106</th>
<th>C123 – C124</th>
<th>B113 – B114</th>
<th>B115 – B116</th>
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<td><strong>09:00 to 10:30</strong></td>
<td><strong>PANEL</strong> Connecting with Kids: What’s New?</td>
<td><strong>PAPERS</strong> Touch &amp; Such</td>
<td><strong>PAPERS</strong> Smart Interaction Techniques 1</td>
<td><strong>PAPERS</strong> Interruptions &amp; Attention 1</td>
<td><strong>INTERACTIVITY</strong> Can You Hear Me Now? Audio Interfaces</td>
<td><strong>SHORT PAPERS</strong> Accessible Design</td>
<td><strong>SHORT PAPERS</strong> Social and Legal Issues</td>
<td><strong>SIG</strong> Do CHI Papers Work for You?</td>
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<tr>
<td><strong>11:30 to 13:00</strong></td>
<td><strong>INVITED PANEL</strong> Early Days of CHI: MIT Lincoln Laboratory</td>
<td><strong>PAPERS</strong> Design Thoughts &amp; Methods</td>
<td><strong>PAPERS</strong> Smart Interaction Techniques 2</td>
<td><strong>PAPERS</strong> Interactive Information Visualization</td>
<td>alt.chi urban pacman</td>
<td><strong>SHORT PAPERS</strong> Cognitive Modeling, Adaptation, and End-user Programming</td>
<td><strong>SHORT PAPERS</strong> Social and Legal Issues</td>
<td><strong>SIG</strong> Making an Impact in your Community: HCI and US Public Policy</td>
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<tr>
<td><strong>14:30 to 16:00</strong></td>
<td><strong>PANEL</strong> Corporate Re-Orgs: Poison or Catalyst to HCI?</td>
<td><strong>PAPERS/SHORT PAPERS</strong> Pen-Based Interfaces</td>
<td><strong>PAPERS</strong> Affect and Intimacy</td>
<td><strong>PAPERS</strong> Assistive Applications</td>
<td><strong>PAPERS</strong> Educational and Help Systems</td>
<td><strong>STUDENT COMPETITION</strong> Finalists Presentations</td>
<td><strong>SHORT PAPERS</strong> Beyond 2D Interaction</td>
<td><strong>SHORT PAPERS</strong> Social Computing and Community</td>
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<tr>
<td><strong>16:30 to 18:00</strong></td>
<td><strong>SPOTLIGHT SESSION</strong> Safety in a Complex World</td>
<td><strong>PAPERS</strong> In-Vehicle Interfaces</td>
<td><strong>PAPERS</strong> Physical Interaction</td>
<td><strong>PAPERS</strong> Technology in the Home</td>
<td><strong>DESIGN EXPO</strong> The Power of Design: Case Studies in Excellence</td>
<td><strong>SHORT PAPERS</strong> Visualization Techniques</td>
<td><strong>SHORT PAPERS</strong> HCI in the Office</td>
<td><strong>SIG</strong> Assessing and Improving Information Usability</td>
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<td><strong>POSTER HIGHLIGHT 1</strong> 10:30 – 11:30</td>
<td><strong>EXHIBITS OPEN</strong> 10:00 – 18:00</td>
<td><strong>INFORMATION BOOTH</strong> 08:30 – 18:30</td>
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<td>Doctoral Consortium, Student Competition, Workshops</td>
<td>ACM SIGCHI Member Meeting 18:10 – 19:00 A105 – A106</td>
<td><strong>RECRUITING BOARDS</strong> 08:30 – 18:00</td>
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<td><strong>Hospitality Events</strong> 18:30 – 20:30 Doubletree Hotel</td>
<td><strong>REGISTRATION</strong> 08:00 – 17:30</td>
<td><strong>RECRUITING BOARDS</strong> 08:30 – 18:00</td>
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WEDNESDAY SESSIONS

09:00 - 10:30

PANEL

Connecting with Kids: So What’s New?
Hall B

Organizer: Lori Scarlatos, CUNY Brooklyn College, USA
Amy S. Bruckman, Georgia Institute of Technology, USA
Allison Druin, University of Maryland, USA
Mike Eisenberg, University of Colorado, USA
Molly Lenoire, American Museum of Natural History, USA
Oren Zuckerman, MIT Media Lab, USA

PAPERS

Touch & Such
Ballroom 201

Session Chair: Sidney Fels, University of British Columbia, Canada

tranSticks: Physically Manipulatable Virtual Connections
Yuji Ayatsuka, Jun Rekimoto, Sony Computer Science Laboratories, Inc., Japan

Discrete Acceleration and Personalised Tiling as Brain-Body Interface Paradigms for Neurorehabilitation
Paul Gnanayutham, University of Portsmouth, UK
Chris Bloor, Gilbert Cockton, University of Sunderland, UK

Effectiveness of Directional Vibrotactile Cuing on a Building-Clearing Task
Robert Lindeman, John Sibert, Erick Mendez-Mendez, Sachin Patil, Daniel Phifer
The George Washington University, USA

WEDNESDAY SESSIONS

09:00 - 10:30

PAPERS

Smart Interaction Techniques 1
Ballroom 202

Session Chair: Steven Feiner, Columbia University, USA

The Bubble Cursor: Enhancing Target Acquisition by Dynamic Resizing of the Cursor’s Activation Area
Tovi Grossman, Ravin Balakrishnan, University of Toronto, Canada

Comparing Cursor Orientations for Mouse, Pointer, and Pen Interaction
Barry A. Po, Brian D. Fisher, Kellogg S. Booth, University of British Columbia, Canada

Snap-and-Go: Helping Users Align Objects without the Modality of Traditional Snapping
Patrick Baudisch, Edward Cutrell, Ken H. Inkley, Adam Eversole
Microsoft Research, USA

PAPERS

Interruptions & Attention 1: Take a Number, Stand in Line
Ballroom 204

Session Chair: John C. Thomas, IBM T.J. Watson Research Center, USA

Towards an Index of Opportunity: Understanding Changes in Mental Workload During Task Execution
Shamsi Iqbal, Piotr Adamczyk, Sam Zheng, Brian Bailey
University of Illinois, Urbana Champaign, USA

No Task Left Behind? Examining the Nature of Fragmented Work
Gloria Mark, Victor Gonzalez, Justin Harris, University of California, Irvine, USA

Examining Task Engagement in Sensor-Based Statistical Models of Human Interruptibility
James Fogarty, Andrew J. Ko, Htet Htet Aung, Elspeth Golden, Karen P. Tang, Scott E. Hudson
Carnegie Mellon University, USA

= Best Paper Award Nominee
INTERACTIVITY
Can You Hear Me Now?
Audio Interfaces
A105-A106
Session Chair: Eric Lee,
RWTH Aachen University, Germany

SonicTexting
Michal Rinott,
Interaction Design Institute Ivrea, Italy

In the Mixxx: Novel Digital DJ Interfaces
Tue Haste Andersen,
University of Copenhagen, Denmark

SHORT PAPERS
Accessible Design
C123-C124
Session Chair: Gilbert Cockton,
University of Sunderland, UK

Web Accessibility for People with Cognitive Disabilities
Jen Smal, Pamela Schalau,
Karen Brown, Richard Appleyard,
Oregon Health & Science University, USA

DanceAlong: Supporting Positive Social Exchange and Exercise for the Elderly Through Dance
Pedarin Keyani, Gary Hsieh, Bilge Mutlu,
Matthew Easterday, Jodi Forlizzi,
Carnegie Mellon University, USA

Human Computer Interfaces for Autism: Assessing the Influence of Task Assignment and Output Modalities
Ouriel Grynszpan, Jean-Claude Martin,
Jacqueline Nadel,
CNRS, France

Designing Interactive Life Story Multimedia for a Family Affected by Alzheimer's Disease: A Case Study
Tira Cohene, Elsa Marziali,
Ronald Baeker,
University of Toronto/ Baycrest Centre for Geriatric Care, Canada

Blind Learners Programming Through Audio
Jaime Sánchez, Fernando Aguayo,
University of Chile, Chile

End User Programming and Context Responsiveness in Handheld Prompting Systems for Persons with Cognitive Disabilities and Caregivers
Stefan Carmien,
University of Colorado, Boulder, USA

SHORT PAPERS
Social and Legal Issues
B113-B114
Session Chair: Clarisse de Souza,
PUC-Rio, Brazil

Building Security and Trust in Online Banking
Maria Nilsson, Anne Adams,
UCL Interaction Center, UK
Simon Herd,
Serco Usability services, UK

A Study of Preferences for Privacy and Sharing
Judith Olson,
University of Michigan, USA
Jonathan Grudin, Eric Horvitz,
Microsoft Research, USA

Voting and Political Information Gathering On Paper and Online
Scott P. Robertson, Palakorn Achananuparp, James L. Goldman,
Sang Joon Park, Nan Zhou,
Matthew J. Clare,
Drexel University, USA

Community Source Development: An Emerging Model with New Opportunities
Dawn Ressel Nidy, Fong Kwok,
DePaul University, USA

Blind Learners Programming Through Audio
Jaime Sánchez, Fernando Aguayo,
University of Chile, Chile

End User Programming and Context Responsiveness in Handheld Prompting Systems for Persons with Cognitive Disabilities and Caregivers
Stefan Carmien,
University of Colorado, Boulder, USA

SIG
Do CHI Papers Work for You?
Addressing Concerns of Authors, Audiences and Reviewers
B115-B116
William Newman, UK
Robin Jeffries,
Sun Microsystems, USA
m.c. schraefel,
University of Southampton, UK
11:30 - 13:00

WEDNESDAY SESSIONS

INVI TED PANEL
Early Days of CHI: MIT Lincoln Laboratory
Hall B

Organizer: Bill Buxton, Microsoft Research, U K

Discussant: Austin Henderson, Pitney Bowes, U SA

Ron Baecker, University of Toronto, Canada

Wesley Clark, Clark, Rockoff and Associates, U SA

Fontaine Richardson, Private Investor, U SA

Ivan Sutherland, Sun Microsystems, U SA

W.R. “Bert” Sutherland, Sun Microsystems Laboratories, U SA

PAPERS
Design Thoughts & Methods
Ballroom 201

Session Chair: Polle Zellweger, U SA

Urban Probes: Encountering Our Emerging Urban Atmospheres
Eric Paulos,
Intel Research, U SA
Tom Jenkins,
Royal College of Art, U K

DeDe: Design and Evaluation of a Context-Enhanced Mobile Messaging System
Younghie Jung, Per Persson, Jan Blom,
Nokia Corporation, Finland

PAPERS
Smart Interaction Techniques 2
Ballroom 202

Session Chair: Mary Czerwinski,
Microsoft Research, U SA

The Vacuum: Facilitating the Manipulation of Distant Objects
Anastasia Bezerianos, Ravin Balakrishnan,
University of Toronto, Canada

A Comparison of Techniques for Multi-Display Reaching
Miguel Nacenta, Dzmitry Aliakseyeu,
Sriram Subramanian, Carl Gutwin
University of Saskatchewan, Canada

Extensible Input Handling in the subArctic Toolkit
Scott Hudson, Jennifer Mankoff,
Carnegie Mellon University, USA
Ian Smith,
Intel Research, U SA

PAPERS
Methods & Usability
Ballroom 203

Session Chair: William Newman, U K

Comparing Usability Problems and Redesign Proposals as Input to Practical Systems Development
Kasper Hornbæk, Erik Frøkjærk,
University of Copenhagen, Denmark

A Method to Standardize Usability Metrics into a Single Score
Jeff Sauro,
PeopleSoft, U SA
Erika Kindlund,
Intuit, U SA

Supporting Efficient Development of Cognitive Models at Multiple Skill Levels: Exploring Recent Advances in Constraint-Based Modeling
Irene Tollinger,
NASA Ames Research Center, U SA
Richard Lewis,
University of Michigan, USA
Michael McCurdy,
Alonso Vera
NASA Ames Research Center, U SA
Andrew Howes,
Cardiff University, UK
Laura Palton,
NASA Ames Research Center, U SA
PAPERS

Interactive Information Visualization
Ballroom 204

Session Chair: Eser Kandogan, IBM Almaden Research Center, USA

Prefuse: A Toolkit for Interactive Information Visualization
Jeffrey Heer, University of California, Berkeley, USA
Stuart Card, PARC, USA
James Landay, University of Washington, USA

Visualization of Mappings Between Schemas
George G. Robertson, M any P. Czerwinski, John E. Churchill, Microsoft, USA

Improving Aviation Safety with Information Visualization: A Flight Simulation Study
Cecilia Aragonn, University of California, Berkeley/NASA, USA
M arti Hall, University of California, Berkeley, USA

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urban pacman
A105-A106

Venue Chairs: Andrew Duchowski, Clemson University, USA; Roel Vertegaal, Queens University, Canada

Sharing the Square: Collaborative Visiting in the City Streets
Barry Brown, Matthew Chalmers, Marek Bell, Ian MacColl, Malcolm Hall, University of Glasgow, UK; Paul Rudman, University of Queensland, Australia

“Does Pacman Need a Helper?”: Analyzing Experience of Physical and Social Interactivity in a Mixed Reality Entertainment Environment
Adrian David Cheok, Huil Siang Teo, Sze Lee Teo, National University of Singapore, Singapore

A Comparison of Situation Awareness Techniques for Human-Robot Interaction in Urban Search and Rescue
Jean Scholtz, Brian Anotnishek, Jeff Young, NIST, USA

Short Papers Madness

Threads of Recognition: Using Touch as Input With Directionally Conductive Fabric
Thecla Schiphorst, Norman Jaffe, Robb Lovell, Simon Fraser University, Canada

Dish Maker: Personal Manufacturing Interface
Leonardo Bonanni, Sam Sarica, Subodh Paudel, Ted Selker, MIT Media Lab, USA

The Distant Gardener: What Conversations in a Telegarden Reveal About the User Experience of Telepresence
Peter H. Kahn, Jr., Batya Friedman, Irene S. Alexander, Nathan G. Freier, Stephanie L. Collett, University of Washington, USA

Estimation of Focus of Attention of Multiple People for Video Conferencing
Kentaro Takemura, Yoshio Matsumoto, Tsukasa Ogasawara, Nara Institute of Science and Technology, Japan

Distinguishing Magnitude and Frequency of Vibrotactile Effects With Tactile Mouse and Trackball
Jukka Raisamo, Katri Kangas, Roope Raisamo, University of Tampere, Finland

Attentive Headphones: Augmenting Conversational Attention with a Real World TV o
Roel Vertegaal, Queens University, Canada

Edible Bits: Seamless Interfaces between People, Data and Food
Dan Maynes-Aminzade, Stanford University, USA

Designing EyeTap: Digital Eyeglasses for Continuous Lifelong Capture and Sharing of Personal Experiences
Dan Chen, University of Toronto, Canada

SIG

Making an Impact in Your Community: HCI and US Public Policy
B115-B116

Jonathan Lazar, Towson University, USA
Ben Bederson, University of Maryland, College Park, USA
Harry Hochheiser, National Institute on Aging, USA
Jeff Johnson, UI Wizards, Inc., USA
Clare-Marie Karat, IBM T.J. Watson Research, USA
## SHORT PAPERS
### Cognitive Modeling, Adaptation and End-user Programming
C123-C124

**Session Chair:** Fabio Paternò, ISTI-CNR, Italy

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<td>Effects of Display Blurring on the Behavior of Novices and Experts during Program Debugging</td>
<td>Roman Bednarik, Markku Tukiainen, University of Joensuu, Finland</td>
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<td>Design Requirements for More Flexible Structured Editors from a Study of Programmers’ Text Editing</td>
<td>Andrew Ko, Htet Htet Aung, Brad Myers, Carnegie Mellon University, USA</td>
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<td>An Empirical Assessment of Adaptation Techniques</td>
<td>Theophanis Tsandilas, University of Toronto, Canada m.c. schraefel, University of Southampton, UK</td>
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<td>Investigating the Effectiveness of Mental Workload as a Predictor of Opportune Moments for Interruption</td>
<td>Shamsi Iqbal, Brian Bailey, University of Illinois, Urbana-Champaign, USA</td>
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<td>Predicting Task Execution Time on Handheld Devices Using the Keystroke-Level Model</td>
<td>Lu Luo, Bonnie John, Carnegie Mellon University, USA</td>
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<td>Profile Before Optimizing: A Cognitive Metrics Approach to Workload Analysis</td>
<td>Wayne Gray, Michael Schoelles, Christopher Myers, Rensselaer Polytechnic Institute, USA</td>
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## SHORT PAPERS
### Ethnography and Design Methodologies
B113-114

**Session Chair:** Rashmi Sinha, Uzanto Consulting, U SA

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<td>Laurel Swan, Brunel University, U K Alex Taylor, Microsoft Research Cambridge, U K</td>
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<td>What’s In Your Wallet? Implications for Global E-Wallet Design</td>
<td>Scott M ainwaring, Ken Anderson, Michele Chang, Intel Research, U SA</td>
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<td>Conveying User Values Between Families and Designers</td>
<td>Amy Voida, Elizabeth D. Mynatt, Georgia Institute of Technology, U SA</td>
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<td>Designing Interactivity for the Specific Context of Designerly Collaborations</td>
<td>Eli Blevis, Youn-kyung Lim, Ozacka M uzaffer, Aneja Shweta, Indiana University, U SA</td>
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<td>A Development Framework for Value-Centred Design</td>
<td>Gilbert Cockton, University of Sunderland, U K</td>
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<td>Using an Interaction Model as a Resource for Communication in Design</td>
<td>Maira Paula, Bruno Silva, Simone Barbosa, PUC-Rio, Brazil</td>
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**Notes**
14:30 - 16:00

WEDNESDAY SESSIONS

PAPERS/SHORT PAPERS
Pen-Based Interfaces
Ballroom 201

Session Chair: Sharon Oviatt, Oregon Health & Sciences University, USA

Design and Analysis of Delimiters for Selection-Action Pen Gesture Phrases in Scriboli
Ken Hinckley, Patrick Baudisch, Microsoft Research, USA
Gonzalo Ramos, Microsoft Research/University of Toronto, USA/Canada
Francois Guimbretiere, University of Maryland, USA

Experimental Analysis of Mode Switching Techniques in Pen-Based User Interfaces
Yang Li, University of California, Berkeley, USA
Ken Hinckley, Microsoft Research, USA
Zhiwei Guan, University of Washington, USA
James A. Landay, University of Washington/Intel Research, USA

Evaluation of Multimodal Input for Entering Mathematical Equations on the Computer
Lisa Anthony, Jie Yang, Ken Koedinger, Carnegie Mellon University, USA

CoR2Ds: Context-Rooted Rotatable Draggables for Tabletop Interaction
Chia Shen, M ERL, USA
Mark Hancock, M ERL/University of Calgary, Canada
Fredric Vernier, University of Paris X1-Paris Sud, France

Affect and Intimacy
Ballroom 202

Session Chair: Heidy Maldonado, Stanford University, USA

Mediating Intimacy: Designing Technologies to Support Strong-Tie Relationships
Frank Vetere, Martin Gibbs, University of Melbourne, Australia
Jesper Kjeldskov, Aalborg University, Denmark
Steve Howard, Florian Mueller, Sonja Pedell, Karen Mecoles, University of Melbourne, Australia
Marcus Bunyan, Charles Sturt University, Australia

Toward Subtle Intimate Interfaces for Mobile Devices Using an EMG Controller
Enrico Costanza, Samuel A. Inverso, Rebecca Allen, Media Lab Europe, Ireland

Emotions and Heart Rate While Sitting on a Chair
Jenni Anttonen, University of Tampere, Finland
Veikko Surakka, University of Tampere/Tampere University Hospital, Finland

Assistive Applications
Ballroom 203

Session Chair: Terry Winograd, Stanford University, USA

A Visual Recipe Book for Persons with Language Impairments
Kimberly Tee, Karyn Moffatt, Leah Findlater, Eve MacGregor, Joanna McGrenere, Barbara Purves, Sidney S. Fels, University of British Columbia, Canada

Participatory Design of an Orientation Aid for Amnesics
Mike Wu, Ron Baecker, University of Toronto, Canada
Brian Richards, Baycrest Centre for Geriatric Care, Canada

Digital Family Portrait Field Trial: Support for Aging in Place
Jim Rowan, Elizabeth D. Mynatt, Georgia Institute of Technology, USA

Corporate Re-Orgs: Poison or Catalyst to HCI?
Hall B

Organizer: Stephanie Rosenbaum, Tec-Ed, USA
Kelly Braun, eBay, Inc., USA
Klaus Kaasgaard, Yahoo!, USA
Anna Wychansky, Oracle Corporation, USA

PANEL

PAPERS
Pen-Based Interfaces
Ballroom 201
STUDENT DESIGN COMPETITION
Finalist Presentations
A105-A106

Co-Chairs: Elizabeth Churchill, Palo Alto Research Center, USA; Jon Sykes, Glasgow Caledonian University, UK

Teams

Project VIRGO: Creation of a Surrogate Companion for the Elderly
Farilee Mintz, Timothy Sherwood, Miroslava Vomela, George Mason University, USA

Supporting Emotional Ties among Mexican Elders and Their Families Living Abroad
Pedro Santana, Marcela Rodriguez, Luis Castro, Angel Andrade, CICESE, Mexico
Victor Gonzalez, University of California, USA

ECHOES: Encouraging Companionship, Home Organization, and Entertainment to Seniors
Sidharth Saxena, Joshua Evnin, Justin Donaldson, Indiana University, USA

ShareComp: Sharing for Companionship
Chun-Yi Chen, Marina Kobayashi, Lui Min Oh, Carnegie Mellon University, USA

HOMIE: An Artificial Companion for Elderly People
Simone Kriglstein, Gunter Wallner, Vienna University of Technology, Austria

PAPERS
Educational & Help Systems
Ballroom 204

Session Chair: Wendy Mackay, INRIA, France

Livenotes: A System for Cooperative and Augmented Note-Taking in Lectures
Matthew Kam, Jingtao Wang, Alastair Iles, Eric Tse, Jane Chiu, Daniel Glaser, Orna Tarshish, John Canny, University of California, Berkeley, USA

Stencils-Based Tutorials: Design and Evaluation
Caitlin Kelleher, Randy Pausch, Carnegie Mellon University, USA

StudioBRIDGE: Using Group, Location, and Event Information to Bridge Online and Offline Encounters for Collocated Learning Groups
Susan Yee, Microsoft Research, USA
Kat S. Park, MIT, USA
14:30 - 16:00

SHORT PAPERS

Social Computing and Community

**Beyond 2D Interaction**

**C123-C124**

**Session Chair:** Scott Klemmer, Stanford University, USA

MusicCube: Making Digital Music Tangible
Miguel Bruns Alonso, David V. Keyson, TU Delft, The Netherlands

Resizing Beyond Widgets: Object Resizing Techniques for Immersive Virtual Environments
John F. Lucas, Ji-Sun Kim, Doug A. Bowman, Virginia Tech, USA

PINS Push In and POUTS Pop Out: Creating a Tangible Pin-board that Ejects Physical Documents
Kher Hui Ng, Steve Benford, Boriana Koleva, University of Nottingham, UK

Annotating 3D Electronic Books
Lichan Hong, Ed H. Chi, Stuart H. Card, PARC, USA

Designing a Generalized 3D Carousel View
Shuo Wang, Microsoft Research Asia, China

Flipper: a New Method of Digital Document Navigation
Liyang Sun, Georgia Tech, USA

SHORT PAPERS

Beyond 2D Interaction

**C123-C124**

**Session Chair:** Scott Klemmer, Stanford University, USA

MusicCube: Making Digital Music Tangible
Miguel Bruns Alonso, David V. Keyson, TU Delft, The Netherlands

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Shuo Wang, Microsoft Research Asia, China

Flipper: a New Method of Digital Document Navigation
Liyang Sun, Georgia Tech, USA

**SIG**

The Role of Human-Computer Interaction in Next-Generation Control Rooms

**B115-B116**

Ronald Boring, Idaho National Laboratory, USA

Jacques Hugo, Pebble Bed Modular Reactor, South Africa

Christian Richard, Battelle Human Factors Transportation Center, USA

Don Dudenhoeffer, Idaho National Laboratory, USA

**Selected Sessions**

**I Saw This and Thought of You: Some Social Uses of Camera Phones**
Timothy Kindberg, Mirjana Spasojevic, HP Labs, USA
Rowanne Fleck, Abigail Sellen, Microsoft Research, USA

**SNIF: Social Networking In Fur**
Noah Fields, Jonathan Gips, Philip Liang, Arnaud Pilpre, MIT Media Laboratory, USA

**Relescope: An Experiment in Accelerating Relationships**
Stephen P. Farrell, Christopher S. Campbell, IBM Almaden Research Center, USA
Suvda Myagmar, University of Illinois Urbana-Champaign, USA

**How Peer Photos Influence Member Participation in Online Communities**
Nishikant Kapoor, Joseph A. Konstan, Loren Terveen, University of Minnesota, USA

**The Uses of Personal Networked Digital Imaging: An Empirical Study of Cameraphone Photos and Sharing**
Nancy Van House, Marc Davis, Morgan Ames, Megan Finn, Vijay Viswanathan, University of California, Berkeley, USA

**Relescope: An Experiment in Accelerating Relationships**
Stephen P. Farrell, Christopher S. Campbell, IBM Almaden Research Center, USA
Suvda Myagmar, University of Illinois Urbana-Champaign, USA

**How Peer Photos Influence Member Participation in Online Communities**
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**The Uses of Personal Networked Digital Imaging: An Empirical Study of Cameraphone Photos and Sharing**
Nancy Van House, Marc Davis, Morgan Ames, Megan Finn, Vijay Viswanathan, University of California, Berkeley, USA
**WEDNESDAY SESSIONS**

**16:30 - 18:00**

### SPOTLIGHT SESSION

**Safety in a Complex World**  
Hall B

**Session Chair:** Gerrit van der Veer, Vrije Universiteit, The Netherlands

**Paper**

Applying the Lessons of the Attack on the World Trade Center, 11th September, 2001, to the Design and Use of Interactive Evacuation Simulations  
Christopher W. Johnson, University of Glasgow, UK

**Interactivity Exhibit**

Acclaim: Questioning biometric technology through an airport security clearance system  
Luther Thie, Eyal Fried, Interaction Design Institute Ivrea, Italy

### PAPERS

**In-Vehicle Interfaces**  
Ballroom 201

**Session Chair:** Erika Orrick, Perceptive Sciences, USA

**Calling While Driving: Effects of Providing Remote Traffic Context**  
Mike Schneider, Sara Kiesler, Carnegie Mellon University, USA

**Studying the Effectiveness of MOVE: A Contextually Optimized In-Vehicle Navigation System**  
Joonhwan Lee, Jodi Forlizzi, Scott E. Hudson, Carnegie Mellon University, USA

**Distract-R: Rapid Prototyping and Evaluation of In-Vehicle Interfaces**  
Dario Salvucci, Mark Zuber, Ekaterina Beregovaia, Daniel Markley, Drexel University, USA

### Physical Interaction

**Ballroom 202**

**Session Chair:** Michel Beaudouin Lafon, University of Paris-Sud, France

David Holman, Roel Vertegaal, Mark Altosaar, Nikolaus Troje, Derek Johns, Queen’s University, Canada

**Fluid Integration of Rotation and Translation**  
Russell Kruger, Sheelagh Carpendale, Stacey D. Scott, Anthony Tang, University of Calgary, Canada

**A Study on the Manipulation of 2D Objects in a Projector/Camera-Based Augmented Reality Environment**  
Stephen Voida, Georgia Institute of Technology, USA  
Mark Podlaseck, Rick Kjeldsen, Claudio Pinhanez, IBM T.J. Watson Research Center, USA

### Technology in the Home

**Ballroom 203**

**Session Chair:** Kristina Höök, SICS, Sweden

**Exploring Technology Adoption and Use Through the Lens of Residential Mobility**  
Irina Shklovski, Carnegie Mellon University, USA  
Scott Mainwaring, Intel Research, USA

**WaterBot: Exploring Feedback and Persuasive Techniques at the Sink**  
Ernesto Arroyo, Leonardo Bonanni, Ted Selker, MIT Media Laboratory, USA

**Artful Systems in the Home**  
Alex S. Taylor, Microsoft Research, UK  
Laurel Swan, Brunel University, UK
16:30 - 18:00

**SHORT PAPERS**

**Visualization Techniques**

**C123-C124**

**Session Chair:** George Robertson, Microsoft, USA

**Effects of Tiled High-Resolution Display on Basic Visualization and Navigation Tasks**

Robert Ball, Chris North, Virginia Tech, USA

**QueryLines: Approximate Query for Visual Browsing**

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**Using Intimacy, Chronology and Zooming to Visualize Rhythms in Email Experience**

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**Dynamic Speedometer: Dashboard Redesign to Discourage Drivers from Speeding**

M anu Kumar, Taemie Kim, Stanford University, USA

**DESIGN EXPO**

**The Power of Design: Case Studies in Excellence**

A105-A106

**Session Chair:** Boyd de Groot, Satama Interactive, The Netherlands

**The Stakeholder Forest: Designing a Travel and Expense Application for the Enterprise**

Jonathan Arnowitz, SAP Labs, USA

Naomi Dorsch, Diana Gray, Monica Haldenberg, Michael Arent, PeopleSoft, USA

**Vista: Interactive Coffee-Corner Display**

Marc Winchary, Lucy Gunawan, Neal Van den Ende, Eindhoven University of Technology, The Netherlands

Qarin Hjortzberg-Nordlund, Aga Måtysäk, Ruud Jansen, Océ Technologies B.V., The Netherlands

Xu Sun, Eindhoven University of Technology, The Netherlands

**Looking Back at Plan AHEAD(tm): Exercising User-Centered Design in Emergency Management**

Leo Frishberg, Tektronix, Inc., USA

**Capturing and Viewing Medio on the Treo 650 Smartphone and Tungsten T5 Handheld**

Keith Saft, palmOne, USA

**Designing the “World as your Palette”**

Kimiko Ryokai, Stefan Marti, Hiroshi Ishii, MIT Media Lab, USA

**SHORT PAPERS**

**HCI in the Office**

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**Session Chair:** S aila Ovaska, University of Tampere, Finland

**Don’t take my folders away! Organizing personal information to get things done**

William Jones, Ammy Phuwanartnurak, Rajdeep Gill, Harry Bruce, University of Washington, USA

**Sources of Structure in Sensemaking**

Yan Qu, George Furnas, University of Michigan, USA

**Managers’ Email: Beyond Tasks and To-Dos**

Catalina Danis, Wendy Kellogg, IBM T.J. Watson Research Center, USA

Naomi Dorsch, Diana Gray, Monica Heidelberg, Michael Arent, PeopleSoft, USA

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Xu Sun, Eindhoven University of Technology, The Netherlands

**Beyond “From” and “Received”: Exploring the Dynamics of Email Triage**

Carmen N. K obyashi, University of Calgary, Canada

A. J. Bernheim Brush, J. R. Smith, Microsoft Research, USA

**Work Coordination, Workflow, and Workarounds in a Medical Context**

Marina Kobayashi, Susan R. Fussell, Carnegie Mellon University, USA

Yan Xiao, F. Jacob Seagull, University of Maryland School of Medicine, USA

**The Advantages of a Cross-Session Web Workspace**

Natalie Jhaveri, Kari-Jouko Rähä, University of Tampere, Finland

**SIG**

**Current Issues in Assessing and Improving Information Usability**

B115-B116

**Session Chair:** Stephanie Rosenbaum, Tec Ed, Inc., USA

Judith Ramey, University of Washington, USA

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**SHORT PAPERS**

**Visualization Techniques**

**C123-C124**

**Session Chair:** George Robertson, Microsoft, USA

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**Dynamic Speedometer: Dashboard Redesign to Discourage Drivers from Speeding**

M anu Kumar, Taemie Kim, Stanford University, USA
Emotions and Heart Rate While Sitting on a Chair
Jenni Anttonen, Veliko Surakka,
University of Tampere, Finland

New methods for unobtrusive monitoring of computer users! Emotion physypsychology are very much needed in human-computer interaction research. The present aim was to study heart rate changes during emotionally provocative stimulation. Six-second long auditory, visual, and audiovisual emotional negative, neutral, and positive stimuli were presented to 24 participants. Heart rate responses were measured with a regular office chair embedded with electromechanical film (the EMFi chair) and with traditional earlobe photoplethysmography (PPG). Ratings of the stimuli were also collected. The results showed that the two heart rate measurements were significantly correlated, r = 0.99. In line with other studies the results showed that, in general, heart rate decelerated in response to emotional stimulation and it accelerated the most in response to negative stimuli as compared with responses to positive and neutral stimuli. Especially, emotional stimulation caused significant changes in heart rate at the 6th second from the stimulus onset. We suggest that the EMFi chair could be used in human-computer interaction for unobtrusive measurement of the user’s emotional reactions.

Improving Aviation Safety with Information Visualization: A Flight Simulation Study
Cecilia Aragon, University of California, Berkeley/USA; Matti Heikkinen, University of California, Berkeley, USA

Many aircraft accidents each year are caused by encounters with invisible airflow hazards. Recent advances in aviation sensor technology offer the potential for aircraft-based sensors that can gather large amounts of airflow velocity data in real-time. With this influx of data comes the need to study how best to present it to the pilot - a cognitively overloaded user focused on a primary task other than that of information visualization. In this paper, we present the results of a usability study of an airflow hazard visualization system that significantly reduced the crash rate among experienced helicopter pilots flying a high fidelity, aerodynamically realistic fixed-base rotorcraft flight simulator into hazardous conditions. We focus on one particular aviation application, but the results may be relevant to user interfaces in other operationally stressful environments.

WaterBot: Exploring Feedback and Persuasive Techniques at the Sink
Ernesto Arroyo, Leonardo Bonanni, Ted Selker,
MIT Media Laboratory, USA

This paper presents an exploration of user interfaces, persuasive interfaces and feedback techniques in the domain of the sink. Waterbot is a system to inform and motivate behavior at the sink for the purpose of increasing safety and functionality and ultimately motivating behavior change. Waterbot can be adapted to many current sink scenarios and demonstrates the breadth of interaction possible at the point of use of water. It functions as a platform for experimenting with safety, hygiene and water conservation in a sink. This paper presents the feedback and persuasion techniques of augmented physical interfaces with value-added design, automation, just-in-time prompts, positive and negative reinforcement, social validation and adaptive interfaces. Four design iterations are presented to affect behavior at the increasing cognitive levels of safety, functionality and behavior change.

tranSticks: Physically Manipulatable Virtual Connections
Yuji Ayatsuka, Jun Rekimoto, Sony Computer Science Laboratories Inc., Japan

A virtually connected medium called tranStick is described that functions both as a “virtual wire” and as a “memory card” containing a shared space. A user can connect two networked devices by simply placing one of a pair of tranSticks with the same identifier into each device. The tranSticks provide feedback indicating that the devices are connected; the connection to be closed or changed in the same way it would be if the devices were connected by a physical cable. A user can also access to a shared space on a network as if the space were in the tranStick. Since tranSticks contain long secret keys, the process of finding another tranStick with the same identifier can be encrypted. The tranStick approach differs from other approaches in that it provides feedback from the connection as well as serving as a medium for establishing a connection, and it enables disconnection and switchover to be done intuitively because the operations are reversible.

Gamification: A Flight Simulation Study
Jenni Anttonen, Veliko Surakka,
University of Tampere, Finland

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The Vacuum: Facilitating the Manipulation of Distant Objects
Anastasia Bezenioros, Ravin Balakrishnan,
University of Toronto, Canada

We present the design and evaluation of the vacuum, a new interaction technique that enables quick access to items on areas of a large display that are difficult for a user to reach without significant physical movement. The vacuum is a circular widget with a user controllable arc of influence that is centered at the widget’s point of invocation and spans out to the edges of the display. Far away objects residing inside this influence arc are brought closer to the widget’s centre in the form of proxies that can be manipulated in lieu of the original. We conducted two experiments which compare the vacuum to direct picking and an existing technique called drag-and-drop. Results show that the vacuum outperforms existing techniques when selecting multiple targets in a sequence, performs similarly to existing techniques when selecting single targets located moderately far away, and slightly worse with single targets located very far away in the presence of distractor targets along the path.

Snap-and-Go: Helping Users Align Objects without the Modality of Traditional Snapping
Patrick Baudisch, Edward Cutrell, Ken Hinklely, Adam Eversole,
Microsoft Research, USA

Snapping is a widely used technique that helps users position graphical objects precisely, e.g., to align them with a grid or other graphical objects. Unfortunately, whenever users want to position a dragged object close to such an aligned location, they first need to deactivate snapping. We propose snap-and-go, a snapping technique that overcomes this limitation. By merely stopping dragged objects at aligned positions, rather than “warping” them there, snap-and-go helps users align objects, yet still allows placing dragged objects anywhere else. While this approach of inserting additional motor space renders snap-and-go slightly slower than traditional snapping, snap-and-go simplifies the user interface by eliminating the need for a deactivation option and thereby allows introducing snapping to application scenarios where traditional snapping is inapplicable. In our user studies, participants were able to align objects up to 138% (1D) and 231% (2D) faster with snap-and-go than without and snap-and-go proved robust against the presence of distracting snap targets.

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Toward Subtle Intimate Interfaces for Mobile Devices Using an EMG Controller
Enrico Costanza, Samuel A. Inverso, Rebecca Allen,
M edia Lab Europe (Ireland)

Using a mobile device in a social context should not cause embarrassment and disruption to the immediate environment. Interaction with mobile and wearable devices needs to be subtle, discreet and unobtrusive. Therefore, we promote the idea of “intimate interfaces”; discrete interfaces that allow control of mobile devices through subtle gestures in order to gain social acceptance. To achieve this goal, we present an electromyogram (EMG) based wearable input device which recognizes isometric muscular activity: activity related to very subtle or no movement at all. In the online experiment reported, the EMG device, worn on an arm band around the bicep, was able to reliably recognize a motionless gesture without calibration or training across users with different muscle volumes. Hence, EMG based input devices can provide an effective solution for designing mobile interfaces that are subtle and intimate and hence socially acceptable.
Examining Task Engagement in Sensor-Based Statistical Models of Human Interruptibility
James Fogarty, Andrew J. Ko, Htet Htet Aung, Elspeth Golden, Karen P. Tang, Scott E. Hudson, Carnegie Mellon University, USA

The computer and communication systems that office workers currently use tend to interrupt at inappropriate times or unduly demand attention because they have no way to determine when an interruption is appropriate. Sensor-based statistical models of human interruptibility offer a potential solution to this problem. Prior work to examine such models has primarily focused on the connection between social engagement and interruptibility, but it seems that task engagement is also important. Using an approach developed in our prior work on sensor-based statistical models of human interruptibility, we examine task engagement by studying programmers working on a realistic programming task. After examining many potential sensors, we implement a system to log low-level input events in a development environment. We then automatically extract features from these low-level events and build a statistical model of interruptibility. By correctly identifying situations in which programmers are non-interruptible and minimizing cases where the model incorrectly predicts interruptibility, we can support a reduction in costly task disruption.

The Bubble Cursor: Enhancing Target Acquisition by Dynamic Resizing of the Cursor’s Activation Area
Tovi Grossman, Ravin Balakrishnan, University of Toronto, Canada

We present the bubble cursor - a new target acquisition technique based on area cursors. The bubble cursor improves upon area cursors by dynamically resizing its activation area depending on the proximity of surrounding targets, such that only one target is selectable at any time. We also present two controlled experiments that evaluate bubble cursor performance in 1D and 2D target acquisition tasks, in complex situations with multiple targets of varying layout densities. Results show that the bubble cursor significantly outperforms the point cursor and the object pointing technique [7], and that bubble cursor performance can be accurately modeled and predicted using Fitts’ law.

Discrete Acceleration and Personalised Tiling as Brain-Body Interface Paradigms for Neurohabilitation
Paul Gunatilaka, University of Portsmouth, UK; Chris Bloor, Gilbert Cockton, University of Sunderland, UK

We present two studies that have advanced the design of brain-body interfaces for use in the rehabilitation of individuals with severe neurological impairment due to traumatic brain injury. First we developed and evaluated an adaptive cursor acceleration algorithm based on screen areas. This improved the initial design, but was too inflexible to let users make the most of their highly varied abilities. Only some individuals were well served by this adaptive interface. We therefore developed and evaluated an approach based on personalized tile layouts. The rationales for both designs are presented, along with details of their implementation. Evaluation studies for each are reported, which show that we have extended the user population who can use our interfaces relative to previous studies. We have also extended the usable functionality for some of our user group. We thus claim that personalized tiling with discrete acceleration has allowed us to extend the usable functionality of brain-body interfaces to a wider population with traumatic brain injury, thus creating new options for Neurohabilitation.

Prefuse: A Toolkit for Interactive Information Visualization
Jeffrey Heer, University of California, Berkeley, USA; Stuart Card, PARC, USA; James Landay, University of Washington, USA

Although information visualization (Infovis) technologies have proven indispensable tools for making sense of complex data, widespread deployment has yet to take hold, as successful Infovis applications are often difficult to author and require domain-specific customization. To address these issues, we have created Prefuse, a software framework for creating dynamic visualizations of both structured and unstructured data. Prefuse provides domain-motivated abstractions for the design of a wide range of visualization applications, enabling programmers to string together desired components quickly to create and customize working visualizations. To evaluate Prefuse we have built both existing and novel visualizations testing the toolkit’s flexibility and performance, and have run Usability studies and usage surveys finding that programmers find Prefuse easy and effective.

Design and Analysis of Delimiters for Selection-Action Pen Gesture Phrases in Scriboli
Kathryn H. Hickey, Patrick Baudisch, Microsoft Research, USA; Gonzalo Ramos, Microsoft Research, University of Toronto, USA/CANADA; Francois Giumberti, University of Maryland, USA

We present a quantitative analysis of delimiters for pen gestures. A delimiter is “something different” in the input stream that a computer can use to determine the structure of input phrases. We study four techniques for delimiting a selection-action gesture phrase consisting of lasso selection plus marking-menu-based command activation. Pigtail is a new technique that uses a small loop to delimit lasso selection from marking. Handle adds a box to the end of the lasso, from which the user makes a second stroke to mark. Target dwell is an improvement on the pen to delimit the lasso from the mark. Button uses a button press to signal when to delimit the gesture. We describe the role of delimiters in Scriboli pen interaction testing, and show how Pigtail supports scope selection, command activation, and direct manipulation all in a single fluid pen gesture.

PaperWings: Interaction Techniques for Digital Paper
David Holman, Roel Vertegaal, Mark Allosaas, Nikolaus Troje, Derek Johns, Queen’s University, Canada

In this paper, we present PaperWings, a prototype windowing environment that simulates the use of digital paper displays. By projecting windows on physical paper, PaperWings allows the capturing of physical affordances of paper in a digital world. The system uses paper as an input device by tracking its motion and shape with a Vicon motion capturing system. We discuss the design of a number of interaction techniques for manipulating information on paper displays.

Comparing Usability Problems and Redesign Proposals as Input to Practical Systems Development
Kasper Ornbak, Erik Frøkjær, University of Copenhagen, Denmark

Usability problems predicted by evaluation techniques are useful input to systems development; it is uncertain whether redesign proposals aimed at alleviating those problems are likewise useful. We present a study of how developers of a large web application assess usability problems and redesign proposals as input to their systems development. Problems and redesign proposals were generated by 43 evaluators using an inspection technique and think aloud testing. Developers assessed redesign proposals to have higher utility in their work than usability problems. In interviews they explained how redesign proposals gave them new ideas for tackling well known problems. Redesign proposals were also seen as constructive and concrete input. Few usability problems were new to developers, but the problems supported prioritizing ongoing development of the application and taking design decisions. No developers, however, wanted to receive only problems or redesigns. We suggest developing and using redesign proposals as an integral part of usability evaluation.
Extensible Input Handling in the subArctic Toolkit
Scott H udson, Jennifer M ankoﬀ, Carnegie Mel lon University, USA; Ian Smith, Intel Research, USA

The subArctic user interface toolkit has extensibility as one of its central goals. It seeks not only to supply a powerful library of reusable interactive objects, but also make it easy to create new, unusual, and highly customized interactions tailored to the needs of particular interfaces or task domains. A central part of this extensibility is the input model used by the toolkit. The subArctic input model provides standard reusable components that implement many typical input handling patterns for the programmer, allowing inputs to be handled in very flexible ways, and allows the details of how inputs are handled to be modiﬁed to meet custom needs. This paper will consider the structure and operation of the subArctic input handling mechanism. It will demonstrate the ﬂexibility of the system through a series of examples, illustrating techniques that it enables—many of which would be very difﬁcult to implement in most toolkits.

Towards an Index of Opportunity: Understanding Changes in Mental Workload During Task Execution
Shamsi Iqbal, Piotr Adamczyk, Sam Zheng, Brian Bailey, University of Illinois, Urbana-Champaign, USA

To contribute to systems that reason about human attention, our work empirically demonstrates how a user’s mental workload changes during task execution. We conducted a study where users performed interactive, hierarchical tasks while mental workload was measured through the use of pupil size. Results show that (i) different types of subtasks impose different mental workload, (ii) workload decreases at subtask boundaries, (iii) workload decreases more at boundaries higher in a task model and less at boundaries lower in the model, (iv) workload changes among subtask boundaries within the same level of a task model, and (v) effective understanding of why changes in workload occur requires that the measure be tightly coupled to a validated task model. From the results, we show how to map mental workload onto a computational Index of Opportunity that systems can use to better reason about human attention.

Applying the Lessons of the Attack on the World Trade Center, 11th September, 2001, to the Design and Use of Interactive Evacuation Simulations
Christopher W. Johnson, University of Glasgow, UK

The collapse of buildings, such as terminal 2E at Paris’ Charles de Gaulle Airport, and of ﬁres, such as the Rhode Island, Station Night Club tragedy, has focused public attention on the safety of large public buildings. Initiatives in the United States and in Europe have led to the development of interactive simulators that model evacuation from these buildings. The tools avoid some of the ethical and legal problems from simulating evacuations; many people were injured during the 1993 evacuation of the World Trade Center (WTC) complex. They also use many concepts that originate within the CHI communities. For instance, some simulators use simple tasks models to represent the occupants’ goal structures as they search for an available exit. However, the recent release of the report from the National Commission on Terrorist Attacks upon the United States (the “9/11 commission”) has posed serious questions about the design and use of this particular class of interactive systems. This paper argues that simulation research needs to draw on insights from the CHI communities in order to meet some of the challenges identiﬁed by the 9/11 commission.

DeDe: Design and Evaluation of a Context-Enhanced Mobile Messaging System
Youngheung Per Persson, Jan Blom, Nokia Corporation, Finland

This paper presents the design, implementation and validation of an enhanced mobile phone messaging system (DeDe), allowing the sender to deﬁne the context in which the message will be delivered to the recipient. A ﬁeld trial among a socially tight group of teenagers showed that the DeDe feature was incorporated as part of the participant’s existing messaging culture. 11.4% of their total messaging output was DeDe. The most frequently used context parameters were location (based on network cell-ID) and time. Nové message practices emerged, as compared to “normal” messaging, both in terms of timing of message sending, as well as creating content that speciﬁcally exploited the DeDe feature. Some use barriers were recognized, the most important being the sender’s uncertainty of delivery success. Implications for design are discussed.

Livenotes: A System for Cooperative and Augmented Note-Taking in Lectures
Matthew Kam, Jingtao Wang, Alastair Iles, Eric Tse, Jane Chiu, Daniel Glaser, Oma Tarshish, John Canny, University of California, Berkeley, USA

We describe Livenotes, a shared whiteboard system and educational practice that uses wireless communication and tablet computing to support real-time conversations within small groups of students during lectures, independent of class size. We present an interface design that enables group members to interact with one another by dragging lecture notes cooperatively, as well as to augment student note-taking by providing instructor slides in the background to annotate over. Livenotes was designed to facilitate more efﬁcient, stimulating modes of learning that other collaborative approaches do not. We report how the system impacts cooperative learning in an undergraduate class and how students interacted with background slides in the workspace. We conclude with directions for improving the system and learning practice.

Stencils-Based Tutorials: Design and Evaluation of a Context-Enhanced Mobile Messaging System
Caitlin Kelleher, Randy Pausch, Carnegie Mellon University, USA

Users of traditional tutorials and help systems often have difﬁculty ﬁnding the components described or pictured in the procedural instructions. Users also unintentionally miss steps, and perform actions that the documentation’s authors did not intend, moving the application into an unknown state. We introduce Stencils, an interaction technique for presenting tutorials that uses translucent colored stencils containing holes that direct the user’s attention to the correct interface component and prevent the user from interacting with other components. Sticky notes on the stencil’s surface provide necessary tutorial material in the context of the application. In a user study comparing a Stencils-based and paper-based version of the same tutorial in Alice, a complex software application designed to teach introductory computer programming, we found that users of a Stencils-based tutorial were able complete the tutorial 26% faster, with fewer errors, and less reliance on human assistance. Users of the Stencils-based and paper-based tutorials attained statistically similar levels of learning.

Fluid Integration of Rotation and Translation
Russell Kruger, Sheelagh Carpendale, Stacey D. Scott, Anthony Tang, University of Calgary, Canada

Previous research has shown that rotation and orientation of items play three major roles during collaboration: comprehension, coordination and communication. Based on these roles of orientation and advice from kinesiology research, we have designed the RotateN (RNT) interaction mechanism, which provides integrated control of rotation and translation using only a single touch-point for input. We present an empirical evaluation comparing RNT to a common rotation mechanism that separates control of rotation and translation. Results of this study indicate RNT is more efﬁcient than the separate mechanism and better supports the comprehension, coordination and communication roles of orientation.

Studying the Effectiveness of MOVE: A Contextually Optimized In-Vehicle Navigation System
Joonhwan Lee, Jodi Forlizzi, Scott E. Hudson, Carnegie Mellon University, USA

In-vehicle navigation has changed substantially in recent years, due to the advent of computer generated maps and directions. However, these maps are still problematic, due to a mismatch between the complexity of the maps and the attention demands of driving. In response to this problem, we are developing the MOVE (Maps Optimized for Vehicular Environments) system. This system will provide situationally appropriate map information by presenting information that uses appropriate amounts of context. In this paper, we describe our ﬁndings of studies to help shape the design of the MOVE system, including studies on map reading and in-vehicle navigation, and studies on the effectiveness of a variety of contextually optimized route map visualizations in a simulated driving context. Results show that contextually optimized displays designed for the MOVE system should signiﬁcantly reduce perceptual load in the context of driving. In our laboratory experiment there was a six-fold decrease in the total map display ﬁxation time and nearly threefold decrease in the number of glances needed to interpret the contextually optimized display compared to a static display.
Experimental Analysis of Mode Switching Techniques in Pen-Based User Interfaces
Yang Li, University of California, Berkeley, USA; Ken Hinckley, Microsoft Research, USA; Zhiguo Guan, University of Washington, USA; James A. Landay, University of Washington/Intel Research, USA

Inking and gesturing are two central tasks in pen-based user interfaces. Switching between modes for entry of uninterpreted ink and entry of gestures is required by many pen-based user interfaces. Without an appropriate mode switching technique, pen-based interactions in such situations may be inefficient and cumbersome. In this paper, we investigate five techniques for switching between ink and gesture modes in pen interfaces, including a pen-pressure based mode switching technique that allows implicit mode transition. A quantitative experimental study was conducted to evaluate the performance of these techniques. The results suggest that pressing a button with the non-preferred hand offers the fastest performance, while the technique of holding the pen still is significantly slower and more prone to error than the other techniques. Pressure, while promising, did not perform as well as the non-preferred hand button with our current implementation.

Effectiveness of Directional Vibrotactile Cuing on a Building-Clearing Task
Robert Lindeman, John Sibert, Erick M. endez-Mendez, Sachin Patil, Dan Phifer, The George Washington University, USA

This paper presents empirical results to support the use of vibrotactile cues as a means of improving user performance on a spatial task. In a building-clearing exercise, directional vibrotactile cues were employed to alert subjects to areas of the building that they had not yet cleared, but were currently exposed to. Compared with performing the task without vibrotactile cues, subjects were exposed to unclesared areas a smaller percentage of time, and cleared more of the overall space, when given the added vibrotactile stimulus. The average length of each exposure was also significantly less when vibrotactile cues were present.

No Task Left Behind? Examining the Nature of Fragmented Work
Gloria M.ark, Victor Gonzalez, Justin Harris, University of California, Irvine, USA

We present data from detailed observation of 24 information workers that shows that they experience work fragmentation as common practice. We consider that work fragmentation has two components: length of time spent in an activity, and frequency of interruptions. We examined work fragmentation along three dimensions: effect of collocation, type of interruption, and resumption of work. We found work to be highly fragmented: people average little time in working spaces before switching and 57% of their working spaces are interrupted. Collocated people work longer before switching but have more interruptions. Most internal interruptions are due to personal work whereas most external interruptions are due to central work. Though most interrupted work is resumed on the same day, more than two interfering activities occur before it is. We discuss implications for technology design: how our results can be used to support people to maintain continuity within a larger framework of their working spheres.

A Comparison of Techniques for Multi-Display Reaching
Miguel Nacenta, University of Saskatchewan, Canada; Dzmitry Aliakseyeu, Eindhoven University of Technology, The Netherlands; Shrman Subramanian, Carl Gutwin, University of Saskatchewan, Canada

Recent advances in multi-user collaboration have seen a proliferation of interaction techniques for moving digital objects from one device to another. However, little is known about how these techniques work in realistic situations, or how they compare to one another. We conducted a study to compare the efficiency of six techniques for moving objects from a tablet to a tabletop display. We compared the techniques in four different distance ranges and with three movement directions. We found that techniques like the Radar View and Pick-and-Drop, that have a control-to-display ratio of 1, are significantly faster for object movement than techniques that have smaller control-to-display ratios. We also found that using spatial manipulation of objects was faster than pressure-based manipulation.

Urban Probes: Encountering Our Emerging Urban Atmospheres
Eric Paulos, Intel Research, USA; Tom Jenkins, Royal College of Art, UK

Urban Atmospheres captures a unique, synergistic moment - expanding urban populations, rapid adoption of Bluetooth mobile devices, tiny ad hoc sensor networks, and the widespread influence of wireless technologies across our growing urban landscapes. The United Nations recently reported that 48 percent of the world’s population current live in urban areas and that this number is expected to exceed the 50 percent mark world wide by 2007 [1]. In developed nations the number of urban dwellers is even more dramatic - expected to exceed 75%. Current studies project that mobile-enabled devices will reach 5.4 billion units by 2005 - five times the number of mobile phones or Internet connections [2]. Mobile phone penetration already exceeds 80% of the population in places like the European Union (EU) and parts of Asia [3]. WiFi hardware is being deployed at the astonishing rate of one every 4 seconds globally [4]. We argue that now is the time to initiate inspirational research into the very essence of these newly emerging technological urban spaces. We desire to move towards an improved understanding of the emotional experience of urban life. This paper describes Urban Probes - a lightweight, provocative, intervention methodology designed to rapidly deconstruct urban situations, reveal new opportunities for technology in urban spaces, and guide future long-term research in urban computing. We also describe a completed Urban Probe exploring urban trash.

Comparing Cursor Orientations for Mouse, Pointer, and Pen Interaction
Barry A. Po, Brian D. Fisher, Kellogg S. Booth, University of British Columbia, Canada

Most graphical user interfaces provide visual cursors to facilitate interaction with input devices such as mice, pointers and pens. These cursors often include directional cues that could influence the stimulus-response compatibility of user input. We conducted a controlled evaluation of four cursor orientations and an orientation-neutral cursor in a circular menu selection task. Mouse interaction on a desktop, pointer (i.e. wand) interaction on a large screen, and pen interaction on a Tablet PC were evaluated. Our results suggest that choosing appropriate cursors is especially important for pointer interaction, but may be less important for mice or pens. Cursors oriented toward the lower-right corner of a display yielded the poorest performance overall while orientation-neutral cursors were generally the best. Advantages were found for orientations aligned with the direction of movement. We discuss these results and suggest guidelines for the appropriate use of cursors in various input and display configurations.

Visualization of Mappings Between Schemas
George G. Robertson, Mary P. Czerwinski, John E. Churchill, Microsoft, USA

In this paper we describe a novel approach to the visualization of the mapping between two schemas. Current approaches to visually defining such a mapping fail when the schemas or maps become large. The new approach uses various information visualization techniques to simplify the view, making it possible for users to effectively deal with much larger schemas and maps. A user study verifies that the new approach is useful, usable, and effective. The primary contribution is a demonstration of novel ways to effectively present highly complex information.
Digital Family Portrait Field Trial: Support for Aging in Place
Jim Rowan, Elizabeth D. Mynatt, Georgia Institute of Technology, USA

A growing social problem in the U.S., and elsewhere, is enabling older adults to continue living independently, as opposed to moving to an institutional care setting. One key part of this complex problem is providing awareness of senior adults’ day-to-day activities, promoting “peace of mind” for extended family members. The Digital Family Portrait (DFP) is one approach to providing peace of mind that has shown promise. To date, research on the DFP has been limited to wizard-of-oz based experiments over short periods of time. This paper describes a DFP field trial in which a private home was instrumented with sensors rather than relying on input from wizard-of-oz technology. This field trial was conducted over a period of one year between an aging parent living alone in her own home and her adult child living 50 miles distant. From this field trial we find that even though there was no critical reason for the adult child to be concerned about her mother, all involved parties found utility in the presence of the DFP, even those family members who were not directly involved in the field trial itself.

Distract-R: Rapid Prototyping and Evaluation of In-Vehicle Interfaces
Dario Salvucci, Mark Zuber, Ekaterina Beregovaia, Daniel M. Arkley, Drexel University, USA

As driver distraction from in-vehicle devices increasingly becomes a concern on our roadways, researchers have searched for better scientific understanding of distraction along with better engineering tools to build less distracting devices. This paper presents a new system, Distract-R, that allows designers to rapidly prototype and evaluate new in-vehicle interfaces. The core engine of the system relies on a rigorous cognitive model of driver performance, which the system integrates with models of behavior on the prototyped interfaces to generate predictions of distraction. Distract-R allows a designer to prototype basic interfaces, demonstrate possible tasks on these interfaces, specify relevant driver characteristics and driving scenarios, and finally simulate, visualize, and analyze the resulting behavior as generated by the cognitive model. The paper includes two sample studies that demonstrate the system’s ability to account for effects of input modality and driver age on performance.

A Method to Standardize Usability Metrics into a Single Score
Jeff Sauro, PeopleSoft, USA; Erika Kindlund, Intuit, USA

Current methods to represent system or task usability in a single metric do not include all the ANSI and ISO defined usability aspects: effectiveness, efficiency & satisfaction. We propose a method to simplify all the ANSI and ISO aspects of usability into a single, standardized and summated usability metric (SU M). In four data sets, totaling 1860 task observations, we show that these aspects of usability are correlated and equally weighted and present a quantitative model for usability. Using standardization techniques from Six Sigma, we propose a scalable process for standardizing disparate usability metrics and show how Principal Components Analysis can be used to establish appropriate weighting for a summated model.

Calling While Driving: Effects of Providing Remote Traffic Context
Mike Schneider, Sara Kiesler, Carnegie Mellon University, USA

Cell phone conversations distract drivers. This research explores the possibility of reducing distracting by providing callers with remote information about the driver’s traffic. We asked whether providing such contextual information would change the caller’s conversation such that drivers would be less distracted. In Experiment 1 we examined this question in a low-fidelity driving simulator; in Experiment 2 we examined this question in a higher-fidelity simulator. In both experiments, remote callers and passengers were distracting. Providing traffic information to the remote caller significantly reduced crashes in the low-fidelity tests and significantly reduced passing in the high fidelity tests, compared with the control conditions. We consider the implications for development of remote displays or signals to promote driving safety.

Exploring Technology Adoption and Use Through the Lens of Residential Mobility
Irina Shklovski, Carnegie Mellon University, USA; Scott Mainwaring, Intel Research, USA

One of the outcomes of massive adoption of technology is that much of daily technology use and consumption is embedded into “unremarkable” daily life routines. Occasionally, these routines undergo major shifts, often in conjunction with major life events such as marriage, birth of a child, or a residential move. We propose a model of settling into a new location as a function of balance between the pull of the things left behind and the demands of the new and unknown. It is through this experience of being unsettled that we explore the processes of behavior adjustment and re-evaluation of old patterns of technology use as it relates to the old location and the demands of the new location.

Artful Systems in the Home
Alex S. Taylor, Microsoft Research, UK; Laurel Swan, Brunel University, UK

In this paper we introduce the idea of organizing systems through a number of examples from an ongoing ethnographic study of family life. We suggest that organizing systems come about through the artful design and use of informational artifacts in the home, such as calendars, paper notes, to-do lists, etc. These systems are not only seen to organize household routines and schedules, but also, crucially, to shape the social relations between family members. Drawing attention to the material properties of informational artifacts and how assemblies of these artifacts come to make up organizing systems, we discuss some general implications for designing information technology for the home. Most importantly, we suggest that technologies must be designed to accommodate the rich and diverse ways in which people organize their homes, providing them with the resources to artfully construct their own systems rather than enforcing ones that are removed from their own experiences.
A Visual Recipe Book for Persons with Language Impairments
Kimberly Tee, Karin Moffatt, Leah Findlater, Eve Mcgregor, Joanna Mcgene, Barbara Purves, Sidney S. Fels, University of British Columbia, Canada

Cooking is a daily activity for many people. However, traditional text recipes are often prohibitively difficult to follow for people with language disorders, such as aphasia. We have developed a multi-modal application that leverages the retained ability of aphasic individuals to recognize image-based representations of objects, providing a presentation format that can be more easily followed than a traditional text recipe. Through a systematic approach to developing a visual language for cooking, and the subsequent case study evaluation of a prototype developed according to this language, we show that a combination of visual instructions and navigational structure can help individuals with relatively large language deficits to cook more independently.

Supporting Efficient Development of Cognitive Models at Multiple Skill Levels: Exploring Recent Advances in Constraint-Based Modeling
Irene Tollinger, NASA Ames Research Center, USA; Richard Lewis, University of Michigan, USA; Michael McCurdy, Preston Tollinger, Alonso Vera, NASA Ames Research Center, USA; Andrew Howes, Cardiff University, UK; Laura Palton, NASA Ames Research Center, USA

This paper presents X-PRT, a new cognitive modeling tool supporting activities ranging from interface design to basic cognitive research. X-PRT provides a graphical model development environment for the CORE constraint-based cognitive modeling engine [7,13,21]. X-PRT comprises a novel feature set: (a) it supports the automatic generation of predictive models at multiple skill levels from a single task specification, (b) it supports a comprehensive set of modeling activities, and (c) it supports compositional reuse of existing cognitive/perceptual/motor skills by transforming high-level, hierarchical task descriptions into detailed performance predictions. Task hierarchies play a central role in X-PRT, serving as the organizing construct for task knowledge, the locus for compositional integrity, and the cognitive structures over which the learning theory is predicated. Empirical evidence supports the role of task hierarchies in routine skill acquisition.

Mediating Intimacy: Designing Technologies to Support Strong-Tie Relationships
Frank Vetere, Martin Gibbs, University of Manchester, UK; Jesper Kjeldskov, Aalborg University, Denmark; Steve Howard, Florian Mueeller, Sonja Pedell, Karen Mecoles, University of Manchester, UK; Marcus Bunyan, Charles Sturt University, Australia

Intimacy is a crucial element of domestic life, and many interactive technologies designed for other purposes have been appropriated for use within intimate relationships. However, there is a deficit in current understandings of how technologies are used within intimate relationships, and how to design technologies to support intimate acts. In this paper we report work on an interface which addresses these deficits. We used cultural probes and contextual interviews and other ethnographically informed techniques to investigate how interactive technologies are used within intimate relationships. From this work we generated a thematic understanding of intimacy and the use of interactive technologies to support intimate acts. We used this understanding to inform the design of intimate technologies. A selection of our design concepts is also presented.

A Study on the Manipulation of 2D Objects in a Projector/ Camera-Based Augmented Reality Environment
Stephen Voida, Georgia Institute of Technology, USA; Mark Podlasec, Rick Kjeldsen, Claudia Pinhanes, IBM TJ Watson Research Center, USA

Are the object manipulation techniques traditionally used in head-mounted displays (HMDs) applicable to augmented reality based projection systems? This paper examines the differences between HMDs and projector/camera-based AR interfaces in the light of a manipulation task involving documents and applications projected on common office surfaces such as tables, walls, cabinets, and floor. We report a Wizard of Oz study where subjects were first asked to create gesture voice commands to move 2D objects on those surfaces and then exposed to gestures created by the authors. Among the options, subjects could select the object to be manipulated using voice command; touching, pointing, and grabbing gesture; or a virtual mouse. The results show a strong preference for a manipulation interface based on pointing gestures using small hand movements and involving minimal body movement. Direct touching of the object was also common when the object being manipulated was within the subject’s arm reach. Based on these results, we expect that the preferred interface resembles, in many ways, the egocentric model traditionally used in AR.

Participatory Design of an Orientation Aid for Amnesics
Mike Wu, Ron Baucker, University of Toronto, Canada; Brian Richards, Baycrest Centre for Geriatric Care, Canada

We present the participatory design and evaluation of an orientation aid for individuals who have anterograde amnesia. Our design team included six amnesics who have extreme difficulty storing new memories. We describe the methods we used to enable the participation of individuals with such severe cognitive impairments. Through this process, we have conceived, designed, and developed the Orients tool, a software application for Personal Digital Assistants that can be used by amnesics to orient themselves when feeling lost or disoriented. Two complementary studies were conducted to evaluate the effectiveness of this tool in ecologically valid contexts. Our findings suggest that the Orients tool can improve an amnesic’s independence and confidence in managing situations when disoriented, and that participatory design may be productively used with participants who have significant cognitive disabilities.

StudioBRI DGE: Using Group, Location, and Event Information to Bridge Online and Offline Encounters for Collocated Learning Groups
Susan Yee, Microsoft Research, USA; Kat S. Park, MIT, USA

StudioB RI DGE is an awareness system, based on instant messaging (IM), developed for students working in open studio spaces in the Architecture Department at the Massachusetts Institute of Technology (MIT). The goal of StudioBRIDGE is to help students initiate online and offline interactions by giving them an awareness of nearby people, groups, locations, and events of the community. Even when students are not in close proximity to each other, they are often not aware of the activities and expertise of their colleagues nearby. We believe that this integrated awareness could lead to increased peer learning and expertise sharing by encouraging informal social communication, particularly in groups whose members have existing social and physical ties. In this paper, we describe the user community and the motivation, design, and initial pilot deployment of StudioBRIDGE.