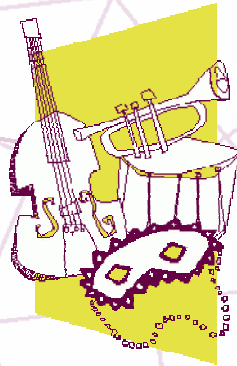


# A Whirlwind Tour of CSCW Research



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Intel Research, Seattle

(Elizabeth F. Churchill  
FX Palo Alto Laboratory)

## Overview

- Traditional CSCW
  - Background, Influences, Technologies
  - Case study (Palen & Grudin)
    - Calendar use in the workplace
- Non-traditional CSCW
  - Beyond the workplace
  - Case Studies
    - MusicFX: A system for Computer Supported Collaborative Workouts
    - Proactive Displays
    - Others...

## What is CSCW?

- *Computer Supported Cooperative Work*
- The field of CSCW focuses on the **use** of **technology** to mediate **interactions** among **people**
  - Use: Ethnography, design, ...
  - Technology: Devices, infrastructures, ...
  - Interactions: Text, audio, video, ...
  - People:
    - Teams, organizations, communities, ...
    - Psychology, organizational behavior, sociology, ...

## HCI vs. CSCW

- HCI: human-computer interaction
  - Individuals' interactions and relationships **with** information technology
    - May involve > 1 person, but not necessarily
- CSCW: human-computer-human interaction
  - Individuals' interactions and relationships **through** information technology
    - Always > 1 person

## Evolution of CSCW

- Computer Supported Cooperative *Work*
  - Work is [typically] a social activity involving > 1 person
  - Technology can aid and abet:
    - Foreground: Communication, coordination, collaboration
    - Background: Awareness
  - Bridging time, space, organizational boundaries, ...
- Computer Supported Cooperative *Whatever*
  - Beyond the workplace: increasingly available in other contexts ...
    - Home, car, coffee shops, public places, private places, ...
  - ... and applied to non-work activities
    - Socializing, recreation, staying in touch, ...

## Trends

- Convergence
  - Computing, telephony, broadcast media
- Mobility (→ Ubiquity)
  - Devices: Laptops, PDAs, mobile phones
  - Infrastructure: WiFi, {2,2.5,3}G, EDGE
- Communities
  - Professional (communities of practice)
  - Others (Ebay.com, match.com, meetup.com)
- Goals
  - Efficiency vs. fun

## CSCW has many influences

- Computer Science
- Engineering
- Sociology: macro and micro
- Psychology
- Organisational Studies
- Management Studies
- Anthropology
- Communication
- Ethnography

## CSCW research has many perspectives

### Hard Determinism

- Behaviour is inevitably shaped by technology

### Soft Determinism

- Behaviour tends to be shaped by technology

### Co-Determinism

- Technology and our intentions control in concert

### Non-Determinism

- We control the uses of technology

## Dimensions of Cooperation: Time and Space

### Place/Space

|      |           |                                      |                                      |
|------|-----------|--------------------------------------|--------------------------------------|
|      | Same      | Different                            |                                      |
| Time | Same      | Synchronous (immediate) technologies | Synchronous (immediate) technologies |
|      |           | Local                                | Remote                               |
|      | Different | Asynchronous (delayed) technologies  | Asynchronous (delayed) technologies  |
|      |           | Local                                | Remote                               |

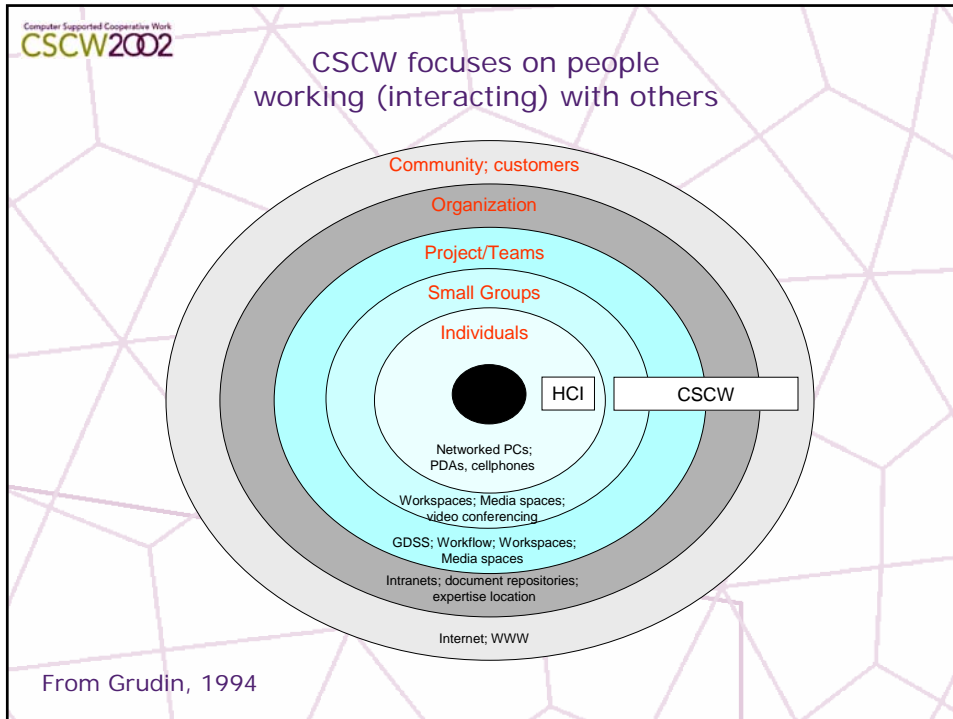
- F2F interactions
- Post-its
- Telephony
- Email
- Newsgroups
- Text chat (IM, SMS)
- Calendar / scheduling
- Electronic whiteboards
- Audio / video conferencing
- App. / data sharing
- Group editing / annotation
- GDSS
- Dataflow, workflow
- Expertise location
- Recommendation Systems
- Awareness (media spaces)

See Bannon and Schmidt, 1991: CSCW: Four Characters in Search of a Context. In Bowers, J. and Benford, S. (Eds) Studies in Computer Supported Cooperative Work – Theory, Practice and Design. North Holland.

## Thinking of activities from focused to peripheral



See Harrison and Bly



- Computer Supported Cooperative Work  
**CSCW2002**
- ## Team and Small Group Characteristics
- **Characteristics**
    - Members know each other
    - Collaborate to achieve a common goal
    - Highly focused, interactive
    - Strong need for communication
  - **Examples**
    - Software development team, proposal writing, conference program committees, small operational groups such as customer support, research project teams
  - **Support technologies include:**
    - Buddy lists, instant messaging, chat, Groove, Quickplace, BSCW, video conferencing, data conferencing
- See Grudin and Poltrock, Tutorial Collaboration Technology in Teams, Organizations, and Communities

## Organization Characteristics

- Characteristics
  - Geographically distributed
  - Hierarchical management structure
  - Strong need for coordination
- Examples
  - Companies, governments or government agencies, non-profit organizations
- Support technologies include:
  - Email, calendars, workflow, Lotus Notes, intranet applications and webs, document management systems, broadcast video

## Community Characteristics

- Characteristics
  - Members do not [all] know each other
  - Common interests or preferences
  - Loose structure & interactions
- Examples
  - Citizens of a city or neighborhood
  - Newsgroups
  - Virtual world citizens
  - Auction participants
- Support technologies include:
  - web sites, chat rooms, virtual worlds
- Issues: reputation, accountability, anonymity
  - Civic support often suffers from uneven participation
    - Lurkers
  - “Tragedy of the Commons”

## Groupware vs. Communityware

- Groupware
  - Medium for contacting and interacting with known collaborators in order to achieve a shared goal
  - Email, Calendars, Chat, Whiteboards, Conferencing
- Communityware
  - Medium for initiating contact / transactions with unknown collaborators who have similar interests and preferences
  - Newsgroups, Ebay, Amazon, Epinions, Meetup.com, Match.com

## Case Study: Shared Calendars

- Adoption of Groupware
  - Managerial Mandate (decide to use)
  - Discretionary Choice (begin to use)
- Effort / benefit tradeoff
  - Benefit to managers, admins
  - Effort required by “contributors”
- Critical mass required
  - [nearly] all or nothing

Discretionary Adoption of Group Support Software: Lessons from Calendar Applications.  
L. Palen and J. Grudin, 2002. In B.E. Munkvold (Ed.),  
Implementing collaboration technologies in organizations, 159-180.

## Studies of Calendar Use

- Initial interviews (Microsoft)
  - 5 subjects; different positions, departments
- More interviews (Sun)
  - 40 questions
  - 12 subjects (users, non-users)
- Survey (both)
  - 20 questions
  - 3000 people (each site)
    - Microsoft: 30% response rate
    - Sun: 50% response rate

## Similarities

- Widespread adoption (75% of appts)
  - Sun: 81%
  - Microsoft: 75%
- “Mundane” technology
  - Part of everyday work
  - “Hard to imagine life without it”

## Differences

- Sun
  - CalendarManager
  - Default (82%): open calendars
    - User name + host computer name
    - Company rolodex
  - Scheduling, coordinating (inferences)
- Microsoft
  - Schedule+
  - Default (81%): free/busy (only)
  - Scheduling only

## Factors affecting adoption

- Peer pressure
  - “widespread expectation”
  - “plus me”, “browse me”
- Exclusive benefits (conf. rooms)
- Integration (email “invitations”)
- Interface transparency & efficiency
- Technical support

## Case Study: Intel

- [intel.com](http://intel.com) vs. [intel-research.net](http://intel-research.net)

## Case Study: Shared Environment



## Proactive Displays

- **Displays** that can **sense** and **respond appropriately** to the people and activities taking place in their vicinity
  - Displays
  - Sensors
  - Contexts
  - Content
  - Interaction Models

## "Ambient" Displays



Dangling String (PARC)



Bus Mobile (UC Berkeley)

## Proactive Displays in the Large



An installation project by SCE (EMH 99) of Billboards Lovers Sunset, September 2002

Sunset @ 200MHz (PARC)



Love Board (Hachiko Crossing)

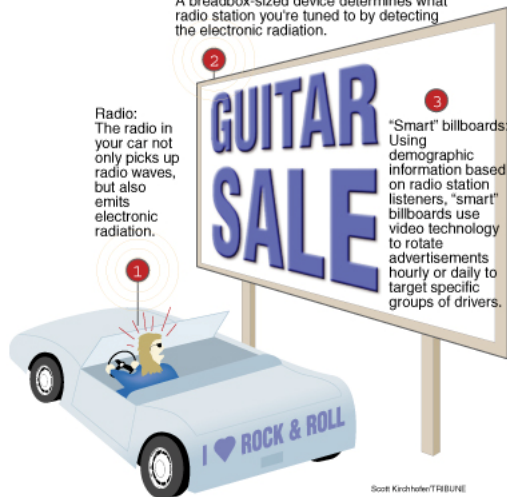
## Proactive Displays in the Large



Alaris E-boards  
([www.alaris.net](http://www.alaris.net))

MobilTrak unit:  
A breadbox-sized device determines what radio station you're tuned to by detecting the electronic radiation.

Radio:  
The radio in your car not only picks up radio waves, but also emits electronic radiation.



Scott Kichler/THEBUNE

## Proactive Displays at a Conference

### AutoSpeakerID

- Q/A session
- Photo, name, affiliation



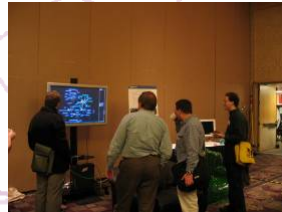
### Ticket2Talk

- Coffee break
- Explicit content
- One person (at a time)



### Neighborhood Window

- Lounge area
- Implicit content
- Multiple people



## Experience UbiComp Project

- Desire for *mutual revelation*
  - show & tell about you & your work;
  - learn about others & their work
- Restricted *contexts*
  - Paper / panel sessions
  - Demo / poster sessions
  - Reception / breaks
- Available *content*
  - Explicit: registration info
  - Implicit: homepage data mining
- *Stakeholders*
  - people who influence, and are influenced by, displayed content

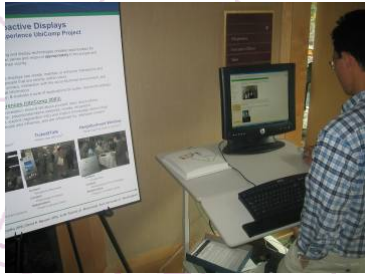
## UbiComp 2003 Deployment

- Register (create profile)
  - [www.proactivedisplays.org](http://www.proactivedisplays.org)
  - WiFi available throughout conference
- Activate
  - Associate profile with RFID tag (kiosk)
- Participate
  - Insert RFID tag into badge sleeve
  - Approach a Proactive Display
- Opt out at any time
  - Delete information / profile
  - Remove RFID tag

## Registration

|  |   |
|--|---|
| E-mail Address:  | <input type="text" value="ssoroczak@intel-research.net"/><br><small>(e.g., jane.doe@intel.com)</small>  |
| Full Name:   | <input type="text" value="Suzanne Soroczak"/><br><small>(e.g., Jane Doe)</small>  |
| Affiliation:   | <input type="text" value="Intel Research, Seattle"/><br><small>(e.g., University of Washington)</small>   |
| Photo:   | <input type="text"/> <input type="button" value="Browse..."/><br><small>Share a GIF/JPG photo of yourself.</small>  |
| Ticket2Talk Image:   | <input type="text"/> <input type="button" value="Browse..."/><br><small>Share a GIF/JPG image of something you'd be happy to talk about with other UbiComp 2003 conference attendees.<br/>Click <a href="#">here</a> for more information on "tickets to talk".</small> |
| Ticket2Talk Caption:   | <input type="text"/>  |
| Homepage URL:  | <input type="text"/>  |
| A few words about your interests:  | <input type="text"/><br><small>Use a comma to delimit the concepts. [e.g. RFID, personal servers, kite boarding]</small>  |
| <input type="button" value="Submit"/> <input type="button" value="Reset"/> |   |

## Activation



## Evaluation

- Survey (as of Nov. 6, 2003)
  - 500 attendees
  - 250 participants
  - 70 respondents (48 were participants)

|                     | <i>Positive</i> | <i>Negative</i> | <i>No Impact</i> | <i>No Response</i> |
|---------------------|-----------------|-----------------|------------------|--------------------|
| AutoSpeakerID       | 52              | 5               | 11               | 2                  |
| Ticket2Talk         | 30              | 3               | 26               | 11                 |
| Neighborhood Window | 17              | 2               | 28               | 23                 |

## Experiences

- AutoSpeakerID
  - 50% of questioners' tags detected
  - Oral only, visual only, visual + oral
  - Fun with picture, name and/or affiliation
    - "I'm the real <X>"
- Ticket2Talk
  - Conversations, awareness about new & old
    - "Who's <X>?!"
- Neighborhood Window
  - Similar to T2T, though more of a novelty factor (and more noise)
    - "red bishops"
    - Death Valley

## PlasmaPoster

- Churchill, et al., FXPAL
- An interactive display
  - poster board / bulletin board / billboard
  - content as "conversational props"
  - complement/spur to online interaction
  - social networks and social capital



## GroupWear Nametags



## GroupWear Nametags

- Richard Borovoy, Fred Martin, Mitch Resnick, Brian Silverman (MIT Media Lab)
  - CHI '98
- Interpersonal augmentation
  - facilitating interaction between people, not people & machines
  - interpersonal displays: display for other people
  - Q&A: programmed by “dunking” in “bucket kiosks”
  - issue: how to augment but not distract
    - lights indicate percentage of similar views, not identifying individual questions

## nTAGs



- Networking Applications
  - Common Ground
  - Idea Sharing
  - Card Exchange
  - Network Tracking and Visualizations
  - Networking Games
- Event Management Applications
  - Lead Capture
  - Polls and Surveys
  - Attendance Tracking and Security
  - Digital Tickets
  - Event Information
  - Message Delivery
- [www.ntag.com](http://www.ntag.com)

## i-balls

- Folk Computing: Revisiting Oral Histories as a Scaffold for Co-Present Communities
  - Rick Borovoy, et al., MIT Media Lab
  - CHI 2001
- i-balls: key-chain computer programs
  - Key-chain-sized video game devices (SEGA / DreamCast)
  - Animations, games, etc.
  - "Hot potatoes", "Quests", "Randomizers", "Hitchers", "Secret i-balls", "Multi-author i-balls"
  - Create, trade, track, teach (everyone, everywhere)

## i-balls



Figures 1 & 2. I-Ball and PC-based I-Ball Editor



Figure 3. Two Children Exchange I-Balls



Figure 4. Kids Sharing Their New I-Balls After Class

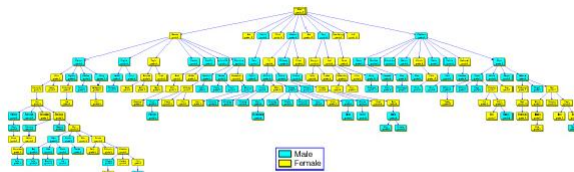


Figure 7: Visualization of How the "Romance" I-Ball Traveled, Colored by Gender (See color plate on page 000)

## Familiar Stranger



clips to bag

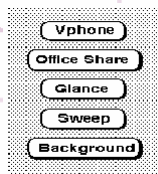
hangs from belt

<http://berkeley.intel-research.net/paulos/research/familiarstranger/>

## Media Spaces

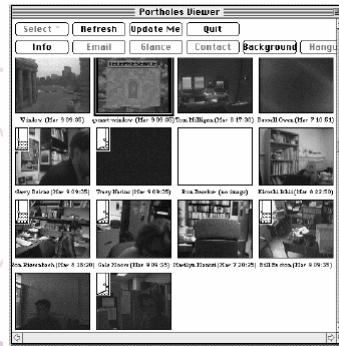
- Media Spaces: Environments for Informal Multimedia Interaction
  - PARC, EuroPARC, 1980s-90s
  - Support for informal, unplanned and unstructured interactions
  - Summary paper by Wendy Mackay
    - In Michel Beaudouin-Lafon, editor, Computer-Supported Cooperative Work, Trends in Software Series. John Wiley & Sons Ltd, 1999
    - <http://www-ihm.lri.fr/~mackay/pdffiles/TRENDS99.Mediaspaces.pdf>

## RAVE



## Portholes

- Passive awareness
- Distributed workgroups
- No explicit video connections

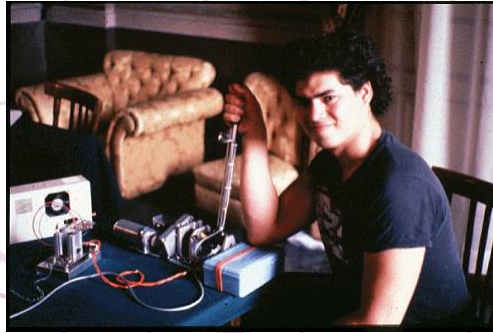


## Hole-In-Space



<http://www.ecafe.com/getty/HIS/>

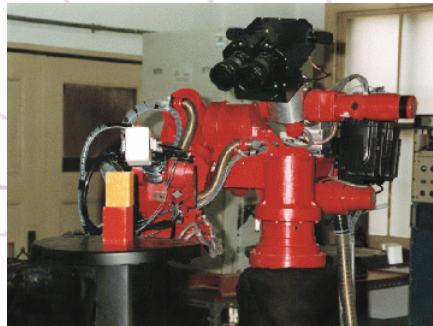
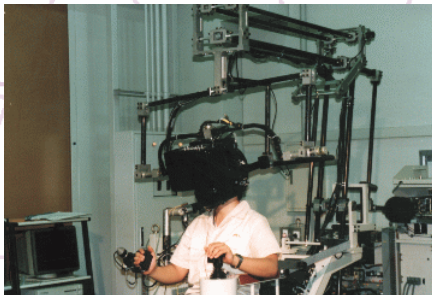
## Norm While (Telephonic Arm Wrestling, 1986)



A collaborative telecommunications project to allow contestants in two different cities to arm-wrestle, using motorized force-transmitting systems interconnected by a telephone data link. First successfully exhibited during a 1986 link-up between the Canadian Cultural Centre, Paris, and the Artculture Resource Centre, Toronto. Sponsored by the McLuhan Programme (Director: Prof. Derrick DeKerkhove), University of Toronto. Materials: Steel, Plexiglas, motors, custom electronics, see <http://www.normill.com/artpage.html>

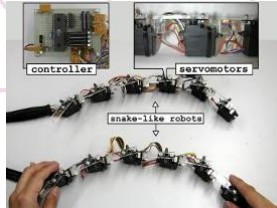
## RobotPHONE (RUI for Interpersonal Communication)

- Dairoku Sekiguchi, et al., Univ. of Tokyo
  - “RobotPHONE: RUI for Interpersonal Communication”
    - CHI 2001 Extended Abstracts
    - <http://www.star.t.u-tokyo.ac.jp/>
- Tele-existence



## RobotPHONE

- Shape-sharing
  - Snakes



- Teddy Bears



## PRoPs



## PRoP: Personal Roving Presence

- Eric Paulos & John Canny, UCB
  - <http://www.prop.org>
- Tele-embodiment in a remote real place
  - casual, unstructured, spontaneous interactions, away from PC
  - simple, inexpensive, internet-controlled, untethered tele-robots
  - mobile physical proxy (vs. image / voice on stationary screen)
- Two prototypes
  - Space Browser (blimp): 600 grams
    - color video camera, microphone, speaker, wireless radio, batteries
  - Surface Cruiser (cart)
    - remote-control vehicle (dampened), 1.5m vertical pole
    - same equipment as blimp + LCD screen & "pointer"

## The Brain Ball

BrainBall is a game unlike others. The "winner" is the player who can relax under stress rather than the player who is the most aggressive. Brain waves recorded from the scalp of the players are processed to extract the alpha activity, which reflects a relaxed state of mind. The motion of a ball on the table is controlled by the difference in the alpha activity between the two players.

**BrainBall™ By Moberg Research, Inc.**



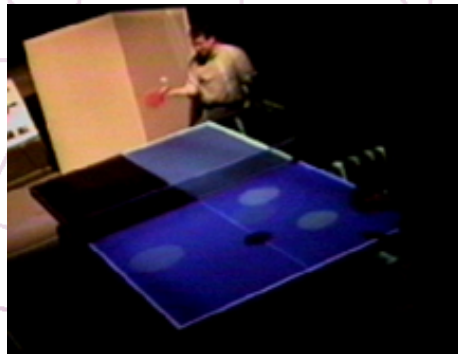
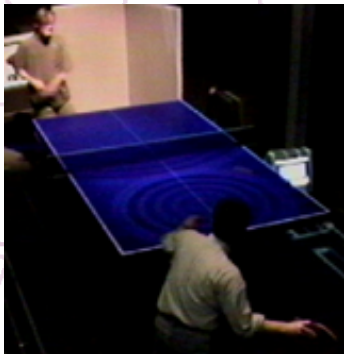
[http://smart.interactiveinstitute.se/smart/projects/brainball/index\\_en.html](http://smart.interactiveinstitute.se/smart/projects/brainball/index_en.html)

## Interactive Institute - Stockholm

### *Brainball*



## PingPongPlus



## PingPongPlus

- Craig Wisneski, Julian Orbanes, Hiroshi Ishii
  - Things That Think, Digital Life (MIT Media Lab)
  - CHI '98
  - <http://tangible.media.mit.edu/projects/PingPongPlus/PingPongPlus.html>
- Computer Supported Collaborative Play
  - augmented reality + tangible bits, in athletic scenario
    - a computer game in the physical world
  - transforms game: competition --> collaboration
  - ball tracking via microphone array + sound source localization (1")
  - water ripple, blackout, thunderstorm, painting, comets
  - SIGGRAPH 98
  - another project: BilliardsPlus

## The BabySense Environment



## The BabySense Environment

- Gili Weinberg, Rich Fletcher, Seum-Lim Gan
  - Hyperinstruments Group, Physics & Media Group (MIT Media Lab)
  - CHI '98
  - <http://web.media.mit.edu/~gili/research/projects.html#7>
  - Toys to Grow With, Toys to Communicate With
  - self-enrichment, monitoring, interaction
- Enhance infant's sensory-motor experience
  - Pressure sensor mattress (fabric electrodes)
  - Mobile sculpture (with lights & sound)
  - Foreground display: toy panda bear (lights & sound)
  - Background display: kinesthetic sculpture (lights)
- Infant interaction
  - Move one toy, other toy (in another crib) responds



## For more information

- Joe McCarthy
  - [seattleweb.intel-research.net/people/mccarthy](http://seattleweb.intel-research.net/people/mccarthy)
  - [mccarthy@intel-research.net](mailto:mccarthy@intel-research.net)
- Proactive Displays
  - [www.proactivedisplays.org](http://www.proactivedisplays.org)
- UbiComp 2003
  - [ubicomp.org/ubicomp2003](http://ubicomp.org/ubicomp2003)

Thanks! ... Questions?