

Understanding Technology use in the Home

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CS 160 Guest Lecture
November 22, 2006
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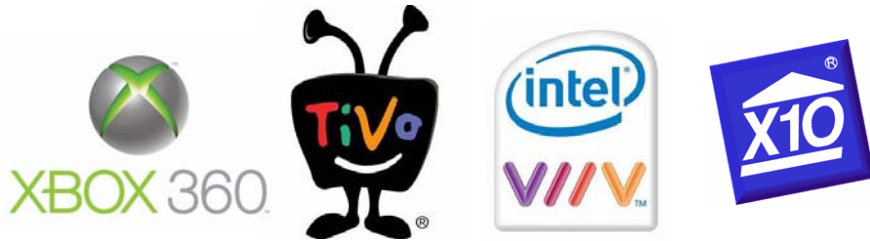
Outline

- Why study the home?
- Ethnography in HCI
- Case study
 - Wireless laptop use and mobility
 - Applying machine learning techniques



Why study the home?

The home is a big market ...



Why study the home?

... but it's not the same as the office.



<http://www.flickr.com/photos/oldtasty/285985/>



<http://www.flickr.com/photos/ratthead/54983800/>



Why study the home?

And, the home environment is more sensitive.

- Domestic violence
- Privacy
- Work/Home Boundaries
- Safety and Fear

I hardly sleep at night, as I know that they may come at any moment. Even that bit of sleep I get is a complete nightmare, full of frightening scenes with the police.

Miradije Aliu, in her bedroom, 1994.



Melanie Friend
No Place Like Home: Echoes from Kosovo



Why study the home?

- Previous research in domestic technology
 - Smart Homes (e.g. *The Adaptive House*)
 - Children and Education (e.g. *Story Mat*)
 - Elder Care (e.g. *Digital Family Portrait and Health Feedback Displays*)
 - Entertainment, TiVo, video games, etc.



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Ethnography in HCI

- Designing for the home (and mobile technologies, and education, and ...) is often about more than just *optimizing tasks*.
 - Which issues are most important to people?
 - What are the structures of relationships (e.g. within a family)?
 - What unwritten rules and norms exist?

Ethnography and HCI

- Traditional Ethnography emerged in Anthropology studying “native” cultures
 - E.g. Geertz, C. Deep Play: Notes on the Balinese Cockfight
- “Rapid” or “Design” Ethnography has been adopted in HCI
 - E.g. Salvador et al. Design Ethnography



<http://www.flickr.com/photos/casers/123802130/>



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Maps of Our Lives: *Sensing People and Objects together in the Home*

Ryan Aipperspach,
Allison Woodruff,
Ken Anderson,
Ben Hooker

Intel
Research,
UC Berkeley



Method and Infrastructure

Location Data

Computer Usage Logs

Application Use
Keyboard/Mouse Activity
Battery/AC Status

Television Status

Participant Interviews



Method and Infrastructure

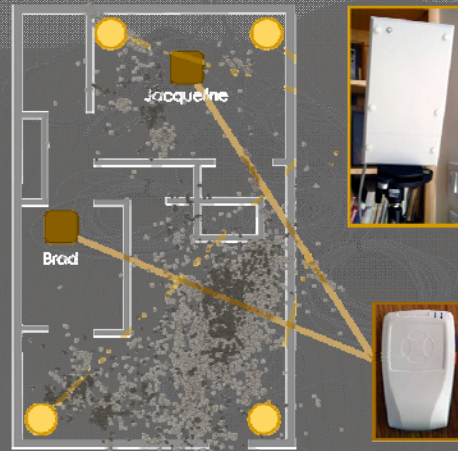
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Method and Infrastructure

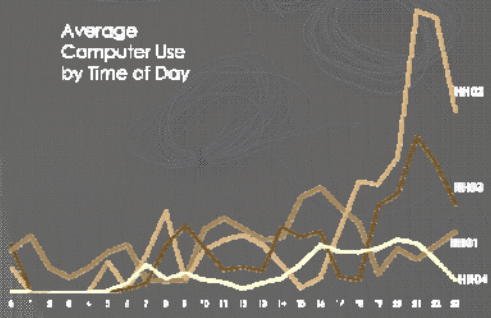
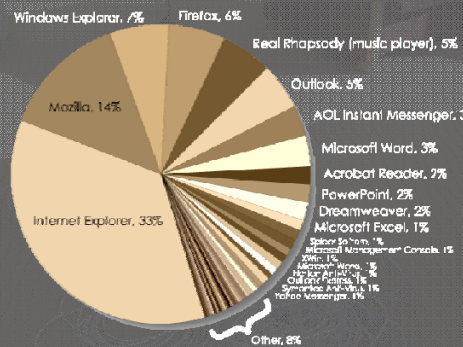
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Method and Infrastructure

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Participant Interviews



Study and Findings

Study Participants

Favored Places

Laptop Locations

Departure from the Home

Social Laptop Use



Study and Findings

Study Participants

Favored Places

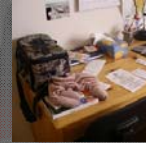
Laptop Locations

Departure from the Home

Social Laptop Use

HH01

Brad and Jacqueline
Graduate students from Australia



HH02

Margaret and Jack
Recently married couple from England, Jack is a graduate student



HH03

Mareesa, Carlo and Jessica
Married couple and 1-year-old daughter



HH04

Sierra, Gaby and Carlota
Female couple and housemate



Study and Findings

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Favorite Places

Multiple visits per day
1-3 places per person (even in larger homes)
Multifunctional



Comfortable and *Ergonomic* places

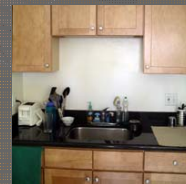
Many positions within each favorite place



Activity Places

More per person
More **specialized** use

e.g. mirror for getting ready, kitchen counter, bathroom



Study and Findings

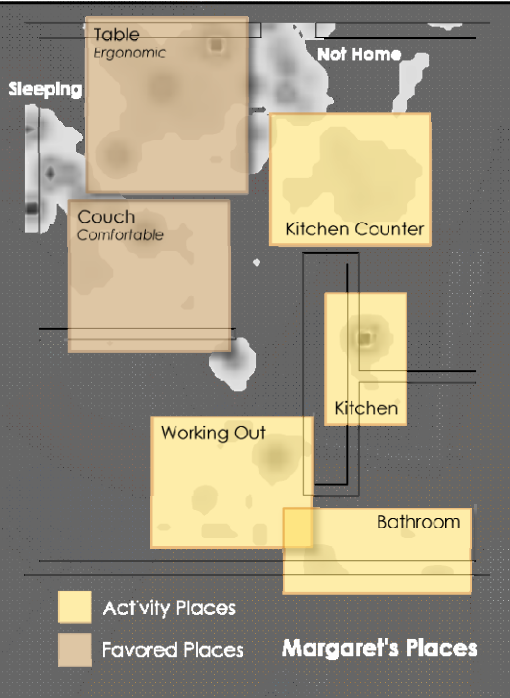
Study Participants

Favored Places

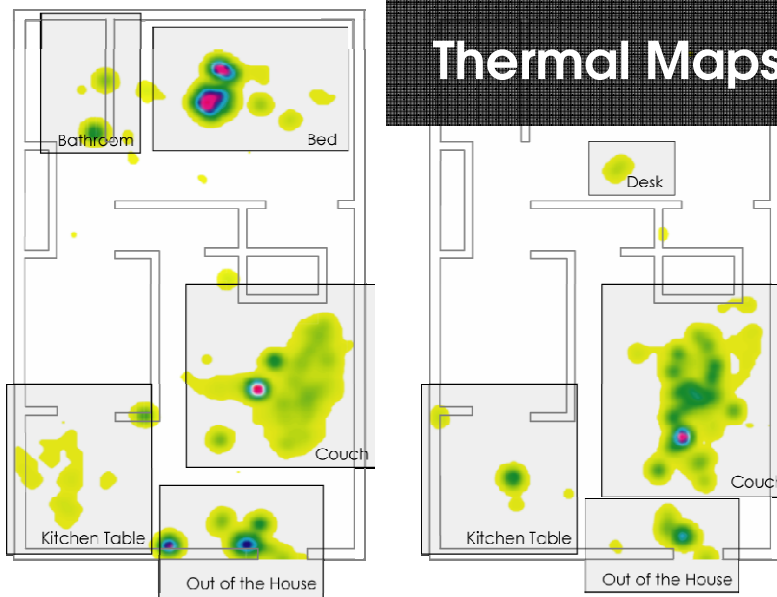
Laptop Locations

Departure from the Home

Social Laptop Use



Thermal Maps



Jacqueline

Jacqueline's Laptop

Study and Findings

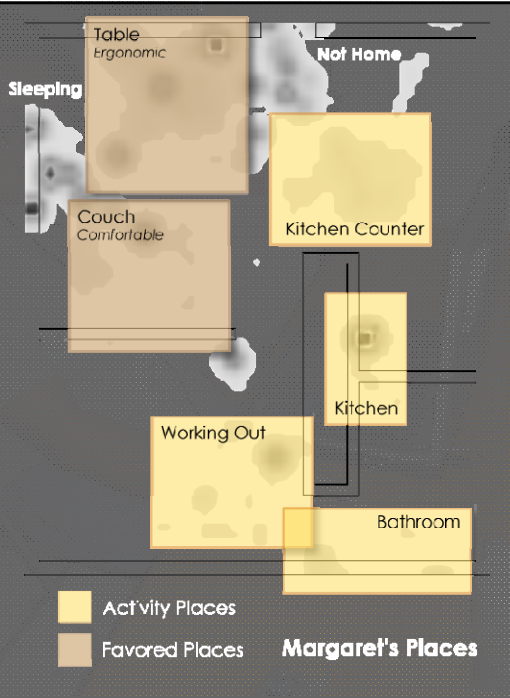
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Study and Findings

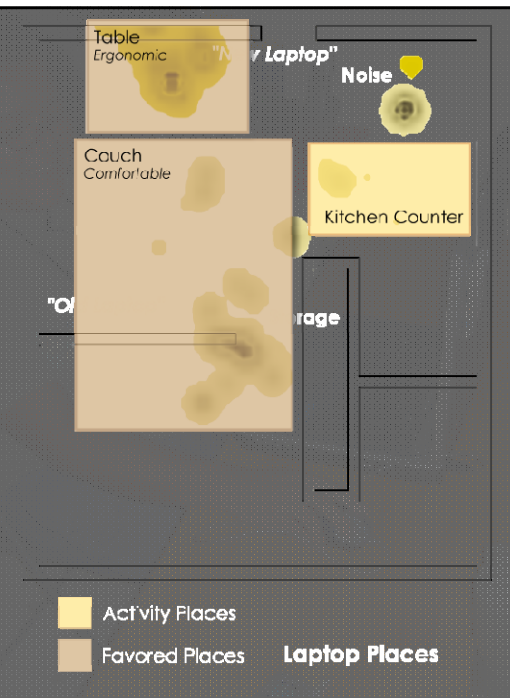
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Study and Findings

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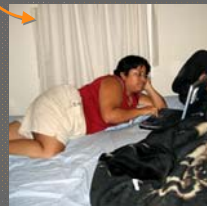
Social Laptop Use

Laptops are **portable**, not **mobile**, used primarily in comfortable and ergonomic **favorite places**

“Work”
books,
supplies



“Relaxing”
“Tired”



Study and Findings

Study Participants

Favored Places

Laptop Locations

Departure from the Home

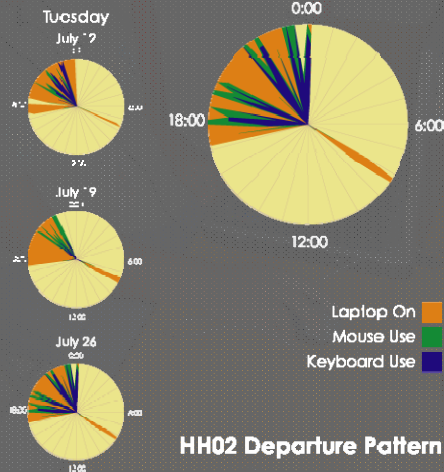
Social Laptop Use

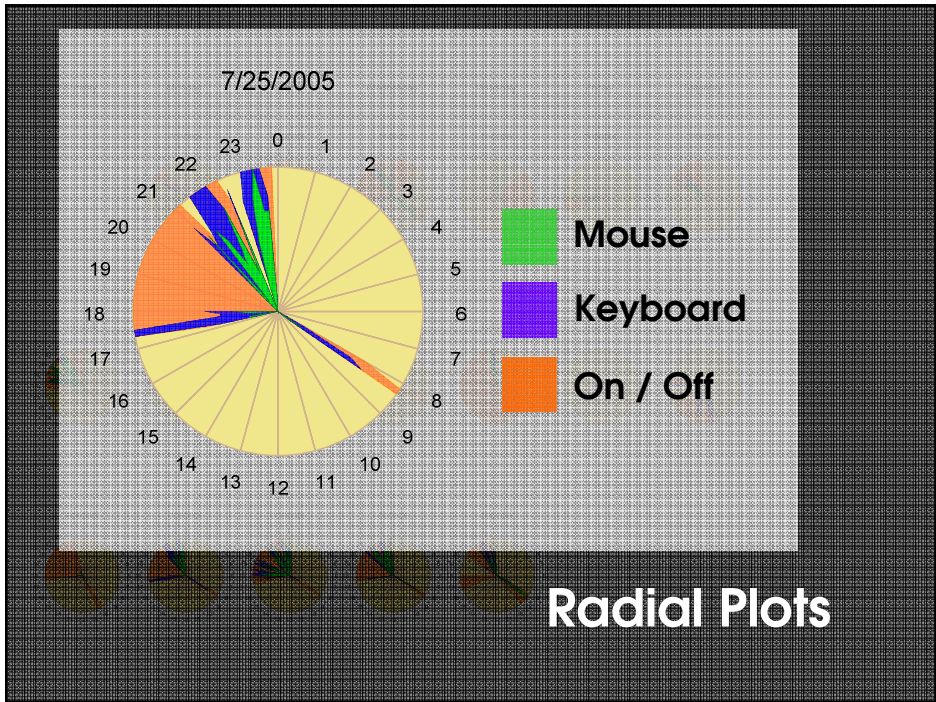
Leaving home

Packing up
Closing blinds
Checking mail
Printing maps

Coming home

Dropping
Unwinding





Study and Findings

Study Participants

Favored Places

Laptop Locations

Departure from the Home

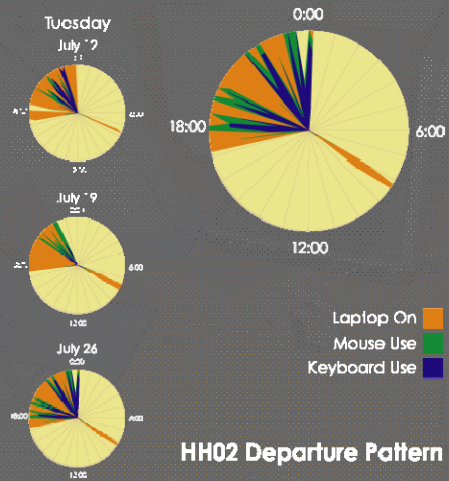
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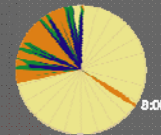
Laptop Locations

Departure from the Home

Social Laptop Use

Sharing

Collaborative Use
Teaching
Turning on the radio



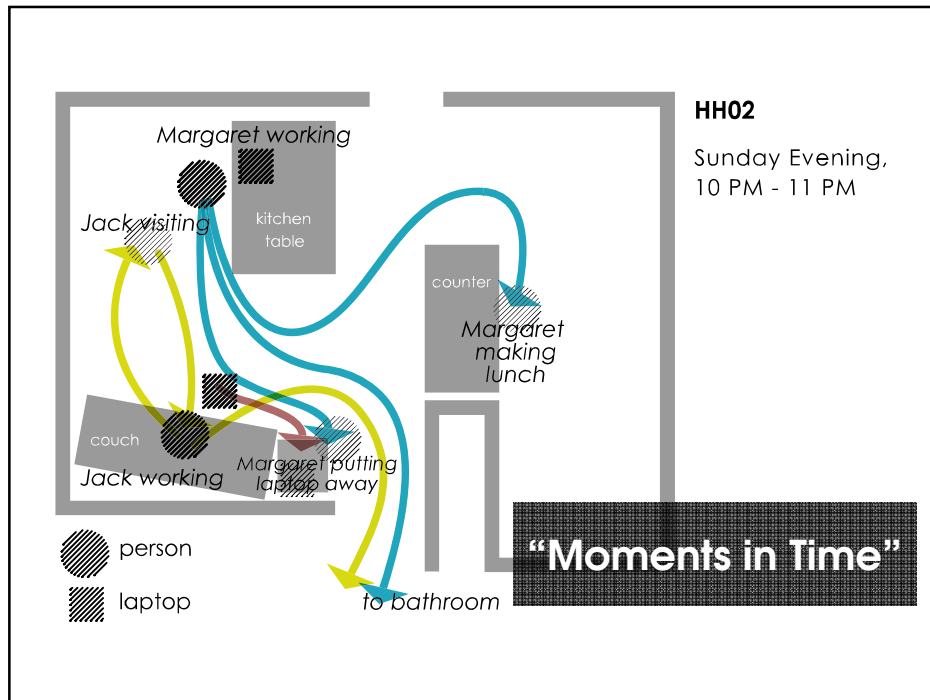
Competition

"Old Laptop" vs. "New laptop"



Following

Taking to the bedroom
Following the baby



Outline

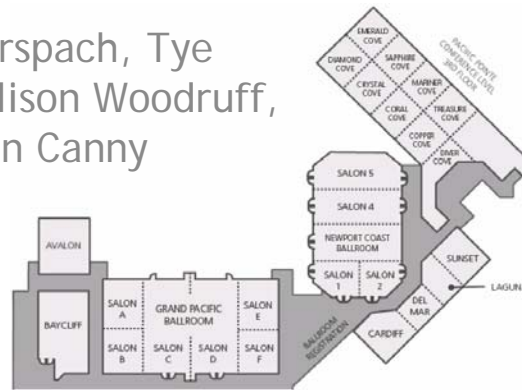
- Why study the home?
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A Quantitative Method for Revealing and Comparing Places in the Home

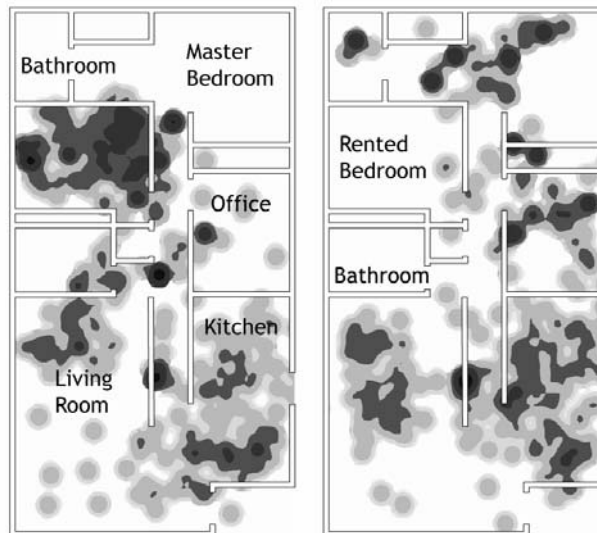
Ryan Aipperspach, Tye Rattenbury, Allison Woodruff, and John Canny



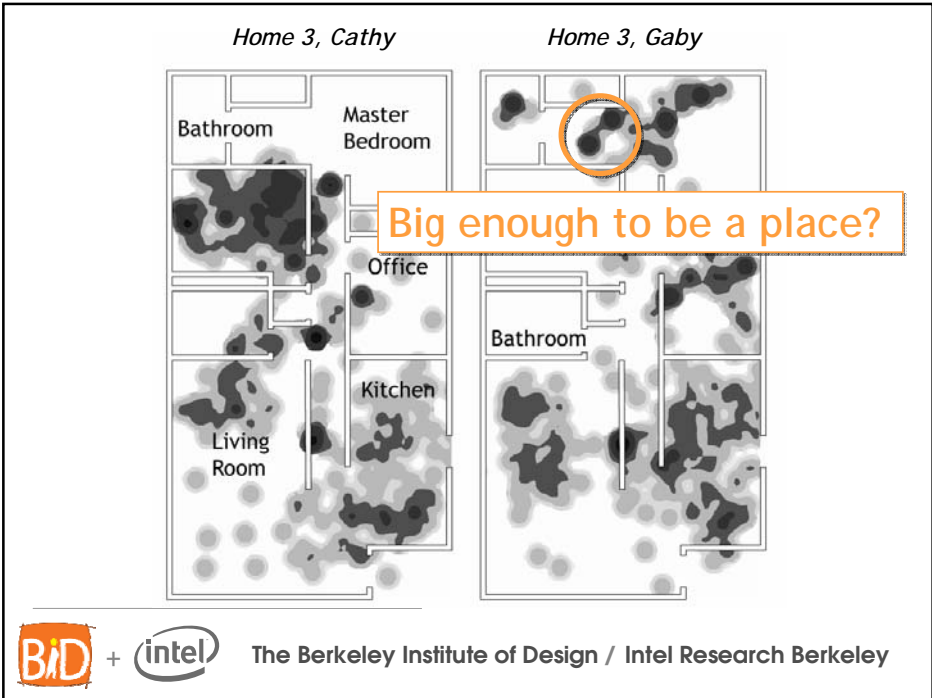
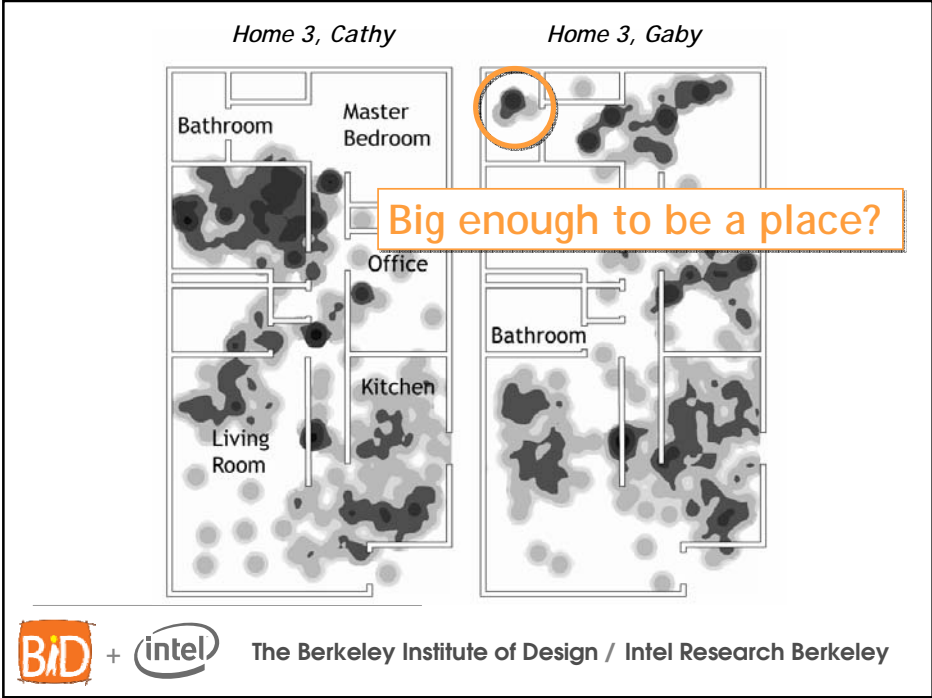
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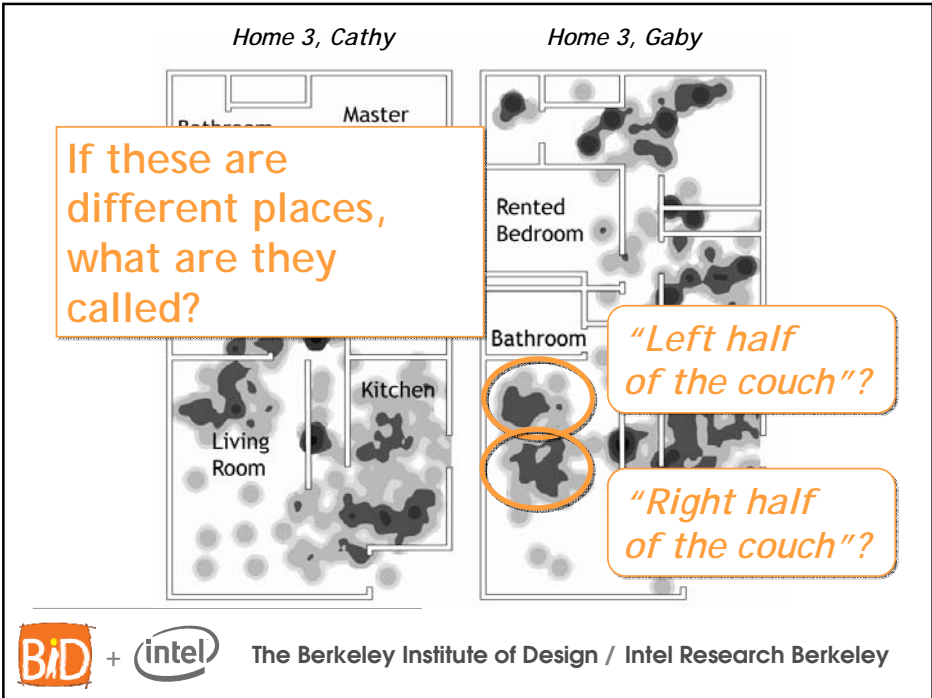
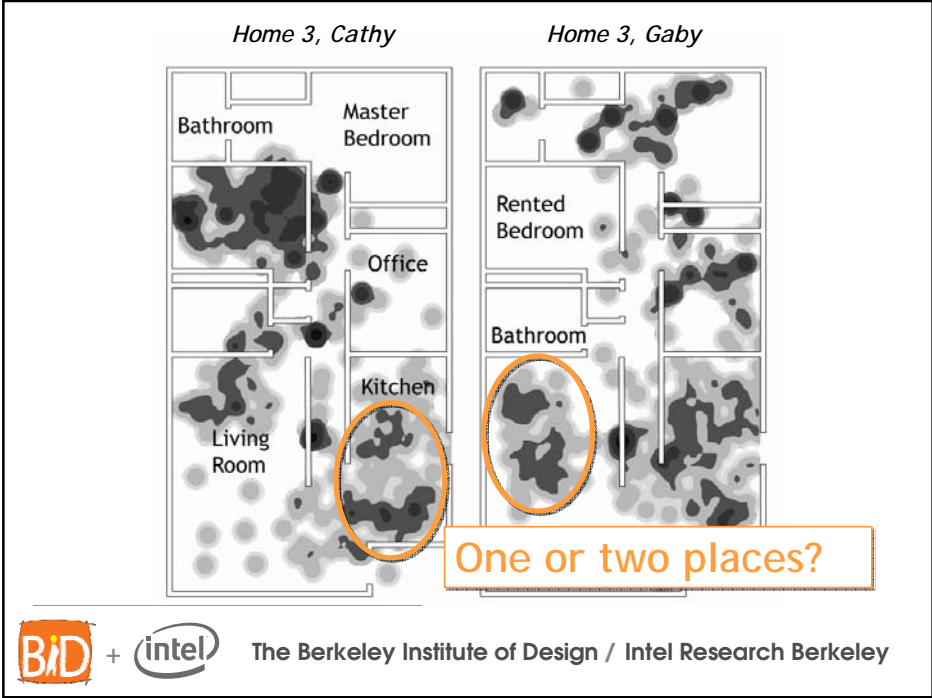
Home 3, Cathy

Home 3, Gaby



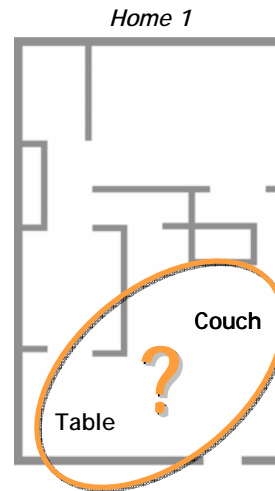
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Defining place

- Are there “correct” places in the home?
 - “Ground truth” is difficult for finding places in the home
 - Different participants have different interpretations of place
- Can people keep track of every time they change place?
- Motivate a place finding algorithm with a theoretical definition of place



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Defining place (Our definition)

[Harrison and Dourish 96] define place and highlight the difference between location and place

We operationalize this definition along two axes

- Attributes relating to physical configuration (e.g. *location*)
 - Positions of people
 - Walls and furniture
- Attributes relating to historical use (e.g. *place*)
 - Distribution of time spent in a location
 - Activity patterns
 - Co-presence patterns



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Algorithm

See Ryan Aipperspach, Tye Rattenbury, Allison Woodruff, and John Canny. "A Quantitative Method for Revealing and Comparing Places in the Home." in *Proc. Ubicomp 2006*, Orange County, CA.

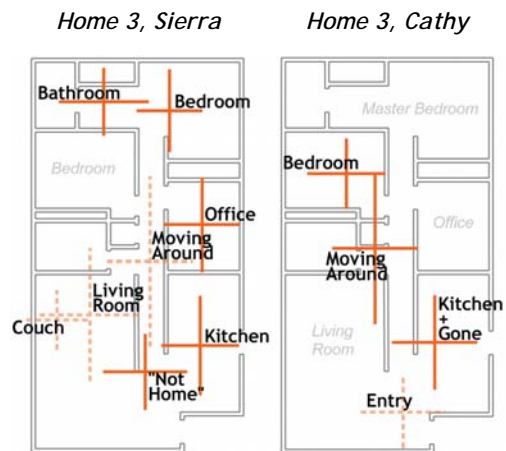


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Results - "Normative places"

- Many significant locations fit with stereotypes about homes

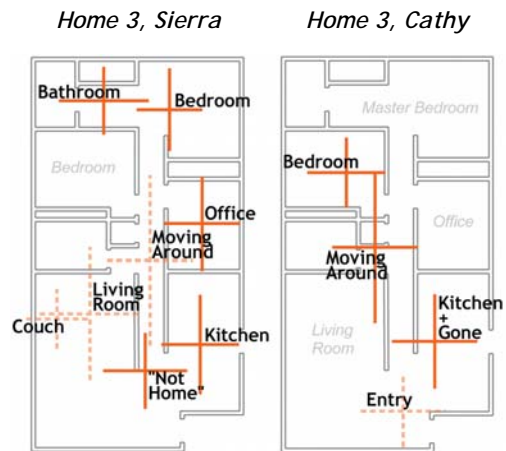
(Locations found by our algorithm were manually labeled based on interview data)



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Is everything normative?

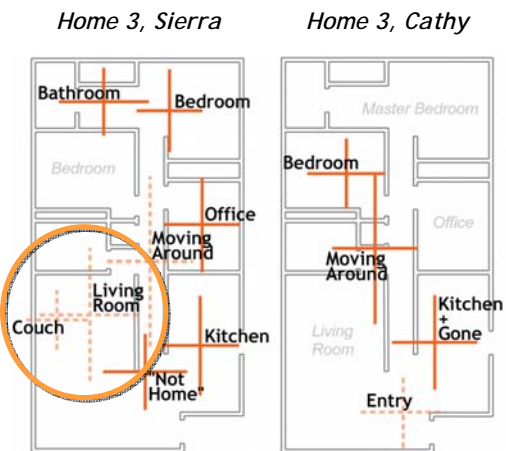
- Which normative places are used?
 - Consider sub-room places
 - Which roles are shown to the right?
- And, there are some surprises...



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Is everything normative?

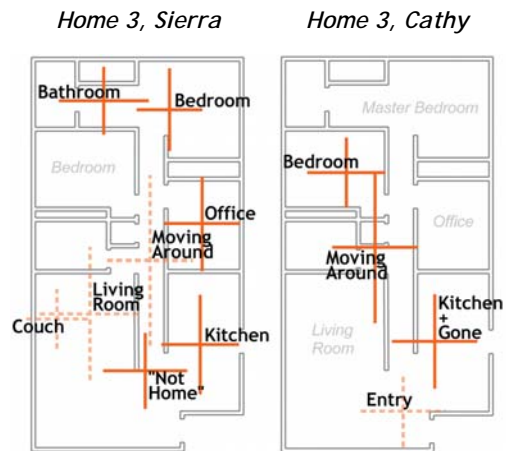
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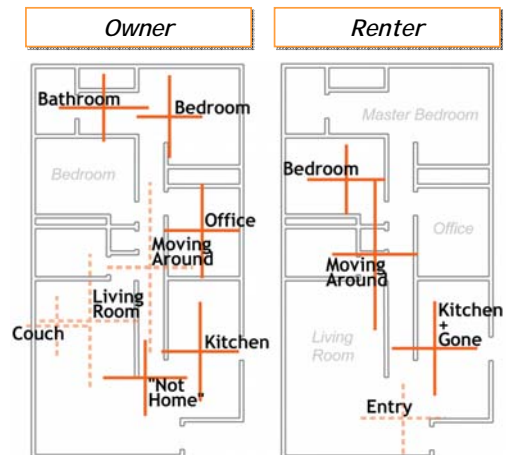
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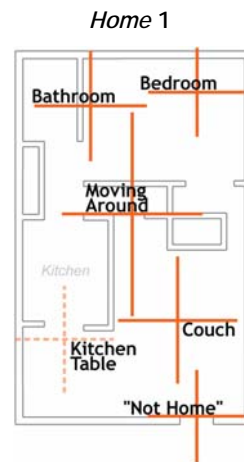
- Which normative places are used?
 - Consider sub-room places
 - The owner goes more places than the renter
- And, there are some surprises...



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Results - "Unexpected Places"

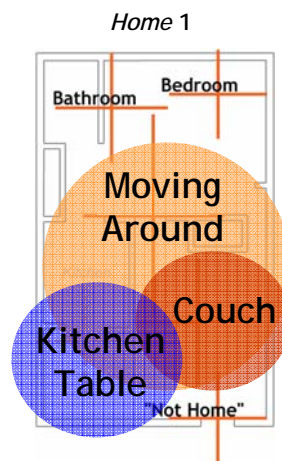
- Overlapping places:
"Moving around place"
 - Extended periods using a larger region as a single place
 - E.g. at a party
- "Deep Couch" place
- Ant farm and Exercise places in an "empty room"



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Results - "Unexpected Places"

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"Moving around place"
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 - E.g. at a party
- "Deep Couch" place
- Ant farm and Exercise places in an "empty room"



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Summary

- The home is a difficult domain to study, but it's a very promising space for technology.
- Techniques like ethnography can help.
- Examples of using ethnography, sensors, and data-mining to explore laptop and space use in the home.
- *Questions?*



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References and Links

- *The Adaptive House:*
 - <http://www.cs.colorado.edu/~mozer/house/>
- *Echoes from Kosovo:*
 - http://www.theconnection.org/shows/2002/04/20020409_b_main.asp
- *Story Mat*
 - Cassell, J. and Ryokai, K. (2001). Making Space for Voice: Technologies to Support Children's Fantasy and Storytelling. *Personal Technologies* 5(3): 203-224. (<http://web.media.mit.edu/%7Ekimiko/publications/PersonalTech.pdf>)
- *Elder Care (e.g. Digital Family Portrait and Health Feedback Displays)*
 - Mynatt, E.D. et al. Digital Family Portraits: Supporting Peace of Mind for Extended Family Members. *Proceedings of CHI 2001*. (<http://doi.acm.org/10.1145/365024.365126>)
 - Morris, M. (2005). Social Networks as Health Feedback Displays. *Internet Computing* 9(5): 29-37. (http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=1510602)
- *Deep Play: Notes on the Balinese Cockfight*
 - <http://webhome.idirect.com/~boweevil/BaliCockGeertz.html>
- *Design Ethnography*
 - Salvador, T. (1999). Design Ethnography. *Design Management Journal* 10(4). (Ask me if you'd like a copy.)



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Interaction Techniques with Mobile Devices

Jingtao Wang

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Nov 22, 2006

Guest Lecture for CS160

North American Launch Date: November 19, 2006

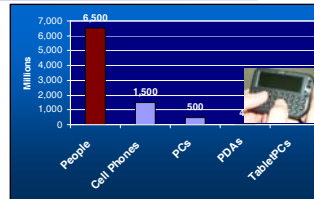




A mini survey before we start.

Why Mobile Devices Matters

- 6.5 billion people in the world
 - 1.5 billion cell phones worldwide
 - 500 million PCs (?)
 - 46 million PDAs
 - 1 million TabletPCs
- Challenge: How can handheld devices *improve* the user interfaces of everything else, and not just be another gadget to be learned



Agenda

- Why Mobile Devices Matters
- Key Challenges in Designing Mobile Applications
- Input Techniques for Mobile Devices
- Output Techniques for Mobile Devices
- Interact With Other Devices

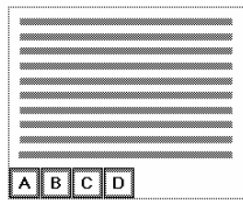
Key Challenges in Making Mobile Applications

- Limited Physical Resources
 - CPU, Memory, Screen Size, Input Devices, Battery Life etc
- Diversified Context of Use
- Different Activities
- Limited Attention

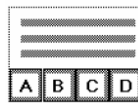


Limited Physical Resources

- A mobile device usually has 1/100 CPU power, 1/30 Screen resources, 1/20 Memory, and extremely limited input devices when compared with desktops in the same era.
- Small Screen Geography is different

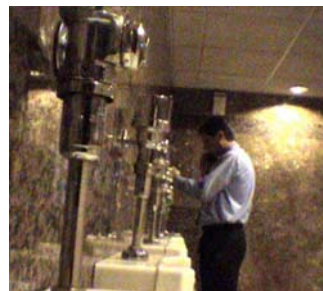


a. Large Screen



b. Small Screen

Diversified Context of Use



Different Activities

- People use small-screen devices for different activities than desktops; don't assume you understand these activities already



Limited Attention

- Don't assume your applications have people's full attention; they're doing something else while using your device.



Context, Activity, Attention

- There is more opportunity for purpose-specific or context-specific devices than for general-purpose solutions that try to work for everyone in any situation.



Agenda

- Why Mobile Devices Matters
- Key Challenges in Designing Mobile Applications
- [Input Techniques for Mobile Devices](#)
- Output Techniques for Mobile Devices
- Interact With Other Devices

Input Techniques for Mobile Devices

- Pointing
- Marker Based Input

Common Pointing/Navigation Techniques



iPod Dialpad



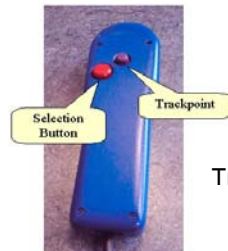
Four-directional keypad



Touch Screen

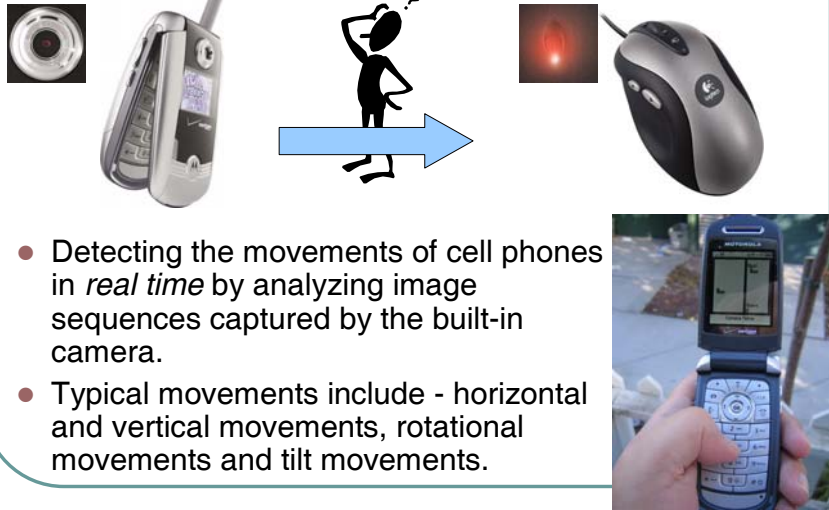


JogDial



TrackPoint

TinyMotion – Camera Phone Based Motion Sensing



- Detecting the movements of cell phones in *real time* by analyzing image sequences captured by the built-in camera.
- Typical movements include - horizontal and vertical movements, rotational movements and tilt movements.

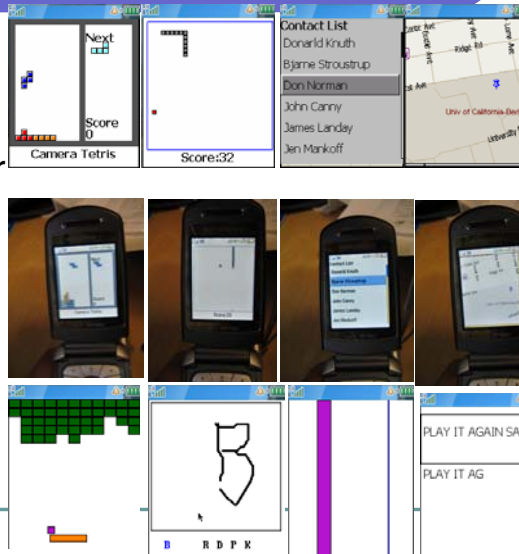
Implementation

- Motorola v710 Camera Phone from Verizon
 - ARM9 Processor, 4M Ram, 176x220 Display
- BREW 2.11 (Binary Runtime Environment for Wireless)
- Realview ARM C/C++ Compiler 1.2
- *TinyMotion* generates 12 movement estimates* per second, 19-22ms for each image

* Without displaying the captured image and additional computation, v710 can capture images at the maximal rate of 15.2 frames/sec

Sample Applications

- Motion Menu
- Vision TiltText
- Image/Map Viewer
- Mobile Gesture
- Camera Tetris
- Camera Snake
- Camera BreakOut



More Complex Applications: Handwriting/Gesture Recognition

A B E F M N Q Y
a b e f m n q y
0 1 2 3 4 5 7 8
电话 设计 科学 基础

The last row is a list of four Chinese words (with two Chinese characters in each word) meaning "telephone", "design", "science", and "foundation" respectively. No smoothing operation was applied.

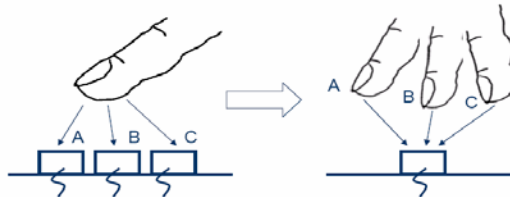
TinyMotion : Camera Phone Based Interaction Methods

Computer Science Division
University of California at Berkeley



FingerSense – Button Disambiguation by Fingertip Identification

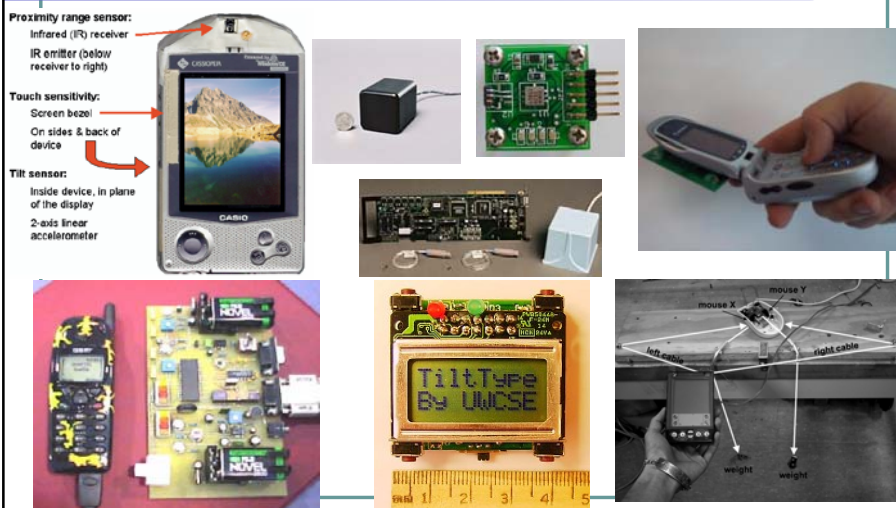
- Differentiating a pressing action by identifying the actual finger involved
- Can be Faster than Regular Tapping When the Adjacent Tapping Involves Different Fingers and Different Buttons (59% on a phone keypad)



Emerging Marker Based Interactions on Camera Phones



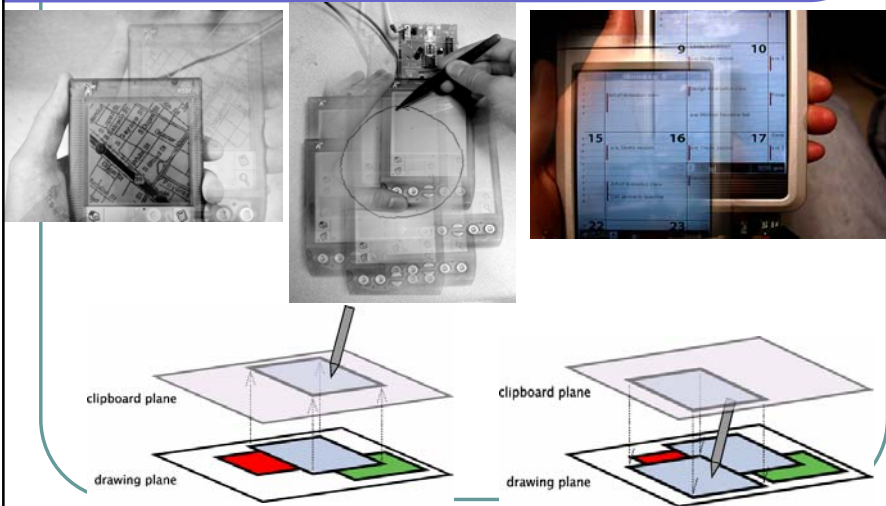
Towards More Sensitive Mobile Devices



Agenda

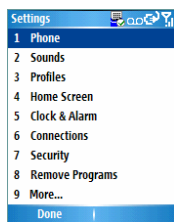
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Peephole Displays (With Demo)



Zoomable Interface on Mobile Devices

- ZoneZoom By Microsoft
- Take advantage of spatial memory



VS.



Halo - A Virtual Periphery for Mobile Devices


Providing Visual Cue for Objects Located Out of the Small Screen



Agenda

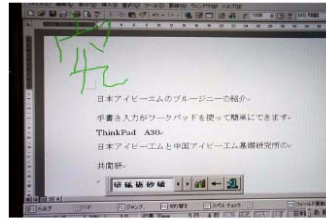
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Using Mobile Devices with Desktop Computers

- Pebbles Project at CMU 
 - Using a PDA as additional keypad, touch pad, scroll wheel and controller of PointPoint slides for desktop Applications
 - <http://www.pebbles.hcii.cmu.edu/>



Using Mobile Devices with Laptops



Wang 2002

Using Mobile Devices with Large Displays



Ballagas 2005

Question and Answer

