User Interface Design, Prototyping, and Evaluation

Mobile Computing & Communication

Prof. James A. Landay
University of Washington
Winter 2009

January 20, 2009

* Based on slides of
Prof. Scott Klemmer, Stanford

Hall of Fame or Hall of Shame?

AT&T 7:52 AM
11/16/2007
No upcoming appointments.

Profile: Vibrate
Messages (0)

Start   Contacts

- **Windows Mobile home screen**
- **What will I use this phone before other than as a phone?**

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Hall of Shame!

AT&T 7:52 AM
11/16/2007
No upcoming appointments.

Profile: Vibrate
Messages (0)

Start   Contacts

- **Too many clicks to do anything**
- **Calendar**
  – **Start**
  – **Scroll through icons to find the one I want**
  – **Maybe less if used it recently (then at top, but still several clicks)**

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Outline

- **Review**
- **History of miniaturization & mobility**
- **Palm Pilot**
- **iPhone**
- **Animating user interfaces**
- **TabletPC handout**

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Action Analysis & Automated Evaluation Review

- **GOMS ?**
  – **goals, operators, methods, selection rules**
  – **only gives ? for ? behavior**
    - **performance for expert, error-free behavior**
  – **hard to create model, but easier than user testing**
- **Automated usability**
  – **advantages**
    - **faster than traditional techniques**
    - **can involve more participants → convincing data**
    - **easier to do comparisons across sites**
  – **disadvantages**
    - **lose observational data**

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In 1954 Harold S. Osborne, the recently retired chief engineer for AT&T, made the following prediction (quoted in Conly 1954, p. 88):

Lets say that in the ultimate, whenever a baby is born anywhere in the world he [sic] is given at birth a number that will be his telephone number for life. As soon as he can talk, he is given a watchlike device with 10 little buttons on one side and a screen on the other [see Figure 8.1]. Thus equipped, at any time when he wishes to talk with anyone in the world, he will pull out the device and punch on the keys the number of his friend. Then, turning the device over, he will hear the voice of his friend and see his face on the screen, in color and in three dimensions. If he does not see him and hear him, he will know that the friend is dead.

Sony Walkman

Car phone

3.3 billion mobile phones worldwide

Percent of Global Population

- Connected
- Available, not connected
- Not available

Source: Informacon (2007)

Mobile design evolving rapidly!

Newton   **Palm Pilot**   **iPhone**

There was the Newton ...

Apple Newton MessagePad

The Newton OS GUI

Photograph of screen displaying a Checklist, some bullet points checked and/or "collapsed"

Newton screen displaying a Note with text, "ink text", a sketch, & vectorized shapes

Source: The Simpsons, Wikipedia CSE 441 - Advanced HCI 13

The Newton had problems

Design Issues
- **Recognition**
  - relied on it too much, didn't work well enough
- **Physical size**
  - too big
- **Connectivity**
  - not much

"Hey, Take a memo on your Newton" "Beat Up Martin" "Baahh!"

The Original Apple Newton's handwriting recognition was made light of in The Simpsons episode, Lisa on Ice

Source: The Simpsons, Wikipedia CSE 441 - Advanced HCI 14

The Palm Pilot Improved...

Design Wins
- **Recognition: simple graffiti**
- **Physical size: fits in the front pocket**
- **Connectivity: easy sync**

Jeff Hawkins, Palm

Graffiti

Rob Haitani, Palm OS [Designs] what should be most prominent based on frequency of use, and makes most often used interactions accessible in a single step.
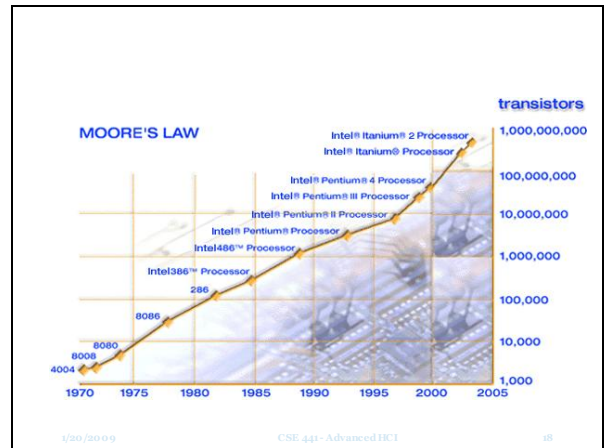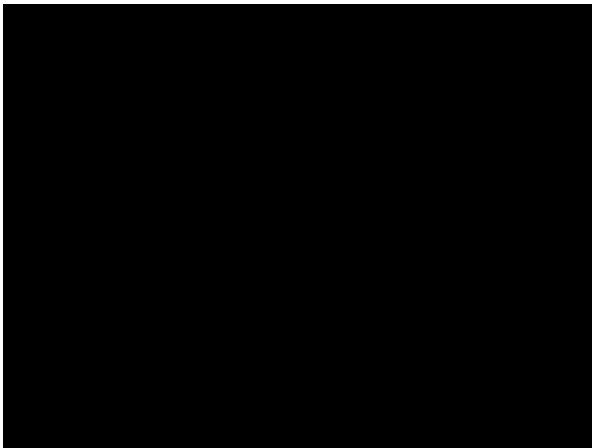
Pocket size **HotSync** **Palm OS**

Source: Palm 1000 Retrospective, Palm V ; Rob Haitani in Moggridge, Designing Interactions, Ch 5, From the Desk to the Palm.
http://www.designinginteractions.com/interviews/RobHaitani CSE 441 - Advanced HCI 15

Prototyping the Palm
hardware, form factor, software

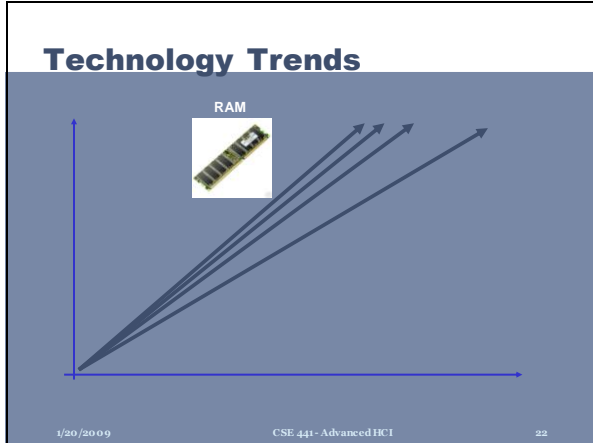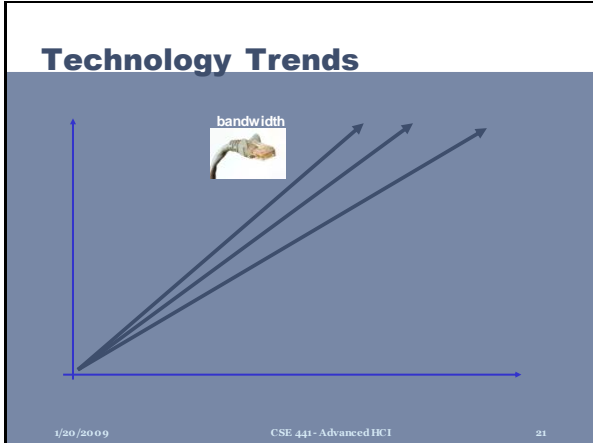1/20/2009 CSE 441 - Advanced HCI 16

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Technology Trends

Display Resolution

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Technology Trends

Size of pockets

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Technology Trends

Unaided human abilities

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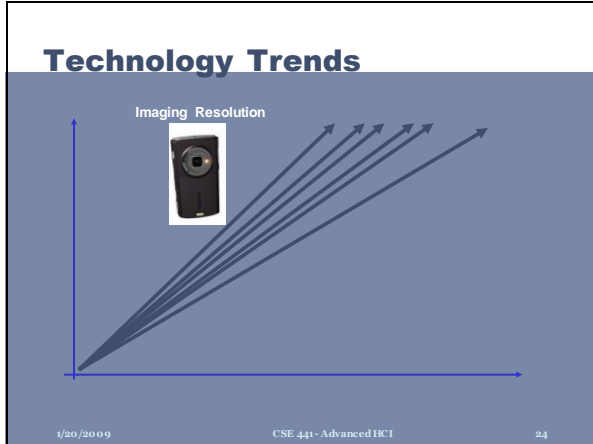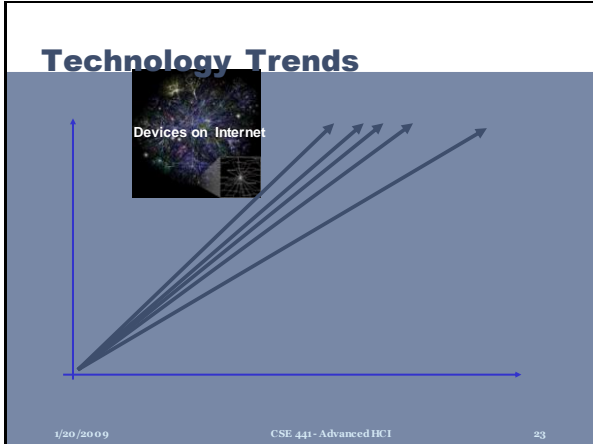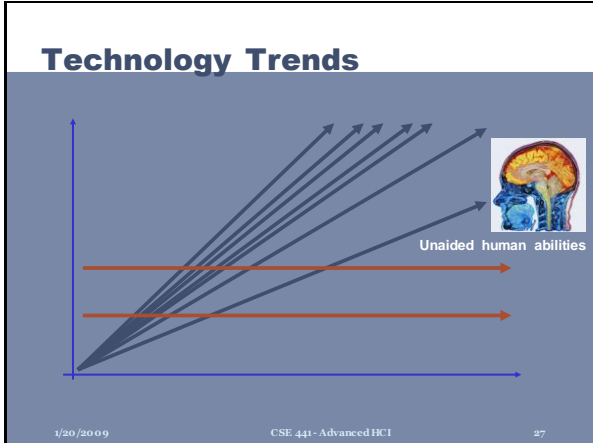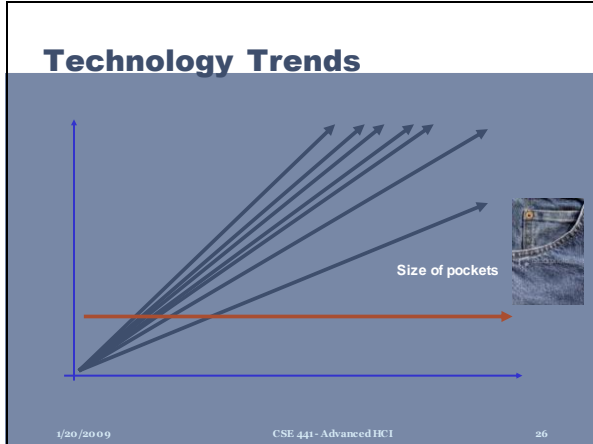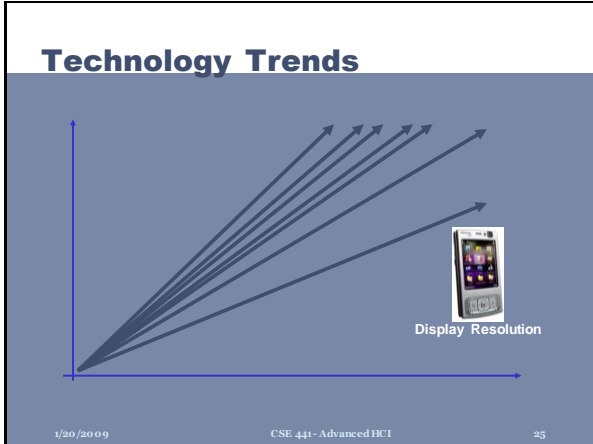
What will we do with Mobile?

- **The same applications?**
- **Different ones?**

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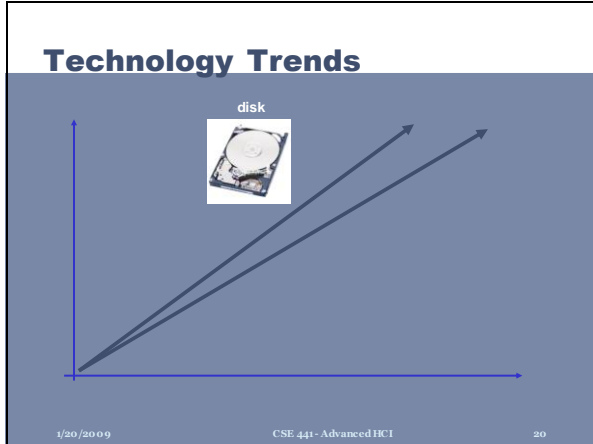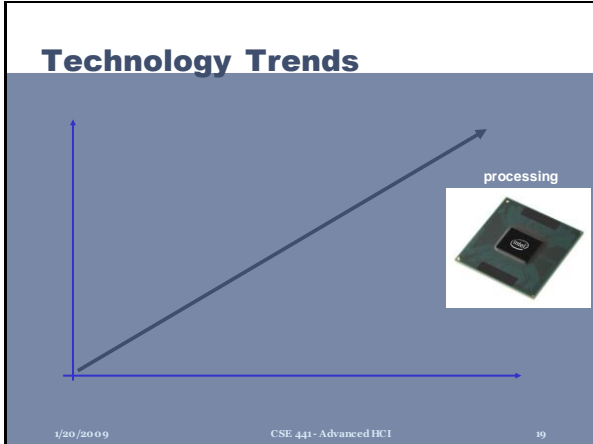1/20/2009   CSE 441 - Advanced HCI   29

Malaysia
Integrated Compass, Why?

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Grameen Telecom
Village Phone

PHOTOGRAPH BY DANIEL PEPPER

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What makes mobile design exciting?

Many Design Choices
• **Think different from GUI/Web**
• **Swiss army vs. dedicated**
• **Pen/speech/gesture modalities**
• **Integrate with other tasks**
• **Social apps**
Always in your pocket

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What makes mobile design difficult?

Design constraints
• **Limited attention/Interactions bursty**
• **Screen size small**
• **Form factor**
• **Limited network connectivity**
• **Speech / pen / multimodal**

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Mobilize ≠ Miniaturize

Mobile Usage Context

• **Mobile device always with user & on**
• **Use gives clues to context…**
  – Calendar
  – Job order…
• **Location gives many contextual cues**
  – ..
• **Simple activity inference gives context**
  – Driving? Adapt how?

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Limited Attention & Input Interaction

- **Minimize keystrokes**
- **Provide overview + detail**
- **Understandable interface at a glance**
- **Design with tasklets**
- **Minimum set of functions**

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Example approach: Nokia Navi-Key

2100
8 buttons

6100
6 buttons

5100
4 buttons

FIGURE 2-1. Nokia's constant push for Simplicity in handset design.

Reducing number of buttons

Source: Scott Jenson, The Simplicity Shift, Cambridge Univ.

The motivation of this Simplicity was the understanding that only two tasks were used the majority of the time: answering the phone and dialing from the phone book. Nokia came up with an extremely simple and elegant design to do this. Answer the phone? Press the big button. Hang up the phone? Press the big button. Call someone? Use the arrow keys to get to the right person and press the big button. By restricting
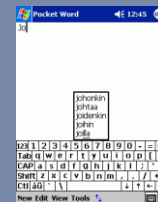
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Mobile Input: Lots of Research

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Disambiguation w/ Dictionary

- **Dictionary based (such as T9, Pocket PC)**
  - e.g., 2-2-5-3
  - able 2-2-5-3-0
  - cake 2-2-5-3-N-0
  - bald 2-2-5-3-N-N-0
  - calf 2-2-5-3-N-N-N-0

- **Lots of "N" = Next**

Source: Microsoft, MacKenzie, I. S., Kober, H., Smith, B., Jones, T., Skepner, E. (2001). LetterWise: Prefix-based disambigua... Symposium on User Interface Software and Technology - UIST 2001, pp. 111-120. New York: ACM.

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Disambiguation w/ Predictive

- **Predictive (such as Letterwise)**
  - e.g., t-h-
  - e A%
  - i B%
  - o C%
  - u D%
  - …

Title: This is a test memo
To use SureType just type like you normally would and let the system offer the proper word and alternatives using the SureType Options box

box nox noz boz

Source: Microsoft, MacKenzie, I. S., Kober, H., Smith, B., Jones, T., Skepner, E. (2001). LetterWise: Prefix-based disambigua... Syeposium on User Interface Software and Technology - UIST 2001, pp. 111-120. New York: ACM.

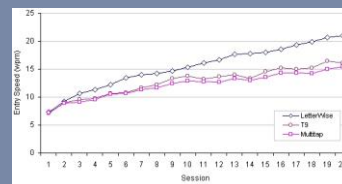1/20/2009   CSE 441 - Advanced HCI   41

Dictionary vs. Predictive

Figure 11. Comparison of entry rates (wpm) with practice for *LetterWise*, T... (Note: *LetterWise* and *Multitap* figure are from Figure 6. Simulated *T9* figur... Figure 10 with 0.85 frequency of words in dictionary)

Source: MacKenzie, I. S., Kober, H., Smith, B., Jones, T., Skepner, E. (2001). LetterWise: Prefix-based disambiguation for... Syeposium on User Interface Software and Technology - UIST 2001, pp. 111-120. New York: ACM.

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Case Study: iPhone Input

Design distinctions
- **Multi-touch Input**
- **Disambiguation of input**
- **Animations**

Internet
+
Music +
Source Phone

Predictive
Touch keyboard

Multi-touch |
Mac OS X |
Wireless |
Accelerometer

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iPhone Typing Algorithm

- **Model where a user touched on the screen**
- **Model the layout of keys and what keys surround the touch**
- **If word not in dictionary (or if an extremely unlikely word), present alternative**
- **While user types, dynamically adjust (invisible) target sizes of keys**
- **User can accept by simply tapping 'Space'**

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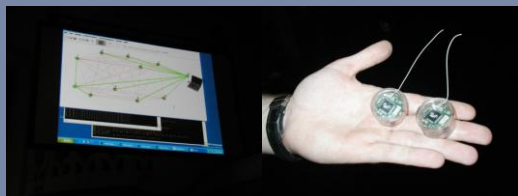
State of the Art: Shapewriter

System/Service Design

The Future: Sensor Networks

Live Ad Hoc Sensor Network showing Light Intensity

A handful of network sensor 'dots'

Lots of 'dots' - getting ready for the big demo

Source: UC Berkeley Smart Dust Program, Largest Tiny Network Yet, http://webs.cs.berkeley.edu/800demo'

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The Future: Mobile Everywhere

- **A 2002 study calculated there were around 4.2 million CCTV cameras in the UK - one for every 14 people.**
- **"If you go forward 50 years, you are probably talking about one million forms of sensor per person in the UK," he said.**
- **This was a conservative estimate, he said. "More aggressive" calculations suggest there could be 20m sensors per person.**

There could be one million sensors per UK resident by 2057

Source: BBC, "Sensor rise powers life recorders"

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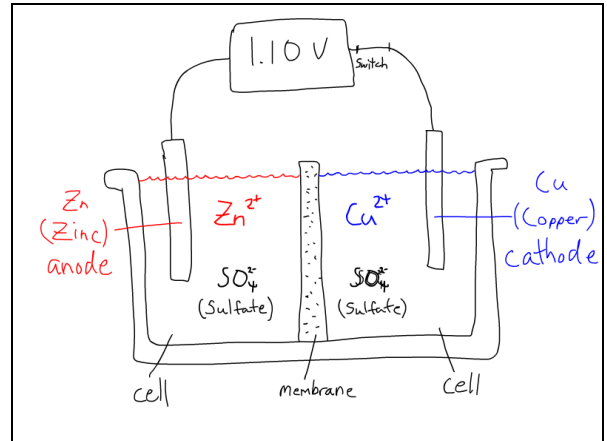## Information Appliances
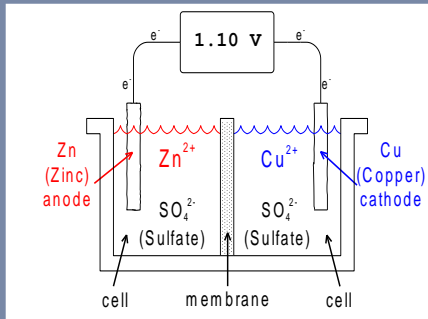
- **Mobile devices with dedicated purpose**

Amazon Kindle eBook

Further Reading on Mobile

- **Studio 7.5, Designing for Small Screens**
- **Mizuko Ito, Personal, Portable, Pedestrian**
- **Rich Ling, the Mobile Connection**
- **Christian Lindholm, Mobile Usability**
- **Matt Jones, Mobile Interaction Design**

How would a teacher animate this?

Need Quick + Easy Animation!

Students & Educators
Learn complex concepts
Need to animate *fast* before or *during* class
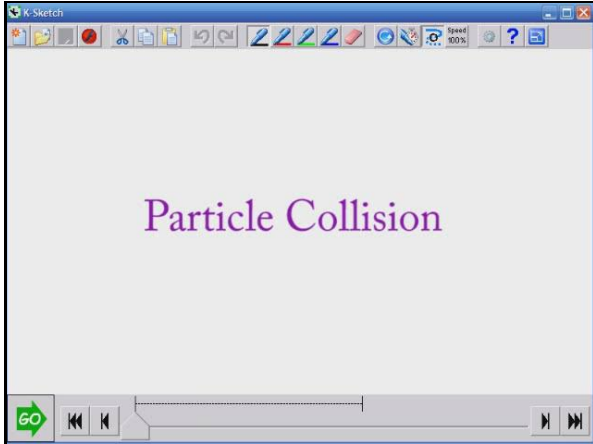
Amateur Artists
Play in new medium
Need a *simple* way to get started

Professionals
Share dynamic ideas
Need tool *expressive* enough for variety of tasks

K-SKETCH DEMO

Interface Optimization

- **Visualize simplicity/expressivity tradeoff**
- **Two step process**
  - **code library of scenarios**
  - **compute minimal sets of animation ops**

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Optimization results

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