User Interface Design, Prototyping, and Evaluation

Mobile Computing & Communication

Prof. James A. Landay
University of Washington
CSE 441
Spring 2012

* Based on slides of Prof. Scott Klemmer, Stanford

Hall of Fame or Hall of Shame?

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

Hall of Shame!

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

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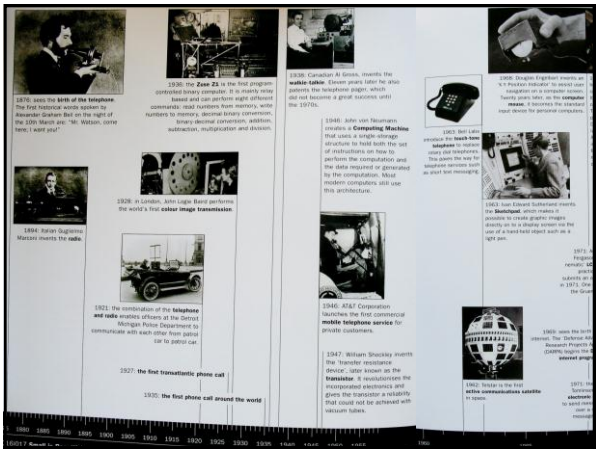
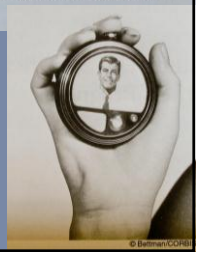
Outline

- History of miniaturization & mobility
- Palm Pilot
- iPhone



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 (1979)

Car Phone (1980s-90s)

6 billion Mobile Phones Worldwide (2011)

Mobile Cellular Subscriptions

per 100 inhabitants

Developed	118
Developing	79
World	87

Data courtesy ITU (International Telecommunication Union), 2011
http://www.itu.int/ITU-D/ict/statistics/at_glance/KeyTelecom.html

Mobile Design Evolving Rapidly!

Newton (1993) Palm Pilot (1997) iPhone (2007)

"You Will" – the future comes slower than we'd like

There was the Newton …

Apple Newton MessagePad

The Newton OS GUI

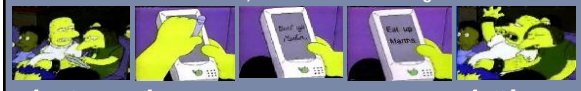
Photograph of screen displaying Checklist, some bullet points checked and/or "collapsed"

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

The Newton Had Problems…

Design Issues

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



"Hey, Take a memo on your Newton"

"Beat Up Martin"

"Baahh!"

Source: The Simpsons, Wikipedia

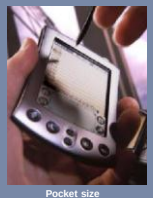
The Original Apple Newton's handwriting recognition was made light of in The Simpsons episode *Lisa on Ice*

The Palm Pilot Improved…

Design Wins

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

Jeff Hawkins, Palm



Pocket size

Graffiti

HotSync

Palm OS

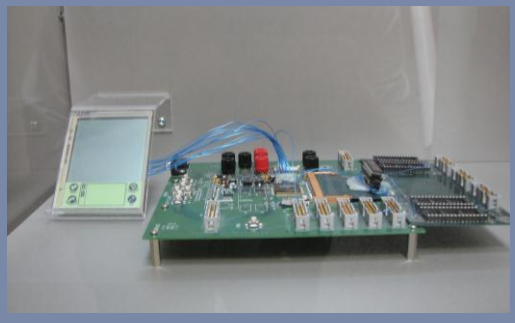
Rob Haitani, Palm OS

[Designs] what should be most prominent based on frequency of use, and makes most often used interactions accessible in a single step.

Source: Palm 1000 Retrospective, Palm V, Rob Haitani in Moggridge, Designing Interactions, Ch. 3. From the Desk to the Palm. http://www.designinginteractions.com/interviews/RobHaitani

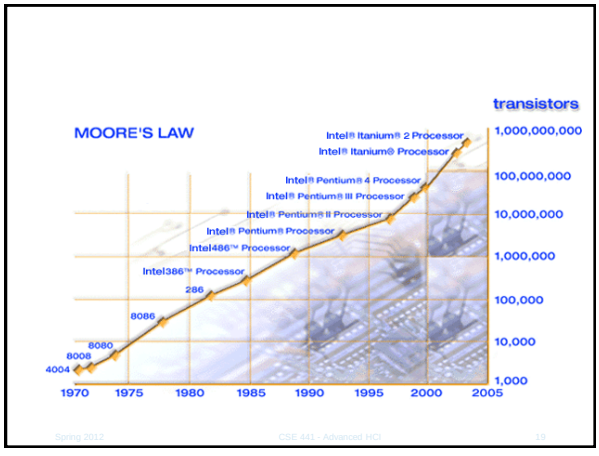
Prototyping the Palm

hardware, form factor, software

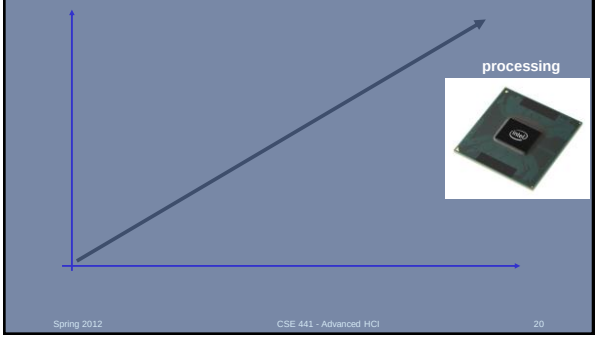


Palm Pilot Prototypes

http://www.computerhistory.org/collections/accession/102716262



Technology Trends



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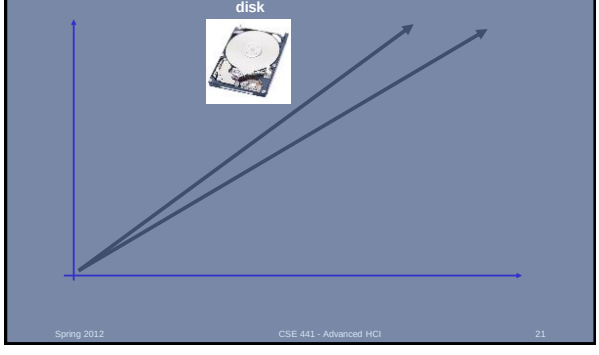

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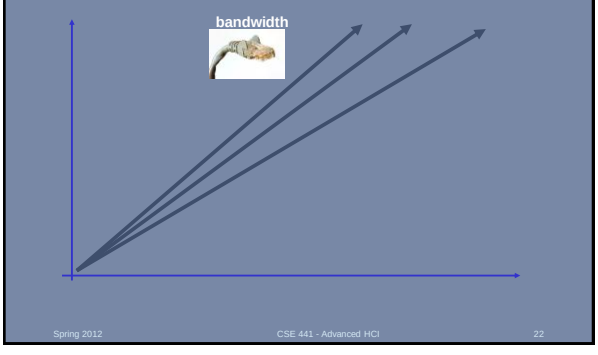

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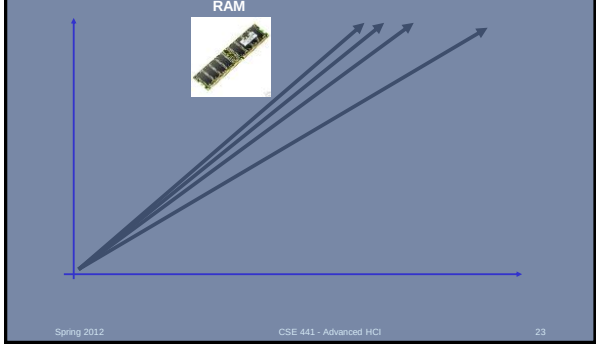

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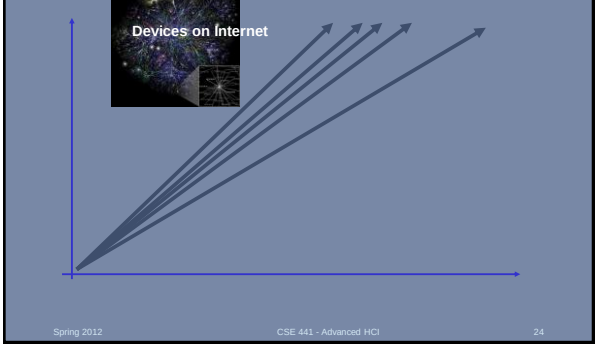

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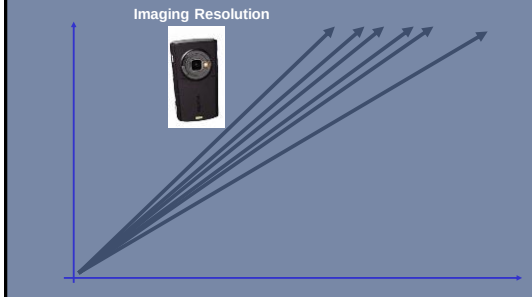

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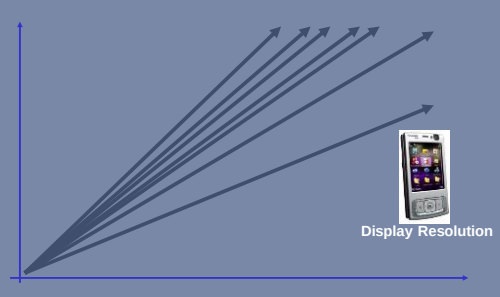

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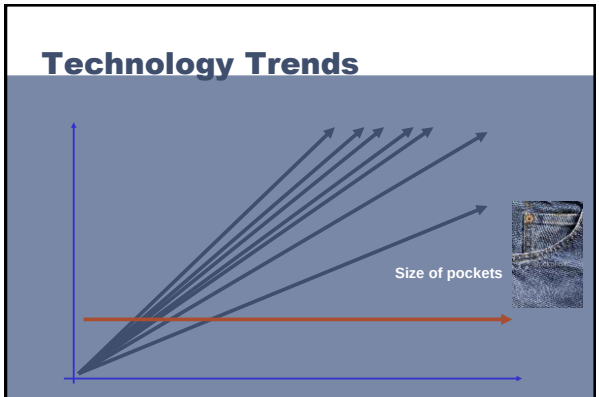

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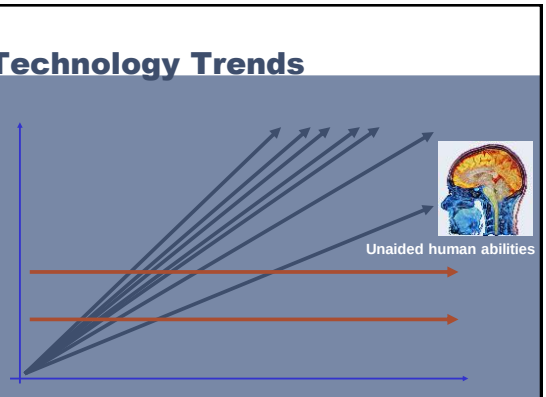


What will we do with Mobile?

- The same applications?
- Different ones?
- Some of both is most likely… but the context & constraints differ

Malaysia
Integrated Compass. Why?

Grameen Telecom
Village Phone

What Makes Mobile Design Exciting?

Many Design Choices
- Think different from GUI/Web
- Swiss army vs. dedicated
- Pen/speech/touch/gesture modalities
- Integrate with other real-world tasks
- Social apps

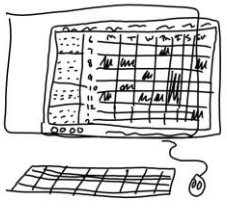
Always in your pocket* or w/ you!

*often not true for women

What Makes Mobile Design Difficult?

Design constraints
- Limited attention/Interactions bursty
  - sometimes not true (people use phones stationary sometimes for long times)
  - see Ubicomp '2006 paper by Patel
- Screen size small
- Form factor
- Limited network connectivity
- Speech / pen / multimodal

Mobilize ≠ Miniaturize



Mobile Usage Context

- Mobile device always with user & on
- Use gives clues to context…
  - Calendar
  - Job schedule
  - Repair man example…
- Location gives many contextual cues
  - ..
- Simple activity inference gives context
  - Driving? Adapt how?

Limited Attention & Input Interaction

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

Example approach: Nokia Navi-Key

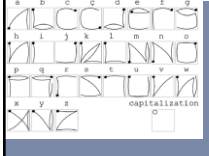
FIGURE 2-1. Nokia's constant push for Simplicity in handset design.

Reducing number of buttons

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

Source: Scott Jenson, The Simplicity Shift. Cambridge University Press, 2002.

Mobile Input: Lots of Research



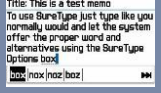
Disambiguation w/ Dictionary

- 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, D., Jones, T., Skepner, E. (2001). LetterWise: Prefix-based disambiguation for mobile text input. Proceedings of the Symposium on User Interface Software and Technology - UIST 2001, pp. 111-120. New York: ACM.

Disambiguation w/ Predictive

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



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Dictionary vs. Predictive

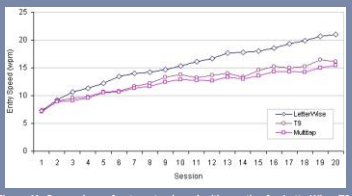

Figure 11. Comparison of entry rates (wpm) with practice for *LetterWise*, *T9*, and *Multitap*. (Note: *LetterWise* and *Multitap* figure are from Figure 6. Simulated *T9* figures are from Figure 10 with 0.85 frequency of words in dictionary)

Source: MacKenzie, I. S., Kober, H., Smith, D., Jones, T., Skepner, E. (2001). LetterWise: Prefix-based disambiguation for mobile text input. Proceedings of the ACM Symposium on User Interface Software and Technology - UIST 2001, pp. 111-120. New York: ACM.

Case Study: iPhone Input

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

Internet + Music + Phone

Predictive Touch keyboard

Multi-touch | Mac OS X | Wireless | Accelerometer | Proximity Sensor

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’

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/

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"

Information Appliances

- Mobile devices with dedicated purpose

Amazon Kindle eBook