Mobile Computing & Communication

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)

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. 68):

Let’s say that in the ultimate, wherever 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 Design Evolving Rapidly!

“You Will” – the future comes slower than we’d like

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

Apple Newton MessagePad

Photograph of screen showing checklist, some 'ink' text, checked and/or "collapsed"

Newton screen showing checklist with 'ink', 'ted', 'ted', 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

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

"Hey, take a memo on your Newton"
"Beat up Martin"
"Baaahh!"

Source: The Simpsons, Wikipedia

The Palm Pilot Improved...

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

Pocket size

The Palm Pilot Prototypes

Prototyping the Palm hardware, form factor, software

Jeff Hawkins, Palm

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.
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?

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**

Reducing number of buttons

**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-0
- Lots of “N” = Next

**Disambiguation w/ Predictive**

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


Dictionary vs. Predictive

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

Case Study: iPhone Input

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

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

The Future: Sensor Networks

- Live Ad Hoc Sensor Network showing Light Intensity
- A handful of network sensor ‘data’
- Lots of ‘data’ - getting ready for the big demo
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.

Information Appliances

- Mobile devices with dedicated purpose

Source: BBC, "Sensor rise powers life recorders"