

Mobile Computing & Mobile UI Design

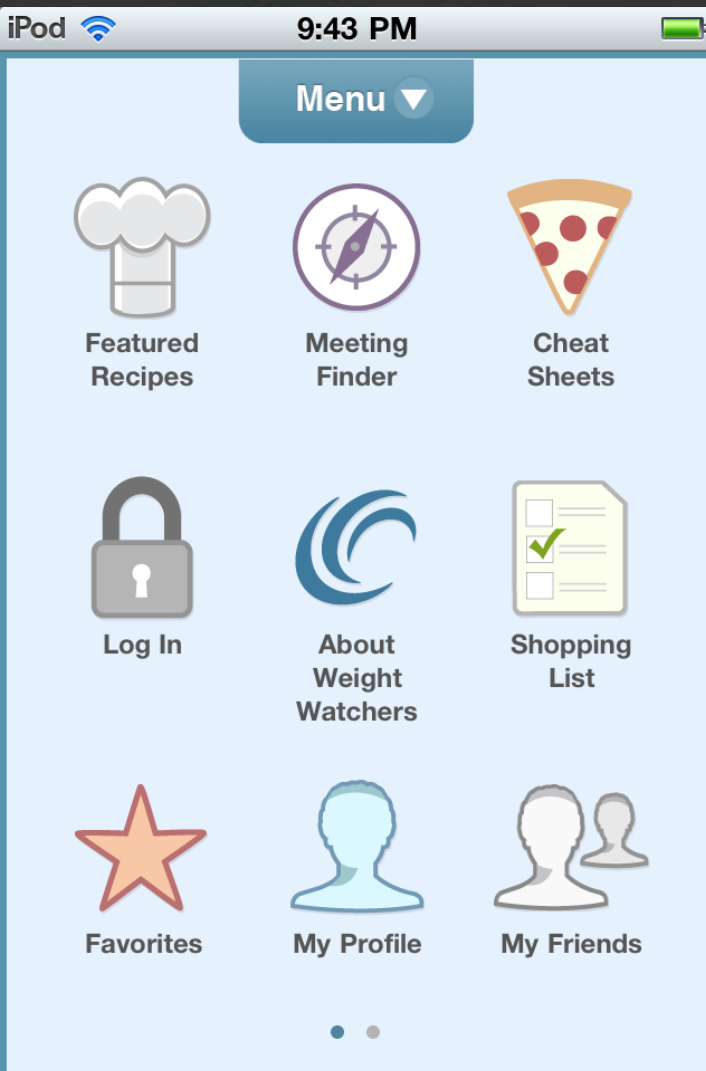
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Computer Science Department
Stanford University

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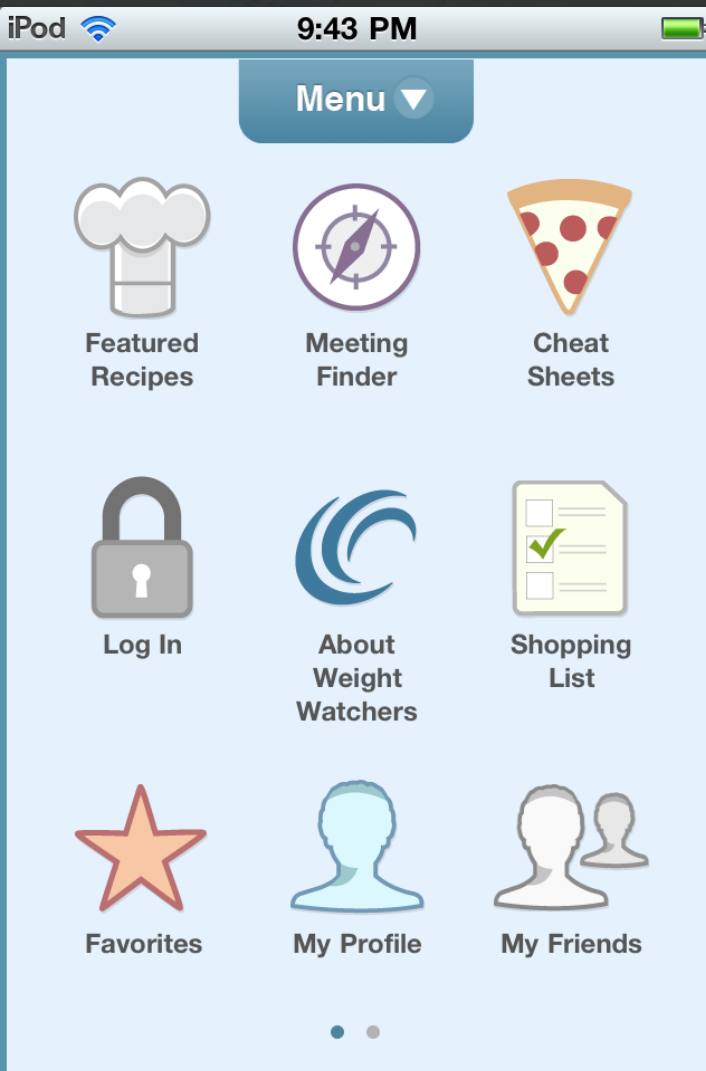
** Some slides based on slides of Prof. Scott Klemmer, Stanford/UCSD*

Hall of Fame or Hall of Shame?



- Weight Watchers app

Hall of Shame!



- Weight Watchers app
- What app am I in?
- Icon mappings?
- Menu non-standard
- No overview+detail
- How do I do “My Friends” w/o Log In?

Outline

- History of Miniaturization & Mobility
- Palm Pilot
- iPhone
- Mobile UI Design



1876: sees the **birth of the telephone**. The first historical words spoken by Alexander Graham Bell on the night of the 10th March are: "Mr. Watson, come here; I want you!"



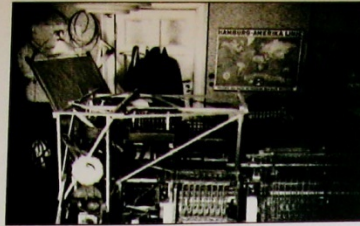
1894: Italian Guglielmo Marconi invents the **radio**.



1921: the combination of the **telephone and radio** enables officers at the Detroit Michigan Police Department to communicate with each other from patrol car to patrol car.

1927: the first transatlantic phone call

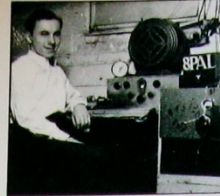
1935: the first phone call around the world



1936: the **Zuse Z1** is the first program-controlled binary computer. It is mainly relay based and can perform eight different commands: read numbers from memory, write numbers to memory, decimal-binary conversion, binary-decimal conversion, addition, subtraction, multiplication and division.



1928: in London, John Logie Baird performs the world's first **colour image transmission**.



1938: Canadian Al Gross, invents the **walkie-talkie**. Eleven years later he also patents the telephone pager, which did not become a great success until the 1970s.



1946: AT&T Corporation launches the first commercial **mobile telephone service for private customers**.

1947: William Shockley invents the 'transfer resistance device', later known as the **transistor**. It revolutionises the incorporated electronics and gives the transistor a reliability that could not be achieved with vacuum tubes.



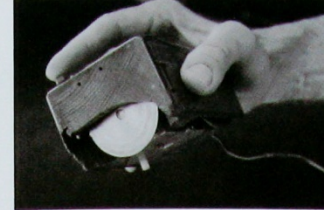
1963: Bell Labs introduce the **touch-tone telephone** to replace rotary dial telephones. This paves the way for telephone services such as short text messaging.



1963: Ivan Edward Sutherland invents the **Sketchpad**, which makes it possible to create graphic images directly on to a display screen via the use of a hand-held object such as a light pen.



1962: Telstar is the first **active communications satellite** in space.



1968: Douglas Engelbart invents an 'X-Y Position Indicator' to assist user navigation on a computer screen. Twenty years later, as the **computer mouse**, it becomes the standard input device for personal computers.

1971: Andrew Fergason invents the 'nematic' **LCD**. He submits a practical application in 1971. One of the Gruen

1969: sees the birth of the internet. The 'Defense Advanced Research Projects Agency' (DARPA) begins the **DARPA internet program**.

1971: the Tomlinson invents the **electronic mail** to send messages over a network.

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)



Sanyo MG30 (1982-83)



Car Phone (1980s-90s)



7 billion Mobile Phones Worldwide (2015)

Mobile Broadband Subscriptions

per 100 inhabitants

Developed	87%
Developing	39%
LDC	12%
World	46%

“of the 940 million people living in the least developed countries, only 89 million use the internet (9.5%)”

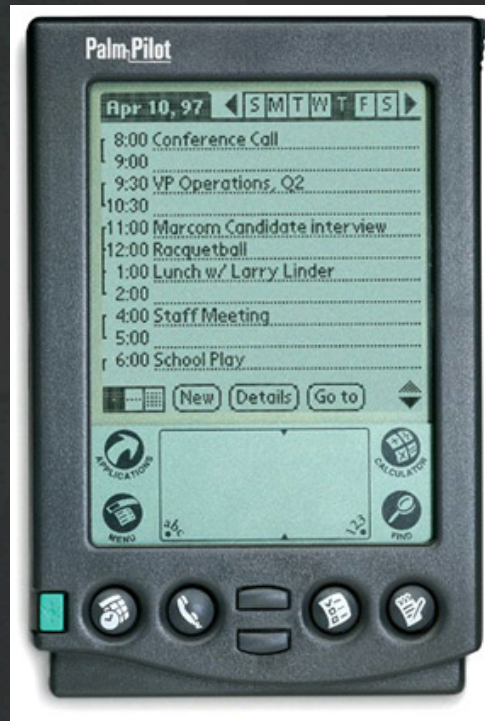
Data courtesy ITU (International Telecommunication Union), 2015

<http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2015.pdf>

Mobile Design Evolving Rapidly!



Newton (1993)



Palm Pilot (1997)



iPhone (2007)



Mobile Design Evolving Rapidly!



Apple Watch (2015)

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

Introducing the EO Personal Communicator

Person-to-Person Communications—Anytime, Anywhere.

Smaller than a clipboard, easy to hold and carry, the "EO" goes where you go and works the way you do. To use it, just write directly on the screen. Jot a memo or dash off a letter: It's as simple as putting pen to paper.

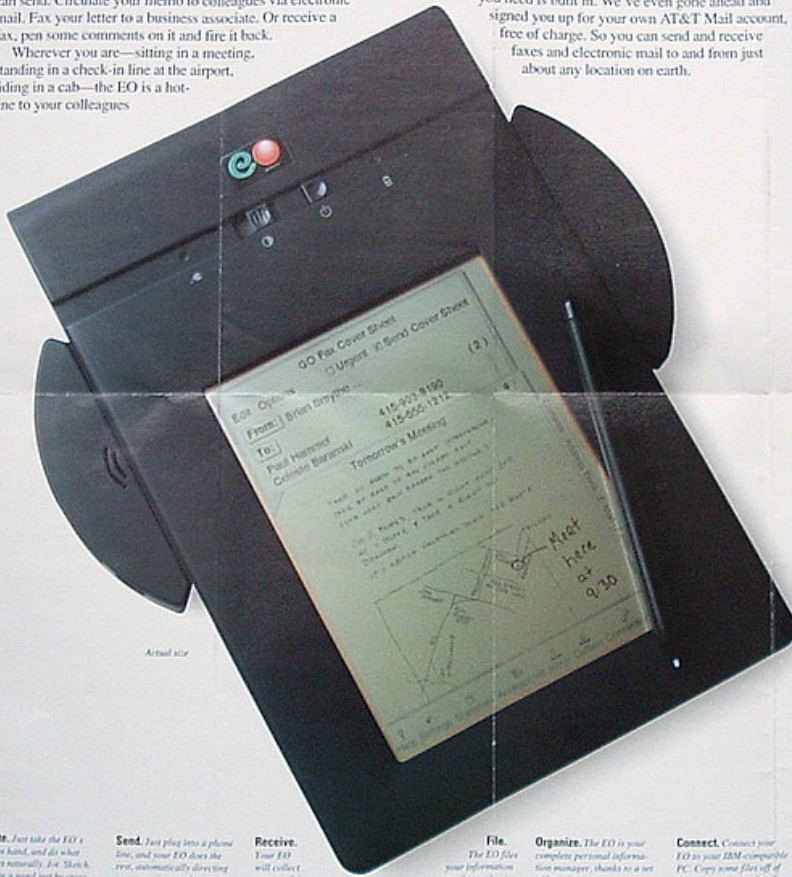
But that's just the beginning. Because what you write, you can send. Circulate your memo to colleagues via electronic mail. Fax your letter to a business associate. Or receive a fax, pen some comments on it and fire it back.

Wherever you are—sitting in a meeting, standing in a check-in line at the airport, riding in a cab—the EO is a hot-line to your colleagues

and your office. You're in touch at all times. Which means you can respond to events as they happen, not hours or days later.

And that's not all. The EO is also a personal organizer, with an electronic calendar, address book, calculator and more. Use it to manage your time and plan ahead. To take notes and capture ideas. To keep vital documents and data at your fingertips. You can even run optional applications such as spreadsheets and databases.

Your EO Personal Communicator is ready to go to work, right out of the box. There are no parts to assemble—everything you need is built in. We've even gone ahead and signed you up for your own AT&T Mail account, free of charge. So you can send and receive faxes and electronic mail to and from just about any location on earth.



Actual size

Write. Just take the EO's pen in hand, and do what comes naturally. Jot. Sketch. Delete a word just by tracing it out. Have the EO convert your hand printing into neat type. You can even use word processing functions to edit what you write. If you want hard copy, attach your EO to a printer, or print out your document through a fax machine.

Send. Just plug into a phone line, and your EO does the rest, automatically directing your messages to their proper destination. If you'd prefer to go wireless, use EO's optional CellPhone module to stay "on line" wherever you go. There's a telephone handset, so you can talk, too.

Receive. Your EO will collect your mail for you, ringing up your AT&T mail box to see if there are faxes or messages waiting for you. If there are, the EO will load them automatically into its "In Box." You can display and review them at your leisure.

File. The EO files your information in a way that makes it a breeze to find and retrieve. Whenever you're looking for notes from past meetings, important documents, spreadsheets—it's all listed in an electronic table of contents. Like that of a book.

Organize. The EO is your complete personal information manager, thanks to a set of built-in software tools called Personal Perspective, created by Pensoft Corporation. Included are a day planner that keeps track of your appointments and a to-do list that's updated automatically. There's also an electronic address book and a note taker.

Connect. Connect your EO to your IBM-compatible PC. Copy some files off of the computer's hard or floppy disk and load them into your EO. Or store your EO files on the PC's disk for safekeeping. You can even phone into your computer from remote locations. So if you leave the office without a critical file, just dial up your PC and retrieve it.

BREAKTHROUGH TECHNOLOGY

If the EO sounds fantastic, that's because it *is*. It boasts some of the latest breakthroughs in communications and electronics. The heart of the system is the new Hitachi microprocessor from ACEL, which uses powerful RISC technology to achieve higher performance than most personal computers. The EO has a lightweight, which means that sends 36,000 bits of data per second—more than three times that volume found in typical notebook computers. And there's loads of memory—4 megabytes of RAM (expandable to 12 megabytes) and 8 megabytes of ROM. For even greater capacity, there's an optional internal hard disk. And standard PCMCIA expansion slots let you add new functions to your needs grow.

The software that controls the EO is the PenPoint operating system from EO Corporation. PenPoint is an all-new approach to software, crafted specifically to work with a pen and geared to communication. A variety of companies are now developing programs for PenPoint, bringing new capabilities to the EO.



FAMILY OF PRODUCTS

Different users have different needs. That's why we created several versions of the EO, with more to be making.

The compact EO Personal Communicator 400 measures only 9.1" x 7.1" and weighs just 1.2 pounds. It's powered by a 20-megabyte Hitachi RISC processor. With its small size and high-contrast reflective screen, the 400 is extra energy efficient, making it its work for up to seven continuous hours without recharging.

For customers who want a larger screen, more processing horsepower and greater storage capacity, here's the EO Personal Communicator 500. The 500 measures 11" x 9", and has a crisp, backlit screen. It weighs 4 pounds, and has a 30-megabyte Hitachi processor. It runs for up to 1 continuous hours on a single charge.

TECHNICAL SPECIFICATIONS

- AT&T Hitachi RISC CPU: 20 MHz, 13 MIPS (EO 400); 30 MHz, 20 MIPS (EO 500) • VLSI RAM: standard, expandable to 12 MB • 1 MB local with PenPoint OS and 1 built in application: Pensoft Corp.'s Personal Perspective (Personal Info Management software including Address Book, Day Planner and Note Taker), PC Connection, Electronic Mail, Fax send and receive, Voice Annotation, and Utilities
- Optional internal hard disk: 20 MB (EO 400), 64 MB (EO 500), 10 MB option (EO) • Speaker and microphone • Built-in 14,000 baud cellular-ready facsimile, V.22bis, V.42, V.42bis, V.22 (2) • Optional cellular phone module • 7.5" Capacitance 410 DPI, high contrast reflective display (EO 400) • 9" diagonal, 85 DPI, backlit supermatrix display (EO 500) • 250 DPI digitizer • Serial port, Parallel port, RJ-45 phone jack, PC2 Ir-based port, Wireless communications port, SCSI II (EO 500 only), SCSI/ATA out (EO 500 only) • PCMCIA type II slot (I on EO 500) • Rechargeable, recharge under 90 minutes • 1-hour battery life, 11 hours with extended life battery (EO 400 only) • 2.2 lbs (EO 400), 4 lbs (EO 500)

The EO Personal Communicator is here today. Communications will never be the same.

To find out more, and to learn how you can take advantage of the next communications revolution, call 1-800-453-0000.

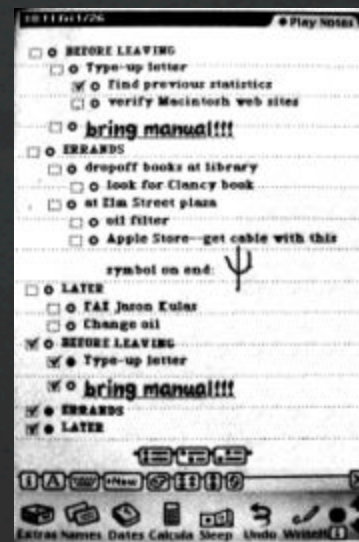
There was the Newton ...



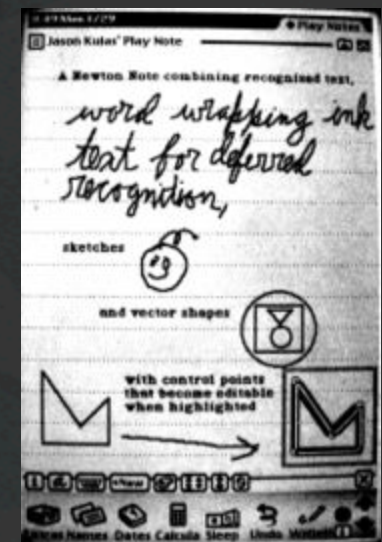
Apple Newton
MessagePad



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!”

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 single stroke



Jeff Hawkins, Palm



Pocket size



Graffiti



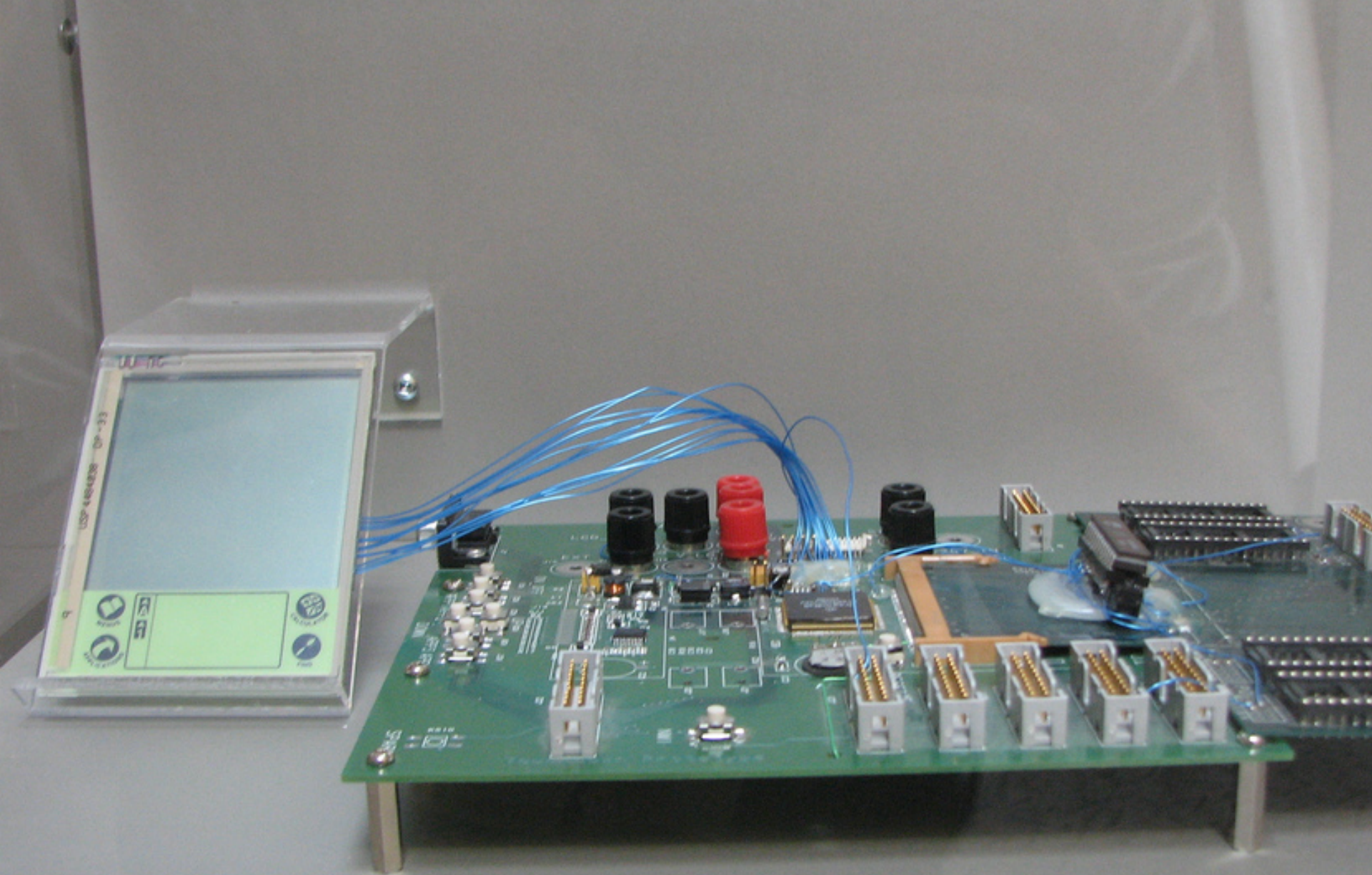
HotSync



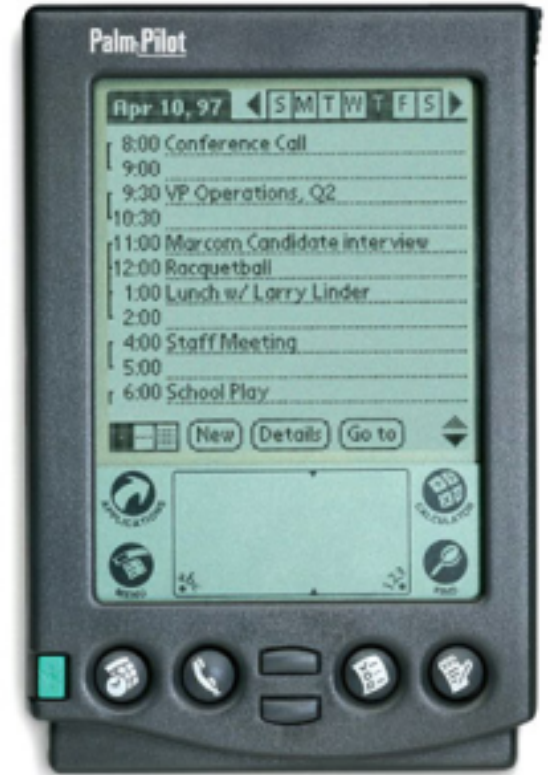
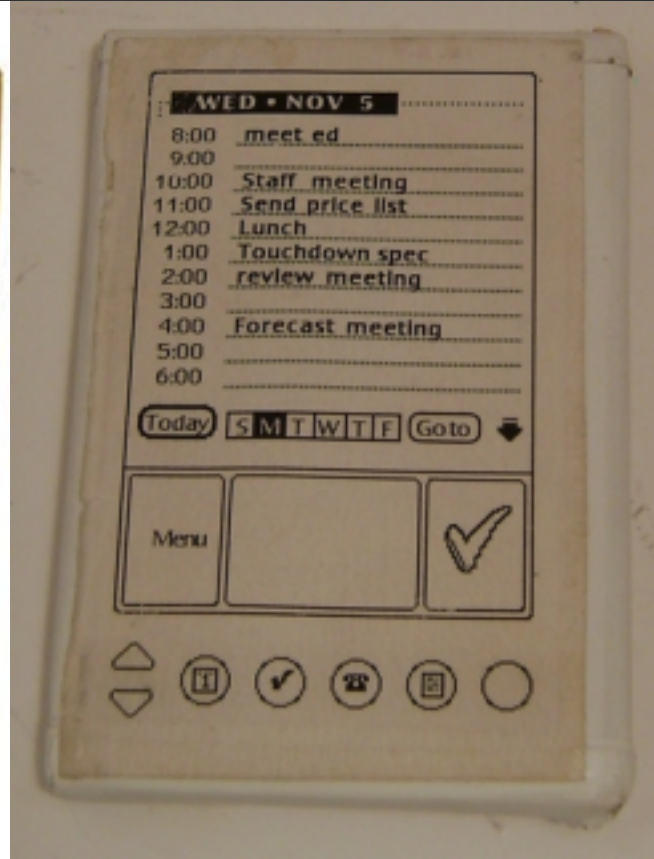
Palm OS



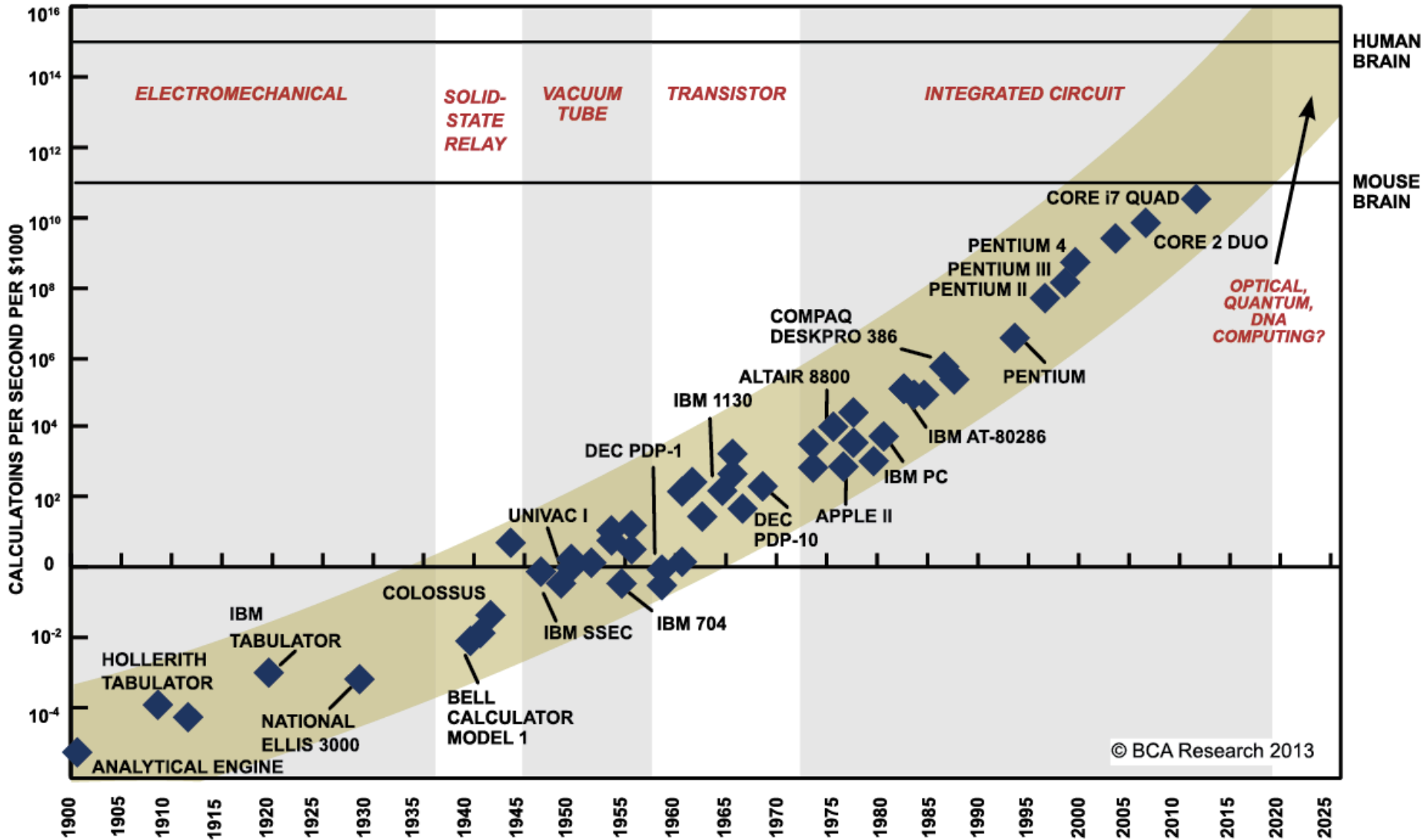
Rob Haitani, Palm OS
[Designs] what should be most prominent based on frequency of use, and makes most often used interactions accessible in a single step.



Palm Pilot Prototypes



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



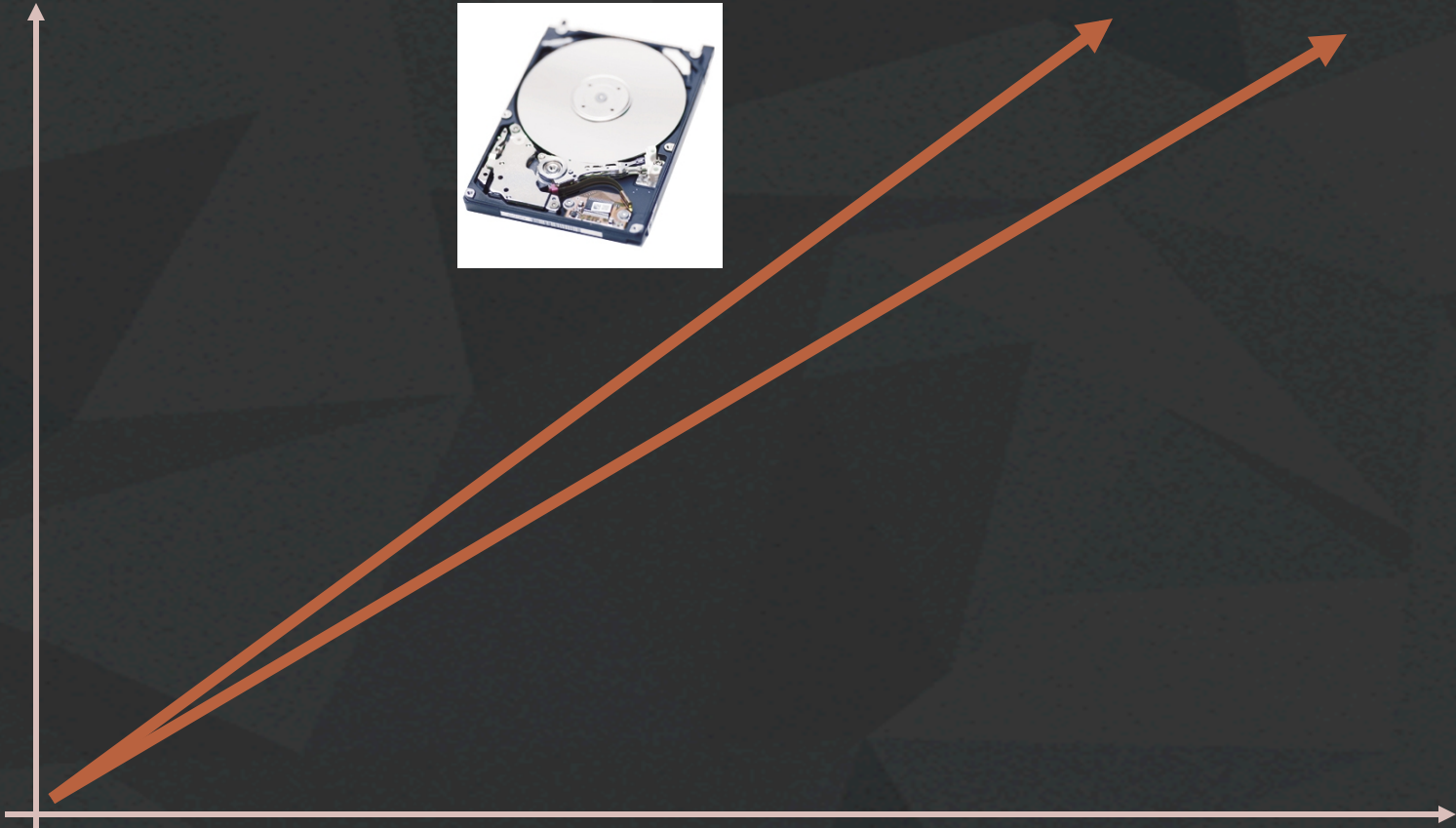
SOURCE: RAY KURZWEIL, "THE SINGULARITY IS NEAR: WHEN HUMANS TRANSCEND BIOLOGY", P.67, THE VIKING PRESS, 2006. DATAPOINTS BETWEEN 2000 AND 2012 REPRESENT BCA ESTIMATES.

Technology Trends



Technology Trends

disk

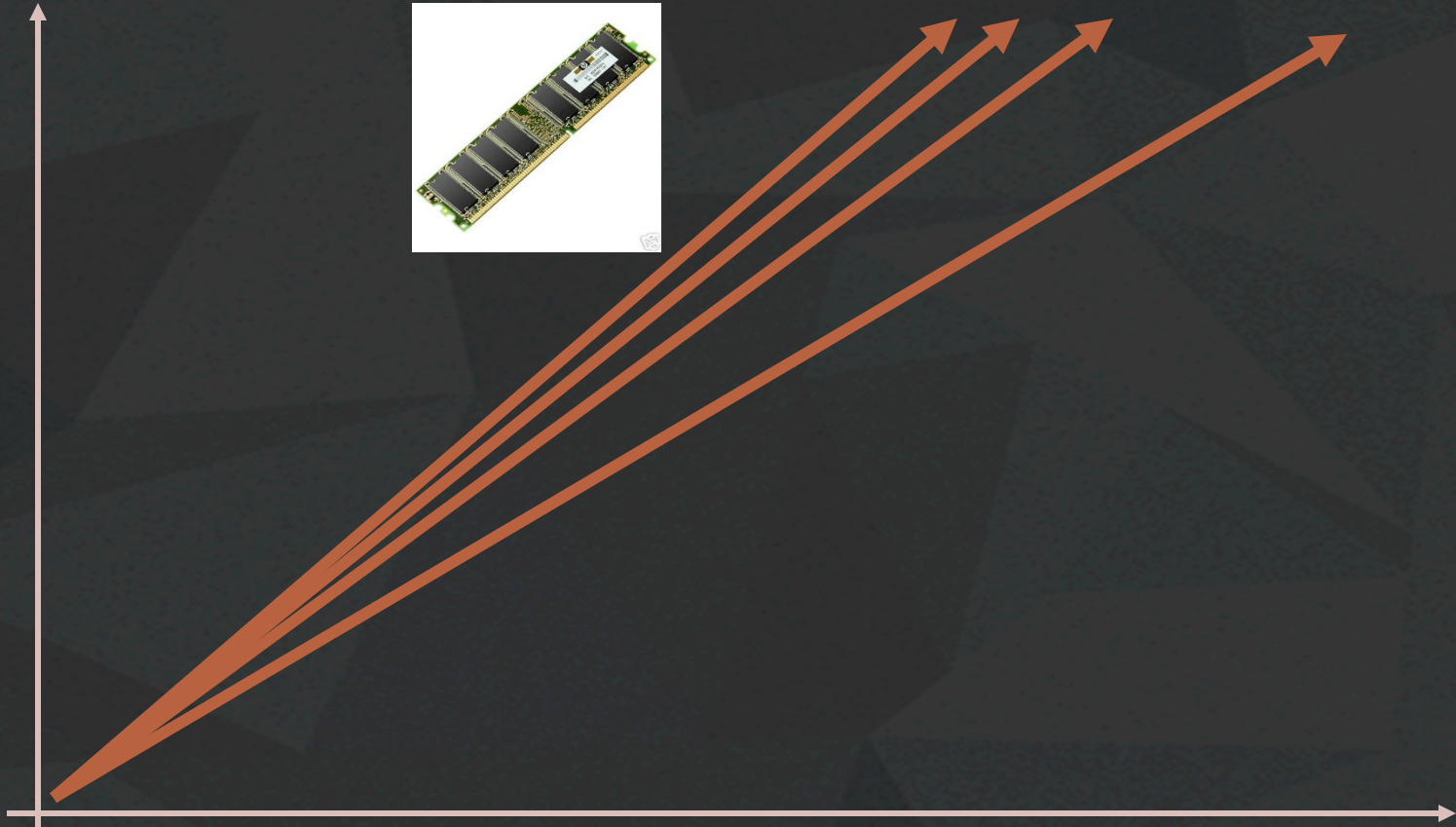


Technology Trends

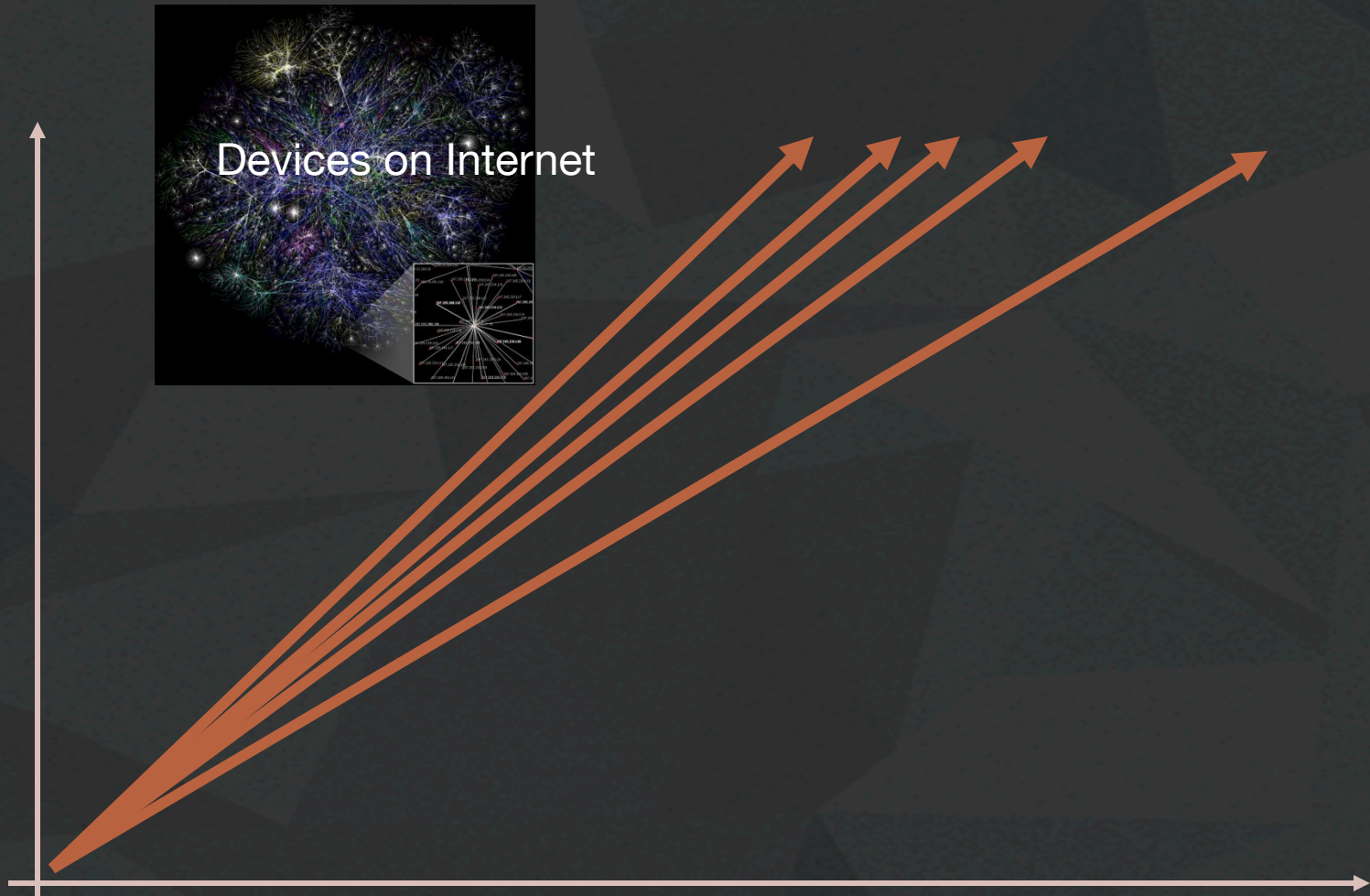


Technology Trends

RAM

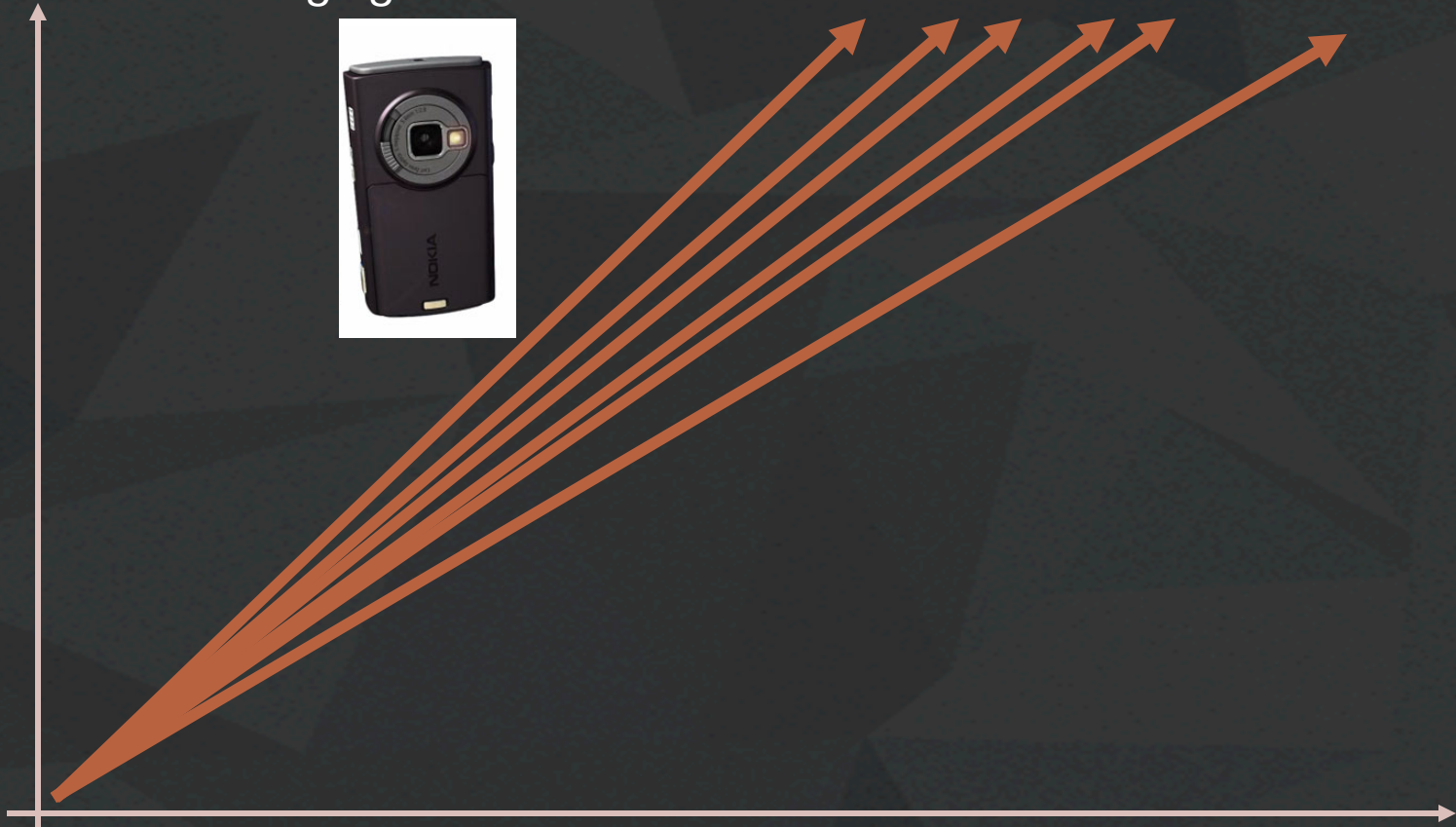


Technology Trends



Technology Trends

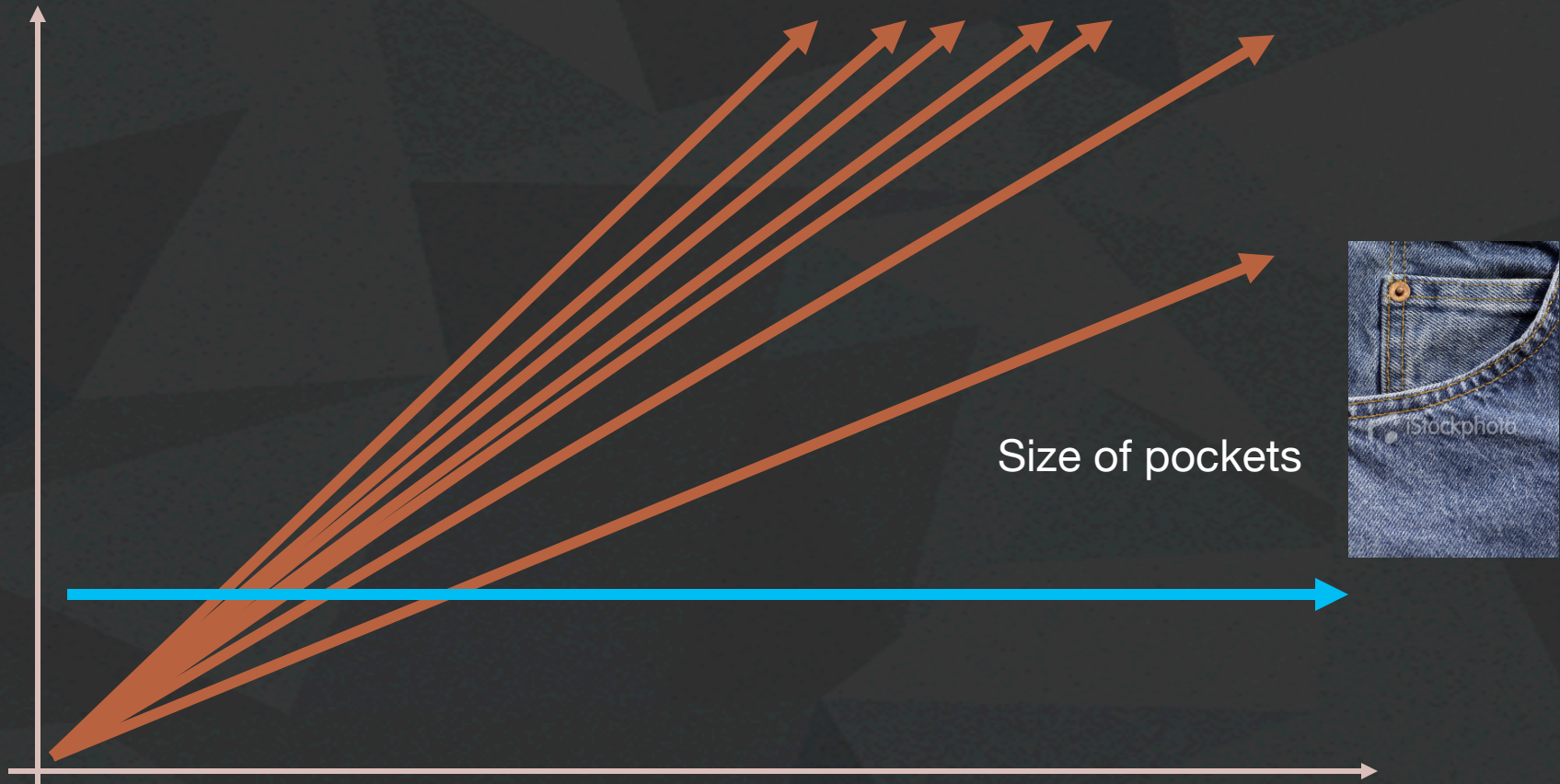
Imaging Resolution



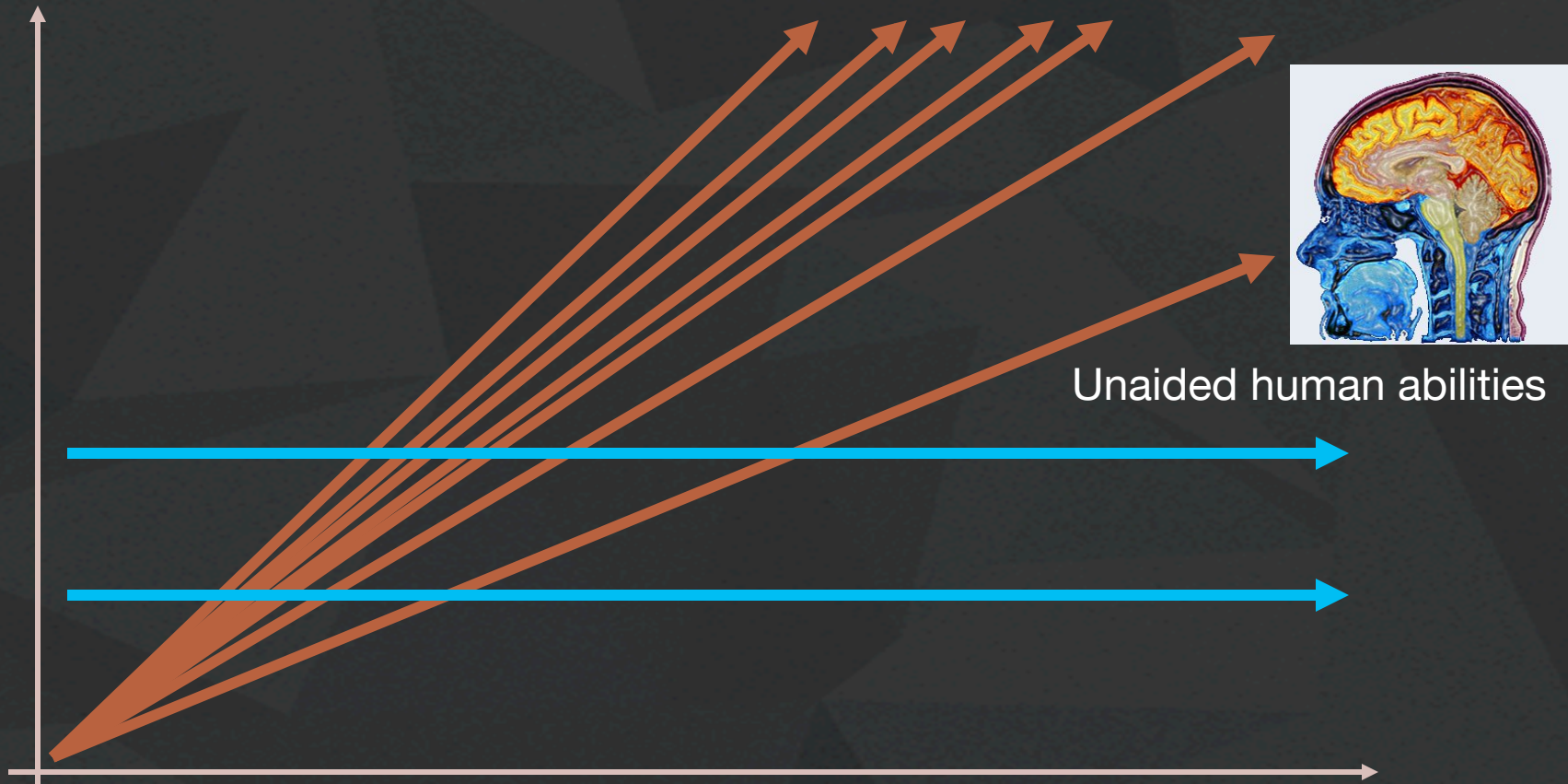
Technology Trends



Technology Trends



Technology Trends



What will we do with Mobile?

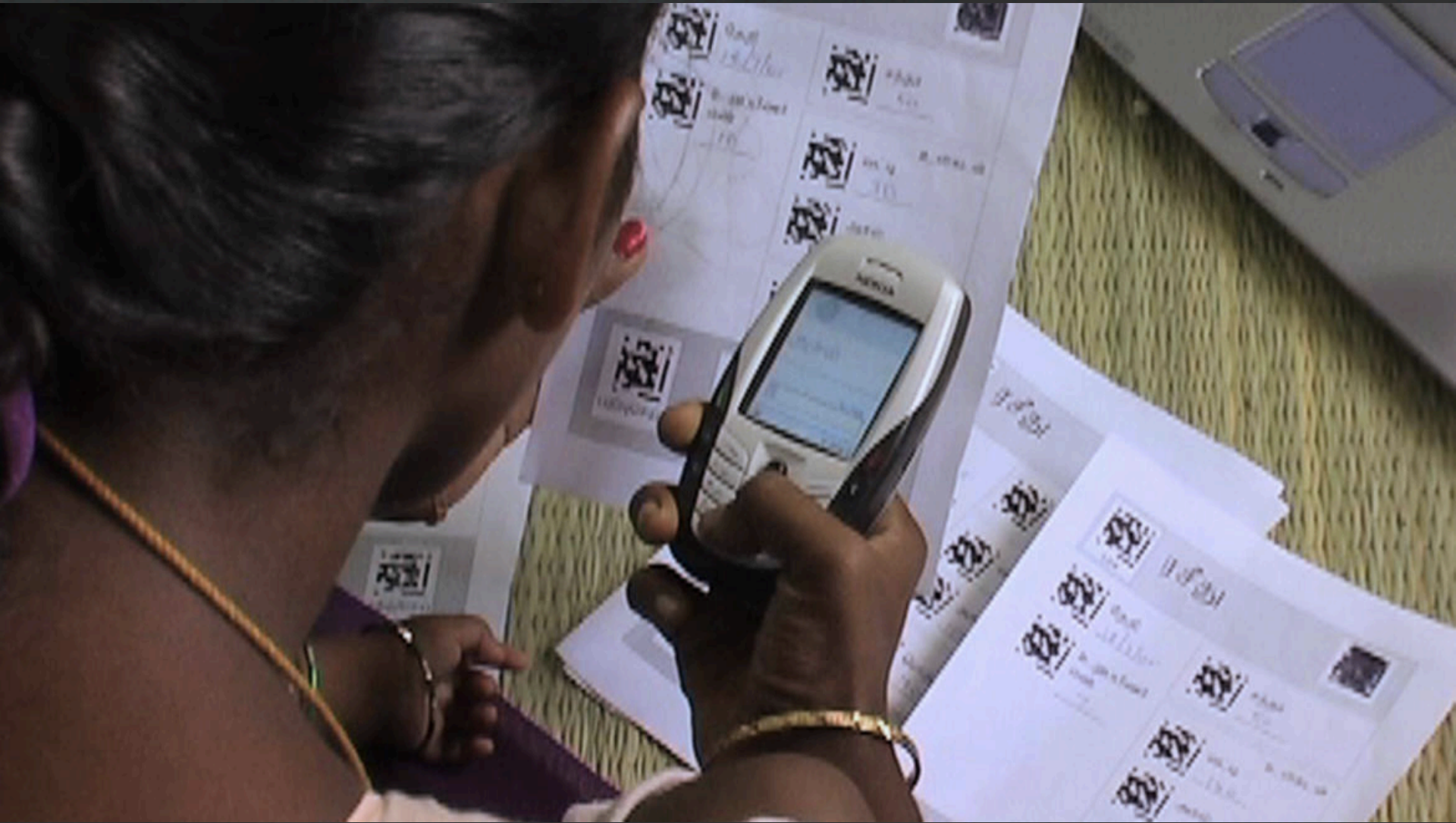
- The same applications?
- Different ones?

- Some of both is most likely... but the context & constraints differ

- Think Mobile First







Tapan Parikh, UC Berkeley (2009)

Why Mobile First?

- Market size & changing demographics!
- Constraints force focus on most important features/tasks of customers

What Makes Mobile Design Exciting?

Many Design Choices

- Think different from GUI/Web
- Swiss army vs. dedicated
- Pen/speech/touch/gesture/vision 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 increasingly use phones stationary sometimes for long times)
- Screen size small (**size** not resolution)
- Form factor / input devices
- Limited network connectivity
- Speech / pen / multimodal

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

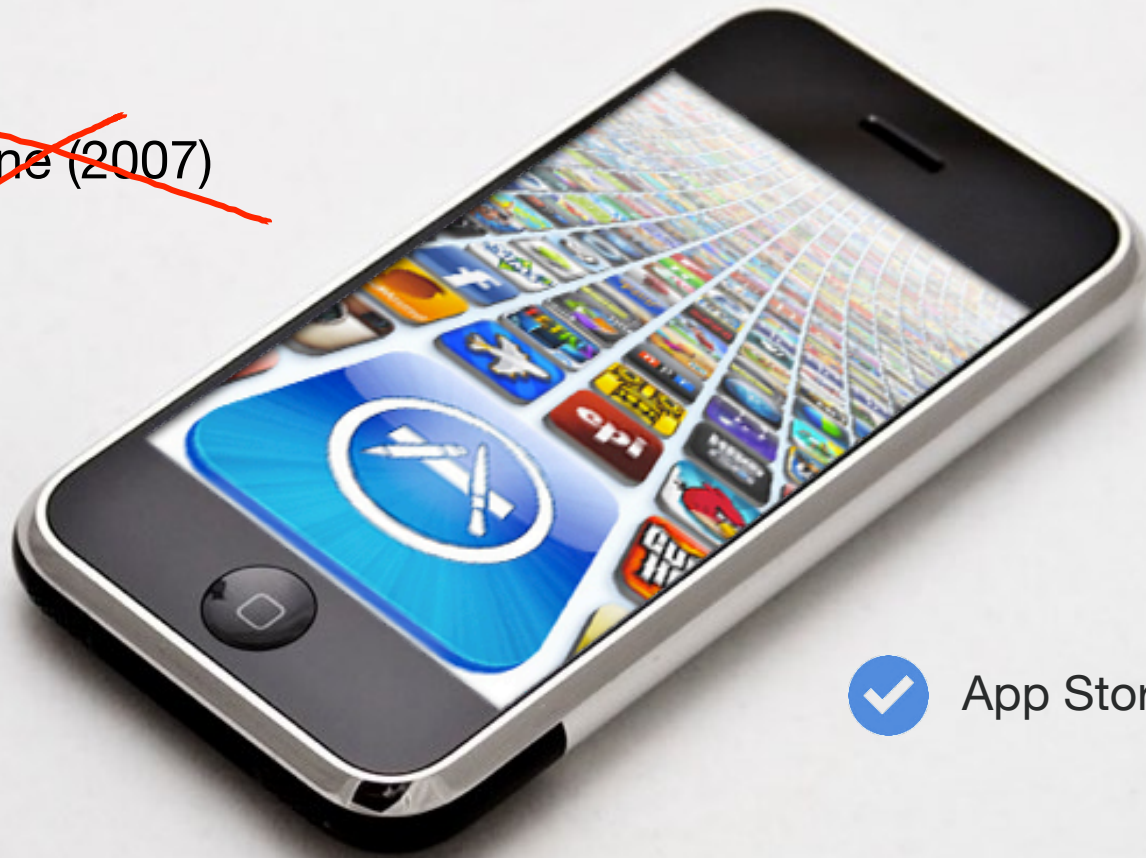
- Minimize keystrokes
- Provide overview + detail
- Understandable interface at a glance
- Design with tasks
- Minimum set of functions

“Good Artists Borrow, Great Artists Steal” – Pablo Picasso(?)

- What apps do you like?
- Why?
- Borrow good features/styles

Mobile Design's Key Moment

~~iPhone (2007)~~



App Store (2008)

Mobile Design Constraints & Context

Design constraints

- limited attention/interactions bursty (sometimes untrue)
- form factor/screen size small (independent of resolution)
- natural (ambiguous) input modalities



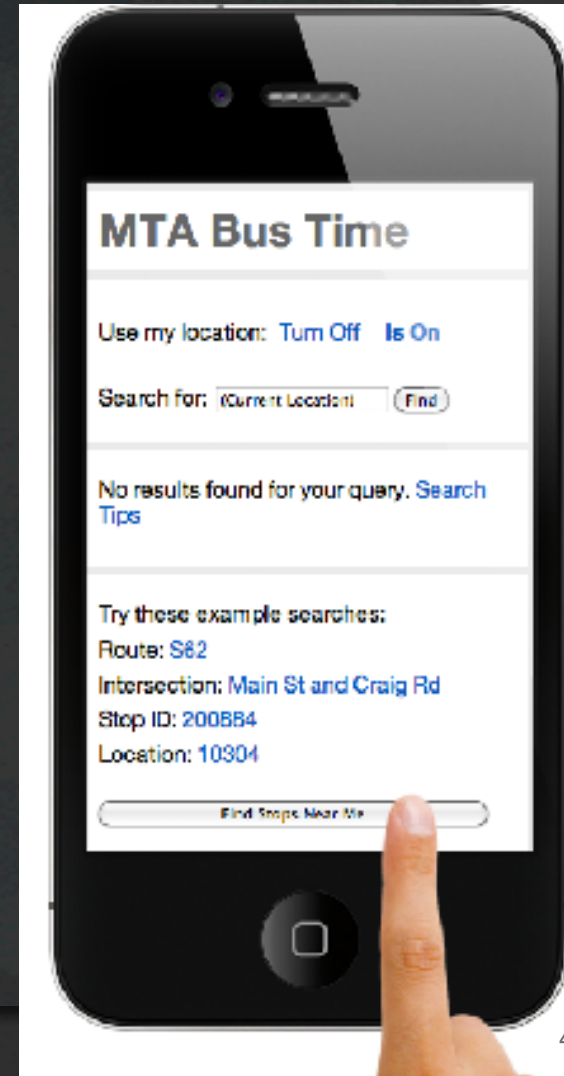
Mobile Design Constraints & Context

Design constraints

- limited attention/interactions bursty (sometimes untrue)
- form factor/screen size small (independent of resolution)
- natural (ambiguous) input modalities

Mobile usage context

- mobile device with user & on
- use gives clues to context...
 - apps give cues (e.g., calendar or job schedule)
 - location gives cues
 - activity inference (e.g., adapt to walking)



Mobile Design Constraints & Context

Design constraints

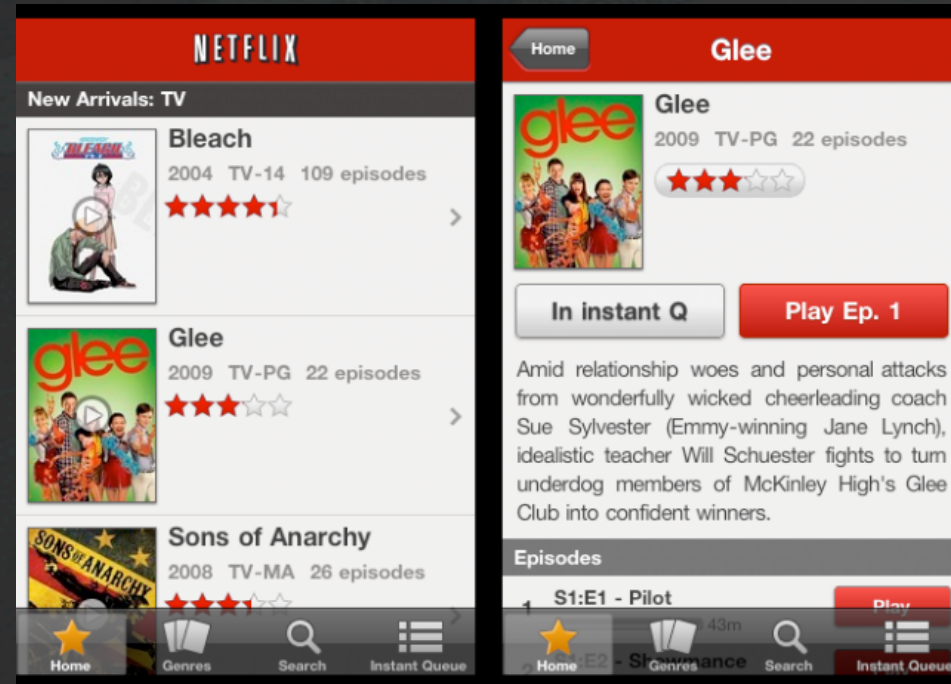
- limited attention/interactions bursty (sometimes untrue)
- form factor/screen size small
- natural (ambiguous) input

Mobile usage context

- mobile device with user & on
- use gives clues to context...
 - apps give cues
 - location gives cues
 - activity inference

Design for limited attention

- minimize keystrokes
- understandable at a glance (overview + detail)
- task-oriented w/ minimum set of functions



Initial Impressions Matter

- If people don't "get it", they won't download or they'll quit after quick look
 - need to have clear "value proposition" in both app store title, blurb, & app design

Instagram

[View More By This Developer](#)

By Burbn, Inc.

Open iTunes to buy and download apps.



Description

★★★★★ Instagram

15 million users love Instagram! **It's a free, fun, and simple way to make and share gorgeous photos on your iPhone.**

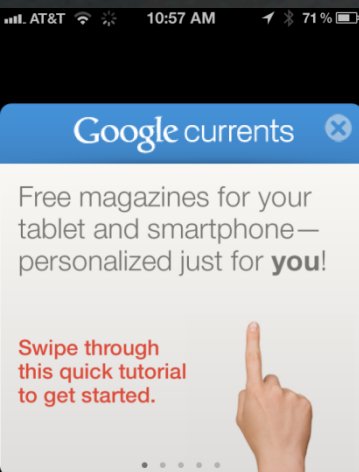
Pick from one of several gorgeous filtered effects or tilt-shift blur to breathe a new life into your mobile photos. Transform everyday moments into works of art you'll want to share with friends and family.

Share your photos in a simple photo stream with friends to see – and follow your friends' photos with the click of a single button. Every day you open up Instagram, you'll see new photos from your closest friends, and creative people from around the world.

[View In iTunes](#)

Initial Impressions Matter

- If people don't "get it", they won't download or they'll quit after quick look
 - need to have clear "value proposition" in both app store title, blurb, & app design
- Give "getting started info", annotate the UI, or provide an *optional* demo



Google currents



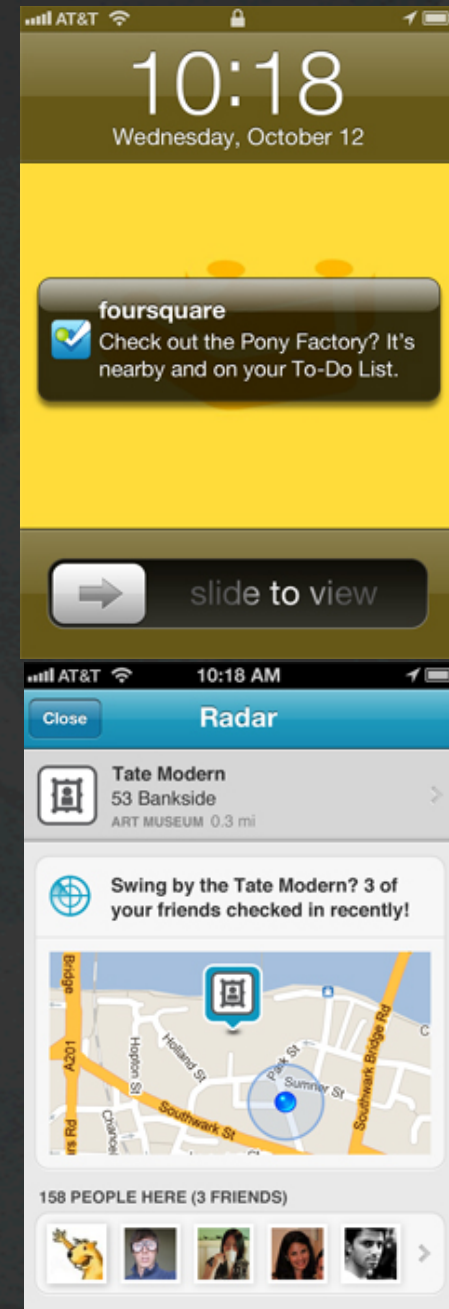
taptivate postman

Personalize User Experience

- Name
 - use it if known & integral (e.g., social networking)
- Settings
 - common ones in app & rest in settings
 - don't make dumping ground for extra features
 - e.g., font size, sound, units, list view, screen orientation, tab content, history, etc.
- Favorites/Bookmarks
 - save item for viewing later (sync across platforms)
 - common in content-rich apps (news, photos, recipes)

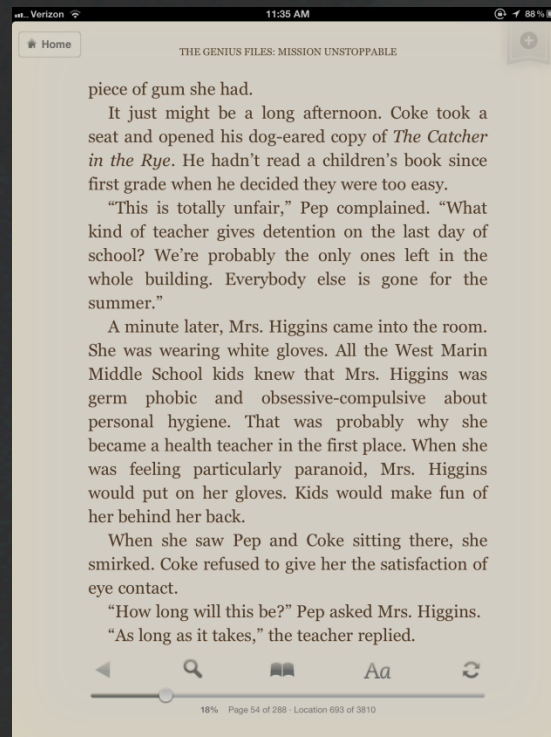
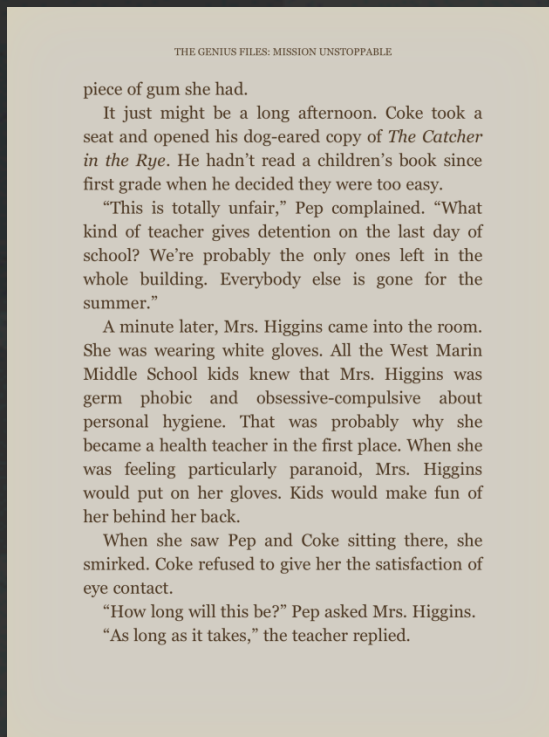
Personalize User Experience

- Name
 - use it if known
- Settings
 - common ones in app
- Favorites/Bookmarks
 - save item for viewing later (sync across platforms)
- Behavior
 - access based on app history (e.g., recent searches)



Let the Content Shine

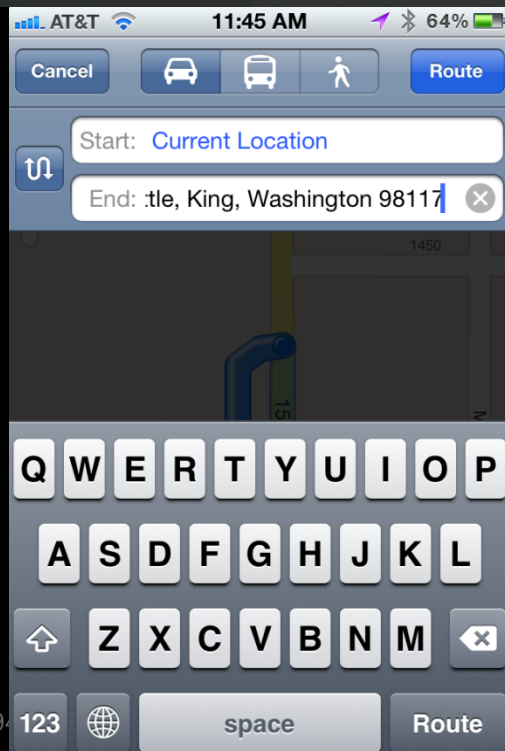
- Immersive applications focus on content
 - “The idea is that the content is the interface, the information is the interface — not computer administrative debris.” – Edward Tufte
- Access controls via tap screen, tap button, & scroll up



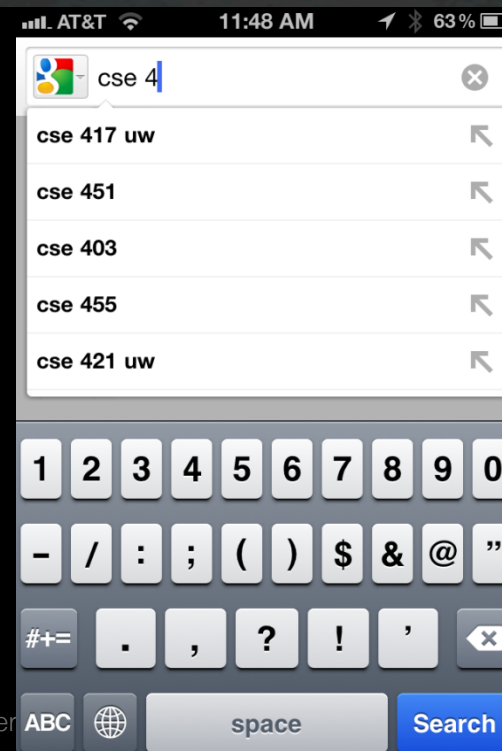
Kindle reader

Make Selections Fast & Error Free

- Provide smart defaults
- Suggest matches during text entry
- Store recent activity / selections



iPhone Maps



Google search

Provide Appropriate Feedback

- Animations
 - Downloading, moving, end of content...
- Transitions
 - when users move between related screens
 - e.g., flip (settings/views), slide left/right (lists), slide up/down (secondary panel), fade in/out, curl (e.g., maps)
- Text alerts
 - If visual not enough (inline or overlay-modal)
- Sound
 - use sparingly as can be annoying