# Mobile Application (Design and) Development

2nd class

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# Administrivia

- Anyone new?
- Are you checking email in Banner?
- Read the syllabus! (and check back regularly...)
- Readings remainder of the week...
- Wiki:
  - Fill in participant info
  - Pick a date for presentation
  - Add to the FAQ/Tips document
  - Use discussion to ask/answer questions
  - Setup monitoring so you are notified of changes

# Questions on reading

1. What is Fudd's first law of creativity? (hint: idea)
2. When doing lo-fi prototyping, Rettig recommends that in addition to the user, you have three people: an observer, a facilitator, and a _____.
3. If you are skeptical about lo-fi prototyping, Rettig suggest that you do what?

# Technical Q&A

- Android SDK version to use
- Environment: Windows, MacOS, Linux
- Porting Java to Blackberry

# Project Q&A

- Plug-in for the CITY project
  - Anything that might plausibly help with weight loss, related to diet, exercise, goal setting, stress, communication, etc. Think broadly within the domain.
- Innovative use of motion sensor for encouraging physical activity or less sedentary behavior
  - Includes fitness, exergames, goal setting, ...
  - Have HR monitors as well as Wockets

# Assignment Q&A: Due tomorrow

- First design exercise:
  - Hot (and not) critical analysis of mobile health apps
    http://www.ccs.neu.edu/home/intille/teaching/MAD/Design1.htm

- Team forming:
  - You'll hear from me via email based on information on the wiki list

# Short term plan

- Today
  - Finish up on yesterday's intro to context-sensitive apps
  - Intro to paper prototyping
  - General introduction to Android
- Tomorrow
  - Looking at code/tools. Putting an app on the Android Market. Q&A.
- Sunday – HelloMAD app due

# Primary design challenges

- Short bursty interactions
- User expectations for simplicity
- Interruptions!
- Limited input modality
- Data reliability (and multiple points of desired data access)
- Standing out in a crowd
- Aggressive operating systems
- In the future: security/privacy
- **Cost of data transmission (can be $$$)**

# Challenge #1: OS limitations

- Need a phone app to run continuously
  - Some disallow completely (iPhone, WM7)
  - Some allow but aggressively shut off (Android)

- My prediction: market forces will solve this

# Challenge #2: Battery life

- Continuous operation of high-sampling sensors (e.g. motion) drains battery
- Phones more efficient, but also have new features, so get status quo
- Impact
  - Critical usability concern for apps
  - Older phones: severe; newer better

# Challenge #2: Battery life

- Prediction
  - No silver bullet ... Always a major consideration
  - Workable with newer phones and careful design
  - Does require careful engineering
    - Phones not designed for continuous monitoring
    - Sensors/operating system interaction may create tricky situations

# Challenge #3: Expectations

- Design must set expectation that app not perfect
- Impact
  - Example from StepLively:
    Not calories, not steps
    Vague but understandable "points"
- Prediction: requires careful design

# Challenge #4:Normal phone use

- Advantage is leveraging phone people have, but must not disrupt that behavior
- Impact
  - StepLively: ≈50%+ of people ... Viable long term?
  - Wockets: Changed entire strategy (dropped original plan to use phone's motion sensor)
- Prediction: only very few "killer apps" will change how people use/carry phones

# Challenge #5: Correction/credit

- People dissatisfied if app misses activity and can't get "credit"
  - Because of sensor/algorithm error
  - Because person forgot or miscarried devices
- Impact
  - Steplively: Easy (but approximate) way to fix graph
  - Wockets: Text messaging feedback
- Prediction: design challenge

# Challenge #6: Behavior

- Deploy apps and see "odd" behavior in data. Tease apart:
  - Bug in code?
  - Subjective reporting errors?
  - Unanticipated/unusual behaviors
- Impact: Need tools to understand
- Prediction: Iterative design using data from remote monitoring tool will increase chances of success

# Challenge #7: Evaluation

- Need relatively long term deployments to make convincing case for...
  - Engagement
  - Impact beyond novelty stage
  - Small changes leading to large sustainable changes and health impact

- Most apps tried then dropped. Focus on sustainable use.

# Take away #1

- Mobile phones are increasingly capable of sophisticated, real-time information processing using internal sensors
- Most people will have this technology and carry it with them nearly everywhere

# Take away #2

- **Haven't yet scratched the surface of behavior-change potential** of using accelerometers, GPS, and external sensors that wirelessly communicate with phones + pattern recognition to wireless networks(e.g., Wockets)

- Key opportunity: "just-in-time" tailored feedback base on behavior

# Take away #3

- There are some challenges. Examples:
  - Dealing with noisy sensors to automatically detect certain types of physical behaviors
  - Unanticipated and variable end-user behavior that impacts user interface system design
  - Power-management issues on mobile devices
  - Effective remote management and interpretation of data and subject behavior as a study is running

# Take away #4

- There are some design and technical challenges, but they can be overcome with creative approaches

- Mobile devices with real-time feedback create novel (and engaging?) options that can't be achieved without the technology … Should be explored!

***So we have our domain...***
***Now what?***

**1. Start thinking about design**

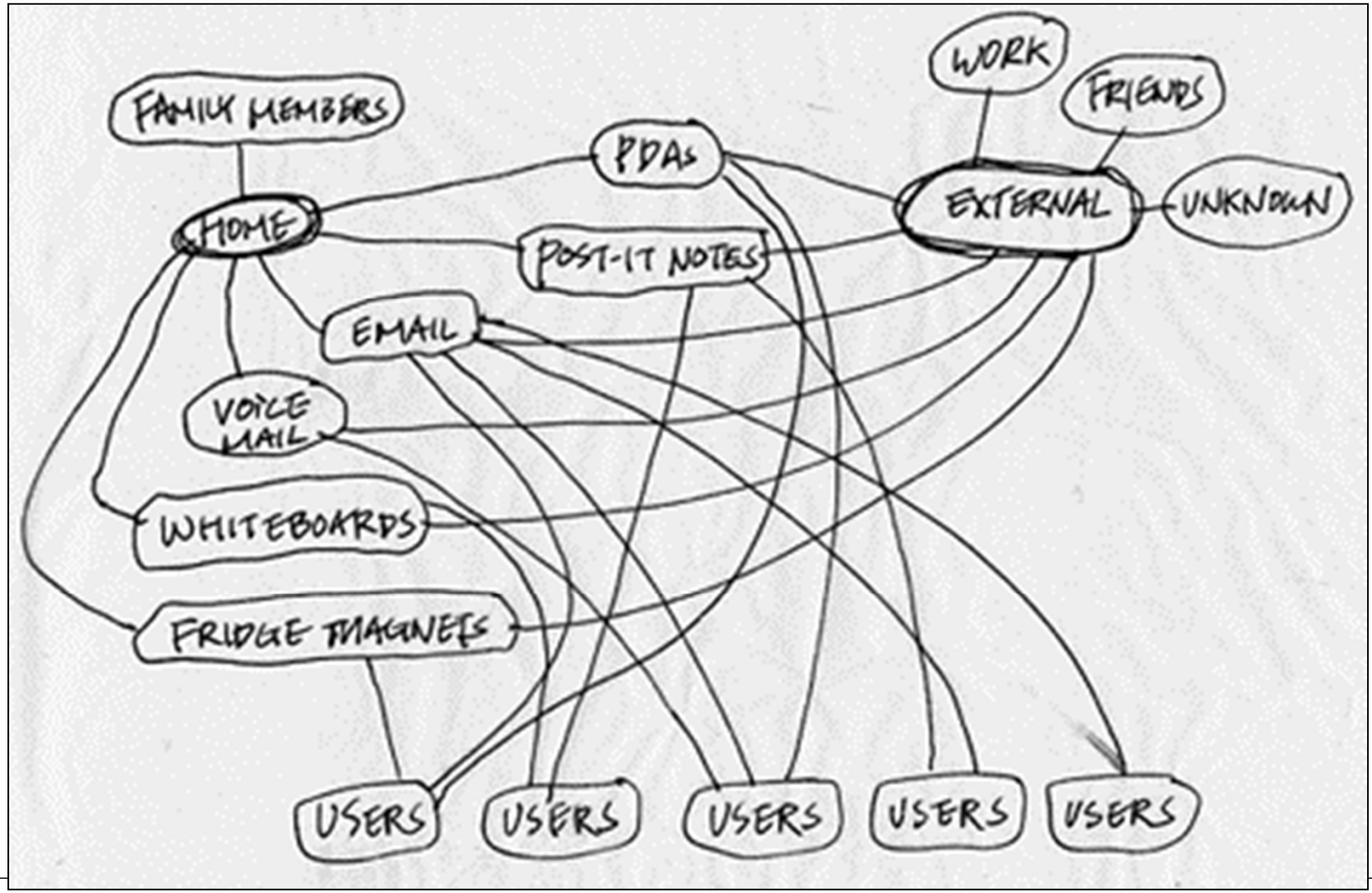
2. Start learning Android

# Typical user interface design

- Observation
- Model tasks
- Simplify/refine/stress-test the task models
- Lo-fidelity prototyping (paper)
- Test in context
- Iterate
- Eventually…
  - High fidelity prototyping
  - Test in context
  - Iterate (entire process)

# Observation


# Model the tasks



# Simplify/refine/stress-test tasks

- Gotchas
  - Missing what's truly important to user
  - Interruptions
  - Influence of environment/context
  - Boredom/lack of novelty
  - Dealing with problems created by
    - Environment
    - Other people
    - Technological limitations

# Paper prototyping

# Paper prototyping

# Test in context (or try)

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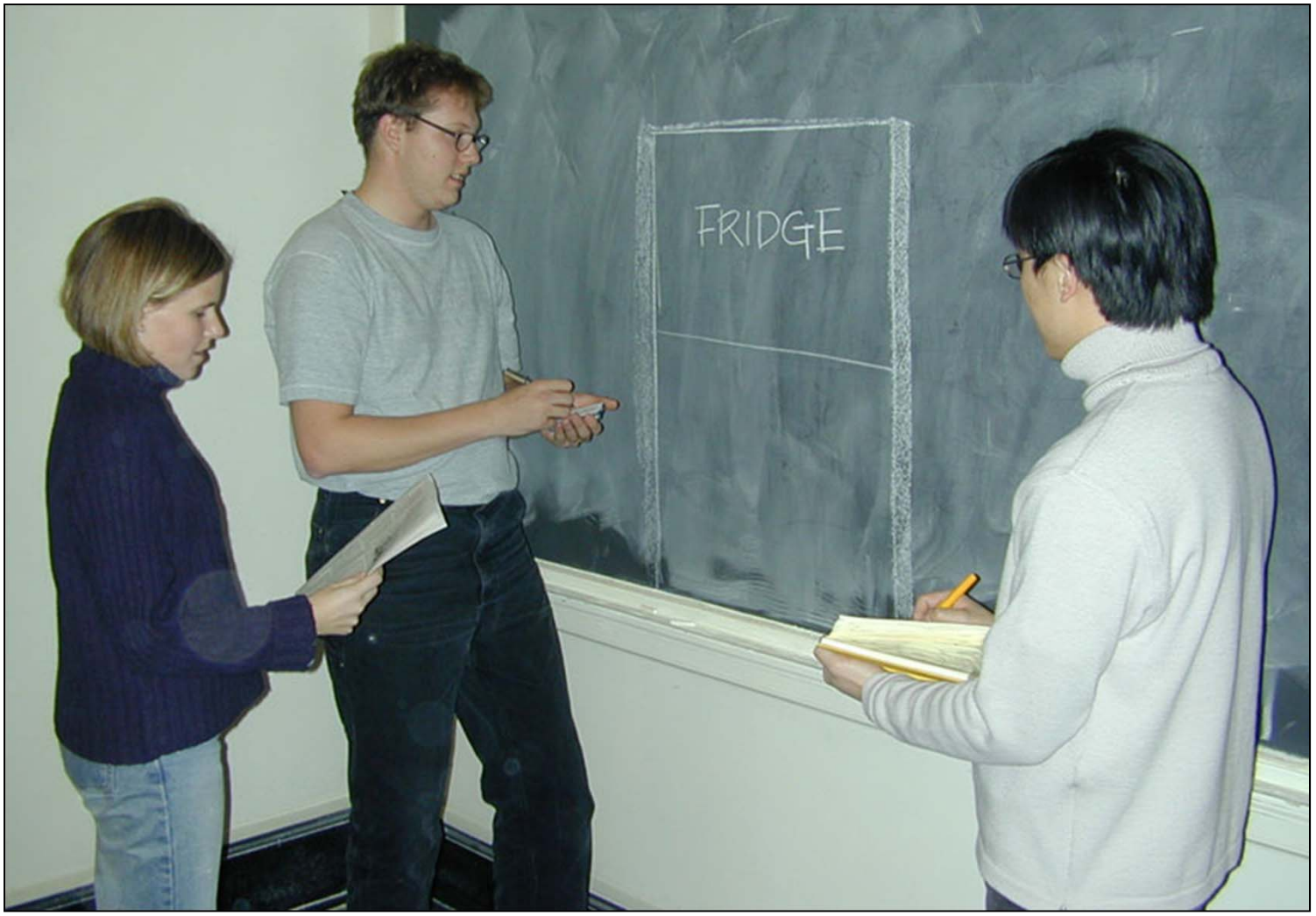
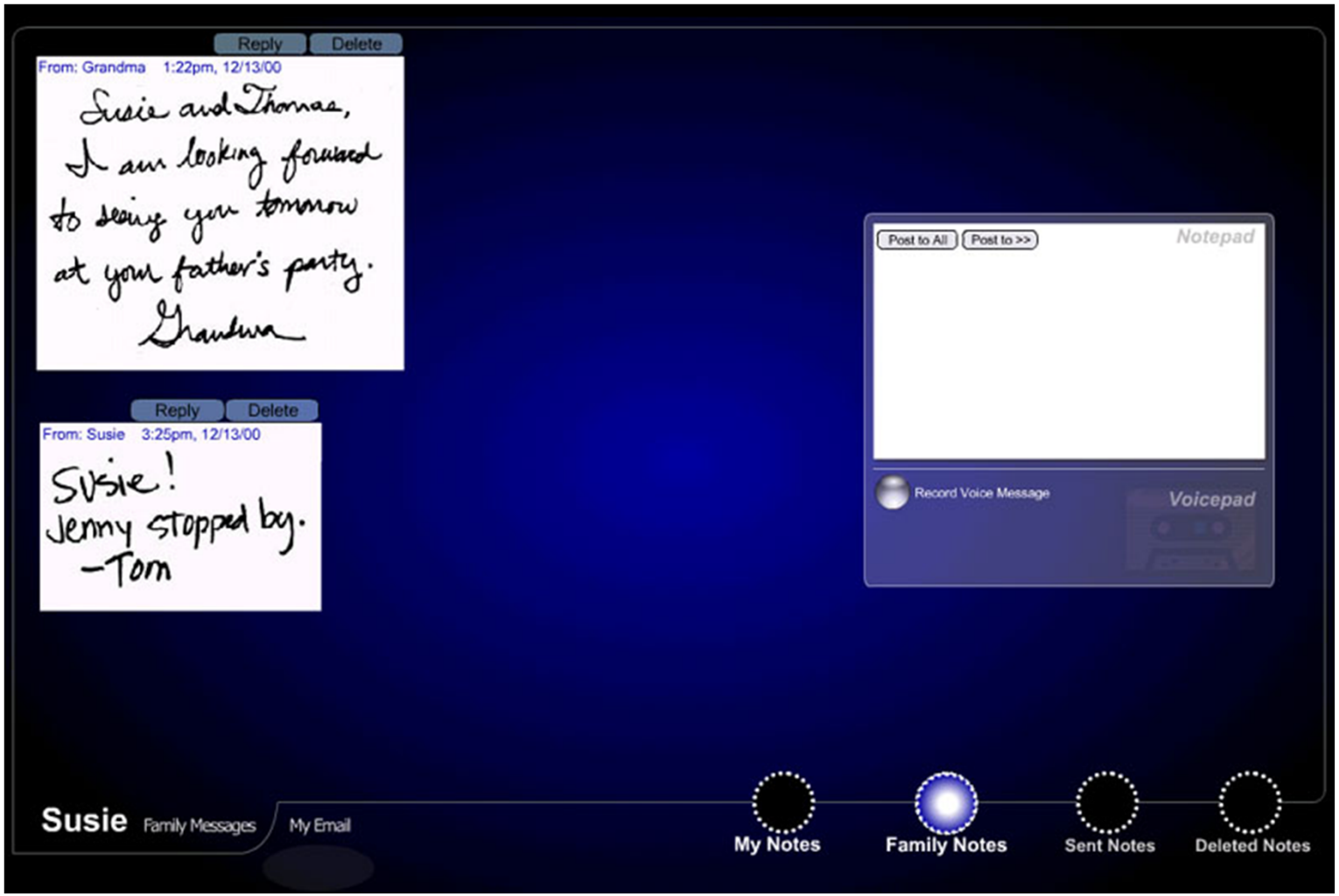
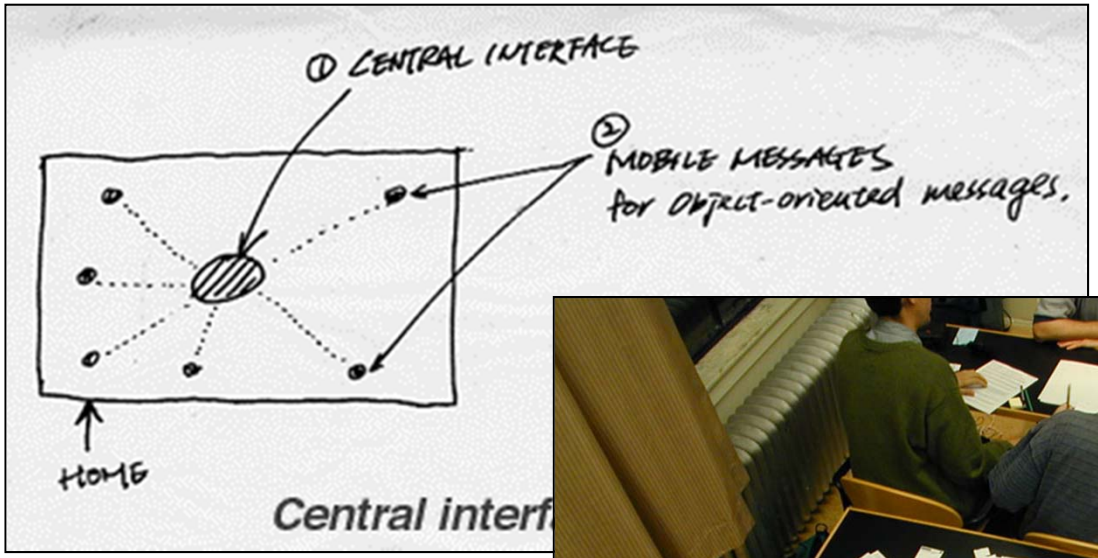
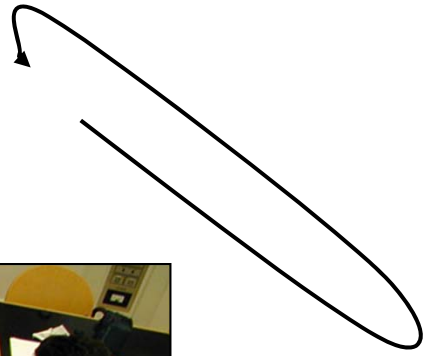


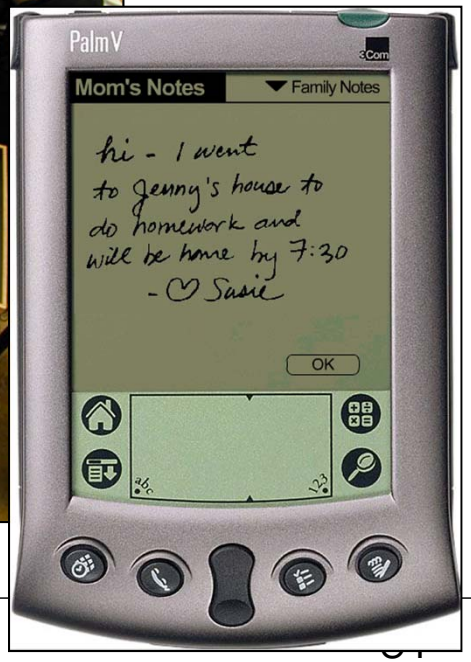
# High-fidelity prototyping



# Iterate!


① CENTRAL INTERFACE
② MOBILE MESSAGES for object-oriented messages.
HOME
Central interf




PalmV
3Com
Mom's Notes
Family Notes
hi - I went to Jenny's house to do homework and will be home by 7:30
- Susie
OK

# Iteration

At every stage!

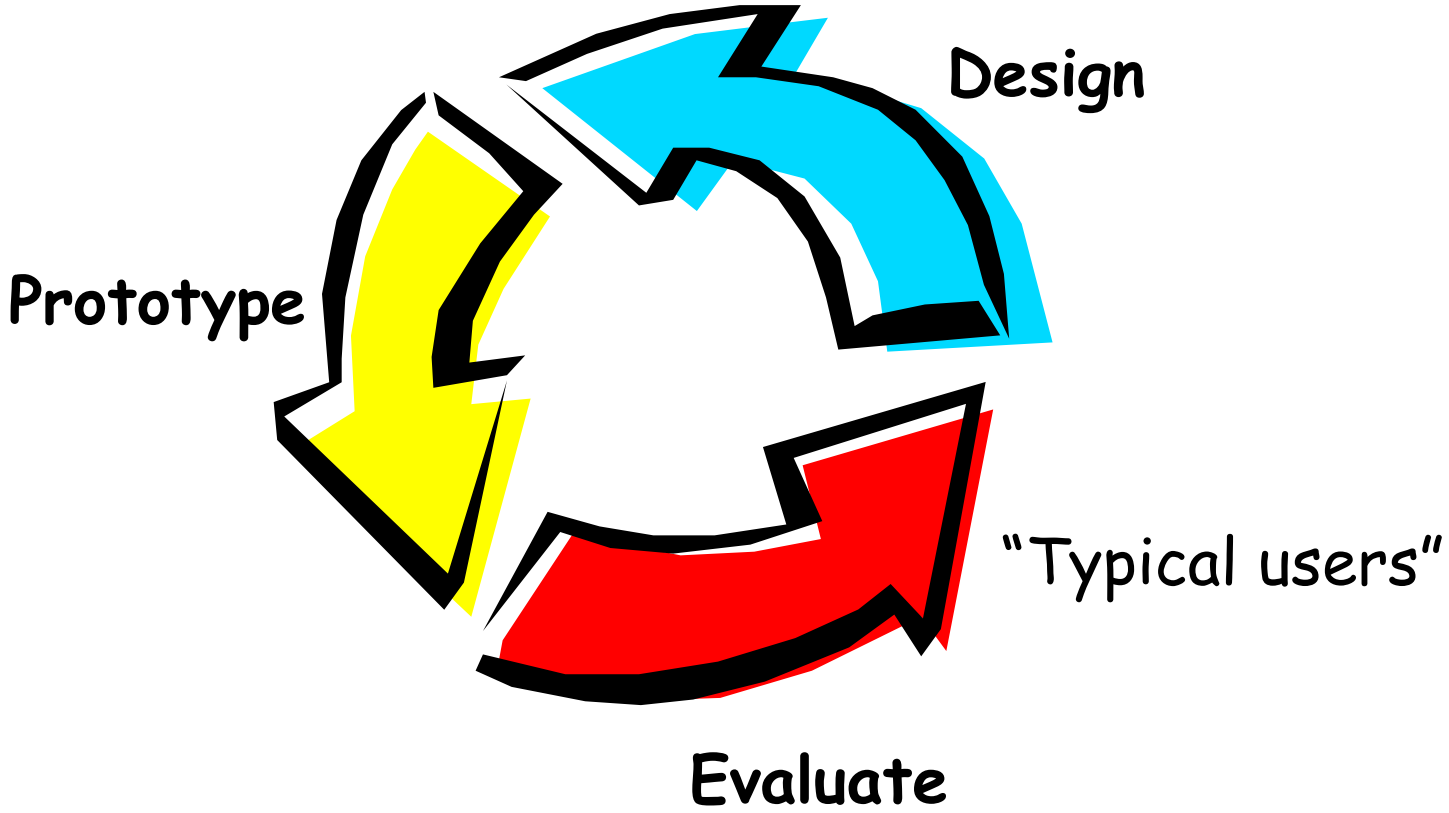



Diagram from J. Landay

# Benefits of paper prototyping

- Focus on interaction
- Fast, fast, fast and affordable
- Tests BIG IDEAS early
- Teams can participate
- Helps designer address three design truisms:
  - Fudd's first law of creativity:
    "To get a good idea, get lots of ideas"
  - "Know your user"
  - "You aren't your user"

# Challenges of paper proto.

- Mobile app use involves quick interactions
- Context is critical and hard to simulate
- Slow simulation of interface behavior
- Some graphical user interface behavior is difficult to simulate with paper
- Non-visual cues may be difficult to simulate (audio, tactile)

# Formative design goals

- Get through as may design iterations as possible
- Create deadlines for ideas: paper prototype early and often … don't wait for perfection
- Worry less about the underlying theory and more about instantiation of that theory in the interface: *What is the experience for the user?*

# Running a session

- Subject
- Facilitator
- Computer
- Observer

- Conduct dry runs with team to debug design first

# Facilitator

- Only person speaking
- Hand person explicit, written tasks
- Don't explain (despite compelling urge)
  - What do you think it will do?
  - What are you thinking right now?
  - What questions are on your mind?
  - Are you confused about what you are seeing?

# Computer

- Organizes the paper model
- Efficiently selects parts
- Works on the fly to modify if necessary

# Observer

- Takes notes
- Things to note:
  - Hesitation
  - Finger pointing
  - Confusion
- Record 1 per index card
  - Observation
  - Solution (if something comes to mind)

# Session organization

- Sessions 1-2 hours
- Schedule 2 hours between sessions for revisions
- 1-2 participants. Friends can be particularly informative.

# Set the stage

- Begin with greetings, introductions, and refreshments
- Assure people that the test is confidential, the results will remain anonymous, etc.
- Stress that this is not a test. There are no right answers. They can be most helpful by being completely honest about their impressions.
- People often say things like, "Am I flunking
- the test? Am I getting it right?" Possible answer:
  - "Don't worry, the question is whether or not we are flunking. The interface is on trial, not you. If you fail to understand something or can't complete one of the tasks, that's a sign of trouble."

# Focus on BIG IDEAS

- Make paper prototype messy
  - Avoid perfection
  - Avoid color
  - Don't use a ruler
- Show participant change on the fly in first ten minutes

# Goal: realistic feedback (despite setting)

- Get to know the person
- Then modify preplanned (realistic) scenarios to fit
- Conduct interview with a friend and ask them: what would s/he really do?

# Learn about simplicity

- Listen – never explain
- Listen for the "aha" moments
  - "What do you think it will do?"
  - [I think it will …]
  - "Ok, press it and see what it does."
  - [Oh, so it does _____]

# Interact, don't ask

- It's not about showing the interface, it is about *using* it
- Asking if they like it gets typical responses
  - People say and do different things
  - Sometimes people love something they can't use and vise versa
- Construct models, not illustrations

# Logistical tips

- Photocopier simplifies construction
- Fan-folding a piece of paper can simulate a long, scrollable page
- Transparencies can be helpful
- Assemble construction kit

# Construction kit

- White, unlined, heavy paper that is bigger than letter size (11 by I7 inches)
- Index cards for construction material and note taking
- Various adhesives. Tape: clear, colored, double-backed, pin strip tape
- Glue sticks, and most importantly, Post-It glue-a stick
- Rolls of white correction tape
- Various markers-colored pens and pencils, highlighters, and
- thick markers, pastels
- Lots of sticky note pads of various sires and colors
- Transparencies
- Scissors, x-acto knives, metal straightedges (band aids)
- Other possibilities found in art stores:
  - Rub on texture
  - Modeling clay (if using physical devices)
  - Sound clicker

# Tips for mobile paper proto.

- Use a real phone and place paper on screen
- Use font guide so you are realistic about font sizes
- Consider the reading glasses challenge
- Avoid components that need a stylus (use finger-sized buttons)
- Minimize text entry … painful
- Screens should be understood at a glance

# Challenges in project domain

- Physiology
  - Delayed gratification (exercise, dietary control)
  - Instant gratification (tempting food)
- Timeline
  - Novelty ... how to exploit, not suffer, from it?
  - When content is required, how can it be kept fresh without requiring a huge amount of manual generation?

1. Start thinking about design
   **Fudd + Paper Prototyping =**
   **Simplicity, Usability & Success!**

**2. Start learning Android**

# Android basics: what is it?

- Open source OS and development platform
  - In theory, you can change anything
  - In practice....
- Hardware reference design
- Linux OS kernel
- Open-source libraries for app development
  - E.g., SQLite, Webkit, OpenGL, media manager

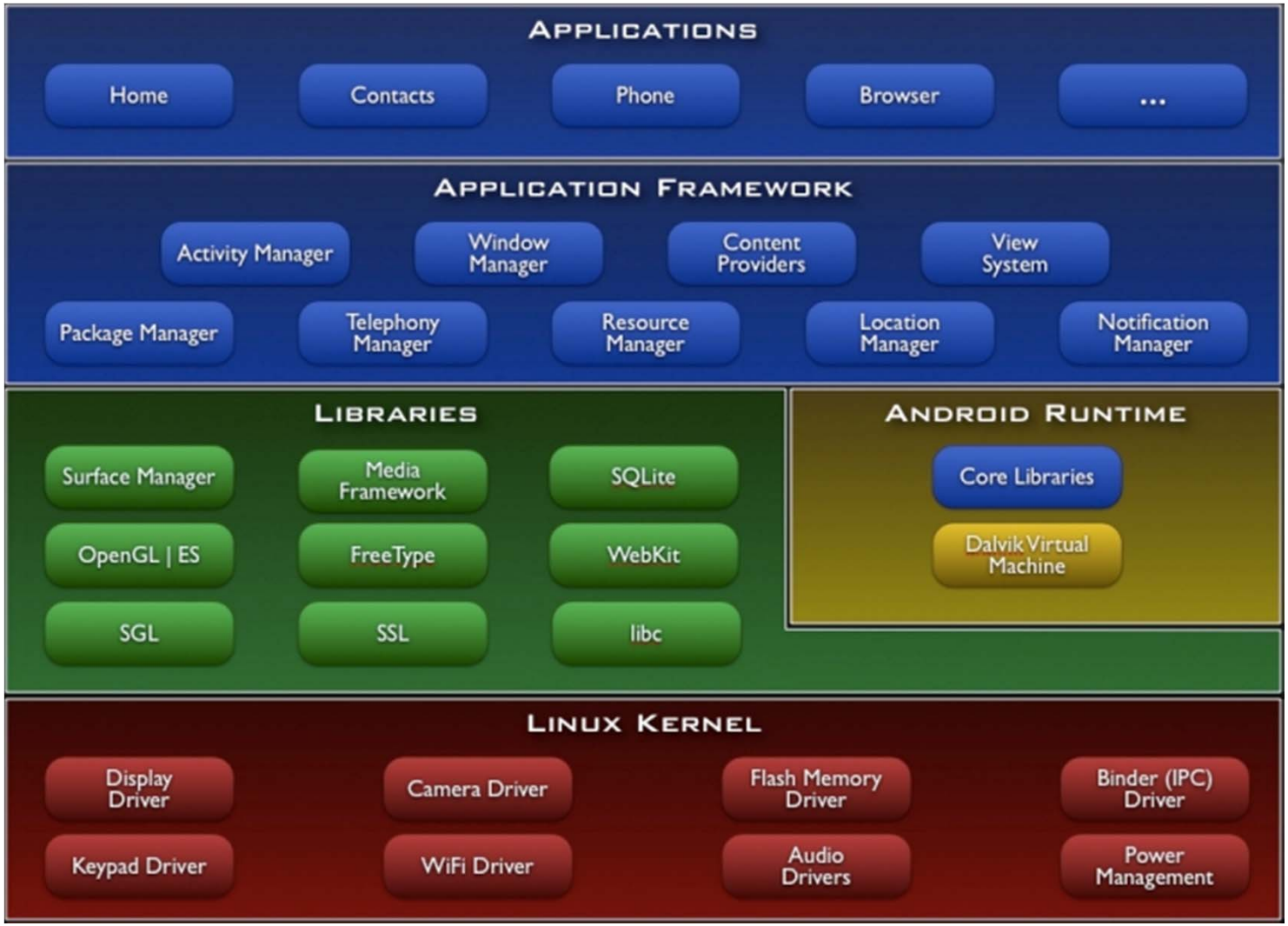
# Android basics: what is it?

- Dalvik virtual machine
  - Not Java ME
  - Use Java, but Dalvik compiles for small and efficient and mutliple VMs
- Application framework
  - Window manager, location manager, telephony, sensors
- UI framework to run and launch apps
- Preinstalled apps

# Android basics: what is it?

- SDK and tools
- Wild west of app stores: the Market

# System architecture



# Notables

- "Open philosophy"
- Application framework that encourages reuse of application components
- Access to (much) hardware (sometimes even without bugs!)
- Release and fix mentality (or it seems like it, sometimes)
- Great standard apps: Google Maps, location services, quick search box
- Background services

# Notables

- SQLite (with app data sandboxed)
- Shared data and interprocess communication
  - Notifications (via UI)
  - Intents
  - Content providers (managed access to app private data)
- All apps created equal
- Widgets and livewallpaper and livefolders

# Notables

- 2d canvas drawing
- 3d OpenGL
- Support for popular media formats: MPEG4, H.264, AAC, MP3, JPG, PNG, GIF
- Native Development Kit (NDK)
  (C++ tinkering under the hood)
- OS optimization of memory and process management

# New way of thinking #1

- Expect...
  - Limited processing power
  - Limited RAM
  - Limited permanent storage capacity
  - Small screen and low resolution
  - High cost of data transfer
  - Slow data transfer rates with high latency
  - Unreliable data connections
- Moore's law less impactful...

# New way of thinking #2

- Application framework that encourages reuse of application components
- "Screens" are Activities that are chained with lightweight exchange of data between them
- OS can handle stack of Activities if you want it to (e.g., back)

# New way of thinking #3

- OS Manages process lifetime **(app assassin)**
  - App responsiveness
  - Setting priority to interaction
- You MUST
  - Ensure that your app is ready for swift death
  - Yet, it must remain response and/or restart in the background
  - Must come to the foreground quickly

# Types of applications

- Foreground
  - Useful when being used.
  - Suspended otherwise
- Background
  - Apart from when being configured, spends most of lifetime hidden (e.g., call screening app)
- Intermittent
  - Some interaction but mostly in the background (e.g., media player)
- Widget
  - Home screen status update

# Good behavior

- Is well behaved
- Switches seamlessly from background to foreground
- Is polite (e.g., stealing focus)
- Presents a consistent user interface
- Is responsive

# Behavior police: process assassin

- Two conditions monitored
  - Must respond to any user action (e.g., key press) within 5s
  - A BroadcastReceiver must return from its OnReceive handler within 10s
- Worst case, not goal! Users notice .5s