Human-Computer Interaction IS4300

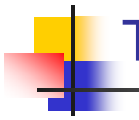
1

Overview for Today

- T8 debrief
- Designing for Mobile (Stone, Hoober & Berkman)
- Case study: iPhone UI design guidelines
- Good & Bad Examples
- Exercise
- Mobile UI Research
- 1:10 – Tony Lazenka – mobile development experience

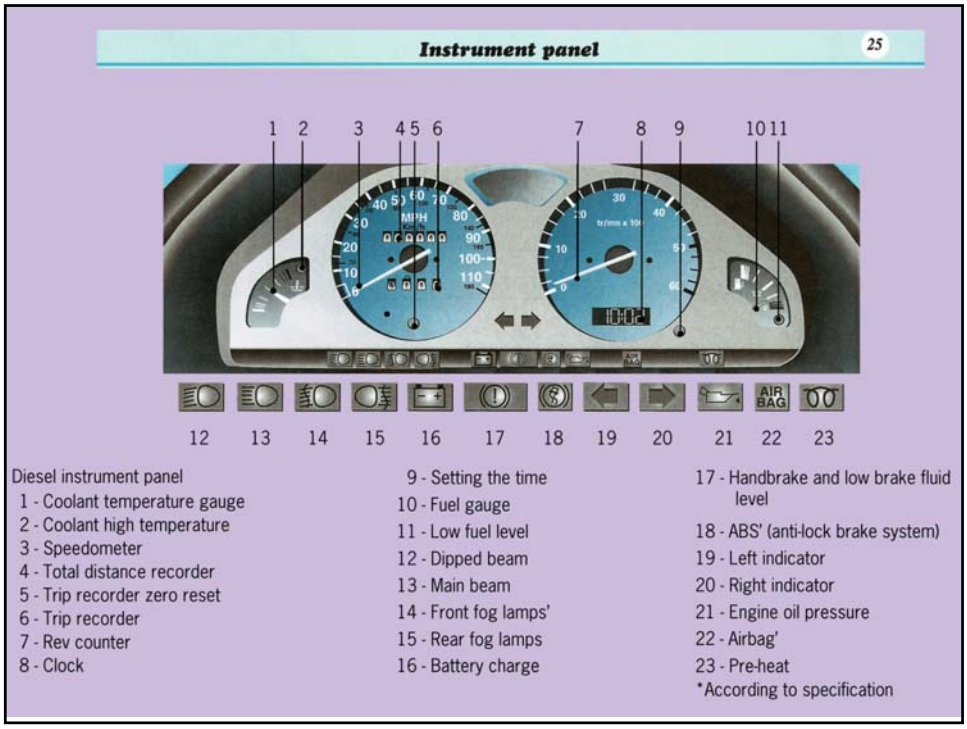
Stone Ch 18

- *Pre-dates smart phones* (2005)
- Lumps mobile UIs together with all embedded systems
  - Anything that does “not look like a conventional PC”
  - Specialist devices – not general purpose
  - Hardware & software designed to work together
- Are smart phones generalist or specialist devices?



Stone: Types of Embedded System

- Safety Critical Systems
  - Those in which human or environmental safety is of paramount concern.
- Design concerns?



Information Appliance

- Information Appliances
  - *An appliance specializing in information…*
  - Design principles
    - Simplicity
    - Versatility
    - Pleasurability
- Smart phones?

Design Issues for Information Appliances

- Portability
- General Purpose versus Special Purpose
- Connectedness
- The Commercial Environment
  - Consumer products
  - Aesthetics of design even more important

"Block of Wood" prototyping

- Ask users to carry around
- Use as if a cell phone
- Jeff Hawkins used to prototype the Palm Pilot

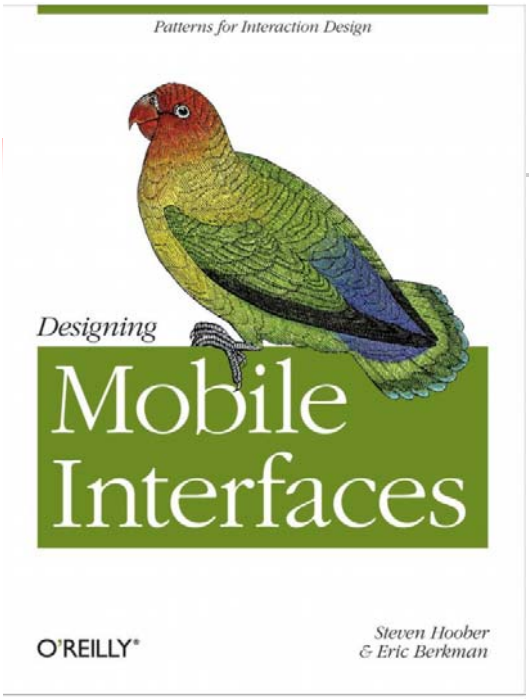
How to do usability studies of *in situ* mobile users?

Oulasvirta & Nyyssönen, "Flexible Hardware Configurations for Studying Mobile Usability"

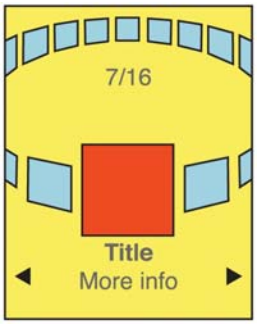
Mobile Usability Lab…

UI Design Guidelines for Handheld Devices (Stone Table 18.1)

- Select vs. Type (typing is hard)
- Be consistent / Consistency between platforms
  - (External) Consistency
- Design stability
  - Robustness of connectivity
- Feedback
- Forgiveness - Error correction
- Use Metaphors
- Clickable graphics should look clickable (Visibility)
- Use icons to clarify concepts (Visiblity)

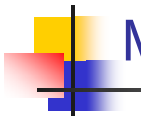


- 584 pages
- 11/11
- Design patterns



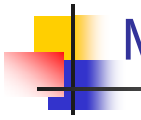
Mobile Interfaces

- What is a mobile UI?
- What is different in design methodology relative to desktop GUIs?



Mobile UIs

- Hoober & Berkman
  - Small
  - Portable
  - Connected
  - Interactive
  - Contextually Aware



Some Issues in Designing for Mobile Devices

- Small UI
- Limited input ability
- Wide variety of
  - Screen size / resolution
  - Hardware inputs
  - Sensor inputs
  - Connectivity options
  - OS / API versions
- Rapidly changing device & OS (some)

Principles of Mobile Design
Hooker & Berkman

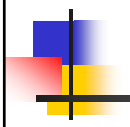
- Respect User-Entered Data
  - Input is hard
- Mobiles are Personal
  - Assume one user, with personal data active
- Lives Take Precedence
  - Don't interrupt unless necessary
- Must Work in all Contexts
  - E.g., screen brightness
- Use Sensors & Smarts
  - Do things for the user when possible
- User Tasks Take Precedence
  - User-directed interaction
- Consistency (external & internal)
- Respect Information (present data precisely)

Page Layout Guidelines

- Mobile screen real estate is valuable.
  - Skip unnecessary banners, images, graphics ("administrative clutter" – Tufte)
- Consistent & simple navigation elements
- Keep everything as simple as possible
- For Serious tools (vs. games)
  - Minimal number of colors
  - Keep UI data-centered

Design Methodology
Hooker & Berkman

- Storyboard UIs (as before)
- Additional considerations
  - Gestural interface & finger size
  - Use contexts
  - Asynchronous events
  - Use of sensors, devices
  - Different display sizes, orientations (e.g., auto-switch landscape / portrait)



iPhone

https://developer.apple.com/library/ios/navigation/

iPhone 5 / iOS 6

- 4” dia, 1136 x 640 screen resolution
- Multi-touch screen
- Audio output
- Vibration output
- Front and rear cameras
- Accelerometer (orientation, motion)
- Connectivity: GSM, CDMA, Wi-Fi, Bluetooth, etc.
- GPS, compass
- 700,000+ apps

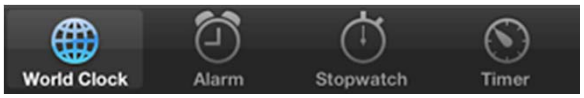
iOS Widgets

Navigation Bar
To traverse hierarchical information

Tool Bar
Controls that perform actions related to objects in the screen or view.

iOS Widgets

Tab Bar
ability to switch between different subtasks, views, or modes.



iOS Widgets

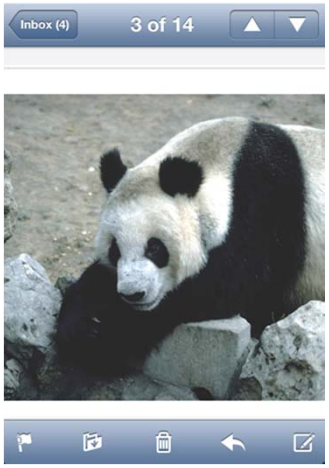
Table View
Display objects in single column

Simple

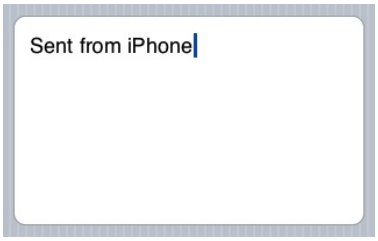
Grouped

iOS Widgets

Web View
displays HTML



Text View
accepts & displays lines of text



iOS Widgets

Action Sheet

Alerts

iOS Widgets

iOS Human Interface Guidelines

- The Display Is Paramount
  - The display of an iOS-based device is at the heart of the user's experience.
  - The display encourages people to forget about the device and to focus on their content or task.
- Device Orientation Can Change

Apps Respond to Gestures, Not Clicks

- Tap
  - To press or select a control or item
- Drag
  - To scroll or pan; To drag an element.
- Flick
  - To scroll or pan quickly.
- Swipe
  - To reveal hidden content / widgets.
- Double tap
  - Zoom in and center; Zoom out.
- Pinch
  - Zoom in ; Zoom out

iOS Human Interface Guidelines

- People Interact with One App at a Time
- Preferences Are Available in Settings
  - Single, common settings app.
- Onscreen User Help Is Minimal
- Most iOS Apps Have a Single Window
- Two Types of Software Run in iOS
  - Apps
  - Web content – customized to varying degrees

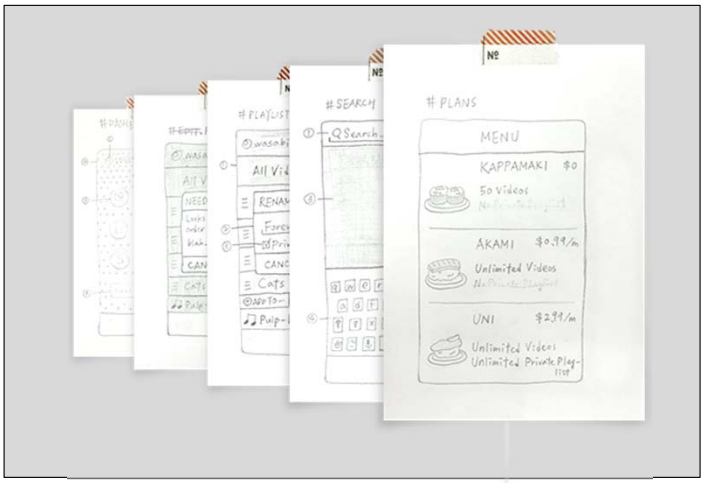
iOS Design Methodology

1. Create an App Definition Statement
   (aka requirements analysis)
   1. List All the Features (tasks) You Think Users Might Like
   2. Determine Who Your Users Are
   3. Filter the Feature List Through the Audience Definition

iOS Design Methodology

2. Design the App for the Device
   - Follow iOS UI Paradigms
     - Controls should look tappable
     - App structure should be clean and easy to navigate
     - User feedback should be subtle, but clear
   - Reconsider Web-Based Designs
     - Focus your app – narrow set of tasks
     - Make sure your app lets people do something – interactive
     - Design for touch
     - Let people scroll
     - Relocate the homepage icon

Remember SILK?
Try POP – Prototyping On Paper



Remember SYLK?
Try POP – Prototyping On Paper

Example Apps

30 Superb Examples of iPhone Interface Design

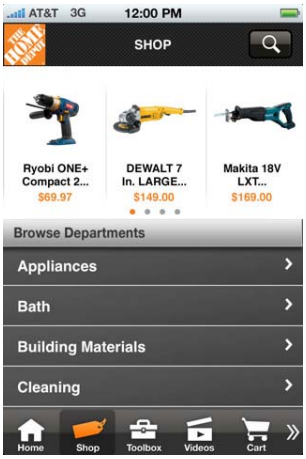
topDesign mag

Simplicity

support few tasks – but do them well

Home Depot

research and purchase over 100,000 products

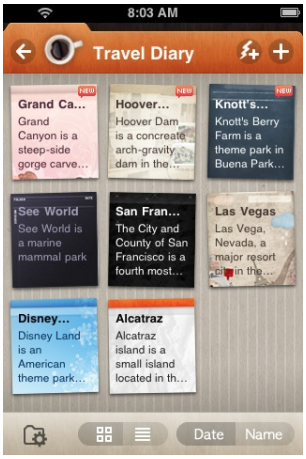


Golfscape

Augmented Reality Rangefinder

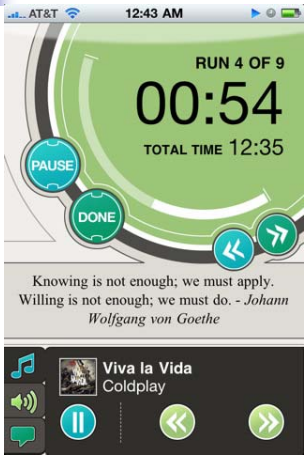
Fotopedia Heritage

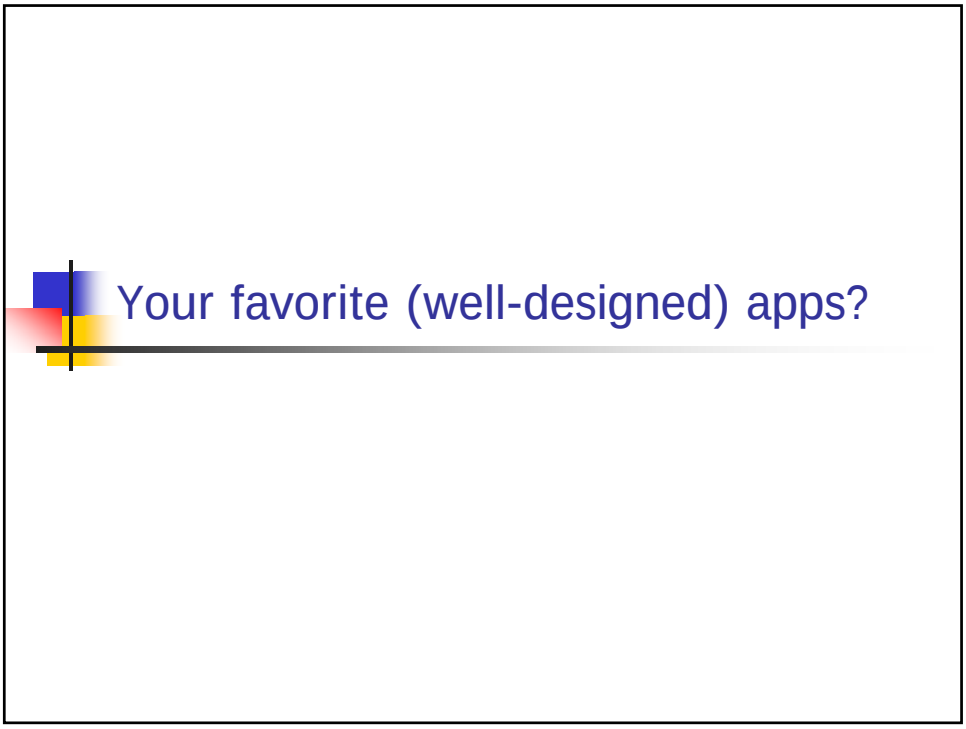
Awesome Note



Nike+ GPS

Couch to 5K




Your favorite (well-designed) apps?


Bad Examples..
Komarov, “iPhone Apps Design Mistakes”, *smashing magazine*
Olsen, “10 Surefire Ways to Screw Up Your iPhone App”, *UX magazine*

Motion X GPS Settings

iFitness – weight entry


AT&T
5:23 PM
What's My GPA Now? 3.00
Previous GPA:
3.00
Previous Credit Hours:
Courses in Progress: 5
Credit Hours
Grade
1 2 3 4 5 A B C D F +/-
1 2 3 4 5 A B C D F +/-
1 2 3 4 5 A B C D F +/-
1 2 3 4 5 A B C D F +/-
1 2 3 4 5 A B C D F +/-

Help Screen

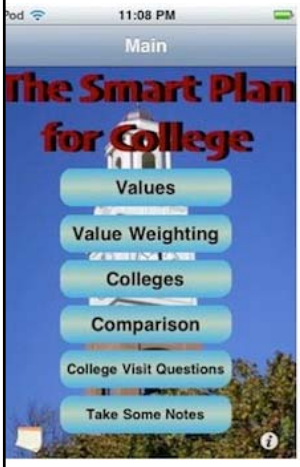

SoftBank
10:36 PM
gpsGuide
Move
Current Location
Latitude
Longitude
Head
North
35 46 29.7N
139 28 2.1E
179 °
S
Latitude
Longitude
Bearing
Dist
35 51 47.2N
139 30 7.8E
17 ° N
10.3km
DEST
Loc: viva home
35 46 26.0N
139 27 16.2E
265 ° W
ORIGIN
Loc: watertower matsu
1.2km
Last Update 10:36:51 PM
Accuracy 17m
Speed 0
#updates 1192
Odometer 81m
Alti 111m ± 70m
Good Accuracy
You must move for accurate heading and bearing arrows
Stop
Save
Reset
Help
Confg


SoftBank
10:27 PM
Dismiss Help
Map Viewing
Show on Map: All Current Destination Origin
Current Location Section
Current Heading
Relative North
Set Destination
Destination Section
Set Origin
Origin Section
Reset Odometer
GPS Status
Switch Origin& Destination
Stop/Start GPS
Reset origin
Configuration
Save Current Location
Display Help

Instead of help manual...

Graphical instructions

In-context text help



Basics of Graphic Design

Contrast: poor contrast between the background and the content.
Repetition: Last two rows in the left example break the font size pattern, and the right example doesn't have much repetition at all
Alignment: Left alignment generally looks more professional than centered alignment (left) or no alignment (right).
Proximity: Very weak spatial groupings

Exercise

- Break into teams
- Design a new myNEU portal* for an iPhone 5
  - Determine most important subset of tasks
  - Sketch conceptual design
  - Sketch main app page
  - How is your design different from a desktop app?

* *or other NU-related app*

Research on Mobile UIs

What would Jiminy Cricket do? Lessons from the First Social Wearable

Timothy Bickmore
Assistant Professor
College of Computer and Information Science
Northeastern University, Boston

Imagine

- A Digital Conscience that goes everywhere with you
- Can sense when you are doing things that might have negative long-term consequences
- Whispers suggestions in your ear

Design Considerations

- Is Portable / Wearable
- Can sense when you are engaging in (or about to engage in) behaviors of interest
- Is Persistent
- Has Counseling skills
- Has Social and Relational competencies
  - Maintains on-going working relationship
  - Adeptness at Interruption

Jiminy Cricket

- Earliest conceptualization of a “wearable conscience”?
  - Le avventure di Pinocchio, Carlo Collodi, 1881
- Jiminy did not fare well in original story:
  - Pinnochio strikes and kills the cricket with a hammer in their first meeting after he provides unwanted counsel.

Some Application Areas

- Pinnochio: avoid short-term indulgences that you may regret later
- Health behavior counseling
  - Choosing healthy over unhealthy foods
  - Taking the stairs rather the elevator
  - Scheduling medication-taking

PDA Platform

- Dell Axim X30
- Extended life battery
- EcerTech TiltControl 2D accel
- 1GB Flash drive
- Custom plastic case

"Just in Time Information for Exercise Adoption"
Funded by NIH National Library of Medicine

Overall Software Architecture

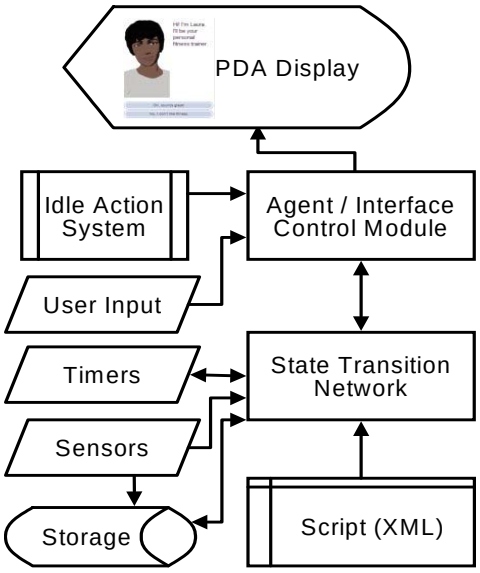
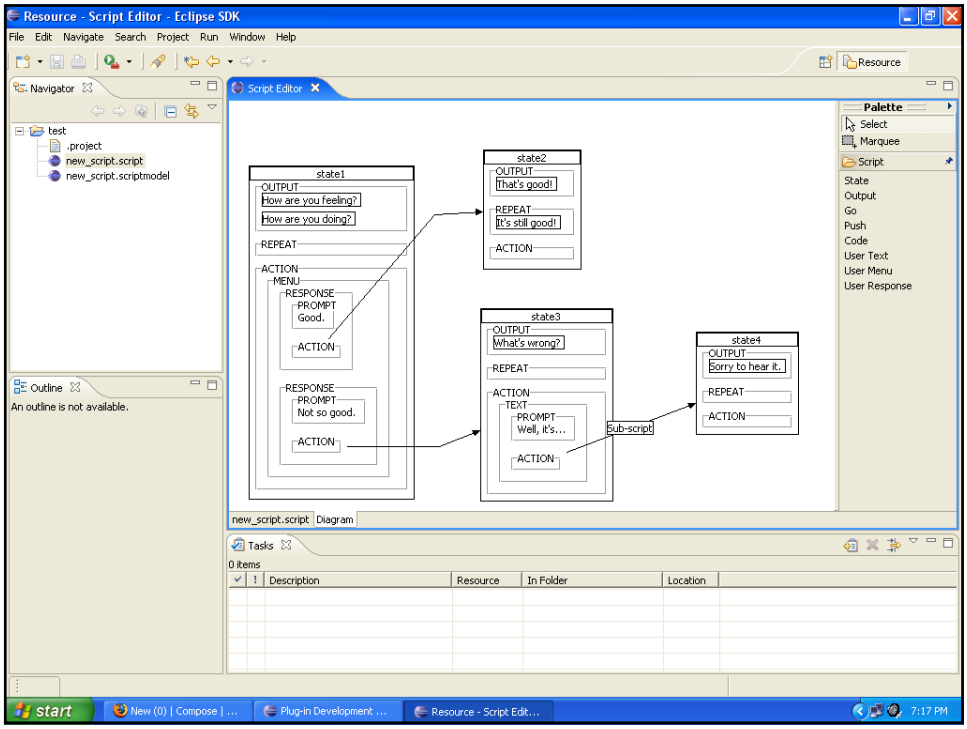


Figure X. Run-time System Architecture

PDA Interaction Scripting Language

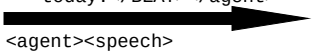
- XML-based
- Defines a set of finite state machines that comprise a hierarchical state transition network.

```
<SCRIPT mode="X">
  <STATE name="FIRSTSTATE">
      …
</STATE>
  <STATE name="SECONDSTATE">
      …
</STATE>
…
</SCRIPT>
```



BEAT PreProcessor

```
<agent><BEAT> I'm glad that we're getting the chance to talk
   today.</BEAT></agent>
```

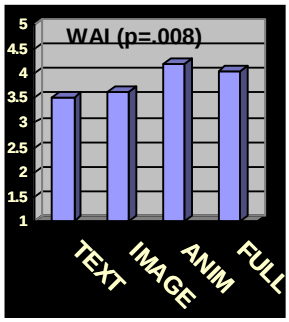


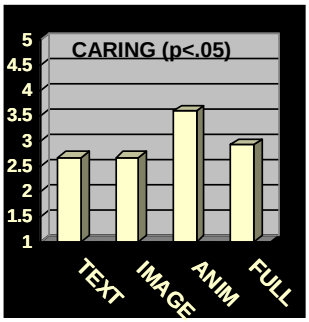
```
<agent><speech>
   <gaze dir="away"/>
   <postureshift/>
   <word text="I" viseme="A" dur="0.15"/>
    <word text="am" viseme="AC" dur="0.14"/>
    <word text="glad" viseme="CTAT" dur="0.29"/>
    <word text="that" viseme="TAT" dur="0.16"/>
    <gaze dir="at"/>
    <word text="we" viseme="AA" dur="0.17"/>
    <word text="are" viseme="OT" dur="0.13"/>
    <word text="getting" viseme="CATAC" dur="0.38"/>
    <word text="the" viseme="TA" dur="0.059"/>
    <eyebrows dir="up"/>
    <headnod/>
    <word text="chance" viseme="TATT" dur="0.43"/>
    <eyebrows dir="down"/>
    <word text="to" viseme="TA" dur="0.13"/>
    <headnod/>
    <word text="talk" viseme="TOC" dur="0.26"/>
    <word text="today" viseme="TATA" dur="0.34"/>
    <word text="." viseme="" dur="0.0"/>
</speech></agent>
```

Modality Study

- Compared 4 modalities:
  - Text only
  - Text + Static agent image
  - Animated agent
  - Animated agent + nonverbal sounds
    - Backchannels, Discourse markers, etc.

Modality Study



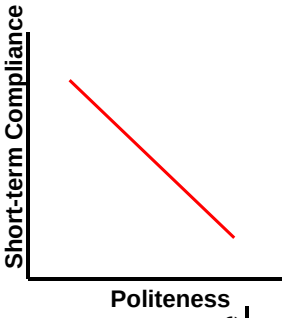


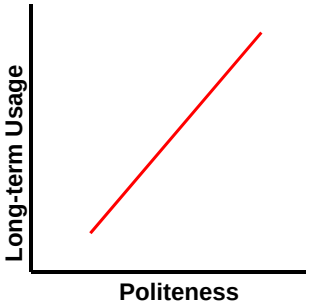
- Animated agent also scored higher (approaching significance) on *credibility of health information* and *comfort using in the workplace.*

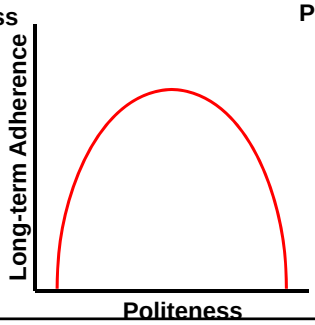
Interruption Studies

- What is the best way to interrupt people at work in order to motivate them to perform a healthy behavior?

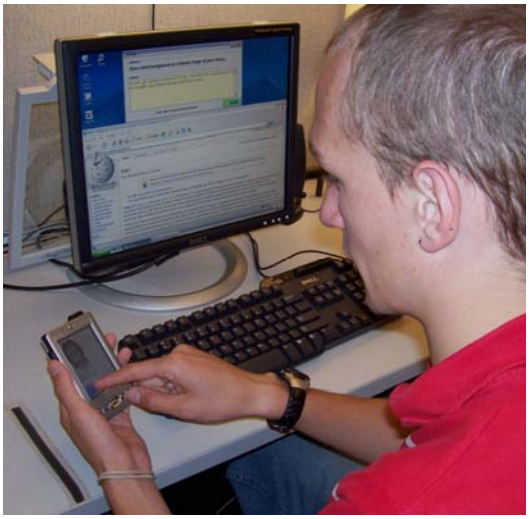
Hypotheses



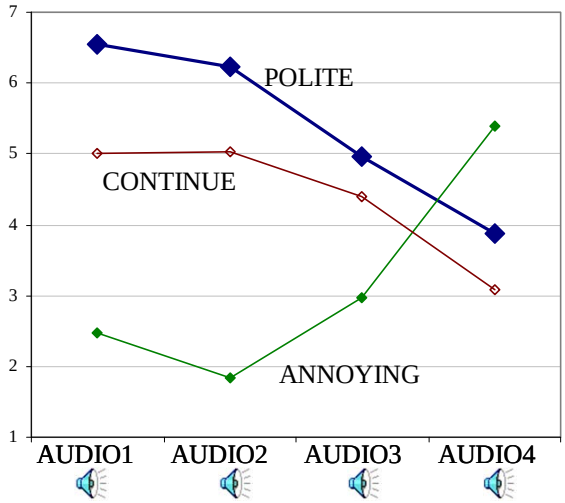




Application: Wrist Rests

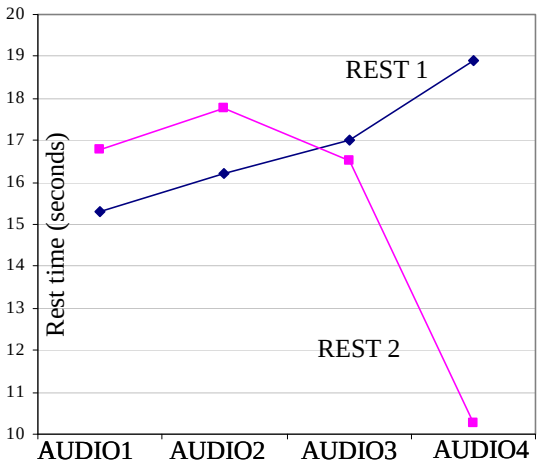


Results – Study 1
Self-report Measures



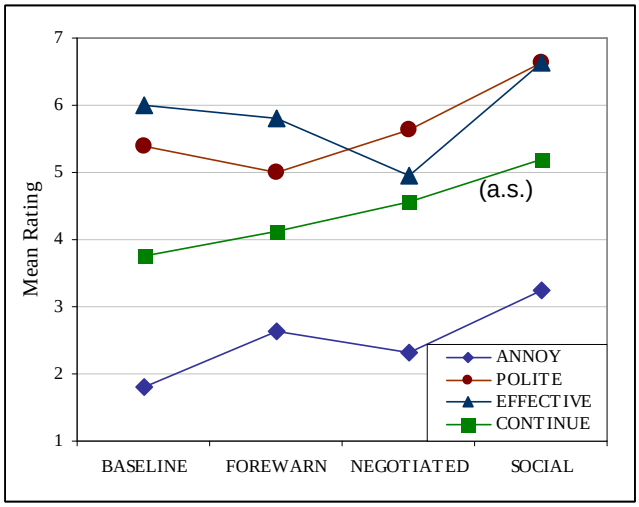
N=29

Results – Study 1
Behavioral



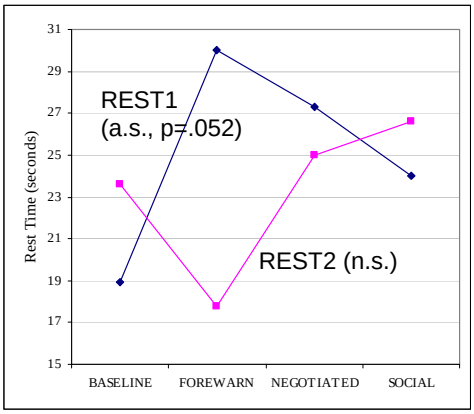
Rest Time

Results – Study 2
Self-report Measures



N=16

Results – Study 2
Behavioral



Rest Time

Field Studies

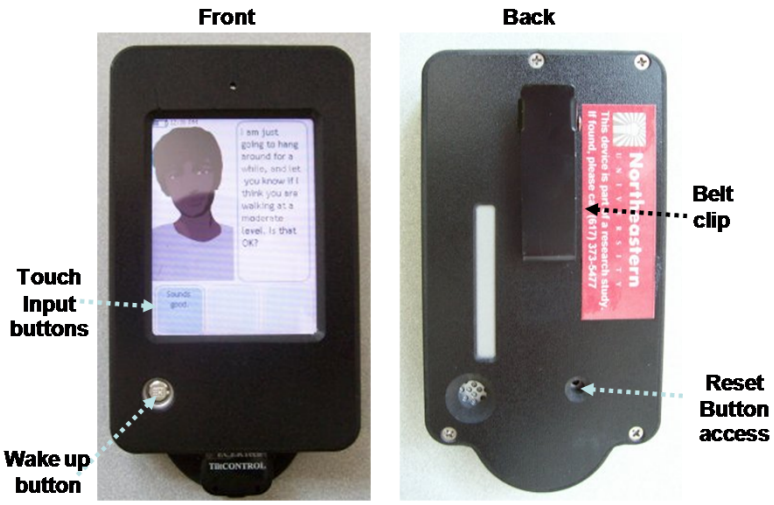


Figure 1. Mobile Advisor Platform

Development Tools

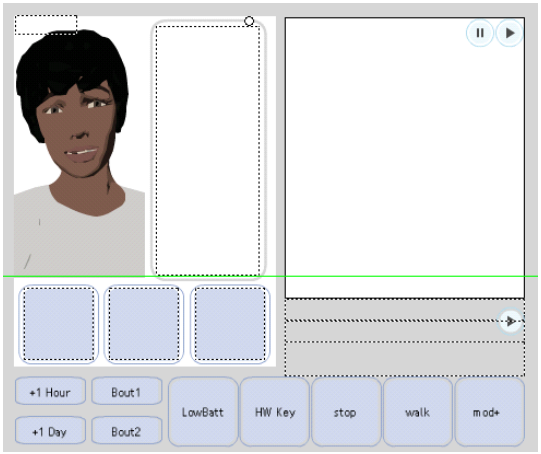


Figure 4. PDA Simulator

Context-awareness Study

- Compared automatic sensing of walking to explicit user signaling of walk start & end.
- Eight subject, 2-treatment (4day ea), within-subjects design.
- Results:
  - Awareness led to greater social bonding, but less walking.
  - Likely due to low perceived reliability & effective commitment of walk signaling.

Wearable Agent Field Study

- Primary hypothesis: real-time intervention more effective than retrospective.
- 5-week, 5-treatment within-subjects design
  - Commit to 2 times/day to walk
  - Cueing
  - Cueing+JIT Counseling Agent
  - Cueing+JIT Counseling TEXT
  - Cueing+End-of-day Counseling Agent
- 100 free-living, sedentary adults

System State Diagram

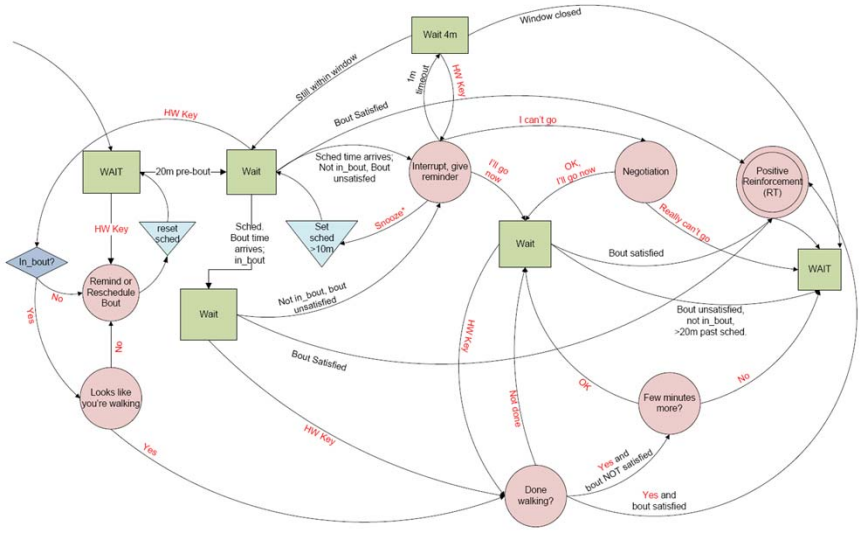
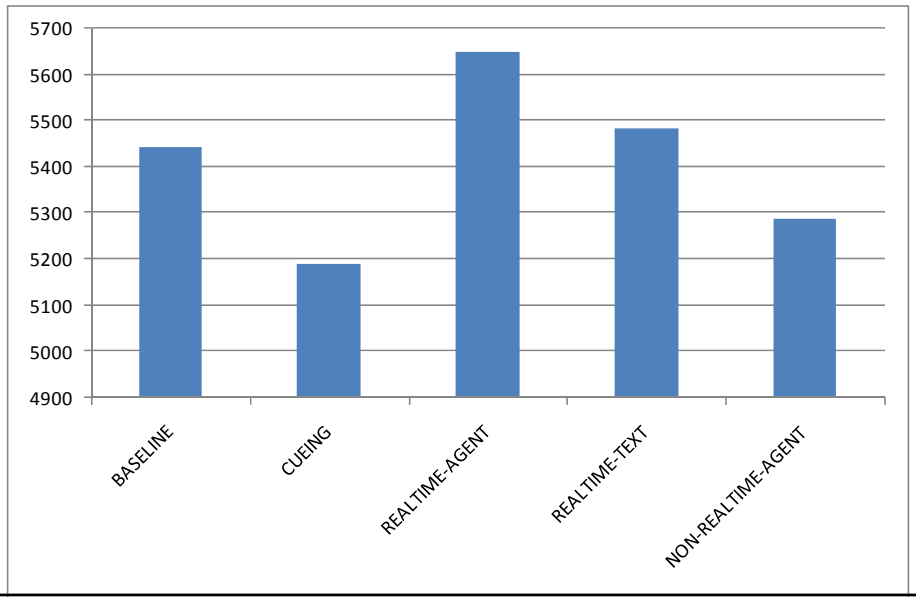


Figure 6. PDA Exercise Intervention State Diagram

Results – steps/day



Conclusion

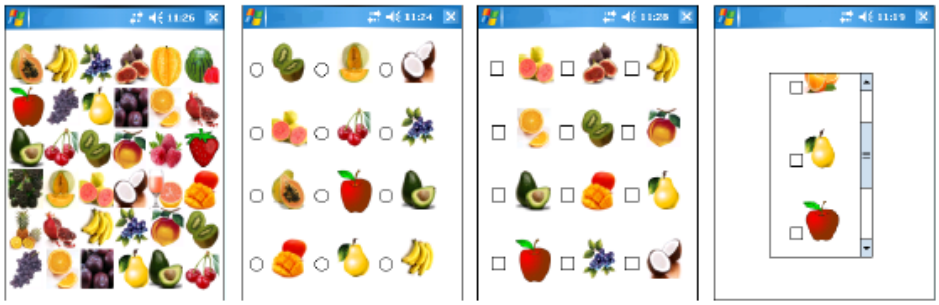
- Social and Relational competencies are important in automated health counselors.
- Significant opportunities exist in making automated counselors that are wearable, sense the user's environment, and are able to maintain an on-going relationship.

Research Papers

- Mobile Interface Design for Low-Literacy Populations
- Multi-Layered Interfaces to Improve Older Adults' Initial Learnability of Mobile Applications

- Kind of study?
- Methodology?
- Main findings?

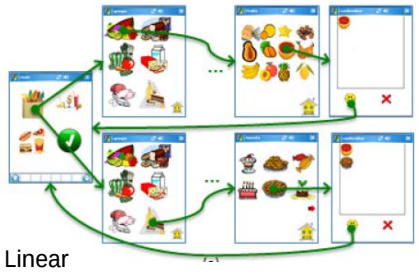
Mobile Interface Design for Low-Literacy Populations



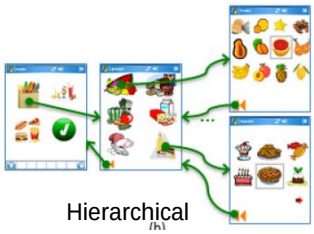
Study 1 – which widget is best?

- Icon vs. Radio Button vs. Checkbox vs. Scrollbar x 3 sizes
- N=17, all below 9th grade reading (REALM)
- Within subjects
- Results
  - Radio buttons best (performance & pref)
  - Large widgets best (performance & pref)

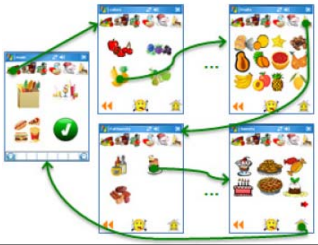
Study 2 – which navigation structure is best?



Linear



Hierarchical



Cross-linked

Study 2 – which navigation structure is best?

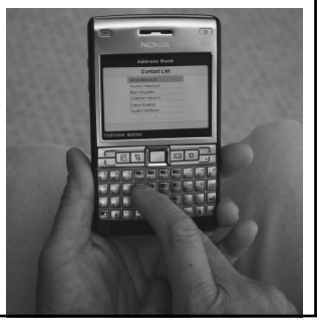
- N=19, low lit
- Users first trained on each interface
- Task = selecting a set of food items

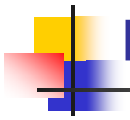
- Results:
  - Linear is best (most tasks completed, most completed without error, recovered faster)
  - But – preferred cross-linked
  - Depth of 5, breadth 5-10 best (fewest errors)
  - Always provide BACK and HOME buttons

Multi-Layered Interfaces to Improve Older Adults' Initial Learnability of Mobile Applications

- "gray digital divide"
- Mobile devices require greater working memory (small UI, overloaded controls), which declines with age.
- Multi-Layered interface
  - "Training Wheels" aka scaffolding
  - Simplified interfaces decrease working memory load
  - May reduce abandonment of device

- N=16 older (65-81), 16 younger (21-36)
- Between subjects, stratified by age
  - ML: first master simple, then complex
  - Control: first master complex



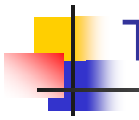


Results

- ML simple could be learned in fewer steps
- ML simple resulted in better retention
- ML simple->ML complex resulted in lower efficiency (steps and time)
- ML simple help elders more than younger users to master ML simple
- Elders rated ML simpler than control
- Methodological error?

Summary

- Why are mobile interfaces for low literacy and elder users important?
- Are these two studies necessarily about mobile interfaces?



To do

- Finish final report & 10 min presentation (next class)
  - **Problem**. (1 min) What user problem are you trying to solve? Who are the users? What are their tasks?
  - **Demonstration**. (2 min) Demonstrate your design and implementation via a live demo of your system, working through one sample task. Discuss major design decisions. Run on YOUR computer to minimize compatibility issues. You should test with the projector before class starts.
  - **Evaluation**. (4 min) Discuss the major findings from all three of your user evaluations (paper prototyping, heuristic evaluation, and user testing).