Class 4 EMTM 608

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Roadmap

- Logbook
- Finish last lecture
- User Interface Evaluation
- Simplicity
- Multimedia Interfaces
- Documentation & Training
- Projects
- Current readings: Chapters 20-27 in Stone et.al., Nardi 6 & 7, finish Maeda
- Readings next class: Stone, et.al., Chapters 28-29; Finish Nardi
Log Book: EcoPsychology

- Reduce, Reuse, Recycle, Rethink
  Thimbleby(2007)
- Design for dismantling, recycling, upgrading, reconditioning, durability
- Design Flexible interfaces
- Consider Whole life-cycle energy costs
Log Book-2

- [http://www.aarp.org/olderwiserwired/](http://www.aarp.org/olderwiserwired/)
- Your turn

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<th>Census</th>
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Generations Online 2010: Summary of Findings

The following chart shows the popularity of internet activities among internet users in each generation.

Survey dates vary—for details, see the Methodology section at the end of the report.

Source: Pew Internet surveys.

Usability Conference

- Older, Wiser, Wired: Designing for Adults over 50 (PPT, 117k)
- Human Factors and the Aware Home (PPT, 6.7mb)
- Connecting Technology and Older Adults (PPT, 6.8mb)
- Caregiving and Technology (PPT, 357k)
- Innovation vs. Research: Getting to the Market (PPT, 867k)
- Designing e-learning material for mature employees: Blending Innovation in Business and Technology (PPT, 3.4mb)
- The Business of Design (PPT, 2.7mb)
- Technology and Older Adults: Evolution, Myths and Revolution (PPT, 2.2mb)
- Making the Web Accessible to All Users (PDF, 1.35mb)
- The Politics of Design (PDF, 727k)
- Demographic Differences in Preferred Web Content (PDF, 195k)
- Freehand Interactive Design Offhand (F.I.D.O.): A New Methodology for Participatory Design (PDF, 1.1mb)
- Older Adults and Web Usability: Is Web Experience the Same as Web Expertise? (PDF, 197k)
- Web Usability and Age: How Design Changes Can Improve Performance (PDF, 414k)
- Making Federal Online Services Usable (PPT, 912k)
Current State

- Select team, topic, Target E’s
- HCI development report
- Industry + questionnaire + ? data -> persona
- Begin first pass design – “eat your own dog food”
- Do PAR review of design – part of iteration
- Begin analysis plan (E related) for first user study
  - Begin to design and build prototype
  - Evaluate early design iterations
  - Begin to develop documentation and training (if necessary)
## Interaction Styles

<table>
<thead>
<tr>
<th>Style</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Manipulation</td>
<td>Visually presents task concepts, easy learning, easy retention, avoids errors, encourages exploration, high subjective satisfaction</td>
<td>Hard to develop, requires graphics display &amp; pointing device</td>
</tr>
<tr>
<td>Menu Selection</td>
<td>Shortens learning, reduces keystrokes, structures decision making, can use dialog management tools, easy support of error handling</td>
<td>Danger of many menus, slows frequent users, consumes screen space, requires rapid display rate</td>
</tr>
<tr>
<td>Form Completion</td>
<td>Simple data entry, modest training, convenient assistance, use of form management tools</td>
<td>Consumes screen space</td>
</tr>
<tr>
<td>Command Language</td>
<td>Flexible, power users, user initiative, creation of macros (customizing)</td>
<td>Poor error handling, long training, memorization</td>
</tr>
<tr>
<td>Natural Language aka Anthropomorphic</td>
<td>Relieves burden of learning syntax</td>
<td>Clarification dialog, more keystrokes, contest is hard, unpredictable</td>
</tr>
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In Summary: DM Definition

• Visual representation of the world of action, objects and actions are shown, analogical reasoning is tapped
• Rapid, incremental and reversible actions
• Replacement of typing with pointing and selecting
• Immediate visibility of results of actions
In Summary: Benefits Over Commands

• Control/display compatibility
• Less syntax reduces error rates
• Errors are more preventable
• Faster learning and higher retention
• Encourages exploration
• Games, social spaces, remote control
Norman on Exploration

- Explorable systems are easier to learn and use, encourages the users to experiment and learn the possibilities.
- Three requirements for explorable systems:
  - In each state of the system the user must readily see and be able to do the allowable action (sound familiar).
  - The effect of each action must be both visible and easy to interpret.
  - **Actions should be without cost.** When an action has an undesirable result, it must be readily reversible or the action should be difficult to do, nonexplorable. However most actions should be cost-free, explorable, discoverable.
- The point cannot be over stressed: make the computer system invisible.
In Summary: DM Concerns

- Increased system resources
- Some actions may be cumbersome
- Macro techniques are often weak
- History and other tracing may be more difficult (replays)
- Visually impaired users may have more difficulty
- You will see more of it – Wii and now Kinect are groundbreaking
Menus, Form Completion, Dialog Boxes

- Our everyday world on the web
  - Information Architecture
- Many issues worthy of experimentation:
  - Depth versus breadth - studies support it
  - Frequency, recency, positional constancy (graying for focus)
    - Serial position curves
    - But beware of vertical scrolling – changes what is recent
  - Possibly adapt menu design to cohorts - task analysis
    - Card sorting
  - Position markers in long interactions to provide information on where you are and the ability to move backwards

Graph from http://en.wikipedia.org/wiki/Serial_position_effect
Form Completion Guidelines

- Meaningful title
- Comprehensible instructions
- Logical grouping and sequencing of fields
- Visually appealing layout of forms
- Familiar field labels
  - Consistent, standardized terminology, abbreviations
- Convenient cursor movement
- Error correction for fields
- Error prevention
- Error messages for unacceptable values
- Marking of optional fields***
- Explanatory messages for fields (esp)
- Completion signal and % done
Dialog Box Guidelines

• Internal Layout
  – Meaningful title, **consistent** style
  – Top left to bottom right sequencing
  – Clustering and emphasis
  – Consistency in layout, terminology, appearance
  – Standard buttons (ok, cancel)

• External Relationships
  – Smooth appearance and disappearance
  – Distinguishable but not overpowering boundary
  – Easy to make disappear
  – No overlap of required items (pop-ups)
  – Clear how to complete cancel (e.g., focus)
Information Appliance Issues

• Account for target domain (and users)
  – the dogbone
• Dedicated devices mean dedicated user interfaces
• Allocate functions appropriately, consider usage frequency and importance
• Simplify, focus on important functions, relegate others to platforms
• Design for responsiveness, plan for interruptions, provide continuous feedback
• IUIs are useful
• Safety
Command and Natural Languages

• Language Design Goals
  – Precision
  – Compactness
  – Ease in reading and writing
  – Completeness
  – Speed in learning
  – Simplicity to reduce errors
  – Ease of retention over time
High level goals:
- Close correspondence between reality and notation
- Convenience in carrying out manipulations relevant to users’ tasks
- Compatibility with existing notations (regular expressions)
- Flexibility to accommodate novice and expert users
- Expressiveness to encourage creativity
- Visual appeal
CNL-3

• Constraints on Language
  – Capacity for humans to record notation
  – Match between recording and display media
  – Convenience in expressing (including speech)
Unix Gems

- ls -f *.doc
- grep vesonder *.txt > namefiles
- cat datafile | uniq -c | sort > counts
- rm *
- enscript -2rgh $*
- man rm
Command Language Guidelines

- Create explicit model of objects and actions
- Choose meaningful, specific, distinctive names
- Try to achieve hierarchical structure
- Provide consistent structure (hierarchy, argument order, action-object pairs)
- Support consistent abbreviation rules (prefer truncation to one letter)
- Offer frequent users the ability to create macros
- Consider menus on high speed displays
- Limit the number of commands and ways to accomplish the task (anti-PERL)
- Provide history and command line editing
In the Beginning was the Command Line

Anthropomorphic

- A resource sink but
  - IVR, database query, intermittent users
- Human/human interaction is not necessarily an appropriate model for HCI
- Habitability issue - how users can know what objects and interactions are appropriate
- Use in IVR, e.g., HMIHY
- Expanding to gesture recognition, facial expressions, eye movements - even a mailing list on artificial emotion
Thought Problems

• Experience with Natural Language systems, translators, TTS, ASR, ...
• Experience with gesture recognition, facial expression, eye movements, artificial emotion
• Enjoyable or annoying?
• Adventure games
• *bots/agents
Errors

- Simply, design for errors, they will happen
  - UNDO!
- Things not covered, as Parnas would call them, are Undesired Events
- Norman Types of errors
  - Slips resulting from automatic behavior
  - Mistakes resulting from conscious deliberation
UE - Undesired Events

• Basis for exception handling
• Always aspects of a program’s execution environment that do not behave as we wish - if you will, defensive programming
  – Arises from the “normal” behavior of the real world
• Goal is to anticipate what can go wrong and make (the possibility for) accommodations in advance that do not mess with the structure
• Basis for variants of throw and catch

Not only for computers...
Slips

- Intend to do one action and discover you are doing another
- Psychology of everyday errors
  - Some slips may have darker meanings (Freud)
  - Most slips can be accounted for by simple things
- Slips result from lack of attention - folks can only concentrate on one thing at a time
- Examples of slips ...
Capture Errors

• A frequent activity takes charge instead of the one intended
• Two different action sequences have their initial stages in common, with one being unfamiliar (or more recent) and the other being well practiced
• Driving to work on Sunday
• Your examples?
Description Errors

- The intended action has much in common with others that are possible
- Internal description of intention was not sufficiently precise
- Correct action on wrong object
- User experienced and well practiced but not paying attention
- Orange juice into a coffee cup
- Yours?
Data-Driven Errors

• Automatic actions are data-driven triggered by arrival of sensory data
• Hearing score of game while dialing number and dialing score instead
• Yours?
Associative Activation Errors

- Internal thoughts and associations can trigger actions
- Freudian slips -- you think something that ought not to be said but you say it
- Yours?
Loss-of-Activation Errors

- Forgetting to do something or forgetting part of the act
- Activation of the goals has decayed
- Too numerous to state just one -- common walking from my office to the lab (50 yds)
  - Increases with age
- Yours?
Mode Errors

- Devices have more than one mode and actions appropriate for one are not for the other
- Especially when controls must do double duty and device does not make mode visible
- Digital watch (gulp! Automatic pilots)
- Yours?
Yet Another View of Errors
Thimbleby

- User may slip and randomly fall off path
- User does things in wrong order
- User misses steps but does sort of right things (on the wrong path)
- Miss some initial steps – preparation, but then proceed on right path
- They may quit before end of path, acting as if finished – completion errors (writing to file)
- They may follow a correct path for a different task – everything looks smooth, could be transfer error
- If two paths start same way they may go down the preferred, more frequent path – they start out doing what they meant, but … capture error
- Users may not stop when they have otherwise completed task – overrun errors

We want to reduce an error’s persistence once it is made!
Detecting/Preventing Slips

• Discrepancy between goal and result - requires feedback

• Issue actions can be specified at many levels and you have to provide feedback at appropriate level
  – Makes error correction difficult - wrong car syndrome

• Error correction mechanism usually starts at lowest level possible and works its way up the chain
More Slip Prevention

• Mode errors are minimized by minimizing modes - Doh!
  – Or at least making them visible
• Confirmation before a command is executed is cool but ill-timed, user still usually content with choice, confirming action not, for example, the file name or pattern to be deleted
• Gaining attention or reducing attention demands!
Mistake Heuristics

- *Seldom does a major accident occur without numerous errors*
- Social pressure is a factor in many accidents
- Try forcing functions - Atari game example
  - A form of physical constraint
  - In safety engineering known as interlocks, lockins, lockouts
- Warning signals are usually not the answer -- they can go off in error and are often subverted
Designing for Error

- Understand the causes of error and design to minimize those causes
- Make it possible to reverse actions or make it harder to do what cannot be reversed
- Make it easier to discover the errors that do occur, and make it easier to correct them
- Change the attitude toward errors, folks are getting there by imperfect approximations
- When someone makes an error there is usually a good reason - record it, logging is critical
Knowing What To Do

• Working simple devices often give us the most difficulty
  – A door should not have an instruction manual, even if it is only one word! BMW gas cap - door that opens outward by pushing inward

• Should give signals:
  – The natural constraints on objects
  – The affordances of objects - messages about their actual use and function
Everyday Constraint Classification

- Physical constraints - good auto keys work regardless or orientation
- Semantic constraints - the meaning of the situation, how the rider should sit on the LEGO toy - our everyday knowledge
- Cultural constraints - frames/schemas/scripts -- a set of allowable actions (and order) for social situations
- Logical constraints - only piece left, goes in only open slot
More Assistance

• (for knowing what to do)
• Mappings should be logical and convey some isomorphism - Norman’s light switch scheme
• Visibility make relevant parts visible
  – Making visible the invisible
  – Visual feedback- a good visual display, e.g., phones
  – Sound enhances visibility (clogged vacuum cleaner)
• Feedback - give each action an immediate and obvious effect
• Now to some theory
Thought Problems

- Your favorite error message here
  - an error has occurred - can we send a copy to X, developer centric to the core!

And all of this discussion about errors leads to more Consideration of design
Design

- Time is the devil -- the force that works against evolutionary design
- The curse of individuality -- marking behavior
- Phone & typewriter
- Do not permit focus on cost, durability aesthetics get in the way of usability and understanding (right!)
Why Designers Go Astray

- Aesthetics first – room numbers at Babbio Center - Stevens
- Designers are not typical users
- Designers clients (aka stakeholders) may not be users
- There is no such thing as the average person
  - Make everything adjustable
  - Designing with our future selves in mind -BBs
- The problem of focus, selective attention, squeaky wheel- problem case
Designer’s Daily Temptations

- Creeping featurism
- Worshipping false images
  - Both designer and user are tempted to worship complexity, Maeda on white space (and sometimes inappropriate metaphors)
  - Component interaction (see Parnas again)
How to Design HCI Wrong

- Make things invisible (different from the invisibility of the tool)
  - Widen gulf of execution - no hints to the operations expected
  - Establish the gulf of evaluation: no feedback, the tyranny of the blank screen
- Be inconsistent, change the rules
- Make operations unintelligible use idiosyncratic language or abbreviations, uninformative error messages
- Be impolite - treat errors rudely
- Make operations dangerous rm *.* at / and unrecoverable

And this suggests a simpler approach
LoS

- Reduce
- Organize
- Time
- Learn
- Difference
- Context

- EMOTION
- TRUST
- FAILURE
- The one
  - Away
  - Open
  - Power
EMOTION

• MORE!
• Simplicity looks cheap
  – Individual differences
• “Form follows function and feeling follows form!”
• Email and :-) -> 😊
• Blinging (marking) nude electronics
  – Protection - enlarge or protect simple surfaces
http://www.decalgirl.com

nvouspc.com

http://www.letscrystalit.com/

alienware.com
EMOTION 2

• Animism, anthropomorphism - naming of cars, computers (Shintoism & Miyazaki)

http://movies.lovetoknow.com/wiki/Fantasia

imdb.com
Emotion - 3

• “Perhaps this is the fundamental distinction between pure art and pure design. While great art makes you wonder, great design makes things clear.”

• “Achieving clarity isn’t difficult. ... The true challenge is achieving comfort.”

• ROE - Return on Emotion
TRUST

• The best interface is none
  – TiVo Suggestions
  – Social filtering
  – Expert filtering - chef’s discretion

• The power of undo

• The fear of “trust me” - trust but verify :-)!
  opps that was EMOTION!
HOW MUCH DO YOU NEED TO KNOW ABOUT A SYSTEM?

HOW MUCH DOES THE SYSTEM KNOW ABOUT YOU?
FAILURE

- ROF - return on failure - even when you fail to simplify, you learn — value to the journey
Ten – The One

- **Away**: More appears like less by simply moving it far, far away
- **Open**: Openness simplifies complexity
- **Power**: Use less, gain more
  - Axiom of Design: More constraints, better solutions are revealed
What’s on your shelf?
Simplicity is about subtracting the obvious and adding the meaningful

Now back to regularly scheduled programming
Multimedia Interfaces
(Moogridge)

• Often about affordances
  – Objects that are self evident, when you see an object it reminds
    you of what it does
    • How interfaces convey information about what you can do with
      them
    – Surfaces for walking, tools for manipulating
    – “perceivable possibilities for action”.
  • Blurring the line between real and simulated
    – Tangible user interface – the sonic finder (size scraping, copying)
  • “sound conveys mostly information about the source”
Interface being a physical environment rather than a command based, conversational metaphor
Multimedia Interfaces

- Actually Ubiquitous Interfaces!
  - Recoverable paper
  - Context aware computing
  - Ubiquitous computing
  - Cyborg, Me++, Thad Starner
  - When things begin to think

- Psychology - learning enhanced, multiple traces, active learning, availability accessibility distinction

- Back to basics - aspects of multimedia

- Augmented Reality
Pointing Devices

- (Keyboard types, chording may have renewed life - cell phones & size)
- Pointing tasks: select, position, orient, path, quantify and text (move)
- Direct control (touch screen or stylus) versus indirect control -- away from screen (mouse and the rest)
- Novel: foot controls, eye/hand tracking (Minority Report), data gloves, digital paper, both hands
Pointing Device Success Criteria

- Speed and accuracy
- Efficacy for task (size of “target”)  
- Learning time
- Cost and reliability
- Size and weight
- (environmental issues)
Pointing Devices - Heuristics

- Touch screens and trackball are durable and easy - kiosks
- Mouse rules - was controversial in early days
- Pens for drawing/handwriting
- Joysticks - games/navigation
- Indirect requires more learning
- Fitts Law, model of human hand movement - time for hand movement dependent on distance moved, $D$, and target size, $W$. Doubling distance is longer, but not twice as long and increasing the size of target makes pointing easier
  $MT = a + b \log_2(D/W+1)$, $MT =$ movement time, $a =$ start/stop time of device, $b =$ device speed. There are variants
Speech and Auditory Interfaces

• “Speech is the bicycle of user-interface design: It is great fun to use and has an important role, but it can carry only a light load.” (Schneiderman)

• HMIHY

• Watson

• AT&T Natural Voices
  – Canned speech
Use Speech When

- Lightweight interface (speaker independent, but ...)
- Speaker’s hands are busy
- Mobility
- Eyes occupied
- Too uncomfortable to use keyboard
Displays

- Portability, privacy, saliency (attract attention), ubiquity, simultaneity (# of users)
- Size, resolution, palette, luminance/contrast/glare, POWER, refresh rates (animation video), cost & reliability
Other Reproduction

- Electronic ink
- 3D printers

Some New “Realities”

- Virtual Reality
- Augmented Reality
- Diminished Reality

http://peaks.augmented-outdoors.com/
Wearable Computing
Holistic Interaction

• As wireless networks pervade our environment and
• Computing becomes smaller and more integrated and
• Our roles become more information centric, as does our existence
• Suddenly computing becomes ubiquitous and essential
• Especially pertinent in our environment
• (Maxwell 2002)
Stage 1: Basic Usability

- (think CMM)
- Support for needs such as ease of use, ease of learning, error protection, graceful error recovery and performance
- Use of the 5 types of interfaces dominated this stage
Stage 2: Collaborative, Organizational and Role Based

- Sociological, organizational and cultural impact of computing
- Role HCI plays in organizations and transactions among folks
- View in strategic and organizational terms rather than technological terms
- Interaction with regard to user roles - also simplifies security - Role Based Access Control
- Use of roles efficient because it reduces need for the individual user
  - constraining
Stage 3: Individualized and Holistic

- Future is “ubiquitous, invisible, embedded, tangible, virtual, active, interactive, integrated, interconnected, interoperable and mobile.”
  - Agents
  - Bodies blended with devices
  - Computers blend into roles and products, not a distinct entity
  - Disappears into environment
Holistic Interaction

- Significant aspects of the environment will consist of information technologies
  - Computing world will be more tightly integrated with physical world
- Holistic interaction - address living in this augmented world
- Needs, goals and lifestyle
  - Machine coaching
  - Design of habitat as opposed to mechanism: electronic + physical habitat
- Information Interaction Counselors
RFIDs

- IFF
- EZPass
- WalMart (pharmaceuticals)
- Department of Defense
- Use foil, honest
- Subdermal RFIDs
- Express credit cards
- Intelligent car keys
- No easy way to activate/deactivate
- More in your future!

Picture credit: http://people.csail.mit.edu/rahimi/helmet/
RFID Gen2

- 96 bits of memory
- 2-3 times smaller
- Reader “kill” capability
- Cheaper
- Less interference
- Read rate 10x faster
Smart Dust

- (lots of other devices in the book)
- Computer atop a battery (limits: power and range, related)
- Commercialized - www.dustnetworks.com
- Software support - TinyOS

Initial source: http://robotics.eecs.berkeley.edu/~pister/SmartDust/
Ubiquitous Computing

http://www.cl.cam.ac.uk/research/dtg/attarchive/spirit/
Intelligent User Interfaces

• (balancing Shneiderman, much from panel report listed in references)
• It is all about content -- the task being done jointly by user and system and data being manipulated -- variant of Expert System philosophy, in fact ES is an intelligent user interface!
• Practice: Simpler techniques may rule, stick to basis of UI design and then supplement with simple rules and control heuristics, pattern matching, similarity metrics (DWIM) and search
IUI-2

- Exploratory: learning usage patterns, dealing with complex situations, adapting to the user -- understanding user’s goals and activating a plan to accomplish them
  - Requires an understanding of context, especially to initiate an effective dialogue
Issues with IUI (Kurlander)

- IUI’s make mistakes and cost of verifying is expensive
- AI techniques are often slow, therefore users may perceive the interface as unresponsive
- Users need a clear mental model of how the computer responds to input and sometimes intelligence clouds that model
- Users want an explanation of what has been done
- (Users want control)
Key IUI Heuristics

- Simple
- Do it all or suggest rather than act (agent)
- Operate in real time
- Watch what the user is doing
- Address the IUI within the context of the rest of the product NOT in isolation
  - Not how much AI, but what works to make a better product
- Remembering yet again ...
Design of the Home Info Center

• You have been hired as the Information Interaction Counselor for a Google executive and his family of four children aged 8 months to 20 years.

• How do you begin?

And when all of this is insufficient …
User Documentation

• “Clean documentation cannot improve messy systems”
• Many users learn from other users who know the interface - **keystone species**
  – But this unfortunately is changing 😞
• Good documentation is intention/task oriented
• Documenter is your first user!
• Traditional paper forms: installation manual, getting started notes, introductory tutorial, thorough tutorial, detailed reference manual, quick reference card, conversion manual, roadmap
User Documentation - 2

- Online help: manual, help, context sensitive help, tutorial animated demonstration, guides (animated or real)
- FAQs
- Online communities and variants
  - PHOAKS, collaborative filtering
Criteria for Effective Documentation

• In order of priority:
  – Availability - does it exist?
  – Suitability - is it focused on the intentions and tasks of the users?
  – Accessibility - can you find what you need?
  – Readability - is it easy to understand?
# User Documentation - 3

<table>
<thead>
<tr>
<th>User's Goal</th>
<th>Paper</th>
<th>Online</th>
</tr>
</thead>
<tbody>
<tr>
<td>buy</td>
<td>Sales brochure, fact sheet</td>
<td>Animated demonstration, *</td>
</tr>
<tr>
<td>learn</td>
<td>Tutorial</td>
<td>Manual, tutorial, guide, animated demo</td>
</tr>
<tr>
<td>use</td>
<td>User manual</td>
<td>Manual, help, context-sensitive help</td>
</tr>
<tr>
<td>solve</td>
<td>FAQ</td>
<td>Help, FAQ, online community</td>
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</tbody>
</table>

LBGUPS = Learn + Buy + Get + Use + Pay + Service
User Documentation Issues

• Reading on screen is slower than text -- proofreading task 15 to 30% slower
  – Generational, check out your local community printer
  – Displays versus photos of displays were equal - but be careful.
  – Key may be resolution and LCDs
• Plasticity of documents - device independence and dynamic documentation are requirements
• Active User Paradox - too busy to learn, skills remain mediocre
• “people are incredibly creative in generating errors and misconceptions” Schneiderman
User Manual Guidelines

• Choose an action oriented approach: get to doing, numerous examples, verbs, ...
• User’s tasks guide the organization of the documentation
• Support error recognition and recovery
• Support reading to do, study and locate
  – Brief, don’t be exhaustive
  – Easy access - table of contents, index, glossary, job aids
  – **Clean, simple writing style: Elements of Style**
  – Closure of each chapter -- a complete lesson
  – Examples
  – Replace prose with structured text: step action table, decision tree, decision table

• **Test it for usability!**
Online Manual and Help Guidelines

• Easy accessibility and return
• Specific and procedural help -- How to do’s
• Collect data -- proto help and manuals
• User control of help system (and customizability)
• Avoid as much as possible being on the web, there is enough disk these days
• Tune help to user type
• Not a panacea for poor user interface design
• Test it for usability!
Cospace
Document Development Process

• Start early
• Manager involved (first user)
• Seek professional writers and creatives interplay with engineer
  – Increasingly refined information from engineer until document emerges
• Review drafts thoroughly
• Field test
• Feedback mechanism
• Maintain currency and readability
• Roadmaps - documents for the documents!

And to find what is appropriate…
Search

• Google
• Availability - Accessibility Distinction
• Vetted sources
• Information gathering, seeking, filtering, collaboration

• Information Architecture Helps
UIs for search

• Formulation - expressing the search
• Initiation of action - launching the search
• Review of results: reading messages and outcomes
• Refinement: formulating the next step
  – Implicit initiation
• Use: compiling or disseminating insight (save and forward)

let’s see how well we did …
Evaluation

- Have a plan considering: what stage is design, is it well defined or exploratory, expected user population (type and number), risk of interface (furby vs nuclear power plant), budget (time, cash, resources), experience of design and evaluation team

- Expectation is that there is ongoing evaluation throughout the lifecycle of the interface, things do change!
Wide Range of Choices

- Real life vs. simulation
- Actual users .......... User reps/experts
- Actual tasks .......... Task descriptions
- Real environment .. Controlled environment
- Users with domain knowledge ..... Users w/o domain knowledge
- Usability checkers: W3C to commercial
- ... the profile
Usability Evaluation Techniques

Adapted from Stone, et.al.
Usability Eval Process

Adapted from Stone, et.al.
Success Criteria, 5E’s
(rational weighting)

Error Tolerant

Effective

Engaging

Easy to Learn

Efficient

Really Critical!

$100
Expert reviews

- Start with colleagues or customers
- Move on to experts (application and interface)
  - Both can be hired
8 Golden Rules - Redux

- Strive for consistency
- Cater to universal usability and design for change
- Offer informative feedback
- Design dialogue to yield closure (beginning, middle and end)
- Prevent errors
- Permit easy reversal of actions
- Support internal locus of control - user is in charge
- Reduce short term memory load
Expert Review Types

- Heuristic evaluation
- Guidelines review - organizational guidelines
- Consistency inspection
- Cognitive walkthrough -- walk through task, wizard of oz prototyping (regular users too)
- Formal usability inspection - courtroom like
Expert Review Goals

- Comprehensiveness (bird’s eye view)
- No comment too small, minutiae should be included
- Live total experience, training courses, ...
Usability Laboratories

- Can rent them
- Most corporations should have them - test their own products and products they use (few do)
- Lab + observation room (think aloud technique)
- Mall based surveys
- Portable Labs
Usability Tests

- Paper mockups
- **Discount usability testing** - Q&D, 3 to 6 folks, early in design
- Competitive usability testing - A vs B
- Universal usability testing - Microsoft beta
- Field tests and portable labs - key
- Remote usability testing send stuff - phone interviews and web surveys
- Can you break this-**managers**
- Issue: first time usage and limited coverage of features, should be supplemented by expert review
Usability Tests

• Who? (peers early, "real" users, alone, pairs, teams)
  – 5+1(spare)
  – Incentives
  – Screening (profile)

• How?
  – Pre approval, ethics, legal details (non-disclosure, ...)
  – Scripted - read to participant (minimize exogenous variables)
  – Schedule (time between)
  – Task cards
  – Roles (greeter, observer, facilitator(flight attendant), note taker, equipment operator, recruiter)
  – Post questionnaire/sessions
  – Evaluate quickly -- may forget details
Rosenthal Effect

- You can influence results, the act of observing, is a change of the normal situation
- Randomly selected children told teachers they did well in IQ test, sure enough, the next year ...
- Hawthorne effect
- My planaria experiment
- Milgram experiment -- effect of authority
- University of Iowa lab
Cognitive Walkthroughs Redux

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>How does the user know what to do next? Is correct action evident/recognized or does it have to be recalled?</td>
<td>Is there anything that tells you what to do next?</td>
</tr>
<tr>
<td>Will the user connect description of correct action with what she/he is trying to do?</td>
<td>Is a choice available that matches what you want to do? Which is it?</td>
</tr>
<tr>
<td>Does the systems response indicate whether user made wrong or right choice?</td>
<td>Now that you tried it, did it do what you expected?</td>
</tr>
</tbody>
</table>
Analysis

• (observe, compare, listen, measure)
• Data collection must be very systematic
  – Automatic collection of timings
  – Systematic: form based coding by observer, sampling, time slices (activity during)
• Coding scheme
  – Pre established rules (use prototypes)
• Verbal scoring scheme inter-rater reliability
• Statistical tests - descriptive, inferential
• Conclusions based on success criteria and analysis plan
• So much more ...
Acceptance Tests

- Go/No Go, need measurable criteria:
  - Time to learn specific functions
  - Speed of task performance
  - Error rate
  - User retention of commands over X interval
  - Subjective user satisfaction
  - Reliability

- Often adversarial
Lifecycle Evaluation

- Focus groups
- Logs
  - Usage frequency
  - Errors
  - Privacy
- If help desk, then logs and emerging problems
- Suggestion boxes of all types
- Discussion groups and news groups
- Periodic, explicit evaluation
We’re Talking Baseball
Psychological Research

- Deal with practical problem w/in theoretical framework
- State a lucid, testable hypothesis
- Identify independent variables to be manipulated
- Identify dependent variables to be measured
- Judiciously select participants and carefully or randomly assign participants to groups
- Control for biasing factors - or at least note them
- Apply statistical methods for data analysis (should have a plan)
- Resolve the problem (hopefully), refine theory and method, give advice on future work
Well-planned evaluations are driven by goals which aim to seek answers to clear questions ...
Determine the goals
Explore the questions
Choose the evaluation approach and methods
Identify the practical issues
Decide how to deal with the ethical issues
Evaluate, analyze, interpret and present ALL the data

And once you have analyzed, time to convince
Persuasion

• In general is the effort worth it and making an impact on specific products

• Use the results - analyze and interpret, not so easy when you stick a bit of usability at the end of the project (recall heads and tails)
  – Entails redesigning and rebuilding not simply receiving the results
Reporting the Results

- Get the developers involved!
  - Interpretation session - meet with developers
  - Highlights video
  - Snapshot reports, one pagers of ongoing work, each day, each week (becomes a part of the project) - avoids working in isolation
  - Reports and recommendations - details in appendices (same for presentations)
  - Attend their meetings
  - Recommendations for action - severity level of issues, e.g.,
    - Severity 1 - disaster dead in the water
    - Sev 2 - serious but workarounds
    - Sev 3 - cosmetic
Organizational Maturity

- (CMM for UI)
- Skepticism
  - Start small and practical
  - Find a champion (air cover)
  - Be an objective voice
  - Be a part of the team
- Curiosity
  - Savings: cost of staff time, computer time, training time, support and maintenance and change
  - PROFIT
- Acceptance
  - The system has to work first
  - Balance user expectations - danger of prototypes
  - Changes are easier/cheaper the more quickly they are incorporated in the process
- Partnership

Onto some theory ...
HCI Evolution

• “from human factors to human actors” - Bannon
  – Actors in social contexts
  – Activity centered

• Historical roots:
  – Behaviorism
  – Cognitive psychology
  – “post cognitive” psychology

• Related influence
  – Ethnomethodology - discover and document methods and commonsense knowledge of daily activities
  – Suchman - plans and situated actions - resources of the current situation shape action and people respond opportunistically to them
The Stimuli
(Kaptelinin & Nardi 2006)

• From a human interacting with a computer to:
  – Collaborative uses of technology by groups
  – Varied virtual and physical contexts
  – Expanded activities and explosive technologies
    • Though not the Singularity yet! (with apologies to Kurzweil)
  – Experience not just cognition

• Work is more distributed, less stable and is evolving as are the artifacts supporting it
Distributed Cognition

- Ed Hutchins, UCSD (Don Norman), in the 1980s
- Recall the view of Cognitive Psychology I provided for you in the first class - this standard view of cognitive psychology explains information processing at the level of an individual “... encompassed by the skin or skull of an individual.”
- However, when you observe humans in the wild:
Distributed Cognition

“...cognitive processes may be distributed across members of a social group, cognitive processes may be distributed in the sense that the operation of the cognitive system involves coordination between internal and external (material or environmental) structure, and processes may be distributed through time in such a way that the products of earlier events can transform the nature of later events.”

Hutchins(2000)
More Distributed Cognition

- Cognitive processes normally associated with an individual is associated with a group, with a society.
- Anthropology:Psychology::Epidemiology:Pathology
- Progress of science as an example of distributed cognition
- Cognitive properties of a group can differ from that of members of the group
- Massive departure from what I described in class 1, where I observed the skull/flesh boundary
- Norman echoes a portion of this - knowledge in the head, knowledge in the world
Studying Distributed Cognition

- Interaction as a source of novel structure, whole greater than sum of parts
  - Studied using ethnographic techniques
  - Phenomena arise from the interactions among individuals that could not be anticipated by studying individuals in isolation

- The Material Environment - representational media
  - Supports memory
  - Computational medium - calculator,...

- Distributing cognition in time
  - Simon’s ant on beach metaphor, trajectory tells us more about beach than ant
  - Humans enhance cognitive abilities by transforming environments
Activity Theory

- Study of mind should focus on analysis of the interaction between humans and the world
- Primacy of activity over the subject and the object
  - Activity is basic analytic unit (duh!)
  - HCI aspect is that it emphasizes studying real use and continuing human interaction with the world
  - Tools are artifacts mediating external activities
  - Technological and psychological tools affect things or affect themselves or others
- Social context
Information Processing -> Activity
(Kaptelinin & Nardi, p35)

<table>
<thead>
<tr>
<th></th>
<th>User-system Interaction</th>
<th>Subject-object Interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Context</td>
<td>Users and systems</td>
<td>Subjects in social world</td>
</tr>
<tr>
<td>Level of Analysis</td>
<td>System specific tasks</td>
<td>Meaningful goal-directed activities</td>
</tr>
<tr>
<td>Methods</td>
<td>Formal models, lab studies</td>
<td>Real life use studies</td>
</tr>
<tr>
<td>Time Span</td>
<td>limited</td>
<td>Developmental transformations</td>
</tr>
</tbody>
</table>
Information Ecologies

- Information ecology is a system of people, practices, values and technologies in a particular local environment.
- Emphasis on human activities served by the technology, not the technology
- Examples:
  - Hospital ICU
  - Kinko’s copy shop
  - Library
- Technologies are integrated into existing habits and practices
- Tools, people, practices
The Information Ecology

- Information ecology is a complex system of parts and relationships.
  - When one element is changed it can be traced throughout the system.
- It exhibits diversity
  - People and tools often have more than one role and roles can be combinations working together in a complementary way
  - It should be teeming with different kinds of people, ideas and technologies
  - Diverse ecologies are lively, human, intensely social places incorporating highly advanced technologies (charm)
The Information Ecology - 2

- Coevolution - healthy ecology is not static even in equilibrium (Developmental)
  - Evolve as new ideas, tools, activities and forms of expertise arise in them
  - Social and technical aspects coevolve
  - Persistent structure evolving over time with its own history
  - Stable participation of tightly knit groups and their tools and practices
The Information Ecology - 3

- Keystone species
  - Presence is crucial to the survival of the ecology
  - E.g., skilled people whose presence is necessary to support and encourage the technology, natural teachers
  - Mediators bridges across institutional and technical boundaries
• Locality
  – Names are adapted to identify what it means to the people (library computer = card catalog, information access)
  – Identity of computer changes because perceived role, utility and other properties change
  – The habitation is the technologies location within a network of relationships
  – Special knowledge of local ecologies that are practically inaccessible to others
Why Information Ecologies?

- Tunes you sensibilities in approaching the system
- Ecological breakdown is catastrophic and often irreversible
- Define or uncover local information technologies, truly frames issues
- May increase acceptance rather than resistance, engagement and participation in the user’s (our) ecologies
- And on to some examples of where we are heading ...
NCI Web Site Research

- 16 external reviewers equal number of web site developers and usability specialists
- Used modified delphi to adjust their scores
- 2003
- Ben Shneiderman, other HCI researchers
  - Education, Enforcement, Exemption, Enhancement
- Only listed items in each area that was listed as Extremely Important
The Results - 1

• Design Process and Evaluation:
  – Set and state goals of the web site
  – Use iterative design
  – Evaluate website before and after changes
  – Provide useful content

• Optimizing User Experience:
  – Display information in a format that does not require conversion
  – Do not display unsolicited windows or graphics
The Results - Section 508

• Requires Federal agencies to ensure that information technologies take into account the needs of ALL users:
  – http://www.section508.gov
  – http://www.w3.org/WAI
  – http://www.usability.gov

• Do not use color alone to convey information
The Results -3

- Hardware and Software:
  - Design for common browsers

- The Homepage
  - Create a positive first impression of your site
  - Ensure the homepage looks like a homepage
  - Present all major options on the homepage

- Navigation:
  - Provide feedback on the user’s location
The Results - 4

- Scrolling and paging:
  - Eliminate horizontal scrolling

- Headings, Titles and Labels:
  - Use clear category labels
  - Use unique and descriptive headings

- Links:
  - Provide consistent click-ability cues - no mine sweeping!

- Text Appearance:
  - Use black text on plain, high contrast background
  - Ensure visual consistency - location and size of pictures, title bar and font
The Results - 5

• Screen based controls (Widgets):
  – Distinguish required and optional data fields
  – Detect errors automatically
  – Minimize user data entry
  – Label data entry fields clearly
  – Place labels close to data entry fields

• Content Organization
  – Organize information clearly so that it shows a clear, logical structure to typical users - Information Architecture
  – Place critical information near the top of the website (above the page fold!)
The Results - 6

• Search:
  – Provide a search option on each page
  – Ensure usable search results - collect data, rate value (customer care sites)
  – Allow simple searches
Information Architecture Components (Morville & Rosenfeld, 2006)

• Organization Systems - how we categorize information (card sort)
• Labeling Systems - how we represent information
• Navigation Systems - how we browse or move through information
• Searching Systems - how we search information
Browsing Aids

- On the web users find their way through menus and links:
  - Organization systems - categorizing content, taxonomies, hierarchies
  - Site wide navigation - where they are (bread crumbs) and where they can go
  - Local navigation - where you can go within a portion of the site
  - Sitemaps/Table of Contents - condensed overview of the site
  - Site Indices - supplemental guides, e.g., alphabetized list of links to content
  - Site Guides - additional navigation to specialized information
  - Site wizards - lead user through sequential steps to help user link to desired content
  - Contextual navigation system - usually within text to link to specific content
Search Aids

- Support user-defined queries to present users with a specialized set of results - beyond hyper-texting
  - Search interface
  - Query language - advanced with boolean logic, ...
  - Query builders- help enhance above - spell checkers, stemming, ...
  - Retrieval algorithms - tune to get what user wants
  - Search zones - parts of sites to support narrow search
  - Search results - presentation of contented, sorted, ranked with perhaps ability to provide feedback
Content and Tasks

• You are there!
  – Headings
  – Embedded metadata - e.g., in a recipe information about ingredients, weights and measure transformation
  – Chunks - logical units of content, e.g., sections and chapters
  – Lists - share traits in common, perhaps ordered - the fact that they are listed provides additional information
  – Sequential aids - where you are in a process- a progress bar, step 3 of 6, ...
  – Identifiers: logo specifying which site, sub-site and breadcrumbs to pinpoint exact location
References

- [http://www.naturalvoices.att.com/0](http://www.naturalvoices.att.com/0)