CS 315 – Intro to Human Computer Interaction (HCI)
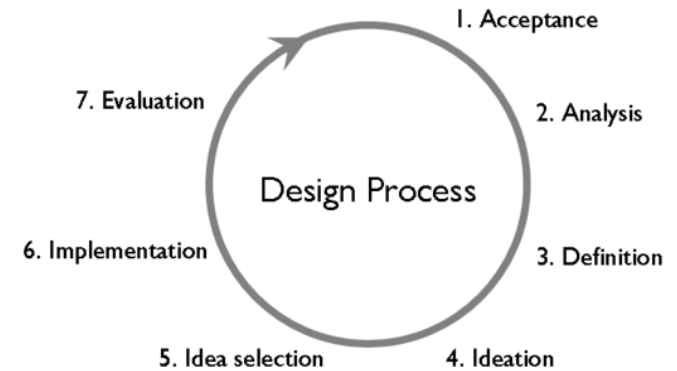
The Design Process [Koberg & Bagnall]

Design Process

1. Acceptance
2. Analysis
3. Definition
4. Ideation
5. Idea selection
6. Implementation
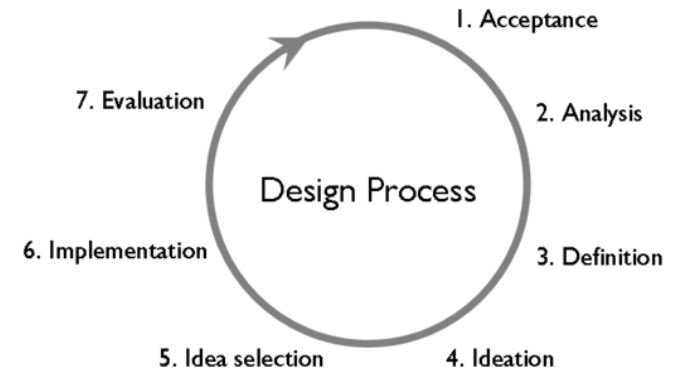7. Evaluation
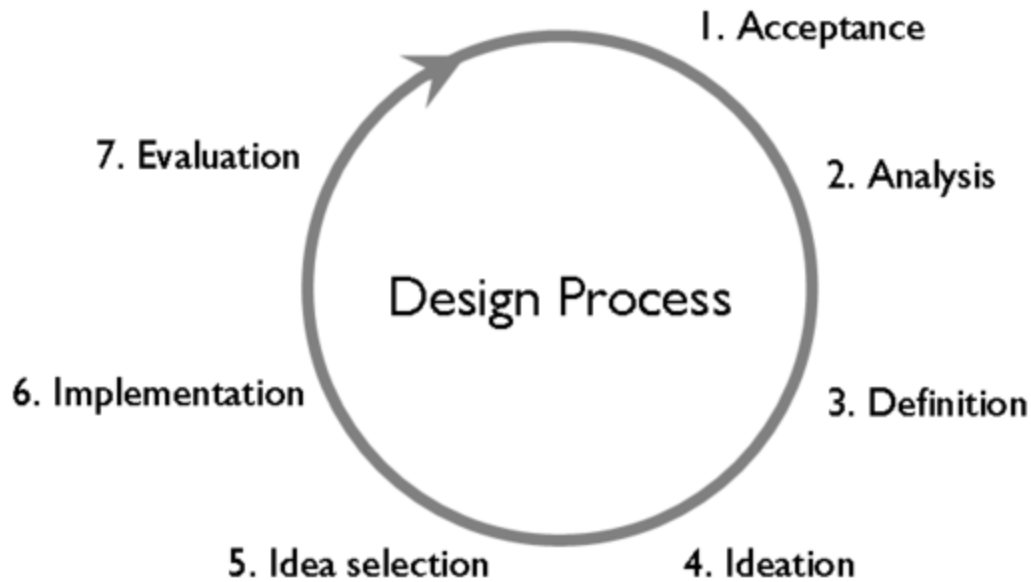
Acceptance

- Getting started
  - Because of a deadline
  - Because of possible reward
  - Because you are forced to
- Commitment
  - Time
  - Resources
  - Responsibility
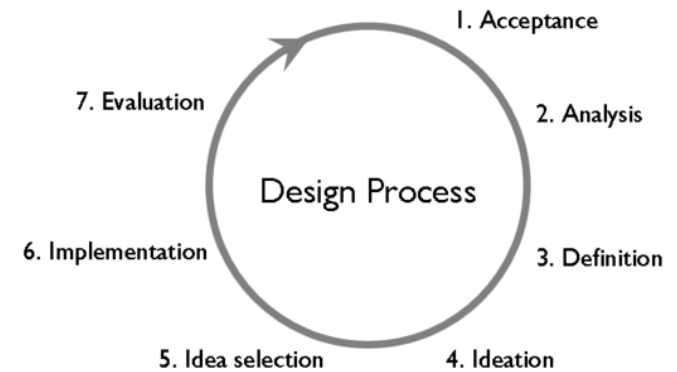- Key is to set motivation

Analysis

- Understand users and tasks
- Who are the users?
- What are their tasks?
- Observe and test, don't guess
- Tools
  - Notebook
  - Tape recorder
 - Camera
  - Video camera

Definition

- Focus on the problem
  - □ Choose appropriate level of detail
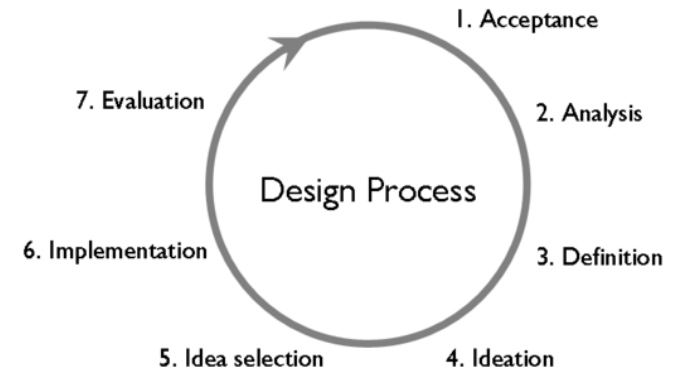- Posing the right problem is critical, neither too narrow, nor too fuzzy

Ideation

1. Acceptance
2. Analysis
3. Definition
4. Ideation
5. Idea selection
6. Implementation
7. Evaluation

Design Process

- Brainstorming
  - Stretch mental muscles
    - Loosen up with simple games
    - Do homework
    - Seed with related ideas/objects
  - Get physical
    - Sketch
    - Make models
    - Act out
  - IDEO rules
    - One conversation at a time
    - Stay focused
    - Encourage wild ideas
    - Defer judgment
    - Build upon idea from others
- Aim for quantity, hope for quality ☺
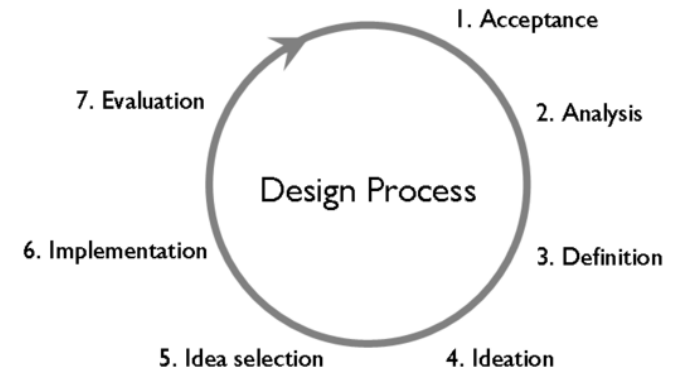
Idea Selection

- Define importance of each idea
  - Does it address problem
  - Will target users like it
  - Is hardware available
  - Is software available
  - What is the cost
  - Market window
- Rank ideas according the your criteria
- Pick top N
 - Choices depend on resources and stage of the project

1. Acceptance
7. Evaluation
2. Analysis
Design Process
6. Implementation
3. Definition
5. Idea selection
4. Ideation

Implementation

- Scale up low -> high fidelity
  - Low-fidelity (quick, cheap, dirty)
    - sketches, paper models, foam core, …
  - Medium fidelity (slower, more expensive)
    - Flash, JavaScript, AJAX, …
  - High fidelity (slowest, most expensive)
    - The full interface
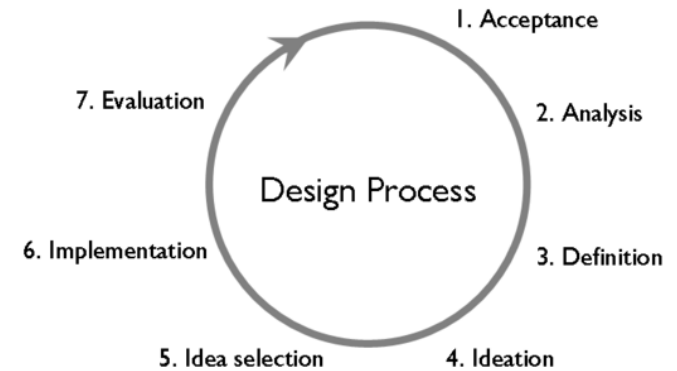
# Evaluation

- Prototype Walkthroughs
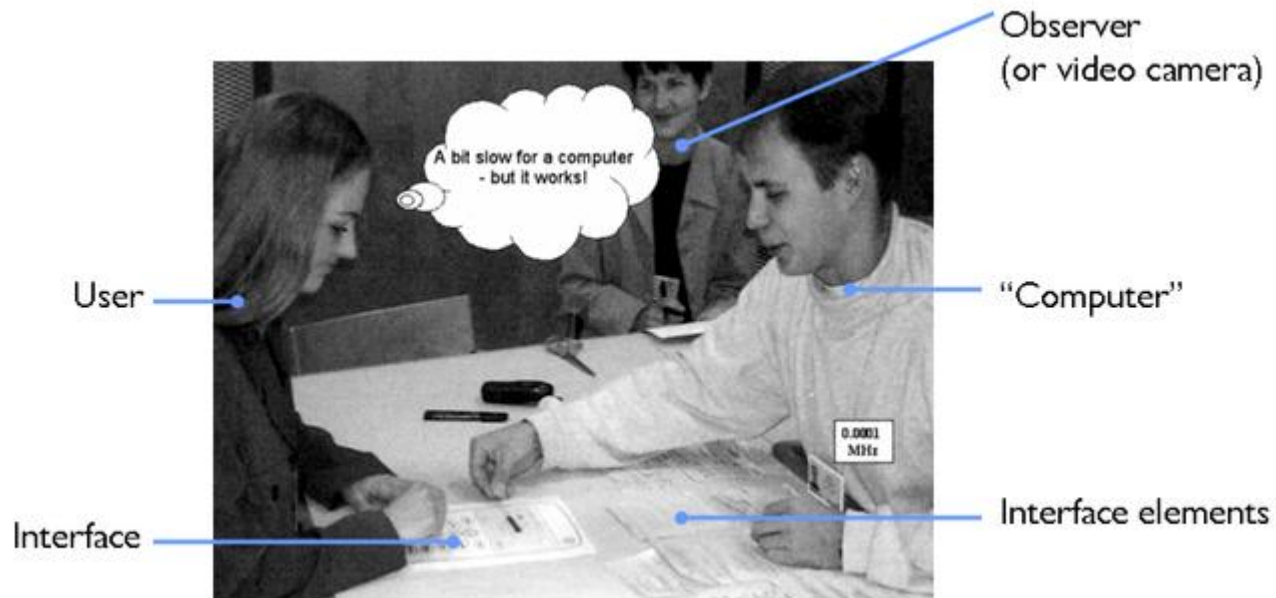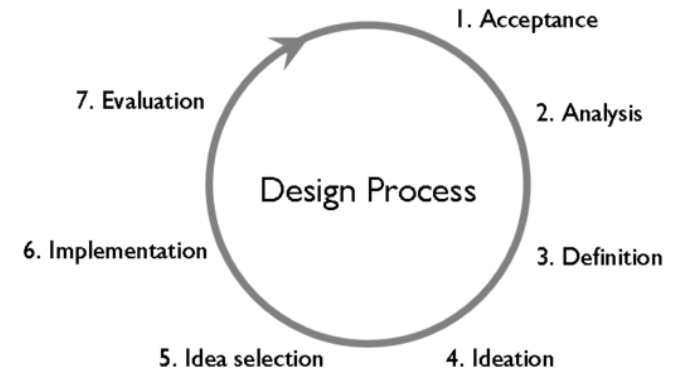
Your Brainstorming Session

Psychology of Creativity

- Conformity: the enemy of creativity
- Pressure to conform affects judgment and perception
- People in minority will adopt majority opinion and even manufacture their own explanation for them

Enhancing Creativity

- Thinking outside the box
  - Draw a series of 4 straight lines through all the points below, without lifting pen from paper
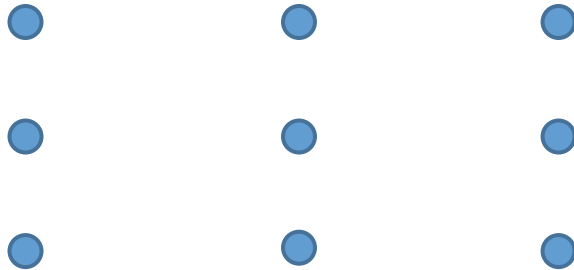
Why was this hard?

- We adopt expectations about the solution
  - Based on conventions
  - Based on what we believe

Creativity and Dissent

- Authentic dissenters:
  - People who really disagree with the group
  - Can enhance group creativity
- Their opinion needn't be right, but they can free the group from stagnant thinking
- The originality of the minority stimulates the majority

IDEO's Brainstorming Rules

- Sharpen the focus
- Playful Rules
- Number your Ideas
- Build and Jump
- The Space Remembers
- Stretch your Mental Muscles
- Get Physical

The Space Remembers

- Covering whiteboards or papering walls with text is extremely useful in group work.

Stretch your Mental Muscles

- Warmups: word games, puzzles
- Get immersed in the domain: go visit the toy shop, or the bicycle shop, phone shop etc...
- Bring some examples of the technology to the brainstormer

The state of HCI art has gone way past intuition…..

…. though reality doesn't quite reflect that yet

Three levels for better design:

- Guidelines
  - ▫ Very specific rule sets usually centered on organizations or commercial entities
- Principles
  - ▫ Mid level of abstractions
- Theories and Models
  - ▫ Universal notions, capable of being predictive

Guidelines

Guidelines

- Shared language
- Best practices
- Critics
  - Too specific, incomplete, hard to apply, and sometimes wrong
- Proponents
  - Encapsulate experience

Guidelines

- By far the most heavily documented
  - Each set of guidelines is an HCI universe unto itself
- Well known guidelines include:
  - Apple Human Interface Guidelines
  - Windows User Experience Interaction Guidelines
  - Android User Interface Guidelines
- We will focus on specific tidbits of interest from assorted guidelines documents

National Cancer Institute

- 388-guideline set for web pages
  - □ Standardize task sequences
  - □ Ensure that embedded links are descriptive
  - □ Use unique and descriptive headings
  - □ Use radio buttons for mutually exclusive options
  - □ Develop pages that will print properly
 - □ Use thumbnail images to preview larger images

W3C guidelines for accessibility

- Provide a text equivalent for every non-text element
- For any time-based multimedia presentation synchronize equivalent alternatives
- Information conveyed with color should also be conveyed without it
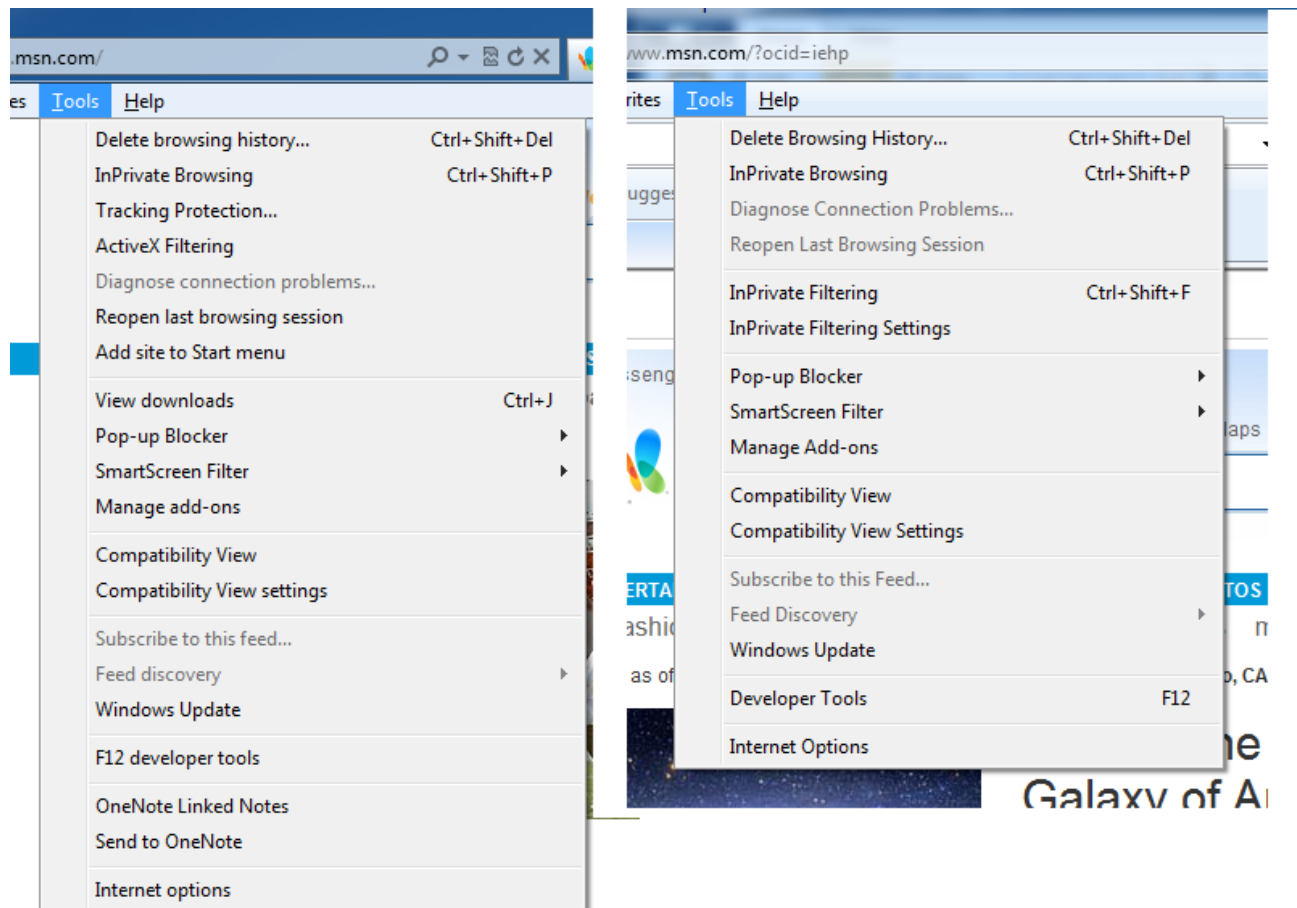- Title each frame to facilitate form identification and navigation

Organizing the display

- Smith and Mosier (1986) offer five high-level goals
  - Consistency of data display
  - Efficient information assimilation by the user
  - Minimal memory load on the user
  - Compatibility of data display with data entry
  - Flexibility for user control of data display

IE9

IE9
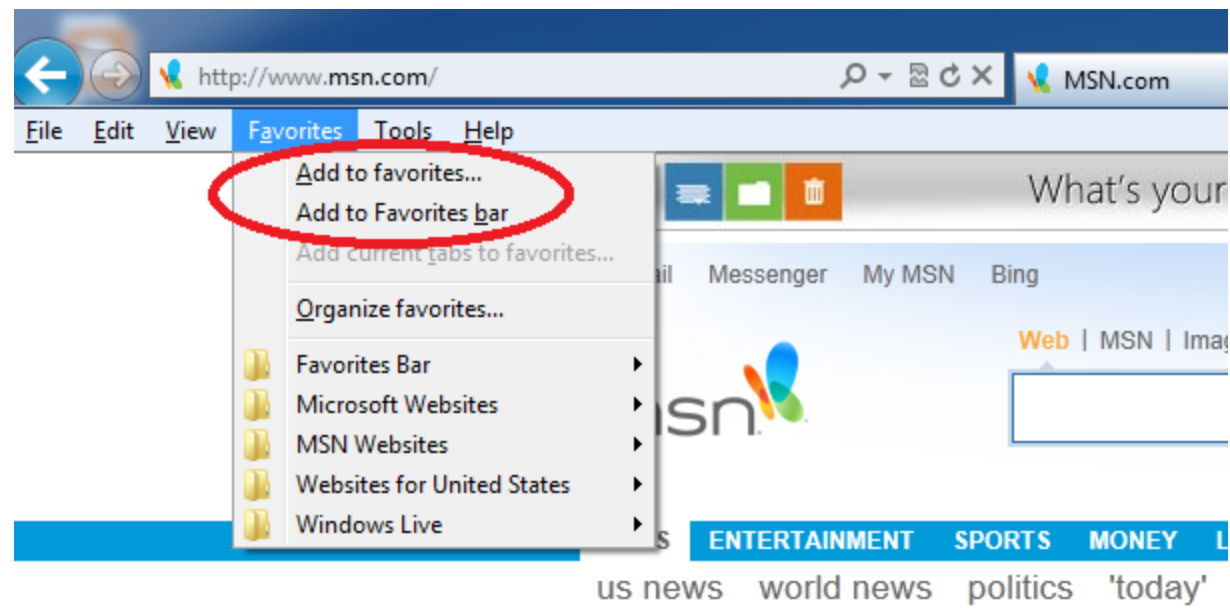
Entering phone numbers

Phone: [   ]

Phone: ([   ]) [   ] - [   ]

Getting the user's attention

- Wickens and Hollands (2000) offer these techniques for getting the user's attention:
  - Intensity
  - Marking
  - Size
  - Choice of fonts
  - Inverse video
  - Blinking
  - Color
  - Audio

Use of color

Use of colors and symmetry

Bad UI makes children cry
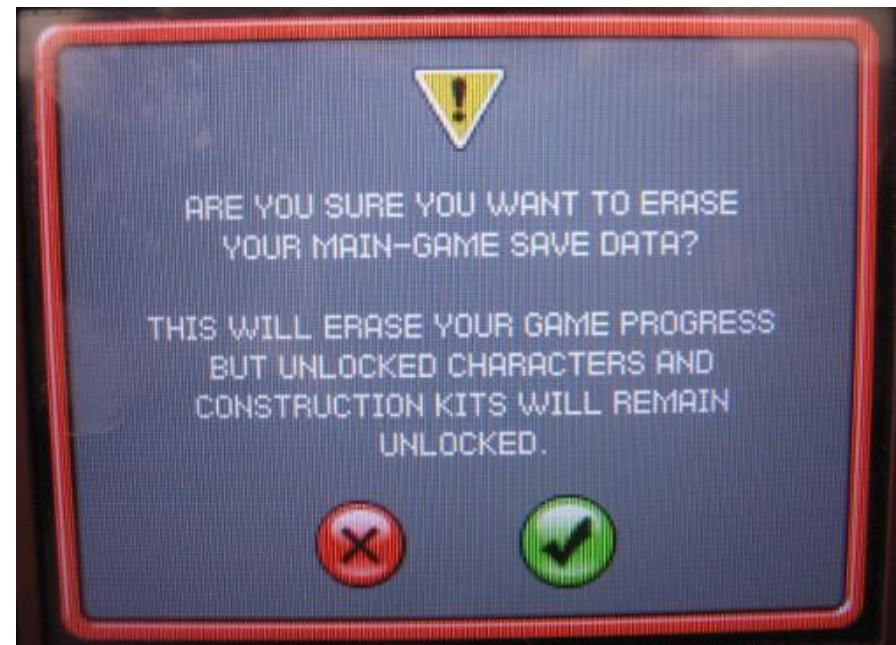
Caveat on notification

- Notification is an area where trade-offs may occur:
  - Boy-who-cried-wolf syndrome
  - Sound saves display real estate, but like visual attention grabbers, must not be overdone

Facilitating data entry

- Smith and Mosier (1986) offer five high-level objectives as part of their guidelines for data entry
  - Consistency of data-entry transactions
  - Minimal input actions by user
  - Minimal memory load on users
  - Compatibility of data entry with data display
  - Flexibility for user control of data entry

Principles

Principles

- More fundamental, widely applicable, and enduring than guidelines
- Need more clarification
- Fundamental principles
  - Determine user's skill levels
  - Identify the tasks
- Five primary interaction styles
- Eight golden rules of interface design
- Prevent errors
- Automation and human control

"Know thy user" Hansen (1971)

- Corollary: If you think you know thy user, think again
- Age, gender, physical and cognitive abilities, education, cultural or ethnic background, training, motivation, goals and personality
- Design goals based on skill level
  - Novice or first-time users
  - Knowledgeable intermittent users
  - Expert frequent users
- Multi-layer designs

Wizards
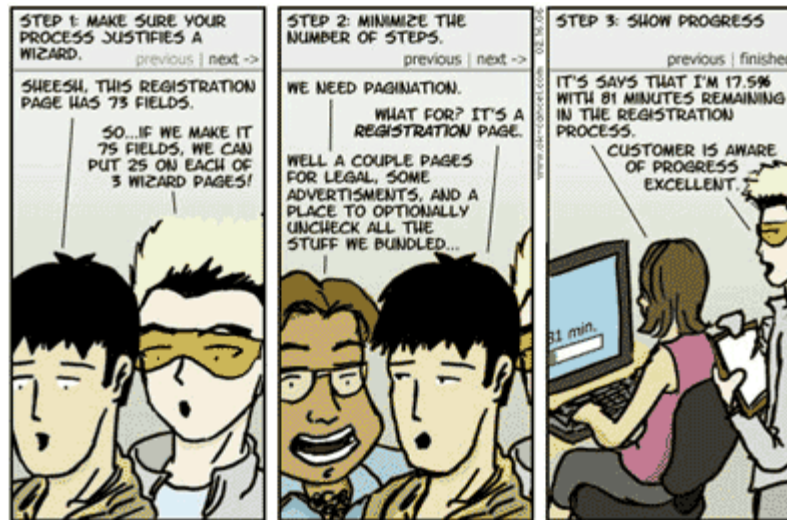
The Wizard of Ok : copyright 2006 tom chi and kevin cheng

Novice Users

Microsoft word
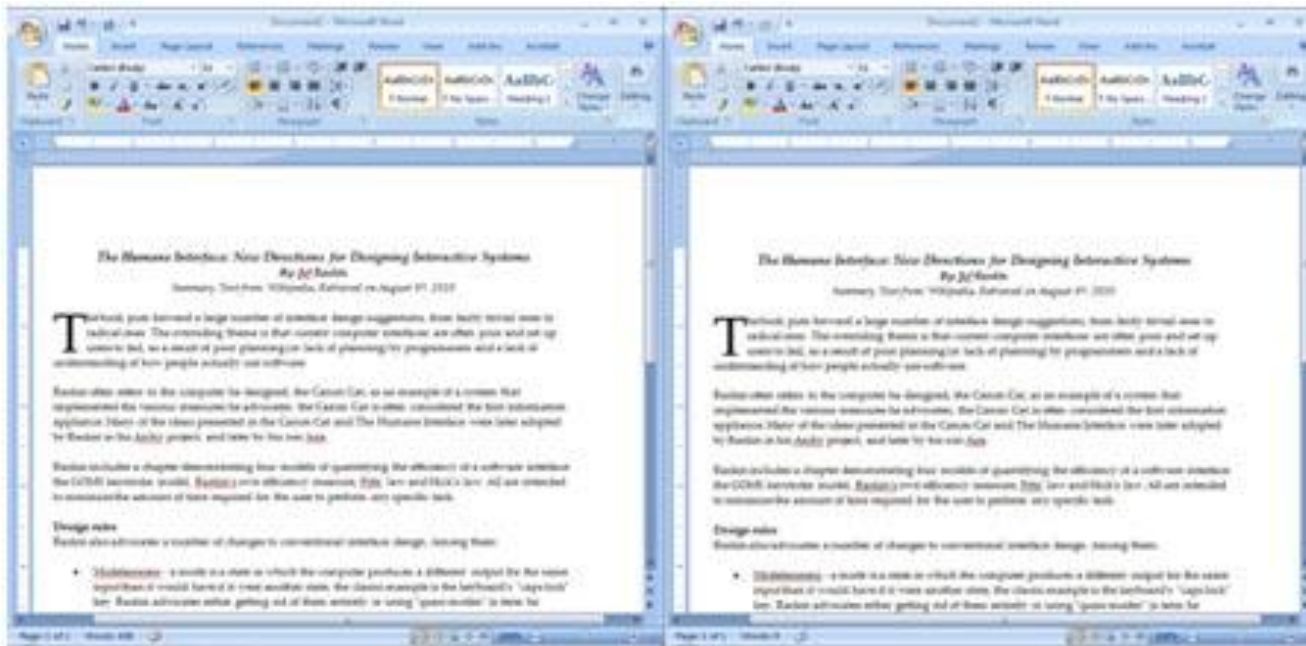
Accommodating multiple user profiles

- Are we designing for all profiles? Or just a subset?
- Multi-layer, level-structured, or spiral interfaces
  - ▫ Novices get training wheels
  - ▫ Increased proficiency enables increased functionality
  - ▫ Multiple layers include both software and documentation
- Not unlike progressing through a modern video game

Examples

```
┌──────────────────────────────────────────────────────┬──────────────┐
│            Expert or Novice                          │ Enter:Next   │
├──────────────────────────────────────────────────────┴──────────────┤
│                  Are you   A novice ?                                │
│                            An expert?                                │
│                                                                      │
│               Press ENTER for the route chosen                      │
│                                                                      │
│ The user may choose one of two possibilities.                       │
│ With the first possibility, the NOVICE, the user will be asked about │
│ general details only. However, the system will provide him/her with  │
│ important guidelines that will suit most of his/her requests.        │
│ With the second possibility, the EXPERT, the user will be free to    │
│ provide more details and use his/her expertise to define work        │
│ conditions.                                                          │
│ The system will provide him/her with both general and detailed       │
│ guidelines.                                                          │
└──────────────────────────────────────────────────────────────────────┘
```

Know thy domain

- Identify the tasks
- Task Analysis usually involve long hours observing and interviewing users
- Decomposition of high level tasks
- Relative task frequencies

Job title	Query by Patient	Update Data	Query across Patients	Add Relations	Evaluate System
			TASK		
Nurse	0.14	0.11			
Physician	0.06	0.04			
Supervisor	0.01	0.01	0.04		
Appointment personnel	0.26				
Medical-record maintainer	0.07	0.04	0.04	0.01	
Clinical researcher			0.08		
Database programmer			0.02	0.02	0.05

Choose an interaction style

- Direct Manipulation
- Menu selection
- Form fillin
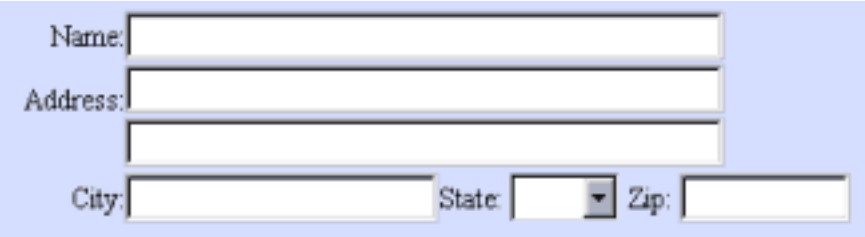- Command language
- Natural language

Command Language

Form Fillin

Menu Selection

Direct Manipulation
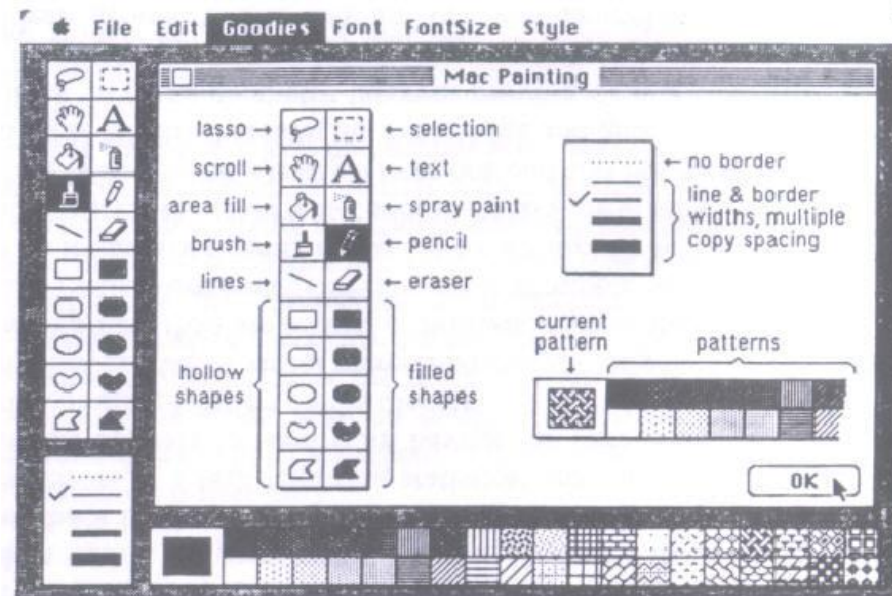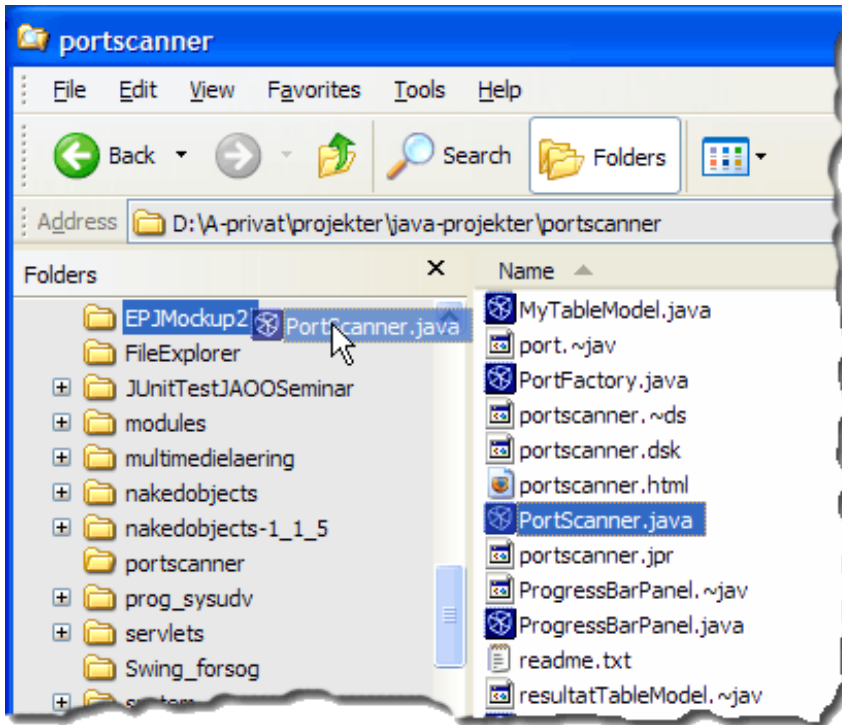
Natural Language

The 8 golden rules of interface design

1. Strive for consistency
2. Cater to universal usability
3. Offer informative feedback
4. Design dialogs to yield closure
5. Prevent errors
6. Permit easy reversal of actions
7. Support internal locus of control
8. Reduce short term memory

Nielsen's Take: Ten Usability Heuristics

1. Simple and natural dialog
2. Speak the user's language
3. Minimize user memory load
4. Consistency
5. Feedback
6. Clearly-marked exits
7. Shortcuts
8. Good error messages
9. Prevent errors
10. Help and documentation

Tognazzini's Take: Sixteen First Principles

1. Anticipation
2. Defaults
3. Human Interface Objects
4. Protect the User's Work
5. Autonomy
6. Efficiency of the User
7. Latency Reduction
8. Readability
9. Color Blindness
10. Explorable Interfaces
11. Learnability — Limit Tradeoffs
12. Track State
13. Consistency
14. Fitts's Law
15. Use of Metaphors
16. Visible Navigation

Discerning Patterns in the Rules

- Despite variations in phrasing and emphasis, certain common themes emerge among these (and other) sets of golden rules — this should give you an idea for prioritization and generality
- One way to reason about these rules objectively is to relate them to how they influence the five metrics of learnability, efficiency, memorability, errors, and subjective satisfaction
- It remains to be seen whether these rules will converge into the "one, true HCI rulebook"

"One Rule to Rule Them All" — Prevent Errors

- If there is any single golden rule that distinctly rises above the rest, it would be Shneiderman #5: Prevent Errors (a.k.a. Shneiderman #6, Nielsen #8 and #9, Tog #7 and #13)
- Consistency and feedback also enjoy multiple appearances in these lists, but they don't have the same bang-for-the-buck as error prevention

Prevent errors

- Make error messages specific, positive in tone, and constructive
- Mistakes and slips (Norman, 1983)
- Correct actions
  - Gray out inappropriate actions
  - Selection rather than freestyle typing
  - Automatic completion
- Complete sequences
  - Single abstract commands
  - Macros and subroutines

Integrating Automation vs. Control

- Sanders and McCormick (1993) suggest that we play to a human being's strengths as opposed to a machine's:

- Avoid routine, tedious, and error-prone tasks — automation

- Focus on making decisions, dealing with the unexpected, and planning for the future — control

- A corollary to control is predictability — we generally don't want the computer to "have a mind of its own"

Integrating Automation vs. Control

- The FAA says it well: "improve system performance, without reducing human involvement" and "train users when to question automation" (2003)
- Automation vs. control grows in significance as anthropomorphic and adaptive user interfaces grow in popularity and sophistication
- Microsoft's Office Assistants (or sometimes, Microsoft Office itself)
- Assorted "bots" and pseudo natural-language interfaces (online help, search engines)
- "Trained" spam filters
- Amazon and others' "your store" or "your page" features

Automation and human control

Humans Generally Better	Machines Generally Better
Sense low-level stimuli	Sense stimuli outside human's range
Detect stimuli in noisy background	Count or measure physical quantities
Recognize constant patterns in varying situations	Store quantities of coded information accurately
Sense unusual and unexpected events	Monitor prespecified events, especially infrequent ones
Remember principles and strategies	Make rapid and consistent responses to input signals
Retrieve pertinent details without a pri-ori connection	Recall quantities of detailed information accurately
Draw on experience and adapt decisions to situation	Process quantitative data in prespecified ways
Select alternatives if original approach fails	Reason deductively: infer from a general principle
Reason inductively: generalize from observations	Perform repetitive preprogrammed actions reliably
Act in unanticipated emergencies and novel situations	Exert great, highly controlled physical force
Apply principles to solve varied problems	Perform several activities simultaneously
Make subjective evaluations	Maintain operations under heavy information load
Develop new solutions	Maintain performance over extended periods of time
Concentrate on important tasks when overload occurs	
Adapt physical response to changes in situation	