

Design



CSEP 510
Lecture 2, January 17, 2004
Richard Anderson

Tonight

- Design of physical objects (Norman)
- Show and Tell
 - Discussion of your artifacts
- Design Principles
- Design Exercise
 - Tablet PC Buttons
- Xerox Star Retrospective

Announcements

- Homework due at 6pm
- Late policy
 - You may turn in up to two assignments one week late
- Class on Thursday, March 4 is moved to Monday March 1.

Design and HCI



- How do people interact with computers?
 - Tremendous flexibility in designing/building interactions
 - Shifts away from desktop increases physical aspects of interaction
- Look at physical objects
 - Thousands of years of design experience
 - Human side is the same

Tradeoffs

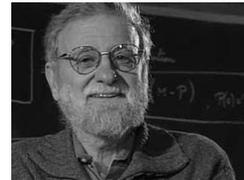


- Recognize that there are engineering tradeoffs
- Avoid whininess
- Design is hard
 - It usually takes about five or six attempts to get a product right
 - Vast number of variables

Design of Everyday Things



- Don Norman
 - Cognitive Scientist
 - Apple Fellow
 - Prolific writer
- Basic theme
 - Understand how common objects are used



Design examples

- Doors
 - Basic requirement – a user must be able to open the door and walk through it
 - What could go wrong?
 - Lack of visual cues

Telephones

- Basic dial / number pad is standard
- Mechanisms for additional functionality can be difficult
 - Arbitrary
 - Multifunction keys
 - No mental model



Stove Top



Automobiles

- Most design intensive product
- Usability critical for effectiveness, safety, and user satisfaction
- Main controls (steering, acceleration, braking)
 - Dedicated, direct response
- Secondary controls
 - Substantial variety



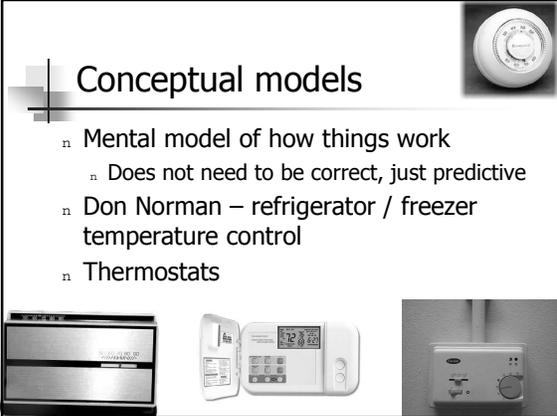
Automobiles

- Use model
 - Substantial learning required to drive
 - Essentially no learning required to use a new car
- UI Problems
 - Hidden controls (gas tank release, seats)
 - Overloaded controls (turn signal, high beams, front / rear wipers, window wash)
 - Control placement
 - Labeling
 - Cruise control mode



Conceptual models

- Mental model of how things work
 - Does not need to be correct, just predictive
- Don Norman – refrigerator / freezer temperature control
- Thermostats



Affordance

- Perceived and actual properties of an object – especially the properties that determines how an object is used
 - A door *affords* going through
 - A chair *affords* sitting on
 - Glass *affords* seeing through (or breaking)
- Doors – indication of how to open them
- Light switches – indication of function

The principle of mapping

- Mental association between objects and actions
- Some natural
- Some cultural
- Some arbitrary



The principal of feedback

- Indication that an operation is taking place
- Key clicks
- Sidetone in phones
- Direct physical response when opening a door
- Hour glass cursor on a long operation

Cognitive Load

- How little memory do we need?
 - Short term memory
 - Long term memory
- Avoid requiring arbitrary information
 - Visual information
 - Labels, Groupings, Mappings
 - Conventions
 - Transfer
 - Common experience
 - Conceptual models



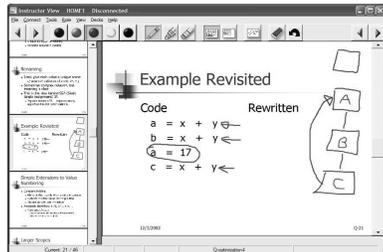
Class Activity



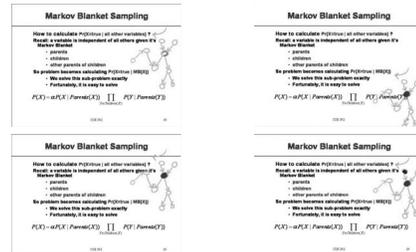
Case study, Virtual Mylar

- Mylar model for handwriting overlay of content
- Model instructors familiar with for persistence / recall of ink
- Simple implementation
 - Scroll bar to control overlay layer position

Classroom Presenter



Accidental use



Mylar lessons

- Essentially zero intentional use
- Real costs
 - Screen Real Estate
 - Interference with user operation
- Metaphor was valid but limited
 - But missed standard usage
 - Broke down with additional functionality
- Demo feature

Demo feature

- Features which are great for demos or marketing – but not for real world use
- A Classic Example: New Coke
 - April 23, 1985, New Coke Introduced
 - July 11, 1985, Coca Cola Classic Introduced



Designing for Failure

- Design for fallible users
- Understand classes of errors
- Error minimization
- Error prevention
- Error mitigation
- Error recovery



Errors

- What is an error?
- What kinds of errors can be accommodated for by better design?
- Car related
 - I drive with my high beams on
 - I misuse the controls in an unfamiliar car in a pressure situation
 - I lock my keys in the car
 - I take the wrong exit off the freeway



Human Error



- Implicated in 60-80% of Automobile / Aviation accidents
- Major accidents often have multiple causes with human error *in operation* a significant factor
- Three Mile Island
 - Emergency light covered by maintenance tag
 - Lights suggested an open valve was shut
 - Operators faced with 100 alarms within 10 seconds of the first one
 - Computer printer registering alarms was two and a half hours behind alarms

Beginners, Experts, Intermediates

- Who are you designing for?

Case study Tablet PC Button Design



- Tablet PC Requirement
 - Support for Secure Attention Sequence (Ctrl-Alt-Del) without keyboard attached
 - Non-overloaded hardware mechanism
- Large range of button formats (examples follow)
- Pressure to include everybody's favorite feature as a button

Compaq

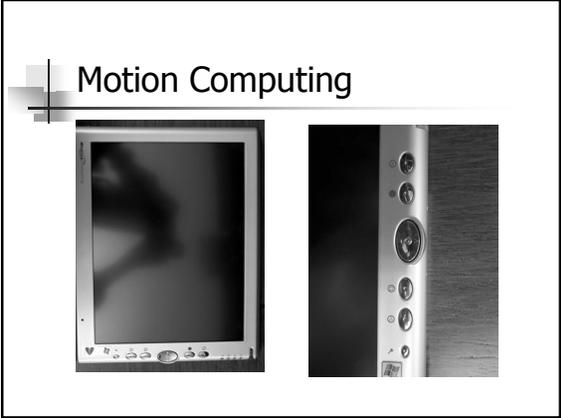


Acer

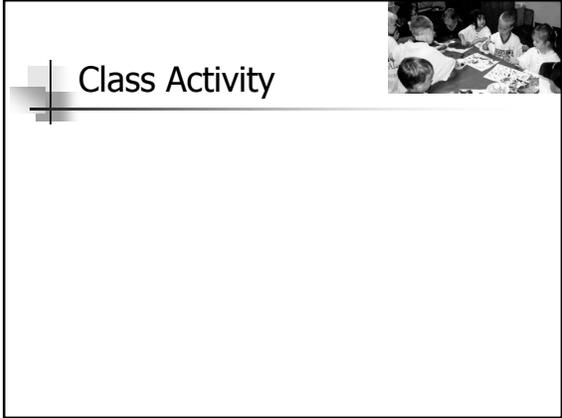


Toshiba





- ## Button questions
- What are the functions to buttonize?
 - Design of buttons
 - Very big range – size, inset, duration of push, pressure vs. pen activation
 - Button layout



- ## Xerox Parc (Palo Alto Research Center)
- Parc invented more than its share of successful computing technologies
 - Alto
 - Ethernet
 - Smalltalk
 - Bravo (Simonyi -> Word)
 - Laser printing
 - Press (Interpress -> Adobe)

- ## Alto - Star
- Enabling technology
 - High DPI screens
 - Not economically viable machines
 - Star price \$16,500 in 1981
 - 384 KB RAM, 10 MB Hard disk, 8 inch floppy drive
 - Nor was the Apple Lisa at \$9995 in 1983
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Xerox Star

- Document Centered Computing
- Desktop Metaphor
- Direct manipulation
- Modeless

Document centered computing

"Star, in contrast, assumes that the primary use of the system is to create and maintain documents. The document editor is thus the primary application. All other applications exist mainly to provide or manipulate information whose ultimate destination is the document."

- Other types of computing
 - Developer Centered Computing
 - Computation Centered Computing

Desktop Metaphor



"Every user's initial view of Star is the Desktop, which resembles the top of an office desk, together with the surrounding furniture and equipment."

- Documents and tools available on desktop
 - Waste basket, floppy drive, printer, calendar, clock, files, in basket, out basket
- Windows compromises on desktop metaphor
 - Task bar

Desktop Organization



Metaphorically speaking

- Why use metaphors?
- Why build UI around a metaphor?
- What are the pitfalls about metaphors?

Direct manipulation

- Physical / continuous actions
 - Drag file to move (or delete)
 - Resize windows by dragging
- Direct vs. Command not completely distinct
 - Window resize by pointing to source / target



Direct manipulation

- What primitives are available for direct manipulation?
- When is direct manipulation superior?
- When is command superior?
- Is direct manipulation easier to learn?
- Is command more powerful?
- Is one form less risky than the other?

Modes

- Recognized as a key UI problem by Parc Researchers
 - Modeless editor
- Evil modes
 - Insert / Overwrite / Delete
 - Copy vs. Move
- Good modes (?)
 - Color and other ink effects
 - Text formatting
- What about cruise control?

Noun-Verb vs. Verb-Noun

- Noun-Verb
 - Choose object, choose operation
- Verb-Noun
 - Choose operation, choose object



Summary

- Design of physical objects
- Considerations for usability
- Xerox Star
 - Commercial introduction of desktop metaphor