

## Design




CSE 403

## Announcements

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## Design



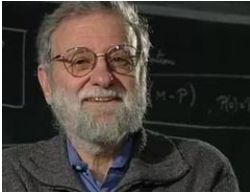

- How do people interact with computers?
  - Tremendous flexibility in designing/building interactions
- Look at physical objects
  - Thousands of years of design experience
  - Human side is the same

## 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

## Saigon Deli – U. District



## 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



## 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



## Motion Computing



## NEC

