topics:
- Norman:
  - everyday things; design principles; activity theory; gulf of execution; gulf of evaluation
- Shneiderman:
  - theories; principles; guidelines

references:
- The Design of Everyday Things, by Donald A. Norman, Ch 1, The psychopathology of everyday things and Ch 2, The psychology of everyday things
- Designing the User Interface: Strategies for Effective Human-Computer Interaction (5th edition), by Ben Shneiderman and Catherine Plaisant. Ch 2, Guidelines, principles and theories.

* on which side do you operate the door (to make it move)?

Common Design Problems
- poor instructions
- poor “visibility” (see ahead) of the operation of the technology (i.e., lacking appropriate visual cues for how to use something)
- lack of “feedback” (see ahead)

When simple things need instructions, the design has failed!
Norman: Design Principles

- Principles of design for Understandability and Usability
  - provide good "Conceptual Model"
  - make things "Visible"
- Visibility
  - mapping between intended actions and actual operation
  - feedback indicating action succeeded (or didn’t)
  - natural design ⇒ natural signs (for how to use something), should be naturally interpreted
  - be aware of cultural references (e.g., stop sign)
- Affordance
  - the perceived and actual properties of an object provide clues to the operation of the object
  - examples:
    - buttons are for pressing
    - knobs are for turning
    - slots are for inserting things into
- Conceptual Model
  - visible structure that implies:
    - affordance (what an object was designed to do)
    - constraints (what cannot be done with an object)
    - mappings (between what the object can do and how to use the object to do it)
  - "mental model" — models people have of themselves, others, devices, etc.
  - "system image" — visible part of a device
- Mapping
  - relationship between two things
  - correspondence between what you want to do and how to do it
- Feedback
  - send user information about their action
  - information can be auditory and/or visual

- Causality
  - response after an action indicates that the action caused the response
  - can we predict the effects of our actions?
  - can we figure out what happened when something goes wrong?
Seven Stages of Action

STAGES OF EXECUTION

1. perceive state of the world
2. determine sequence of actions sequence of actions we plan to take
3. execute action sequence physical execution of that action sequence
4. interpret perception interpreting the perception according to our expectations
5. evaluate interpretation evaluation of interpretation of what we expected to happen

STAGES OF EVALUATION

1. form goals what we want to happen
2. form intention to act intention to act, so as to achieve goal
3. determine sequence of actions sequence of actions we plan to take
4. execute action sequence physical execution of that action sequence
5. perceive state of the world
6. interpret perception interpreting the perception according to our expectations
7. evaluate interpretation evaluation of interpretation of what we expected to happen

Gulf of Execution
- difference between user’s intention and allowable actions
- how well does a system allow a user to perform their intended actions?

Gulf of Evaluation
- amount of effort required to interpret state of the system and how well the user’s intention has been met
- how easy is it to get information about the system and interpret that information, and match that interpretation with the user’s expectations?

Shneiderman and Plaisant: Theories

- User Interface (UI) design theories can be categorized in either of the following ways:
  - descriptive vs explanatory vs prescriptive vs predictive
  - motor vs perceptual vs cognitive

- descriptive = provide consistent terminology
- explanatory = describe sequence of events, cause and effect
- prescriptive = give guidance
- predictive = evaluate design’s execution time, error rates, trust level, conversion rates; depends on type of user (novice, expert); these values can have high standard deviations across user types

- motor = pointing with mouse, using keyboard; theories such as Fitt’s Law (to be discussed later in the term) describe human capabilities
- perceptual = finding items on a display
- cognitive = planning sequences of actions; memory load requirements

- Gulf of Evaluation
- good ”scent” ⇒ which way to go; helps user find what they are looking for
- ”taxonomy” = classification of complex set of ideas/phenomena/actions into categories

- Theories:
  - Design-by-levels (Foley)
    - natural decomposition of a system
      - conceptual: user’s (mental) model
      - semantic: meanings conveyed by interface design
      - syntactic: how users conveys semantic meaning
      - lexical: hardware, device dependent
  - GOMS (Card)
    - Goals: user’s goals
    - Operators: actions
• Methods: decomposed actions
• Selection rules: how to select between methods
  – Stages-of-action (Norman) activity theory, described earlier
  – Context (Suchman) “situated action”

Shneiderman and Plaisant: Principles

• Determine user’s skill level
  – novice or first-time user
  – knowledgeable intermittent user
  – expert frequency user
• Identify the user’s tasks
  – high-level, mid-level, low-level tasks ⇒ Task Analysis
  – reduce frequency of actions
• Choose interaction style
  – direct manipulation
  – menu selection
  – form fill-in
  – command language
  – natural language

Shneiderman and Plaisant: Guidelines

• Guidelines:
  – provide consistency
  – promote best practices
• Navigating the interface
  – a good interface should “reduce the user’s workload”
  – some examples:
    – Standardize task sequences
    – Ensure embedded links are descriptive
    – Use unique and descriptive headings
    – Use radio buttons for mutually exclusive choices
    – Develop pages that will print properly
    – Use thumbnail images to preview larger images
  – consider accessibility:
    – Use text alternatives
    – Provide alternate ways of conveying time-based media (e.g., movies, animations)
• Make elements distinguishable from one another
• Design for predictability

• Organizing the display
  – Consistency of data display (e.g., colors, fonts, capitals, etc)
  – Efficient information assimilation by user
  – Minimal memory load on user
  – Compatible data display with data entry
  – Flexibility of user controls for data display

• Getting user’s attention
  – intensity (e.g., brightness of color)
  – markings
  – size
  – fonts
  – inverse video
  – blinking (use sparingly)
  – color
  – audio

• Facilitating data entry
  – consistent data entry transactions
  – minimal input actions
  – minimal memory load
  – compatible data entry and display
  – flexible user control for display

to do

• read the first handout: Norman *The Psychopathology of Everyday Things* (from the first class)
• read the second handout: Shneiderman and Plaisant *Guidelines, principles and theories* (from today’s class)