CMPT 363: User Interface Design
Spring 2021

Week 7: Psychology of Everyday Things

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Recap from Last Lecture

- Design of Everyday Things
  - Fundamental Principles of Interaction: Affordance, Signifiers, Mapping, Feedback, Conceptual Model
  - Action Cycle, Gulfs of Execution & Evaluation:
    Pathway of Execution: Goal → Plan → Specify → Perform → World
    Pathway of Evaluation: World → Perceive → Interpret → Compare → Goal
- How people learn new things
  - Experience transfer, Cultural conventions, Observing others, Instructional manuals
  - Forming Mental models

Today

- How people learn new things
  - Mental models (last lecture), metaphors
- Direct manipulation
  - Definition, benefits & limitations

How Do People Learn New Things?

People Are Always Trying to Make Sense of Things

- Mental models are often extracted from fragmentary evidence and reinforced by positive feedback
  - Even when the association is inaccurate (that's how most unfounded habits form)

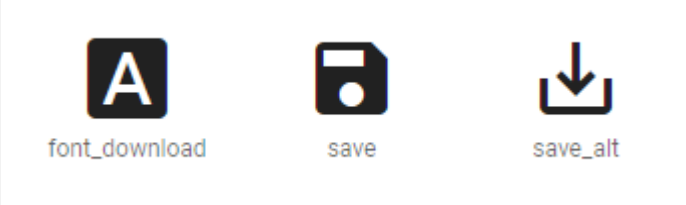
https://medium.com/@erskine/humans-suck-at-elevator-etiquette-8199e7c3c380

A Common Technique to "Understand" Complex Things

- When things are novel or complex, we use metaphors to understand how to use them or how they work
  - Metaphor: application of name or descriptive term to an object to which it is not literally applicable ("this works like that")
  - Example 1: a camera app works like a real camera to take a photo
  - Example 2: a presentation tool is like a slide projector
- When it works, this technique leverages our knowledge of familiar, concrete objects/experiences to understand abstract computer and task concepts (e.g., encryption, cloud computing), making things easier to understand
- However, metaphors may portray inaccurate or naïve conceptual model of the system, creating false expectations, and causing frustration if it behaves otherwise (e.g., pressing a button in a game controller vs. stepping on the gas); sometimes even limits what the user thinks the system can actually do (e.g., rotate the screen to trigger expert mode in the calculator app)

Communicating the Correct Metaphor

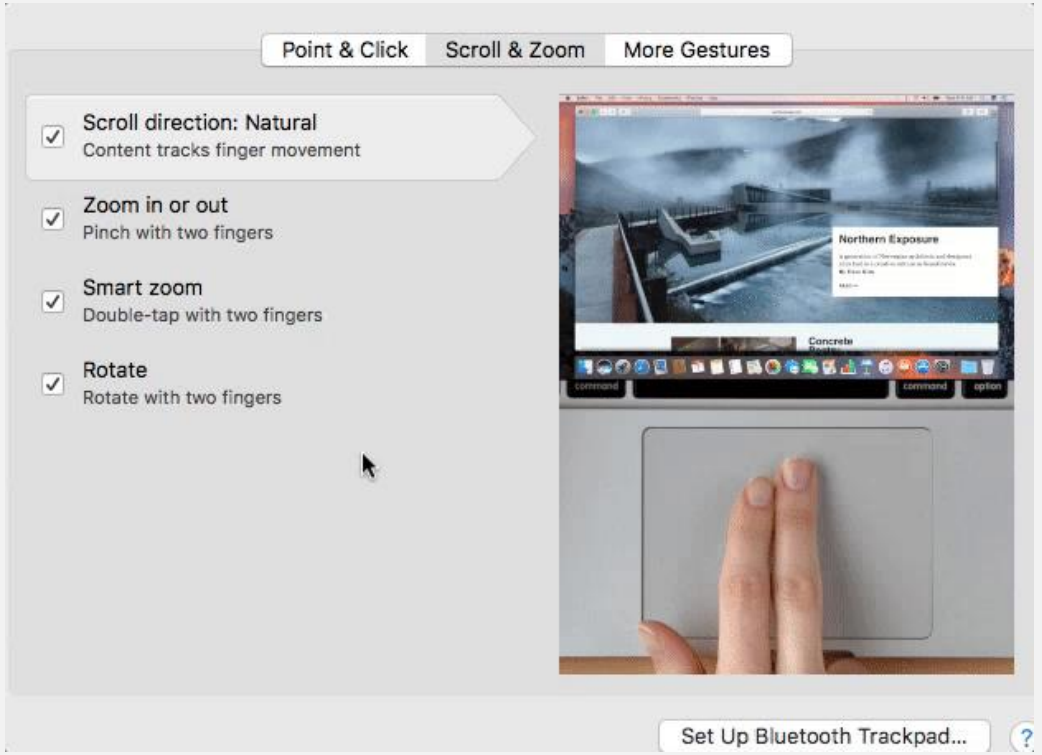
- A well-chosen/designed metaphor creates a robust mental model in the user's mind
  - Use metaphors that match the user's task (e.g., desktop for office workers, paintbrush for artists)
  - When there is a choice, choose the metaphor closest to the way the system works (e.g., a switch button for an on/off switch)
  - Ensure emotional tone is appropriate to users (e.g., a trashbin for deleting file instead of a blackhole, a shredder, or a burner)
  - Do not over-do it (e.g., adding unnecessary parts like spirals to a notepad app interface, or a cute-looking helper)
- Communicate the metaphor to the user through good use of text (matching terms) and graphics (matching icons)



https://material.io/resources/icons

An Example of Different Metaphor – Scrolling

- Moving the content or moving the slider?
- Quick poll – which side are you on?
  - A – fingers scrolling down goes to the top of the content
  - B – fingers scrolling up goes to the top of the content

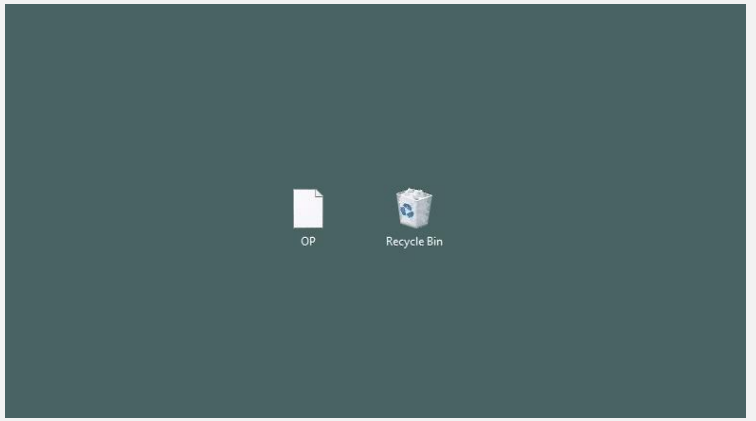


Source: https://www.makeuseof.com/tag/new-mac-setup/

Direct Manipulation

A Useful System Image – Direct Manipulation

- Proposed in 1983 by Ben Schneiderman
- Direct manipulation provides the user the feeling that they are directly affecting the virtual representations of objects in the system as if they were doing it in the real-world
  - Virtual representations of objects closely resemble their nature
  - Actions done in the real-world translate to actions in the virtual world



Source: https://knowyourmeme.com

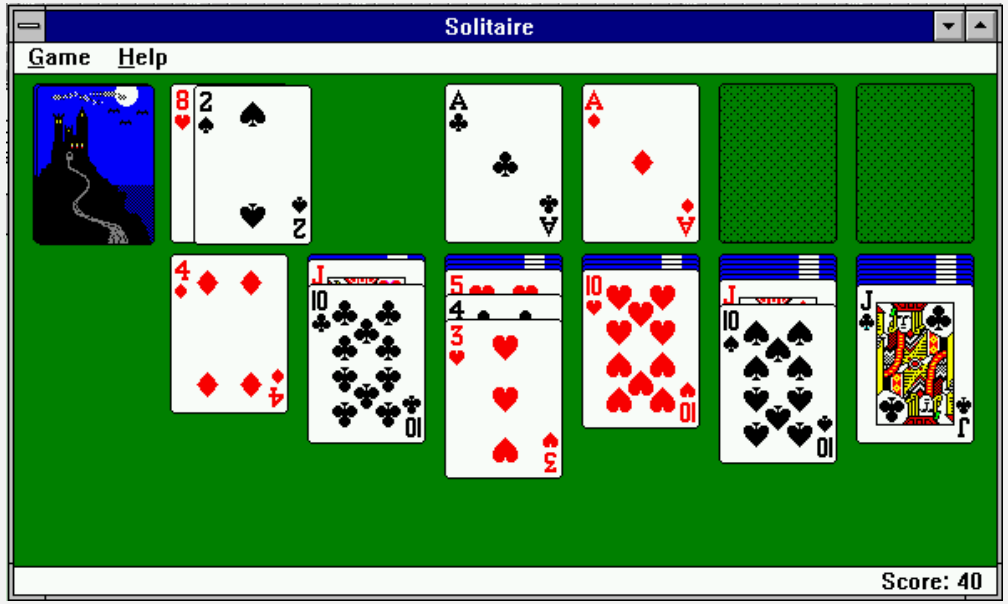
Shneiderman, "Direct Manipulation: A Step Beyond Programming Languages," in Computer, vol. 16, no. 8, pp. 57-69, Aug. 1983, doi: 10.1109/MC.1983.1654471.

Principles of Direct Manipulation

- Continuous representation of the object of interest
  - They are persistently shown on the screen
- Physical actions or labeled button presses instead of complex syntax
  - Actions instead of words
- Rapid, incremental, reversable operations whose impact on the object of interest is immediately visible
  - Like most things in real-life user can control speed, placing & replacing, and get instant feedback
- Layered or spiral approach to learning that permits usage with minimal knowledge
  - Novices can learn a modest and useful set of commands (actions) and build expertise

Application Examples of Direct Manipulation

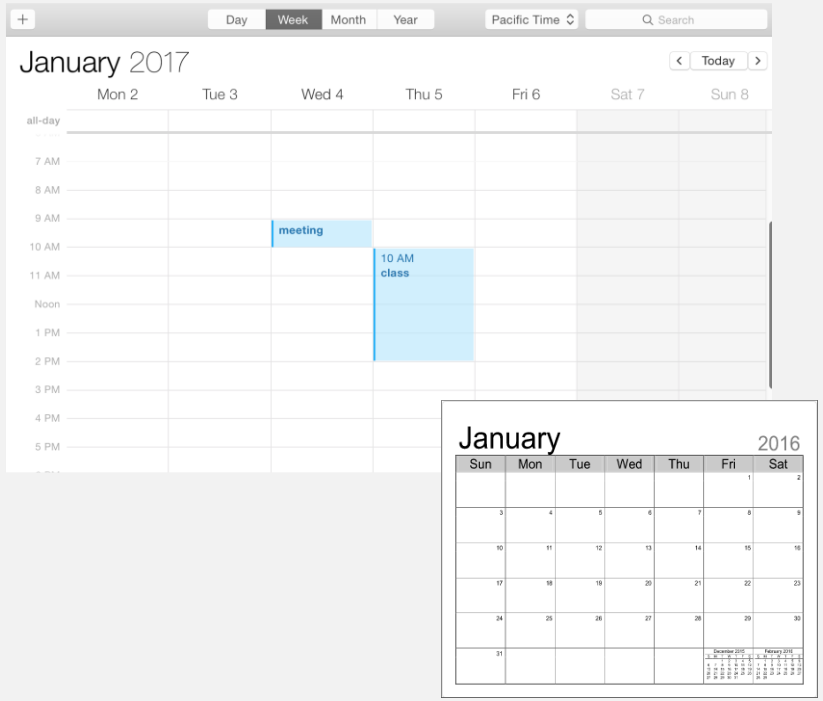
- Games



Wii mote: By Evan-Amos - Own work, Public Domain, https://commons.wikimedia.org/w/index.php?curid=16059354
Cut the Rope game: By Source, Fair use, https://en.wikipedia.org/w/index.php?curid=32163028

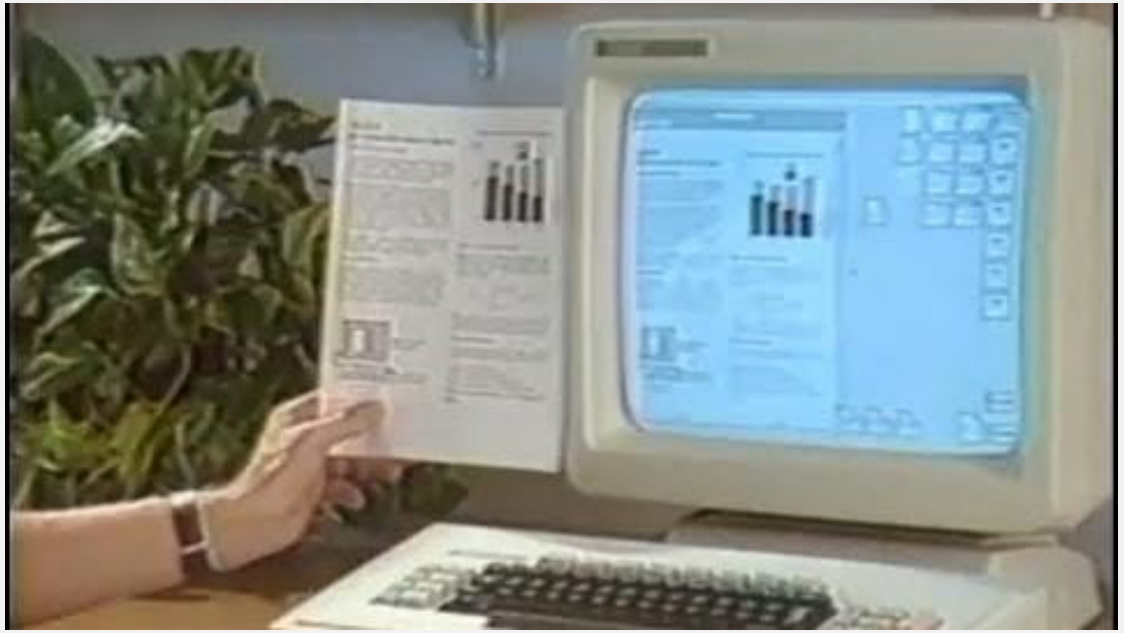
More Application Examples of Direct Manipulation

- Utility



Works Well with WYSIWYG

- Using real-world terms (e.g., select, move, desktop) and objects (e.g., folder, drawer, printer)



https://www.youtube.com/watch?v=wOAm7EiFNu8

Promoting Direct Manipulation with Interaction Instruments

- An interaction instrument is a mediator between the user and the objects in the system, actions on the instrument transforms the user's actions into commands affected the objects
  - Low degree of indirection (spatial/temporal offset between instrument & action on object)
  - Matching degree of integration (ratio of DOFs of instrument to DOFs of input device)
  - High degree of compatibility (similarity between actions on instrument to actions on object)

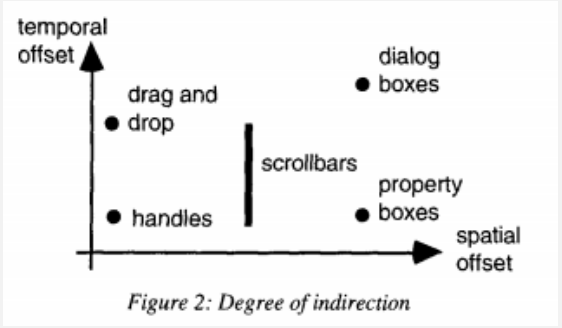
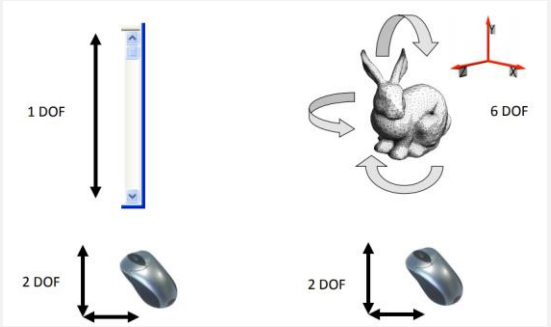
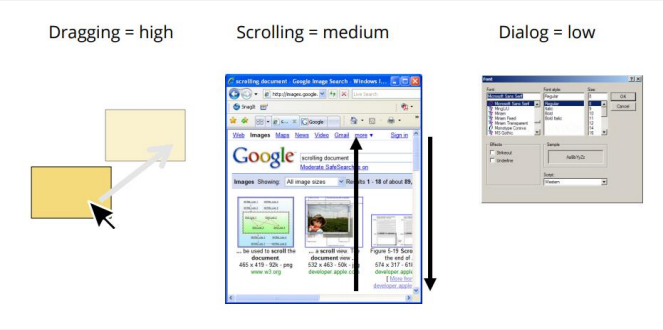


Figure 2: Degree of indirection





Beaudouin-Lafon, M. 2000. Instrumental interaction: an interaction model for designing post-WIMP user interfaces. Proceedings of CHI '00, 446-453. http://doi.acm.org/10.1145/332040.332473

Benefits of Direct Manipulation

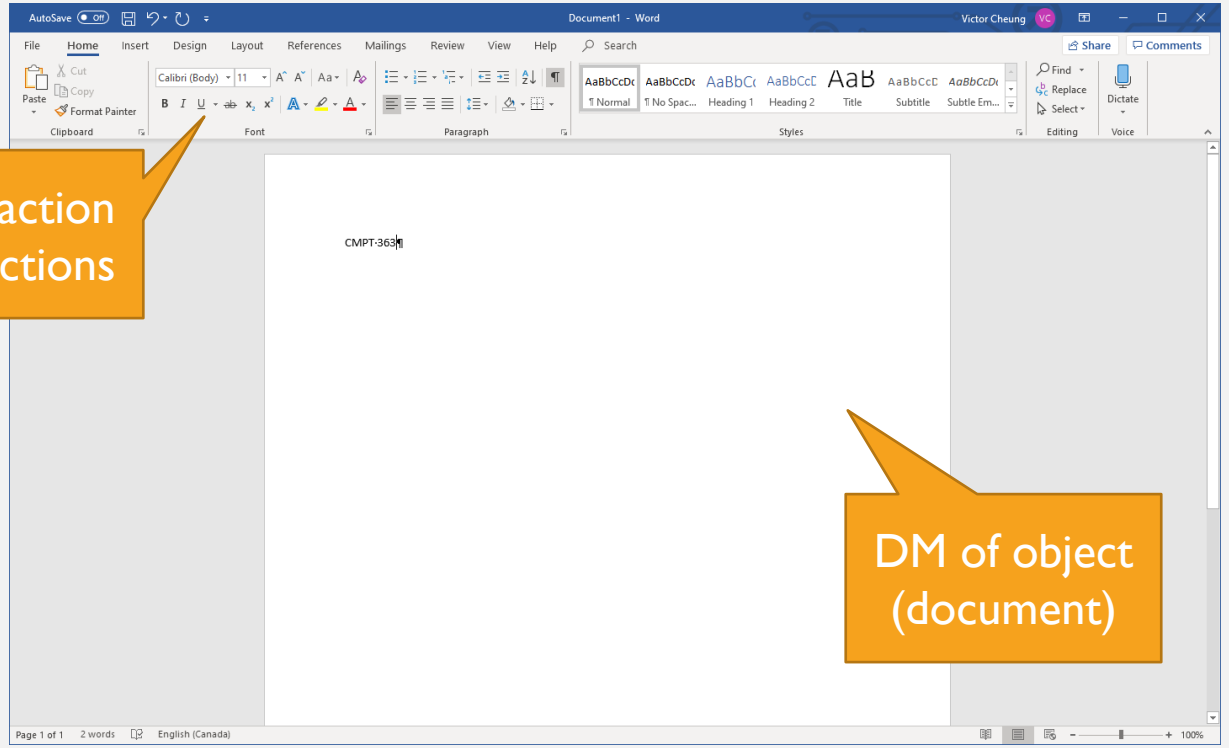
- Takes full advantage of the capabilities of modern display technologies
- Feels more engaging as the user feels like working directly on the task
- User can focus on the task rather than on the technology
- Once learned it is easy to recall as it follows the rules of the real-world that we are familiar with

Limitations of Direct Manipulation

- Users must first learn the meaning of the components, wrong representations can lead to greater confusion
- Can't represent abstract concepts
  - How do you "copy" things? How do you "spell-check"? How do you "compare" two blocks of texts?
- Might not be the most efficient
  - Limited support for shortcuts & repetition
  - Takes space to show virtual representation

Balanced Inclusion of Direct Manipulation & Abstractions

- Most systems combine DM & abstractions
  - For example, in Word processor:
    - WYSIWYG document (DM)
    - Buttons, menus, dialog boxes (abstractions, but DM "in the small")



Putting All Together

- Provide a good conceptual model
  - Allows users to predict consequences of actions communicated through the image of the system
- Make things visible (discoverable)
  - Relations between user's intentions, required actions, and results should be sensible, consistent, meaningful (non-arbitrary)
- Make use of visible affordances, mappings, and constraints
  - Remind users of what can be done and how to do it
- Provide proper feedback
  - Communicate system status, confirm and teach users

Summary

- Design of Everyday Things
  - Fundamental Principles of Interaction, Action Cycle, Gulfs of Execution & Evaluation
- How people learn new things
  - Mental models, metaphors
- Direct manipulation
  - Definition, benefits & limitations
- General design strategies

Post-Lecture Activity

- Read/watch these (and those in the slides)
  - Whitenton, K. The Two UX Gulfs: Evaluation and Execution
    https://www.nngroup.com/articles/two-ux-gulfs-evaluation-execution/
  - Benson, S. Leveraging Mental Models in UX Design
    https://www.toptal.com/designers/ux/mental-models-ux-design
  - Rekhi, S. Don Norman's Principles of Interaction Design
    https://medium.com/@sachinrekhi/don-normans-principles-of-interaction-design-51025a2c0f33

- Exercise
  - Continue with the writing an email activity and think about how to apply the fundamental principles of interaction to the email client design