Interaction Techniques 1

SWE 632
Fall 2015

Administrivia

- HW 5 due today

- HW 6 due next week

Interaction Techniques

Interaction technique

- A method by which a user can perform an action or sequence of actions with a computer.

- Might encompass **software** (e.g., accelerators on a menu) and/or specialized **hardware** (momentum scrolling on iOS)

Designing interaction techniques

- **Many** possible interaction techniques
- Can be organized around computing modality
  - Desktop, mobile, tablet, car, tangible, spoken, …
- Influenced by interaction techniques supported by underlying GUI toolkit
  - AWT, SWT, Cocoa Touch, .NET, Bootstrap, …
- Many important choices to be made in how individual GUI elements are used and how they work together

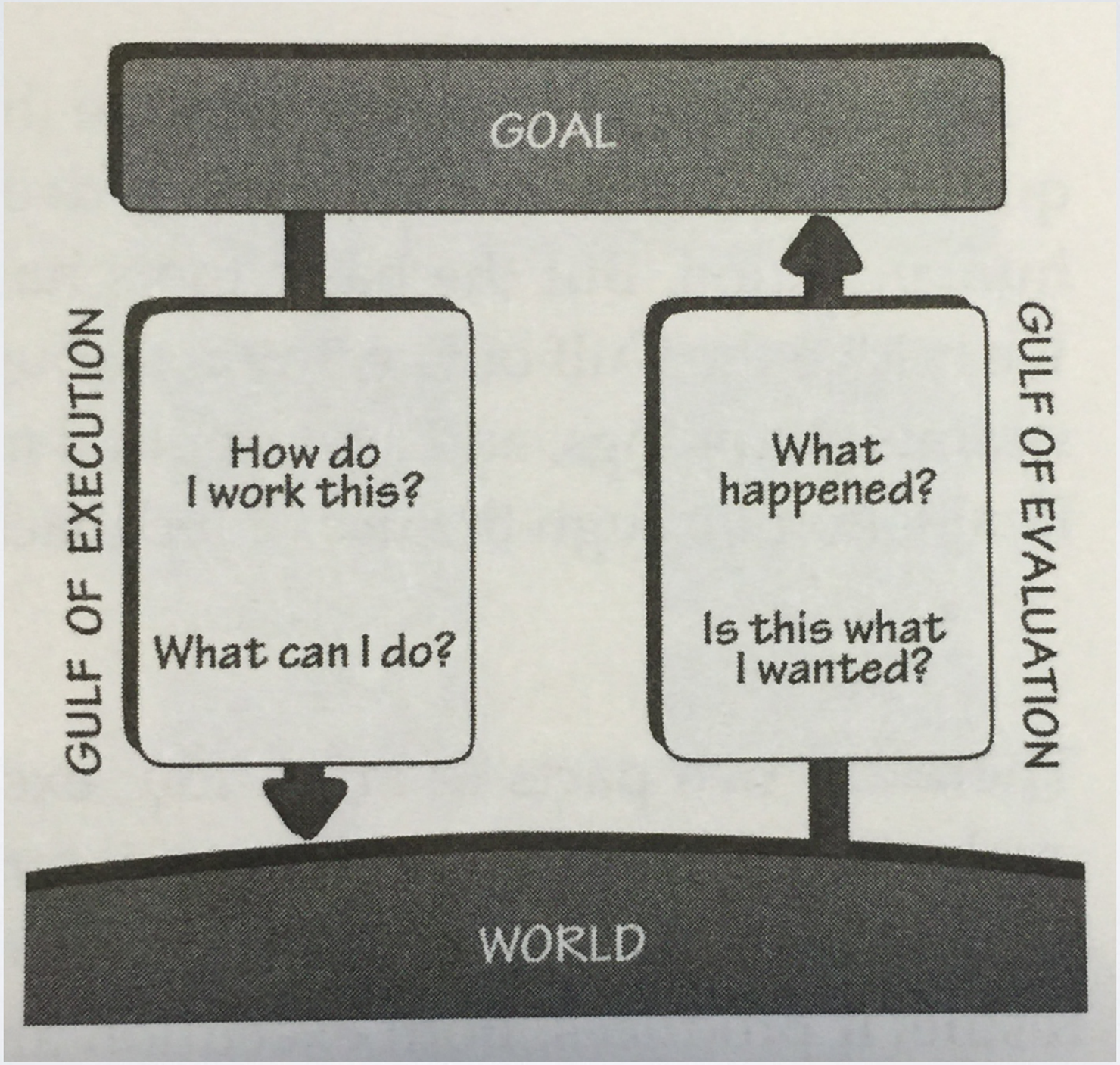
Designing interaction techniques

- Overall goal is to design for usability, particularly task performance
  - Understand user tasks, design interaction techniques that support these tasks
- Interaction techniques describe the low level design of how users interact with software to accomplish tasks

Guidelines for interaction techniques

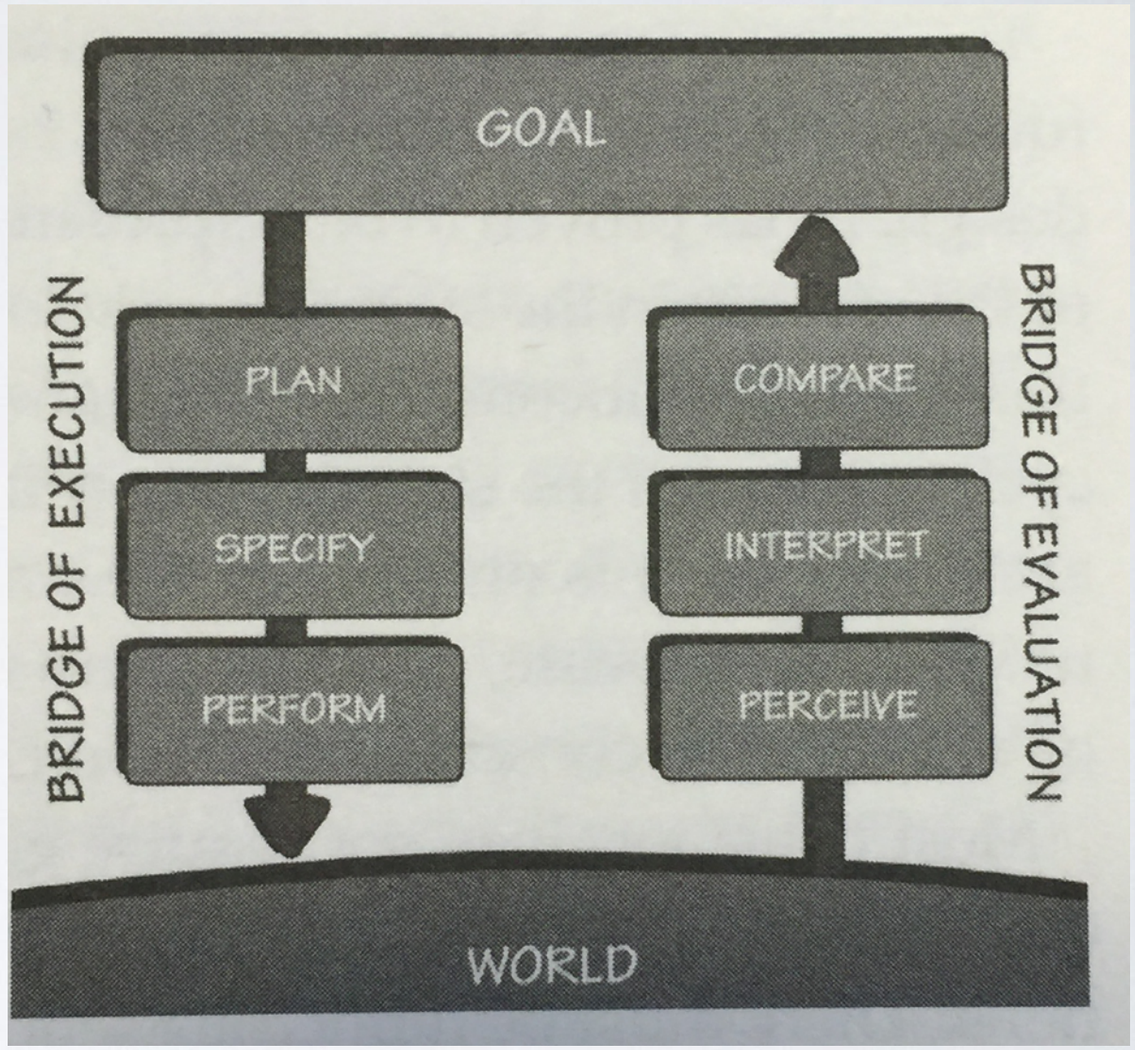
- Often tradeoffs between alternative interaction techniques
- What's the right choice?
- It depends…
  - No absolute right answer
  - Goal is to optimize for task performance, which might lead to different choices in different situations
- Understanding interaction techniques help provide options and understand tradeoffs

Gulfs of execution and evaluation

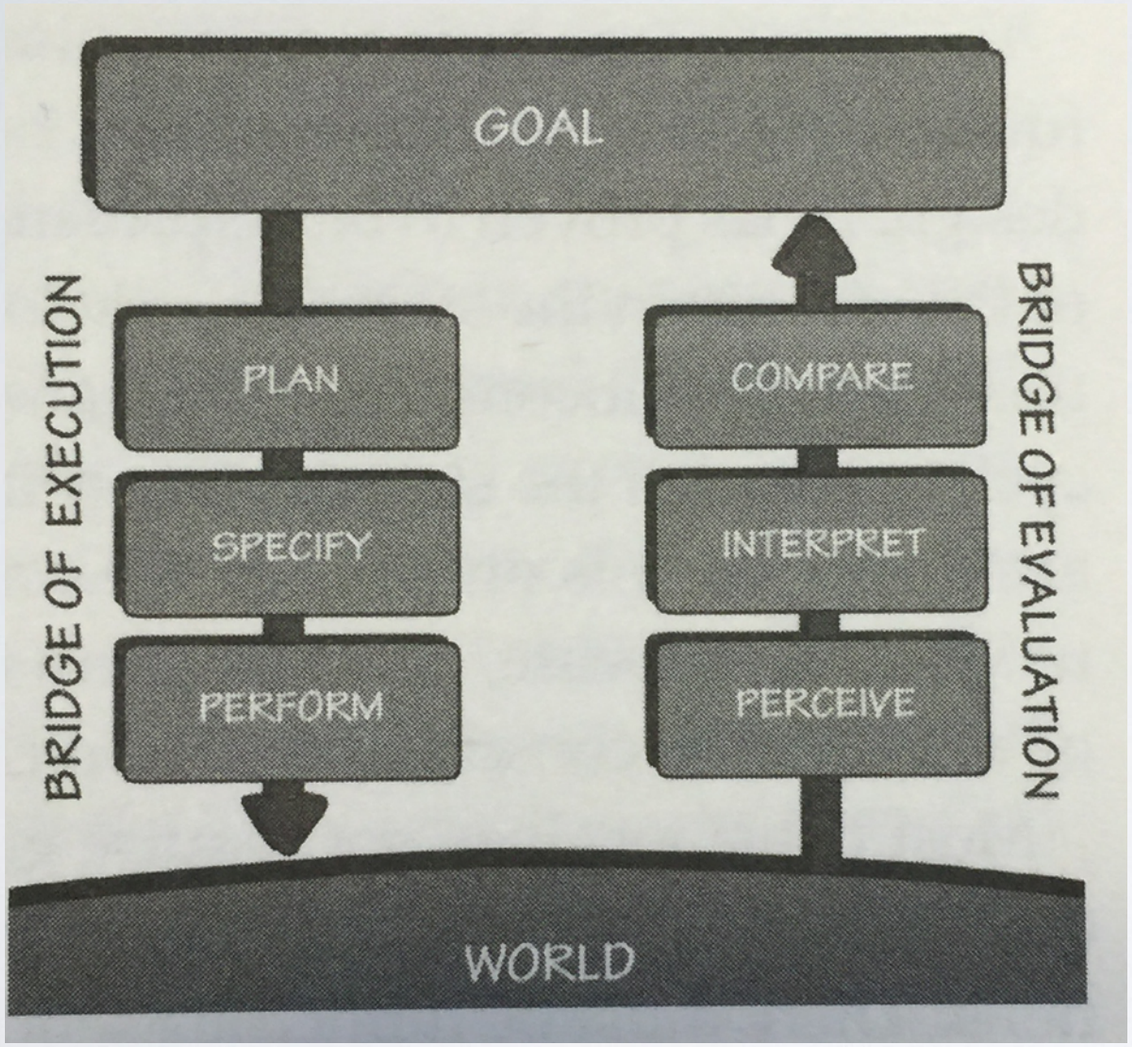


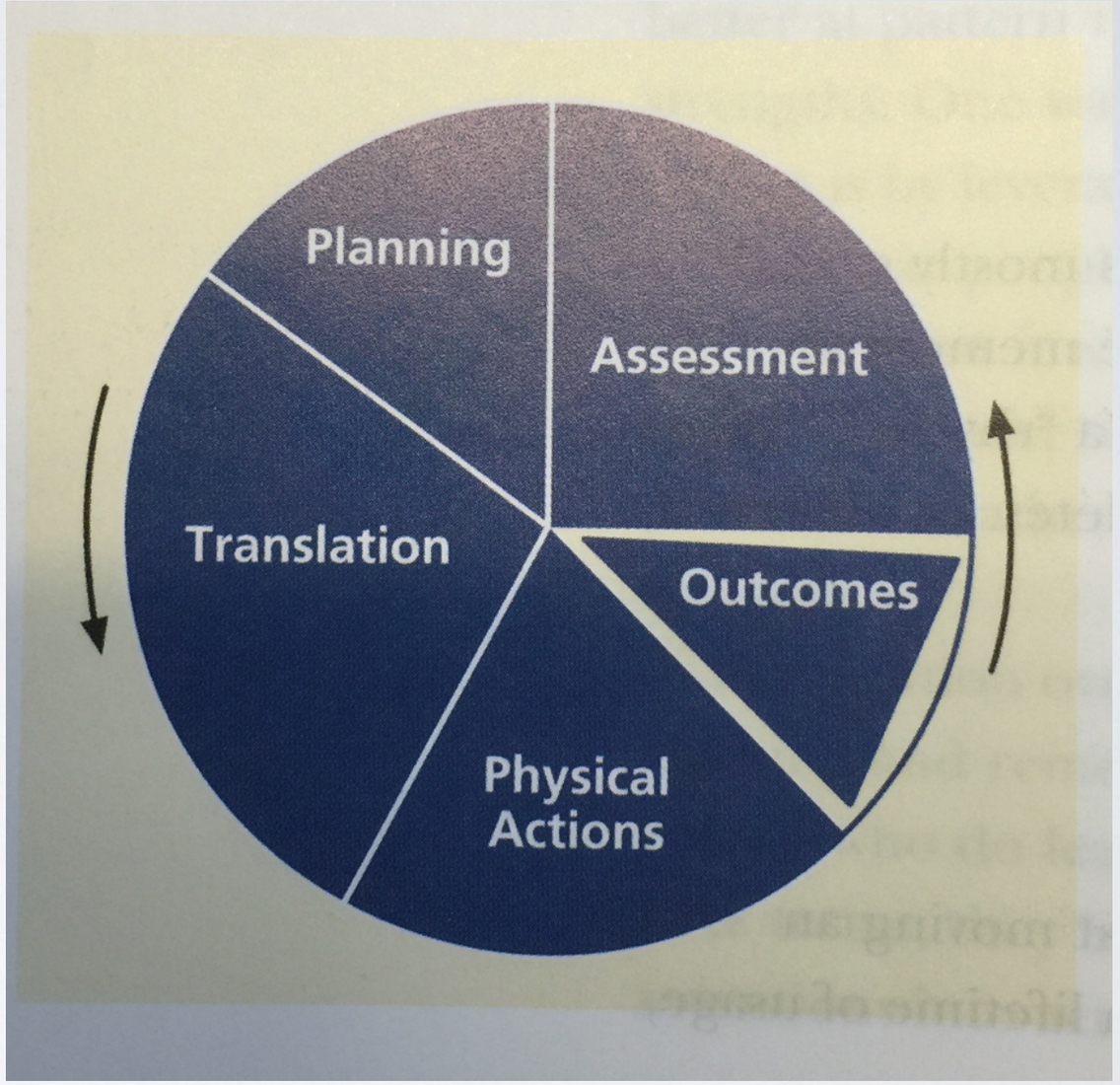
Norman's 7 stages of action

1. Goal (form the goal)
2. Plan (the action)
3. Specify (action sequence)
4. Perform (action sequence)
5. Perceive (the state of the world)
6. Interpret (the perception)
7. Compare (outcome w/ goal)



Hartson & Pyla Interaction Cycle





- cognitive affordances (Hartson & Pyla) —> signifiers (Norman)

Planning

Planning

- Support users in how they **determine** what to do

- Help users determine what they **can** do

Clear system task model

- Help users accomplish goals by providing clear model of how users should view system in terms of tasks
- Design to match users' conception of high level task organization
- Help users understand what features exist and how they can be used
- Help users decompose long tasks into small pieces
- Keep task context visible to minimize memory load

Effective planning

- Help users plan most efficient ways to complete tasks
- Keep users aware of task progress, what has been done and what is left to do
- Provide constraints to avoid transaction completion slips
  - e.g., prevent users from starting task and accidentally throwing away work mid-task

Example

Home Notifications Moments Messages Search Twitter

Thomas LaToza
@ThomasLaToza

TWEETS 28 FOLLOWING 142 FOLLOWERS 91

Who to follow · Refresh · View all

UPMC Health Plan @UPMC...
Followed by Christian Kästner
Follow Promoted

Davide Di Ruscio @DDiRus...
Followed by FSE 2014 and ...
Follow

Phil McMinn @philmcminn
Followed by Tao Xie and oth...
Follow

Find friends

Trends · Change

Missy
61.8K Tweets about this trend

#1DR1LiveLounge
586K Tweets about this trend

#ModiInUK
118K Tweets about this trend

#ItsNotAHolidayUntil
Trending for 2 hours now

YouTube Music
Started trending in the last hour

#1DayTillPURPOSE
215K Tweets about this trend

iPad Pro
75K Tweets about this trend

Canada
171K Tweets about this trend

To Read
89.4K Tweets about this trend

Sketch
21.5K Tweets about this trend

What's happening?

Firebase @Firebase · 2m
5 steps for securing user data with the Bolt compiler. firebase.com/blog/2015-11-1...

1

VARIDESK @Varidesk · Sep 9
Meet the newest member of the VARIDESK family-the VARIDESK Laptop! Work sitting or standing anywhere for $175.

The affordable & no-hassle standing desk for laptop & tablet users.
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NetBeans Team @netbeans · 11h
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12 14
View summary

Orchestration & interaction flow

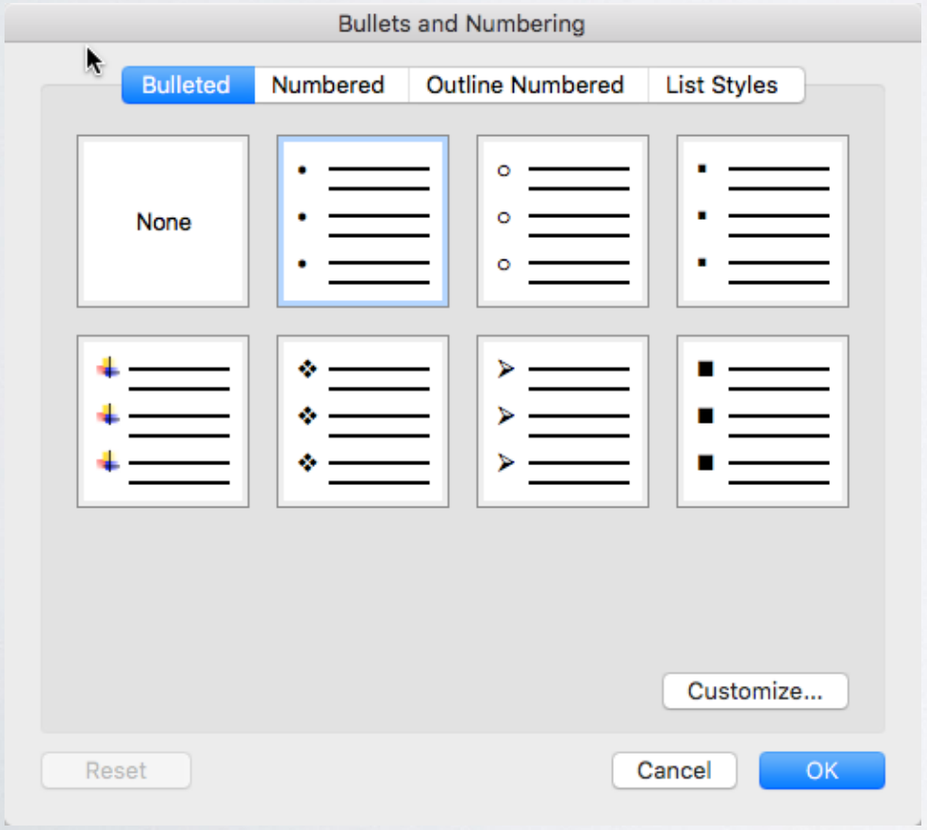
- Interaction flow - the next thing the interface wants to do is exactly what user expects
  - Follow users' mental model
  - Let user direct software
  - Keep all related tools available
- Surprises interrupt interaction flow
- Interfaces should be invisible

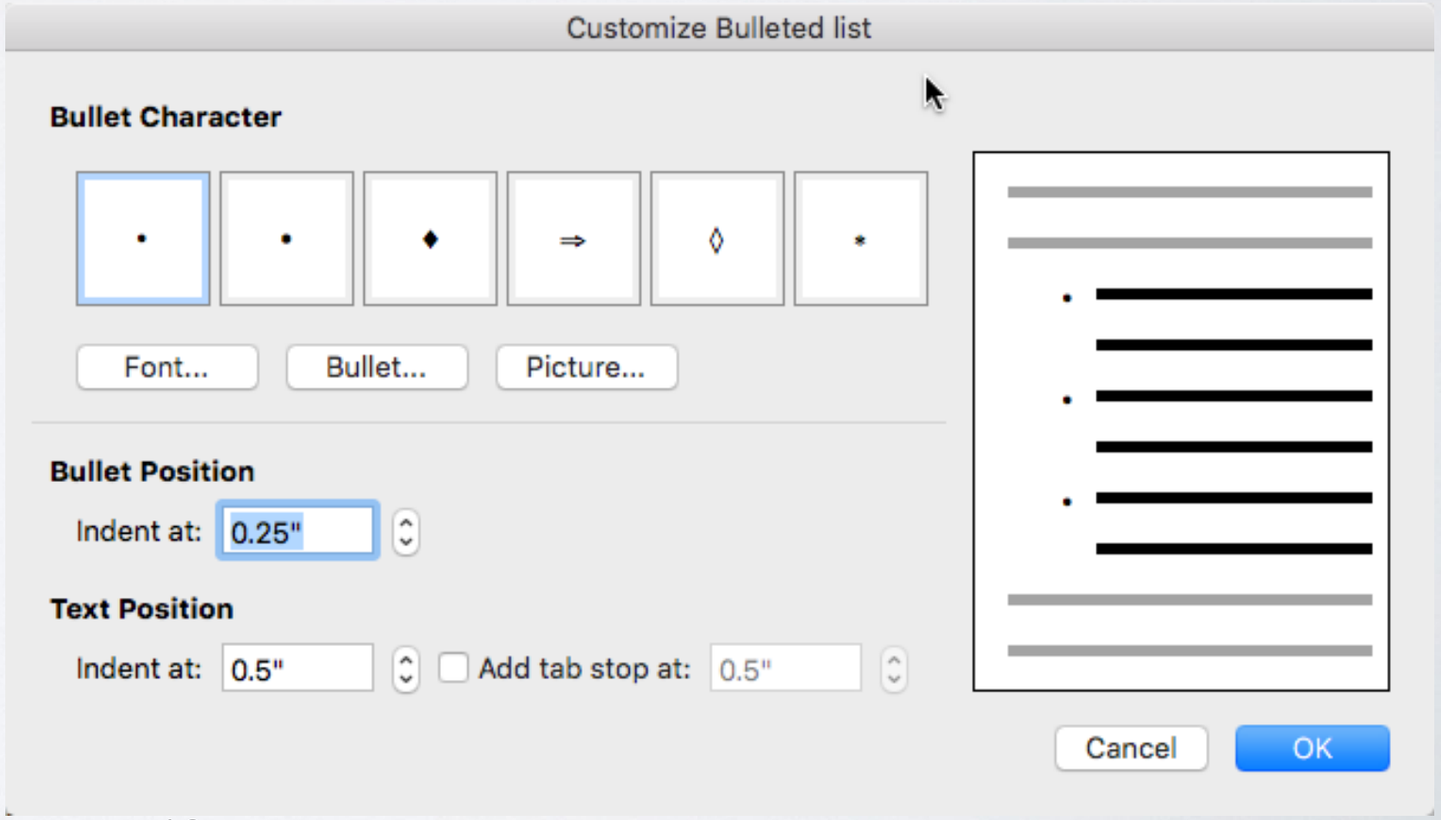
Interaction flow guidelines

- Don’t use dialogs to report normal behavior
- Separate commands from configuration
- Don’t ask questions, give users choices
  - Give users default input, show possible options
- Make dangerous choices hard to reach
- Design for the probable, provide for the possible

Progressive disclosure

- a.k.a. details on demand
- Separate information & commands into layers
- Present most frequently used information & commands first





Translation

goals → action sequence

Signifiers

- a.k.a "cognitive affordances" [Hartson & Pyla]
- Goals
  - Show which UI elements can be manipulated
  - Show how they can be manipulated
  - Help users get started
  - Guide data entry
  - Suggest default choices
  - Support error recovery

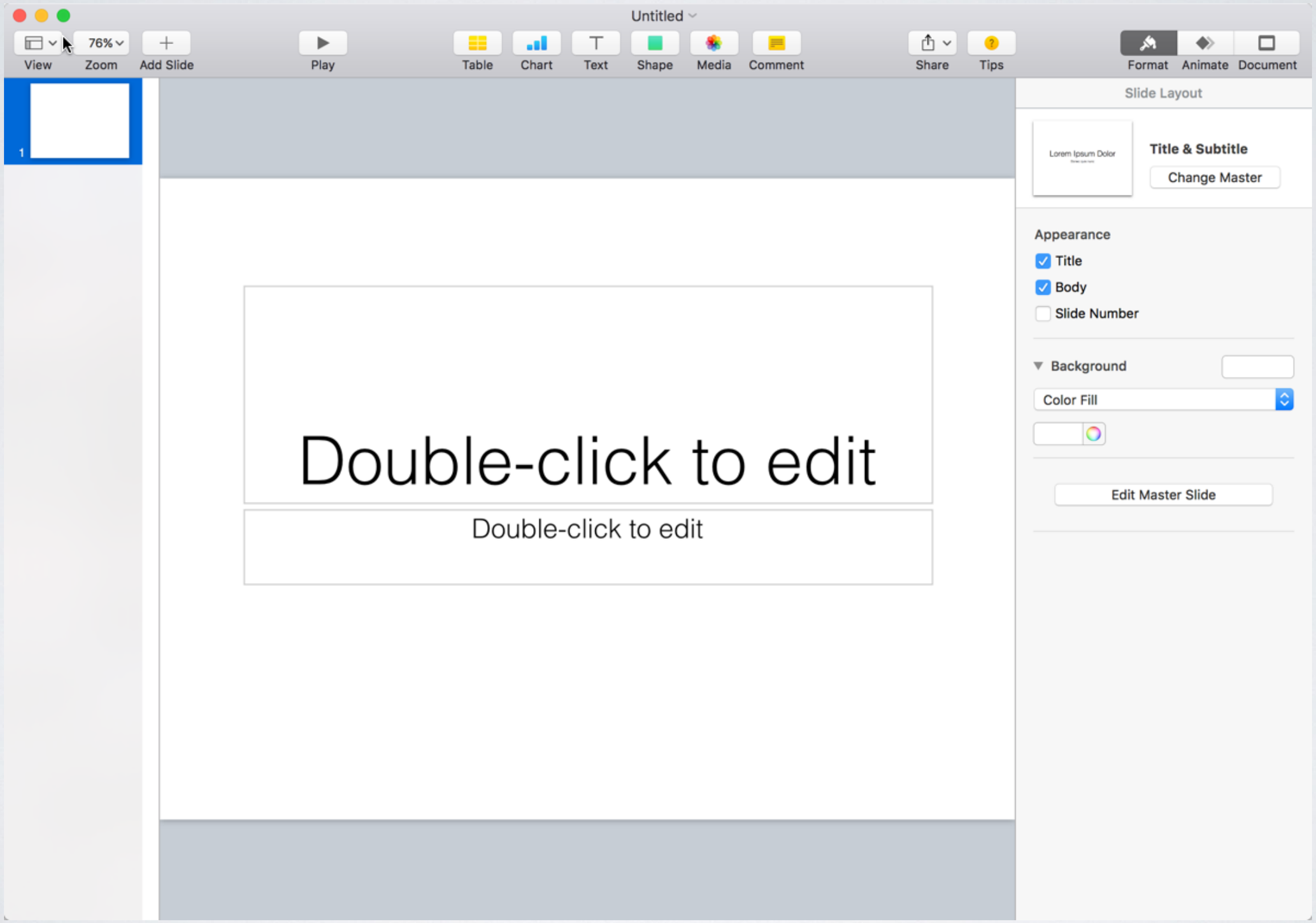
Hinting

- Indicate which UI elements can be interacted with
- Possible visual indicators
  - Static hinting - distinctive look & feel
  - Dynamic hinting - rollover highlights
  - Response hinting - change visual design with click
  - Cursor hinting - change cursor display

Help users predict outcome of actions

- What does this do?
- Should I click it?

Help users determine where to get started



Visual design considerations

- Should be visible, noticeable, & legible
- Reduce complexity w/ visual design organization & structure, module & program
- Presented before needed

Clarity of wording (Example)

Implement Function Behavior (10 Pts)

Implement a behavior for this function

← Back | Dispute this test | Inspect code | ▶ Run Tests

STATUS	failed
DESCRIPTION	it should throw an exception if the parameters are invalid
EXECUTION TIME	6ms
MESSAGE	expected 4 to equal 3
DIFF	3 - 4
CODE	`1 expect(calculate('+',[1,2])).to.equal(3);`

Function Editor

```
11  * @return {Number}
12  */
13 function calculate(command,numbers){
14     if( ['*','/','+','-'].indexOf(command) == -1 )
15         throw 'command not recognized'
16
17     if( !(numbers instanceof Array) || numbers.length === 0)
18         throw 'numbers not valid';
19
20     switch( command ){
21         case '+':
22             var res = sum(numbers[0],numbers[1]);
23             return res;
24         case '*':
25             var res = proc
26             return res;
27         default:
28     }
```

sum(numbers[0],numbers[1]) X
4
stub this function call

1. Line 15: Missing semicolon.

Clarity of wording

- Choose words carefully
- Speak the user's language
- Avoid vague, ambiguous terms
- Be as specific as possible
- Clearly represent domain concepts

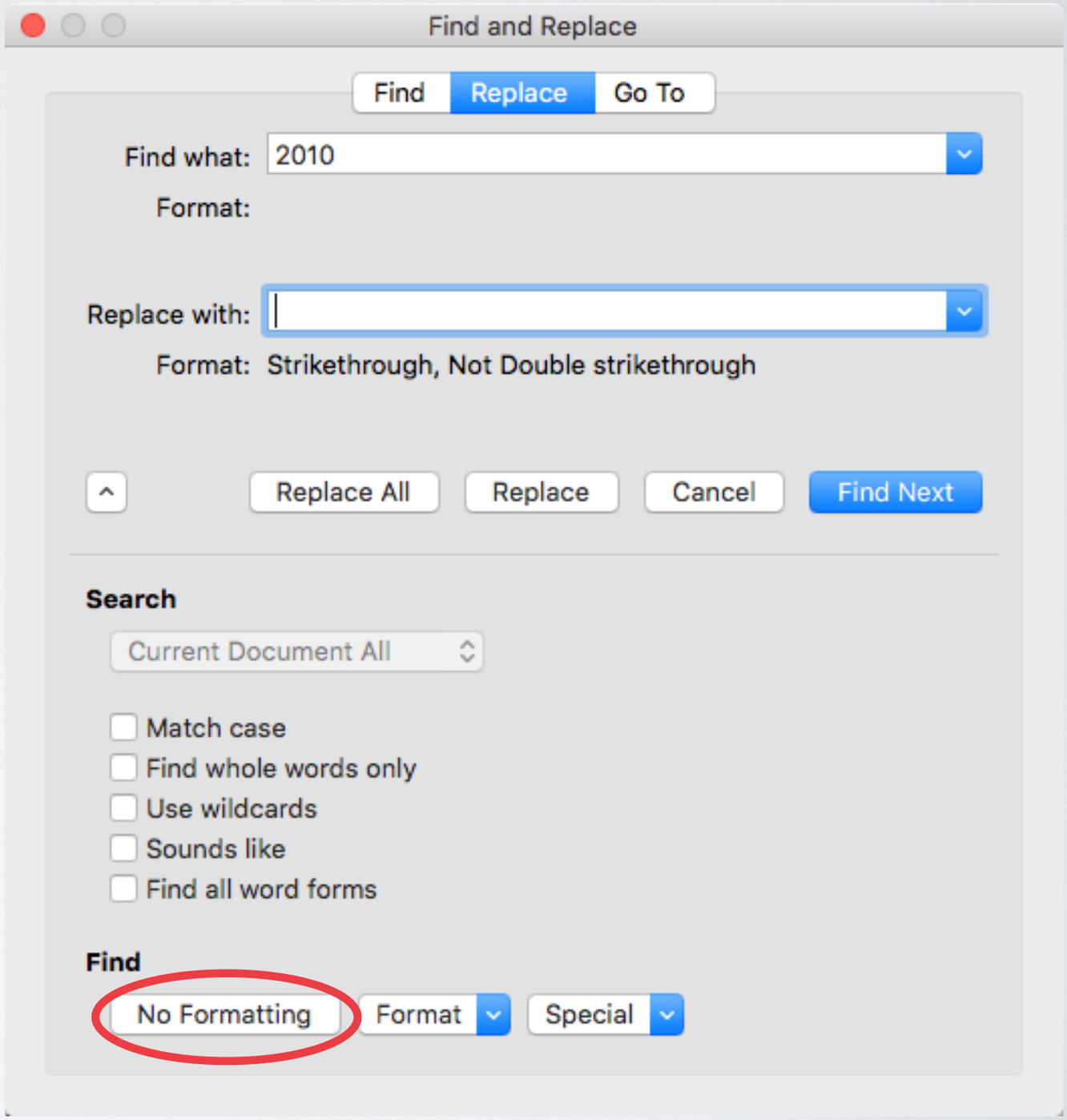
Data entry

- Indicate formatting constraints or directly use constraints

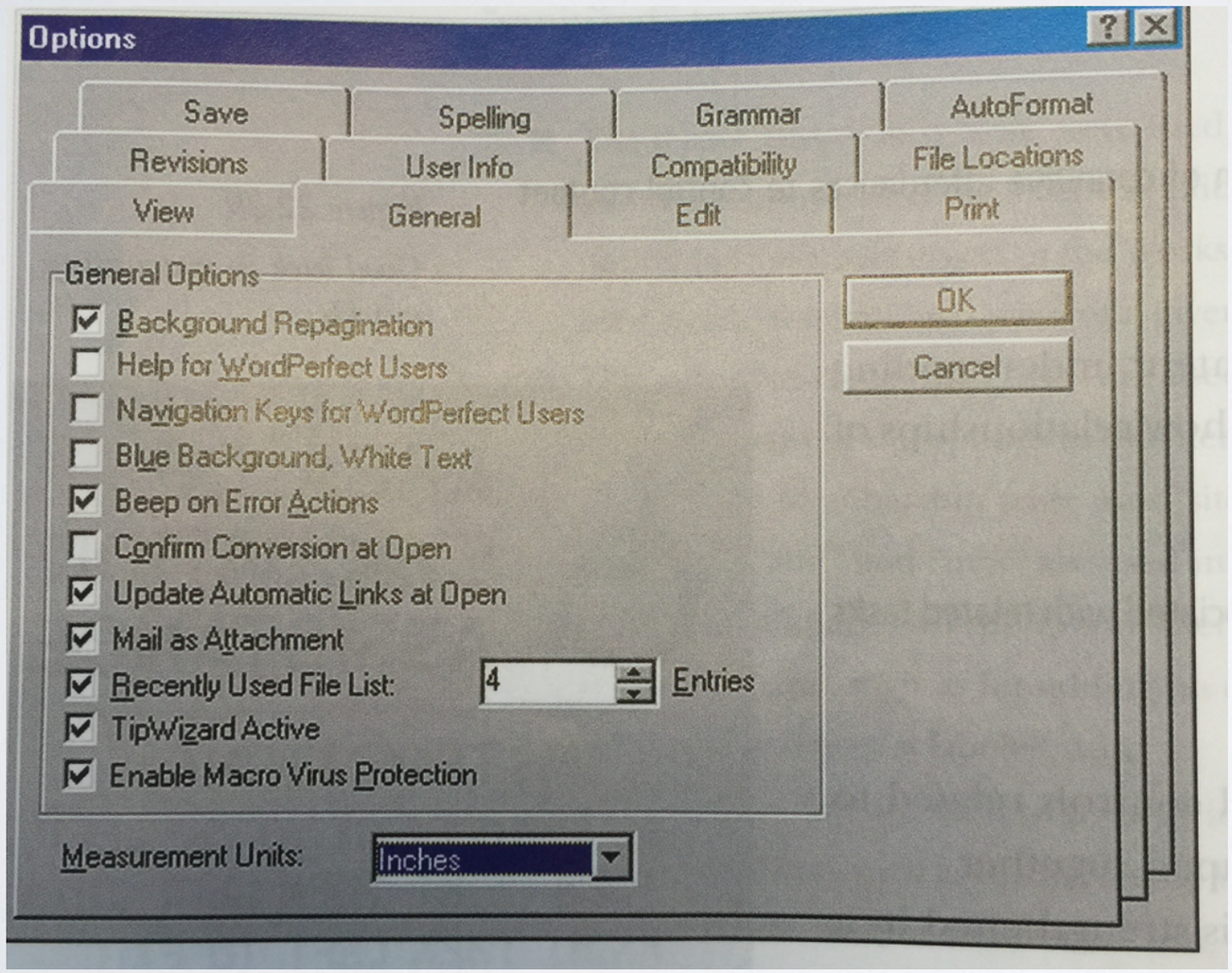
- e.g., dates

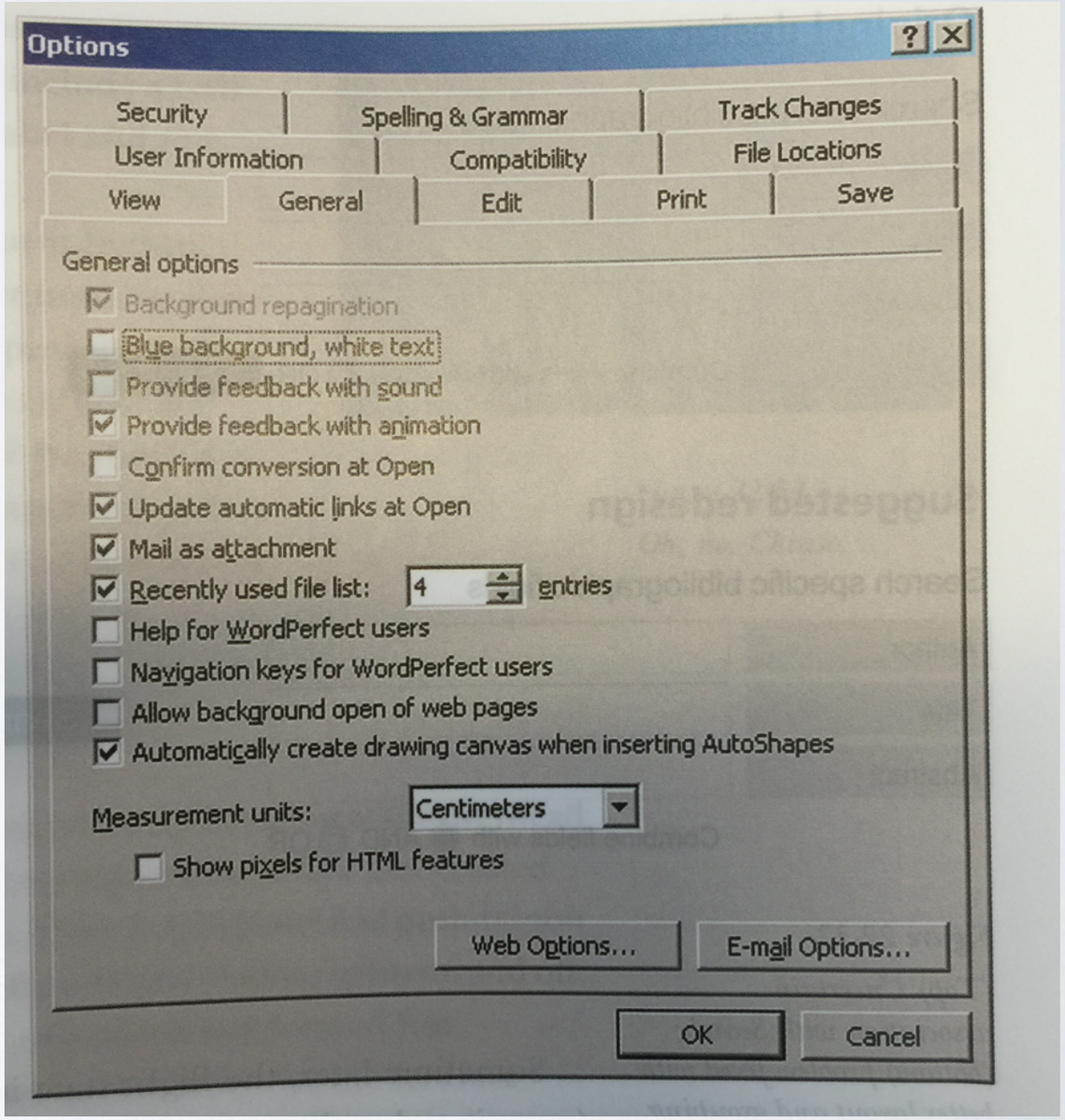
Consistency

- In use of **terms**
  - e.g., do not use "revise" and "edit" interchangeably
- In how commands **map** to UI interactions



Indicate functional groupings visually

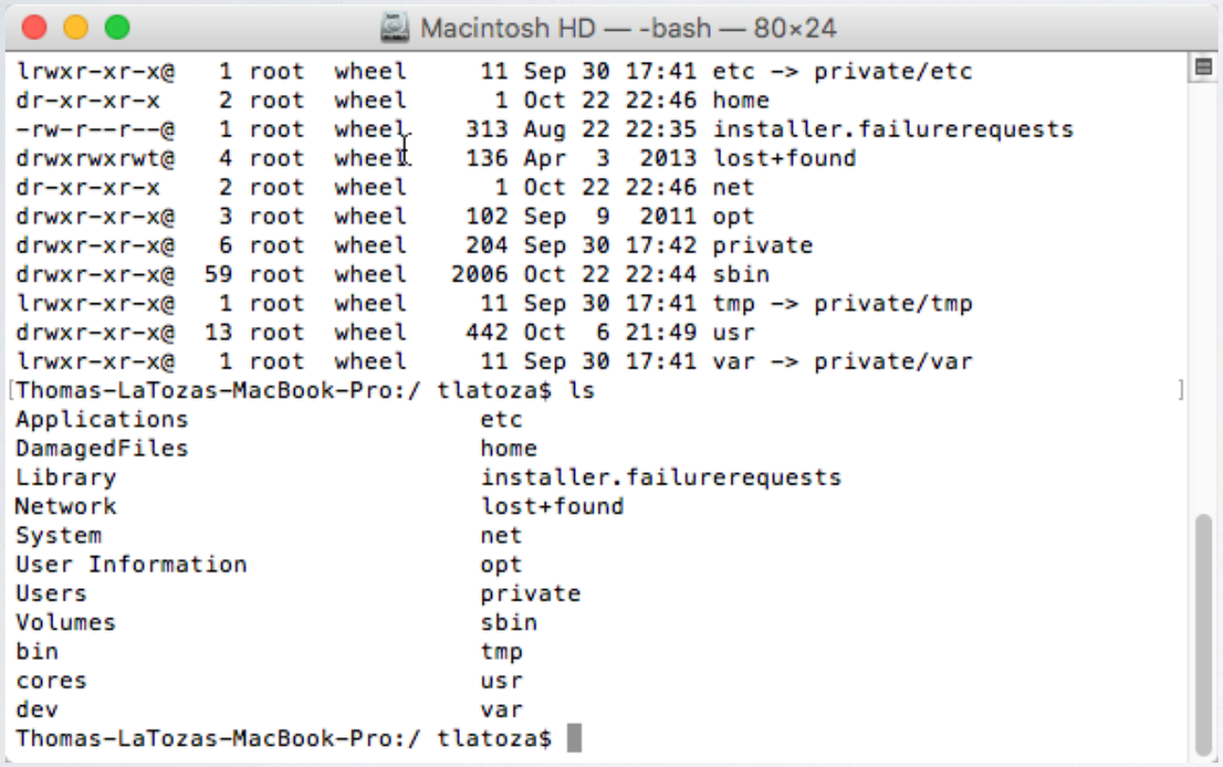


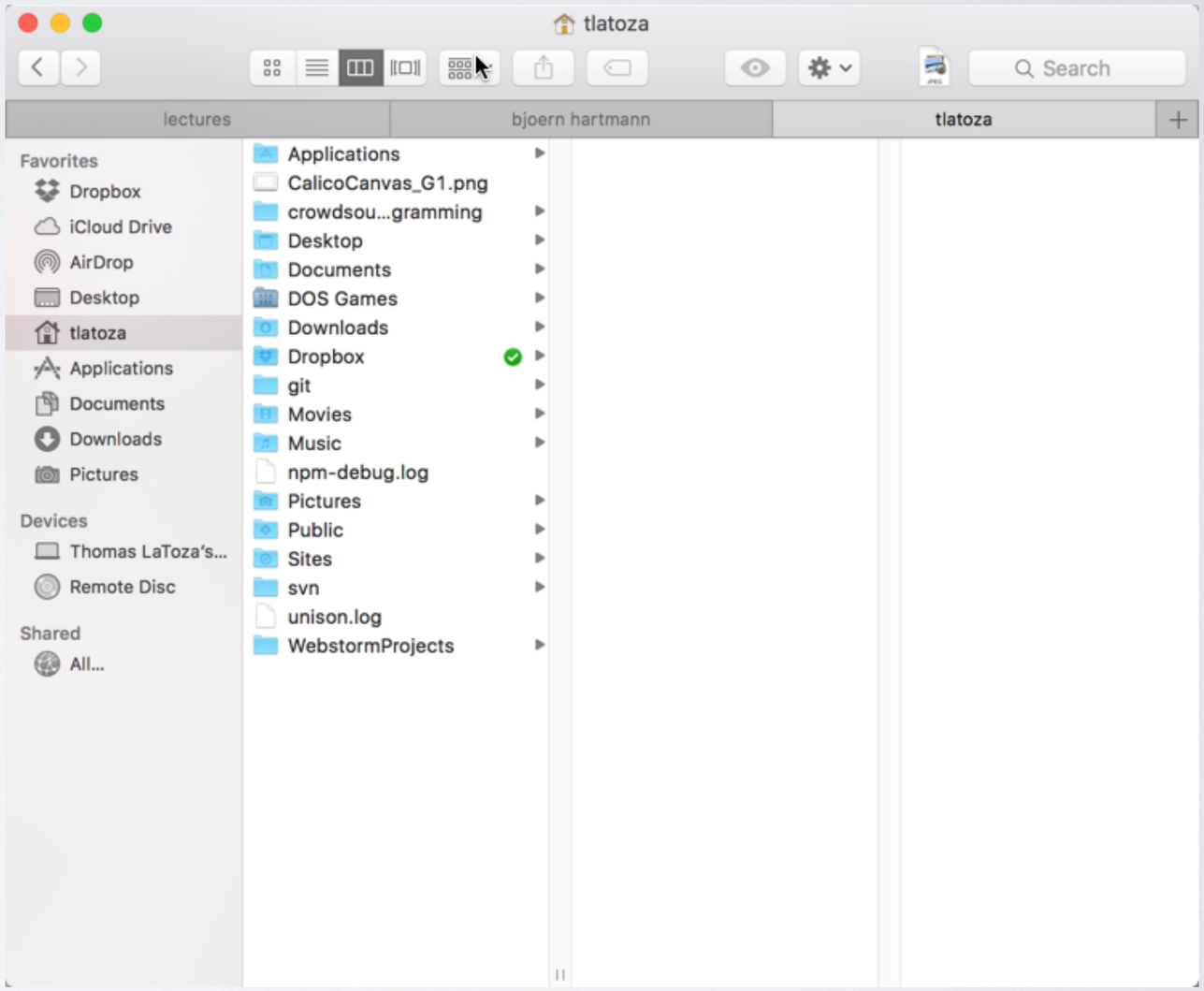


Likely & useful defaults

- Default text, if relevant (e.g., date)
- Default cursor position
- Avoid requirements to retype & re-enter data

Prefer recognition over recall





Error prevention & recovery

- Use constraints (e.g., grey out & disable inappropriate buttons, end choices)
- Offer undo & redo
- Offer constructive help for error recovery

Be careful w/ modes

- Modes create inconsistent mapping
  - E.g., control S sometimes saves, sometimes sends email
    - Especially dangerous for frequent interactions that become highly automatic System 1 actions
- Avoid when possible
- Clearly distinguish if necessary

Metaphors & idioms

Metaphors

- One way to communicate interaction techniques is through metaphors to the real world

Metaphors - advantages

- Leverages understanding of familiar objects & their functions
  - File cabinets, desks, telephones
- Provides **intuitive** understanding of possible affordances & eases mapping tasks to actions
  - Open a folder, throw file in trash, momentum scrolling

Metaphors - disadvantages

- Tyranny of metaphor: ties interactions closely to workings of physical world

- Adds useless overhead in extra steps, wastes visual bandwidth

- Taken literally, becomes non-sensical

  - e.g., nesting folders 10 levels deep

Alternative - Idioms

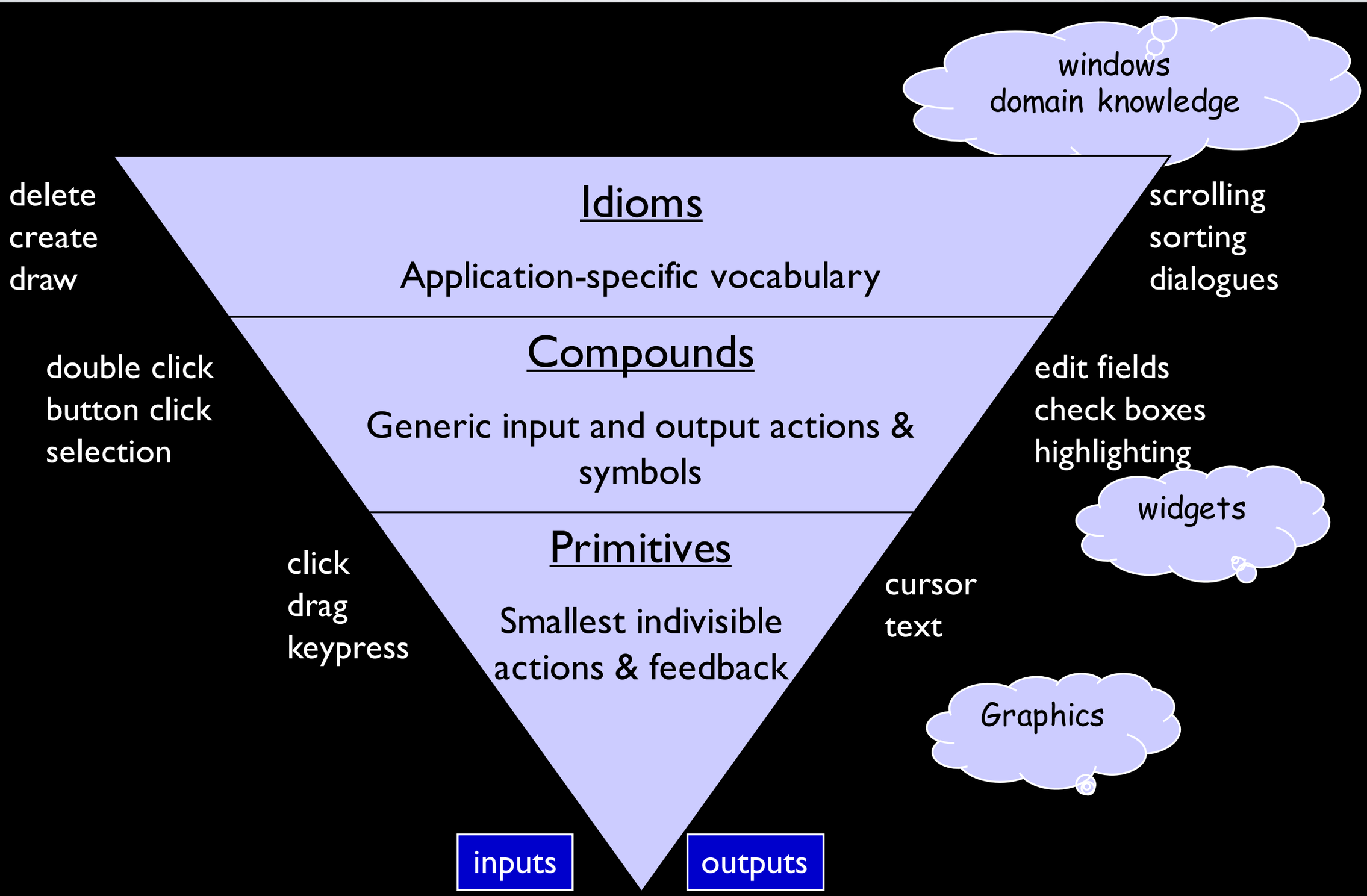
- A consistent mental model of how something works
  - e.g., Files: open / close / save / save as
- Offers intuitive understanding of affordances & interactions
- Provides consistent vocabulary for describing interactions
- Only have to learn it **once**
- Might have originated in real world, but thought of in terms of mental model for UI interactions

Examples of idioms

Examples of idioms

- Email
- Clipboard: cut / copy / paste
- Format painter
- Newsfeed
- Follow item

Designing idioms



Navigation

Navigation

- Among windows & screens
- Among panes or fames in a window
- Among tools and menus
- Within an information space

Possible navigation problems

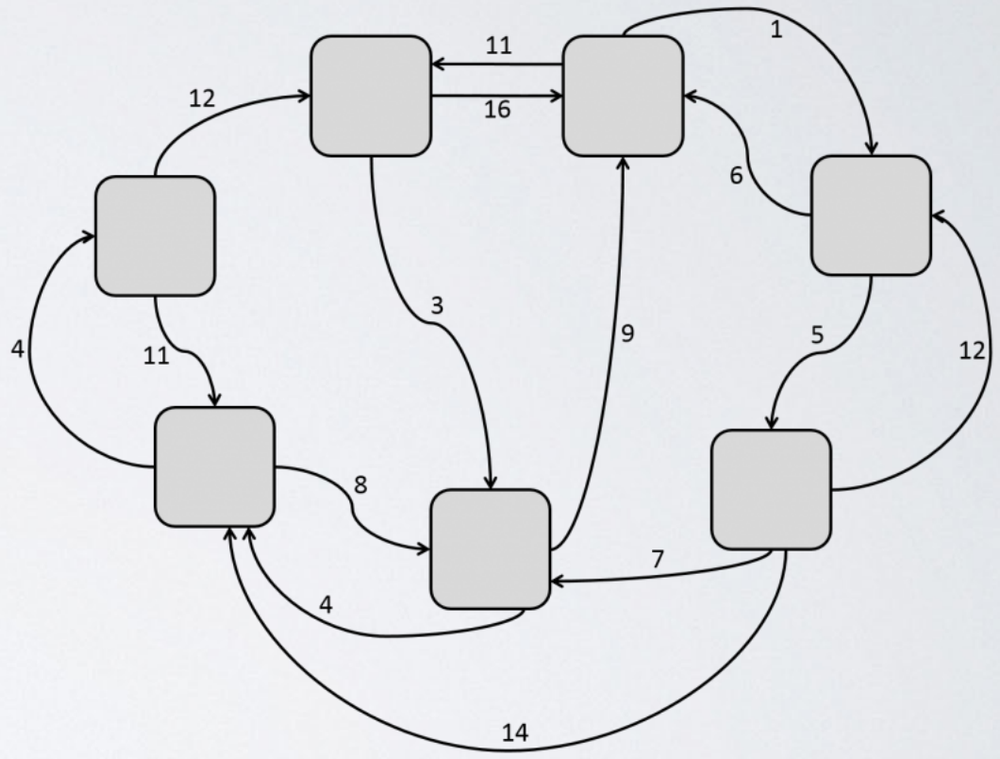
- User can't find desired location
- User loses track of location
- User can't remember information from another location

Information foraging

- Mathematical model describing navigation
- Analogy: animals foraging for food
  - Can forage in different patches (locations)
    - Goal is to maximize chances of finding **prey** while minimizing time spent in hunt
- Information foraging: navigating through an information space (patches) in order to maximize chances of finding prey (information) in minimal time

Information environment

- Information environment represented as **topology**
  - Information patches connected by traversable **links**
- Examples
  - Web pages, connected by links
  - Menu options & dialogs connected by commands
  - Locations on map, connected by search, scroll, move interactions with map



Traversing links

- Links - connection between patch offered by the information environment
- Cues - information features associated with outgoing links from patch
  - E.g., text label on a hyperlink
- User must choose which, of all possible links to traverse, has best chance of reaching prey

Scent

- User interprets cues on links by likelihood they will reach prey

- e.g., do I think that the "Advanced" options are likely to have the option I'm looking for?

Simplified mathematical model

- Users make choices to maximize **possibility** of reaching prey per cost of interaction
- Predators (idealized) choice = max [V / C]
  - V - value of information gain, C - cost of interaction
- Don't usually know ground truth, have to estimate
- Predator's desired choice = max [E[V] / E[C]]

Design recommendations for navigation

- Organize information into functionally **related** groups
- Design effective **cues**, describing what will be found by traversing links
- Match **expectations** of user's mental model
- Provide **search**

In Class Activity

Design a course catalog & registration system

- In groups of 2
  - Design a course catalog & registration system
  - Create sketches showing key screens
  - Should support
    - browsing course catalog, registering for classes, waitlists
    - building plan of courses to take over multiple semesters to fulfill degree requirements