

# SWE 432 -Web Application Development

Spring 2023



George Mason  
University

---

Dr. Kevin Moran

## *Week 13:* Think-aloud Usability Evaluations & Site Design





# Administrivia

- Midterm Exam Grades Posted!!
- *HW Assignment 3* - Working on Grades and Comments now.
- *HW Assignment 4* - Out now, Due next week (April 28th)!
- Extra Credit Opportunity!



# HW Assignment 4

## **Step 1: Sign up on GitHub Classroom to Clone the Starter Project**

Please follow the instructions for setting up this homework assignment in GitHub Classroom and deployment of your project via Heroku. The starter project includes code for a React Front-End. You may reuse your code from HW2 or HW3 if you would like to use a backend for this assignment, however, this is not required.

[Click Here to View HW 4 Tutorial \(Coming Soon!\)](#)

## **Step 2: Choose an Idea for an Interactive App**

In this assignment, you are free to choose any idea for an app you'd like as long as it involves user interactivity, where the application is taking input from the user (e.g., clicking on buttons, entering text), updating the state of the application, and rendering new visual content from the new state. You might create a simple game, such as a number guessing game or checkers. You might create a data management app to, for example, create and browse recipes or track expenses. You should pick something that is interesting and exciting to you.



# HW Assignment 4

## Step 3: Implement your Interactive App

You'll implement your app as a front-end React app. Your app should satisfy the following requirements:

### Requirements

- **React**
  - Create at least 5 separate React components.
  - Use conditional rendering to conditionally render visual content
  - Include handlers in your React components for at least 5 events
  - Create at least two controlled components, where input from an HTML control is bidirectionally synchronized with state in a React component
  - Create a list of child elements or components with unique keys
- **CSS**
  - Create at least one cascading selector which overrides another selector
  - Use at least two pseudo-classes
  - Center at least one element inside its container
  - Use the z-index and absolute or fixed positioning to display an element stacked on top of another element
  - Create at least one animation using transition
  - Specify at least one fixed size and one relative size
  - Use display grid to create a layout with multiple rows and columns
  - It is optional to use any styling libraries like Bootstrap or Material-UI, however, you must manipulate CSS as required above (for example, customizing the library with your own CSS files, or inline by setting style within your React components).



# HW Assignment 4 - Extra Credit

I will be offering Extra Credit on this assignment. This extra credit will be applied toward your midterm exam grade, with a maximum of 10 potential points to be earned (out of 200). This is essentially amounts to half a letter grade.

- **Bonus (Extra Credit)**
  - Create at least 5 jest tests to test the functionality of your app
  - You should use at least 3 tests that use the `jest-dom` package and at least 2 "normal" Jest tests



# Class Overview

- Lecture: Think-Aloud Usability Evaluations
  - Quick Lecture
  - Usability Study Activity

# Usability Studies



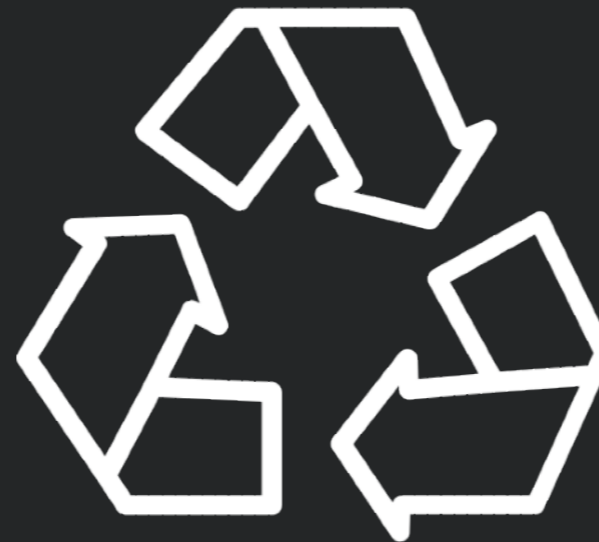
# Iterative Model of User-Centered Design

## Observation

(Re)Define the Problem  
Understand User Needs

## Idea Generation

Brainstorm  
what to build



## Test

Evaluate what  
you have built

## Prototype

Build



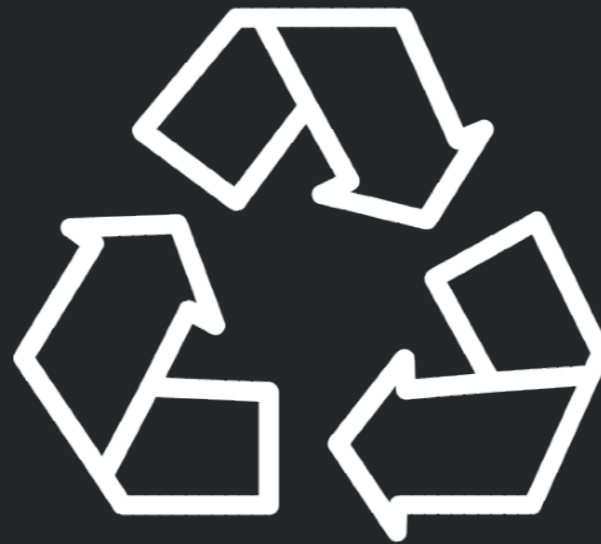
# Iterative Model of User-Centered Design

## Observation

(Re)Define the Problem  
Understand User Needs

## Idea Generation

Brainstorm  
what to build



## Prototype

Build

## Test

Evaluate what  
you have built

### Empirical

Usability Evaluation (Now)



# Why Conduct Usability Studies?

- Evaluate interaction design with *real* empirical data, gathering ground truth of user performance
- Identify *usability issues*





# Think-aloud Usability Study

- Goal: observe users using app, identify usability issues
- Can use with
  - paper prototype
  - HTML prototype
  - Wizard of Oz study
  - actual app



# Steps in a Usability Evaluation Study

- Formulate goals of study
- Design study protocol, tasks, materials, data collection, ...
  - Pilot study design
- Conduct study
- Analyze data to assess task performance and identify usability issues

# Formulate Study Goals



# Study Goals



- Where are you in the design process? What feedback do you seek?
  - Exploring new design idea
  - Validating high-level approach
  - Identifying important usability issues
  - Evaluating a new feature just added or a particular corner case
  - Studying performance by specific users (e.g., expert users familiar with old version)
  - Comparing performance against competitors

# Study Design





# Selecting Participant Population

- Who will be the users?
- Goal: users representative of system's target users
- Are there multiple classes of users (e.g., data analysts, site administrators)?
  - If so, which are appropriate given goals?
  - May choose several classes
- System novices or experts?
- Might choose to include UX experts to help flag potential issues





# Number of Participants

- More participants —> different participant interactions, more data
- Fewer participants —> faster, cheaper
- No right answer, as depends on potential diversity of interactions and users
- Nielsen & Morlich (1990) found that 80% of problems could be detected w/ 4-5 participants
  - Most serious usually detected with first few
  - Krug suggests 3



# Informed Consent

- Important for participants to be told up front what they will do and provide affirmative consent
- Helps allay potential participant fears
- Make clear purpose of study
- Make clear that you are evaluating your design, **not** the user



- What will users do?
- Goals for task design:
  - Provide specific goal: something that the user should accomplish
  - Comprehensive enough to exercise key features of your app
  - Short enough to minimize participant time commitments



# Communicating Tasks

- Provide a scenario explaining the background of what users will be doing
- Provide a specific goal that the user should accomplish
  - But ***not*** how they should accomplish it
  - Don't give away how you hope users will accomplish goal
- Communicate ***end criterion*** for task - how do they know they're done?
- Provide maximum time limit after which they will be stopped



# Recruiting Participants

- Many potential sources
  - Co-workers, colleagues, friends, family
  - Email, mailing lists, online forums
  - Announcement at related user groups
- Important to select sources that best match the background & knowledge of target users



# Incentives for Participants

- Often (but not always) helpful to pay participants
- Most applicable when seeking participants with specialized expertise with whom you do not already have a personal or professional relationship
- Can also offer other incentives, such as gifts, coffee mugs, gift certificate; or free consulting, training, or software
- In some cases, just learning about future product can be incentive



# Managing Participants

- Participants are valuable resource
  - Often finite resource
- Think carefully about how participants will be used
- Devise mechanisms for scheduling participants & reminders



# Training

- Goal: *avoid* unless really necessary
- Training necessary when
  - Participants require specialized knowledge to act as target users
  - Target users will have access to specialized training materials before they begin study





# Data Collection

- Think aloud
- Screencast
- Questionnaires interview questions to gather participant feedback



# Questionnaires and Interviews

- Gather background or demographics about participants (if important)
- Supplement task performance data with subjective reactions
  - Perceptions of design, comments on potential issues, ideas for features
- Questionnaire - pre-defined questions, focused, less bias
- Interviews - more open ended, longer responses



# Example Open-ended Questions

- What did you like best about the UI?
- What did you find most difficult or challenging?
- How might the UI better support what you're trying to do?



# Piloting Study Design

- Dress rehearsal for conducting actual study
- Goals
  - Ensure software / prototype won't "blow up"
  - Test tasks - ensure right length & difficulty
  - Test that materials are comprehensive and comprehensible
- As-needed piloting
  - Use first study session as pilot only if issues arise and must be addressed

# Conducting the Study





# Introduction (I)

- Greet participants, introduce yourself, thank them
- Build rapport, socialize
- Introduce them to the setup



# Introduction (2)

- Give participant Informed Consent
- Answer any questions about study design
- Relieve anxiety and curiosity as much as possible
- Make clear evaluating design, not participant
- Let participants know you can't answer questions about how to do task



# Starting Session

- Give participants description of task
- Start any video recording
- Start encouraging participant to think aloud
- Begin observing participants work on task





# Interactions During the Task

- Goal: listen, not talk
- Prompt participants to think aloud when necessary
  - e.g., What are you trying to do? What did you expect to happen?
- If show signs of stress / fatigue, let them take a break
- Keep participants at ease
  - If participants frustrated, reassure & calm participants
  - If so frustrated they want to quit, let them



# Giving Help

- If participants totally off track, small reminder of goal might help
- Should ***not*** give participants information about how to complete the task
- What if user asks for help?
  - Direct them to think through it or work it out for themselves



# Collecting Critical Incidents

- *Any action that does not lead to progress in performing the desired task*
- Often related to a gulf of execution or gulf of evaluation
- Generally does not include
  - accessing help
  - random acts of curiosity or exploration



# Understanding a Critical Incident

- Important to understand in the moment what users goal is and what actions they are taking
- When a critical incident occurs, jot down
  - The time
  - What user was trying to do
  - What user did



# Wrapping Up the Study Session

- Provide questionnaire (if applicable) / conduct interview (if applicable)
  - Probing into causes of behavior
- Answer any lingering questions the participant may have
- Thank the participant!!
- Provide any incentives (if applicable)



# Reset Study Environment

- Make sure study environment is in the same state for all participants
  - Reset browser history / cache (if applicable)
  - Delete any user created content or materials

# Analyzing Data





# Critical Incident Analysis

- Identify critical incidents where something went wrong
- Easiest to catch in the moment - *important to take good notes*
- Going back and looking at screencast can help you study context of issue in more detail





# Reporting a Critical Incident

- Problem statement: summary of problem and effect on user (but not a solution!)
- User goals: what was user trying to do?
- Immediate intention: at the moment in time when problem occurred, what was the user trying to do
- Possible causes: speculate on what might have led user to take action they did



# Critical Incidents → Usability Issues

- Group together similar incidents to form *usability issue*
  - Match similar critical incidents within and across study sessions
  - Identify underlying cause
- Brainstorm potential fixes



# Example of Thinking Aloud

http://ambassadorsforlife.org/ambassadors/ Who We Are

File Edit View Favorites Tools Help

Page Safety Tools

AMBASSADORS FOR LIFE

Sign in to my account BECOME AN AMBASSADOR


HOME ABOUT THE NEED IDEAS TOOLS FIND AFL CONTACT

ABOUT

WHO WE ARE

- AMBASSADOR SPOTLIGHT
- STORIES & VIDEOS
- FIND AN AMBASSADOR
- AMBASSADOR TOOLS
- FAQS
- AMBASSADOR SIGN-IN

WHO WE ARE



100%

# In-Class Activity





# Group Activity

- In groups of two
- Take turns conducting a usability study of an app of your choice
  - Try to think of a semi-difficult task that you might be able to improve
  - 5 mins to brainstorm 5-10 min task for each app
  - ~10 mins to conduct each study
  - Identify critical incidents (if any)

# SWE 432 - Web Application Development

---



George Mason  
University

---

Instructor:  
Dr. Kevin Moran

Teaching Assistant:  
Oyindamola Oluyemo

Class will start in:  
**10:00**

# Overview of Site Design Principles





# Exercise: How Should a Shopping App be Organized?

- Items organized into categories
- Shopping cart for collecting items you want to buy
- Secure way to enter payment information
- An easy way to search for items



# Today



- What's a design space?
- How do you help users understand if it is possible to do what they'd like to do?
- How do you help users find what they're looking for?
- How do you balance tradeoffs between competing objectives in site design?



# Design Space

- Space of **alternatives** that might potentially exist
  - All potential aspects of design (dimensions) that might vary
  - All potential choices for each design dimension
- Choosing a point in this space requires choosing design goals
  - Thus far: task performance
  - Achieving this can often be decomposed into smaller design goals
    - e.g., minimize user errors, support more efficient navigation
  - And sometimes other design goals
    - Help users relax
    - Confuse users to teach them something
    - Encourage contributions to community
- Can use user-centered design to explore design space
  - Identify needs, sketch / prototype solution, evaluate
  - But large, so hard to enumerate every value for every variable




# Interaction Techniques

- Way in which user interacts with user interface
- Examples
  - Search
  - Tabs
  - Progressive disclosure
  - Direct manipulation
- Represents a specific solution for a specific problem
  - May or may not be the best solution for a specific set of user needs and design goals
  - But helps reduce size and complexity of search space by offering standard choices



# What can you do with this app?

The screenshot shows the Google Cloud Platform console interface for the 'crowd-coding-dev' project. The main content area is titled 'Task queues' and includes a 'REFRESH' button. Below the title, there are tabs for 'Push Queues', 'Pull Queues', and 'Cron Jobs'. A 'Show quotas' link is visible in the top right corner of the table area. The table lists the following queues:

Queue Name	Tasks In Queue	Completed In Last Min.	Oldest Task ETA ?	Maximum Rate ?	Enforced Rate ?	Bucket Size ?	Maximum Concurrent
default	0	0		1/s		1	
 subscription-queue	0	0		0/s		5	



# Analogy: Buying a Chainsaw

- You walk in to a hardware store to buy a chainsaw. What do you do?



# Challenges in Site Design

- Sometimes large space for users to navigate to find information.
- No spatial sense of scale. 50 pages? 500 pages? 50,000 pages?
- No sense of direction. Which way did I just go?
- No sense of location. No spatial anchoring of where I am now and how that relates to where I could go.
- No place to check if something is *not* present or supported.



# Site Design

- Some key design dimensions
  - Organization of content into pages / screens
  - Organization of content within pages / screens
  - Ways in which users navigate between pages / screens
- Key design goals
  - Reduce the time / cost for users to reach content
  - Reduce the irrelevant information users must read



# Planning

- Help users determine what they **can** do
  - Is this the right site for my goals? Is this the right page where I should spend my time?
- Support users in how they **determine** what to do
  - If this is the right place, how do I reach goal?



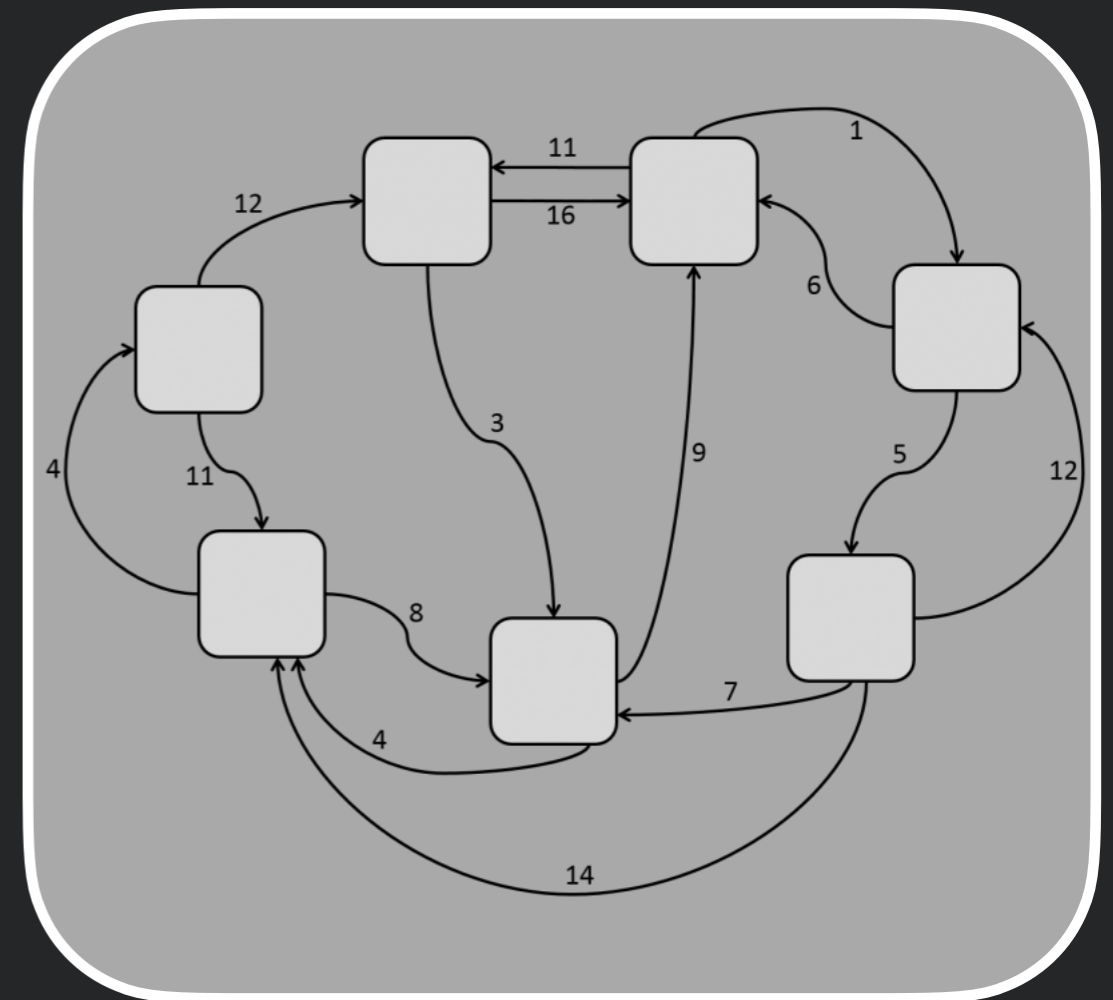


# Information Foraging

- 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

- Patch - a space in the environment where a user is located (e.g., a page, a dialog)
- 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

- User interprets cues on links by likelihood they will reach prey
- e.g., do I think that the “Advanced options” page is 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 Implications of Information Foraging Theory

- Organize information into functionally **related** groups
  - If information required is already on same page, no need to go elsewhere
- Design effective **cues**, helping users predict what will be found by traversing links
  - Better cues --> better ability to navigate to correct pages
- Match **expectations** of user's mental model
  - Cues are interpreted relative to mental model
- Provide **search**
  - In large spaces, faster to search than traverse links



# Search Increases Competition

- Users often enter sites through search engines, looking for site that will help accomplish goals
- Users form first impressions of sites rapidly
- Users will try another site if they perceive the value of continuing to forage in patch is low

# Navigation







# Common Navigation Usability Problems

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

# Hierarchy

- Information in sites is hierarchical
  - Different pages at different levels of hierarchy
  - May be different navigation elements that lead into different subtrees
- Important to signal
  - what hierarchies are present
  - which navigation elements are part of the same hierarchy
  - where the user currently is on each hierarchy

# Example: Wikipedia



Not logged in | Talk | Contributions | Create account | Log in

Main Page | Talk | Read | View source | View history | Search Wikipedia

## Welcome to Wikipedia,

the free encyclopedia that anyone can edit.  
5,594,019 articles in English

- Arts
- Biography
- Geography
- History
- Mathematics
- Science
- Society
- Technology
- All portals

### From today's featured article

**Barry Voight** (born 1937) is an American geologist, volcanologist, author, and engineer. He was a professor of geology at Pennsylvania State University from 1964 until his retirement in 2005. He still conducts research on rock mechanics, plate tectonics, disaster prevention, and geotechnical engineering. In April 1980, Voight's publications on landslides, avalanches and other mass movements convinced Rocky Crandell of the U.S. Geological Survey (USGS) to ask him to look at a growing bulge on the Mount St. Helens volcano in the state of Washington. Voight predicted the collapse of the mountain's north flank as well as a powerful eruption. After his predictions were realized in May 1980, he was hired by the USGS to investigate the debris avalanche that initiated the eruption. His work at St. Helens brought him international recognition, and he continued researching and guiding monitoring efforts at several active volcanoes, including Nevado del Ruiz in Colombia, Mount Merapi in Indonesia, and Soufrière Hills, a volcano on the Caribbean island of Montserrat. (Full article...)

Recently featured: *Resident Evil: Apocalypse* · Elcor, Minnesota · Freedom Planet

Archive · By email · More featured articles

### Did you know...

- ... that a badly wounded **Major Shaitan Singh** (*statue pictured*), who was later awarded the **Param Vir Chakra**, ordered his soldiers to leave him behind rather than face enemy fire evacuating him?
- ... that **Citicorp** chose to build a tower near the **Court Square–23rd Street** station in Queens because it was one subway stop away from the company's headquarters in Manhattan, across the East River?
- ... that the performances of **Maaya Sakamoto** and **Sanae Kobayashi** inspired **Saori Ōnishi** to pursue a voice acting career?
- ... that the **Orange College of Breda** was founded by **Frederick Henry, Prince of Orange**?
- ... that the **inland free-tailed bat** can survive the most extreme range of body temperatures of any mammal known?
- ... that upon her completion in 1885, the **French cruiser Milan** was considered the fastest warship afloat?
- ... that in 2016, annual global internet traffic reached 1.2 **zettabytes**, leading some to label the current period the **Zettabyte Era**?
- ... that **Charles Phillips**, who excavated the **Sutton Hoo** ship-burial, was tasked as a schoolboy with digging latrines near **Stonehenge**?

Statue of Shaitan Singh

### In the news

- Vladimir Putin** (*pictured*) is **re-elected** President of Russia.
- Brazilian politician and human rights activist **Marielle Franco** is killed in a shooting in Rio de Janeiro.
- In response to the **poisoning of Sergei Skripal** with a nerve agent, the United Kingdom expels 23 Russian diplomats.
- British physicist and cosmologist **Stephen Hawking** dies at the age of 76.

**Ongoing:** Rif Dimashq offensive · Turkish military operation in Afrin · UK higher education strike

**Recent deaths:** Ayaz Soomro · Sudan · Mike MacDonald · Adrian Lamo

Nominate an article

### On this day...

**March 20:** **March equinox** (16:15 UTC, 2018); Independence Day in **Tunisia** (1956)

- 235 – **Maximinus Thrax** succeeded to the throne of the Roman Empire, a so-called **barracks emperor** who gained power by virtue of his command of the army.
- 1852 – **Uncle Tom's Cabin** by **Harriet Beecher Stowe** (*pictured*) was first published, profoundly affecting attitudes toward African Americans and slavery in the United States.
- 1922 – The United States Navy commissioned its first aircraft carrier, **USS Langley**.
- 1987 – The antiretroviral drug **zidovudine (AZT)** became the first antiviral drug approved for use against HIV and AIDS.
- 1993 – The Troubles: The second of **two bomb attacks** by the Provisional IRA in Warrington, England, killed two children.

**Adrienne Lecouvreur** (d. 1730) · **Paul von Lettow-Vorbeck** (b. 1870) · **Willie Brown** (b. 1934)

More anniversaries: **March 19** · **March 20** · **March 21**

Archive · By email · List of historical anniversaries

### Today's featured picture

The **Acacus Mountains** are a mountain range in western **Libya**, part of the **Sahara**. Situated east of the city of **Ghat**, they stretch north from the border with **Algeria**, about 100 kilometres (60 mi). The mountains have a large variation of landscapes, from different-coloured **dunes** to arches, gorges, isolated rocks and deep **wadis**. The area has a particularly rich array of prehistoric rock art.



# Web navigation conventions

The screenshot shows the Amazon website interface. At the top, there's a navigation bar with the Amazon Prime logo, a search bar containing 'LED & LCD TVs' and 'lg tv 4k', and a 'BLACK FRIDAY DEALS WEEK' banner. Below the search bar, there are links for 'Departments', 'Browsing History', 'Thomas's Amazon.com', and 'Today's Deals'. On the right, there's a user account section with 'Hello, Thomas', 'Your Account', 'Prime', 'Lists', and a 'Cart' icon.

The main content area shows search results for 'LED & LCD TVs : "lg tv 4k"'. There are 1-24 of 147 results. The results are sorted by 'Relevance'. A sponsored advertisement for 'LG SUPER UHD TV' is displayed, with a 'Save on LG Super UHD TVs' message and a 'Shop now' link. Below the ad, there are two product listings:

- LG Electronics 55UH6550 55-Inch 4K Ultra HD Smart LED TV (2016 Model)**  
by LG Electronics  
Sponsored  
\$747<sup>00</sup> ~~\$897.00~~ Prime  
4.5 stars (25 reviews)  
• Display Size: 55 inches  
• Resolution: 4K Ultra HD  
• Connectivity Technology: Built-in Wi-Fi  
• Display Technology: LED  
• Display Resolution Maximum: 4K Ultra HD
- LG Electronics 60UH8500 60-Inch 4K Ultra HD Smart LED TV (2016 Model)**  
by LG Electronics  
Sponsored  
\$1,297<sup>00</sup> ~~\$1,697.00~~ Prime  
4.5 stars (87 reviews)  
Electronics Gift Guide

On the left side, there are filters for 'Show results for' (Any Category, Electronics, Television & Video, Televisions, LED & LCD TVs), 'Refine by' (Delivery Day, Amazon Prime, Television Feature, Television Resolution), and 'Showing most relevant results. See all results for lg tv 4k.' and 'Television Feature: Smart TV | 3D'.





# Web navigation conventions

Site ID

You are here

Local navigation

Utilities  
Sections

The screenshot shows the Amazon website interface. At the top, there's a navigation bar with the Amazon Prime logo, a search bar containing 'LED & LCD TVs' and 'lg tv 4k', and a 'BLACK FRIDAY DEALS WEEK' banner. Below the search bar, there are navigation links for 'Departments', 'Browsing History', 'Thomas's Amazon.com', and 'Today's Deals'. A secondary navigation bar lists categories like 'Televisions & Video', 'Deals', 'Best Sellers', etc. The main content area shows search results for 'lg tv 4k', including a sponsored advertisement for LG Super UHD TVs and two product listings: 'LG Electronics 55UH6550 55-Inch 4K Ultra HD Smart LED TV (2016 Model)' and 'LG Electronics 60UH8500 60-Inch 4K Ultra HD Smart LED TV (2016 Model)'. A sidebar on the left provides filters for 'Show results for', 'Refine by', 'Delivery Day', 'Amazon Prime', 'Television Feature', and 'Television Resolution'. The footer contains links for 'Conditions of Use', 'Privacy Notice', and 'Interest-Based Ads'.

Footer  
navigation

## MS in Computer Science

### Masters Students

- Advising
- FAQs
- Foundation Courses
- MS in Computer Science
- Core Courses
- Pre-approved Courses
- CS Course Descriptions
- Accelerated BS/MS Programs
- MS in Information Systems
- MS in Information Security and Assurance
- MS in Software Engineering
- Graduate Certificates

The MS in Computer Science prepares students for research and professional practice in computer science and related technologies. The program includes both fundamentals and advanced work in the areas of artificial intelligence and databases, programming languages and software engineering, systems and networks, theoretical computer science, and visual computing.

### Degree Requirements

Students are required to complete 30 credits corresponding to 10 graduate courses. Courses are divided into **basic courses**, which have no graduate course prerequisite, and **advanced courses**, which have a graduate course as a prerequisite.

Courses are grouped in the following five broad areas:

- Artificial Intelligence and Databases
- Programming Languages and Software Engineering
- Systems and Networks
- Theoretical Computer Science
- Visual Computing

All the following requirements should be satisfied for the MS in CS degree:

- CS 583 - Analysis of Algorithms (from the Theoretical Computer Science area) and two additional core courses from two other areas must be successfully completed with a grade of B- or better.
- At least four courses (12 credits) must be chosen from the **advanced courses** in the list of preapproved courses from at least three different areas.
- At least six courses, including two advanced courses, must be designated CS.
- At least eight courses must be taken from the list of preapproved courses. Up to two computer science-related courses that are not on the list of preapproved courses may be taken with the approval of the Computer Science Department.

### Project/Thesis (optional):

Three to six credit hours of the advanced classes may be replaced by a project or thesis. The project or thesis must be guided and approved by a committee of three appropriate faculty members and presented at an appropriate forum. The thesis must meet relevant university requirements.

For additional information on the degree requirements of the MS in CS:

- The MS CS section of the Mason Catalog is the **official source** for the degree requirements of the program.
- These slides from the orientation for new MS students provide an overview of the program, as well as additional useful information.

### Academic Advising

A plan of study form for the MS degree should be completed and submitted by the student soon after admission to the program. This serves as a planning guide for the student. This plan should be kept up to date by regular consultation with the academic advisor. A final signed version of the plan must be included when the student submits a graduation application.

Plan of Study forms for all the MS degrees offered by the CS department are available at this web page.

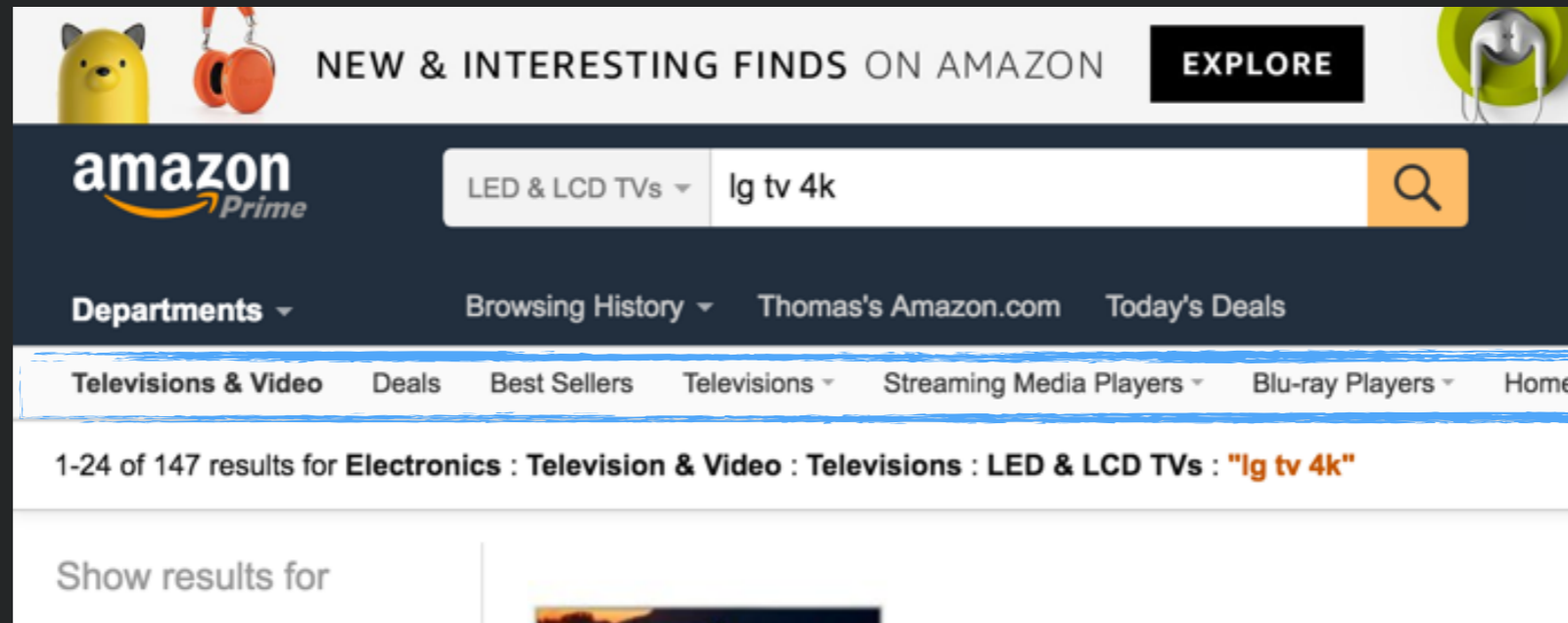
For more information, please see the academic advising pages and the FAQ for Masters students.



# Persistent Navigation

- Forms a common idiom users already understand
- Gives instant confirmation that still on the same site
- Supports consistency and standards
  - If *all* of your pages function same way, users know how to do actions & what to expect
  - Ok for specialized page like forms that are clearly different to not follow conventions.

# Tabs



- Example of a metaphor: tab dividers in a three ring binder or folders in a file drawer
- Partition into sections
- Advantages
  - Easily understood and self-evident
  - (Usually) hard to miss





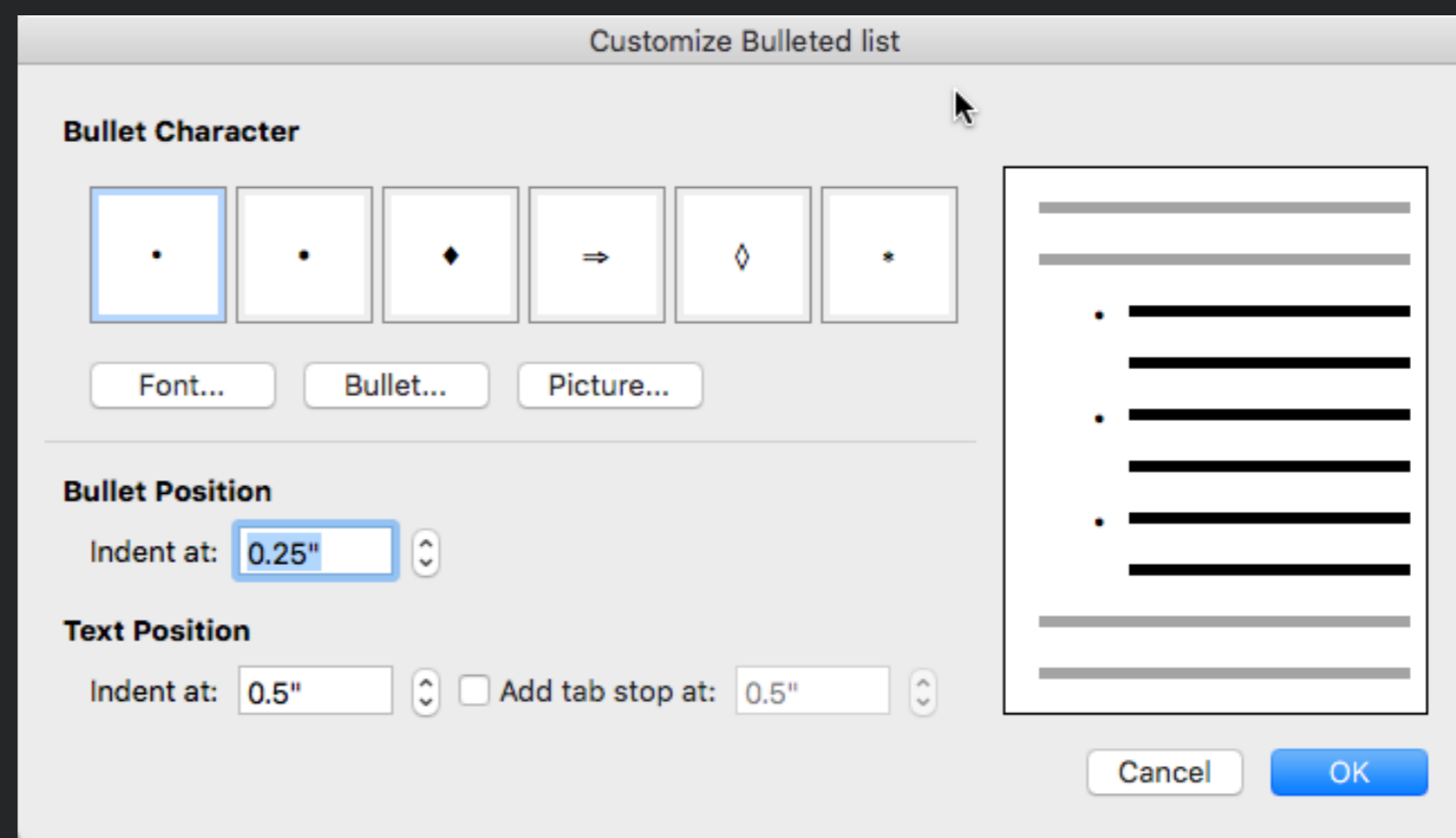
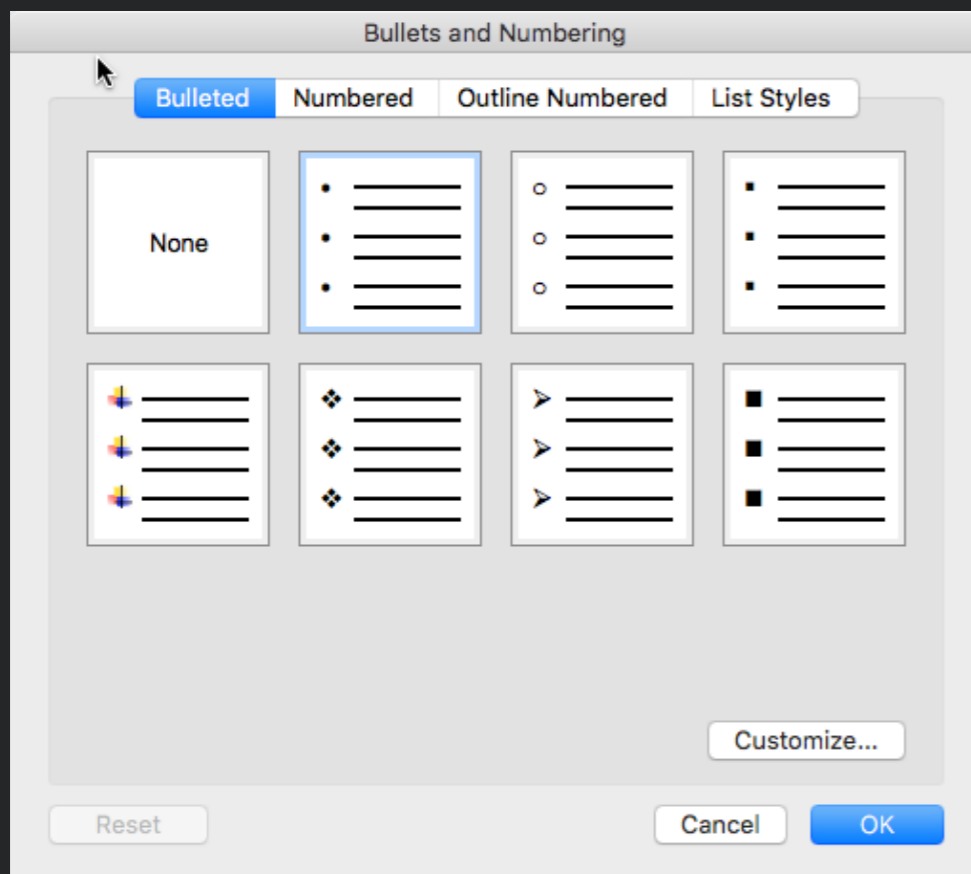
# Breadcrumbs

- Offer trail of where the user has been and how they got there
- Shows hierarchy of information space
- Shows current location

The screenshot shows the Amazon website interface for a search query 'lg tv 4k'. At the top, there's a navigation bar with the Amazon Prime logo, a search bar containing 'LED & LCD TVs' and 'lg tv 4k', and a 'BLACK FRIDAY DEALS WEEK' banner. Below the search bar, there's a breadcrumb trail: 'Televitions & Video > Deals > Best Sellers > Televisions > Streaming Media Players > Blu-ray Players > Home Theater Systems > A/V Accessories > 1-24 of 147 results for Electronics : Television & Video : Televisions : LED & LCD TVs : "lg tv 4k"'. The breadcrumb trail is highlighted with a yellow box. Below the breadcrumb trail, there's a 'Show results for' section with a hierarchy: '< Any Category > < Electronics > < Television & Video > < Televisions > LED & LCD TVs'. To the right of the breadcrumb trail, there's a 'Sort by' dropdown menu set to 'Relevance'. Below the breadcrumb trail, there's a 'Refine by' section with filters for 'Delivery Day', 'Amazon Prime', 'Television Feature', and 'Television Resolution'. The main content area shows a sponsored advertisement for 'LG SUPER UHD TV' with the text 'SPONSORED BY LG HOME ELECTRONICS Save on LG Super UHD TVs > Shop now'. Below the advertisement, there's a section for 'Showing most relevant results. See all results for lg tv 4k.' and a 'Television Feature: Smart TV | 3D' section. The first product listing is 'Sponsored LG Electronics 55UH6550 55-Inch 4K Ultra HD Smart LED TV (2016 Model) by LG Electronics' with a price of '\$747.00 \$897.00 Prime' and a star rating of 4.5 stars (25 reviews). The second product listing is 'Sponsored LG Electronics 60UH8500 60-Inch 4K Ultra HD Smart LED TV (2016 Model) by LG Electronics' with a price of '\$1,297.00 \$1,697.00 Prime' and a star rating of 4.5 stars (87 reviews). At the bottom of the page, there's a footer with 'Conditions of Use Privacy Notice Interest-Based Ads © 1996-2016, Amazon.com, Inc. or its affiliates'.

# Progressive Disclosure

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





# Effective Site Design

- Answers to the following should be obvious for a good site design
  - What site is this? (Site ID)
  - What page am I on? (Page name)
  - What are the major sections of this site? (Sections)
  - What are my options at this level? (Local navigation)
  - Where am I in the site? (“You are here” indicators)
  - How can I search?

# Metaphors & Idioms



# Metaphors

- One way to communicate what interface can do is through metaphors to the real world
- Uses existing mental models from 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





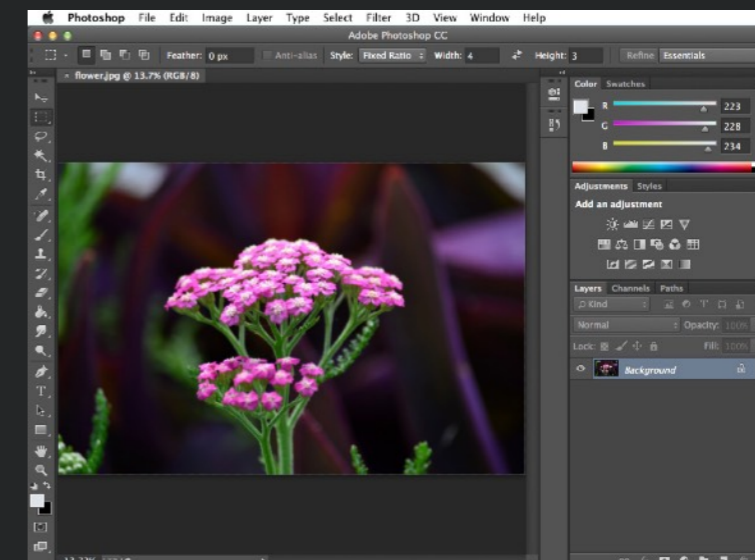
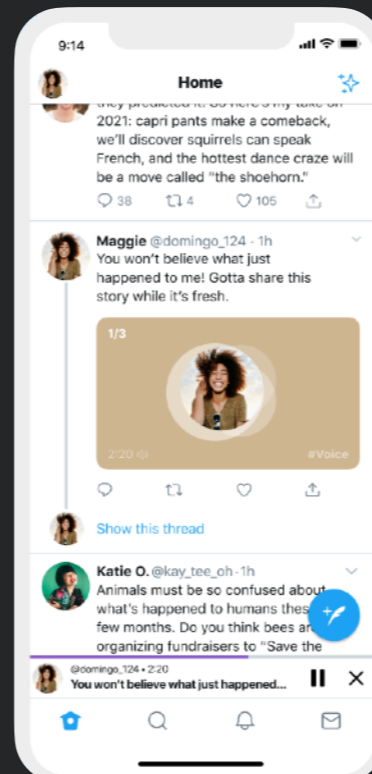
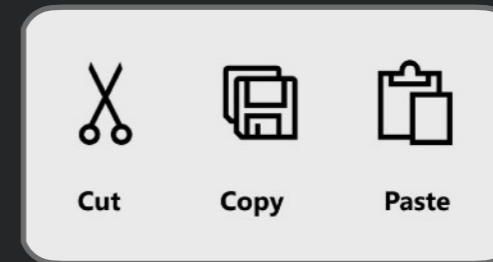
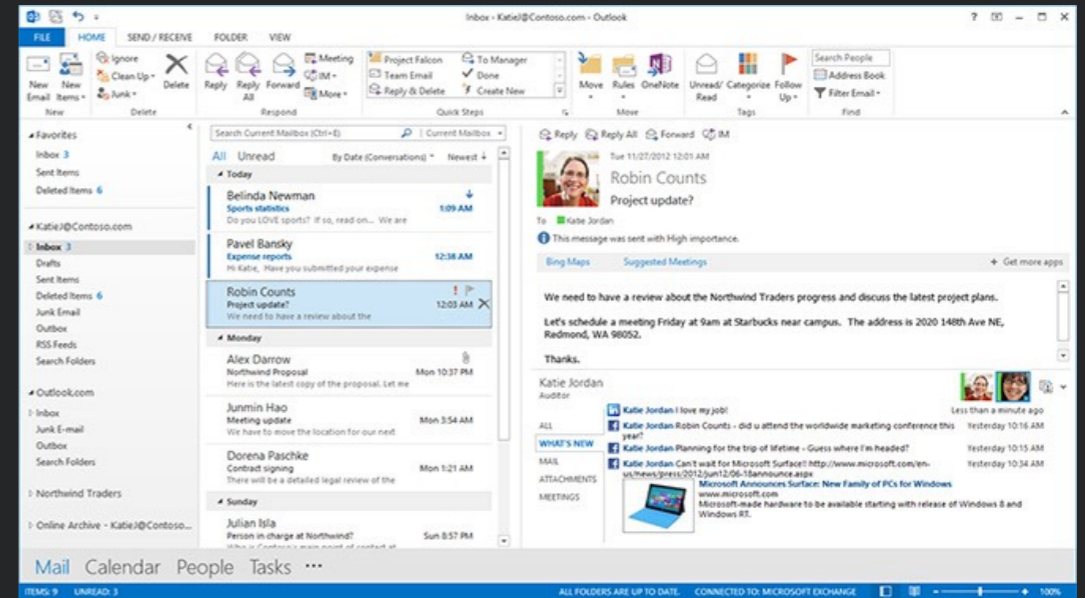
# Alternative - Idioms

- 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

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



# Ordering User Actions





# Task Structure

- In some cases, users must take actions in specific sequence
- Must input some information before being able to access subsequent information
  - e.g., must select a shipping method before seeing a final price
- To the extent possible, want to leave users in control of task (user control and freedom)
- But also do not want to distract users by making unrelated decisions in random order (flexibility and efficiency of use)
- And do not want to overwhelm users with too many options at a time (minimalist design)
- Good designs need to balance tradeoffs

# Separate long tasks into sequences

- Reduce short term memory demands by having user only work on one aspect of larger task at a time
- Don't interrupt users in the middle with unrelated tasks
- Provide closure of each subtask at the end

The screenshot shows the American Airlines website during a flight booking process. The top navigation bar includes links for Home, Login, Hello, THOMAS, English, and a search bar. The main navigation bar has links for Plan Travel, Travel Information, and AAdvantage. The progress bar shows the current step is 'Travelers', with other steps being Find Flights, Choose Flights, Trip Options, Select Seats, Review & Pay, and Finish.

The 'Travelers' section displays the flight details: Washington to Raleigh/ Durham, 1 Adult, Sunday January 10, 2016 – Monday January 11, 2016. The trip price is \$203.70 USD. A 'Show Trip Details' button is visible below the flight information.

A promotional banner for AAdvantage miles offers 40,000 bonus miles, up to \$100 in statement credits, and a first checked bag free\*. The banner includes a Citi logo and a 'Learn More' link.

The bottom section, 'Passenger Details', includes a note: 'Please enter all passenger names as they appear on the passenger's government-issued photo identification. More details on passenger names' and a 'TSA Privacy Notice' link. A '\*Required' note is at the bottom left.

# Design for flexibility & efficiency

- Users may take paths never envisioned by designer
- Using studies to identify different task flows, design flexible support for each

Home Login Hello, THOMAS English Search aa.com

American Airlines Plan Travel Travel Information AAdvantage

Find Flights Choose Flights **Travelers** Trip Options Select Seats Review & Pay Finish

## Travelers

⚠ Check below for errors

✈ Washington to Raleigh/ Durham  
1 Adult  
Sunday January 10, 2016 – Monday January 11, 2016

Your Trip Price: **\$203.70 USD**  
[Baggage and Optional Charges](#)

Show Trip Details

Earn 40,000 bonus miles,  
up to \$100 in statement credits, and your **first checked bag free\***!  
[Learn More](#)

Your Trip Price: \$203.70 USD  
Statement Credit: - \$100.00 USD  
**\$103.70 USD**

### Passenger Details

Please enter all passenger names as they appear on the passenger's government-issued photo identification. [More details on passenger names](#)  
[TSA Privacy Notice](#)

\*Required



# Keep users in control

- Important users do not feel constrained
- Want users to feel that they can do things the way they want to do them, not as software dictates to them

The screenshot shows the American Airlines website interface. At the top, there's a navigation bar with 'Home', 'Login', 'Hello, THOMAS', 'English', and a search bar. Below that, the main navigation includes 'Plan Travel', 'Travel Information', and 'AAdvantage'. The 'Travelers' tab is highlighted in the secondary navigation bar. The main content area shows flight details for 'Washington to Raleigh/ Durham' for '1 Adult' on 'Sunday January 10, 2016 - Monday January 11, 2016'. The 'Your Trip Price' is '\$203.70 USD'. Below this, there's a promotional offer: 'Earn 40,000 bonus miles, up to \$100 in statement credits, and your first checked bag free\*!'. A summary table shows 'Your Trip Price: \$203.70 USD' and 'Statement Credit: -\$100.00 USD', resulting in a total of '\$103.70 USD'. The 'Passenger Details' section is partially visible at the bottom.

Home Login Hello, THOMAS English Search aa.com

American Airlines Plan Travel Travel Information AAdvantage oneworld

Find Flights Choose Flights **Travelers** Trip Options Select Seats Review & Pay Finish

## Travelers

⚠ Check below for errors

✈ Washington to Raleigh/ Durham  
1 Adult  
Sunday January 10, 2016 – Monday January 11, 2016

Your Trip Price:  
**\$203.70 USD**  
[Baggage and Optional Charges](#)

Show Trip Details

Earn 40,000 bonus miles,  
up to \$100 in statement credits, and your first checked bag free\*!  
[Learn More](#)

Your Trip Price:	\$203.70 USD
Statement Credit:	-\$100.00 USD
<b>Total:</b>	<b>\$103.70 USD</b>

### Passenger Details

Please enter all passenger names as they appear on the passenger's government-issued photo identification. [More details on passenger names](#)  
[TSA Privacy Notice](#)

\*Required



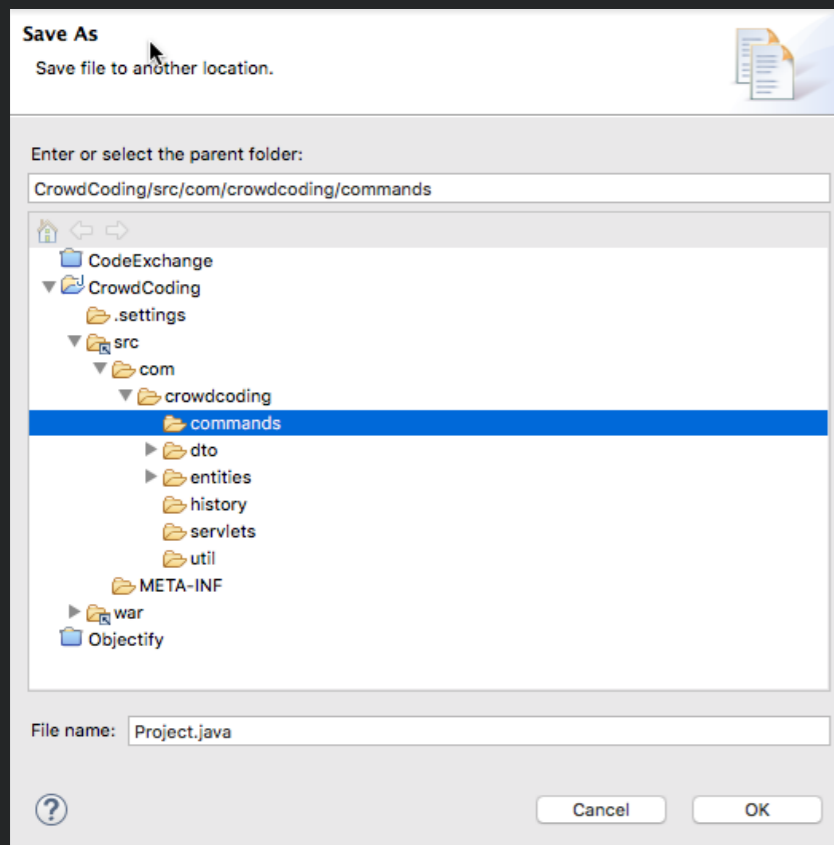
# Orchestration & Interaction Flow

- 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

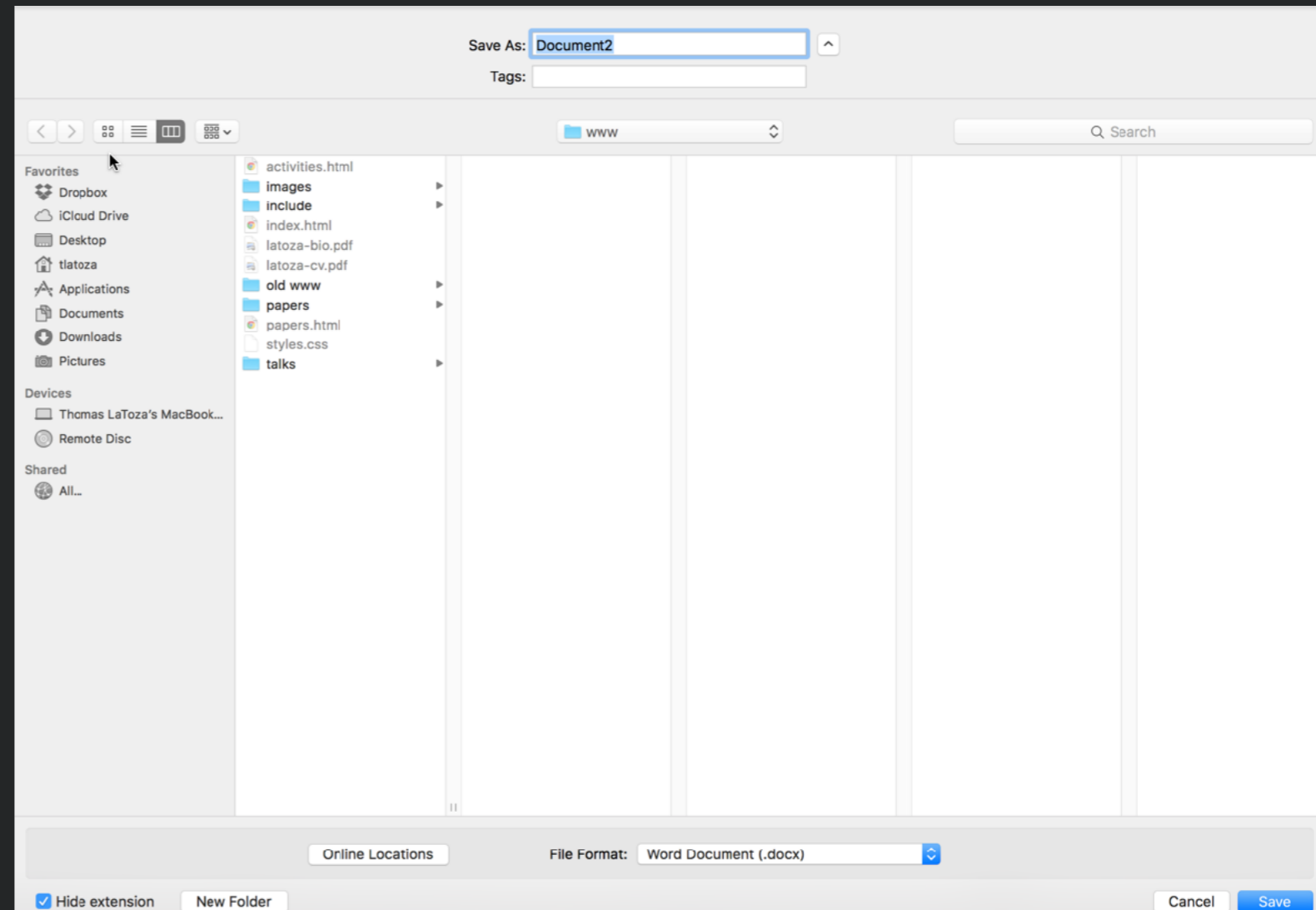
# Anticipate Likely Next Actions

- Based on typical observed task flows, surface options for user to take likely next steps

## What if folder does not exist?



vs.







# 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

# Group Activity





# Acknowledgements

- Slides adapted from Dr. Thomas Latoza's SWE 432 course



# Acknowledgements

- Slides adapted from Dr. Thomas Latoza's SWE 432 course