

Site Design

SWE 632, Spring 2018

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?

Exercise: How should a shopping app be organized?

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

Theories and principles

- Offer ways to better explore design space
- Design principles offer guidance on which design choices are more effective in a particular context
 - e.g., User control and freedom
- Sometimes informed by underlying theories of human psychology

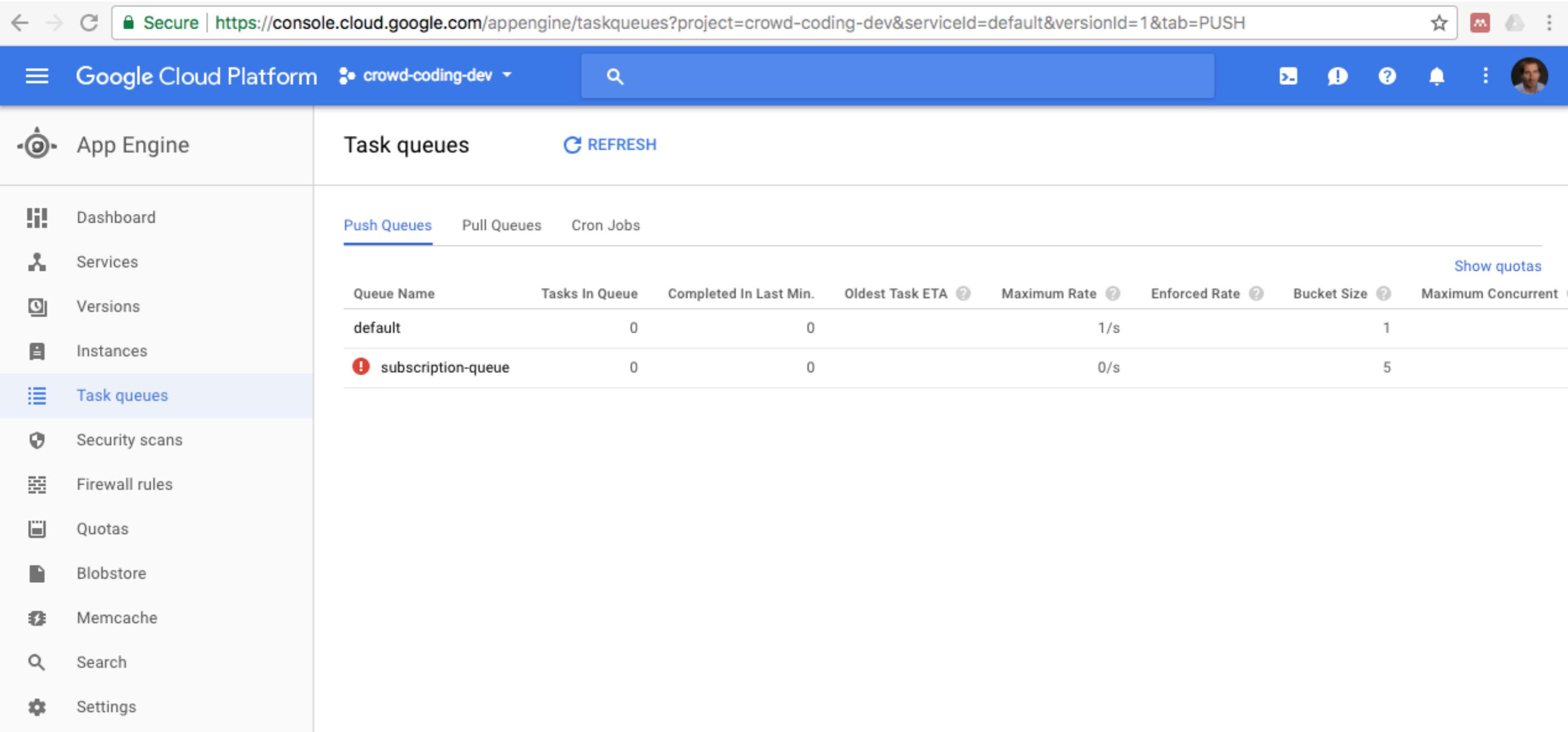
Interaction techniques

- 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

Plan for second half of course

- Examine principles, theories, design goals for different types of interaction design
- Site design (today)
- Interaction techniques
- Preventing errors
- Visual design
- Information visualization
- Community design

What can you do with this app?



The screenshot shows the Google Cloud Platform App Engine Task queues page. The left sidebar is for App Engine, with 'Task queues' selected. The main content area is titled 'Task queues' and shows two push queues: 'default' and 'subscription-queue'. The 'default' queue has 0 tasks, an oldest task ETA of 0, and a maximum rate of 1/s. The 'subscription-queue' has 0 tasks, an oldest task ETA of 0, and a maximum rate of 0/s. There are tabs for 'Push Queues', 'Pull Queues', and 'Cron Jobs'. A 'REFRESH' button is in the top right of the content area. The top navigation bar shows the URL as https://console.cloud.google.com/appengine/taskqueues?project=crowd-coding-dev&serviceId=default&versionId=1&tab=PUSH.

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

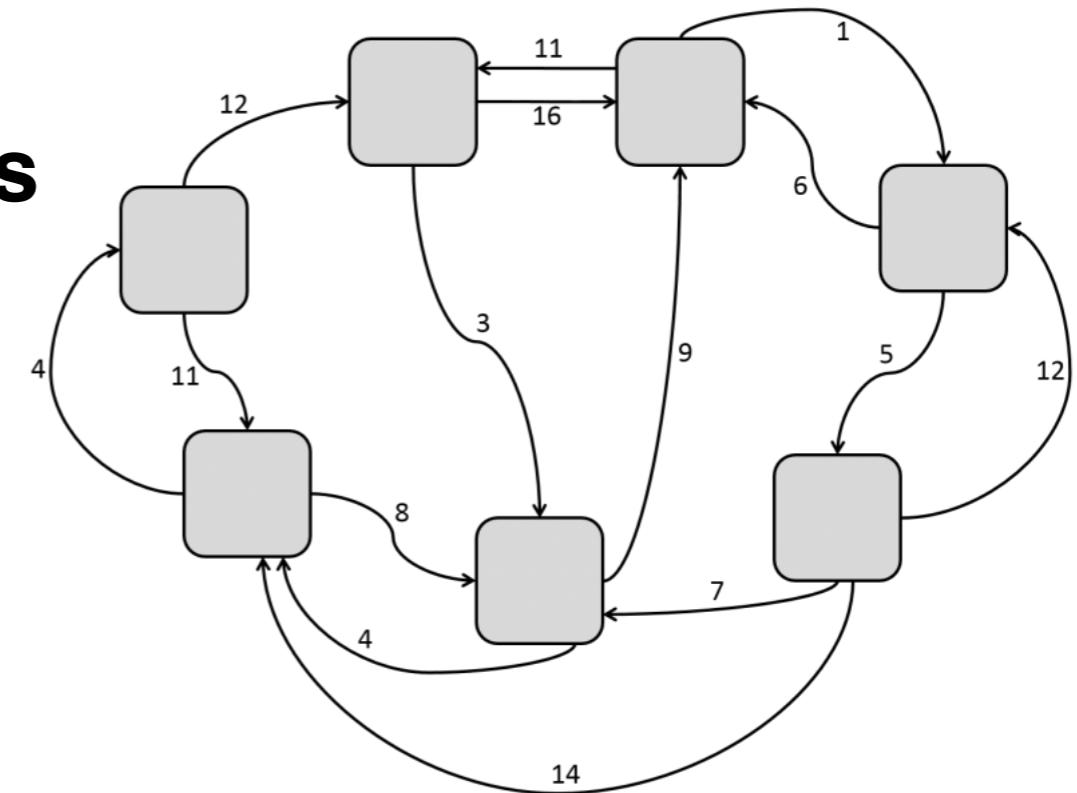
- Help users determine what they **can** do
 - Is this the right site for my goals? Is this the right page where I should spend my time?
- Support users in how they **determine** what to do
 - If this is the right place, how do I reach goal?

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

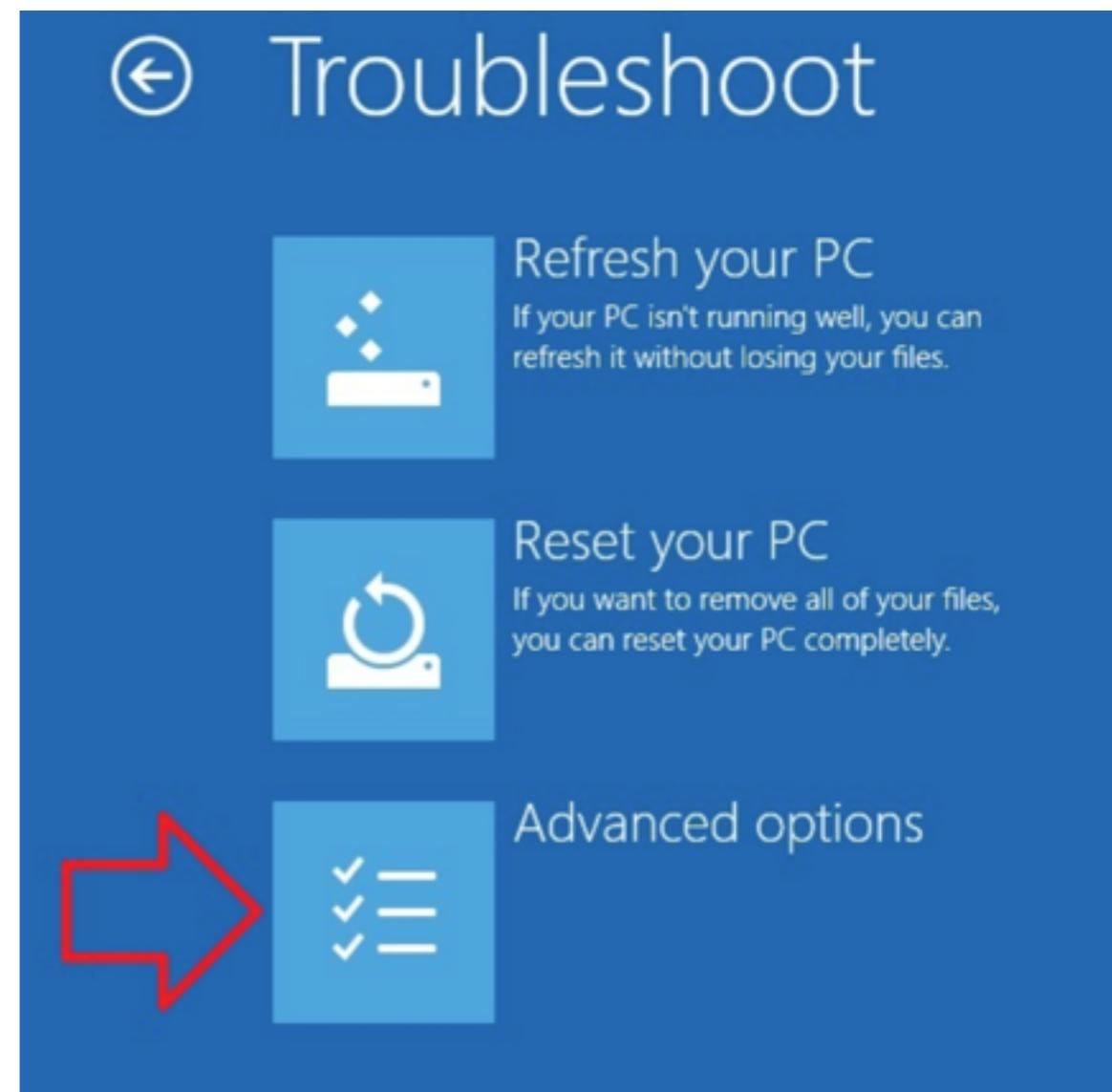


Traversing links

- 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

Scent

- 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 = $\max [E[V] / E[C]]$

Some design implications of information foraging theory

- Organize information into functionally **related** groups
 - If information is 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 hierarchic
 - 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



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...](#))

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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

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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.

Photograph: **Pir6mon**

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.



Vladimir Putin

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.



Harriet Beecher Stowe

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

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

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Dansk

Deutsch

Eesti

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Web navigation conventions

NEW & INTERESTING FINDS ON AMAZON **EXPLORE**

amazon Prime **LED & LCD TVs** **lg tv 4k** **BLACK FRIDAY** **DEALS WEEK**

Departments **Browsing History** Thomas's Amazon.com Today's Deals Hello, Thomas **Your Account** Prime Lists **Cart**

Televisions & 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"** Sort by **Relevance**

Show results for **LED & LCD TVs**

Refine by **Delivery Day** **Amazon Prime** **Television Feature** **Television Resolution**

Showing most relevant results. See all results for **lg tv 4k**.

Television Feature: **Smart TV | 3D**

Sponsored **LG Electronics 55UH6550 55-Inch 4K Ultra HD Smart LED TV (2016 Model)**
by LG Electronics **\$747⁰⁰** **\$897.00** **Prime** **★★★★★** **25**
• Display Size: 55 inches
• Resolution: 4K Ultra HD
• Connectivity Technology: Built-in Wi-Fi
• Display Technology: LED
• Display Resolution Maximum: 4K Ultra HD

Sponsored **LG Electronics 60UH8500 60-Inch 4K Ultra HD Smart LED TV (2016 Model)**
by LG Electronics **\$1,297⁰⁰** **\$1,697.00** **Prime** **★★★★★** **87**

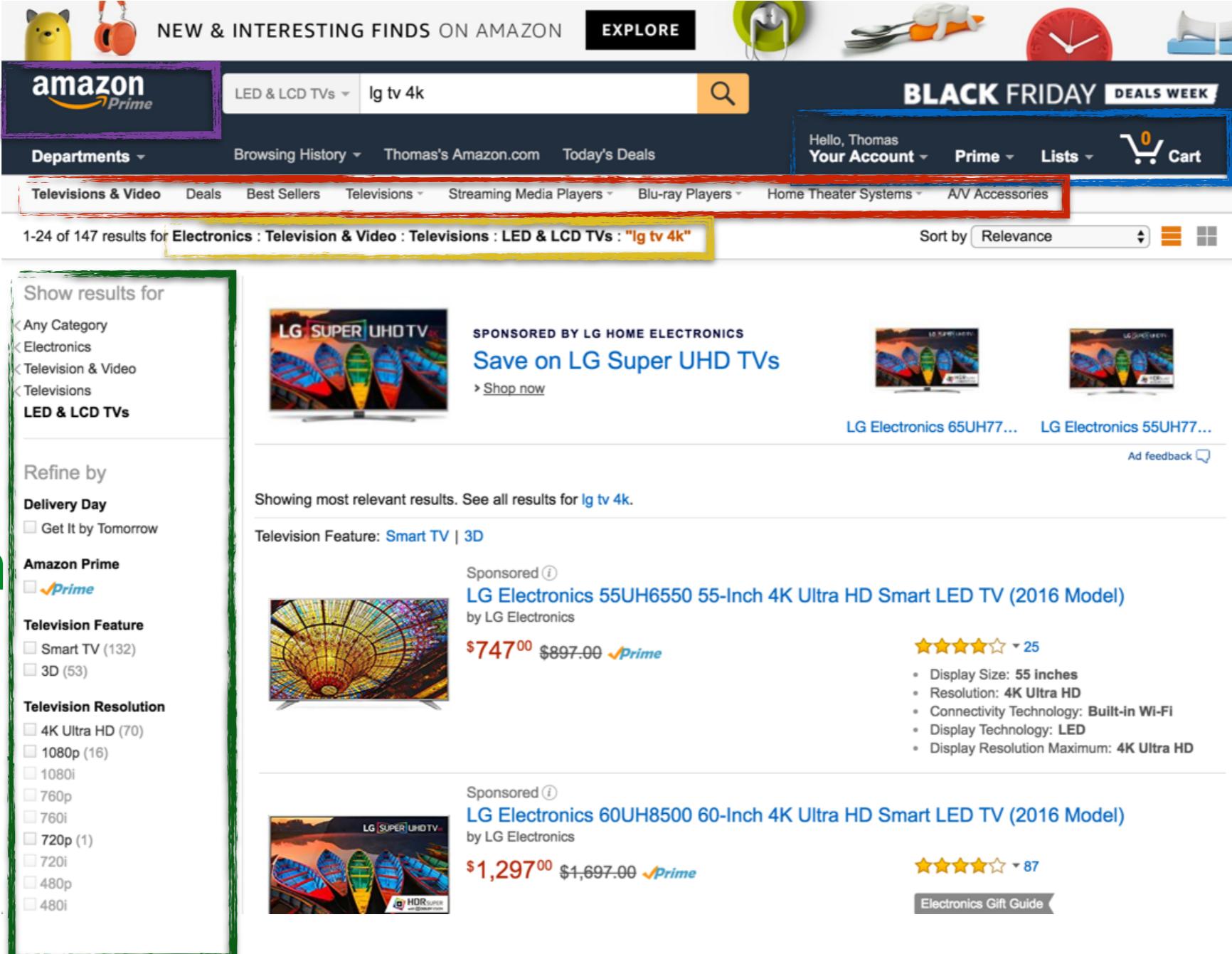
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Web navigation conventions

Site ID

You are here

Local navigation



The screenshot shows the Amazon.com search results for 'lg tv 4k'. The search bar at the top contains the query 'lg tv 4k'. The results page displays 1-24 of 147 results for 'Electronics : Television & Video : Televisions : LED & LCD TVs : "lg tv 4k"'. A yellow box highlights the search term 'lg tv 4k' in the results bar. The left sidebar contains a 'Show results for' dropdown and various filtering options: 'Any Category', 'Electronics', 'Television & Video', 'Televisions', and 'LED & LCD TVs'. Under 'Refine by', there are sections for 'Delivery Day' (checkbox for 'Get It by Tomorrow'), 'Amazon Prime' (checkbox for 'Prime'), 'Television Feature' (checkboxes for 'Smart TV (132)' and '3D (53)'), and 'Television Resolution' (checkboxes for '4K Ultra HD (70)', '1080p (16)', '1080i', '760p', '760i', '720p (1)', '720i', '480p', and '480i'). The main content area shows sponsored ads for 'LG Super UHD TVs' and product listings for the 'LG Electronics 55UH6550' and 'LG Electronics 60UH8500' 4K Ultra HD Smart LED TVs. Each product listing includes the price, original price, Prime logo, star rating, and a list of features.

Utilities
Sections

Footer
navigation

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MS in Computer Science

Masters Students

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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/Tesis (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.

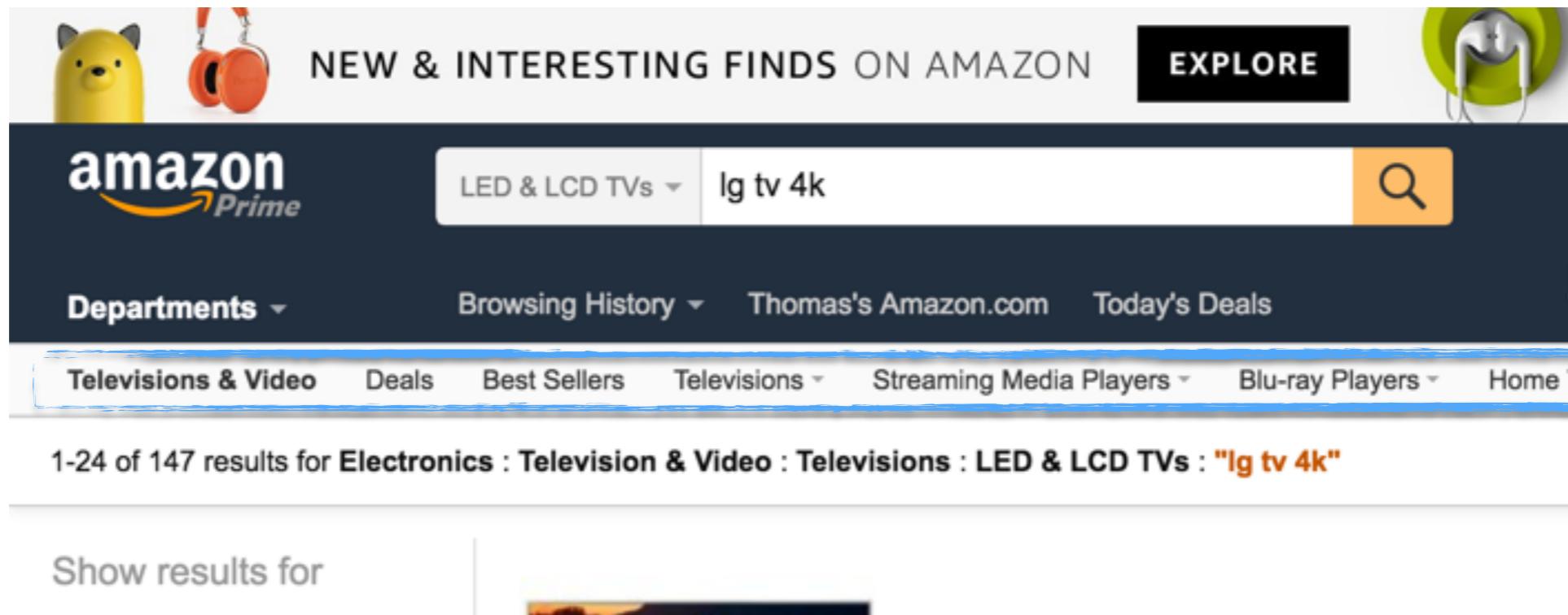
Plan of Study forms for all the MS degrees offered by the CS department are available at [this web page](#).

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

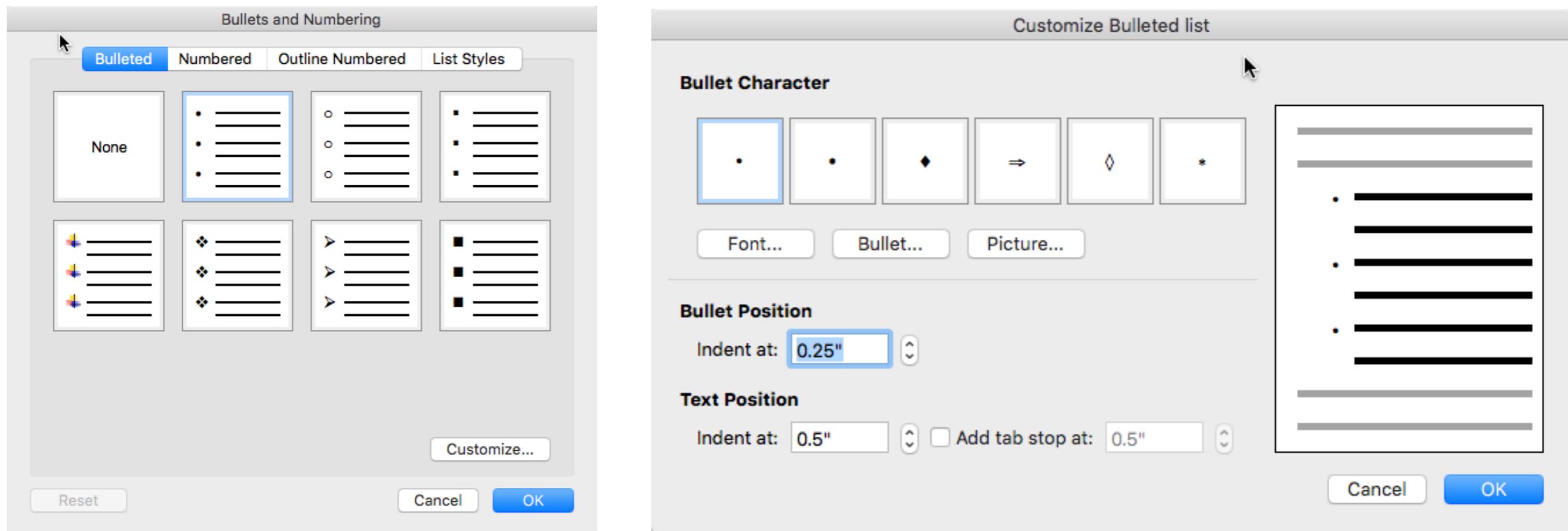
Breadcrumbs

- 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 search results for "lg tv 4k". The search bar at the top contains "lg tv 4k". The breadcrumb trail in the header shows: NEW & INTERESTING FINDS ON AMAZON > EXPLORE > BLACK FRIDAY > DEALS WEEK > Departments > Browsing History > Thomas's Amazon.com > Today's Deals. The main search results page displays 1-24 of 147 results for Electronics: Television & Video: Televisions: LED & LCD TVs: "lg tv 4k". The results are sponsored by LG Home Electronics, showing two LG Super UHD TVs (65UH77 and 55UH77) and an LG Electronics 55UH6550 55-Inch 4K Ultra HD Smart LED TV (2016 Model). The LG 55UH6550 is highlighted with a yellow box. The results are sorted by Relevance. The page also includes a sidebar for refining search results by category, delivery day, Amazon Prime, television feature, and resolution.

Progressive disclosure

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



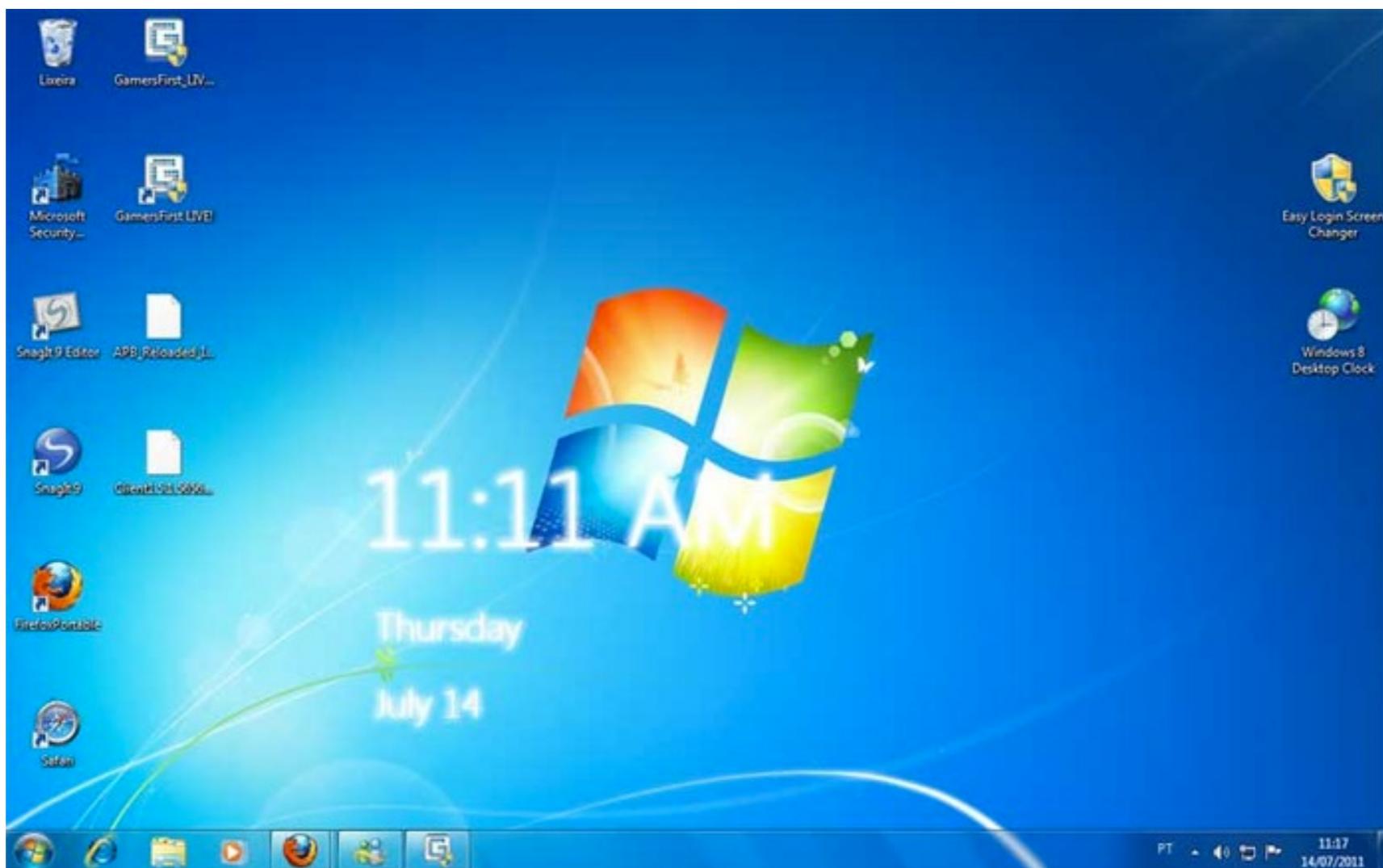
Effective site design

- 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

Exercise: Examples of idioms

Examples of idioms

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

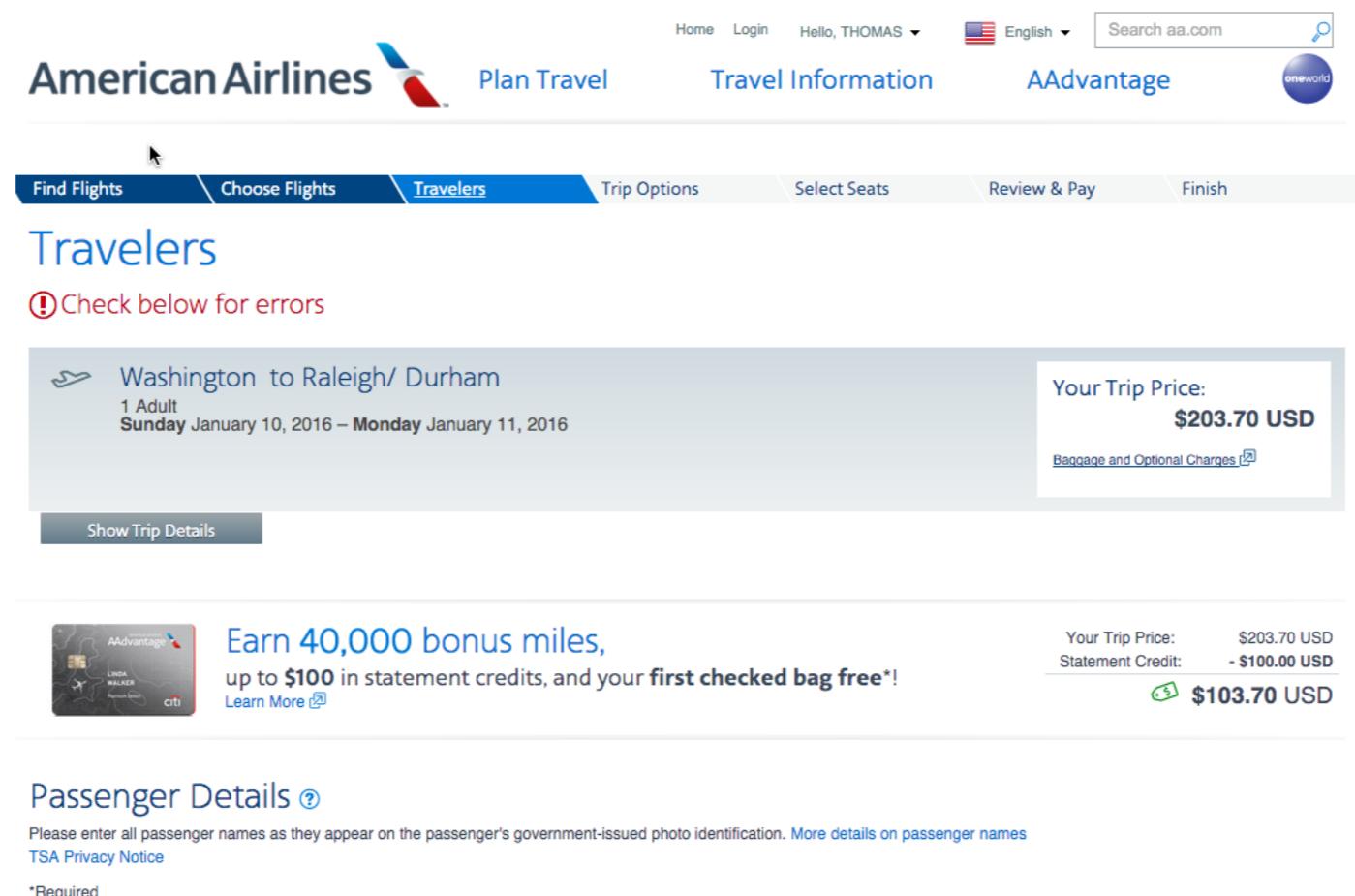
Ordering user actions

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

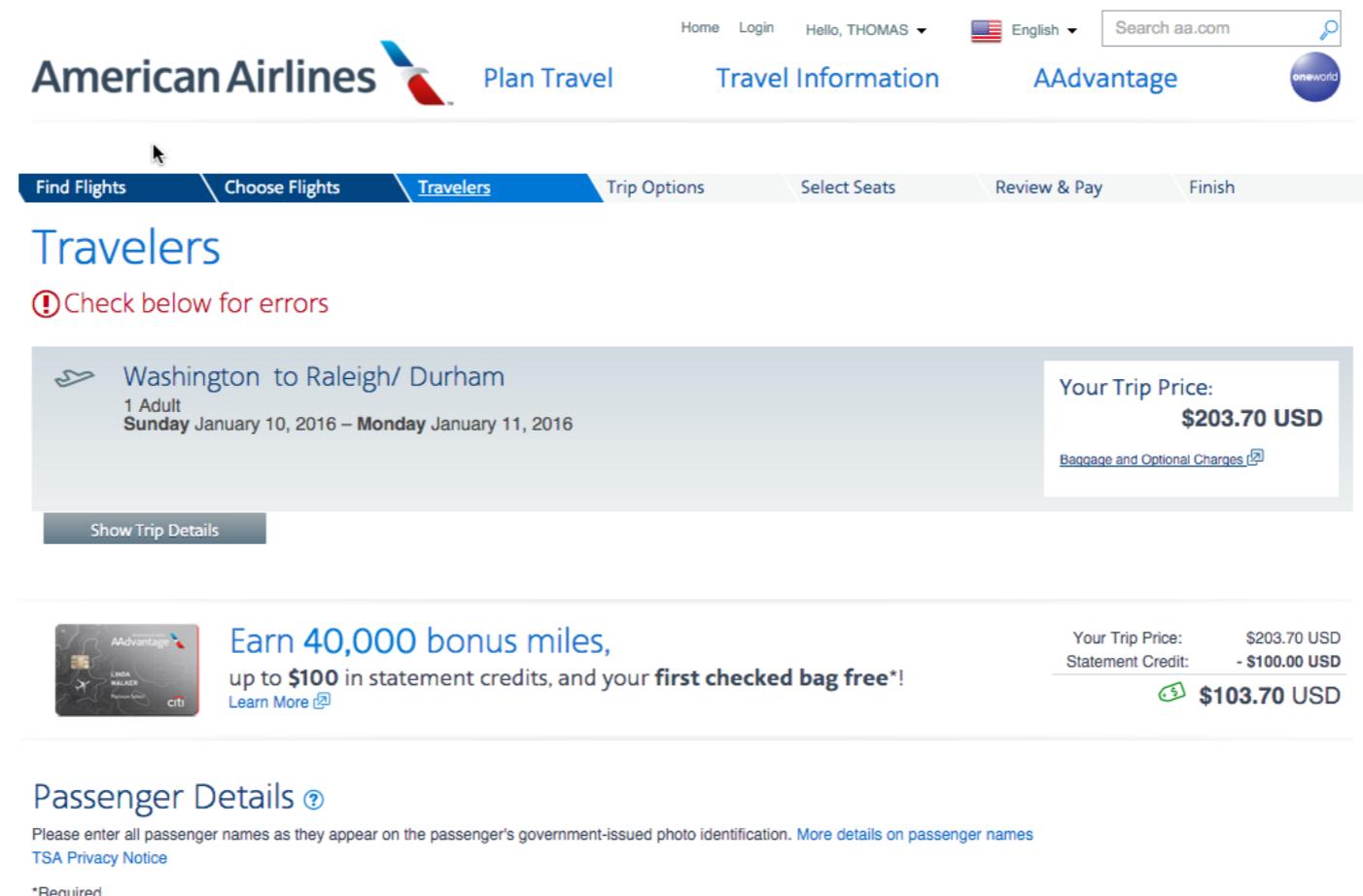
- Reduce short term memory demands by having user only work on one aspect of larger task at a time
- Don't interrupt users in the middle with unrelated tasks
- Provide closure of each subtask at the end



The screenshot shows the American Airlines website interface for booking a flight. The top navigation bar includes links for Home, Login, Hello, THOMAS, English, and a search bar. Below the navigation is a breadcrumb navigation bar with steps: Find Flights, Choose Flights, **Travelers**, Trip Options, Select Seats, Review & Pay, and Finish. The main content area is titled "Travelers" and includes a note "Check below for errors". It displays flight details: "Washington to Raleigh/ Durham" for "1 Adult" on "Sunday January 10, 2016 – Monday January 11, 2016". To the right, the "Your Trip Price" is listed as "\$203.70 USD" with a link for "Baggage and Optional Charges". A "Show Trip Details" button is located below the flight info. At the bottom, there's an advertisement for AAdvantage miles and a summary of the total trip price: "Your Trip Price: \$203.70 USD", "Statement Credit: -\$100.00 USD", and a final amount of "\$103.70 USD". The "Passenger Details" section at the bottom asks for passenger names, with a note that names must appear on government-issued photo identification. A "Learn More" link is also present.

Design for flexibility & efficiency

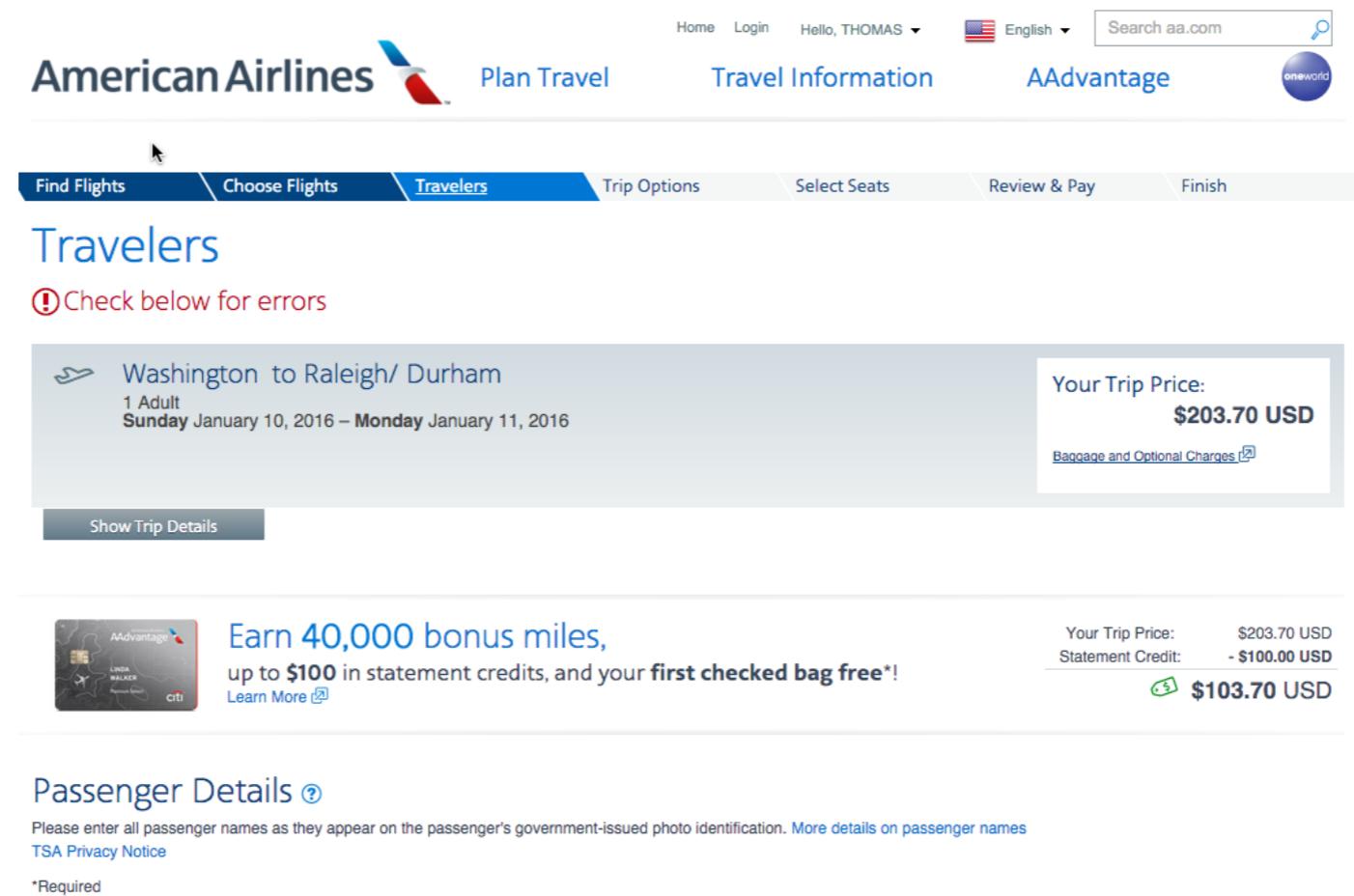
- Users may take paths never envisioned by designer
- Using studies to identify different task flows, design flexible support for each



The screenshot shows the American Airlines website interface during a travel booking process. The top navigation bar includes links for Home, Login, Hello, THOMAS, English, and a search bar. The main menu features 'Plan Travel', 'Travel Information', and 'AAdvantage' with the 'oneworld' logo. Below the menu, a progress bar indicates the current step: 'Find Flights' (highlighted in blue), 'Choose Flights', 'Travelers' (underlined in blue), 'Trip Options', 'Select Seats', 'Review & Pay', and 'Finish'. The 'Travelers' section displays flight details: 'Washington to Raleigh/ Durham', '1 Adult', 'Sunday January 10, 2016 – Monday January 11, 2016'. To the right, the 'Your Trip Price' is listed as '\$203.70 USD' with a link for 'Baggage and Optional Charges'. A 'Show Trip Details' button is present. At the bottom, an advertisement for AAdvantage and Citi offers '40,000 bonus miles' and '\$100 in statement credits'. The 'Passenger Details' section asks for passenger names, with a note about government-issued photo identification and a 'Learn More' link. A small note at the bottom states: 'Please enter all passenger names as they appear on the passenger's government-issued photo identification. More details on passenger names' and 'TSA Privacy Notice'. A required field indicator is shown.

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 during the 'Travelers' step of a flight booking. The top navigation bar includes links for Home, Login, Hello, THOMAS, English, a search bar, and AAdvantage. Below the navigation, a progress bar shows the steps: Find Flights, Choose Flights, Travelers (which is the active step), Trip Options, Select Seats, Review & Pay, and Finish. The main content area is titled 'Travelers' and includes a note: 'Check below for errors'. It displays flight details: 'Washington to Raleigh/ Durham', '1 Adult', 'Sunday January 10, 2016 – Monday January 11, 2016'. To the right, the 'Your Trip Price' is listed as '\$203.70 USD'. Below the flight details is a promotional offer: 'Earn 40,000 bonus miles, up to \$100 in statement credits, and your first checked bag free*! Learn More'. The total trip price is then shown as '\$103.70 USD'. At the bottom, there is a section for 'Passenger Details' with 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 small note at the bottom left says '*Required'.

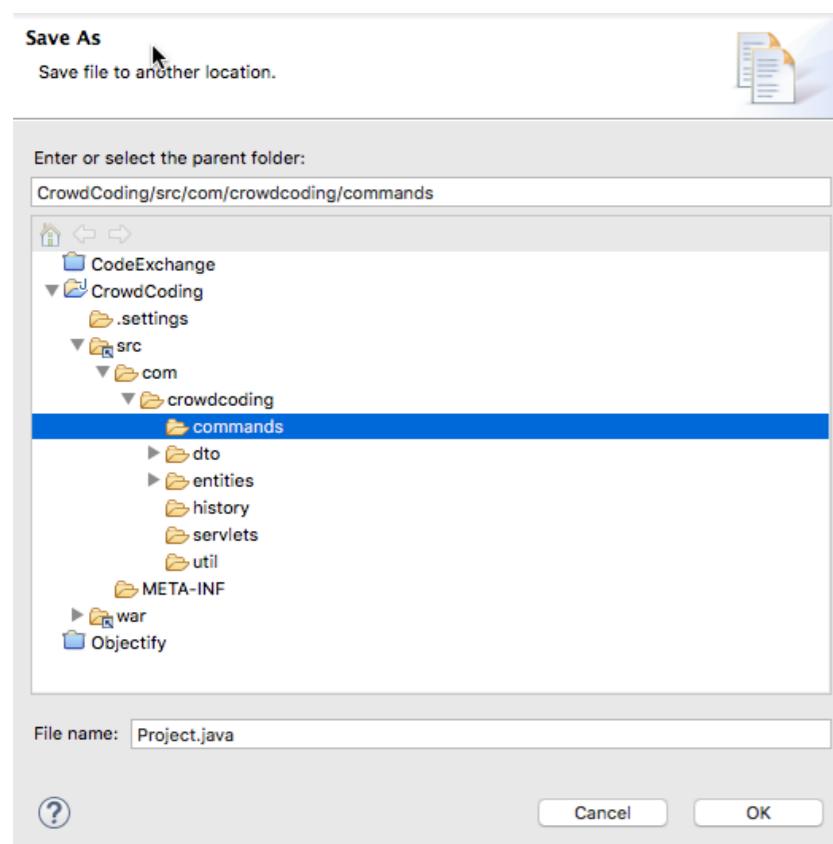
Orchestration & interaction flow

- 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

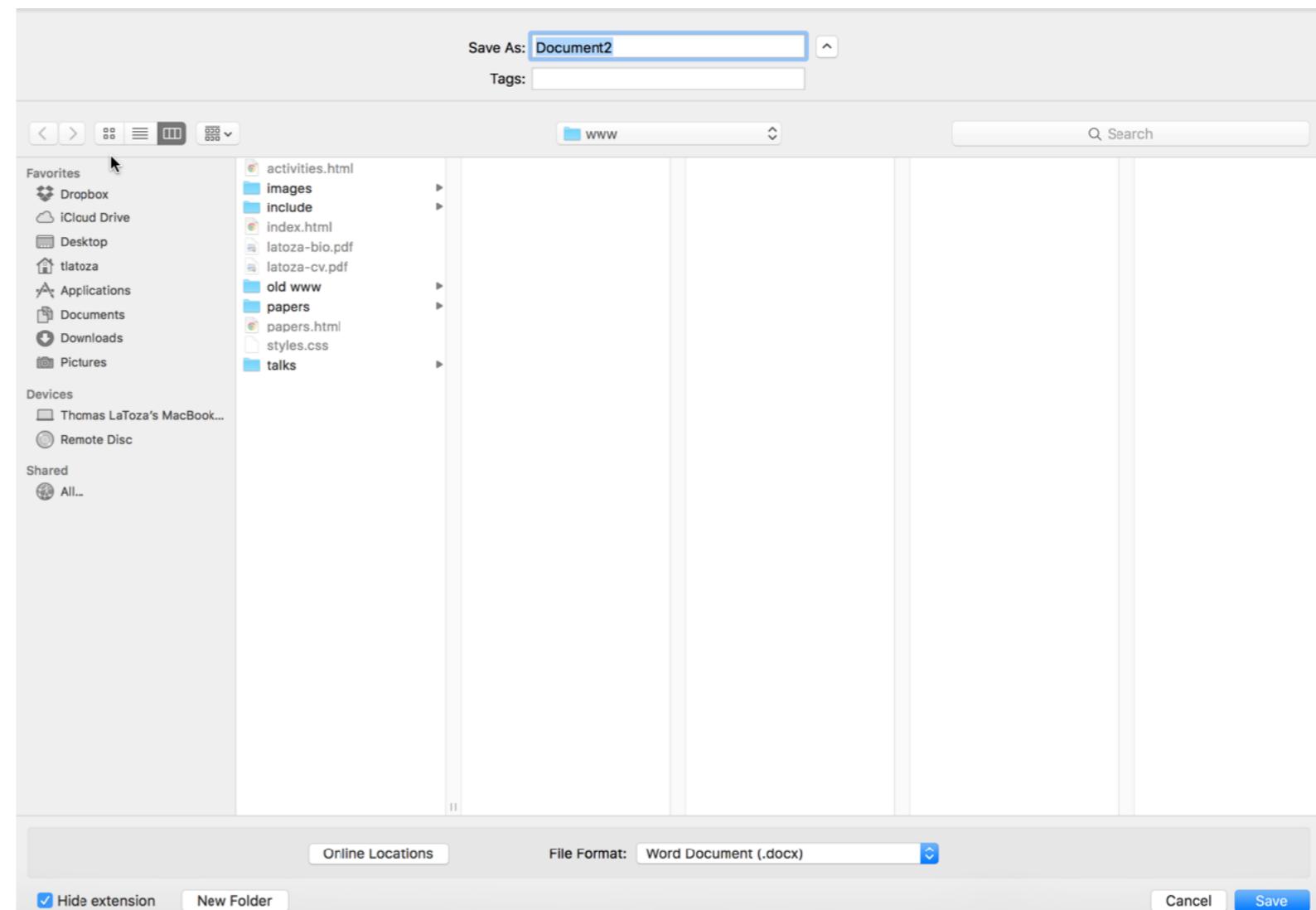
Anticipate likely next actions

- 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