COMS 4170 · SPRING 2022

Inclusive Design & Accessibility

Prof. Lydia Chilton
March 2, 2022
Graphic design by Prof Celeste Layne

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DESIGN &
DONUTS
x COOKIES & CODE
2/28, 7-8PM
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ChatGPT Usage Study

- Student group is working on a study for Prof. Brian Smith's HCI class
- Focused on student ChatGPT usage in UI Design course
- Participants needed for 15-30 minute interviews!!!
- Sign up here:

http://bit.ly/hci-chatgpt-study

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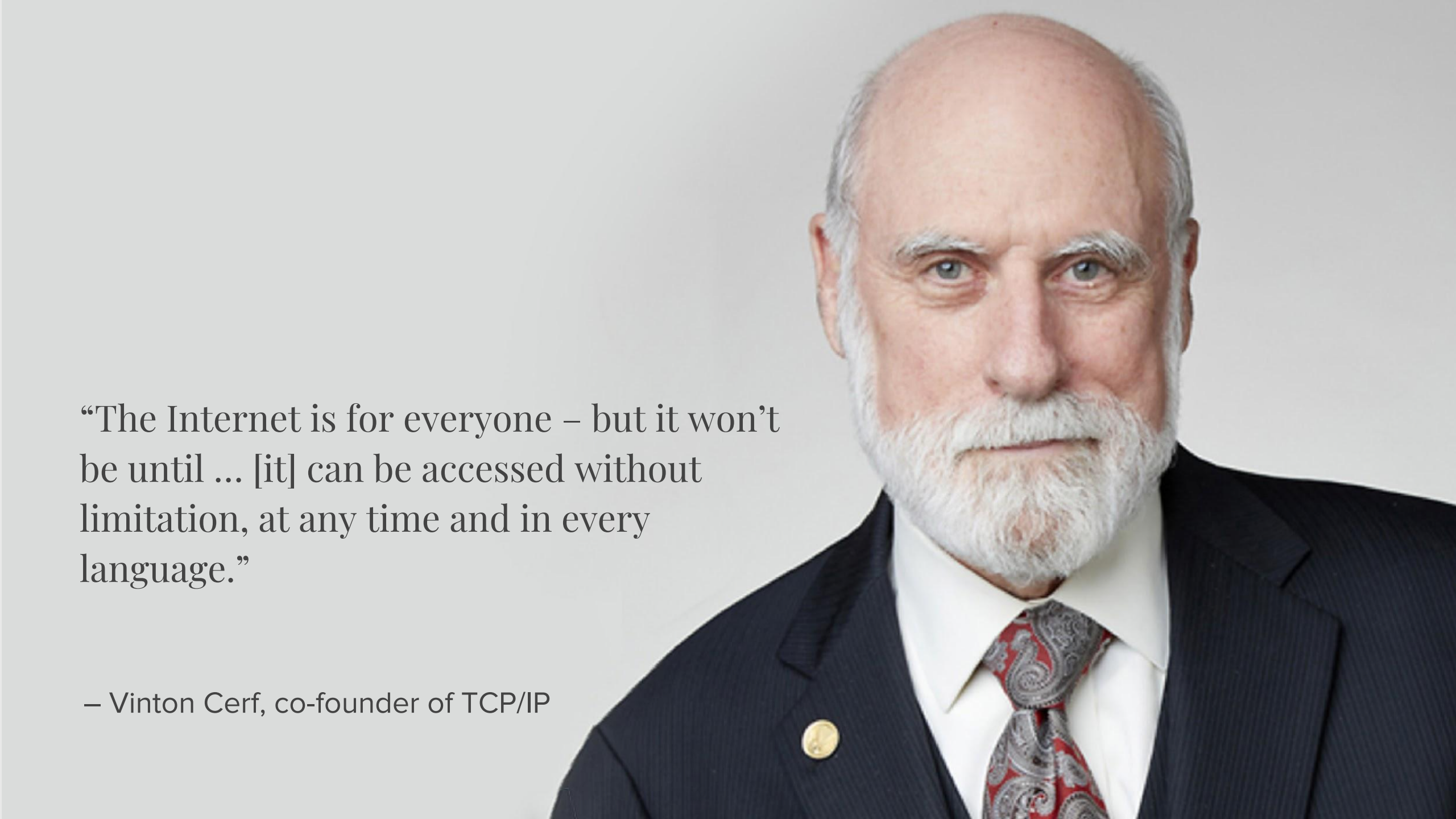
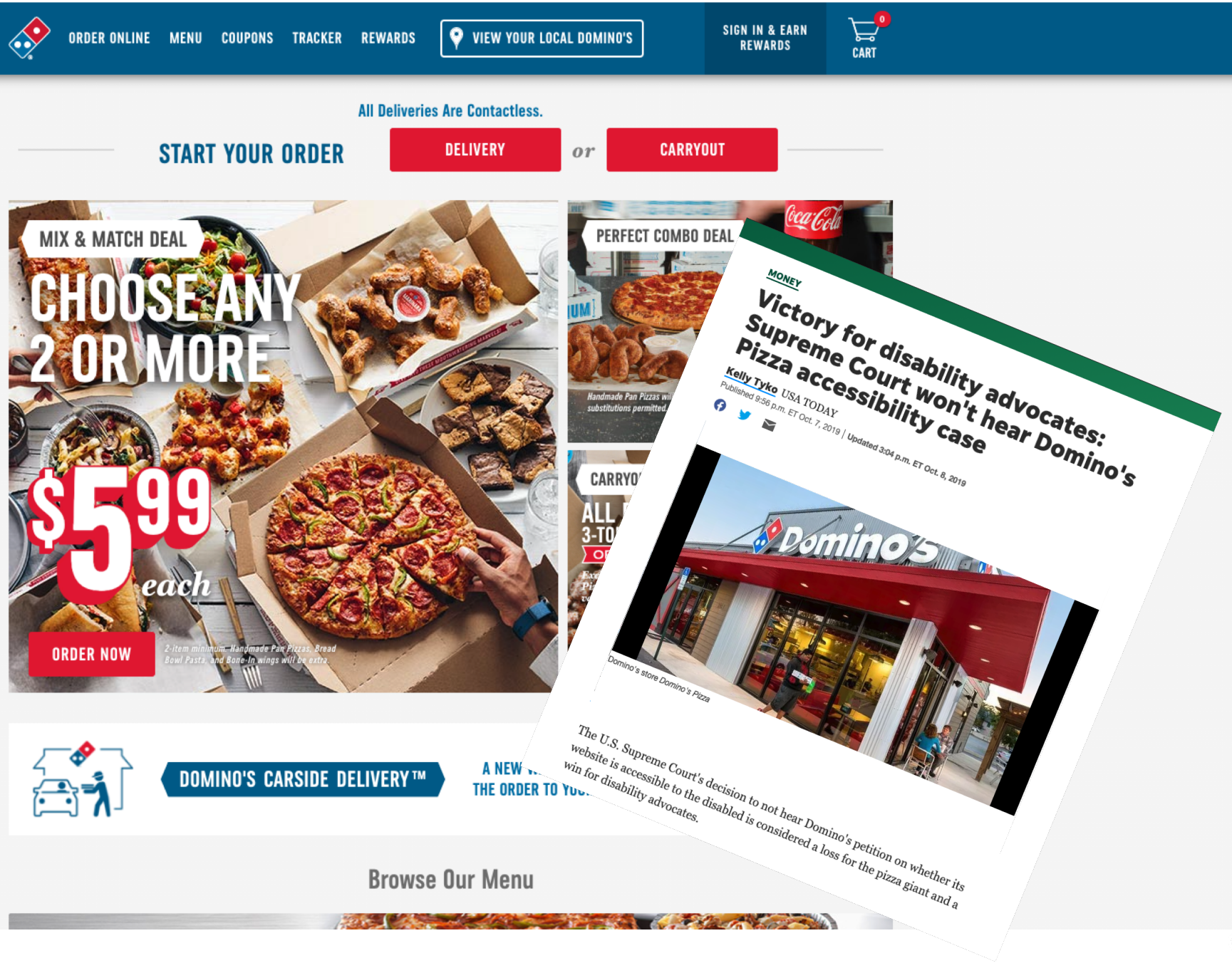

“The Internet is for everyone – but it won’t be until … [it] can be accessed without limitation, at any time and in every language.”
– Vinton Cerf, co-founder of TCP/IP

Accessibility = Open to all

And there are laws in the US that ensure the web is accessible.

UC Berkeley student Bruce Sexton sued Target because its website was **inaccessible to the blind**.

Guillermo Robles, who is blind, claimed in U.S. District Court in California that the pizza maker violated the federal disability requirements because he couldn't order a pizza on his iPhone: **The website didn't work with his screen-reader software.**



Accessibility Today

Internet inventor: Make tech accessibility better already

Vint Cerf says "it's almost criminal" that programmers aren't held accountable to design with disabilities in mind.

Joan E. Solsman April 10, 2017 5:00 a.m. PT

Both Vint Cerf, known as a "father of the Internet," and his wife have hearing disabilities.

it won't
ut

World Health Organization redefined disability

Disability is not a property of a person,
but a **property of a system**.

It reflects the interaction between features of a person's body and features of the society in which he or she lives.

Disability is part of being human in the world.

Inclusive Design & Accessibility

What assumptions do we make about people?

What assumptions do we make about users?

- Right-handed
- Fine motor control to move mouse around
- Fine motor control for scroller and ball motion
- Enough strength to press the buttons/move the ball
- Sensitivity to find smaller buttons

What assumptions do we make about users?

- They can see well
  - Distinguish between colors
  - Distinguish between small icons
  - Distinguish between small letters (when typing)
- They can hold it in their hand
  - Arm mobility
  - Grip strength
  - Fine motor control

Inclusive Design & Accessibility

Visual

Blindness

Ways that websites fail the visually-impaired

- Poorly structured HTML
- Images with no meaningful alt text
- Poorly structured forms
- Repetitive items that cannot be skipped
- Features that require vision, or where the fallback is poorly implemented

How does a blind person use a computer?

How does a blind person use a computer?

- Screen reader says out loud what is on the screen
- Gives rich feedback when the user types
- Allows for keyboard navigation (no mouse)

Web accessibility for the visually-impaired

Heading Structure

Headers should descend logically and should be used for section headers.

```
<!-- Example 2 -->
<!-- Be as explicit as possible when using tags and always include headings for main titles -->
<!-- Do This -->

<h1>Special Pizza NYC</h1>
  <h2>About Special Pizza</h2>
    <h3>Our Story</h3>
    <h3>Our Founder</h3>
  <h2>Why Our Pizza Is Special</h2>
    <h3>Our Ingredients</h3>
    <h3>Our Chef</h3>

<!-- Not This -->
<div>Special Pizza NYC</div>
<div>About Special Pizza</div>
<div>Why Our Pizza is Special</div>
```

Web accessibility for the visually-impaired

Using Accessible Rich Internet Applications (ARIA)

ARIA roles provide screen reader users with more information, context and greater interactivity. ARIA roles are relevant to making sure readers can perceive content.

You can add an ARIA role by simply assigning a role attribute to a tag:

```
<div role="banner">
```

Web accessibility for the visually-impaired

Alt tags

Alt tags are added to images in order to help users understand what they are unable to **perceive** or **interact** with, particularly if they have low or no vision.

```
<!-- Example 3 -->
<!-- Add alternate text descriptions to images -->
<!-- Do This -->

<img src="http://pizza.photos.jpg" alt="photo of pepperoni pizza">

<!-- Not This -->

<img src="http://pizza.photos.jpg">
```

Web accessibility for the visually-impaired

Forms

```
<form>
  <label for="first_name">Enter your first name</label>
  <input type="text" id="first_name">
</form>
```

Inclusive Design & Accessibility

Visual

Low Vision and Color Blindness

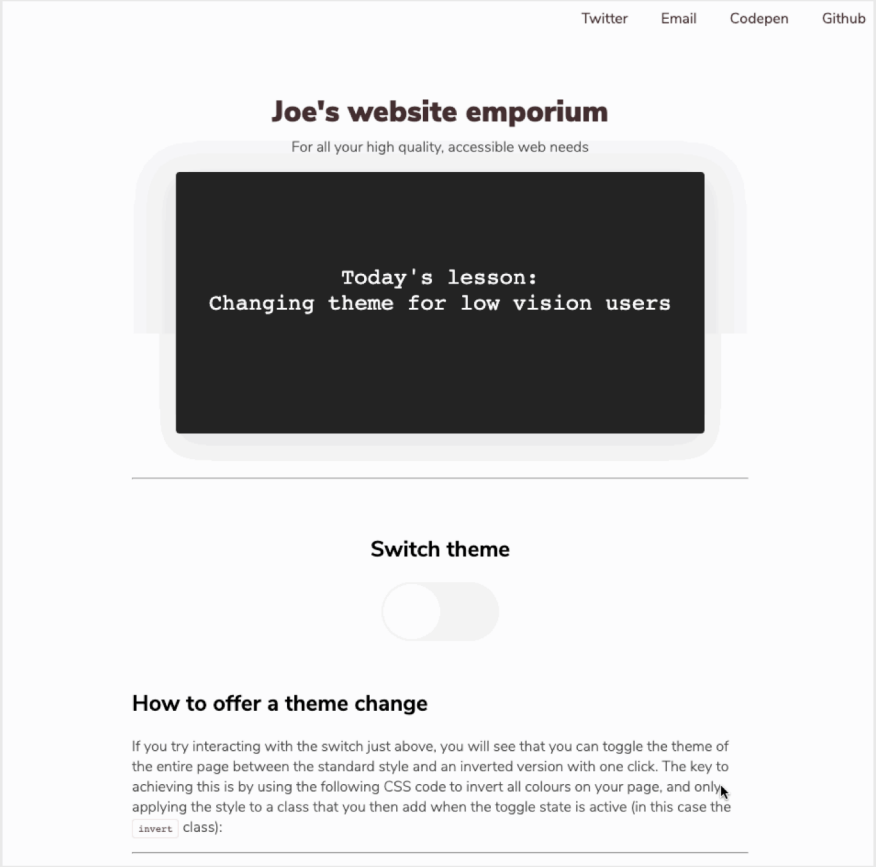
Ways that websites fail the visually-impaired

Accessible Text

- Relative units
- Stop using pixels
- Raise your base font size
- Line height
- Letter spacing

Ways that websites fail the visually-impaired

Contrast Ratio



Depending on the browser supported, CSS has a filter property available that can create a whole range of different visual effects.

```
body.invert{
  filter: invert(100%);
}
```

Ways that websites fail the visually-impaired

Color Blindness

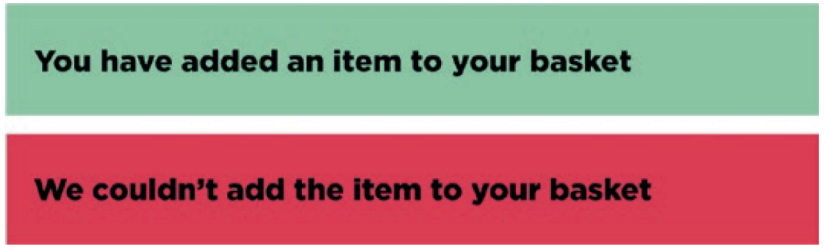


Figure 3-10. *Two alerts, one positive and one negative, both where colour is the primary way in which status is displayed*

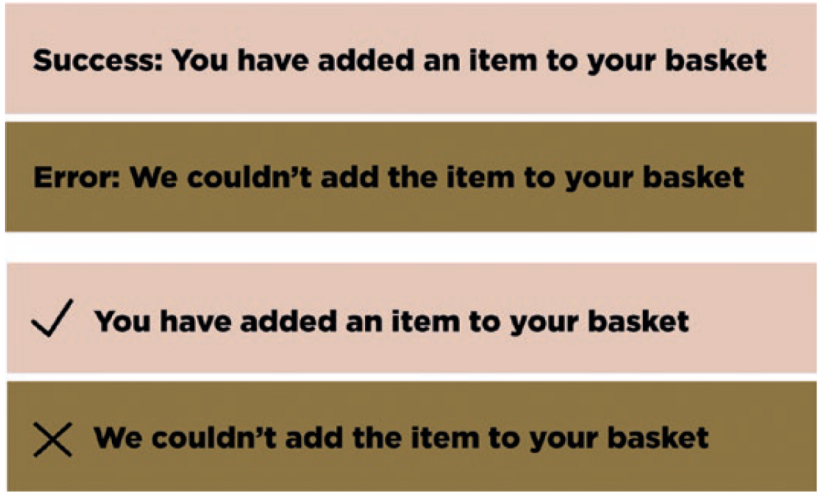


Figure 3-12. *The status messages now use either "Success" and "Error", or a tick and a cross icon, so the meaning of the message doesn't rely on colour*

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Audio

Ways that websites fail the hearing-impaired

- Videos with no captioning
- Videos with poor captioning
- Interactive features with no visual alerts
- Poor quality live feeds

Web accessibility for the hearing impaired

<track> element

HTML5 allows us to add subtitles for a video using the <track> tag:

```
<video controls>
  <source src="videos/video.mp4" type="video/mp4">
  <source src="videos/video.webm" type="video/webm">
  <track label="English" kind="subtitles" srclang="en" src="captions/vtt/video-en.vtt"
default>
  <track label="Deutsch" kind="subtitles" srclang="de" src="captions/vtt/video-de.vtt"
default>
</video>
```

Web accessibility for the hearing impaired

<audio> tag and captions

```
/* CSS */
.audio {
    height: 120px;
}

WEBVTT

00:00:08.100 --> 00:00:10.500 line:1
I'm not the monster here. You are.
```

Figure 5-9. A custom audio player using the <video> tag, a fixed height, and positioned captions

```
<video class="audio" controls>
  <source src="media/audio.mp4" type="audio/mpeg">
  <track label="English" kind="subtitles" srclang="en" src="vtt/audio.vtt" default/>
</video>
```

Inclusive Design & Accessibility

Physical

Web accessibility for the physically impaired

Keyboard-only navigation

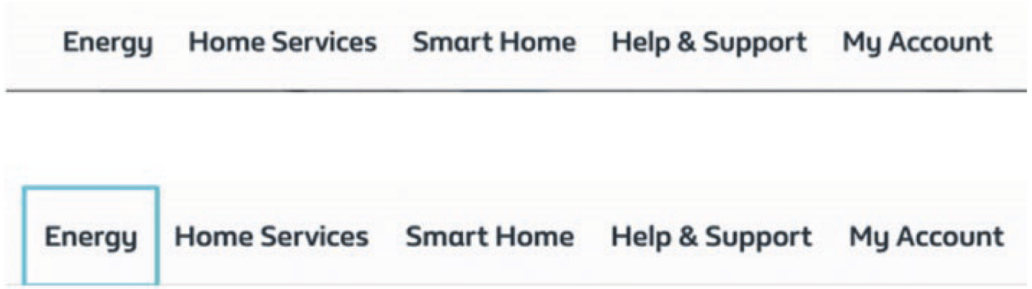
Figure 4-1. *A picture of a button and then that same button with keyboard focus style applied*

Have you ever tried using a website without a mouse?

The most common method of keyboard-only navigation relies on the Tab key, which moves the user sequentially between elements on a page. When you're focused on an element using the keyboard, by default an outline appears to reflect that.

Web accessibility for the physically impaired

Set visible keyboard focus



Imagine you're a keyboard-only user and you're aiming to interact with one of these menu items. In the first example, you're left to guess which link you're on and could potentially end up heading to pages you weren't trying to navigate to.

Inclusive Design & Accessibility

Cognitive

Web accessibility for the cognitively impaired

Clear iconography

Figure 6-4. *A "speech bubble" icon*

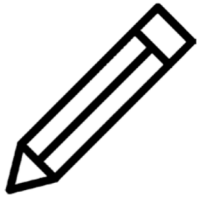


Figure 6-5. *A "pencil" icon*

Figure 6-6. *An icon of an arrow, pointing upward and left*

Web accessibility for the cognitively impaired

Autocomplete

Figure 6-15. *Strict search accurately returning "Croatia" when the user has entered "cro"*

Strict Search

Relies on an exact match

Fuzzy Matching

Doesn't rely on an exact match

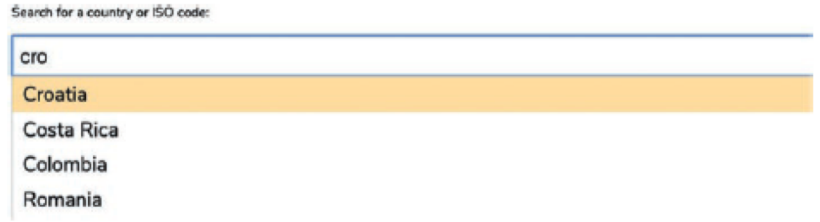


Figure 6-17. *Fuzzy search accurately returning "Croatia" when the user has entered the start of the word – "cro" – the same as strict search*

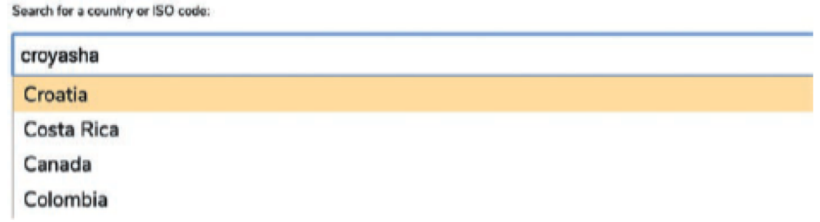


Figure 6-18. *Fuzzy search accurately returning "Croatia" when the user has entered an incorrect spelling based on how the word is said – "croyasha"*

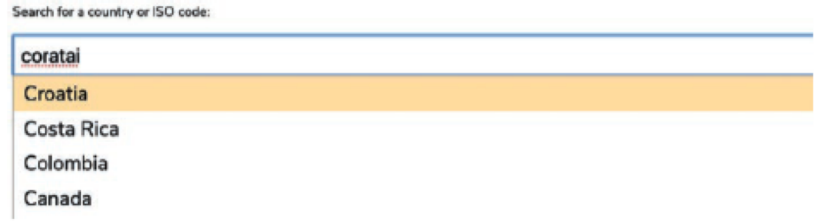


Figure 6-19. *Fuzzy search accurately returning "Croatia" when the user has entered all of the correct letters for the word but in the wrong order – "Coratai"*

Inclusive Design & Accessibility

Inclusive design focuses on individuals, not averages

The myth of average

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When U.S. air force discovered the flaw of averages

By **TODD ROSE**
Sat., Jan. 16, 2016

In the late 1940s, the United States air force had a serious problem: its pilots could not keep control of their planes. Although this was the dawn of jet-powered aviation and the planes were faster and more complicated to fly, the problems were so frequent and involved so many different aircraft that the air force had an alarming, life-or-death mystery on its hands. “It was a difficult time to be flying,” one retired airman told me. “You never knew if you were going to end up in the dirt.” At its worst point, 17 pilots crashed in a single day.

Designing for the Average

Pros

- Only have to design one system
  - Faster and simpler
- Maybe you can model after yourself
  - Need fewer test users
- Almost always cheaper

Cons

- Limit who can use your system
- Might be imperfect for everyone
- Might make incorrect assumptions about what average means
- Might never learn how to design for others

Inclusive Design & Accessibility

Situational Impairments

World Health Organization redefined disability

Disability is not a property of a person,
but a **property of a system**.

It reflects the interaction between features of a person's body and features of the society in which he or she lives.

Disability is part of being human in the world.

What are some situational impairments of this system?

- Only using one hand
- Distracted (riding a bike)
- Wearing a long coat
- Diminished hearing

What are some situational impairments of this system?

- Only using one hand
- Distracted

What are some situational impairments of this system?

- Diminished hearing
- Distracted
- Low lighting
- “Cognitive impaired.”

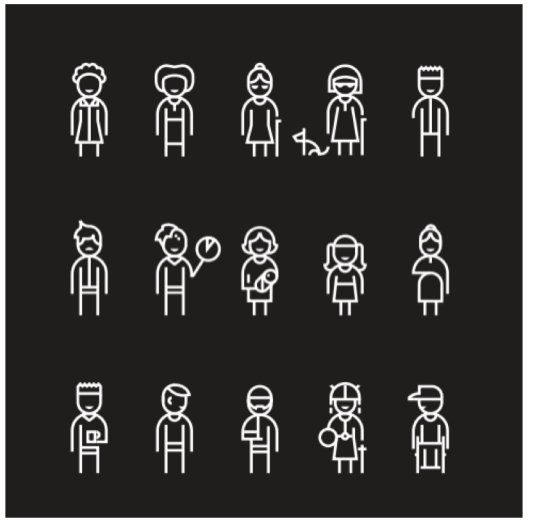
What is Inclusive Design?

A **design methodology** that enables and draws on the full range of human diversity. Most importantly, this means including and learning from people with a range of perspectives.

Inclusive Design

Who we design for

If we use our own abilities and biases as a starting point, we end up with products designed for people of a specific gender, age, language ability, tech literacy, and physical ability. Those with specific access to money, time, and a social network.



Who gets excluded

When it comes to people, **there's no such thing as "normal."** The interactions we design with technology depend heavily on what we can see, hear, say, and touch. Assuming all those senses and abilities are fully enabled creates the potential to ignore much of the range of humanity.

Inclusive Design

3 Principles of Inclusive Design

1. Recognize exclusion

2. Learn from diversity

3. Solve for one, extend to many

Recognize exclusion

One arm

Arm injury

New parent

Situational impairments

Sometimes exclusion is **situational**. e.g. inability to hear in a loud crowd; trying to see after looking into a bright light.

Activity limitations

Context affects how people interact with the world: e.g. a new parent spending their day doing one-handed tasks.

Restrictions on participation

Sometimes exclusion is **temporary**. e.g. ordering dinner in a foreign country; wearing a cast on your arm.

Learn from Diversity

The insight is in the adaptation

When experiences don’t serve people the way they should, people adapt. Insights come when we understand those adaptations.

Learning how people adapt to the world around them means spending time understanding their experience from their perspective.

Solve for one, extend to many

Permanent **26K**

Temporary **13M**

Situational **8M**

The beauty of constraints

High-contrast screen settings were initially made to benefit people with vision impairments. Today, many people benefit from high-contrast settings when they use a device in bright sunlight.

Different people benefit

By designing for someone with a permanent disability, someone with a situational limitation can also benefit.

More people benefit

In the United States, 26,000 people a year suffer from loss of upper extremities. But when we include people with temporary and situational impairments, the number is greater than 20M.

Designed for wheelchairs. Who else benefits?

- People with luggage
- People with shopping carts
- People with strollers
- People walking and texting

Designed for fire safety. Who else benefits?

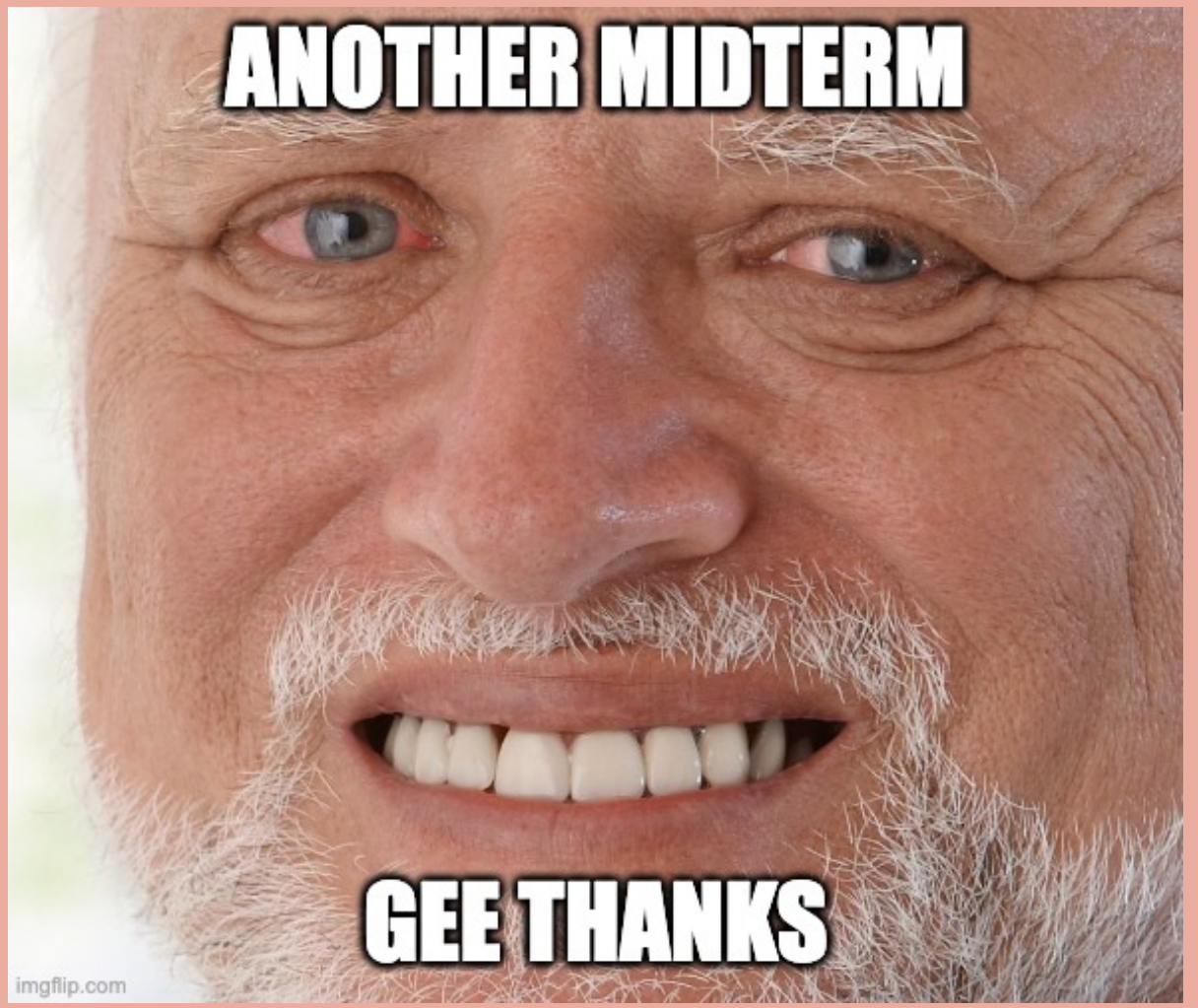
- People in a rush
- People holding two cups of coffee
- People who can’t read
  - Children
  - Elderly
  - Non-English speakers

Designed for arthritis. Who else benefits?

- Anyone who has ever peeled anything!

Inclusive Design & Accessibility

Midterm



Due Friday 3/8
It's worth 10% of your grade

Midterm: Usable CRUD Application

Warm-Up: Due 3/1 @ 11:59pm on Courseworks
Main: Due ***Friday*** 3/8 @ 11:59pm on Courseworks
For both there is a grace period until 8am the next morning.

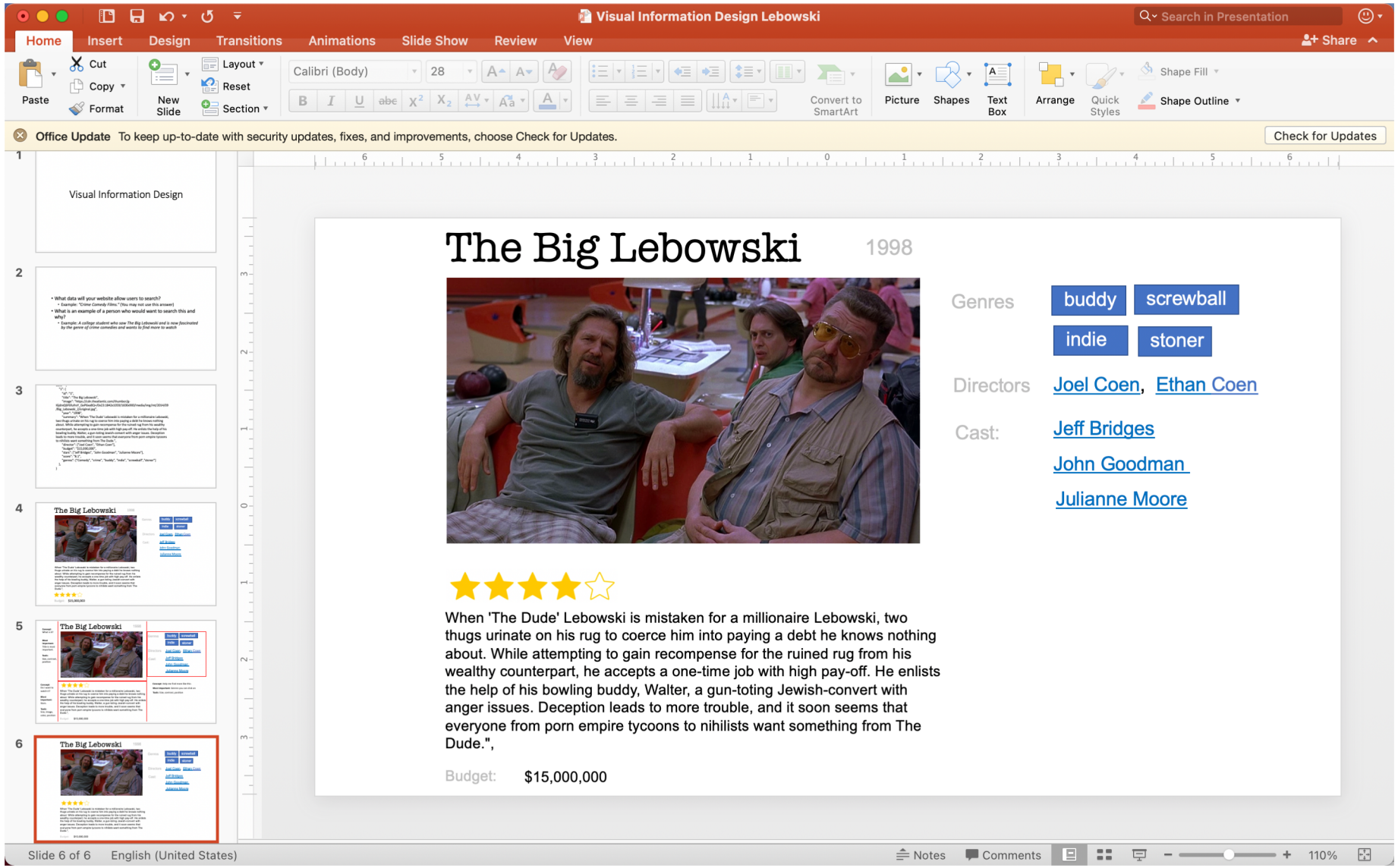
This assignment is the midterm in this classes – it displays cumulative knowledge of the things learned in all the lectures in the first half of the class and it is worth 10% of your final grade. Although it has the same structure as a homework assignment, treat it with the same urgency as an in-class midterm. However, just like a regular homework, you are still allowed to Google things, use ChatGPT, come to office hours, work with others, and seek other forms of help.

You may not use a late pass on this assignment. If you have an emergency situation that requires an extension, please contact your advising dean and have them reach out to me.

There will be no office hours the week of spring break.

When students ask me for letters of recommendation, I always ask them to give me links to the Midterm and Final project videos. These are portfolio pieces that demonstrate your technical and design skills, and your ability to put them together for a polished final product. It's worth

Warm up: Visual Information design



Purpose and User background

- What data will your website allow users to search?
    - Example: *“Crime Comedy Films.”* (You may not use this answer)
- What is an example of a person who would want to search this and why?
    - Example: *A college student who saw The Big Lebowski and is now fascinated by the genre of crime comedies and wants to find more to watch*
- What information on this page should help the user issue a new search? And why?
    - Example: *The similar movies, genres, directors and actors are searchable because they can help the user find similar movie they may like*

~3 conceptual groups


```
data = {
   "1": {
      "id": "1",
      "title": "The Big Lebowski",
      "image": "https://cdn.theatlantic.com/thumbor/g-
I6jdrxQ6F6fuIhsY_GeP6xaBQ=/0x23:1842x1059/1600x900/media/img/mt/2014/09/Big_Lebowski_2/origin
al.jpg",
      "year": "1998",
      "summary": "When 'The Dude' Lebowski is mistaken for a millionaire Lebowski, two thugs urinate on
his rug to coerce him into paying a debt he knows nothing about. While attempting to gain recompense for
the ruined rug from his wealthy counterpart, he accepts a one-time job with high pay-off. He enlists the
help of his bowling buddy, Walter, a gun-toting Jewish-convert with anger issues. Deception leads to more
trouble, and it soon seems that everyone from porn empire tycoons to nihilists want something from The
Dude.",
      "director": ["Joel Coen", "Ethan Coen"],
      "budget": "$15,000,000",
      "stars": ["Jeff Bridges", "John Goodman", "Julianne Moore"],
      "score": "8.1",
      "genres": ["Comedy", "crime", "buddy", "indie", "screwball","stoner"]
   },
}
```

The Big Lebowski

1998

Genres: buddy, screwball, indie, stoner

Directors: Joel Coen, Ethan Coen

Cast: Jeff Bridges, John Goodman, Julianne Moore

★★★★☆

When 'The Dude' Lebowski is mistaken for a millionaire Lebowski, two thugs urinate on his rug to coerce him into paying a debt he knows nothing about. While attempting to gain recompense for the ruined rug from his wealthy counterpart, he accepts a one-time job with high pay-off. He enlists the help of his bowling buddy, Walter, a gun-toting Jewish-convert with anger issues. Deception leads to more trouble, and it soon seems that everyone from porn empire tycoons to nihilists want something from The Dude.",

Budget: $15,000,000

Concept:
What is it?

Most important:
Title is most important.

Tools:
Size, contrast, position

The Big Lebowski

1998

Genres: buddy, screwball, indie, stoner

Directors: Joel Coen, Ethan Coen

Cast: Jeff Bridges, John Goodman, Julianne Moore

Concept:
Do I want to watch it?

Most important:
Stars.

Tools:
Size, Image, color, position

★★★★☆

When 'The Dude' Lebowski is mistaken for a millionaire Lebowski, two thugs urinate on his rug to coerce him into paying a debt he knows nothing about. While attempting to gain recompense for the ruined rug from his wealthy counterpart, he accepts a one-time job with high pay-off. He enlists the help of his bowling buddy, Walter, a gun-toting Jewish-convert with anger issues. Deception leads to more trouble, and it soon seems that everyone from porn empire tycoons to nihilists want something from The Dude.",

Budget: $15,000,000

Concept: Help me find more like this.

Most important: Genres you can click on

Tools: Size, contrast, position

Main Assignment: Complete CRUD application

- Functionality:
  - Homepage
  - View item
  - Search
  - **Add item**
  - **Edit item**
- Visual Design:
  - **Visual Information Hierarchy**
  - **Colors**
    - **Base, accent, light grey, dark grey**
  - **Accessibility**
    - **Alt text**

Next week: no lectures

- Office hours – check the website!
- If you want to see HW6 Solutions, ask a TA! We want to walk you through it and help you understand, so you can build on it.

After Spring break, we switch to group projects

- We'll be learning and practicing human-centered design.
- On Monday, you'll meet in your TA group,
    - **In-person section:** Your TA will tell you a time and place.
    - **Zoom section:** Your TA will reach out to you with a link.
    - **CVN:** Your TA will reach out to you. We may find a time that works for everyone, we may give feedback asynchronously.