

## WebAIM Campus Training-Session 2

OK, another aspect of accessibility for users with low vision is ensuring that there is sufficient contrast between the text content and the background. This is something that impacts everybody. We all have difficulty reading content if there is insufficient contrast.

It is important to keep in mind that ultimately the end user has control over the way they view your web content. They can change colors. They can invert contrast. They can enable high contrast to override your colors to view content in a way that works best for them. So keep that in mind. This is always something that they can do.

That idea that we fully control the user experience-- we have to give that up. We have to give up that notion that we control what the user is going to see or what they're going to do. What we want to do instead is to enable a good experience. If the user comes and they customize, they adapt the content for their own needs, what we have provided still is going to work for them.

To ensure that you provide sufficient contrast, WCAG does define this for you. They provide some measures. All you have to do is implement this very basic formula, and just put this in your memory banks and you'll be good. No, you don't want to be doing this complex math to determine if your content has sufficient contrast. You want to use tools like the WebAIM Contrast Checker. This is a tool that we've built. It's on the WebAIM site.

I'm going to actually enlarge this content because you're all experiencing low vision right now. There we go. So this contrast checker has some basic tools where you can input the foreground and background colors.

There's also a little color picker that you can use to select particular colors, but usually most colors on the web are defined in this six character hexadecimal value. You can put those values in or use this color picker and it will generate this contrast ratio based on those colors. That contrast ratio is what comes from that complex formula, and then WCAG defines thresholds for passing or failing at both AA and AAA-- there is no single-A contrast requirement, I don't know why, there just isn't-- for both normal text and large text. So this color of blue, you're going to see how it changes the contrast ratio and pass or fail for various colors.

So let's see here. Let me find a nice color. So large text is defined as 14-point and bold or larger, or 18-point and larger. The idea is that if it's big and bold or really big, it doesn't have to have as much contrast because it's big and bold or really big. Anything that's not large text is normal text. It's smaller than large text.

So this will show you that this color of blue fails AA and AAA for normal text, passes AA for large text, fails AAA for large text. They built in these lightness and darkness letters. We can drag this up just a little bit and make it a little bit slightly darker blue.

Going the wrong direction here. There we go. To where [INAUDIBLE] passes, AA for normal text. Still fails AAA for normal text. But if AA were your goal, then that would pass, and then passes for large text.

So this is a very popular tool. There are others out there that would allow you to perform some basic analysis of the colors of your site to ensure where they're at when it comes to contrast. And the definitions are all on that page of what large text is and the point sizes. And nobody uses point, so it converts it to pixels. Things like that.

Now what's most important, though, is that common sense is vital when considering color contrast. So up on the screen here there are words in various colors. Some of these colors pass the WCAG 2.0 AA threshold, some of them do not. Any ideas-- just maybe throw out words or colors. Which of these seem to pass? Which of these, just looking at it, seem to be most visually distinctive for you?

OK, the word sense. OK, good. Others? Is, OK. OK, the word contrast. Good, any others that seem to be OK for you? Common, OK. You might just think for yourself which of these you think are good or which maybe wouldn't pass.

All right, and here's the answer. The first four all pass, the bottom four all fail. I've shown this to tens of thousands of people and almost always one of the first ones that's mentioned is the red, the one at the very bottom. Seems to be the most visually distinctive, yet it does fail the WCAG contrast requirements. That is a function of the colors, reds and greens. They require higher levels of contrast in order to be more visible for us. Reds and greens, we just don't tend to perceive as well. So that formula does discriminate against reds and greens a little bit which can make it more difficult, especially if you're a school in Texas or something, to meet the contrast requirements with reds. Texas burnt orange, it's pretty much impossible to meet the WCAG requirements on white or on black.

What about those two in the middle, the two ones that are gray? One is slightly darker than the other. One passes-- it's just above the threshold-- one's just below. You probably can't visually tell a difference between those.

That's the way the guidelines work. They draw a line. Anything this side, you pass-- yay accessibility. Anything this side, you fail-- boo fail, right? But that's not how the human experience works because we're talking about accessibility as being a human thing. It's not like somebody with low vision would see that gray would pass and be able to read it just fine and not be able to see the word fail below it. It just doesn't work that way, but guidelines do.

Again, guidelines help inform. They define this threshold. But the human experience can be much more dynamic than that, as I'll demonstrate.

One thing to consider is that formula that I showed and those thresholds for pass and fail were defined by the W3C based on research that was conducted on an Amiga 1000 computer. Some of you probably don't even have these things and have no memory of computers like this because you're young enough. Consider these displays that we used to have compared to what we have

today. A retina display on an iPhone, they're brighter. They have higher levels of contrast, truer colors, higher resolution. The edges of those texts on this are really kind of pixelated.

Now, does that mean we can get away with lower levels of contrast because of the edges of the text are better defined? I don't know. There's some interesting questions there.

A couple of other things with WCAG and how it works with colors and contrast. It doesn't really consider font weight. I mean, it has like that large big and bold. But both of these, as far as the WCAG is concerned, would have the same contrast ratio. But the one on the left certainly is more visually distinctive than the very thin font on the right. WCAG doesn't make that differentiation.

Beyond just the threshold for large text and anything else, it doesn't really consider text sizing. Again, if you look just at contrast ratios, this teeny, tiny text and the large one would have the exact same contrast ratio, but the perception of them is quite different.

When it comes to text outlines, WCAG says that you can use the outline in determining the contrast ratio for text. So this would be black on white text, or white on black. One or the other. Perfect contrast, right? Highest contrast available, but is this as perceivable this true black text on white or white text on pure black? No, but according to WCAG, the ratio would be the same. It would be the highest available.

Same thing with drop shadows. This would be black on white and white on black. But because of the drop shadow-- sure, the drop shadow helps with the readability. It increases the contrast, but is this as readable as black on white and white on black? No.

What about background images? WCAG doesn't provide really good guidance as to how you would measure this. I certainly would err on the side of the user and probably measure the contrast in the areas where it has lower amounts of contrast. But certainly, background images are much more common on the web today and they can impact readability. Even if you were to do something like add a drop shadow, according to WCAG, this would be black on white or kind of a grayer on black. These would meet the contrast requirements, but because of the busyness of that background, that can impact the readability and perception of that text. But WCAG doesn't really tell you how to deal with those things.

Background gradients, same thing. Again, you'd probably measure this in the areas where there's lower amounts of contrast, but this can impact human readability. You guys would probably say that the one on the left-- I'm sorry, that the one on the right is more readable than the one on the left. It's the same gradient, just inverted. But just because the predominance of the text is in the area where there's more contrast on the right. How do you really measure these in a real accurate way? WCAG doesn't define very well.

If you have pure black on white or pure white on black, this will generate a 21 to 1 contrast ratio. That's the highest contrast ratio possible using that formula, or say the web WebAIM tool is 21 to 1. Does this mean that this is best for accessibility? Not necessarily. It's actually possible to have too much contrast. Because of the starkness of that contrast, that can actually impact

readability. Some users will see halos or shadows if there's too much contrast and can make it difficult.

For users with dyslexia, this can also be an issue. Now, dyslexia is not a visual disability. It's a cognitive processing thing that can cause letters to be jumbled up. But if you have too much contrast, because of those halos and shadows that you can see, that can aggravate the condition of dyslexia for some people. So you might consider that, especially with large amounts of text, pure black on white or white on black can also be a little difficult to read. So maybe a slightly decreased foreground or background can also be helpful. WCAG doesn't consider that at all, but studies have shown that really high amounts of contrast, especially with modern displays because they're so bright and so contrasty, can have an impact.

Here's an interesting case. Here we have this gray text on white, and then the same color of gray on black. Which of these two seems the most visually distinctive for you? If you're just looking at these, which one would you probably prefer to be reading or seems to be easier to read for you?

How many of you would say the gray on white is better for you? OK, who here would say the gray on black? OK, a few. If you look at WCAG, the gray on black actually has a higher contrast ratio, even though the vast majority of you said that you would probably prefer reading the one that has a contrast ratio that is actually below the 4.5 to 1 WCAG requirement for normal text. Now, this is probably large text. But 4.5 is kind of the threshold we look at a lot. Kind of interesting. This primarily measures dark colors on white. If you take lighter colors on a dark background, sometimes it doesn't always align with what we might think or visually perceive as being optimal.

Another case here. Here we have red on black, and the same color red on white. How many of you would say that the one on the left is better for you to read? OK, a handful of you there. How many would say red on white? OK, more of you there. Pretty significant difference in contrast here, OK? Definitely much higher with the red on black.

Now, I mentioned that WCAG does discriminate against reds and greens. It's more difficult to get sufficient contrast unless you put it on black, and that actually kind of boosts the contrast ratio a little bit.

Yes?

Isn't it true that the on this projector screen is not black, though?

Yeah.

And that would affect our perception.

It would. Yeah, exactly. And if I turn up the lights or turn down the lights, that's also going to change. If I looked at it here, it's a very, very dark black on my screen.

That's another thing that WCAG doesn't consider. It can't consider all end user environments. If I'm looking at my content on my phone, it's really small. In the sun, it's a low contrast environment. It only considers the colors that are defined by you as the author, not the way in which they might be presented to the user, which can be hugely, hugely variable.

Another one here. Here we have kind of this darkish-- it's kind of a maroonish text, actually, as I looked at it here on an orange background, and then blue on white. How many of you would say the one on the left with the orange is better? OK, a few there. How many would say the blue on white? OK, the vast majority of you there. And you're all wrong or right, I don't know.

[LAUGHTER]

These have the exact same contrast ratio. Now, the reason for this is the WCAG formula looks at luminance, or brightness differences, only. It doesn't consider the actual colors that are being used. When you have this kind of maroonish dark red color on orange, they both contain a lot of reds. The hue of those is both in the red category. When we visually perceive those, because the reds are so similar, we have a lower level of perception or perceived contrast between those. But if we look only at brightness differences as measured by WCAG, they're the same. So there's more to human-perceived contrast than simply brightness. The actual colors that are used can have a big impact.

What about these ones? Yeah, OK, so how many of you would say the one on the left, the blue on yellowish, is better? OK, a few of you there. How many of you say the yellow on red? OK, more of you there. This is interesting, too. Pretty significant difference in the contrast ratios there.

So I don't know. What does this mean? Are these colors that you would want to use online? No, probably not, even though WCAG might suggest that one's better than the other. Interestingly, a lot of you kind of grimaced, and somebody actually looked away from the screen when I put this up here.

How many of you are more bothered by the one on the left? OK, how many are more bothered by the one on the right? OK, interesting. This just highlights some of the subjectiveness to this. The actual colors that are used, the conflicting nature of colors can impact our ability to perceive. Even though there might be higher levels of luminance, the color combinations may not be optimal for us.

This is actually something that is learned as to which colors conflict. In Asian cultures, certain color combinations that we might find very glaring or icky are very much accepted because that's kind of the cultural norm there. As I've shown this, again, some of you were a little more bothered by one than the other just because our own perceptions of colors tends to be quite different.

How do you measure all of these things? It can get really, really difficult. WCAG only measures one aspect of contrast. Now, what's the most important aspect of contrast? Luminance is king. It's the most important thing. If you have insufficient luminance difference between your text, it

will be difficult to read. But there's a lot of other factors that come into play beyond just the brightness difference between the text. Yes?

The black text on red, I'm sure we're going to talk about that later, but I just wanted to double check. Are we going to talk about color blindness?

Yes, we will. That's our next topic, yup.

This might be a more general question, but I learned when I was going to school in my computer photography class that light text on dark backgrounds is better because it's like looking through the sheet, whereas black on white is a lot harder because it's like text jumping out into your face.

Yeah. Well, kind of. Dark on light tends to be the norm for print, for online. It's more common for sure. A lot of that is just preference. There have been studies of black on white, white on black, and they tend to be fairly mixed in their results. Generally, when there's higher levels of contrast on either side, it tends to decrease. It's usually more in the middle where you get more consistency in perception, and readability, and all of those things.

So I don't know. I don't know what's the best. It's hard to know what's best. Certainly, you need sufficient contrast and common sense, all right? If you look at something and it doesn't look right, if it doesn't seem to have enough contrast, it probably doesn't. It needs to be better regardless of what WCAG says.

Where WCAG gets a little fuzzy, as you saw through those examples, is when you're around the 4.5 to 1 contrast ratio. Anything below about 3 to 1 is generally going to be more difficult to read. It needs more brightness contrast. Now, I mentioned WCAG does not have a single-A contrast threshold. You might define for yourselves a single-A thing. Maybe nothing on our site will be below 3 to 1, and anything between 3 to 1 and 4.5 to 1, which is the AA requirement, maybe it has to meet these certain requirements. Maybe bigger, bolder headings and a particular font weight, or something like that.

I'm not sure what your school colors are if that's a difficulty when it comes to contrast, but very often it is. Black and yellow, OK. Yeah, I don't know where those might come when it comes to WCAG, but that's not a battle you're going to win. So be reasonable in the use of those types of colors. Yes?

So if I can piggy back off that for the people that use our content management system through UNC, all the heading colors and widget colors, et cetera, that come through, you test for the contrast. So as long as you don't override our colors and choose your own colors or implement the colors that your department chair tells you to use, et cetera, you will be fine. But if you do choose your own colors and put your own colors in the CMS, highly recommend using that contrast tool to make sure you're following the guidelines.

Good, excellent. Yeah, that idea of consistency in color presentation and having themes that you know align and sticking with those is powerful. Yeah, excellent.

Any questions about this? OK, I just want to real briefly mention a WCAG 2.1 contrast requirement. So this is something that's new. In WCAG 2.0, it deals only with text and images of text. 2.1 has expanded that to apply to graphical elements and user interface components. So this would be like borders for text boxes, right? If you have a white background and really, really light gray text border, it can be really difficult to see where that text box is. WCAG 2.1 would require 3 to 1 contrast ratio between those.

Also, graphical elements like your three line hamburger menu, a gear icon, things like that that are graphics now require 3 to 1 contrast ratio under 2.1. They didn't at all under 2.0. Icons are really, really common in modern interface design.

I don't know if you use Slack. I counted a little while ago on the Slack interface, the web interface in the web browser, one page, one screen of content I counted 21 distinct icons, functional icons that either conveyed important content or you could click on to do something. If those did not have sufficient contrast, that interface would be pretty difficult to use because those graphics were pretty important to the functionality of that application. So let's just keep in mind that this is a new thing with WCAG 2.1.

Somebody mentioned colorblindness. I want to talk about colorblindness for a minute.

[LAUGHTER]

It takes a minute, and if you're colorblind you're wondering why people are laughing. So colorblindness, or technically it's called color deficiency. Colorblindness doesn't mean you can't see color, it just means that you can have difficulty differentiating between certain color combinations. Colorblindness affects about 8% of men. So statistically, there'd be one or two of us probably in this room that have some form of colorblindness. About 0.1% of women, so about 4% of the population overall has some form of colorblindness.

The most common form is red-green color deficiency. It's not that you can't see reds and you can't see greens, it's just the reds and greens can be difficult to differentiate when they're used together. But there are many other forms of color deficiency with other color combinations. So it's not so much the color that matters, it's the principle of not using color as the only way to convey important information or meaning.

So I have an example of this. The green mushrooms listed here are OK to eat. The red mushrooms will kill you. So you're seeing a list of red and green mushrooms, but you're seeing them as they would be seen by someone with the most common form of red-green colorblindness.

So do any of you know your mushrooms well enough that you could choose some of these? No? Chanterelles, OK. The three middle ones are OK? Willing to risk your life on that? OK, you did pretty good. OK, so you have the three middle ones are OK. In all the years I've used this example, no one has ever said that the tylopilus is edible because you just know from its name that it's going to kill you, right?

[LAUGHTER]

So how could you make this content more accessible without relying on color alone? I'm sorry? A star? Yeah, so an icon or a star or asterisk. Something like that would do that. Now, if you're blind, you're also colorblind. Now, it sounds really obvious when I say that, but it's very often overlooked that if I can't see the colors at all, the color information isn't conveyed. Even if I'm using a screen reader, a screen reader isn't going to tell me this text is green, this text is red. It'll generally ignore those types of visual stylistic type things.

So let's say that we did use an icon like, say, a skull and crossbones image after all the ones that are poisonous. Of course, being an image, we would give it alternative text that I'll talk about in a few minutes of, say, will kill you. So let's say you come to this page using the screen reader and you hear, amanita will kill you chanterelle. So is it actually clear which of those two is going to kill you? You would want to consider how that might be read.

Now, in this case, if you were to use a true list, that would be OK because the icon would be associated with that particular list item. The screen reader will pause between lines or between list items. The user can navigate line by line or list item by list item that will provide a structural grouping of that icon with amanita in this case. So that would be fine. So that's one way to provide the visual differentiation.

How else could you differentiate these? Yes?

Two lists.

Yeah, two lists, right? These ones are OK, these ones will kill you. That would probably be maybe the best approach here, or at least the most clear approach. Especially for something this life or death, you probably don't want much ambiguity, so separating those out is probably going to be best.

Now, you could still use the colors, right? You could still use the red and green if there's sufficient contrast. You can use that to enforce, reinforce, or supplement the two lists, and that's perfectly fine. There's nothing wrong with using reds and greens. It's using color alone as to convey information or meaning.

On our contrast checker tool, we had red and green but we also had text of pass or fail. The colors, again, reinforced and provided some visual enhancement to the text that was available. If I couldn't see those colors or perceive or differentiate the colors, the text provided the sufficient differentiation.

Any other ideas of how we could differentiate these? Sometimes people will suggest things like italics or bold, something like that. Again, while that would provide a visual differentiation for users that are colorblind, for a screen reader user, it doesn't always read italics or bold text any different. So you'd want to be careful with those purely stylistic types of approaches.

So this will affect users that are colorblind. It'll affect users that are blind. This can also impact users with low vision that override page colors. Maybe I need yellow text on a blue background. That's the combination I need to be able to optimally read this content. So I override your page colors, this color information is lost, I would not be able to differentiate those. So that's a pretty big audience that can be impacted by color reliance.

So just to get those two points in mind. You want to ensure sufficient contrast and don't rely on color alone to convey information or meaning. Do keep these separate. Sometimes they tend to get a little conflated and you hear people say things like, red is evil, don't use green. And that's not the case. You could even have red text on a green background and that would be OK if there's sufficient contrast and color isn't used alone. Even if I have red-green colorblindness, if there's sufficient contrast, I'll be able to read it. I may not see it as red and green, but because of the contrast difference it'll still be readable to me.

There is an area where these tend to come together a little bit and that's for links that are not underlined. We'll cover that this afternoon. If you have links that aren't underlined by default, you're relying on color to differentiate those, there are some additional requirements that come into play.

Questions about colorblindness for color deficiency? OK, we'll move on and talk about blindness. I mentioned screen readers will take text content of a page and read that content to the user. This is a screenshot of the WebAIM homepage. Very often if we were to visually present what we think the screen reader experience might be like as it reads text, we might kind of envision something like this like the screen reader just reading this wall of text to the user.

This isn't really accurate. This is maybe a little better visual representation of what the screen reader experience might be like where the screen reader will read images. It'll read alternative text for images. We can define structure and semantics. Those are two important words as we consider accessibility-- structure and semantics. We can build things into our page to enhance accessibility and to support navigation within page.

Examples of that are headings. Instead of just styling text to be big and bold because it's important or describes a section of content, we can use a true heading. Those headings will be identified by a screen reader to the user. The user can navigate by those headings. So main navigation, we have web accessibility in mind. Accessibility, community, those are headings that the user can navigate through that page.

Lists, that's also structure and semantics. Visually, we look at that first list and we go, OK, it's four items that are parallel in structure. It's an unordered list. And we gain meaning from that visual presentation of an unordered list. If we use a proper unordered list in our page and our code and our markup, that will also be identified to a screen reader user. It's an unordered list with four items. They know, OK, these are parallel items and there are four of them.

So defining that structure and semantics into our page can really, really enhance accessibility. One of the most important things you can do is to find good headings. One of the most

foundational things that almost anybody that authors content should be aware of and can readily do to enhance accessibility.

We've conducted several surveys of screen reader users. We found that navigating by headings is the most common way in which users will explore page content-- very, very common. Most common way. In fact, 67 over 2/3-- in fact, it's higher now. I think we just did a survey. I think it's 68% or 69%. I mean, the fact that almost-- I mean, most users do this. I mean, do any kind of user testing and find 2/3 that do things the same way. It doesn't happen very often.

So as you consider headings within your page, headings should always describe a section of content. It should be that big bold text that describes the content that comes after it. As such, headings should never be empty. They should always be descriptive of some content. Should always contain text, or an image with alternative text is OK. We recommend one H1, or first level heading, per page. And usually that would be the page title, the big bold text at the beginning of the main content area.

Screen reader users can navigate by headings. They can hit the H key in most screen readers to navigate by headings. They can pull up a list of the headings. They can filter by heading level to say, I only want to see the second level headings. They can hit 1, 2, or 3 keys on their keyboard-- 1 to navigate through first level headings, 2 for second level headings, and so forth.

If your content has a single H1 at the beginning of the main content area, if you do that consistently, when a user comes to your page, they can just hit the one key on their keyboard and two things happen. First of all, it will jump to that first level heading. It just bypassed all of that navigation, search, all of the stuff that comes before that otherwise they generally would need to navigate with the keyboard. Most screen reader users navigate with the keyboard.

A mouse as a visual input so if I can't see the mouse cursor, it doesn't do me a lot of good so they'll navigate with the keyboard. And we talked about how many times the user would have to hit the Tab key on your pages to navigate through all of that. If I can just hit the 1 key and bypass all of that and jump right to the main content area, that's really valuable. And two, it reads that heading, so I know what the page is about. That's really, really powerful.

Now, if you have two H1s-- say maybe the logo or site name and the document title is H1-- that works, I just hit the 1 key an extra time. But that's a pretty powerful strategy to just have a single H1 is what we recommend.

And then you would define subheadings below that to define the structure of your page. Really, in isolation, if you pulled out just the headings, that essentially serves as the table of contents for the content on that page. If you're like me, when I come to a really long web page, I scroll real fast and I look for big bold text. The bigger and bolder the text, the more important it is. Then I look for subheadings and sub-subheadings below that. And really quickly just by scanning the headings, I can get a good idea of the content and structure of that document.

Screen reader users can do the same thing if you provide a good document heading structure within your document. That does mean you generally should not skip heading levels. So if you

have your first level heading and then an H2 second level heading below it, the next heading in the page shouldn't be an H4. There should always be a third level section before you jump to an H4, or a fourth level section.

Now, you can skip backwards. Say you have an H2, then an H3, then an H4. Your next heading may be a main heading, back to a second level heading. That's perfectly fine. This also means that you can have lower level headings that precede your H1 because your H1 usually is the big bold text at the top of the main content area. You could have second level headings or other headings that precede that. Maybe for your main navigation, maybe a sidebar that comes before your main content, you could have an H2 or multiple H2s within that. That's perfectly fine. There's nothing in HTML or accessibility that would necessitate that your H1 be the first heading within the page.

Now, if you're dealing with a document like a Word document, I usually just start with an H1, and then H2s and H3s below that. But in web content, it's OK to have an H2. I like to think of that as like-- you might have like a preface that comes before your main title in a book, right? If you're reading, you might have a preface and then you get to your title page. That's perfectly fine for web content to have subheadings come before your main heading. Yes?

Cool, so if you define a page title, it becomes the H1 at the beginning of the main content area. As you're authoring content, your main headings for content should be H2s, then H3s, and so forth. Excellent, very good. Yes?

Yes, so if you are dealing with, say, a Word document, if you define headings appropriately-- which is probably the most important thing you can do in Word documents. If you export correctly to PDF, the heading structure will be maintained. Yes?

Regarding skipping headings, because this has come up in my department a couple of times, is there a specific usability issue that comes up when you do skip headings or is it just from a principle standpoint?

Yeah, so that is something else we've asked in our surveys. Users do indicate that they do use that heading structure to figure out what the content is just like we do visually. We look for bigger, bolder headings, and having those consistently be presented is important. Now, if you jump from, say, an H2 to an H4, is it inaccessible? No. Is it a WCAG failure? No. WCAG doesn't require a proper heading structure until AAA, but at AA it's not a failure. So it's a best practice but we very often say that any heading is better than no heading at all. A good structure is optimal, but if you have a little mismatch there in your head structure, don't worry too much about it.

Now, you do want to define your heading levels based on structure, not on the way that they look. Sometimes we say, well, I want this text to be written in bold so you make it an H1 or an H2, and I want this text to be smaller so I make it an H5. You should use styles to define those and use your heading levels appropriately. That's fine. Very often we'll get a mismatch or a skipped heading level.

We're dealing with the template or shell of our page and then we also have the content, and they kind of have distinct themes. You might have headings for search, and a sidebar, and headings in your footer, and then you have a heading structure for your documents. So sometimes if you get a mismatch going from the template to your content or content to your template, it's not a real big deal. The impact is pretty low, but it's a consideration. Does that answer the question?

Yeah, yeah, making my whole life harder.

Yeah, again, it's not-- WCAG doesn't require it. What would be a failure for headings in WCAG would be big bold text that describes a section of content that is not a heading. That would be a WCAG failure. Visually you're conveying this is a heading that's not conveyed to a screen reader user. That would be a failure. What else would be a failure is if you have something that's defined as a heading but it's not actually a heading. It doesn't describe a section of content.

Very often a home page might have like a banner image, and it's like, MTU rocks, right? You just want it to be big and bold. It's highlighted text, but doesn't describe a section of content. But if you made that an H2, that would be a failure because it doesn't actually function as a heading. Yes?

Did you say screen readers, if it's strong text, does it read that it's bolded?

Yeah, so in HTML, you can make text bold or italicized a few different ways. You can use B and I-- B for bold, I for italics. Those were intended to be kind of more stylistic.

Yeah, so does the screen reader read that? Does it say strong text?

Maybe, or you can use strong, or em. Strong tags-- I'm doing my geeky HTML gang signs here. So the strong tag or em tags for emphasis or strong emphasis will also make it visually appear bold or italicized, but those have more semantics, more meaning to them in that it's emphasized or strongly emphasized. Not all screen readers support those regardless of how you define them. Some will read it louder or with an inflection or like an angry robot voice to indicate that there's a difference there, but not all do. Some just read it normally. So go ahead and use those appropriately. If it's purely stylistic, generally we recommend B or I or CSS to style it. If it is emphasized text, use strong or em to emphasize that just with the understanding that the screen reader may not treat it different.

So you would want to be careful with important stuff. Like, these mushrooms will kill you. The ones in bold will kill you. And if it's not read, that could be lost. So probably think of other ways to differentiate really important content. Yes?

So strikethrough has had various levels of support in the past. Now, like the S element, just S tag in HTML is intended primarily to be stylistic. Usually, it's ignored by screen readers. In HTML5, there's now D-E-L. DEL for deletion, and INS for insertion. That would be more appropriate if you're doing true strike out and maybe even insertions of content that has been stricken. I don't know, it's been a while since I've done testing. Usually, the screen will provide some indication there that it's deleted or inserted text. Yeah, good.

Other questions on this? Yes?

So like a subheading below the main heading, right? Jared's blog about his cat, the best blog ever. Right? I don't have cats but if I did, I would blog about them, I'm sure. That is a tricky area.

OK, I'm trying not to get too much into the weeds. In HTML5, there was something called hgroup that was intended to provide a grouping of headings to support that, provide a semantic way to do that. It wasn't really supported. I think it has been dropped from HTML5 now.

I don't know. Really what you want to consider is is it part of the H1? If so, probably put it in there and just style it to be a subheading. If it's OK with it not being read as part of the heading, then I would omit it. What I wouldn't generally do is have an H1 then your subheading be H2 because usually that H2 doesn't describe the next section of content. It's just kind of either tangential to the H1 or it's part of the H1. So put it in or keep it out.

There's not a good way to handle that. HTML5 has actually defined that in the specs. Yeah, subheadings, we tried with hgroup and it didn't work very well. So any other questions on headings?

Really important, especially important for documents-- Word, PDF documents, PowerPoint supports headings as well. Really, really important. One of the top things you can do to increase the accessibility of your content.

Another one of the critical things is alternative text. So alternative text is an alternative to the image. If the user can't see or doesn't view the image for some reason, the alternative text would be presented instead. So it is read by screen readers in place of the image when it comes to the image. It is an alternative to images when images are disabled or not supported. So if you're on a really low bandwidth environment, some users with cognitive or learning disabilities may disable images because they're overwhelmed by graphical content. They learn best or read best just with plain text. They would see the alternative text in place.

Also, provides semantic meaning and description to the images. In other words, you should know what the content of an image is just by looking at the code without having to actually view the image. Alternative text is also accessed and used by search engines as content within the page, and most importantly, to define the content of the image itself. So if somebody does a Google image search, the alternative text is the primary content that's used to determine what that image is.

The term that's used in accessibility guidelines is equivalent alternative text. So what is equivalent? What does that mean? It doesn't mean exactly the same as. You know, if it meant exactly the same as, that would kind of suggest that we couldn't use images at all because the content of a graphic can't always be perfectly equivalent in a perfect way via text itself. So it means roughly the same as.

We suggest content and function. Those are the two keywords to consider-- content and function. What's the content of the image? If the image has a function, you can click on it to do something ensuring that that function is conveyed via alternative text.

But very rarely it'd be a description of the image, what the image looks like. A description of what the image looks like can be very different. So if you consider, say, a photo of me in a web page, what would probably be alternative text for a photo of me in a website? Probably my name. Again, the context may vary a little bit, but probably my name. That's what's being conveyed is that it's Jared Smith. That would probably be appropriate. That's the content of the image. Compare that to a description of the image of tall, dashing handsome, rugged, which may not be very accurate, right? But what the image looks like can be significantly different from the actual content of the image. We want to focus on content.

One question you can ask is if you couldn't use that picture, what text would you put in its place? It's a good way to help you determine good alternative text. If you couldn't use the image and you had put text in its place, what would that text be? Very often that will be appropriate alternative text for the image.

Maybe. Yeah, if my name's [INAUDIBLE]. Yeah, we're going to cover that. Yeah, sometimes we have images like that.

Now, first though, the alternative text can be presented in two ways. It can be in the ALT attribute. So image, I-M-G, ALT equals and within quotes. In our code, we would put that alternative text. That's what would be read by the screen reader or presented if the image isn't presented.

But alternative text can also be in the context or surroundings of the image itself. So the example on our staff page, if we have a photo of me and immediately after it we have text of Jared Smith, that text of Jared Smith conveys the content of the image. If we gave the image an ALT attribute value of Jared Smith, the screen reader would read Jared Smith, Jared Smith. That's redundant. It isn't really necessary.

So it's OK to have alternative text be in the context or surroundings of the image. So just keep that in mind. Another way to say this is alternative text doesn't have to be in the ALT attribute. A caption or nearby text is OK in some cases.

Was there a question? We're going to go through several scenarios so I may answer a lot of your questions as we go.

So do you have this presentation online?

Yeah, so I'm going to distribute this to Jeff.

OK, so in your picture where you have Norm, what's your ALT text for him?

Probably just Norm from Cheers or something like that would be probably sufficient. That's really the content that's conveyed. Yeah, but this alternative text is the most difficult thing I'm going to talk about. I'm going to get into some code stuff this afternoon. It's nothing. Alternative text is the most difficult thing I'm going to talk about, not because it's hard to implement. It's easy. Give it an ALT attribute or give it nearby text, but it's so subjective. You can look at one image, get 10 accessibility experts in a room and you'll get 11 alternative texts. It's so, so subjective, but there are just some general guidelines and frameworks that can help us determine good alternative text. But ultimately, you have to choose what you think is best. Yes?

Are you going to talk about ALT text for scientific figures? You said not to include a description but figures, really-- there's a lot of context within the visual that would take a lot of text to explain.

Yeah, so I'm going to cover some more complex images where you can't give it a brief succinct alternative text. Things like scientific figures, chemical compounds, things like that. I'll kind of cover that, but there's kind of different and distinct approaches to that. Maybe at lunch we could chat about some of those. But yeah, I'll talk about generally the concept of what do you do when you can't do this directly.

A couple of other just high-level guidelines for alternative text. It should be accurate and equivalent but also succinct. It should be short. Those are a little bit at odds with each other. You want to convey the content and function, but also do it efficiently.

The vast majority of images on the web, the alternative text will be one or two words. Occasionally, a short phrase or sentence, rarely a couple of sentences, almost never would it be any longer than that. Usually, if it's more than a couple of sentences, you need to think of other ways to maybe convey that content that I'll talk about. The vast majority of images, the alternative text will be very short.

Now sometimes people say, well, I'll just put that extra stuff in the ALT attribute. I'll just put it in there and if the user wants it, they'll get it. If not, they can skip it. It doesn't really work that way. If you add alternative text, the screen reader will read it. They don't really have a choice. You're kind of forcing it on the user. So we want to be efficient.

We want to be succinct in our alternative text but also be equivalent, and that's where the subjectivity really comes into play. It shouldn't be redundant. So again, the image of me with text below it of Jared Smith, don't give the image ALT attribute of Jared Smith. It would read it twice.

And images are usually identified by the screen reader. Most readers will read graphic and then read the alternative text, or read the alternative text and say graphic so you'd know that it's an image. So image of, or graphic of, in the alternative text usually is not appropriate. It would be a little redundant.

Now, if the nature of the image is important-- let's say it's a portrait of Jared Smith, which would be pretty awesome-- then sure. If it's important the user know it's a portrait or a schematic or

something like that, sure, put that in the alternative text if it's content. Now, on our staff page photo of Jared Smith, I don't know. It's not wrong, but users probably know if they come to an image on a staff page and it says Jared Smith, they probably know it's a photo and not a portrait, right? So photo of might be a little extra that isn't really necessary, but it's certainly not wrong if you were to add it.

OK, so let's go through a few scenarios. Here's our logo from our homepage. What do you think would be good alternative text for this image? Any thoughts?

OK, so I heard WebAIM logo. Any other thoughts?

OK, that's interesting. Is it the first thing they see on the page? Context is really everything when it comes to alternative text. Another way to say that is the same image may have different alternative text based on its context-- where it's placed in the page, what's around it. A third way to say the exact same thing is you can't always determine appropriate alternative text by viewing an image in isolation.

You know, sometimes we hear strategies like, we're going to create this repository of images with alternative text, and sometimes that doesn't work very well because you don't know how that image might be used in a particular context. It may change the alternative text. So yeah, that's a good question. I don't know. Maybe it matters, I don't know. Yes?

Right, so does it have a function? If it's in the top left of our homepage and the user can click on it, does that change the alternative text? You can see how this starts to get a little bit tricky.

This is what we have. We have WebAIM web accessibility in mind. That's the text that's conveyed via the image. We did add the tagline there, web accessibility in mind. Visually you can see that text. We felt that would be important for a screen reader user to also have, that they know WebAIM stands for web accessibility in mind. We didn't include the word logo. We could have. That would be perfectly fine.

Again, on our website, it is a link to our homepage in the top left. We didn't include something like homepage or logo with link to homepage for a couple reasons. One is even though that's just a little bit of extra text, it is a little bit on every single page. Also, it's a pretty well-known convention. We kind of know that if we come to a website and we hover our mouse over the logo and the cursor gives us the finger, as I hate to say, we know it's a link. we know it's a link to the homepage. That's a pretty well-known convention.

Screen reader users can probably understand the same thing. If one of the first images they come to is a link and it conveys the site name, they probably know it's a link to the homepage. Now, if you added that extra stuff, is it wrong? Is that a WCAG failure? No, but it's a little bit of extra stuff. So I don't know. Either way works. We chose not to do it on our site.

Will a screen reader tell them if it's a link?

It will, yes. So a screener reader for a linked image will usually read, link, graphic, and then read the alternative text. Yeah, that's a good question.

Now, we didn't include gray head silhouette with gear inside, right? We just figured that was probably a little more extraneous, a little more description of what the image looks like. We focused on the core content in that it's WebAIM.

Here's another scenario, another example. Here we have this image. Below the image is text of minivans, and both the image and the text are contained within a single link. So we looked at the markup, the HTML. If you don't know HTML, don't worry about this.

We have the link. Within the link, we have the image. And then we have text of minivans all within the link. Just throw out ideas-- what do you think would be a good ALT attribute value for that image? Any ideas? Any guesses? Just throw out ideas.

OK, yeah, that goes back to the context. It could impact this. I don't know, just regardless of the context, what do you think might be a good ALT text? Have I scared you? What's that? Blue minivan? Great, thank you. Any other ideas? I'm sorry?

View our minivans.

OK, good, other ideas?

No ALT text? Yeah, see how this gets tricky. Usually, what we'd recommend in this case is no ALT text, or what we call null ALT text-- N-U-L-L-- which is ALT equals quote quote.

Now, the context may change this. There might be cases where ALT text would be appropriate. But in this case, usually ALT equals quote quote for a few reasons. First of all, the text of minivans really conveys the function of that. Really what we think we're probably most concerned with is that this is a link that takes you to a minivans page. The text succinctly describes that.

So if you were to come to this, the screen reader would read, link minivans. ALT equals quote quote would cause the image to be ignored. ALT equals quote quote states one of two things. It means the image is decorative-- it does not convey useful content-- or the content of this image is conveyed somewhere nearby in the context or surroundings. So if we were to put the ALT text in there, it would just be redundant. So in this case, the text of minivans probably is sufficient. Probably go with ALT equals quote quote.

Now, if you went with something like blue minivans, maybe the color of the minivan is important, right? You've got blue, silver, gray minivans, so the color suddenly is now relevant. Then yeah, you would want to give that alternate text. In that case, it would read, link graphic blue minivans minivans. Maybe just the word blue might be sufficient in that case. So you can see how the context can really change this.

So ALT equals quote quote, in this case, works because the text nearby probably is sufficient. Now, there is an important rule to keep in mind, though, and that is that if the image is the only thing inside the link, it must have alternative text. Remember our two keywords-- content and function. If the image is the only thing inside of a link, it has a function. [INAUDIBLE] users can see it. They know that it'll link somewhere. You must add alternative text so the screen reader user is given that content or that function of the link. So anything that's functional-- image map hotspots, image buttons-- must have alternative text because they have a function.

So if these were separate links-- you have one link for the graphic, one link for the text-- you would have to give the image alternative text. In this case, it would be redundant. It reads something like, link graphic minivans minivans. It's redundant, but that's certainly better than the alternative. If you have a linked image that does not have alternative text, the screen reader may read the URL or the image file name, which might be helpful or it might be like one of those amazon.com URLs with 1,000 characters, which is worse than useless to have all of that gibberish read. So you want to be definitive. You want to make that declaration of that.

Questions to this point about alternative text? Another scenario here for you. Here we have this link-- download the employment application. At the end of the link, we have this icon. What do you think would be a good ALT attribute value for that icon? Any ideas there?

PDF? OK. Yeah, that's probably what I'd go with. It's just PDF. That's what's being conveyed is that visually we know that link takes us to a PDF file, so just a text of PDF within that image would probably be sufficient. ALT equals quote quote probably would not be appropriate in this case because visually we know what that it goes to a PDF file. Someone that's blind can't see the image, would lose that content. So it does convey content. So it would need alternative text. PDF is probably the most succinct, sufficient way to convey that.

With these types of icons, do make sure that the icons are inside the link. Sometimes we put them just outside the link. I mentioned that screen reader users most often navigate with the keyboard. Hitting the Tab key would navigate through links within the page and pull up a list of the links within a web page. If I hear just, download the employment application, as I'm hitting the Tab key, I lose that important information that visually we associate it with a link that it's a PDF file. So put that icon inside the link so it's read as part of the link text.

There is no accessibility requirement that you identify links to things like PDF files or Word documents or external pages, things like that. But if you have a visual indication saying icon that indicates that, it needs to have alternative text. Now, I think it's a good idea for usability for everyone to usually identify those. You've all clicked on a link and you see opening Acrobat Reader. You're like, oh, if only I would have known I would not have clicked the link, right? So I think for usability it's a good idea, but that really impacts everybody regardless of disability.

OK, so these kind of alternative texts work well for most images but sometimes it gets a little bit tricky. You know, what about these types of images that you see a lot, like on homepages or kind of these emotive-type images, do they need alternative text? What would that alternative text be?

You can't say that these images don't convey anything, right? Go to your marketing person and tell them this image doesn't convey anything. They'll be like, I spent four hours on iStock photo finding the perfect students under a tree, right? So it does convey something, but is what it conveys important? I mean, does it need alternative text?

This is tricky. It's subjective. You also need to consider the context in which that alternative text would be read, right? You're on your homepage, it's like, MTU strives for academic excellence and image students studying under a tree. Does it really work in that context, and is that really what's being conveyed? This is tricky.

We really hear two things from screen reader users regarding these types of images. One is if it conveys important content, make sure I get it. I don't want to be left out. The second one is I'm reading this at 300 words per minute listening to a robotic computer voice, I don't care about your moody fluffy feely stuff. Just give me the content and give it to me efficiently. And those are conflicting a little bit.

We generally tend more towards ALT equals quote quote for these types of images. If we go back to that question of if you couldn't use the image what text would you put in its place, you probably wouldn't put students studying under a tree. You might post something about the environment or mood or something like that of your university. And really, if that's important content, maybe you should put it in text so it's available to everyone, so we tend to err towards ALT equals quote quote.

This is a difficult area because if you ask screen reader users if they want ALT text for these types of images, they will tell you yes, which violates the fundamental rule of usability testing that if you ask the user if they want something, they will almost always tell you they do. And if you follow their guidance, you end up with things like Microsoft Word with 100,000 functions of which you use 2% because everybody wants something.

But when we actually do like true usability testing with these types of images, very often giving them especially more verbose descriptive alternative text tends to be extra noise. So there is no right or wrong here. You just have to make a good informed decision that supports good accessibility.

One thing with kind of these alternative text things, do consider your processes for alternative text. Who is the person that should best determine good alternative text for these types of images? Probably the person that designed or chose that image. Very often we get designs and then you throw it over cubicle wall to a developer that codes it up, and if there's not alternative text defined, they're like, it looks like this. And they don't really know the content or even the context of why that image was there. So think about that in your processes. That also means that the people that are authoring alternative text need to have some guidance on what alternative text is.

What do you do if you have images where a brief succinct alternative text would not be sufficient? Charts, graphs, things like that where maybe a sentence or two of alternative text really isn't sufficient to convey the content of that image. There are a couple of approaches. One

is to provide the alternative in context. So just add text in the context of that complex image that conveys the content.

We will very often do this on a lot of our research reports where we'll have a chart or a graph, then immediately after it we'll have a data table with the data that is presented via that chart or graph. That's really useful because some people just like the summary of the image, right? What are the percentages? What are the big pieces? Some people want the data, the numbers, the percents. We present that in a data table. Putting them both in context provides everybody the level of detail that they need.

In that case, we give the image a very succinct alternative text like, screen reader preferences for headings, right? Or it should be something like, pie chart of screen reader preferences for headings. Then, the data table-- sorry. Then the data table below provides the additional detail. That works really well. That's also good juicy indexable content, searchable, all of those other benefits of having that text in the page.

Sometimes, however, we have content that's so complex that a data table may not be sufficient or appropriate within the context of the page. In that case, you can provide a link to another page that contains that content in an accessible way. It can be a data table, text, or other types of content that would present the content of that complex image. And having that link to that page allows anybody with access to it. It's indexable. Search engines will follow that link. There's an association between the image and the page that has that long description.

There is in HTML the `longdesc` attribute. This was a way that you could reference a page that has a long description. Don't use it. It's had very limited support. Not supported on Mac screen readers at all. It's been dropped from HTML5. We don't recommend using `longdesc`. Just provide a link to that page instead.

And if you have a complex image, the main image should still have some alternative text, even if it has a data table or a long description page. The user should probably know that there is a chart here or graph or whatever and what the overall content of that chart or graph is. Questions about this? Yes?

Yeah, we don't indicate, followed by data table, just because the table comes right after. Just reading through, they would get to it. We also have good headings for all of those so it associates the chart and the data table all within a heading section, so probably not. If you were to add that, if you felt it important that they knew that the data table for that image was coming after, then that could be appropriate. Any other questions?

What about really complex images? Maps, things where really it's not even possible to provide a good alternative text, there still may be some things you can do. This is the London subway map. They provided alternative presentations of the maps, high contrast with different styles for the lines with low vision. It's readable, doesn't rely on color alone. They also have lists of all of the stops in order for each line just in text, so you can get it via text.

And probably most importantly, they have a trip planner, right? They pulled out the core content of that complex image. What's most useful? Well, the users want to get from here to here. They can put in that information and present it in an accessible version as well as the graphical map. And some things you can do that with really complex images. You can pull out the content or functionality that's most important for that.

Now, is that equivalent to the very, very complex image? No, it's not. It's not going to be. Is that a WCAG failure? I don't know. Probably not, because you couldn't provide that text in a way that would actually be meaningful and equivalent to that image, but you can provide the important stuff. Very often you can find a way with some creativity.

Considering something like Google Directions-- Google Directions started as an accessibility project that said, hey, well we have all this graphical data. There's underlying the information. Is there a way that we could provide it in a useful way in text? And then they found that that was useful for everybody. And now we tend to use directions, even the text directions in Google, sometimes more than the graphical map itself.

OK, that's it for images and alternative text. Questions about that?

OK, all right, a few quick odds and ends. I want to talk real briefly about photosensitive epilepsy. You can, with bright strobing flashing content, cause users to have a seizure. One of the famous cases was this Pokemon episode that aired in Japan had a strobing flashing sequence. And in just a few seconds of content there were almost 700 kids that had seizures and went by ambulance to the hospital because they had seizures, just in Japan.

So this is something that can be very impactful. This isn't a matter of access. You can physically harm or kill people by this. I don't know if you saw the new Incredibles movie actually apparently has a sequence. A lot of the theaters now-- I don't know if all of them, they're supposed to have kind of a warning about the flashing sequence because some users with photosensitive epilepsy had seizures within the movie. So this is so, so impactful.

Really, it has to flash more than three times per second. It has to be sufficiently big, bright, and strobing. The color red is more likely to cause a seizure. We just boil it down to our annoying rule. If it's big, bright, strobing more than three times per second, it can have the possibility of causing a seizure. It is most common in video content. This probably isn't going to be an issue on your homepage unless you're planning, like, a new disco campaign or something. Probably not going to be an issue. But for video, especially full screen HD-quality video, be very mindful of this.

Yeah, usually like blink and marquee usually aren't sufficiently fast or large enough to cause that. Another consideration is users with multiple disabilities. You know, a little blinking banner ad may not meet the size requirements, but what if I also have low vision? Now that banner ad fills my screen. If I have low vision and photosensitive epilepsy, that could be a concern. WCAG doesn't really address that, but just be careful with this.

For users with motor disabilities, a lot of different types of motor disabilities that can impact the user's ability to interact with a computer using a mouse, using the touchpad, touchscreen, things like that. Usually, if anything can be accessible via touch or mouse, it should be accessible to keyboard users. Also, consider lack of fine motor control. Small things can be difficult to click on, moving elements can be difficult. We have a colleague who has cerebral palsy. He has tremors in his hands, but he has better control with his feet so he uses a large trackball with two big buttons on the floor and uses his feet to navigate with the computer. But it's a little hard using that big trackball with his feet to be able to accurately click on small things.

So making sure that there's sufficient size and sufficient spacing between clickable elements. Sometimes you might click on the wrong thing, which we've all done on the phone-- please, let me tap the right thing-- and you know, you click on the wrong thing. Really helpful for usability, generally. And considering just repetition and fatigue, right? 600 navigation items for our friend with a stick in his mouth is not going to be very friendly, though technically compliant because it's keyboard accessible.

You want to make sure you provide meaningful link text. The link text will be read by the screen reader. This can also impact voice control users. I can use my voice and say, click, and then read the link text. If I have multiple Click Here links on a page, how does it know which one I want to activate? That can be problematic.

So there's kind of a sequence or hierarchy here. Interestingly, all of these are WCAG compliant, even the very ambiguous Click Here. Because WCAG says the link has to make sense by itself or in its context unless it's ambiguous to everyone. Because if it's ambiguous to everyone, you're not discriminating.

[LAUGHTER]

And that's important because there are a lot of things in WCAG that deal only with disability accessibility. If there are things that are just unusable and also inaccessible, they may not be covered by WCAG at all because they're unusable to everybody. So yeah, that's just the way that it works.

But we want good-- just the word login. Click here is extraneous, we don't need it. You know, things like read more, continue, sometimes we see a lot of those, even multiples of those links on the same page. Just consider the impact.

Now, you can have a heading, and then text, then read more, heading text, read more. That's allowed in WCAG 2.0, but there's still overhead for everyone. When I see read more, I don't know what that is unless I visually explore the context. For a screen reader user, they can't just visually explore context to figure out what it is. They need to read, kind of navigate before or after that link to figure out what it's about. So there's a little overhead there. Just be cautious of that. As much as we can make our links distinct and descriptive is going to provide a better experience, and it's going to be better for search engines and things like that, as well.

This also applies to images. You know, if you have linked images, make sure the alternative text matches. You know, a next image here with ALT of continue, just might be difficult. An important note here-- most screen reader users have some vision. Most do. So I may have significant low vision. Maybe I even use a screen reader in conjunction with screen magnification or high contrast. So I can see maybe some content, but I use the audio to supplement, or vice versa.

So I may actually be seeing content on the page. If I fear something that's totally different, that can be really confusing. Imagine being on with tech support and they're like, oh yeah, just click the next link. So you're trying to find the next link in your screen reader and it's not there because it's identified continue. So just make sure that that alternative text aligns. This is something in WCAG 2.1 that has been addressed. It basically says if you have visual text that describes something, that text has to be in the thing that's read by the screen reader.

I mentioned ensuring adequate spacing between clickable elements for users that don't have fine motor control, or maybe you're on a small screen, making sure that clickable things look clickable. You know, when you look at something, you know that you can activate it. Also being careful that things that aren't functional don't look functional. Being careful with things like underline if it's not a link. If it's appropriate, like a bibliography, sure. But be careful with the use of those things that may convey functionality that actually isn't accurate.

There's a whole lot more for motor disabilities. There are a few other principles that we'll cover this afternoon for efficiency and things like that for navigation. But are there any questions about any of these points?

All right, I want to talk about our last major category for accessibility, and that's users with cognitive and learning disabilities. This is the largest disability group by far. Generally considered to be larger than all of the others that I've talked about all put together. At Higher Ed institutions, again, I mentioned that users need to register to receive accommodations if they have a disability. Many campuses find that the number of registered students can be upwards of 20%, the vast majority of those having cognitive or learning disabilities.

So very common, but also very, very diverse. There are so many different types of cognitive and learning disabilities, and the needs of those users are equally varied and can even conflict a little bit. And what might provide a benefit for one user, say a text-heavy content, graphics and images and design and the layout are distracting, may be beneficial for one user but difficult for another. Some other users may learn best through graphical content and visual styling that helps highlight the important stuff and can really struggle with just a wall of text.

So how do you best meet the needs of both users in one presentation? It can be really difficult. Because of these difficulties, the accessibility guidelines don't do a whole lot here. They don't define a lot when it comes to cognitive and learning disabilities. They're kind of generic. Most of the things are at the AAA level.

So I'm going to really focus on just kind of generic recommendations, things that are generally going to be helpful for everyone. One is being careful with movement or other distractions. A

little animating banner ad might be mildly annoying to you but it can render the page content totally inaccessible with someone with very high levels of distractibility. I'm that way. Movement, people coming in and bringing lunch, those things are really-- I mean, I'm just really easily distracted by those types of things. When I come to a page, if there's a video that automatically plays, background video, I'm done. I scroll it out of view if I can. If now, it's not worth the cognitive effort for me almost always to try to engage in content where I'm continually distracted away from it. And there are many people that. So be cautious with those.

Using good organization-- headings, lists, things like that-- to help structure your content. Using good design to help the user focus on the important stuff. Color, white space, fonts, images, things like that to help user focus on the important stuff is good usability, but especially helpful for users with certain types of cognitive and learning disabilities.

Simplifying the content. In WCAG 2.0 at AAA, there is a requirement that content be readable to users with a lower secondary reading level. Great idea, right? You generally would want your content to be readable by someone with kind of a lower high school reading level. Would that be appropriate for your college chemistry class? Probably not. In fact, if you tried to write it to that reading level, it would probably be less accessible for everyone. But you want to make that content as simple as is appropriate to the content and to the audience. Good usability for everyone.

A couple of other considerations, just being really careful with small text. We conducted some research at WebAIM with users with cognitive and learning disabilities to try to determine the types of things that were most impactful to them. We found that small text was a big one. Sometimes when they saw small text, we saw these students just kind almost disengage. It was like, oh, this is going to be hard. It's small. They knew that effort to have to focus and try to read that small text.

Now, WCAG does not have any text size guidelines. One pixel text, WCAG compliant, inaccessible to everyone. I don't know why it doesn't. Certainly, users with low vision are more impacted by small text, but it does not have any text size guidelines. Now, I'm not saying you have to have big text, just not really small text, especially with large blocks of text.

You want to be considerate of your line lengths. So that's the number of characters per line. If you have a lot of characters per line, the user will read across the line then it takes some effort to kind of scan back to the beginning of the next line. If you're not careful, you might skip a line or end up on the same line. So if it's too long, there's a lot of effort there. If your line lengths are too short, you spend a lot of time scanning to the beginning of the next line. So there's overhead there. So it's kind of a happy medium area in the middle where line lengths are much more optimized for readability.

This is also something that we tested in the research that we did. We had three samples of text. We accounted for character count, word count, reading level, all of those types of things, and the only variability was the line length. So we had short, kind of medium, and long line lengths. One thing we did is we timed these students with cognitive and learning disabilities reading the text.

As we timed, the medium line length one was the fastest, then the short line length, and then the long line lengths took the longest.

When we were done, we'd also ask them some questions. One thing we asked is, you know, which of these three seem more difficult? Almost universally, they said the one with the short line lengths, which was interesting because they actually read those faster than the ones with the long line lengths. When we asked them why, they said because it was longer. It wasn't longer, it just looked longer. It kind of wrapped further down the page. They actually didn't even have to scroll to read these, but they thought it was longer.

And that's something that we saw consistently in our research is that the perception that something might be difficult seemed to make it more difficult, not necessarily because it was more difficult, but because they thought it would be, which is kind of interesting. I think we experience this type of thing.

I buy a lot of plane tickets and when I go to buy a plane ticket, I have to be in a certain cognitive set and I need a certain amount of time because it's an intensive process, they design it to be difficult, they distract me away, they check that insurance check box that I don't want. I've got to make sure I get it right. I have to enter all of the information exactly. I want to make sure I get to the right place at the right time, and I'm spending money. It's really intensive and they design the process to be inherently difficult. So when I go to buy a plane ticket, I'm like, oh, OK, here we go. I know it's presented to be difficult and therefore it becomes difficult.

Compare that to maybe like an amazon.com checkout flow, which they made probably too easy because the UPS guy's at my door like every day. I mean, it's not all that much different, right? I'm still spending money, but they broke it into these steps and processes that I'm only presented what I really need in a stepwise manner that makes it much easier. So that idea of just designing things to look simple, to appear more easy, can make them more easy, especially for users with cognitive and learning disabilities.

And then also being consistent in your design, in your presentation. This is especially hard in college settings. Sometimes if a user comes to your university homepage and they get one design, and they click on a college, they get a different design, in a department, they get a different design, in a program, they get a different design. Every time you come to no new homepage, you have to orient. You always [INAUDIBLE] OK, navigation here. Search, OK, I might use that later. Let's look for the big headings. Old banner ads, I will never look at those again. What can I have to orient?

And there's this whole process that we go through with each new design or site. And if we have multiples of those within one site, there's overhead to that. WCAG doesn't require that, but it's really impactful for users. And it sounds like you have some themes and styles, things like that, that hopefully help you to build in some of that consistency.

WCAG does have some things that talk about consistent identification and presentation of elements. You know, if you have one design and button values change from one page to another,

there are things in WCAG that address that. But other than that, just good consistency is really important.

OK, as a gift to all of you for coming today, I'm going to give you the secret to everlasting happiness. So here you go. Oh, sorry.

[LAUGHTER]

You'll have to go back to the slides to get it. Sometimes we introduce time constraints for web content that can be frustrating that sometimes are not even necessary that can really result in frustration, especially for users that need more time. That's the real power of the web, especially in education, is that students with disabilities can access content where they need it using the technologies that they need and they can take just as long as they need to engage it in the environment that's best for them. That's what's so awesome about the web and online learning.

Yes, sometimes we tend to kind of pull the rug out from under them by introducing constraints that negate some of those benefits, especially when it comes to time, that may be necessary. So just consider that if you have session timeouts, even timing for tests, things like that. Sure, when it comes to assessment, timing may be necessary. But maybe students with disabilities, there would be accommodations that would allow them to take longer instead of just suddenly being kicked out of the process. For security, maybe you have a 20-minute session timeout. After 15 minutes, you receive a prompt that says you've been inactive for 15 minutes. You're going to be logged out in five minutes. Click Continue to continue your session, Logout to logout now.

And we've worked with clients that have high security concerns-- banks, stockbrokers, the CIA-- and they've been able to implement that with good success and actually found that it has an increased security as opposed to the opposite, and made things much more usable. As opposed to airlines, where if I step away for a minute and come back, I've got to start that process all over again. So yeah, keep that in mind.

There is in WCAG something that talks about kind of automatically scrolling moving content that can be distracting, that the user must have a mechanism to pause, stop, or hide that. The biggest culprit for that is carousels, especially like homepages where content automatically advances, can be really, really distracting for users. Studies have consistently shown they're not very usable. They're not very effective at what they do. Engagement is usually less than 1% for anything past the first frame, yet it takes very often the prime real estate on the homepages and would be a WCAG violation if it automatically advances if there's not a mechanism to pause or stop that.

All right, if you consider your typical developers, this is your typical developer team, right? Their corner office and their white crisp linens, and they're perpetually 23. Their Macbook with the Apple logo Photoshopped out of it. So you know, most of us that do web stuff are maybe a little more geeky. I can say that, OK? I'm talking about me here. We're very used to using the web. We've learned the strategies for using the web. I have a web browser open all day long. The vast majority of the work that I do happens within the web. I carry browsers in my trousers, right? They're always accessible to me.

I learned these strategies for search, ignoring banner ads, getting through content very quickly. Not everybody can develop those strategies. Not everybody has developed those or can. It's important that we step out of our own experience.

I like to consider my grandmother. She's almost 90. She's 88. She's on Facebook. She's pretty amazing. She's online, but certainly not as adept at using the web as I am. What would her approach be in engaging with something that I have built? Very often, our testing for web content involves you building something, you go to the cubicle next door and say, does that make sense? Does that work? Yeah, makes sense to me. Well, they are you, essentially, in a different cubicle. They probably have the same level of understanding of the web as you. So it's just important that we consider other users, especially users with cognitive and learning disabilities.

Any time we have to think, anytime we have to remember, anytime we experience frustration, just magnify that by 1,000. That maybe that type of experience of users with various types of cognitive and learning disabilities.

OK, so that was our final category. We covered visual disabilities, auditory disabilities, motor disabilities, photosensitive epilepsy, and cognitive learning disabilities. So if we think about accessibility, think of those four principles-- perceivable, operable, understandable, and robust. We can use the details of the guidelines to help inform that and think about the needs of users with various types of disabilities and really focus on that end user experience, we can better create content that is going to be highly accessible to those users. Are there any questions that you have?

So we had students, basically middle to high school. It was grant funded to look at that particular audience. So was that age of students, just looking in the types of things-- we have some things on our website that talk about the results there. Yes?

Very good, thank you. You know, in some ways, disability is one of the things that almost everybody will experience. Statistically, almost all of us will experience disability at some point in our lives. Certainly with aging processes, we tend to experience that more, but it's pretty unifying. I sometimes use the term temporarily able-bodied. We're all kind of temporarily not disabled.

And that's one thing that motivates me to do the work that I do every day is that by making the web better today, I'm kind of making it better for my future self. Thank you. Any other questions-- knowing that you raising your hands is the only thing keeping everyone from lunch?

[LAUGHTER]

The web really is just the great equalizer. You know, just on that topic, a great equalizer for people with disabilities. The web is a great convenience for us. It's awesome that we can go to the mall, and we can go to the bank, and we can go to a traditional classroom, but we can do those things online. For people with disabilities, the web sometimes is their only possibility for

engaging in those types of things. So you all have great potential to go and make awesome things highly accessible.