# Don’t Prioritize Color Over Content Transcript

Hello, and thank you very much for attending my talk today, which is called Don’t Prioritize Color Over Content. My name is Adam Saucier, and I’m a Senior Accessibility Engineer at TPGi.

* I started in digital accessibility in 2013 when I was working as a web developer at

an advertising agency building websites for a large health insurance company

* I then worked at a community college, managing the website and helping faculty members create accessible course content
* I have a color vision deficiency, which does not have a cure – the colorblind glasses do not work and are similar to accessibility overlays because they make the issue worse
* I remember being unofficially diagnosed with a color vision deficiency – or colorblindness - by my sister when we were both young, when she would make fun of me for picking the wrong color crayon out of the box. This was followed by an official diagnosis some years later. My optometrist said, “Yes, you are very color blind.”
* There are approximately 350 million color blind people in the world, making the use of color a more impactful issue than some might think.
* The three types of color vision deficiencies are red-green – the most common, where certain shades of green look more red or you can’t tell red and green apart at all – blue-yellow – where it’s difficult or impossible to tell blue and green, purple and red, and yellow and pink apart – and complete color deficiency, where you can’t see any colors at all. This one is very rare.

This is an example of the color plate test, a very common method of testing when you go to an optometrist. It's made up of a large circle made up of smaller circles that are different colors. If you clearly see a number 2 in the jumble of colors, you might not be color blind. If you do not see a number, then you might be colorblind. If you are curious though, you should go to your eye doctor and have a full test done.

Here’s the classic angry girlfriend meme. The girl walking toward the camera has the text "pretty colors" overlaid on her. The boyfriend who looks back longingly at her has the text "many designers" and his upset girlfriend has the text "content". The point is that many designers think about how colors make something look nice without considering the effect they might have on the content itself.

The WCAG Success Criterion 1.4.1 Use of Color is a Level A criterion and affects not only those who are color blind but also those with low vision who have a difficult time distinguishing certain visual elements. It's worth noting that this criterion did not change from WCAG 2.1 to 2.2. It is still the same level.

Before I go any further, I just wanted to warn you that I am an untrustworthy source of information, according to Sara Bareilles and her Broadway show The Waitress. One of the stars in the show sings “He could be colorblind! How untrustworthy is that?” when referring to someone she might go on a date with. So take everything I say here with a grain of salt.

I’m just joking, obviously. Sara Bareilles is an amazing singer and songwriter, and The Waitress is a great musical. I’ll just have to ask her what she means by that line if I ever come across her in real life.

The next few slides will show some examples of color being used as the only method of showing information. A simple example that will be shown in the next slide is a link that is distinguished from its adjacent text with an underline, which is the default HTML style. If this underline is removed and only color is used, it can easily become a failure of the success criterion and cause a serious issue for many users.

Here are a couple paragraphs with lorem ipsum text. The first paragraph contains a link that uses only color but still technically passes criterion 1.4.1 because the contrast ratio between the link text and non-link text is greater than 3:1. But just because you can do something doesn’t mean you should. The link in the second paragraph has the same color text along with an underline, which makes the difference much clearer. A WCAG Technique suggests to at least add an underline to a link when it is hovered over, if you choose to use only color to distinguish it.

Form field error validation is another classic example of using color as the only way to present information. Fortunately, its solution is incredibly straightforward. As you’ll hear quite a bit throughout this presentation, using text along with or instead of color is often the best solution to making sure your design is accessible to those with low vision or color vision deficiency. The first example in this slide fails success criterion

1.4.1 because a global error message appears at the top of the form that says “Please fix the errors below. Fields in error have a red border.” Other than the field being empty, its dark red border is the only difference between the field that has an error and the field that does not. In the second example, which passes the success criterion, the field in error also has a text message below it that says “Please enter your first name.”

This example shows a star rating system on a shopping website that you might be familiar with. It shows five possible stars, 3 and half of which are filled with a yellow color and the remaining 1 and a half are empty. The contrast ratio between the fill color and its adjacent empty color are less than 3:1, so something more than just color needs to be used here. The only information presented in text is the total number of ratings for this product, 32. Nothing is telling users in text how many stars the product has.

Many possible solutions to this problem are shown here. The first example shows the same group of five stars, but the color of the filled stars has been darkened and therefore has more contrast with the unfilled section, making it easier to tell which stars are filled and which are empty. More importantly, text has been added below the stars that provides the number of filled stars – 3.5. The second example is taken straight from Google Reviews and has not been changed since the number of filled stars – 4.8 – is provided in text right before the stars themselves. The third and fourth examples from a section of the WCAG Understanding document of a different criterion – 1.4.11 Non-text contrast – where the relationship between these two criterions is discussed. Both pass the Use of Color criterion because the black fill has very strong strong contrast, and the border of the filled stars is thicker than the non- filled stars in the final example.

Now I’ll move to my personal favorite way to test the use of color in a design – making the page grayscale and checking if the content can still be understood visually. While actual full colorblindness, or monochromacy, is incredibly rare, you don’t need to have this condition to be affected by an over-reliance on colors. For example, my wife applies a color filter to her phone’s display to make everything monochrome, which she says makes her less likely to get distracted by her phone during the work day. This means any content that relies on only color to make sense will be lost on her.

This is a simple bar graph created in Microsoft Excel, with five bars that are all different colors and do not have a text label below each bar. To the right of these bars is a legend that only refers to the color of each bar in order to associate their meaning. I don’t think it’s too unreasonable to say that this is bad design, but is also very common.

This is the same bar graph as before, but it’s now grayscale, where all bars and their associated legend elements are just shades of gray. While it can be argued that since the order of each bar from left to right matches the order of each item in the legend from top to bottom, the bars can be understood without using color. But that is not guaranteed to always be the case, and it also adds a lot of unnecessary cognitive load that a user should not need to deal with.

This is the same exact bar graph from the previous slides but instead of only being distinguishable by color, the bars and legend now use distinct patterns. While the patterns might be difficult to see on this slide, they consist of dots, dashes, horizontal and diagonal lines within each bar. Their color doesn’t matter at all.

And here’s the same bar graph with patterns, but in grayscale. Ideally the legend icons would be larger to more easily see the pattern inside them, but the point is that the bars can now be distinguished based on only their patterns whether they are filled with colors or shades of gray. Nice.

Line graphs are another common place to see only color used in a legend to differentiate each data point, and that can solved in a similar way. This example shows two possible solutions combined into one graph – text labels that point at their respective lines, and each line composed of a different pattern.

This feels like a perfect time to show the meme of a young girl raising her shoulders inquisitively and asking "Why not both?" But I think I've already gone over the meme limit.

Speaking of line graphs, this is a good example and possibly a cruel joke. It’s from the Wikipedia page dedicated to congenital red-green colorblindness. This is a line graph on that page that shows the luminous efficiency function, which I’ll try to quickly explain. Since color blindness effects the eye’s sensitivity as a function of a wavelength, like the one shown here, it shifts the response time of a person’s eye to make it more or less sensitive to the light from certain wavelengths. People who are color blind are less sensitive to lights at certain parts of this wavelength and therefore have a harder time seeing the colors at these wavelengths correctly. If that doesn’t make much sense, I’m sorry. Blame Wikipedia. The reason it might be a cruel joke is because the lines in the graph use only color – red and green.

This is the same Wikipedia line graph as of a couple months ago, when it was fixed by a color blind person to give the lines different patterns – dotted, dashed and solid. If only that person chose a better color for the green dashed line, which has extremely low contrast with its adjacent white color.

The previous line graph showing the text labels pointing directly at each line is a good example of data being easier to parse when text is used instead of colors or patterns. Oftentimes the simplest solution is the best, and using text labels is as simple as it gets. Even when patterns can make charts and graphs perceivable for more people, they still require the user to look back and forth between the chart and legend and try to remember what pattern and data point are associated. This adds to cognitive load, and while sometimes necessary if the text labels are too long or complex to fit within the chart, it’s best to consider the text label first and use it if possible.

While reading an article recently about the environmental impact of downloaded versus physical versus cloud-based media – a very interesting topic – I came across a few different types of graphs and charts. The next few slides will go over these real- world examples of the use of color on the web. Keep in mind that these also have issues with text contrast and text alternatives, but try to focus on just how colors are used to convey information.

This was an interesting one. The caption directly below this graphic refers to multiple things – color and position, referring to elements that are “red” on the “left” or ”blue” and “right”. They are also labelled in text as “Upstream activities” and “Downstream activities”, ultimately making the reference to colors unnecessary. This would pass the criterion.

But the circles added to the image by the author are more of a concern. Right below the graphic and its caption, the author states, “Last time we looked at all the parts of game production circled in red. This time we’re looking at the part circled in blue”.

They do not reference these elements in any other way, such as using the text label for each of the circled elements. Since all the reader has to go by here is the color used for each circle, this would ultimately fail the criterion.

This next example is some type of bar graph/pie chart hybrid, where there is an x axis with “Number of hours playing game” and “Game file size in gigabytes” on the y axis. Three different sections fill in the entire graph area, each with their own background color – Cloud gaming, disc gaming and Download gaming. Since each of these sections also has a text label within it, it passes the use of color criterion. The text contrast is insufficient though, so that would need to be improved.

This next example is a fairly standard bar graph with 10 different groups of vertical bars along the x-axis. Each group has a text label below it, but the bars within each group – of which there are six - are only distinguished with color based on a legend. Some of the colors are extremely similar. Since the bars are very close together and there is not much space for a text label for each, a distinct pattern for each bar would be sufficient here.

Providing an accessible alternative is often a good way to provide content for users where a certain format is required – such as a complex chart or graph – but is overly difficult to make fully accessible. In the following example from Wikipedia, the content is provided in two different ways. One is very inaccessible since it is an image with embedded text and uses only color, but most of the same information is also provided in an unordered list.

This is a graph contained in an embedded image from Wikipedia that shows the lineup of a band from 1999 to 2023. The y-axis has the name of each band member and the x-axis contains the years that the band has been active. A horizontal bar for each band member shows how long they were in the band for, and the instrument they played is shown by the color of the bar and referenced in a legend below the graph. The color issue could be easily solved by adding the band member’s instrument next to their name on the y-axis, but since the same information is already provided in a bulleted list, this is not necessary.

Here is the unordered list that contains the same exact information as the graph, showing the members separated by current and former, along with their instrument and years active in the band. The information about the number of EPs and studio albums is also provided in a data table in the “Discography” section of the page. The next slide will show an edited version of the band member graph that is more accessible for color blind users and has all the information in one place, because why not?

Here is the same graph showing the members of the band throughout the years, but every horizontal bar is the same color and the instruments are added as text next to each member’s name on the y-axis. The type of album released in certain years – EP or studio album – is also labeled with text pointing to each vertical line. This was also referenced using only color in the original graph. The best of both worlds are provided here – a simple unordered list and table that contains all the information, and a graph with the same information that does not rely on colors at all.

The next few slides will show a few more classic examples of color being used incorrectly on the web. This is an interactive seating chart for a theater. All seats in the theater are represented by circles. Any circles filled with black are available, and the gray circles are unavailable. There are also two seats somewhere in the theater that have been selected for purchase. Can you find them?

If you could spot those seats, congratulations. You have the vision of Superman. For me, anyway, it was impossible to tell which seats had been selected. This slide shows the same exact seat selector, but the selected ones are contained within a blue rectangle to more clearly point them out. This quite clearly fails the use of color criterion and is just difficult for most people to use.

This is a much more accessible way to show a seating chart. The only thing missing is a legend that shows the meaning of each type of pattern - filled, empty, or dashed lines. There are different colors being used, but they do not mean much since each seating section is also labeled with text. This is taken from an article called Accessibility Theater by a TPGi colleague, Doug Abrams.

This was an interesting example sent by my wife. It’s in a travel booking app when a user is scheduling their stay. Only color is being used to distinguish the different price ranges of certain dates – cheaper, average, or higher than usual. This is great information to know when trying to decide when to schedule a trip, but unfortunately the only things providing this information are very similar background colors. Using patterns within these dates might be a challenge since they might conflict with the number. In this case, the pattern would need to be very simple and the number would need to maintain strong contrast against it.

Next up, I’ll go through a few more examples that I’ve come across either in the real world or on places like Reddit. I want to point out just how common it is to come across designs where color is used as the one and only way to understand information. It goes far beyond just graphs, charts and form fields, where it’s even found out in the physical world.

The first example found on Reddit is a map of China’s many counties, separated with different colors that represent the predominant religion in each county. Not only is color the only thing being used here, but some of the colors are extremely similar and might be hard to tell apart even for people with no color vision deficiency. Since some of these counties are incredibly small, would using different patterns work here? I don’t think so. I would recommend adding text directly below the image with a heading for each religion followed by an unordered list containing the name of each county where that religion is predominant. It would be very long, so each list could be contained in a collapsible component if vertical space is a concern.

Here’s a screen from a toddler lesson on YouTube called Ms. Rachel with a Christmas tree that has four ornaments of different colors. The question for the student is “Which ornament is purple?” Now, I’m not a parent or a teacher so I could be off base here, but it seems inconsiderate to ask this question. Kids can be color blind too, after all. Why not ask about the color and the symbol on the ornament? Each ornament already has a unique graphic on it. Maybe “Which ornament is purple and has a snowflake with six points?” Does that give away the answer too easily or make it too difficult? I’m not sure, but if the child already has difficulty telling purple apart from blue, the original question is flawed anyway.

Many of the comments on this thread mention that color blind people just assume that the one with the darker hue is purple when they need to compare it to a similar blue color. I can tell from experience that this doesn’t always work, but it’s an interesting approach.

Here’s an example from the real world, on a real piece of paper. It’s a little word puzzle called ”Wave Words” where it asks the user “What are these colorful fish trying to spell out? Use the key below to reveal the answer!” Two rows of fish with the same exact shape but different colors each make up a letter in the phrase, which has two words. Below that is a key with many different colored fish and the letter they represent. The problem here is that all the fish are exactly the same size and shape, meaning only their color can be used to tell them apart. The first solution I can think of is to use some different sea creatures with different shapes – whale, dolphin, octopus, jellyfish, crab – there are so many options!

This is a companion planting chart, where 30 plants are shown with their relationships to other plants – whether they grow well when planted next to each other, if their combination would help with bug control, if they shouldn’t be planted anywhere near one another, and so on. There are many ways to represent this information, but this designer chose to use a key where colors represent their relationship with the main plant. For example, in the Broccoli section, the text for “tomatoes” is red, which means broccoli and tomatoes should not be planted together. For gardeners, this is vital information that could lead to bad results in the food they grow for themselves and their families. Relying on just different colored text here can potentially have a very real impact. Don’t even get me started on screen reader interactivity here – unless a lot of visually hidden content is attached to the name of every plant in order to tell assistive technology users how they relate to other plants, this chart would be completely useless to these users.

Here is a table showing very similar information with the previous one, but this time it’s presented in a table with Plant, Companion, Enemy, and Additional Info column headers. Colors are not relied upon at all here, and the different associations between the plants can be seen just from the table’s structure. Screen reader users can also understand the information from this table, assuming it’s marked up correctly. This is in a PDF, so odds are likely that it is not marked up with the correct tags. But that’s a different topic for a different presentation.

Moving into a slightly different topic for a little while, this slide shows two images of the board game Ticket to Ride. Colors are certainly a factor here, since players need to claim certain routes on the board based on their color. But each route is also distinguished by a distinct shape. Each card has a shape in all four corners that corresponds to each available route on the board. This gives players an option to use color or shape to claim their transit routes and play the game.

This next example is found on the web, but it relates more to the real world. Public transportation is used by millions, so you would think that more focus would be put on making sure their maps are accessible for as many riders as possible. In some cases, this is true. But in the case of London’s tube, shown in the next slide, that isn’t the case.

Color blind riders of the London tube cannot easily tell the difference between the colors in the legend, so they will find it very difficult to know which line is which on the map. That’s a big problem. While those who ride it every day will mostly likely adjust to it and remember which lines go where, it is still a problem for visitors and many other color blind people.

This is a small section of a fully black and white version of the London tube map provided by Transport for London (TFL). It has a legend similar to the colored version but only different patterns are used. While this is still a complex map with many overlapping lines and patterns, it is definitely an improvement for colorblind travelers and does not rely on color at all.

In contrast to the London Underground map, the New York City Subway map uses numbers, letters, shapes, and even lines with different patterns depending on whether it’s a train, bus, or commuter rail. It can still be overwhelming for those of us who don’t live in NYC and use it every day, but that’s more of a general issue – you can be just as confused by this gigantic map and its legend whether you’re color blind or not. Isn’t that fun?

For the final few slides, I will be looking at a couple very popular puzzle video games that rely on color. One of them is an arcade and console game from 1996 and the other is a mobile game from 2019. You can probably guess which of the two has options that make it more playable for those who cannot distinguish colors.

When I first tried playing Puzzle Fighter 2 as a kid - a puzzle game where you need to clear the board by aligning gems of the same color to make them disappear - the gems just weren’t disappearing even though I thought I was matching them up correctly. I just took it as a sign that the game was broken and walked away, frustrated.

After trying it again as an adult, I asked my wife if I was placing the correct yellow pieces next to each other. She said some were yellow and some were bright green.

Here is a zoomed in example of the gems from Puzzle Fighter 2. All four different colored square gems are shown here. Other than the one circular gem, you can see how these gems look exactly the same aside from their different colors. To my eyes, there are only three distinct colors here – red, yellow and blue. While the console version of this game has options for adjusting the difficulty of the AI and how quickly the gems fall into the play area, there are no options to make the gems easier to tell apart. Making them into differently shaped gems would be one helpful option.

On the other hand, this newer game called Grindstone – another puzzle game where players need to clear the board by matching items of the same color – has a lot of accessibility baked into its design.

* Each monster has a very distinct design with different shapes and colors
* When a certain type of monster is first chosen, the rest of the board becomes much darker, only keeping monsters of that same type really noticeable. This not only helps colorblind players, but it's a nice option to make the game a little bit easier to play in general.

Because I can’t mention video games without bringing up the ultimate puzzle game to ever to exist, here is the original version of Tetris, designed and programmed in the USSR in 1985 by Alexey Pajitnov. He was using an Electronika 60 computer with a monochrome display, so his design needed to work with visual means other than colors. What he ended up designing was Tetris, where various shapes called tetrominos need to fit together to clear lines, while more randomly fell from the top of the screen at increasing speeds. I’m assuming most people here have at least heard of Tetris by now. The tetromino blocks in the original version are all made up of simple pairs of square brackets. Over the years colors have been added to these blocks and the game has been modernized in some ways, but never has color been a major part of the game which has sold 520 million copies.

So, to wrap things up, I’d like to go over just a few things regarding the use of color in design.

* Of course colors should be used in a design. They just need to be considered and not be the only thing that conveys content.
* When designing your next project, consider how different shapes or patterns can be used along with color.
* When creating content, remember not to use instructions like “click the green

link.”

* For many more examples, refer to the article on the TPGi blog titled “Well Color Us Surprised—This SC Can Be a Tricky Customer” from the great Ian Lloyd

Thank you again for joining me, and I hope you have a great time at the last day of the conference. If anyone has any questions I’d be happy to answer them.