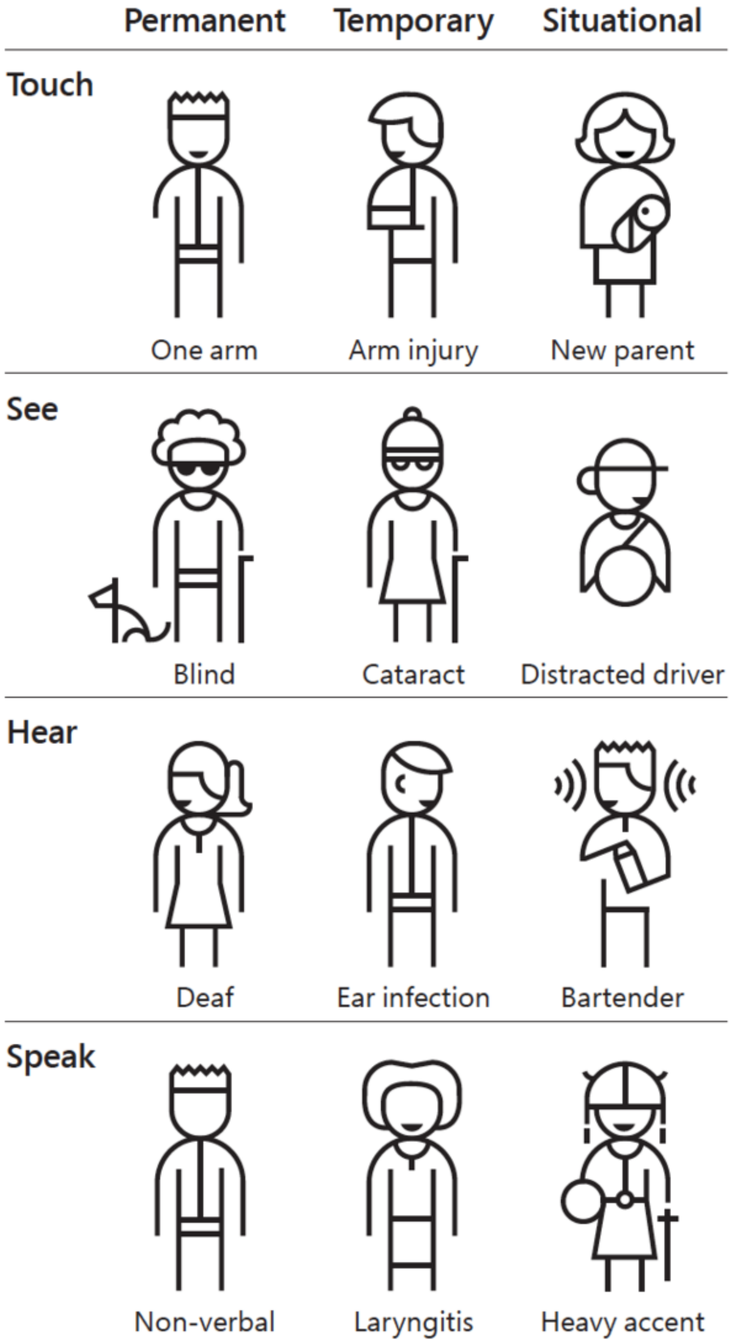
Accessibility in Data Visualization

A Primer

Presented by: Emily Kund

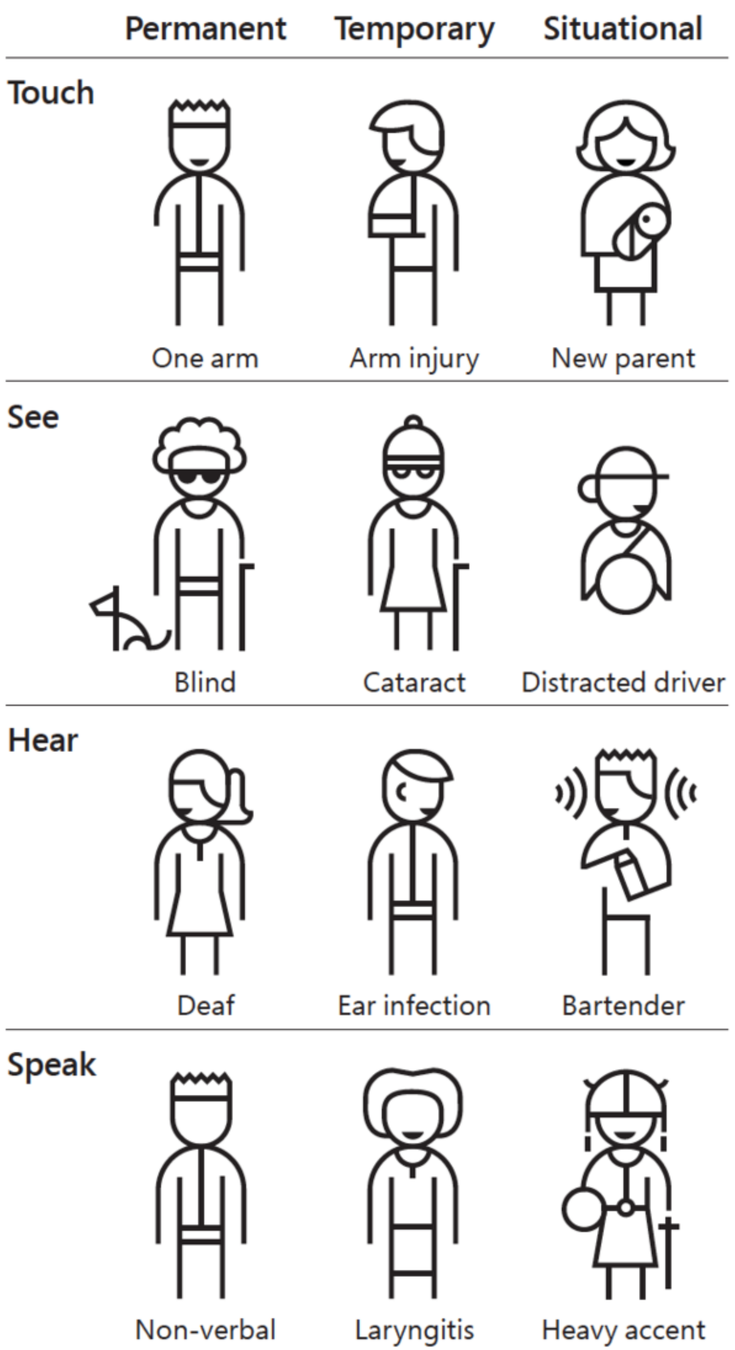
Use the #accessibleviz



Persona Spectrum, Microsoft

What we’re talking about
The Agenda

- What does accessibility mean?
- Requirements
- Simple ways to be more accessible
- The challenge ahead



Hi! I’m Emily

And I’m your guide for today’s talk on accessibility in data visualization.

What does accessibility even mean?

It’s more than color blindness

- Blindness (unable to see visual information)
- Color-blindness (unable to reliably distinguish colors)
- Limited vision (can see, but not well)
- Deaf (cannot hear sounds reliably)
- Low Dexterity (unable to use a pointing devise and must use keyboard or switch)
- Low Comprehension (having problems understanding content)
- Low Reading (having problems reading text)
- Epilepsy (may be subject to epileptic episodes)

Experience the Screen Reader

https://youtu.be/Vsj1MIg-gf8?t=185

What’s required?

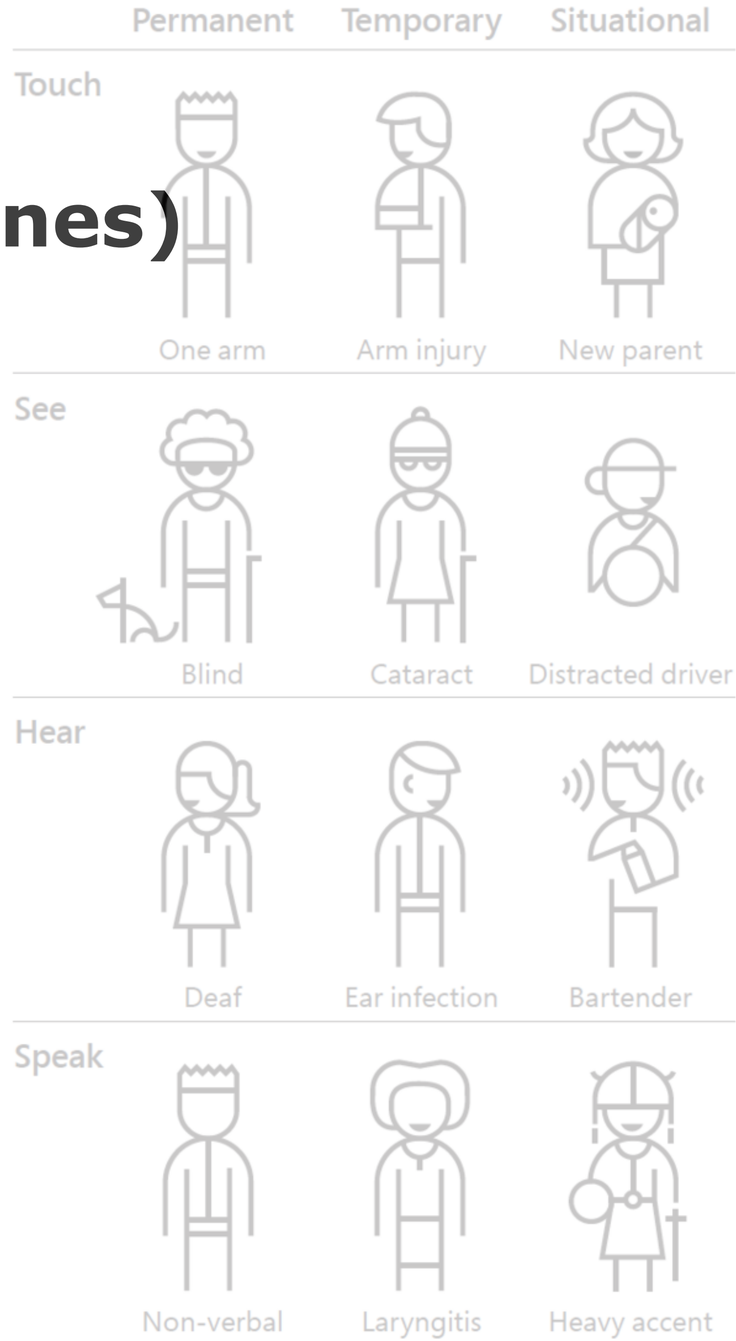
WCAG (Web Content Accessibility Guidelines)

Perceivable

Operable

Understandable

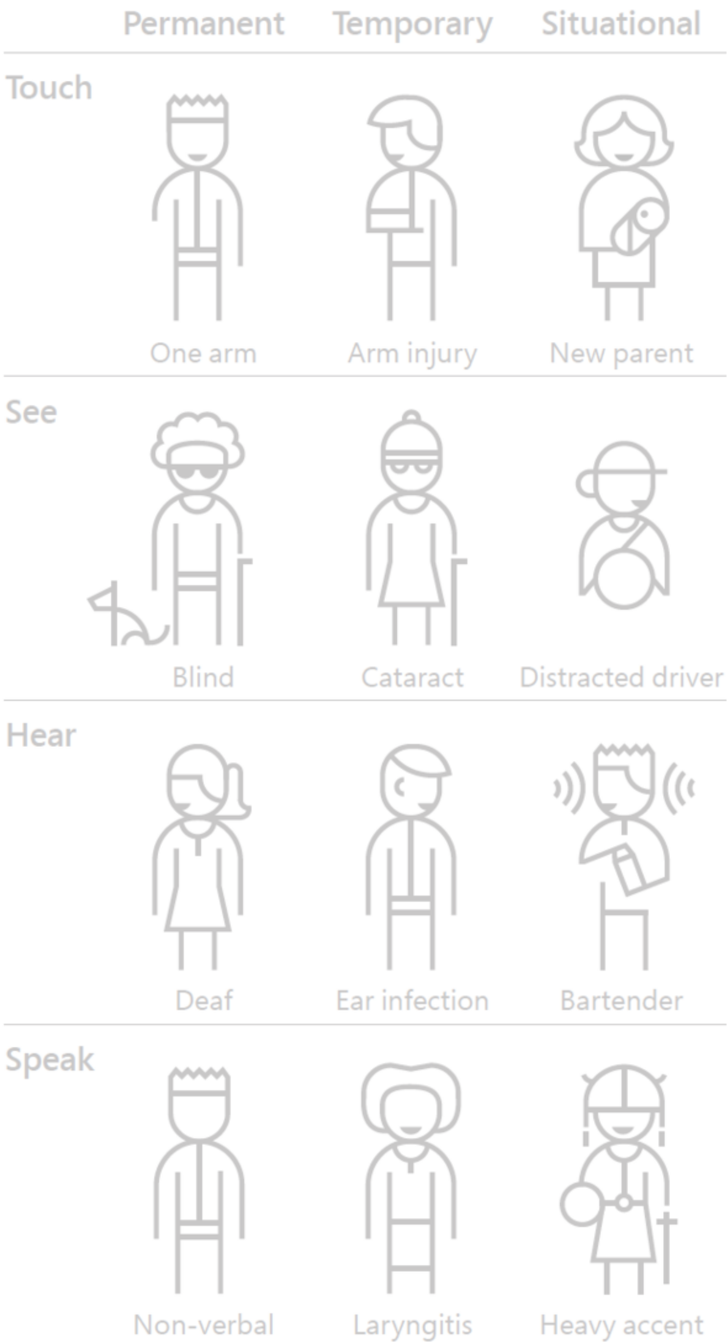
Robust



What’s required?
Section 508

How is Section 508 different than WCAG?

Section 508 was amended and now is written to address WCAG level AA, which means that the organization can be pretty confident that they’ll be in compliance with other accessibility standards.



What’s required?

WCAG 2.0 Explained

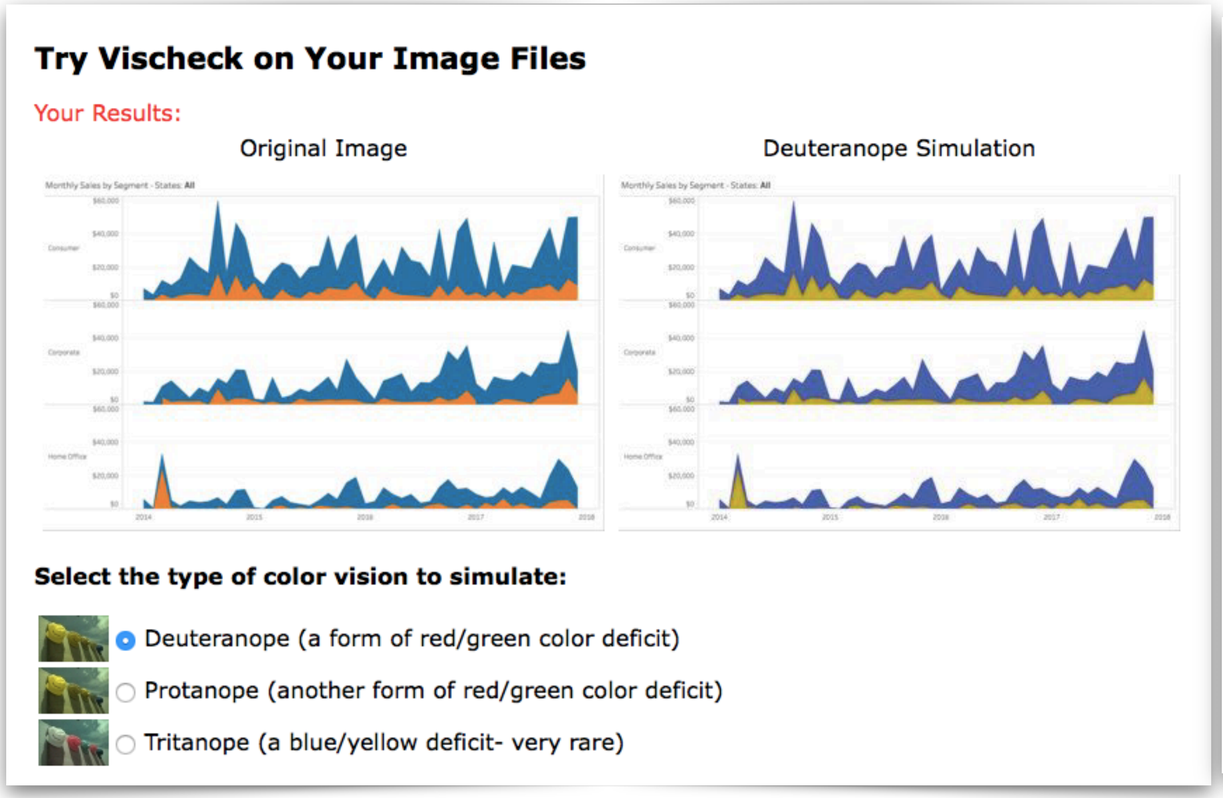
Principles	Guidelines	Level A	Level AA	Level AAA
PERCEIVABLE	Text Alternative	Provide text alternative for all non-text content		
	Time-based Media	Provide alternative to video/audio only content Provide captions for video and audio Video with audio has a second alternative	Live video has captions Users have access to audio descriptions for video content	Provide sign language translations for videos Provide extended audio description for videos Provide text alternative to videos Provide alternatives for live audio
	Adaptable	Logical structure Present content in a meaningful order Use more than one sense for instructions		
	Distinguishable	Don’t use presentation that relies solely on color Don’t play audio and animations automatically	Content ratio between text and background is at least 4.5:1 Text can be resized to 200% without loss of content or function Don’t use image of text	Contrast ratio between text and background is at least 7:1 Audio is clear for listeners to hear Offers users a range of presentation options Don’t use images of text
OPERABLE	Keyboard Accessible	Accessible by keyboard only Don’t trap keyboard users		Accessible by keyboard only
	Enough Time	Provide user controls for content with time limits Provide user controls for moving content		No time limits Let users control interruptions, except emergencies Preserve user data when re-authenticating
	Seizures	No content flashes more than 3 times per second		Avoid flashing objects or limit to three flashes per second
	Navigable	Provide ability to skip duplicate content’ Provide descriptive page titles Support logical navigation and viewing order Provide descriptive link text	Offer multiple ways to find pages Use descriptive headings and labels Ensure keyboard focus is visible and clear	Let users know where they are Every link’s purpose is clear from its text Break content with headings
UNDERSTANDABLE	Readable	Specify language of each page	Tell user when the language within a page changes	Explain any unusual words Explain any abbreviations and jargon Users with nine years of school can read your content Explain any words that are hard to pronounce
	Predictable	Elements don’t change when they receive focus Elements don’t change when receive input	Keep menus consistent Use icons and buttons consistently	Don’t’ change elements on your website until the user asks
	Input Assistance	Clearly identify input errors Label elements and give instructions	Suggest corrections when the user makes an error Reduce the risk of input errors for sensitive data	Provide detailed help and instructions Reduce the risk of all input errors
ROBUST	Compatible	No major code errors Build ell elements for accessibility		

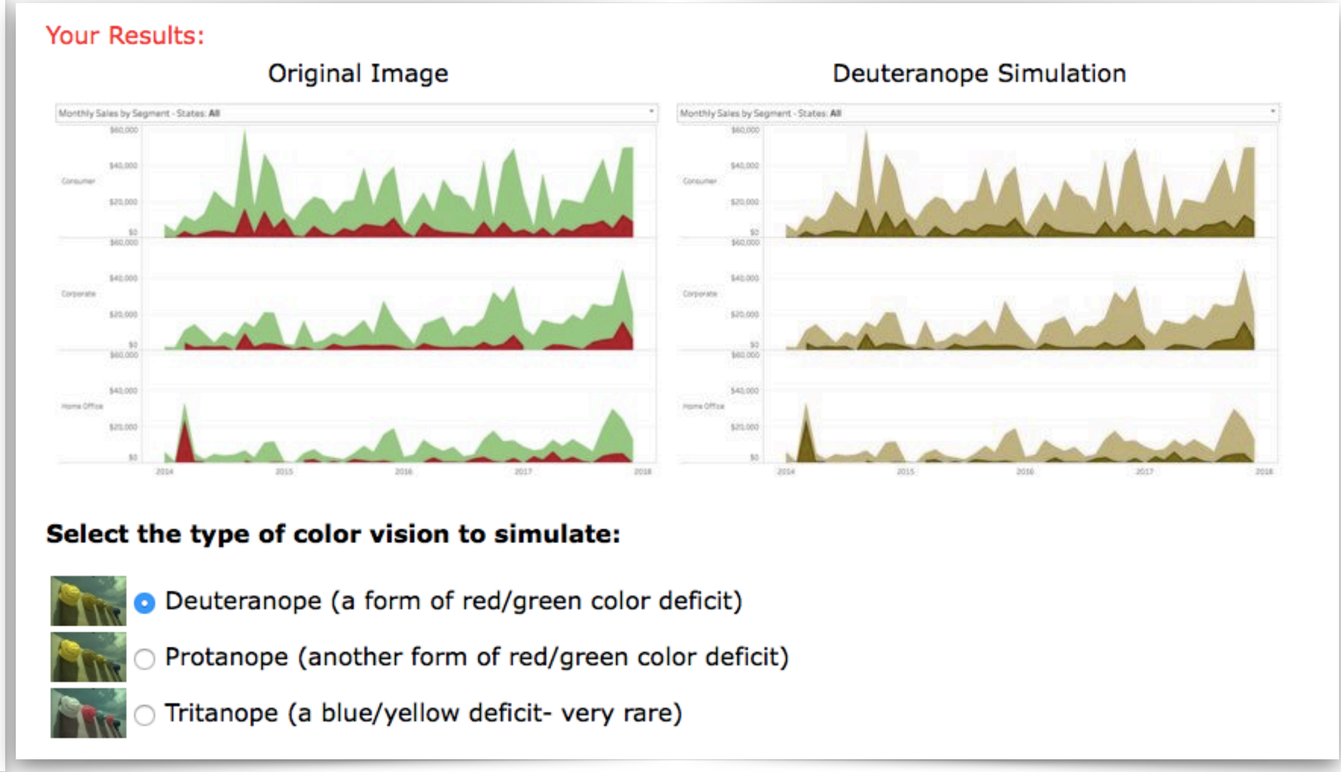
Color Blindness

Two primary approaches:

Use the color-blind palette or

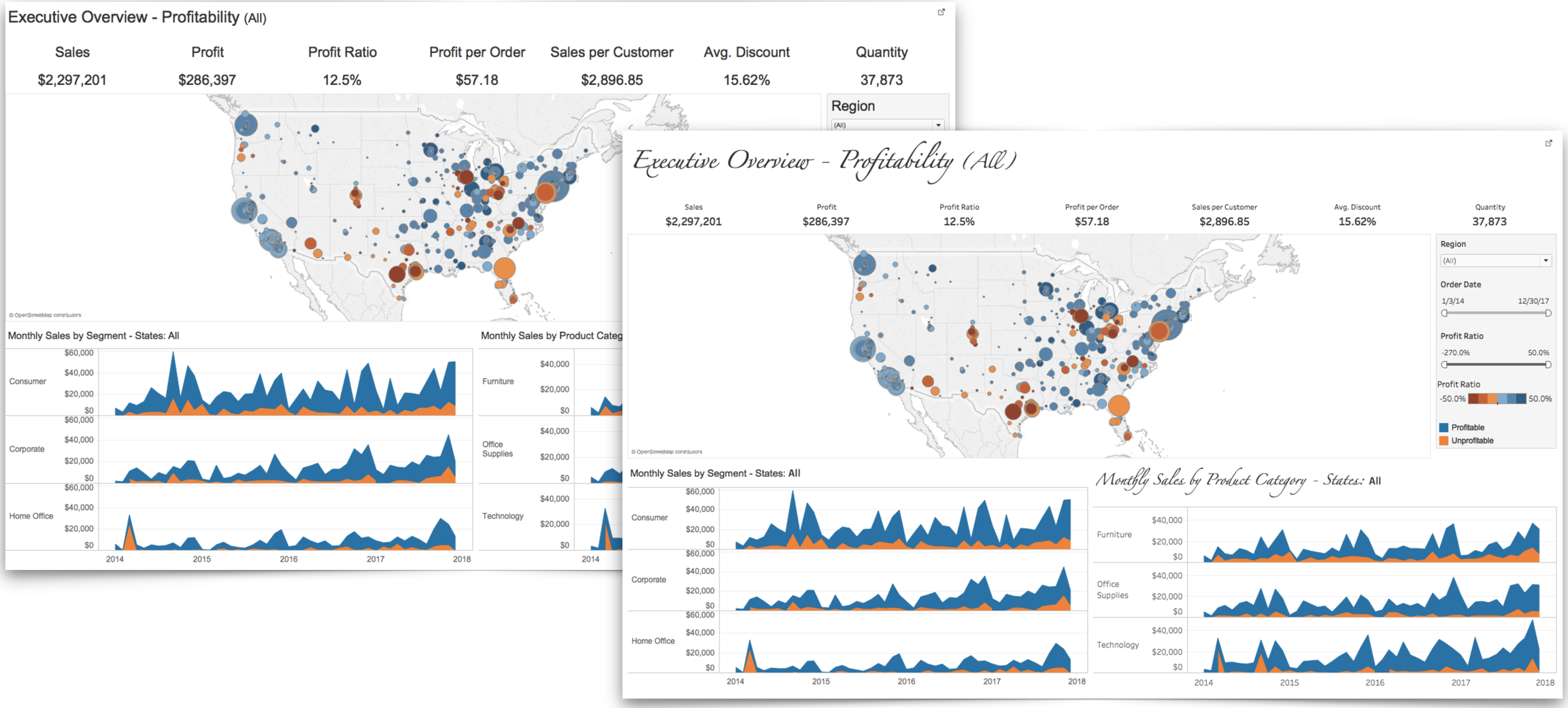
High contrast red and green.





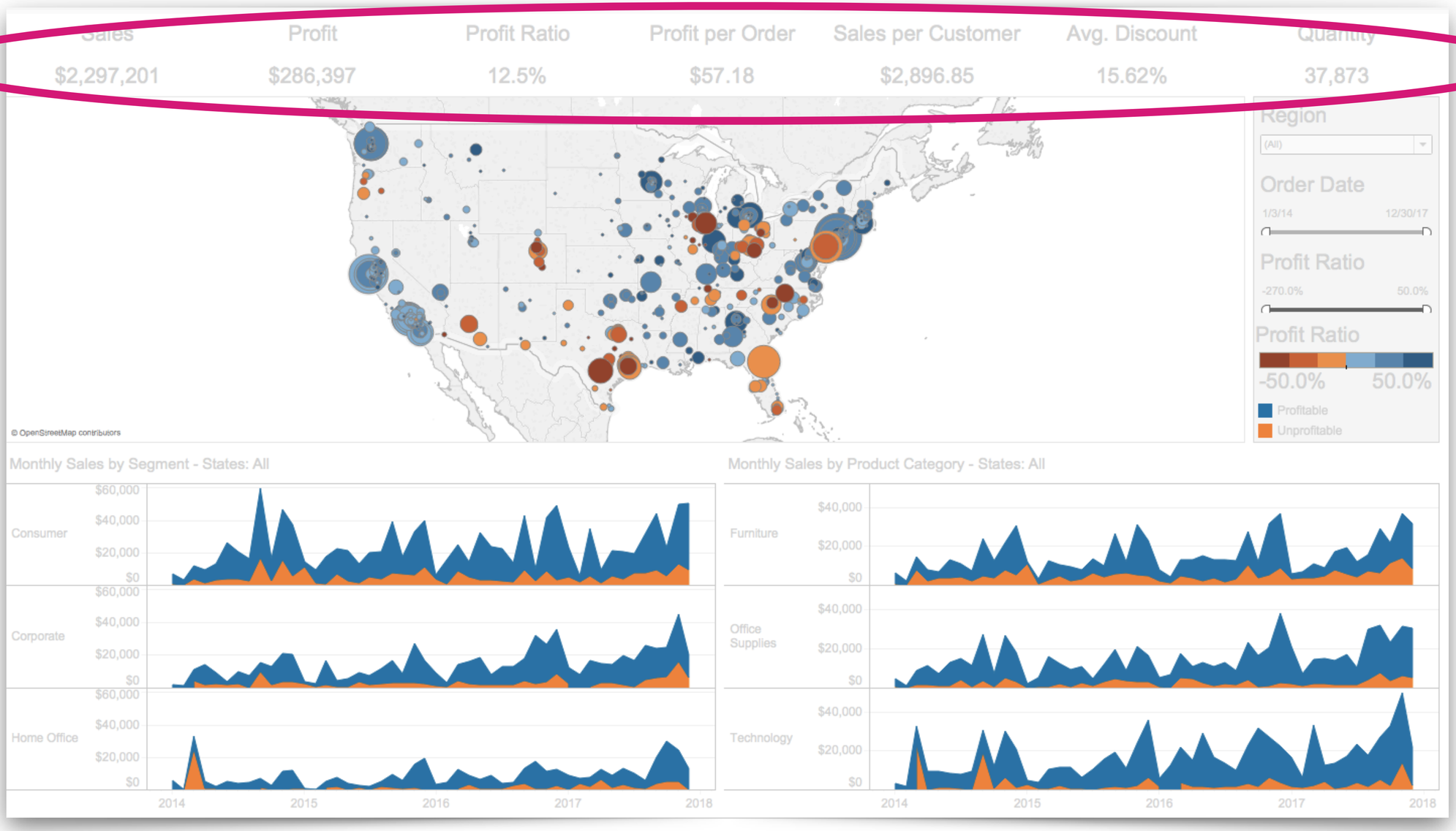
Low Vision

font size and font choice matter



Low Vision

contrast matters...not just for the color blind

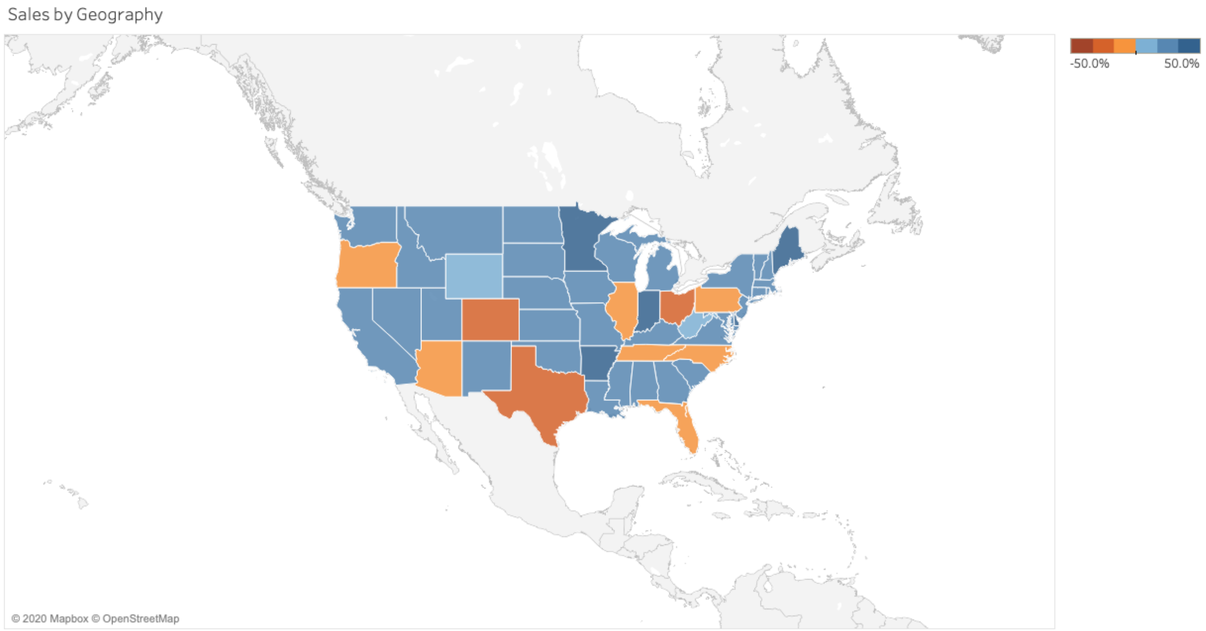


Considerations and ways to solve them

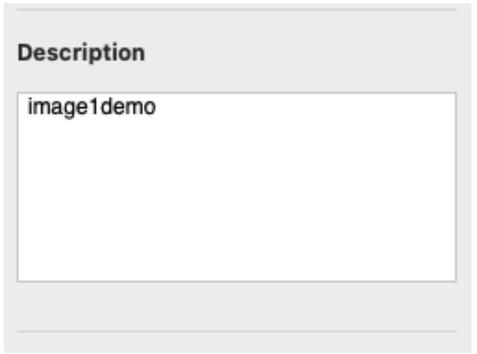
Consideration	Ways to Solve
• Blindness (unable to see visual information)	Use of screen reader/voice over
• Color-blindness (unable to reliably distinguish colors)	Use contrasting colors and/or double encoding (arrows + color)
• Limited vision (can see, but not well)	Select a readable font, use white space
• Deaf (cannot hear sounds reliably)	Visual display/don’t rely on audio/captioning
• Low Dexterity (unable to use a pointing device and must use keyboard or switch)	Make it accessible with the keyboard
• Low Comprehension (having problems understanding content)	Annotation
• Low Reading (having problems reading text)	High contrast, font choice
• Epilepsy (may be subject to epileptic episodes like seizures)	Do not have more than 3 flashes in one second

Actionable Tips for Accessibility

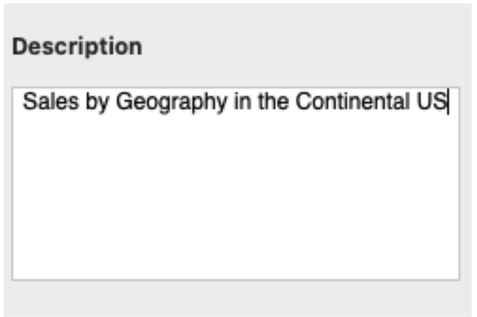
alt-text your images



What's more informative for a screen reader?



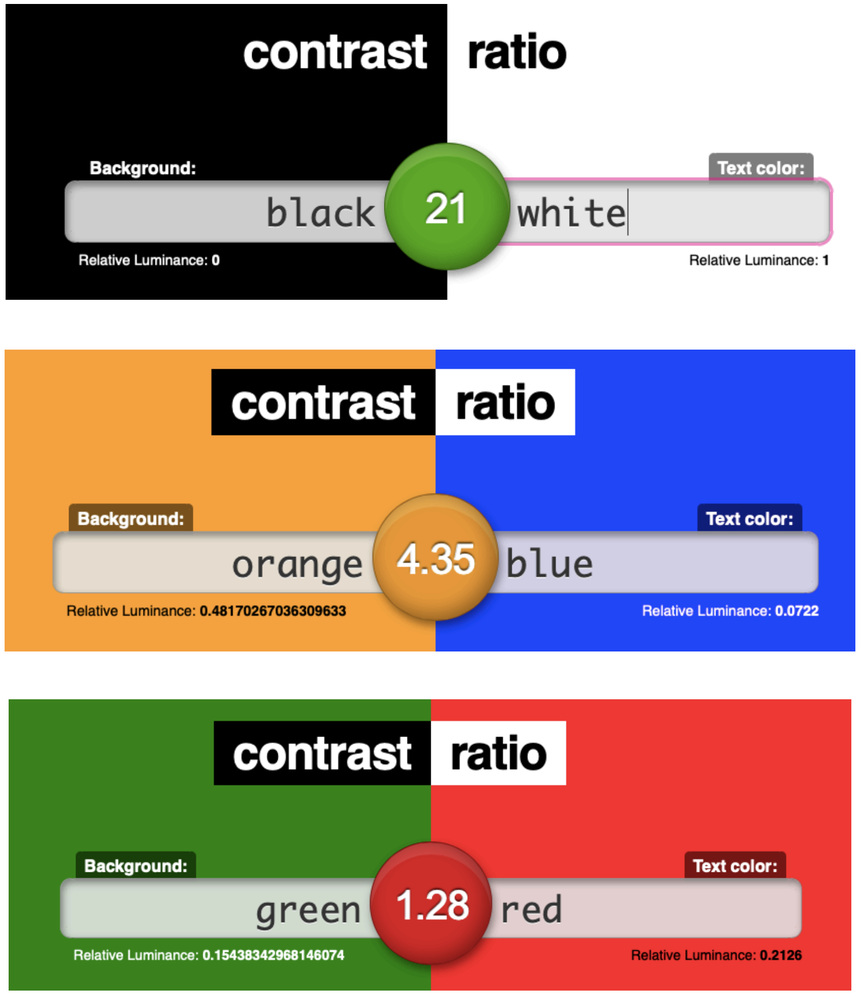
or



A screen reader reads the description of the image (make it informative).

Actionable Tips for Accessibility

contrast your colors



Contrasting colors helps people see

Actionable Tips for Accessibility

use white space

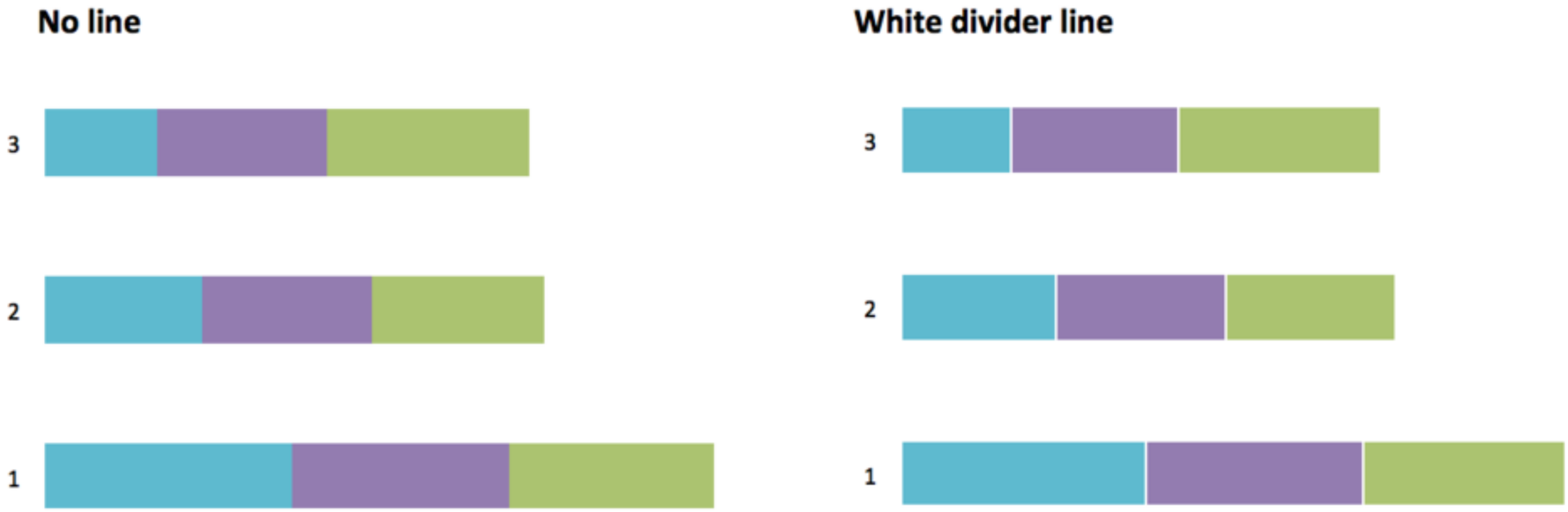


Image credit: Storytelling with Data/Amy Cesal

White space helps detect differences

Actionable Tips for Accessibility

font choice & how we construct sentences matter

Which font choose?

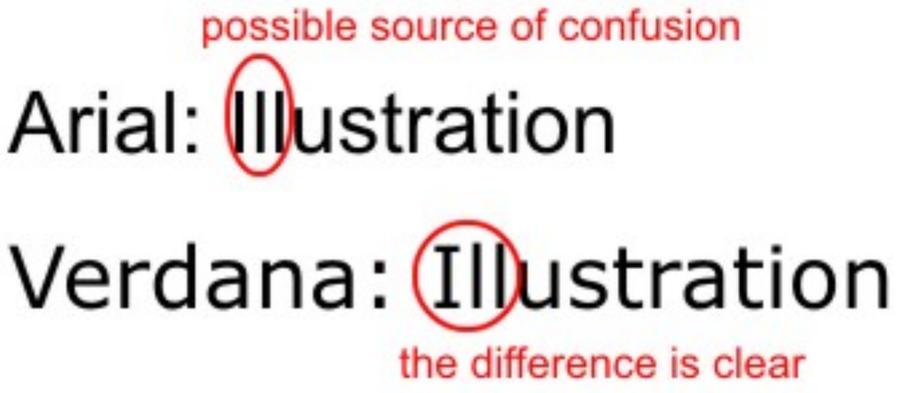


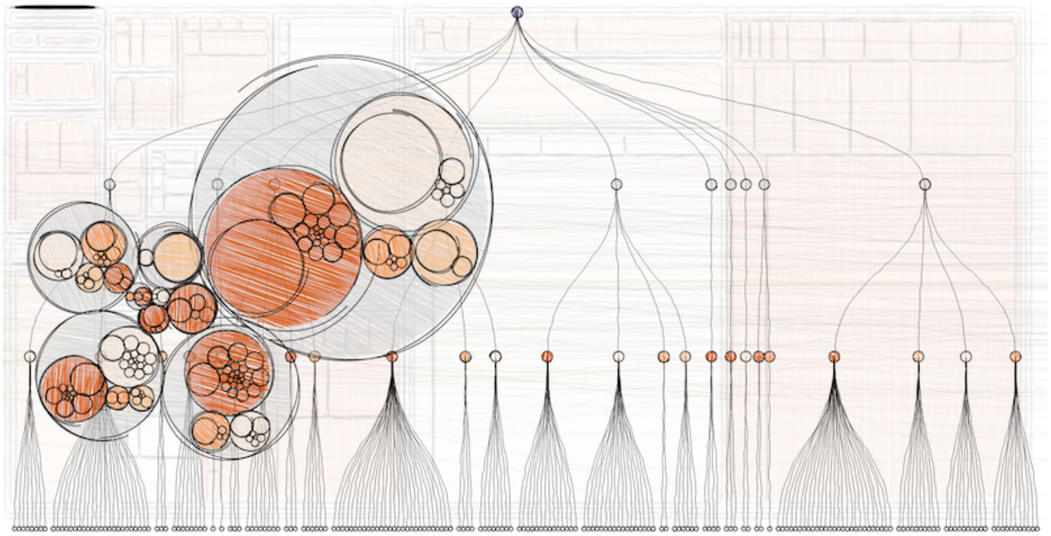
Image credit: Webaim.org

Arial: Here is a sentence written in Arial.
Tahoma: Here is a sentence written in Tahoma.
Verdana: Here is a sentence written in Verdana.

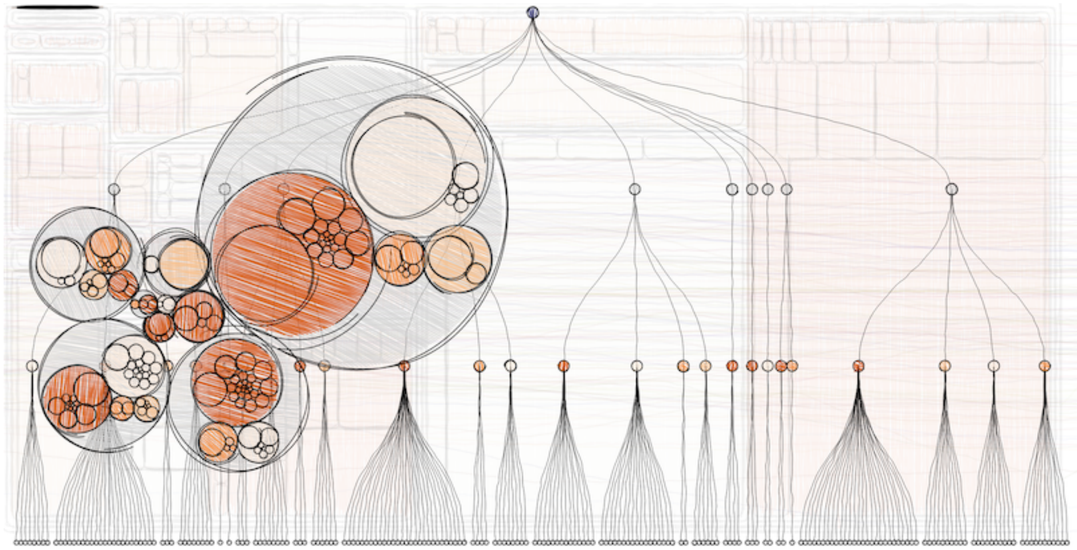
Make sure your font choice can accommodate increased text sizes without loss of readability or functionality.

Actionable Tips for Accessibility

Annotate to understand



The west coast switch causes a bubble up of issues in California and other states.

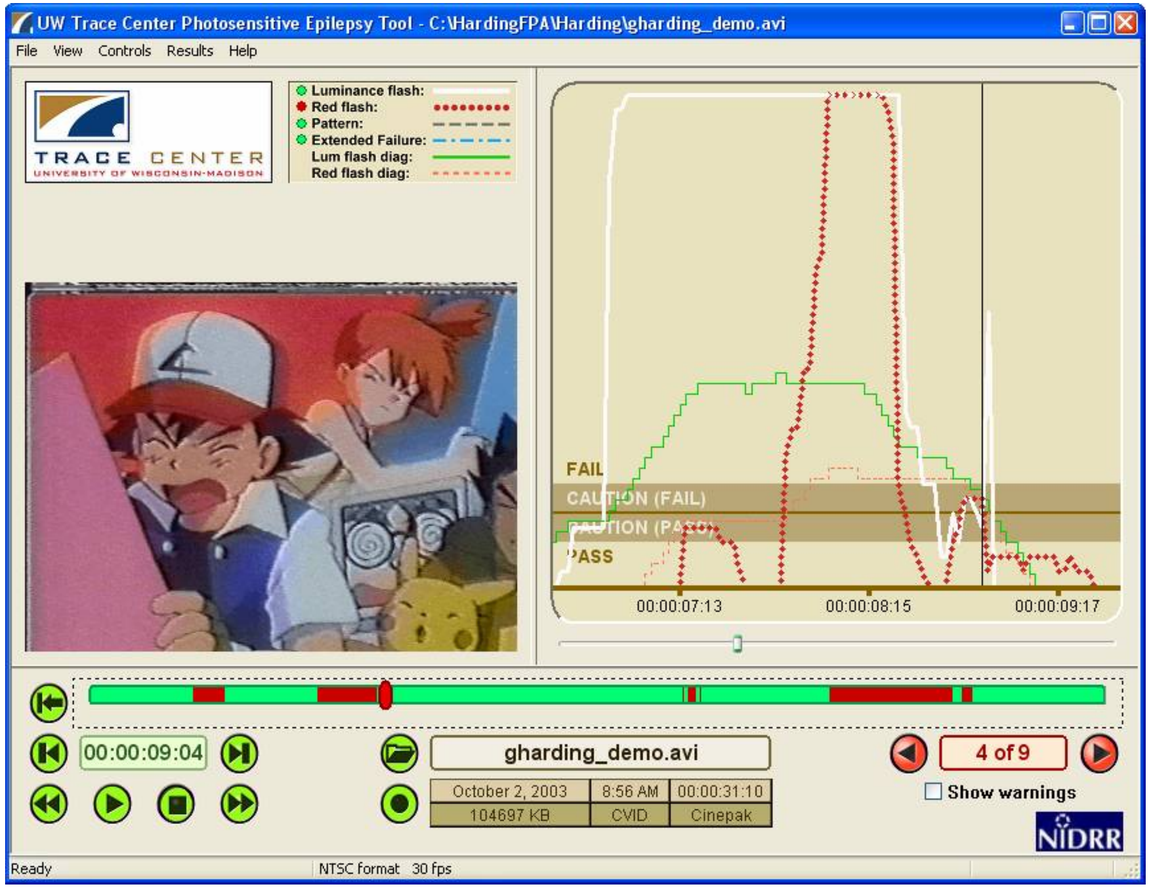


Providing annotation helps a reader understand

Image credit: Webaim.org

Actionable Tips for Accessibility

test flashes



This tool is available for Windows users (and Mac if you run Bootcamp).

It allows you to see the number of flashes per second and whether it passes/fails the threshold.

Ensure any flashes in data don’t cause health issues

Image cre

Actionable Tips for Accessibility

simple is better

A	B	C	D	E	F	G	H	I	J	K	L	M
3	396	218	127	77	48,7	31,7	21,3	14,7	10,3	7,42	5,41	4,01
4	958	528	307	186	118	76,9	51,6	35,5	25	17,9	13,1	9,7
5	1900	1050	608	369	234	152	102	70,5	49,6	35,6	26	19,2
6	3330	1830	1060	647	409	267	179	123	86,8	62,3	45,4	33,7
7	5340	2940	1710	1040	656	428	288	198	139	99,9	72,9	54,1
8	8050	4430	2580	1570	989	645	433	298	210	151	109	81,5
9	11550	6360	3700	2250	1420	927	622	428	302	216	158	117
10	17000	8790	5110	3100	1960	1280	860	592	417	299	218	162
11	1180	676	5750	3570	2300	1530	1050	733	524	381	282	212
12	1540	880	529	4530	2920	1940	1330	929	665	484	358	269
13	1960	1120	674	422	3630	2420	1650	1160	827	602	445	335
14	2460	1400	844	529	324	2960	2020	1420	1010	737	545	410
15	3030	1730	1040	652	424	284	2440	1710	1220	889	658	495
16	3680	2100	1260	793	515	345	237	2040	1460	1060	785	590
17	4430	2530	1520	952	619	415	285	201	1720	1250	926	696
18	5260	3010	1810	1130	736	493	389	239	172	1460	1080	814
19	6840	3940	2380	1500	983	662	459	325	235	173	1130	858
20	7930	4570	2770	1750	1140	769	535	377	272	200	150	974
21	9140	5260	3190	2010	1320	868	620	434	314	231	172	131
22	10460	6020	3650	2300	1500	1010	710	497	359	264	197	150
23	11890	6850	4150	2620	1710	1150	802	565	409	300	224	170
24	13460	7750	4690	2960	1940	1310	903	640	462	340	254	193
25	15150	8730	5280	3330	2180	1470	1020	720	520	383	286	217
26	16970	9780	5920	3730	2440	1850	1140	807	583	429	320	243
27	19700	10910	6600	4170	2720	1840	1270	900	651	478	357	271
28	1990	12120	7340	4630	3030	2040	1410	1000	723	532	397	301
29	2250	13400	8120	5130	3350	2260	1560	1110	800	589	440	333
30	2530	11800	8960	5660	3700	2400	1730	1220	883	649	485	368
31	2840	1720	8200	6220	4070	2740	1900	1340	971	714	534	405
32	3170	1920	8970	6820	4460	3010	2080	1470	1060	783	585	444
33	3520	2140	1360	6220	4880	3290	2270	1610	1160	856	639	485
34	3910	2370	1510	6790	5320	3580	2480	1760	1270	938	597	529
35	4320	2630	1670	1100	4830	3900	2700	1910	1380	1020	758	575

Rank	Region	Amount
1	Central	1,345,678
2	East	978,529
3	West	632,109
4	South	403,430
5	Midwest	347,820

Show data at a more aggregate level so it doesn’t overwhelm a screen reader or other assistive technology

Image cre

Challenges

Interactivity-Can a screen reader read it?

Chart types-Network diagrams aren’t able to be easily translated into a table

Big Data-Overwhelming someone with so. many. numbers.

These are challenges we need to find balance and solutions for

Invitation

We have challenges, but as a community, we can find solutions.

https://bit.ly/accessiblevizinterestform

These are challenges we need to find balance and solutions for

Resources

https://www.aph.org/all-products/

https://www.macularsociety.org/preparing-documents-visually-impaired-people

https://reciteme.com/uploads/articles/accessible_fonts_guide.pdf

https://www.slideshare.net/SusanneMills/accessibility-poster-final

https://uiowa.instructure.com/courses/40/pages/accessibility-principles-pour

https://www.access-board.gov/guidelines-and-standards/communications-and-it/about-the-ict-refresh/final-rule

https://cfpb.github.io/design-system/guidelines/data-visualization-guidelines

https://webaim.org/standards/wcag/WCAG2Checklist.pdf

https://help.tableau.com/current/pro/desktop/en-us/access_keyboard_navigation.htm

Resources

https://soap.stanford.edu/tips/screen-reader-testing

https://youtu.be/n5sjhLLJHHk?t=5

https://contrast-ratio.com

https://trace.umd.edu/peat

https://equalentry.com/tableau-accessibility-demo/

https://bit.ly/ekaccessibilitychecklist

Connect

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