Color Charts

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Random Apps of Kindness
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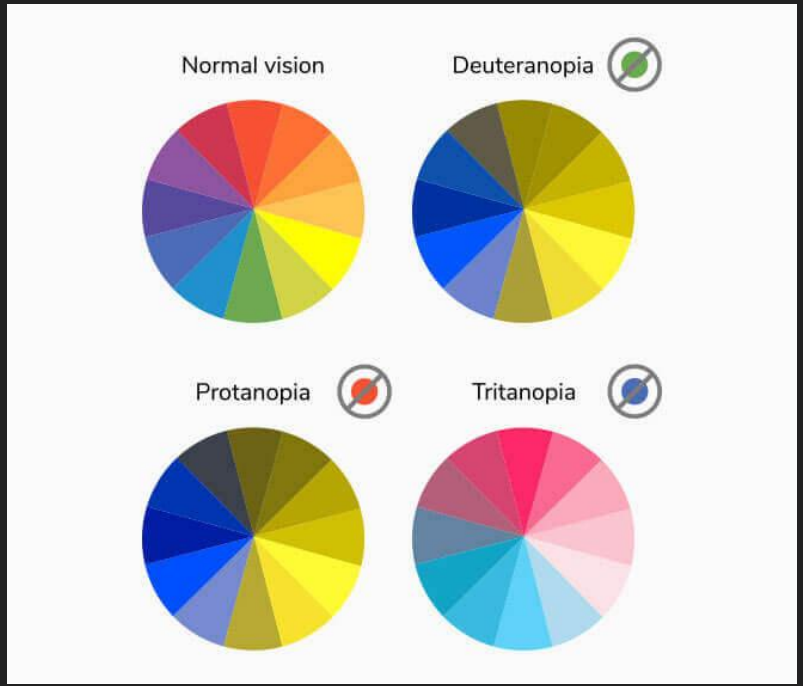
Motivation

- Common color blindness types:
  - Red-green
  - Blue-yellow
  - Complete
- More common in males [1]:
  - 1 in 12 males
  - 1 in 200 females
- Affects approximately 13 million Americans [1]



[1] https://ghr.nlm.nih.gov/condition/color-vision-deficiency

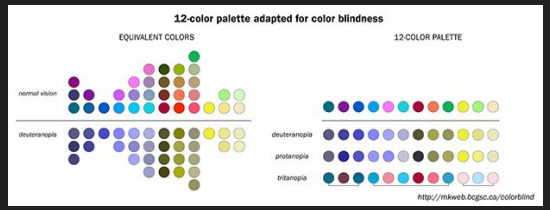
The goal of this project is help color blind people better read charts, graphs, and diagrams on the web.

Problem Background and Related Work

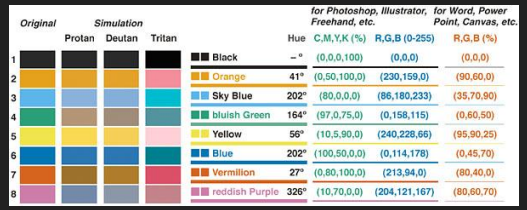
Two relevant areas:

1. Researched color blind friendly palettes
2. Existing color blind accessibility Chrome extensions

Researched Palettes



M. Kyrzywinski [2]

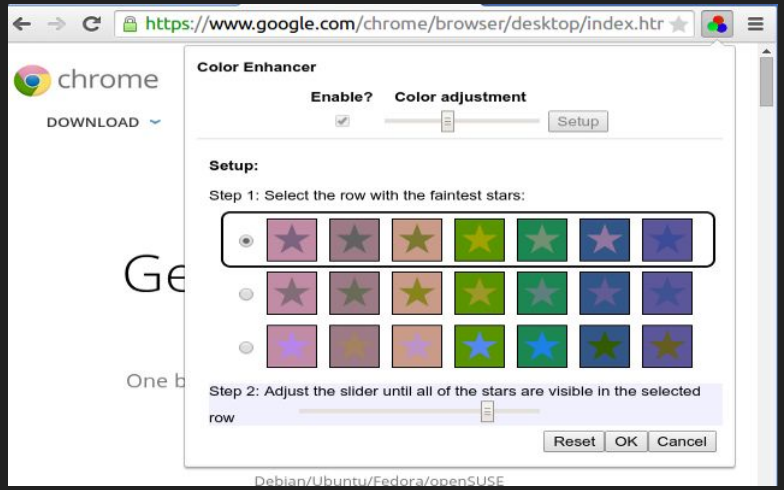


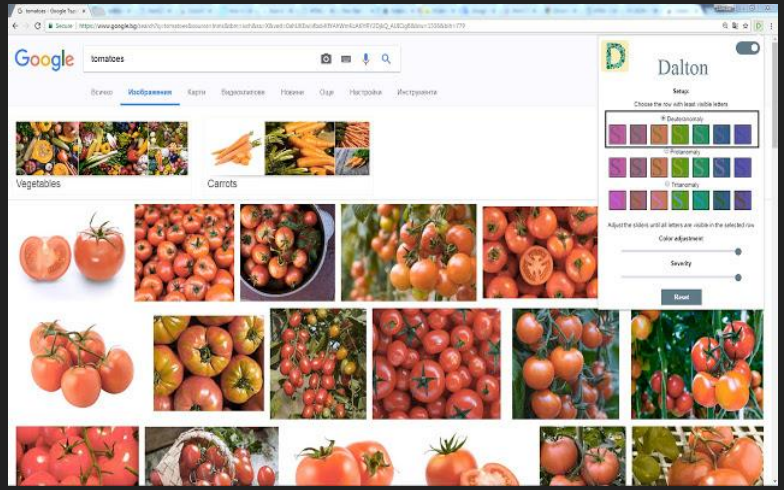
M. Okabe and K. Ito [3]

P. Tol [4]

[2] http://mkweb.bcgsc.ca/colorblind/
[3] https://jfly.uni-koeln.de/color/
[4] https://personal.sron.nl/~pault/#sec:qualitative

Existing Chrome Extensions

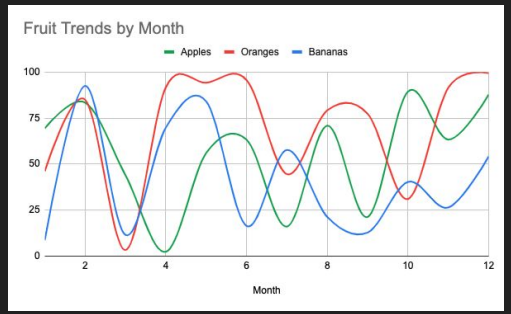
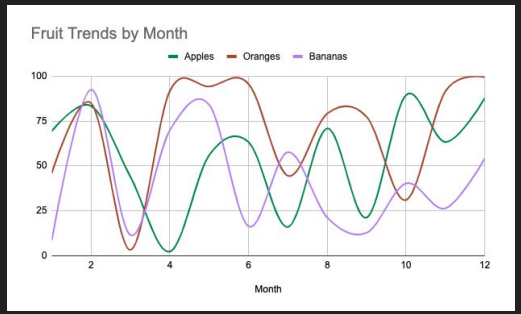
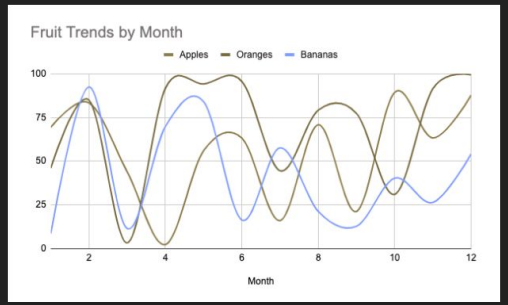
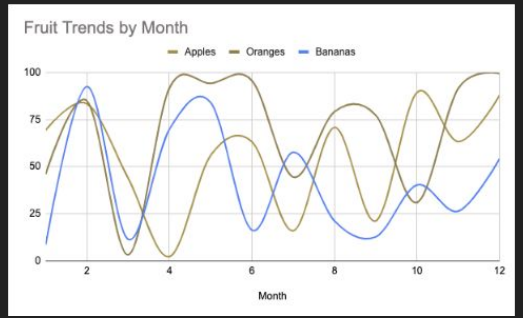




Color Enhancer — suggested by Chrome under their accessibility settings (188,934 users)

Dalton — alternative 3rd party extension (3,634 users)

Existing Chrome Extensions (cont.)

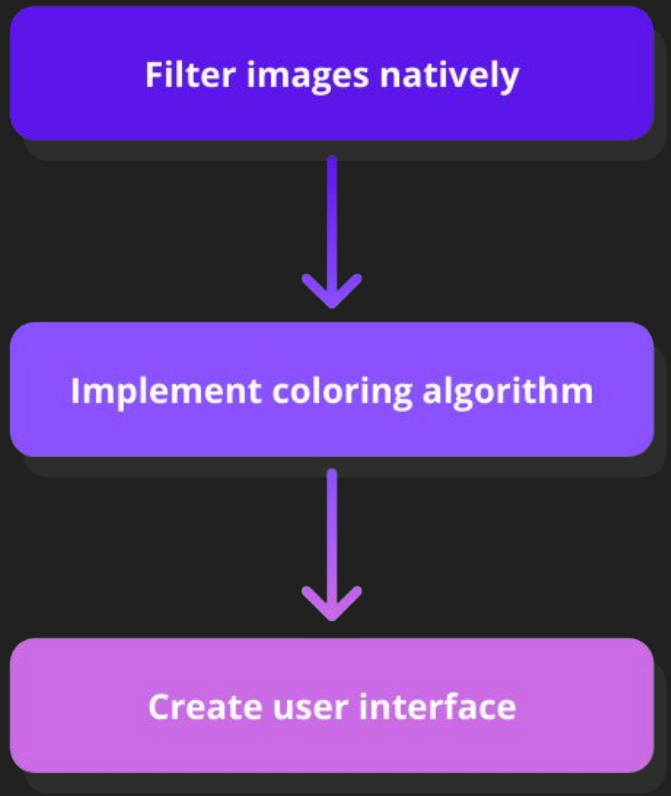
	Without Color Enhancer	With Color Enhancer
Normal vision		
Protanopia		

Approach

- Combine both areas of related work
- Create a Chrome extension that filters images (specifically visuals such as charts, graphs, and diagrams) on a page with researched color blind friendly palettes
- Output colors are not dependent on input colors

Implementation

1. Filtering images in line and preserving the structural integrity of the page
2. Implementing recoloring algorithm, mapping original colors to color blind friendly colors
3. Creating user interface where users can selectively filter and select palettes



Filtering Images Natively

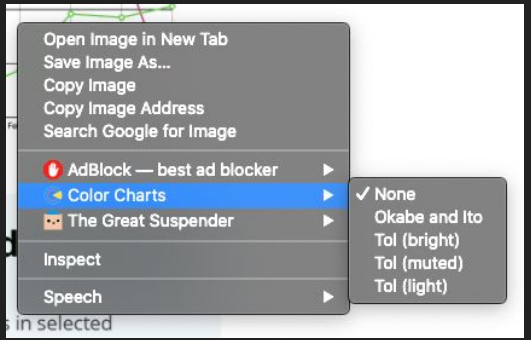
- For each image:
  - Use HTML Canvas to “draw” image and access pixels
  - Export filtered image into base64 encoded data URI format
  - Set original src attribute to data URI

Implementing Coloring Algorithm

- Uses two pass recoloring process
- Maps original → 12 main colors of color wheel → color blind friendly colors
- Ignores grayscale colors
- Uses between RGB and CIE L*a*b* colorspaces

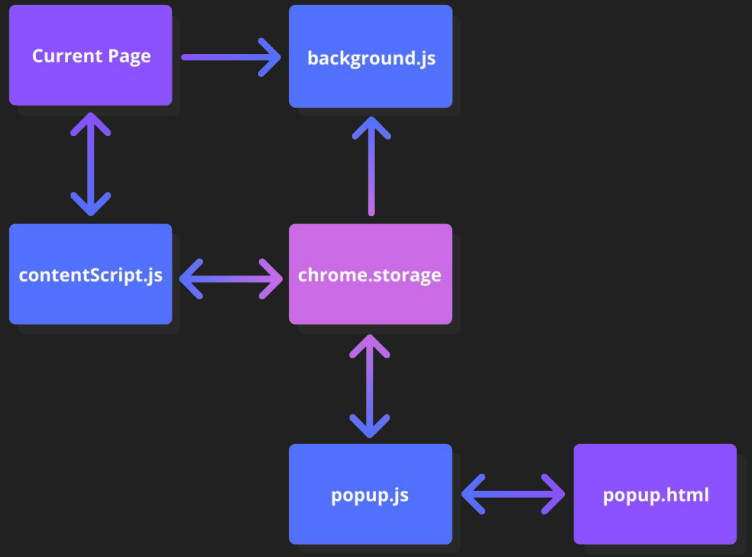
Creating User Interface

- Popup menu
  - Choose palette
  - Turn selective filtering on/off
- Right click menu
  - If selective filtering is on, right click on image and select palette

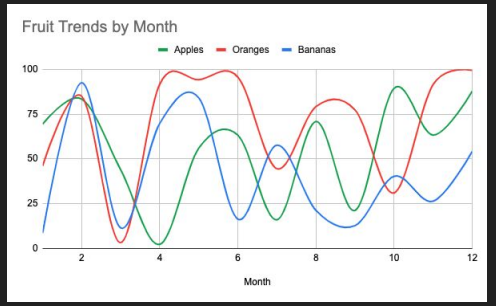
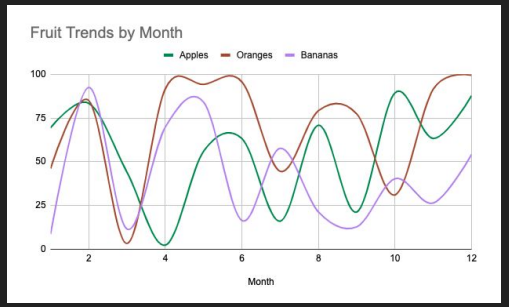
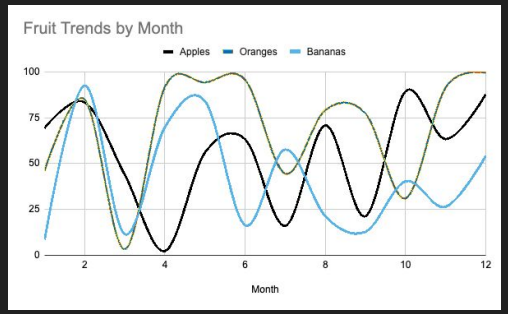
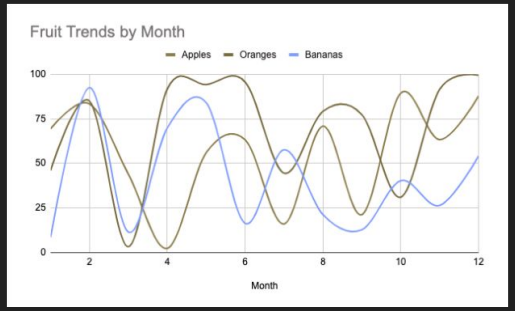
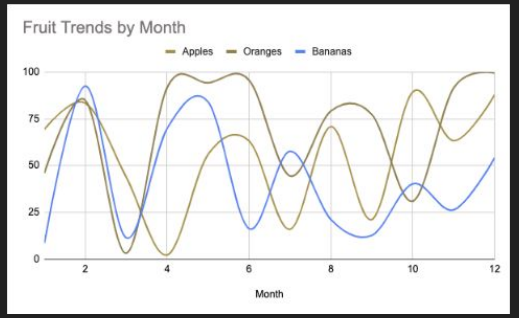
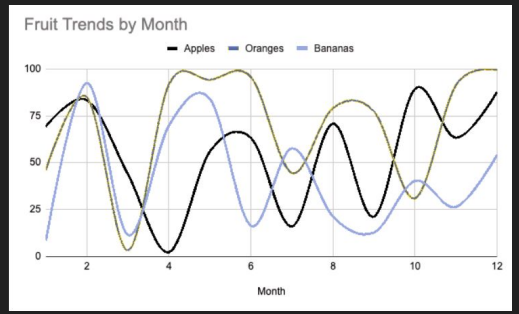


Creating User Interface (cont.)

- Uses Chrome local storage to save user preferences
- Scripts read and write to local storage
- To switch between palettes,
  - Revert images back to original by reading from cache
  - Apply new palette



Results

	No extension	With Color Enhancer	With Color Charts
Normal vision			
Protanopia			

Conclusion

- Color blind friendly palettes exist as guidance for ideal colors of visuals
- Badly colored diagrams might not be improved with the use of existing Chrome extensions
- Solution: complete remapping of colors to color blind friendly colors
- Color Charts achieves this with a three step process:
  - Filtering images natively
  - Implementing coloring algorithm
  - Creating user interface