

The Use of Color in User Interfaces

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SWE 632

User Interface Design and Development

Sources:

Nate Bucheit

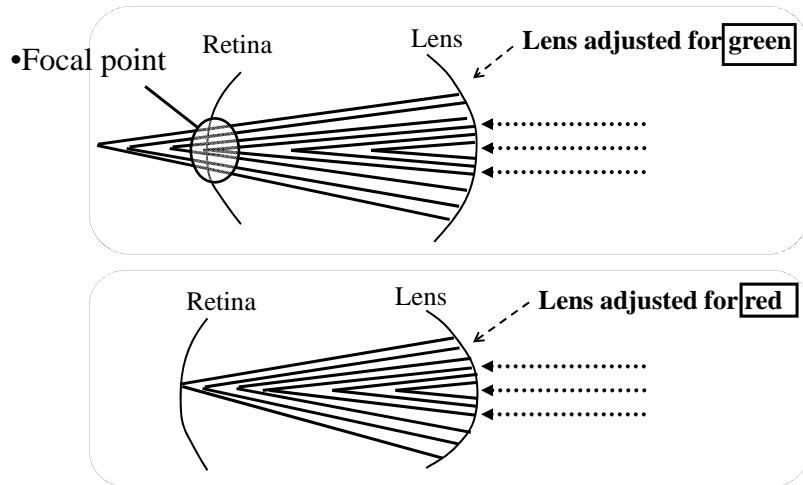
Tamar Cohen

Christopher Anthony

Color Topics

- The Eyes
- Color
- Guidelines
 - Physiological
 - Perceptual
 - Cognitive

How the Eyes See Color



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The Eyes: Lens and Retina

- Lens: Use muscles to change shape to focus on colors
- Retina: Absorbs longer wavelengths better
- Rods: See shades of gray
- Cones: See color and detail
- Chromostereopsis: Cannot focus on different colors at the same place

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Color

- Hue: What we usually see as color
- Luminance: Amount of light entering eye
- Brightness: Perceived amount of light
(blue appears brighter than white)
- Saturation: Purity of color
- Lightness: Amount of light an object reflects

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Color Spectrum

Color	Wavelength
Purple	< 430 nm
Blue	450 – 480 nm
Green	500 – 550 nm
Yellow	570 – 590 nm
Orange	610 – 630 nm
Red	> 640 nm

See the Java Applet color wheel at:

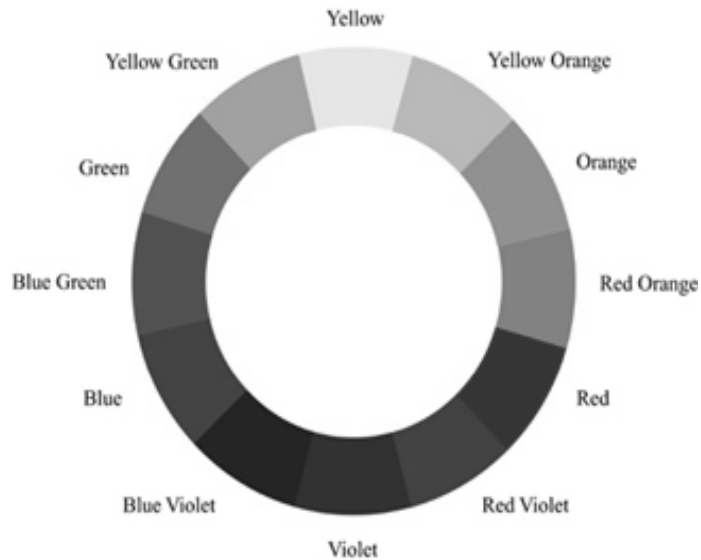
<http://www.ficml.org/jemimap/style/color/wheel.html>

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Color Wheel – Opposites



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Notes on Human Eyes

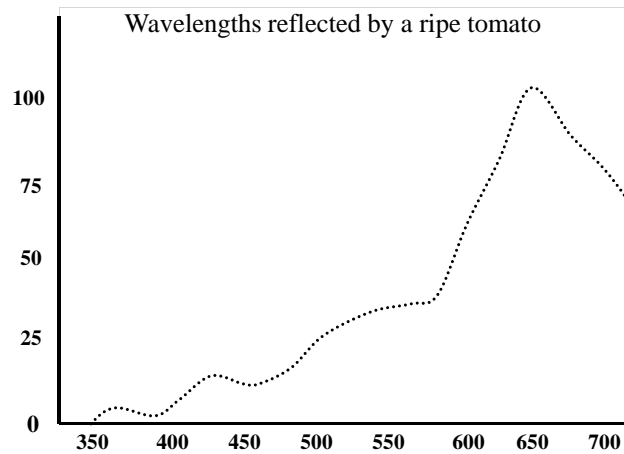
- Lens are adjusted for green when relaxed
- Reds are easiest to discriminate
- Blues are hardest to discriminate
- The number of hues we can perceive shrinks as we age

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Color Lightness



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Color Contrast

- Relative brightness of signal over background
- Greater contrast – better perception
- Opponent colors yield better contrast
(orange:blue, red:green)
- **Dark on light** has better contrast than **light on dark**
 - This is true on paper and on computer screens
 - This effect is reversed when *projecting*

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Color Guidelines

- Physiological
- Conceptual
- Cognitive

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Physiological Guidelines

1. Avoid highly saturated opponent colors at the same time
 - Use opponent colors for higher contrast
2. Do not use blue for text, thin lines, and small shapes
3. Do not use adjacent colors that only differ in the amount of blue
4. Older users need more brightness
5. Use dark on light when printing and on-screen
Light on dark when projecting
6. Try not to put red and green on the sides of large displays
7. Adjacent colors should have different levels of brightness

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Perceptual Guidelines

1. Hue changes perceived brightness
2. Use brighter, spectrum-centered colors for text
(white, yellow, red)
3. Do not require color discrimination in small areas
4. Avoid using hue to indicate numeric information
5. Use greater intensity for hues that indicate larger amounts
6. Use two different background colors to split screen

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Cognitive Guidelines

1. Use color to categorize information and controls
2. Do not use too much color
3. Group related elements by using a common background color
 - Use color to indicate “regions” in web sites
4. Use similar colors to imply similar meanings
5. Use brightness and saturation for highlighting
5. The same color may have different meanings in different cultures
6. Use redundant coding of shape and color

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Usable Color Combinations

<i>Background</i>	<i>Best Colors</i>	<i>Worst Colors</i>
White	Black, Blue	Cyan, Yellow
Black	Yellow, White	Blue
Red	Black	Blue, Magenta
Green	Black, Red	Cyan
Blue	Red, White, Yellow	Black
Cyan	Blue, Red	Green, White, Yellow
Magenta	Black, Blue	Cyan, Green
Yellow	Black, Blue, Red	Cyan, White

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Color in HTML

Color is defined as #RRGGBB

Some predefined colors:

<i>Color Name</i>	<i>Hex Value</i>	<i>Color Name</i>	<i>Hex Value</i>
Aqua	#00FFFF	Navy	#000080
Black	#000000	Olive	#808000
Blue	#0000FF	Purple	#800080
Fuchsia	#FF00FF	Red	#FF0000
Gray	#808080	Silver	#C0C0C0
Green	#008000	Teal	#008080
Lime	#00FF00	White	#FFFFFF
Maroon	#800000	Yellow	#FFFF00

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An Effective Use of Colors To Categorize

Borland C++ 3.1 was the first editor to use color to categorize

Six colors :

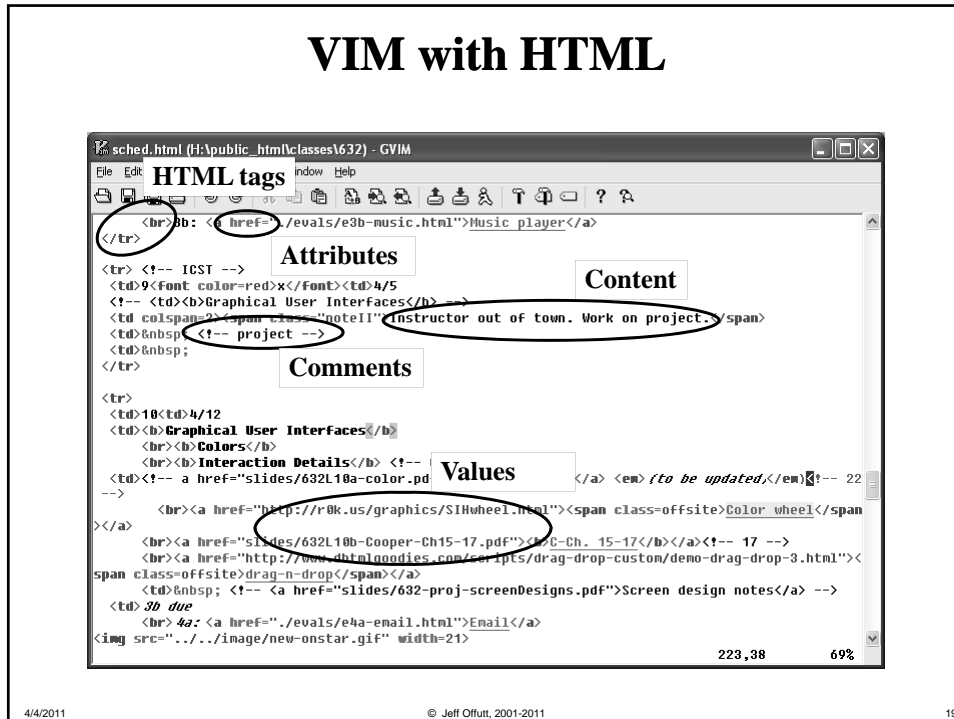
1. Reserved words – **white**
2. Identifiers – **yellow**
3. Macros – **green**
4. Literals – **cyan**
5. Comments – **gray**
6. Syntax errors – **red**

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VIM with HTML



Conclusions

- Color can enhance the usability of interfaces
- Color can (and often is!) greatly over-used
- When using color:
 - be gentle
 - be thoughtful

