

Color Project Software, Datasets

Lecture 6 CPSC 533C, Spring 2004

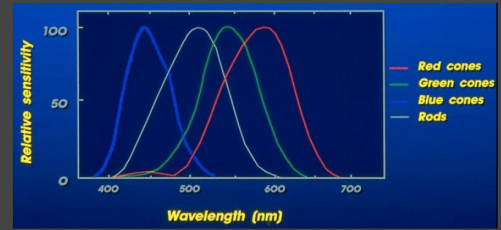
28 Jan 2003

Tamara Munzner

Trichromacy

cone response is a function of wavelength for a given spectrum

- multiple by response curve
- integrate to get response



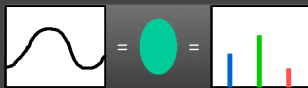
[Stone, SIGGRAPH 2001 course notes, graphics.stanford.edu/courses/cs448b-02-spring/04cdrom.pdf]

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Metamerism

brain sees only cone response

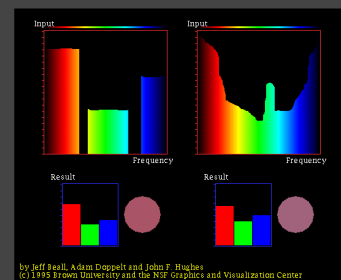
different spectra appear the same



[Stone, SIGGRAPH 2001 course notes, graphics.stanford.edu/courses/cs448b-02-spring/04cdrom.pdf]

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Metamerism Demo



by Jeff Beall, Adam Doppelt and John F. Hughes
(c) 1999 Brown University and the NSF graphics and Visualization Center

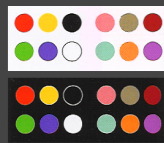
[www.cs.brown.edu/exploratories/freeSoftware/repository/edu/brown/cs/exploratories/applets/spectrum/metamers_java_browser.html]

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Color rules of thumb

nominal

- bad: > 12 hues
- good: use <= ~12 hues



[Colin Ware, Information Visualization: Perception for Design, Morgan Kaufmann 1999, Figure 4.2.1]

ordinal

- bad: using hue
- good: saturation/brightness

quantitative

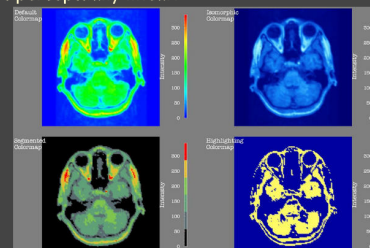
- bad: rainbow colormaps
- good: interpolate between two hues

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Colormaps

rainbow colormaps usually bad idea

- hue is mediocre for showing order
- not perceptually linear!

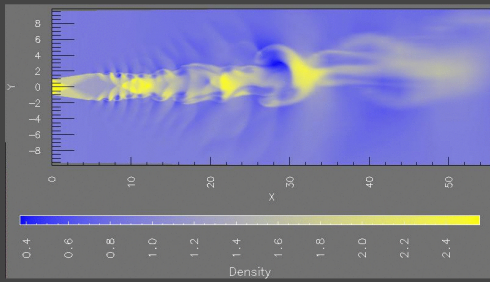


[Rogowitz and Treinish, How NOT to Lie with Visualization, www.research.ibm.com/dx/proceedings/pravda/truevis.htm]

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Colormaps

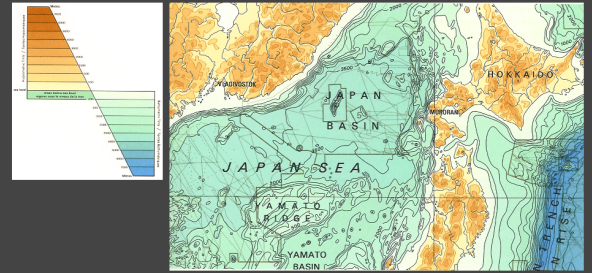
interpolating between two hues usually safe



[Rogowitz and Treinish, How NOT to Lie with Visualization, www.research.ibm.com/dx/proceedings/pravda/truevis.htm]

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Colormaps, Tufte



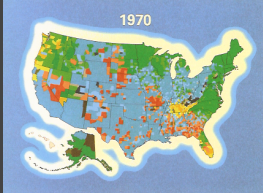
[Tufte, Envisioning Information, p. 91]

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Color In Large Areas

Ware and Tufte agree: desaturate!

"excessively exuberant"



pastels for text bg

```
import java.applet.Applet;
import java.awt.Graphics;
import java.awt.Color;

public class ColorTest extends Applet
{
    public void init ()
    {
        red = 100;
        green = 225;
        blue = 20;
    }

    public void paint (Graphics g)
    {
        GraphicsColor (new Color (red, green, blue));
        GraphicsColor ("Colored Text", 30,50);
    }

    private int red;
    private int green;
    private int blue;
}
```

[Edward Tufte, Envisioning Information, p.82]

[Colin Ware, Information Visualization: Perception for Design, Morgan Kaufmann 1999, Figure 4.20]

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Color Deficiency

deutanope
protanope

- has red/green deficit
- 10% of males!

tritanope

- has yellow/blue deficit

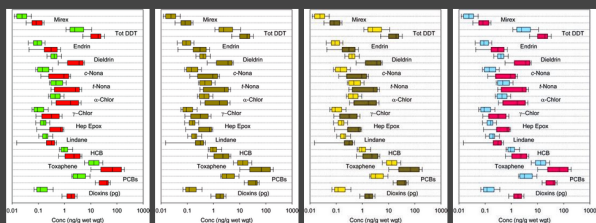
<http://www.vischeck.com/vischeck>

- test your images
- use this with your final projects!

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Color Deficiency Examples: vischeck

original deutanope protanope tritanope



[www.cs.ubc.ca/~tmm/courses/cpsc533c-04-spr/a1/dmityr/533a1.html, citing Global Assessment of Organic Contaminants in Farmed Salmon, Ronald A. Hites, Jeffery A. Foran, David O. Carpenter, M. Coreen Hamilton, Barbara A. Knuth, and Steven J. Schwager, Science 2004 303: 226-229.]

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Designing Around Deficiencies

red/yellow/green could have domain meaning then distinguish by more than hue alone

- saturation, brightness

original deutanope protanope tritanope

Job	Limit	Dist	Status	Ex Job	Job	Limit	Dist	Status	Ex Job	Job	Limit	Dist	Status	Ex Job	Job	Limit	Dist	Status	Ex Job
20,000	19.95			10,000	20,000	19.95			10,000	20,000	19.95			10,000	20,000	19.95			10,000
80,000	MKT			15,000	80,000	MKT			15,000	80,000	MKT			15,000	80,000	MKT			15,000
200,000	MKT			15,000	200,000	MKT			15,000	200,000	MKT			15,000	200,000	MKT			15,000
200,000	3P			85,000	200,000	3P			85,000	200,000	3P			85,000	200,000	3P			85,000
20,000	19.95	DOT		13,000	20,000	19.95	DOT		13,000	20,000	19.95	DOT		13,000	20,000	19.95	DOT		13,000
20,000	19.95	Port		17,000	20,000	19.95	Port		17,000	20,000	19.95	Port		17,000	20,000	19.95	Port		17,000
20,000	19.95	Job O		20,000	20,000	19.95	Job O		20,000	20,000	19.95	Job O		20,000	20,000	19.95	Job O		20,000
20,000	19.95	DOT		13,000	20,000	19.95	DOT		13,000	20,000	19.95	DOT		13,000	20,000	19.95	DOT		13,000
20,000	19.95	Port		17,000	20,000	19.95	Port		17,000	20,000	19.95	Port		17,000	20,000	19.95	Port		17,000
20,000	19.95	Job O		13,000	20,000	19.95	Job O		13,000	20,000	19.95	Job O		13,000	20,000	19.95	Job O		13,000
80,000	19.95	DOT		10,000	80,000	19.95	DOT		10,000	80,000	19.95	DOT		10,000	80,000	19.95	DOT		10,000
200,000	MKT			200,000	200,000	MKT			200,000	200,000	MKT			200,000	200,000	MKT			200,000
20,000	MKT	Job O		25,000	20,000	MKT	Job O		25,000	20,000	MKT	Job O		25,000	20,000	MKT	Job O		25,000

[Courtesy of Brad Paley]

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Color Constancy

relative judgements

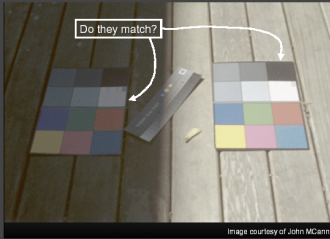


Image courtesy of John McCann

[courtesy of John McCann, from Stone 2001 SIGGRAPH course
graphics.stanford.edu/courses/cs448b-02-spring/04cdrom.pdf]

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Color Constancy

relative judgements

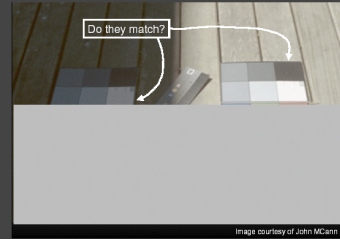


Image courtesy of John McCann

[courtesy of John McCann, from Stone 2001 SIGGRAPH course
graphics.stanford.edu/courses/cs448b-02-spring/04cdrom.pdf]

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Color Constancy

relative judgements



Image courtesy of John McCann

[courtesy of John McCann, from Stone 2001 SIGGRAPH course
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Color Constancy

relative judgements

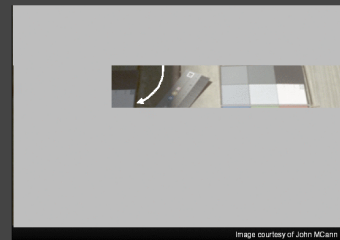


Image courtesy of John McCann

[courtesy of John McCann, from Stone 2001 SIGGRAPH course
graphics.stanford.edu/courses/cs448b-02-spring/04cdrom.pdf]

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Color Constancy

relative judgements

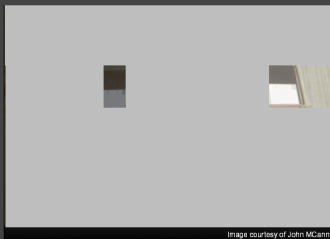


Image courtesy of John McCann

[courtesy of John McCann, from Stone 2001 SIGGRAPH course
graphics.stanford.edu/courses/cs448b-02-spring/04cdrom.pdf]

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Color Constancy

relative judgements

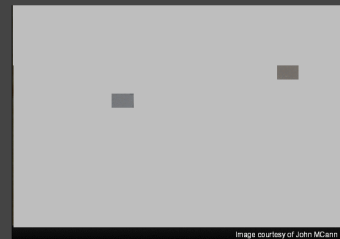


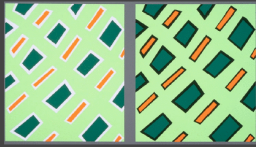
Image courtesy of John McCann

[courtesy of John McCann, from Stone 2001 SIGGRAPH course
graphics.stanford.edu/courses/cs448b-02-spring/04cdrom.pdf]

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Context Matters

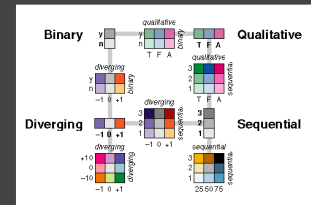
Bezold effect: outlines



[from Stone 2001 SIGGRAPH course
graphics.stanford.edu/courses/cs448b-02-spring/04cdrom.pdf]

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Cartographic Color Advice



[Brewer, www.personal.psu.edu/faculty/c/a/cab38/ColorSch/Schemes.html]

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Project Resources

Software

- Java
- Flash

Data

[www.cs.ubc.ca/~tmm/courses/cpsc533c-04-spr/resources.html]