CMPT 165
Color

June 19th, 2015

Admin

Midterm

- Monday June 29th is midterm
  - Topics covered: Unit 1-5 (including today's)
  - Bring photo ID (student ID)
  - Do not bring valuables, personal belonging will be asked to leave at front of lecture hall
  - Must not have electronic devices at all times during the exam
- Next Monday June 22: midterm prep. session
  - Bring pen + papers for practice questions
  - Hand-in ALL your answers at the end of class on 22nd for bonus credits toward midterm exam! ☺

Coursework

- Getting help
  - Please try your best to seek help during TA office hours
  - For help outside office hours, you need to give us advance notice (>2 days); no last-minute requests please
  - Upload all your pages/etc. and point us to the URLs, or attach them in your email

Role of colours in webpage design

- Visual design issues
  - Effective use of colors
  - Effective use of shapes
  - Visual flow
  - Design principles

- Usability design issues
  - Consistency
  - Minimalism
  - ….

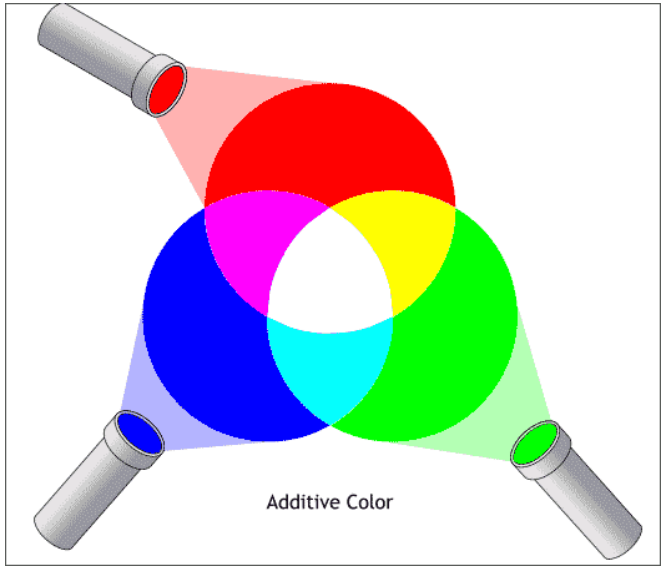
Today's Agenda

- Key terminologies
  - Luminance vs. brightness
  - Hue, saturation, value
  - Human's color perception: rods, cones, etc.
- RGB, HSV, HSL models
  - Color space, color gamut
  - Alternative ways to specify colours in CSS
- Colour theories
  - Colour wheel + choice of color schemes
  - Contextual and semantic meaning of colours

Colors and light

Recall the RGB model…

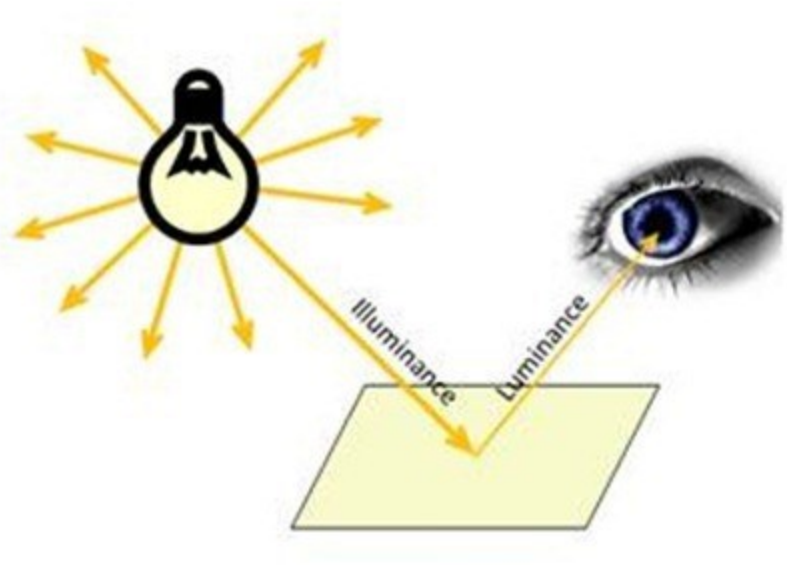
- turn off all 3 light sources → dark → black
- "additive": all 3 → white
- used in monitors and TVs

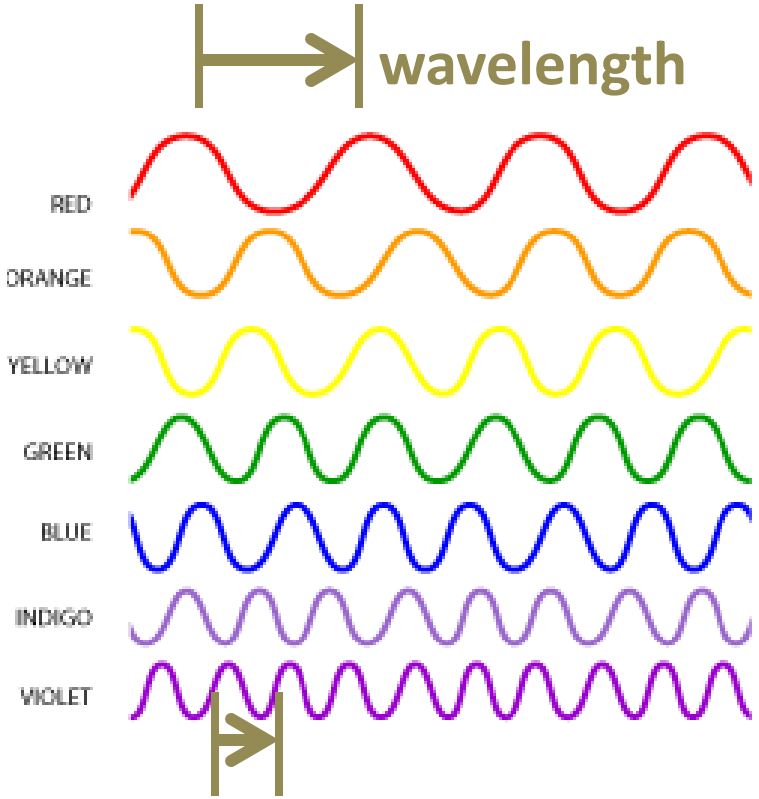


http://www.xaraxone.com/webxealot/workbook40/page_1.htm

How we perceive colors?

- Light waves are reflected off from surface
  - White surface: light waves of "all" **wavelengths** are reflected off the surface
  - Red surface: long wavelengths





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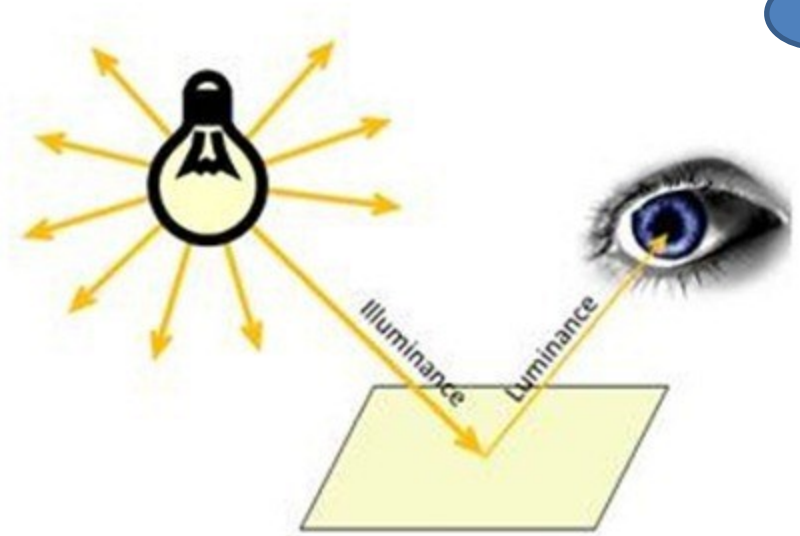
Perceiving light

- **Luminance**: the physical amount of light emitted from a surface
- **Brightness**: *perceived* amount of light
  - Perception involves…
    - signal processing (in brain)
    - interpretation



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Human's Visual System

Simplistic view, our eyes have two types of "sensors" (known as receptors):

- **Cones**: for bright-light vision/ day
  - photopic vision
- **Rods**: for low-light vision/ night
  - scotopic vision

Greek words:

- "Opia": condition of sight
- "photo": (day) light
- "skotos": darkness

"Mesopic": combination of the 2 visions

Images from https://en.wikipedia.org/wiki/Scotopic_vision

Example of vision under low light.
Top: Human, Bottom: Cat

Human's Visual System

Rods:

- 100 million
- only one wavelength sensitivity function

Cones:

- 6 million
- Focused in the centre of vision (fovea)
- 3 types: sensitivity functions peaks at different wavelengths (red, green, blue)

References

- "A Field Guide to Digital Color" A.K. Peters
- Slides from Dr. Makonin

Colors and light

RGB model:

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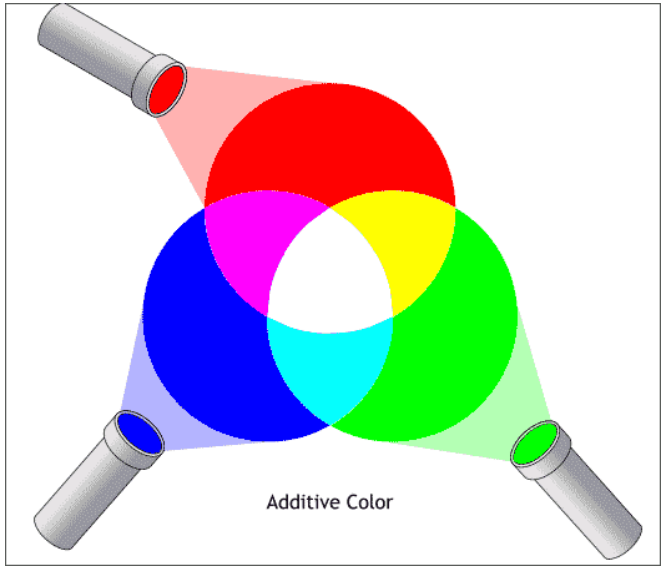

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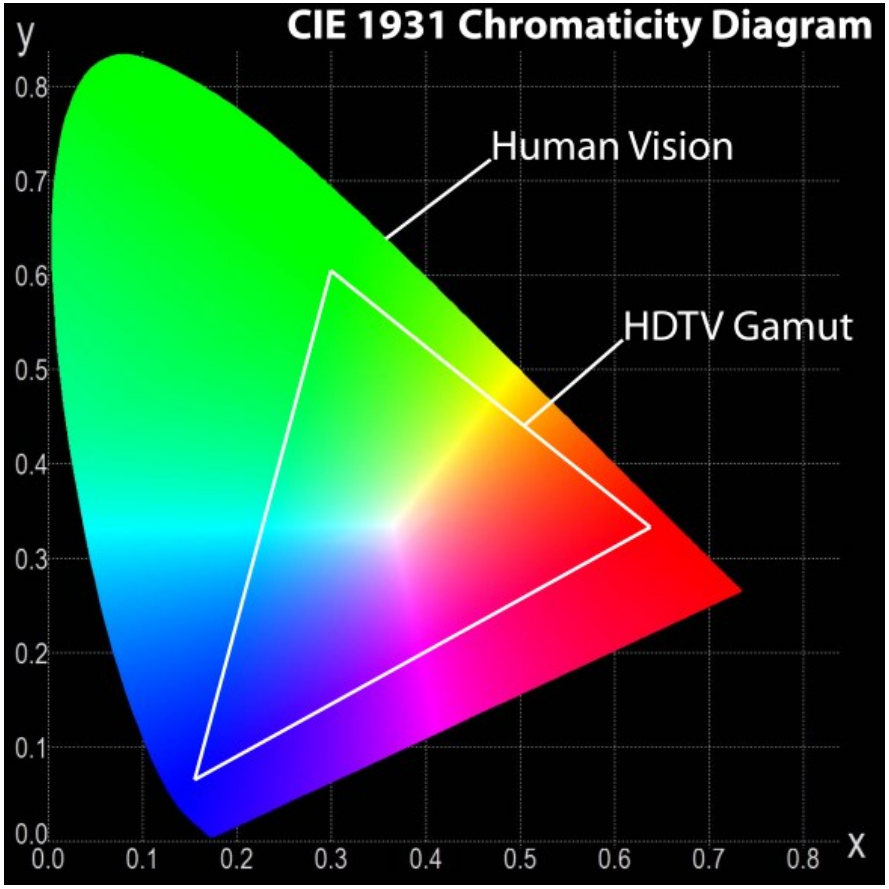
The “color gamut”

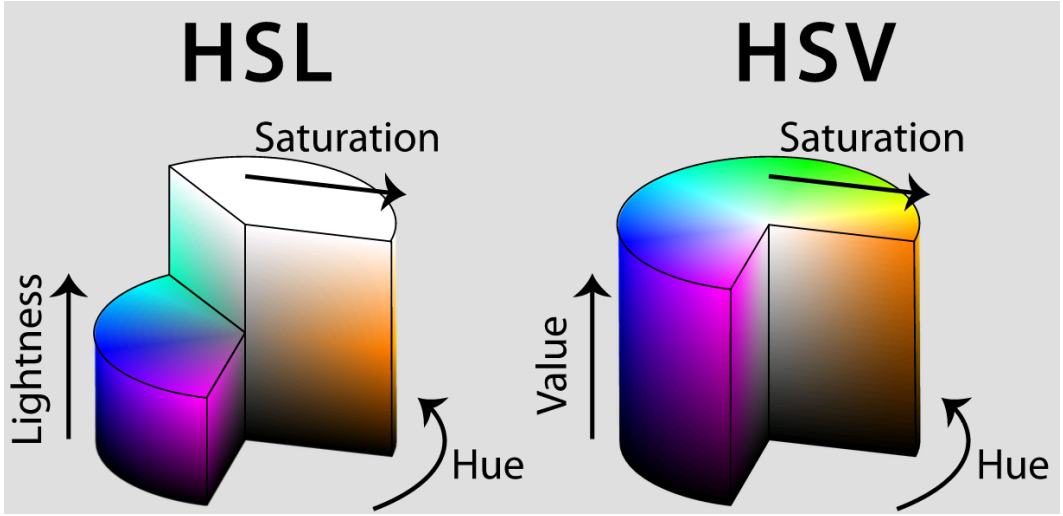
Color space



http://dotcolordotcom.files.wordpress.com/2011/10/cie1931gridedit1.png?w=584&h=584

Alternative representations: HSL+HSV

- Hue: color E.g. to describe blue: “pale blue", 'pastel blue”
- Saturation: vividness
  - E.g. “Washed out”
  - E.g. “Saturated red”: #FF0000
- Lightness/Value: refers to strength/intensity of emitted light



https://upload.wikimedia.org/wikipedia/commons/a/a0/Hsl-hsv_models.svg

RGB and HSL representations

Hue: [0,360]^{o} on a rainbow color wheel

Saturation: [0,100]%

100% is the full color

Lightness: [0,100]%

100% gives white

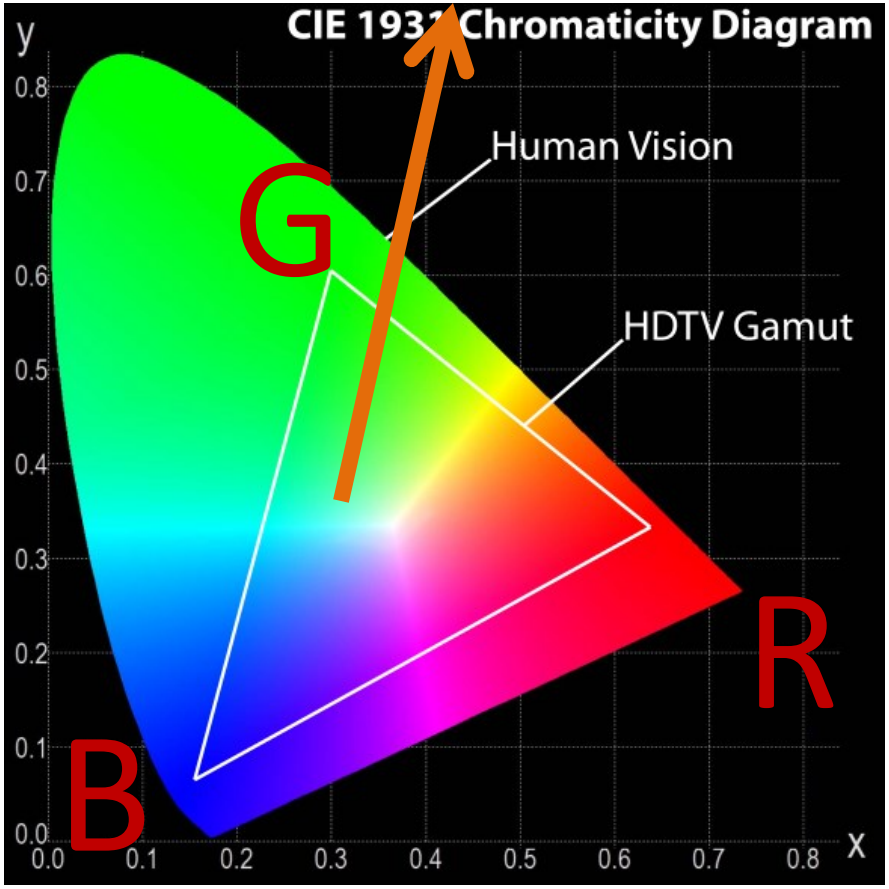
Try these RGB-HSL converters:

- http://www.workwithcolor.com/hsl-color-picker-01.htm
- http://hslpicker.com/#fff

(Image of color wheel taken from first link on right)

RGB and HSL representations

Increasing saturation in green



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RGB and HSL in CSS + CSS3

```
body {
        background-color: rgb(256,0,0);
}

h4 {      /* red with opacity */
        background-color: rgba(255, 0, 0, 0.3);
}

h1 {     /* green */
        background-color: hsl(120, 100%, 50%);
}

h2 {     /* dark green */
        background-color: hsl(120, 100%, 25%);
}

h3 {     /* dark green with opacity 0.3 */
        background-color: hsla(120, 100%, 25%, 0.3);
}
```

Color theory

- Literature on various complex theories

- 3 basic categories
  - Logical arrangement of colors: colour wheel
  - Aesthetics: color harmony
  - Context and use (related to cultures)

Web design: choice of color scheme

Don't pick colours randomly!

- 2 general schemes:

Dark on light. **Light on dark.**

- Various selection methods:
  1. Monochromatic Scheme
  2. Complementary Scheme
  3. Analogous Scheme
  4. …

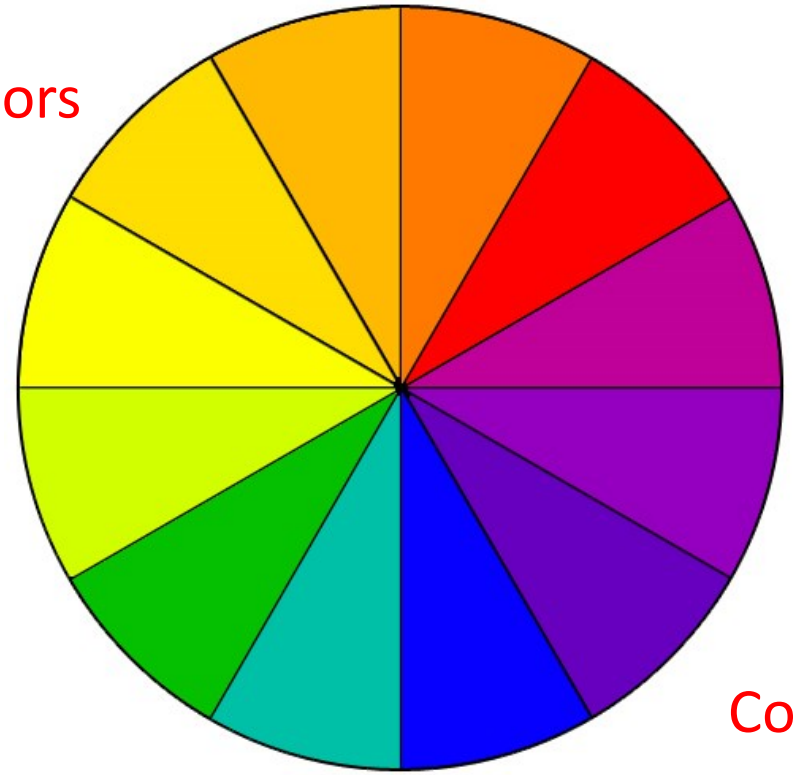
More details here:

1. http://www.tigercolor.com/color-lab/color-theory/color-theory-intro.htm
2. Slides from Dr. Makonin

Colours and their associations

- Colours associated with temperature

Warm colors



Cold colors

Image from

http://www.smashingmagazine.com/2010/02/08/color-theory-for-designer-part-3-creating-your-own-color-palettes/

Colours and its context

- Colours are often used symbolically, encode different information
- What's color for warning?
  - Red or Yellow (traffic signs)

- Cultural context:
  - E.g. Bad luck: Black + white in Asian cultures, etc.

- Western holiday colour themes?
  - Christmas?
    - red + green
  - Halloween?
    - Black + orange
  - Valentines?
    - Red + pink + white
  - Etc.

Summary

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