The presentations and assignments have been develop by the Georgia Tech HCI faculty over a period of years, and continue to evolve. Contributors include:

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Agenda

• How to characterize
• How? When? Why? of use
• Searching and highlighting
• Color palettes
• Color contrast
• Color associations
Characterizing Color - HSV Model

- **Hue**
  - basic color, pigment
- **Saturation**
  - relative purity, brightness, or intensity of a color
- **Value**
  - lightness or darkness of a color
- **Most commonly-used model**

*Image from: Adventures in HSV Space, Darrin Cardani, dcardani@buena.com*
HSV Color Space

- Typical color selection tools
Color - Reflected and Emitted

- We see the world via reflected color: light strikes a surface and is reflected to our eyes - properties of surface dictate color (printers, objects)
  - Subtractive color model - Cyan Magenta Yellow primaries

- Colors on CRT are emitted: light is generated by phosphors and emitted
  - Additive color model - Red Green Blue primaries
  - RGB doesn't correspond to how humans perceive color.
Color

- Monitors typically work on the RGB scheme
- 0–255 value each red, green, blue
- RGB doesn't correspond to how humans perceive color.

Dark cyan (red 0, green 255, blue 255)

add red to get...

Light cyan (red 200, green 255, blue 255)
Color

• Use it for a purpose, not to just add some color in
Your Screen?

I DESIGNED THE USER INTERFACE MYSELF. HOW DO YOU LIKE THE COLORS?

PUKE

FLU? INTERFACE DESIGN.
Color Guidelines

• Use color sparingly – design in b/w then add color where appropriate
  ▪ Thus use color as a redundant code
  ▪ Helps color-blind users
  ▪ For monochrome displays (not too many left :)
• Use color to:
  ▪ Draw attention
  ▪ Facilitate searching
  ▪ Communicate organization
  ▪ Indicate status
  ▪ Establish relationships
Color Guidelines

• Display color images on a black, white, or gray background

• Be sure foreground colors contrast (in both brightness and hue) with background colors

• Avoid using color in non-task related ways
How many small ovals?
Now how many small ovals?
Visual Exercise

• How many small objects?
• How many rectangles?
• How many orange objects?
How Many Small objects?
How Many Rectangles?
How Many Orange objects?
Visual Exercise

• Find the red letter

• Find the ‘A’
Find the Red Letter; Find the ‘A’
Find the Q and Z
Color Meanings: Contextually Specific

- Red
  - aggression, love, hot, warning, stop
- Pink
  - feminine, cute, cotton candy
- Orange
  - warm, autumn, Halloween
- Blue
  - cold, off, sadness

- Yellow
  - happy, caution, joy
- Brown
  - warm, fall, dirt, earth
- Green
  - go, on, safe, envy, lush, pastoral
- Purple
  - royal, sophisticated, Barney
Cultural Meanings of Color

• Red
  ▪ China: Good luck, celebration
  ▪ Cherokee: Success, triumph
  ▪ India: Purity
  ▪ South Africa: color of mourning
  ▪ Russia: Bolsheviks & Communism
  ▪ Eastern: worn by brides
  ▪ Western: excitement, danger, stop
Searching and Color

- Search for a particular item on a display
- Color generally faster
  - Shapes (60% faster)
  - Size (40% faster)
  - Brightness (40% faster)
  - Alpha characters (40% faster)
  - Letters (10% faster)
- An initial decrease in search time occurs as the first few colors are used, but then search times go up as more colors are added.
Accuracy and Color Coding

• Color is more accurate than some alternatives for coding:
  ▪ Shape (202% more accurate)
  ▪ Size (176% more accurate)
  ▪ Intensity (32% more accurate)

Accuracy and Color Coding

• Redundant coding increases discrimination
  ▪ Red triangle
  ▪ Green square

• Viewer cues on either code, results are:
  ▪ Brightness & color (104%)
  ▪ Size & brightness & color (61%)
  ▪ Size & color (60%)
Color Guidelines

• To express difference, use high contrast colors (and vice versa)

• Make sure colors do not “vibrate”
  ▪ Due to focal plane and relative wavelengths of light.

These colors vibrate: they will give you a headache
Color Palettes

• Color palette – set of colors used on one screen
• Choose color palette from HSV space by varying one or two of H, S, and V.
  ▪ Don’t vary hue, saturation and brightness at the same time.
• Unless want continuous tone or ‘artsy’ effect, best to use only 4-6 colors per screen
Color Palettes/Suites

- Designers often pick a palette of 4 or 5 colors

- Variations of 2 colors
- Monochromatic (variations of 1 color)
- Southwestern (culturally evocative)
Color Palettes

• Is black really black?
Effect of Colored Text on Colored Background

- Black text on white
- Gray text on white
- Yellow text on white
- Light yellow text on white
- Green text on white
- Light green text on white
- Blue text on white
- Pale blue text on white
- Dark red text on white
- Red text on white
- Rose text on white
Effect of Colored Text on Colored Background

- Black text on red
- Gray text on red
- Yellow text on red
- Light yellow text on red
- Green text on red
- Light green text on red
- Blue text on red
- Pale blue text on red
- Dark red text on red
- Rose text on red
Effect of Colored Text on Colored Background

<table>
<thead>
<tr>
<th>Text Color</th>
<th>Background Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black text</td>
<td>Dark blue</td>
</tr>
<tr>
<td>Gray text</td>
<td>Dark blue</td>
</tr>
<tr>
<td>Yellow text</td>
<td>Dark blue</td>
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<td>Light yellow text</td>
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<td>Blue text</td>
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<td>Pale blue text</td>
<td>Dark blue</td>
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<tr>
<td>Dark red text</td>
<td>Dark blue</td>
</tr>
<tr>
<td>Red text</td>
<td>Dark blue</td>
</tr>
<tr>
<td>Rose text</td>
<td>Dark blue</td>
</tr>
</tbody>
</table>
Effect of Colored Text on Colored Background

- Also important when colored text is shown on gray scale monitors or printed.

- “As can be seen from the green sector…”
Effect of Colored Text on Colored Background

- Not enough contrast between blue text and grey, textured background
- Side note: Inconsistency may cause user to puzzle over icons being different sizes
Effect of Colored Text on Colored Background

• Substituted black text for blue
• Increased contrast