

# Graphics Under the Hood

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## Outline

- Update on web graphics
- Understanding graphic quality issues
  - Color systems
  - Graphic file formats
  - Sharp and fuzzy images
  - Recommendations for technical documents

# Web Graphics

## Browser Support

- Word, FrameMaker, and all major browsers support
  - PNG
  - Transparent PNG
  - JPG
  - GIF
  - SVG with basic features
- HTML code  
``

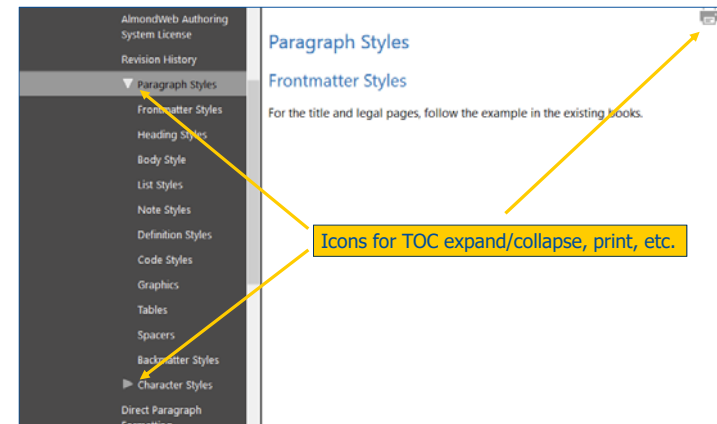
## Web Sprites (CSS Image Sprites)



- Old way: Each image is an independent graphic file
  - Example: 50 icons = 50 files
  - Browser loads 50 files (slow and jerky)
  - Customizer must edit 50 files
- New way: Combine all images ("sprites") in a single graphic file
  - 50 icons = 1 file
  - Browser loads 1 file (fast and smooth)
  - Customizer must edit 1 file
  - Used in WebWorks Reverb help format
  - Used in single-page HTML5 applications

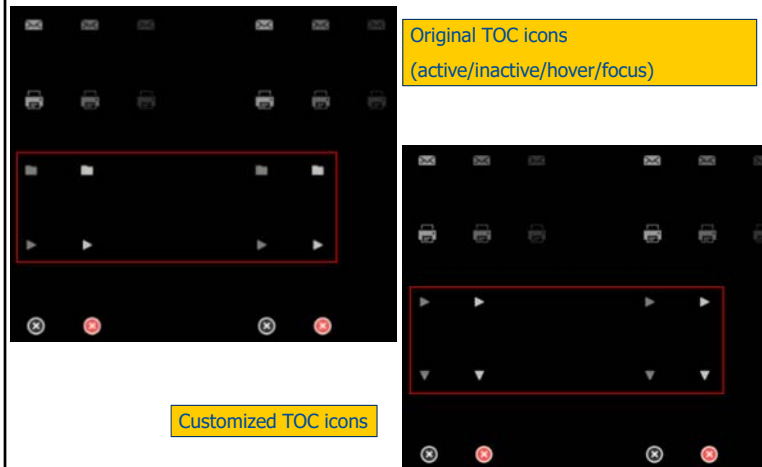
5

## Example: Customizing a WebWorks Skin



6

## Example: Customizing a WebWorks Skin



## CSS Code to Display Sprites



```
.ww_skin {  
    background-image: url('../connect/images/skin.png'); }  
    Define sprite file as a background image  
  
.ww_skin_toc_dropdown {  
    width: 16px; }  
    Crop the sprites to 16 x 12 pixels  
    height: 12px; }  
  
.ww_skin_toc_entry_selected > .ww_skin_toc_dropdown_closed {  
    background-position: -80px -896px; }  
    "Expand" sprite is at coordinates (80, 896) in file  
  
.ww_skin_toc_entry_selected > .ww_skin_toc_dropdown_open {  
    background-position: -80px -992px; }  
    "Collapse" sprite is at coordinates (80, 992) in file
```

8

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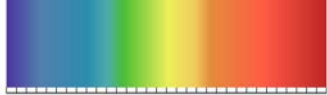
# Color Systems

9

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## Physical Spectrum of Light

- Spectrum of light contains "pure" colors
- The light we see is hardly ever a pure color



Full spectrum

Increasing Wavelength (Å) in nm →

"Daylight" fluorescent bulb

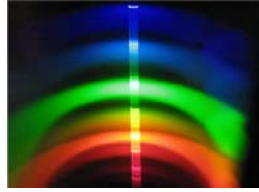


Image credits: <https://en.wikipedia.org/wiki/Light>, [https://en.wikipedia.org/wiki/Fluorescent\\_lamp](https://en.wikipedia.org/wiki/Fluorescent_lamp)

10

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## How the Eye Sees Color

- Eye has 3 color-sensitive receptors ("cone cells")
  - Reddish
  - Greenish
  - Bluish

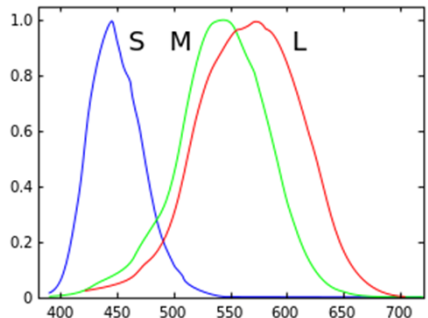



Image credit: [https://en.wikipedia.org/wiki/Cone\\_cell](https://en.wikipedia.org/wiki/Cone_cell)

11

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## How the Brain Perceives Color

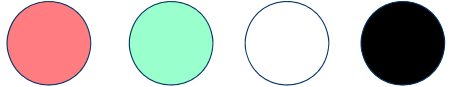
- Cones send signals to the brain
- The brain interprets as color
  - Bright pure red: RGB 255 0 0
  - Dark pure green: RGB 0 50 0
  - Brown: RGB 128 64 0



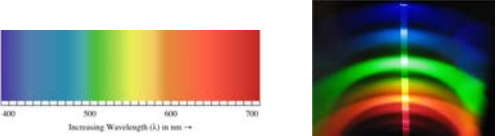
12

## Color perception is three-dimensional

- We perceive colors that do not exist in the spectrum



- But we perceive different spectra as the same color

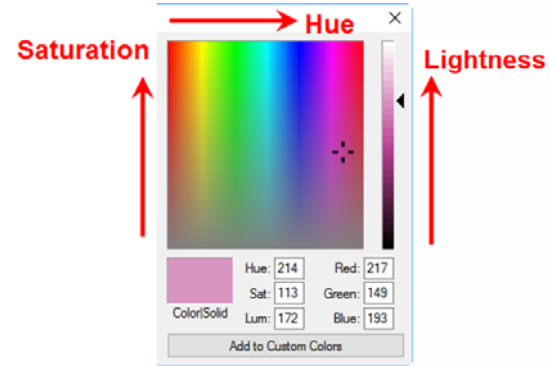


400 500 600 700  
Increasing Wavelength (λ) in nm →

13

## 3D Color Representations

- RGB: **R**ed **G**reen **B**lue (electronic representation)
- HSL (HSB/HSV): **H**ue **S**aturation **L**ightness (psychological)



14

## Using HSL to Select Tasteful Colors

- Vary H, while keeping SL or SB constant

S=255, L=128

H=0 RGB 255 1 1	H=75 RGB 65 255 1	H=150 RGB 1 122 255	H=225 RGB 255 1 182
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S=100, L=180

H=0 RGB 209 151 151	H=75 RGB 165 209 151	H=150 RGB 151 179 201	H=225 RGB 209 151 192
------------------------	-------------------------	--------------------------	--------------------------

15

## Color Depth

- 1-bit
  - 2 colors
- 8-bit
  - $2^8 = 256$  colors
  - Grayscale
- 24-bit
  - $2^{24} = 16.7$  million colors ("RGB", "true color")
- 32-bit
  - 24-bit RGB + transparency ("RGBA")

16

## Color Depth

24-bit (16 million colors), 4 kB

8-bit (256 colors), 3 kB

Grayscale, 3 kB

17

## RGBA Color

- A = alpha
- 0 = transparent, 255 = opaque

18

## Graphic File Formats

19

## Vector Formats


- A line is a line

6 pt, RGB 36, 220, 84

- File types:
  - SVG (web-friendly)
  - \*.ai, \*.dxf, \*.eps, \*.wmf, etc.
- Advantages:
  - Small files
  - Easy to draw by hand
  - Scalable
- Disadvantages:
  - Requires specialized editor, limited portability (except SVG)
  - Not suitable for photos, screen captures

20

## SVG Example




Original SVG image, size = 3 kb

```


<rect
  style="fill:#000000;stroke-width:0.26162291"
  y="49"
  x="49.514877"
  height="17"
  width="36.663689"
  id="rect10" />
<text
  transform="scale(0.99791545,1.0020889)"
  id="text22"
  y="68"
  x="93"
  style="color:#ff00ff"
  xml:space="preserve"
  id="text22" />

```

Editable




Scalable



21

## Bitmap Formats

■ A line is a set of points




( $x_n, y_n$ ): RGB 255 192 0

- File types
  - PNG, JPG, GIF (web-friendly)
  - BMP, TIFF
- Advantages:
  - Portable among all editors and viewers
  - Suitable for photos, screen captures, all images
- Disadvantages:
  - Large files
  - Hard to draw by hand
  - Hard to scale
- Resolution = dots per inch (DPI)
  - Modern screens display ~96 DPI

22

## Bitmap Example




Original BMP image, 44 kb

```

00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 6d 6d 6d ff ff ff ff ff ff ff ff ff
ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff

```

Scales with rough edges



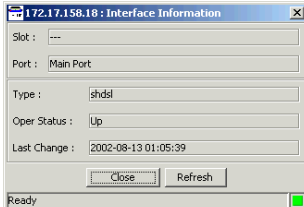
23

## Compression


- Uncompressed
  - Explicitly defines every pixel
  - Example: 400 x 300 pixels x 3 bytes/pixel = 360 KB
  - BMP
- Lossless Compression
  - RRBBBBBBBBBBBBGG -> 2R13B1G
  - 1-50 KB
  - PNG, GIF, TIFF
- Lossy Compression
  - Approximates the image (Fourier transform)
  - Removes sharp edges (high-frequency spatial variations)
  - 1-50 KB
  - JPG
  - Quality level: sharpness/file size compromise
  - Application-defined QL scale (typically 0-100)

24

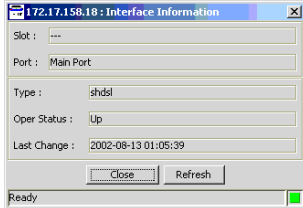
## Comparison of Compression Methods



PNG 24-bit, 4 kB




JPG 24-bit, 20 kB




GIF 8-bit, 15 kB

25


## 8X Zoom



PNG 24-bit

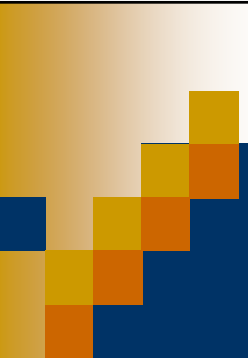


JPG 24-bit




GIF 8-bit

26


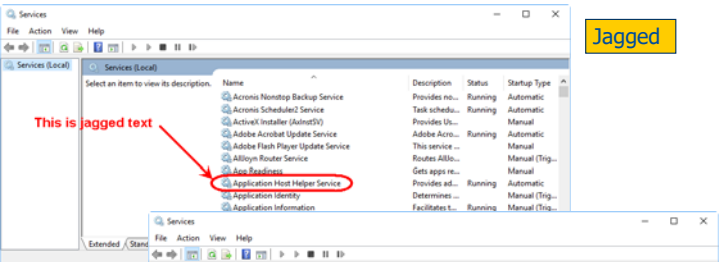



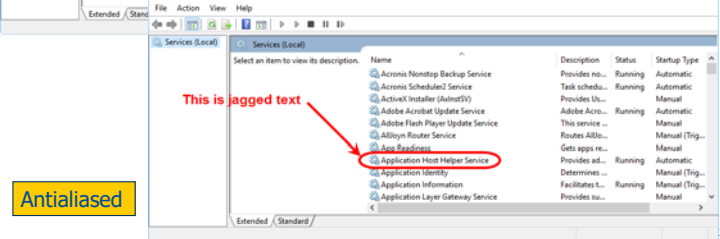
# Sharp and Fuzzy Images



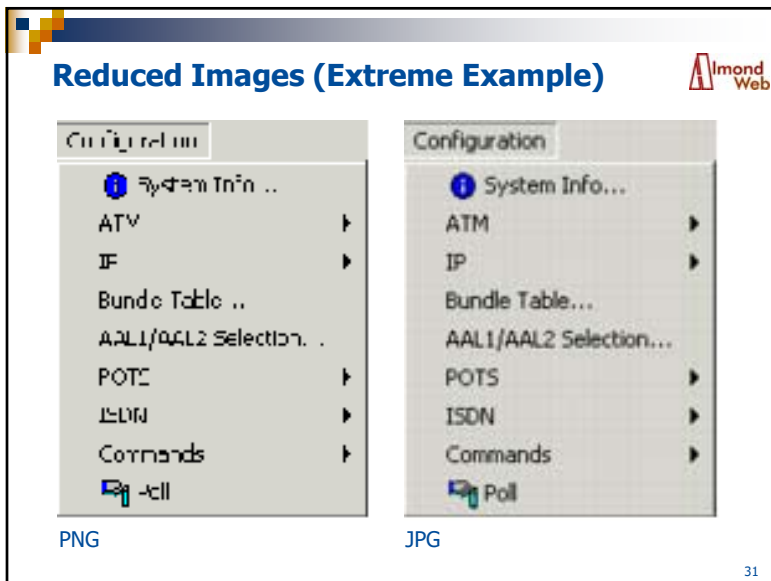
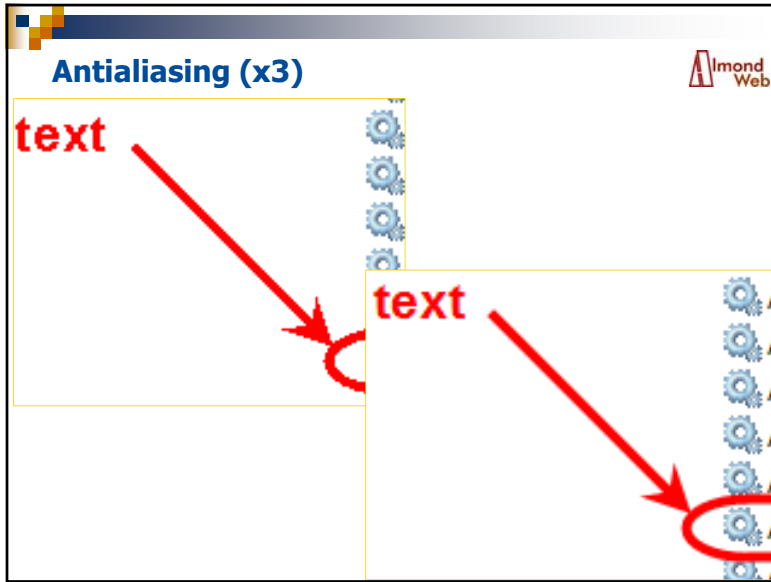
27

## Antialiasing (Smoothing)



28






**No Jagged Lines in DOCX (x5)** Imond Web

Aug 1, 2016

4PM

Service Edge

Tasks Clipboard



33

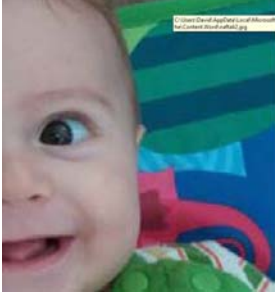
**PDF (Acrobat Distiller Standard)** Imond Web

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Service Edge

Tasks Clipboard



34


**PDF (Zip Compression)** Imond Web

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Service Edge

Tasks Clipboard



35

**PDF Image Compression Settings** Imond Web

- Standard
 

Color Images

Downsample: Bicubic Downsampling to 150 pixels per inch  
for images above: 225 pixels per inch

Compression: Automatic (JPEG)

Image Quality: Medium
- ZIP Compression
 

Color Images

Downsample: Off 150

Compression: ZIP

36

## Recommendations for Technical Documents

## Graphic Editors for Non-Artists

- Adobe Creative Cloud
  - \$2100 per year
- SnagIt, PaintShop Pro
  - \$40-\$65
- paint.net, GIMP
  - Free
  - Bitmap editor
  - Layers, transparency, RGBA color
- Inkscape
  - Free
  - Vector drawing
  - SVG output

## Software Screenshots

- PNG with 24-bit color
  - On mobile phones: only JPG is available
- Reduce window size before capturing
  - So you can reduce less in document
- Set up a good example
- Consider doc maintenance effort
- Consider localization costs

## Company Logos

- Start with a high-resolution PNG
- Reduce the size
- Test in the planned output formats
- Watch out for jagged edges
- To smooth: save as JPG or antialiased PNG

## Online Help



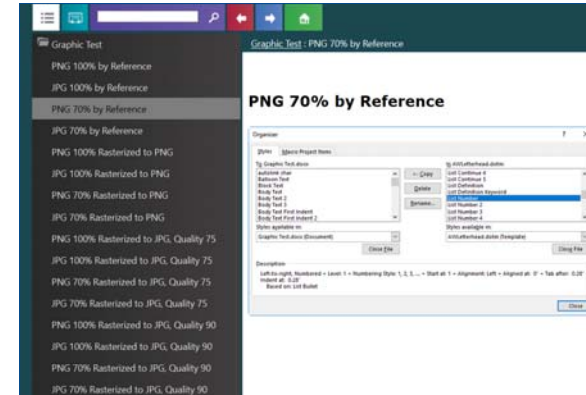
- Full-size graphics
  - Import image files by reference
- Reduced graphics
  - Import by reference
  - Or rasterize to high-quality JPG
  - Consider thumbnail links

41

## Testing Graphics in Online Help



- Example: WebWorks ePublisher output
- DOCX source contains full-size and reduced PNGs and JPGs



42

## Testing Graphics in Online Help (x8)



PNG imported by reference (18 kb)



PNG rasterized to PNG (43 kb)



PNG rasterized to JPG 75 (23 kb)



PNG rasterized to JPG 90 (33 kb)



JPG rasterized to JPG 90 (34 kb)



43

## Bottom Line



- There is no single best setting for all documents
  - Experiment!

44

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# Hidden Slides

45

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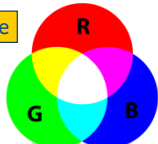
## CMYK Representation

- CMYK
  - Cyan Magenta Yellow Key (black)

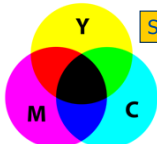


- Subtractive color
- Not equivalent to RGB
- For print, not for web

Additive



Subtractive




46

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## Color Resolution of Human Eye

RGB 51, 204, 51



- G = 224
- G = 204
- G = 204
- G = 194
- G = 184

Under ideal viewing conditions, eye can distinguish ± 2 color differences

47

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## Font Scaling

Bitmap font (MS Sans Serif)

Outline font (Verdana)

Font name: MS Sans Serif  
1234567890.;: " (!?) +-\*/=

Font name: Verdana  
Version: Version 5.32  
OpenType Layout, Digitally Signed, TrueType Outlines

12 The quick brown fox jumps over the lazy dog. 1234567890

18 The quick brown fox jumps over the lazy dog. 1234567890

24 The quick brown fox jumps over the lazy dog. 1234567890



36 The quick brown fox jumps over the lazy dog. 1234567890

48 The quick brown fox jumps over the lazy dog. 1234567890


60 The quick brown fox jumps over the lazy dog. 1234567890

72 The quick brown fox jumps over the lazy dog. 1234567890


### Repeated Lossy Compression (x5)



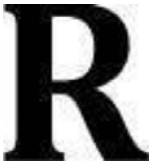
Original SVG



Saved as PNG





Saved once as JPG




Saved 4 times as JPG

49

### Repeated Lossy Compression (x12)



Saved once as JPG



Saved 4 times as JPG

50