Web Media

Chapter 6

Randy Connolly and Ricardo Hoar

Fundamentals of Web Development

Chapter 6

1 Digital Representations of Images

2 Color Models

3 Image Concepts

4 File Formats

5 Audio and Video

6 Summary

Chapter 6

1 Digital Representations of Images

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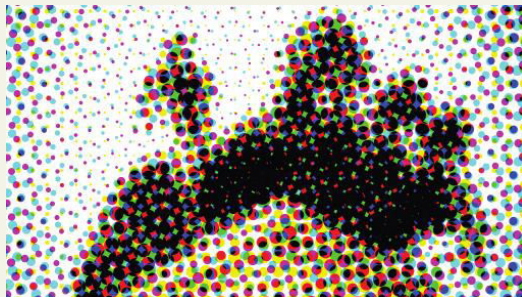
Digital Representation of Images

Digital compared to Print
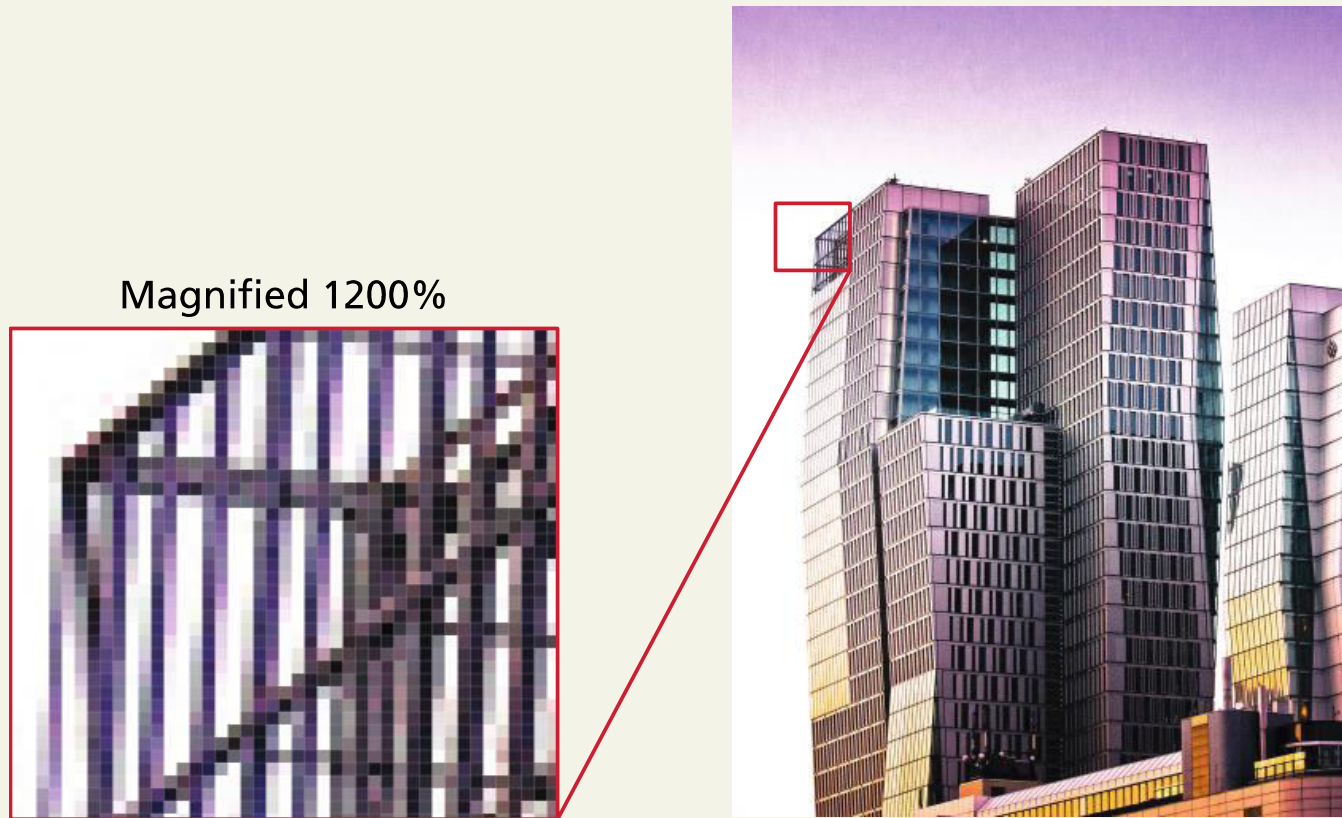

Original photographic image

Output as pixels
(size exaggerated)

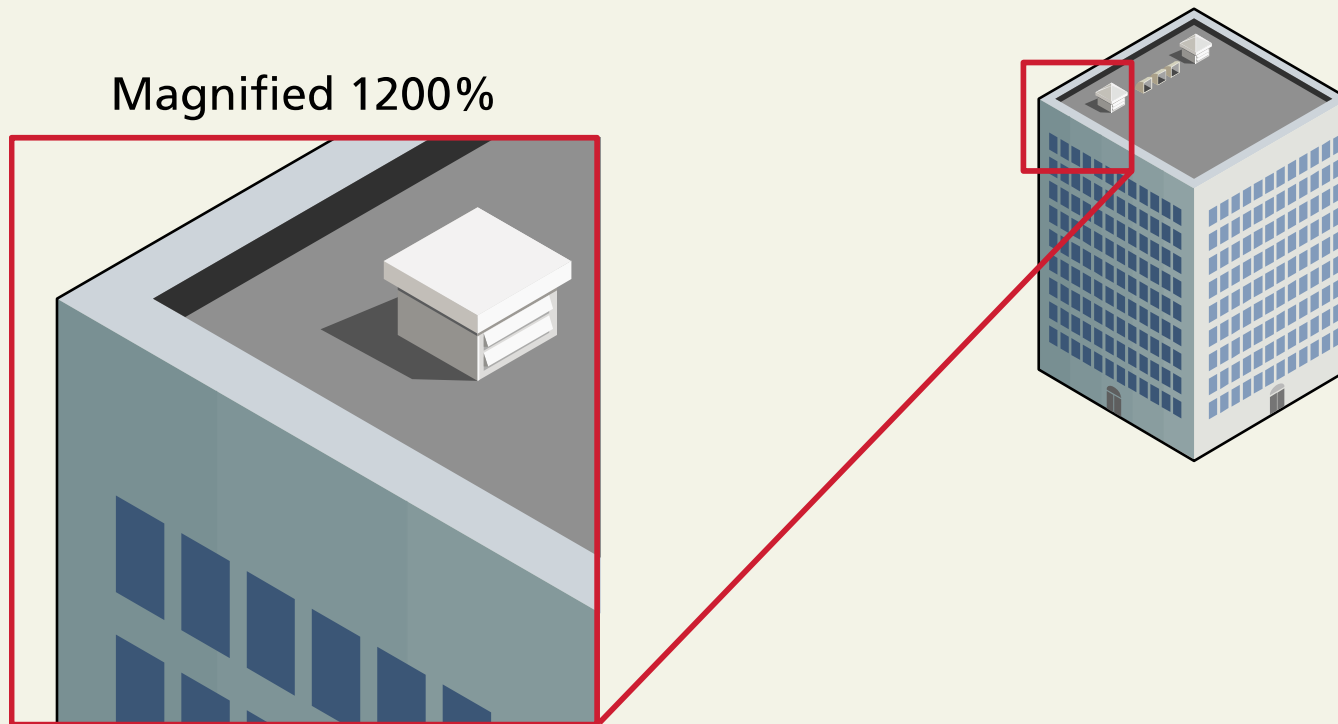Output as halftones
(size exaggerated)
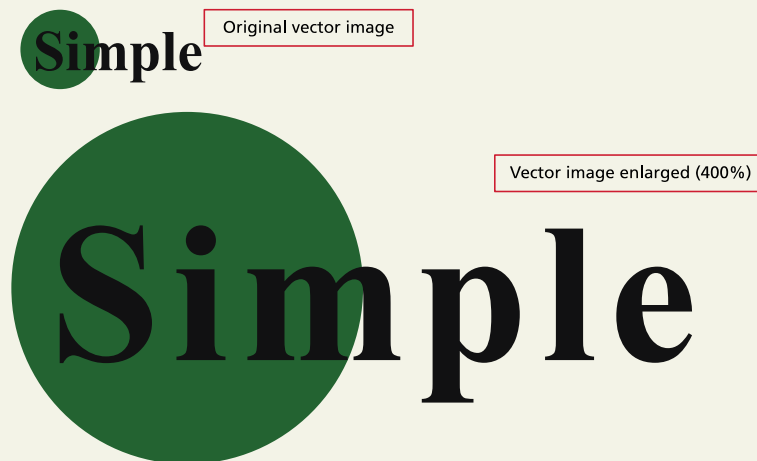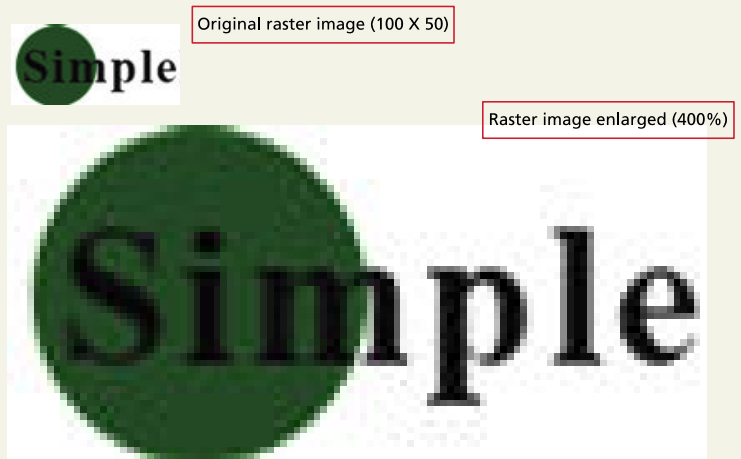
Digital Representation of Images

Raster

Magnified 1200%

Digital Representation of Images

Vector

Magnified 1200%

Digital Representation of Images

Resizing – an example

Original raster image (100 X 50)

Simple

Raster image enlarged (400%)

Simple

Original vector image

Simple

Vector image enlarged (400%)

Simple

Chapter 6

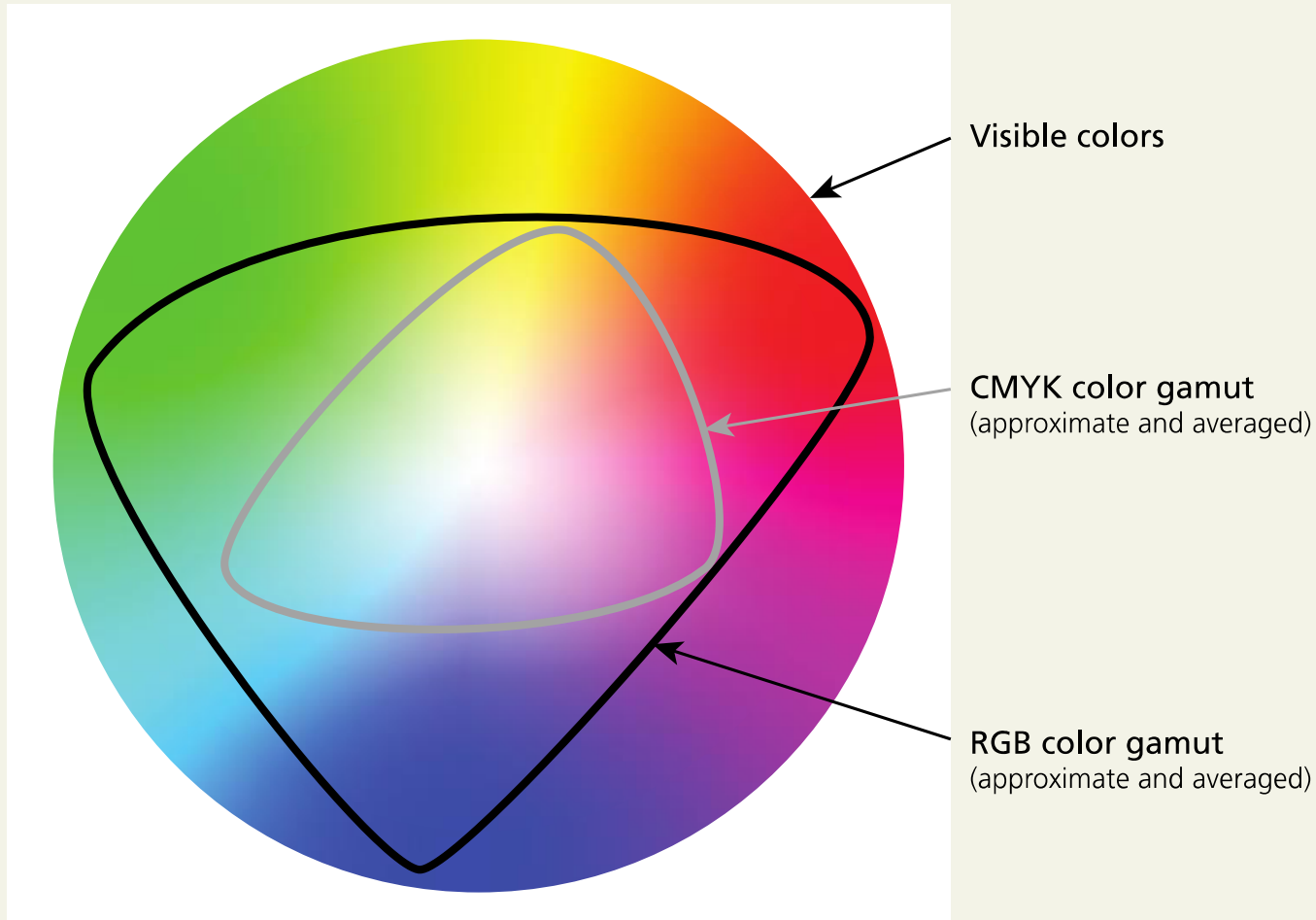|	
1 Digital Representations of Images	**2** Color Models
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Color Models

More than 1 model

Visible colors

CMYK color gamut
(approximate and averaged)

RGB color gamut
(approximate and averaged)

Color Models

RGB

Color Models

CMYK

Color Models

HSL

Color Models

Opacity

A   1.0

B   0.75

Opacity

C   0.5

D   0.25

Color Models

Opacity

A   1.0

B   0.75

Opacity

C   0.5

D   0.25
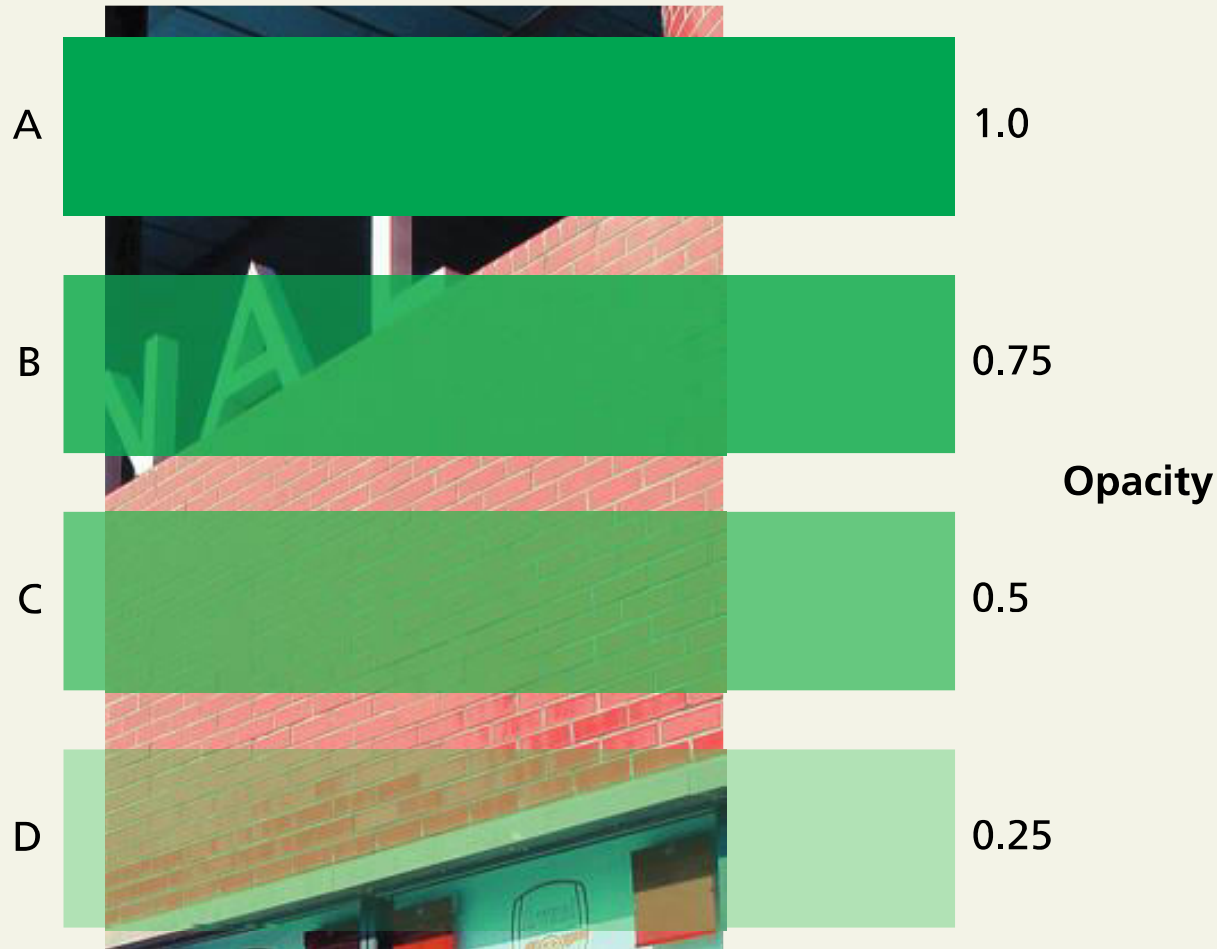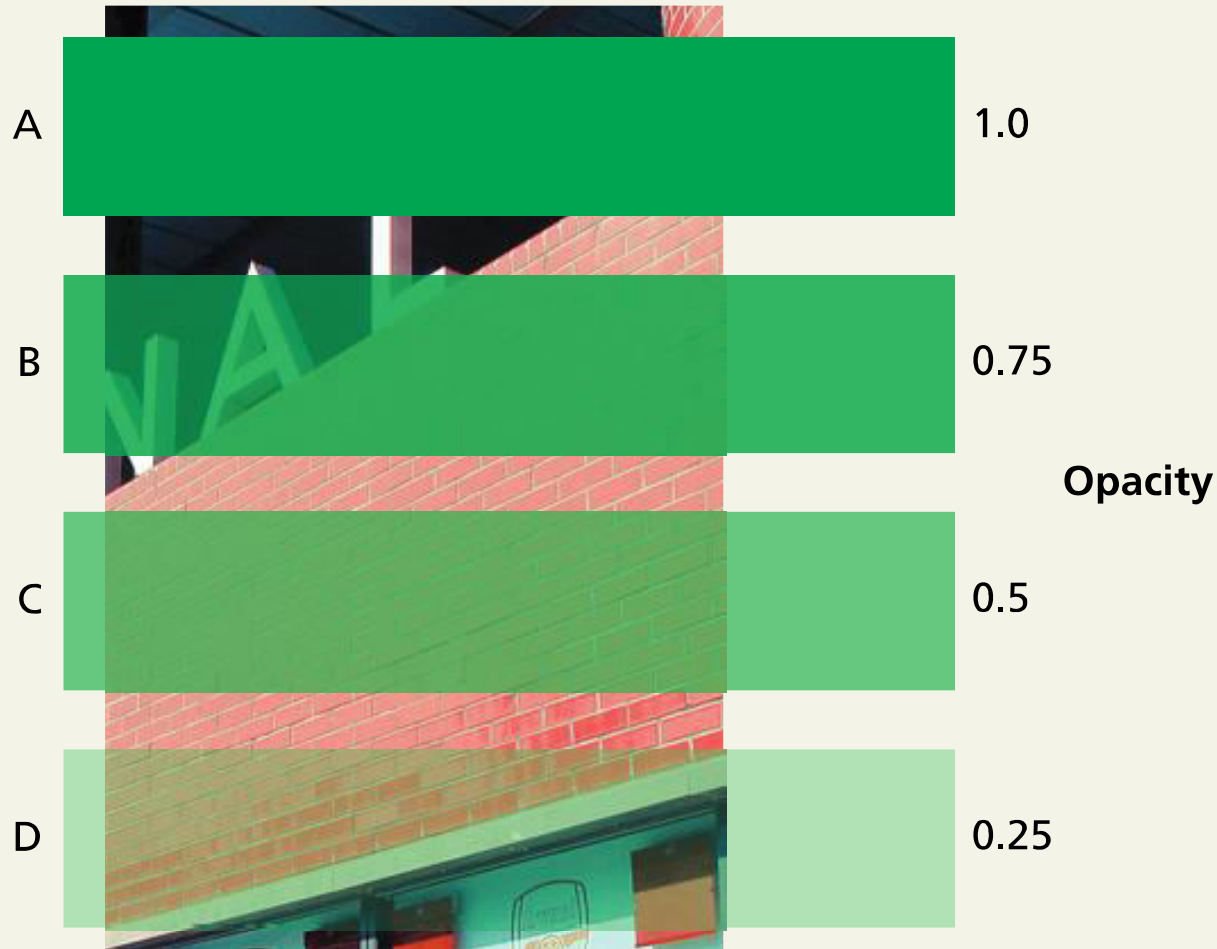
Color Models

Gradients

default
direction
is top to
bottom

A

color stop   color stop

`background-image: ``linear-gradient``(green, white);`

CSS function

B

destination direction
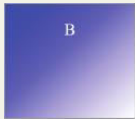
`background-image: linear-gradient(to top left, white, blue);`

C

angle   you can specify multiple color stops

`background-image: linear-gradient(90deg, green 50%, orange, blue);`

size of color stop

D

first a black stripe from 0 to 0.75em

`background-image: ``repeating-linear-gradient``(135deg, black 0, black .75em,`
`                  green 0, green 2em);`

then a green stripe from 0.75 to 2.75em

E

shape

`background-image: ``radial-gradient``(circle, yellow, red);`
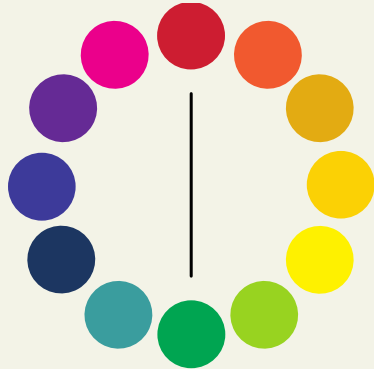
Color Models

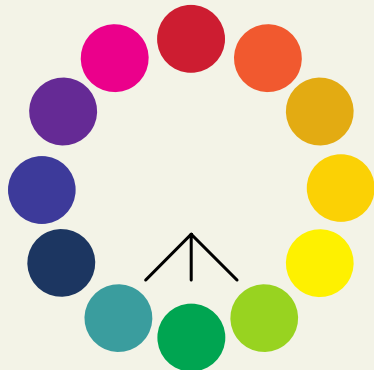Color Relationships - Wheel

Warmer colors

Cooler colors
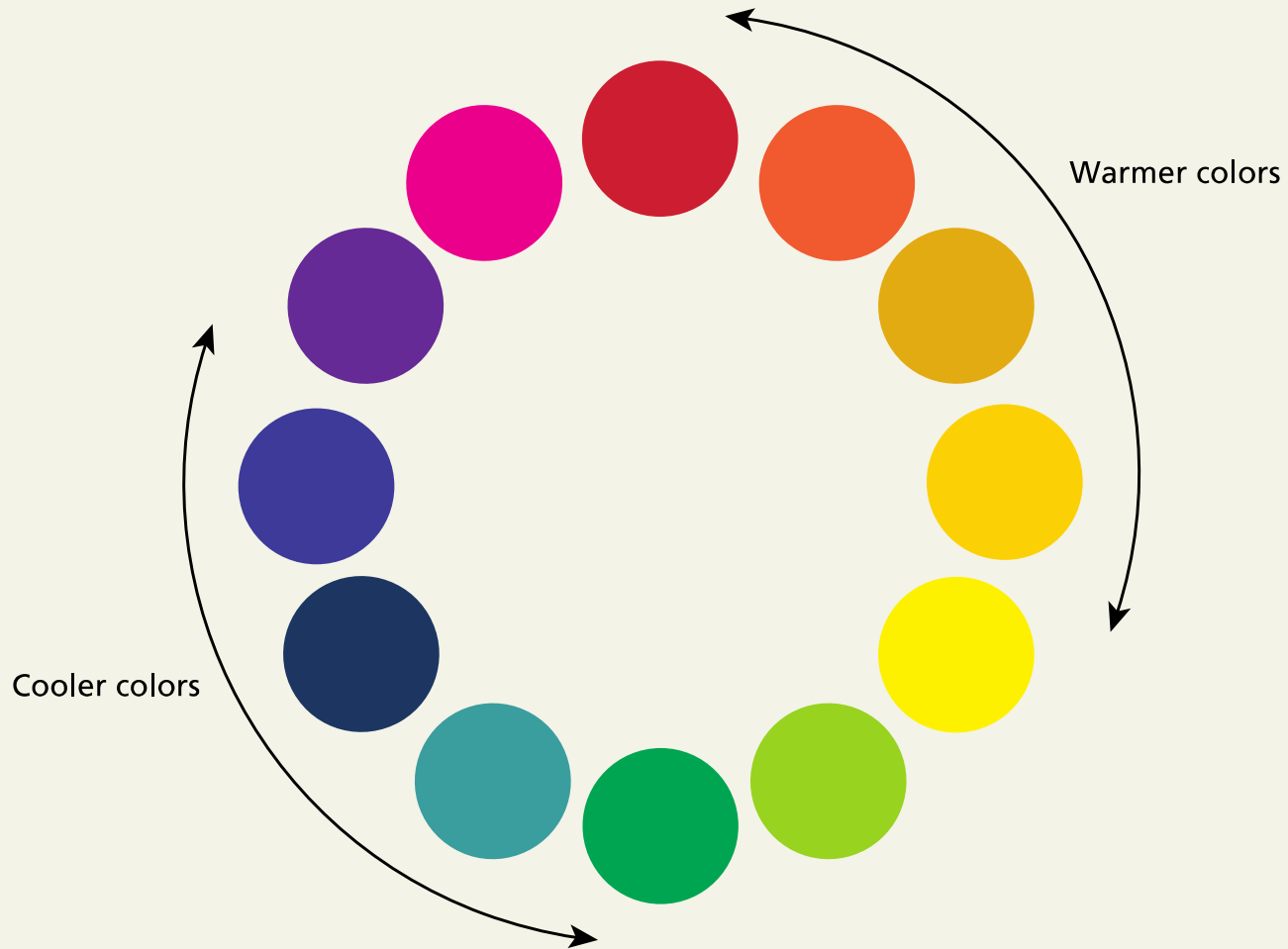
Color Models

Color Relationships

Complementary
These are color pairs that are on opposite ends of the color wheel. Complementary colors are highly contrasting and are believed to create a vibrant look. This scheme looks best when you place a warm color against a cool color.
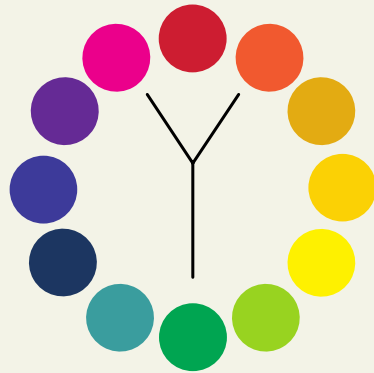
Analogous
These are colors that are adjacent to one another on the color wheel. Since they lack contrast, they match well and create serene and harmonious designs. One color can be used as a dominant color while others are used to enrich the scheme.
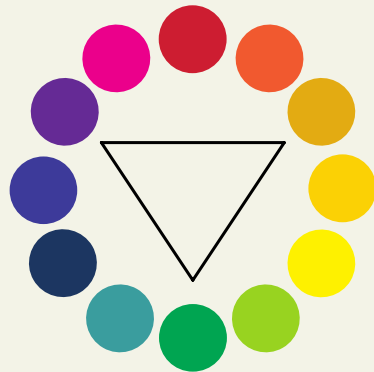
Color Models

Color Relationships

Split Complementary
It uses a primary color and the two colors on each side of its complementary color. This provides contrast but without the strong tension of the complementary scheme as well as providing some of the harmonies of an analogous scheme.
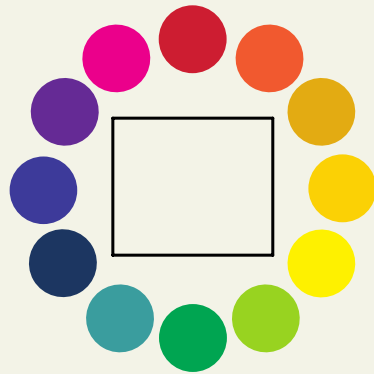
Triad
Uses three colors on the color wheel in an equilateral triangle. Tends to be quite vibrant, gives a strong visual contrast but still retains a harmony among the colors. Works best if one color is dominant and the two others are used as accent colors.

Color Models

Color Relationships

Tetradic (Rectangular)
Also called a double complement, since it combines two sets of complementary colors. This rich scheme can be hard to harmonize if all four hues are used in equal amounts, so only one or two of the four colors should be dominant.

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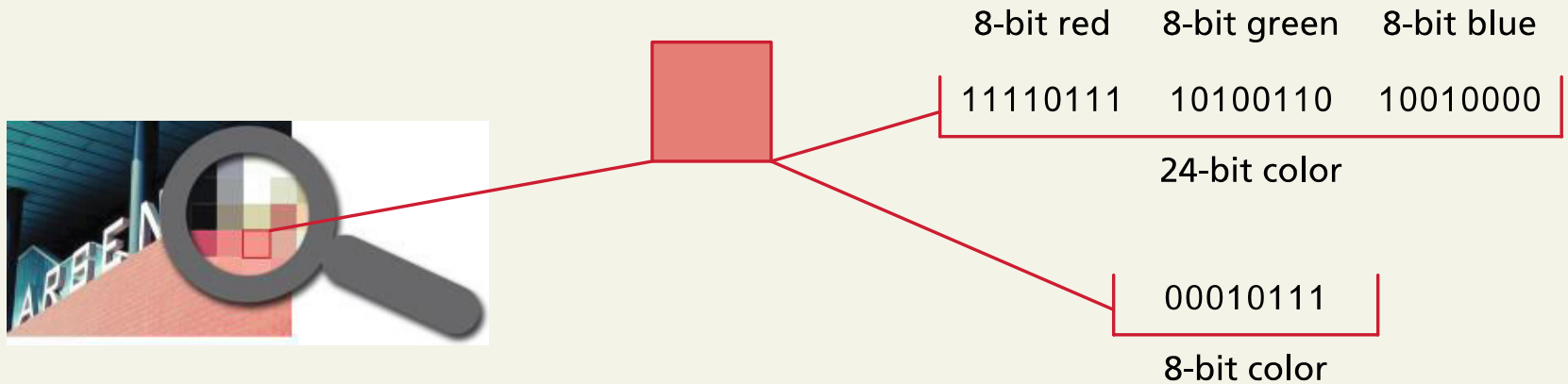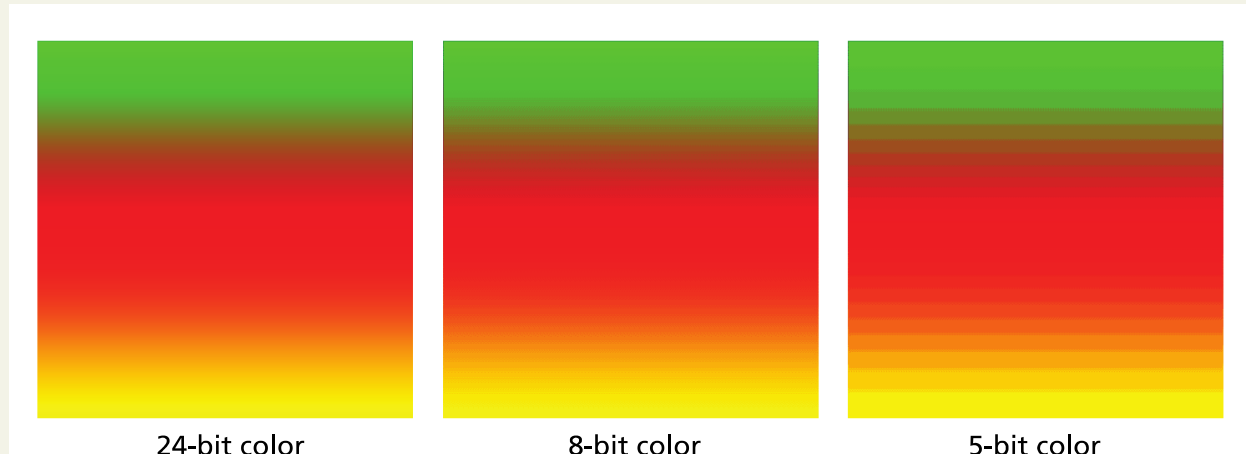|	
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Image Concepts

Color Depth

Color depth refers to the maximum number of possible colors that an image can contain.

8-bit red   8-bit green   8-bit blue

11110111   10100110   10010000

24-bit color

00010111

8-bit color

Image Concepts

Dithering

24-bit color   8-bit color   5-bit color

Notice the banding due to the dithering (dithering is more obvious on screen than on paper)

Image Concepts

Image Size

Raster images contain a fixed number of pixels; as such, image size refers to how many pixels it contains.

The size of an image onscreen is determined by the pixel dimensions of the image, the monitor size, and the computer's display resolution
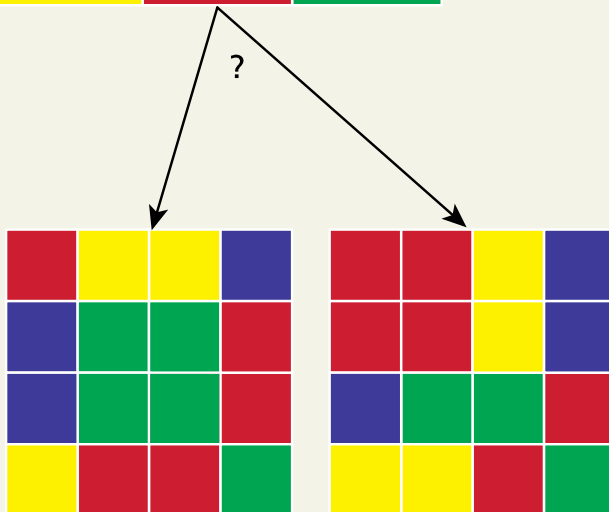
Whenever you resize (either larger or smaller) a raster image, the program doing the resizing must *interpolate*

Image Concepts

Image Size - Interpolate
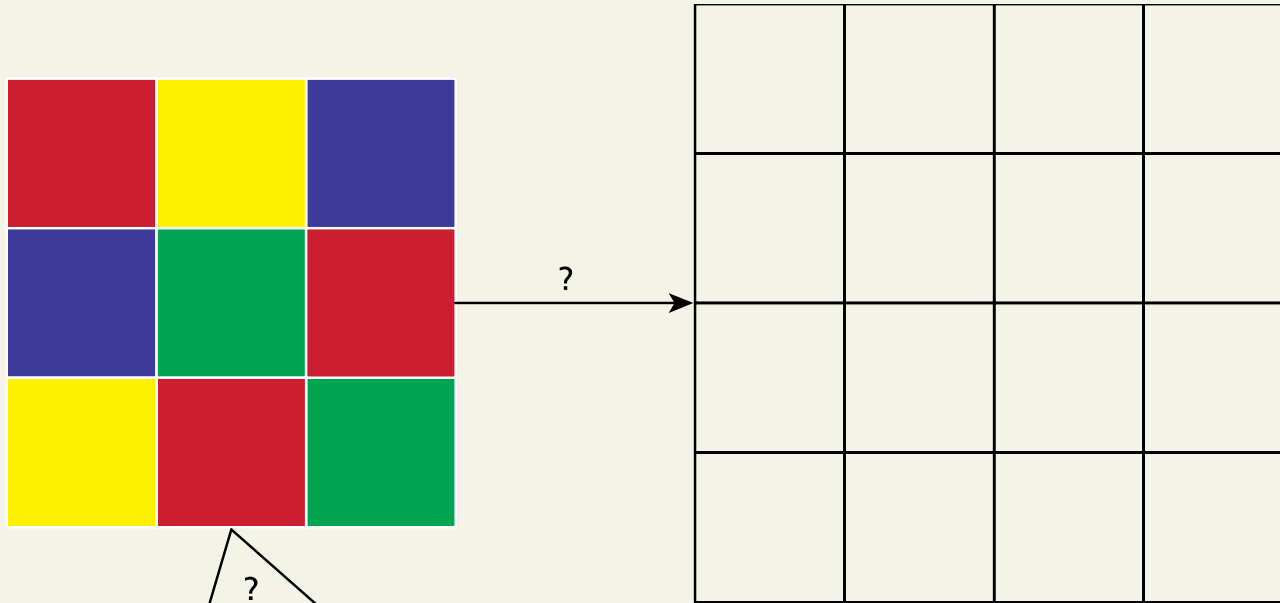
If we enlarge the 3×3 image on the left and make it a 4×4 image, what color should each square be?

There is no optimal interpolation solution to the problem of enlarging raster images.

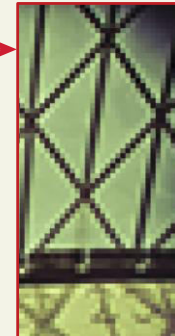Certain algorithms work better for certain types of images.

Image Concepts

Image Size - Interpolate

Enlarged using
bicubic interpolation
in Photoshop

Enlarged using nearest
neighbor interpolation
in browser

Image Concepts

Image Size - Enlarging versus reduction

Enlarging a small image a substantial amount will noticeably reduce its quality.

Decreasing the size of an image does reduce the quality as well, but it is not nearly as noticeable.

Image Concepts

Image Size – Enlarging in browser vs enlarging originals

Original (200 x 50)

Enlarged in browser via
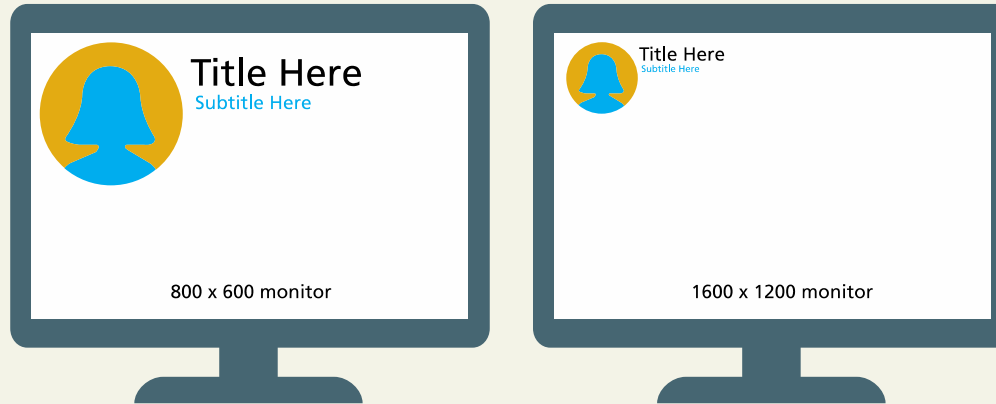`<img src="file.gif" width="600" height="150">`

Enlarged original (600 x 150)

By enlarging the artwork in the program that it was originally created in
(i.e., by increasing/decreasing the font and object sizes), the quality is maintained.
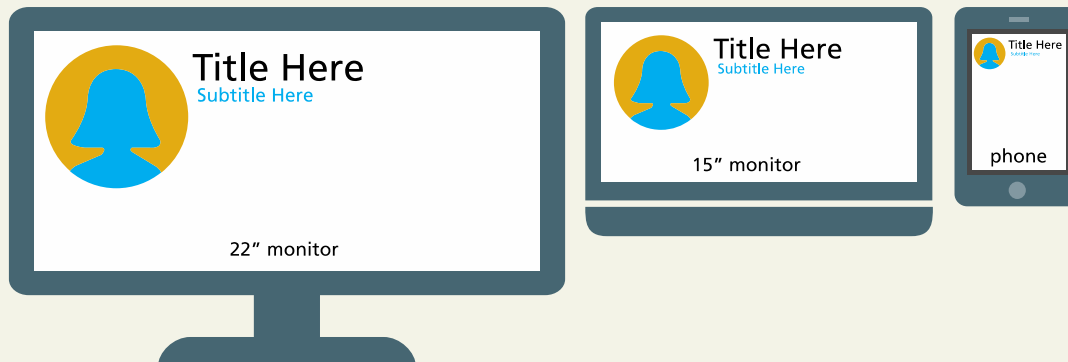
Image Concepts

Display Resolution

Effect of display resolution

Title Here
Subtitle Here

800 x 600 monitor

Title Here
Subtitle Here

1600 x 1200 monitor

Effect of monitor size

Title Here
Subtitle Here

22" monitor

Title Here
Subtitle Here

15" monitor

Title Here
Subtitle Here

phone

Chapter 6

File Formats

JPEG

JPEG (Joint Photographic Experts Group) or JPG is a 24-bit, true-color file format that is ideal for photographic images

- lossy compression

- can create artifacts

Notice the noise artifacts at high contrast areas and in areas of flat color.

File Formats

JPEG

Original = 931 K

JPG Quality 100 = 335 K

JPG Quality 60 = 136 K

JPG Quality 30 = 77 K

JPG Quality 10 = 52 K

File Formats

JPEG

original

Saved as jpg

Notice the noise and artifacts!

File Formats

GIF

The GIF (Graphic Interchange Format) file was the first image format supported by the earliest web browsers.

- pronunciation controversy

- GIF is an 8-bit or less format, meaning that it can contain no more than 256 colors.
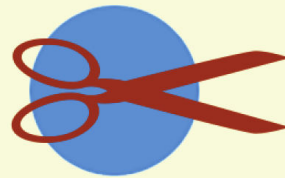
- Not great for photos

File Formats

GIF

GIF = 181 K

JPEG = 104 K

GIF = 23 K

JPEG = 40 K

File Formats

GIF (Run length compression)

Pixels								
Color value								
23	23	23	23	12	12	88	143	23

Simplified file representation

| 4 | 23 | 2 | 12 | 1 | 88 | 1 | 143 | 1 | 23 |

\| # pixels \| color
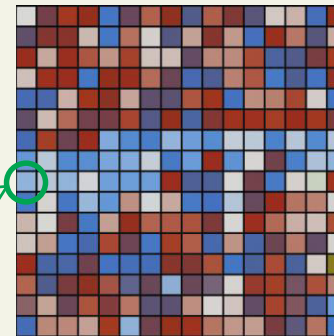
Sample file sizes

GIF = 6.7 K   GIF = 11.5 K   GIF = 56 K
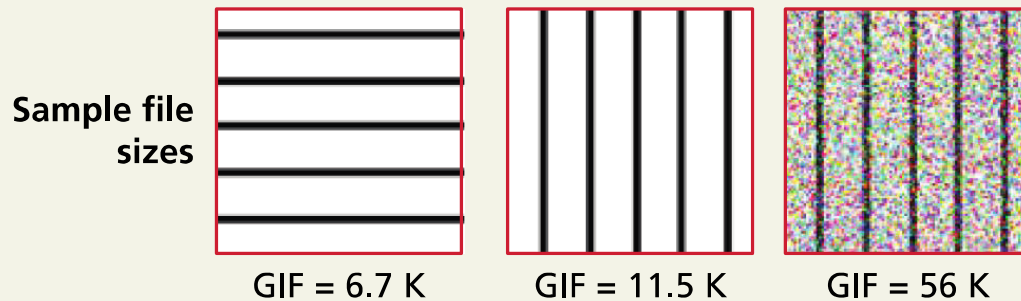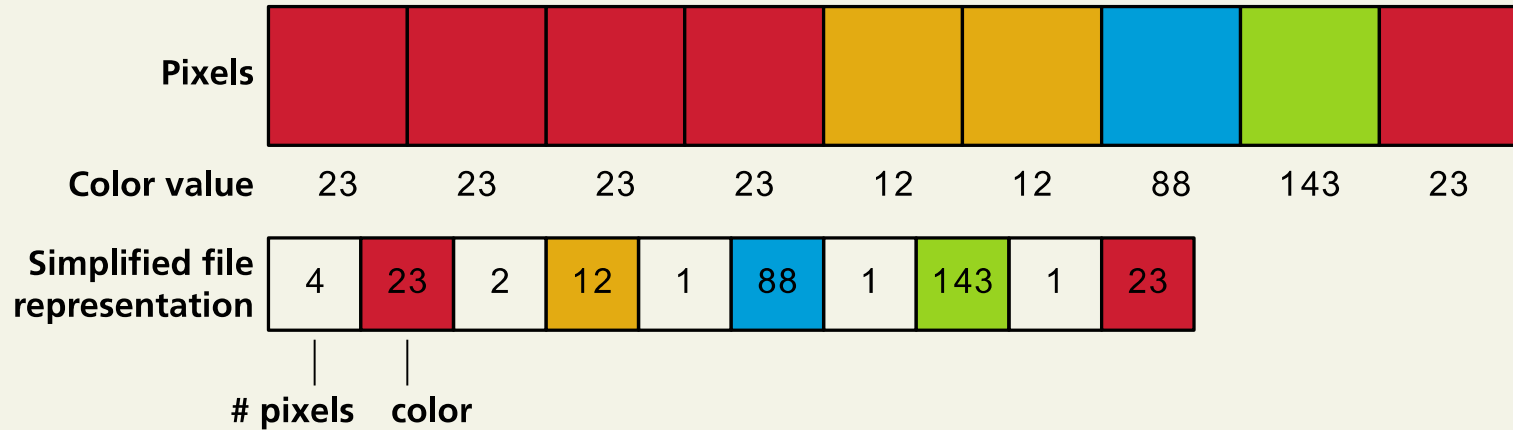
File Formats

GIF (Pallete)
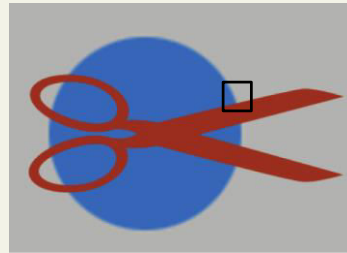
256-color palette = 8 bits per pixel
file size = (100000 pixels x 8) / 8 = 10 K)
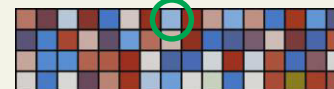
Indexed 8-bit color
value in file:
128 = 10000000

Position 128 in palette
color definition = 00000001 00000111 11111010
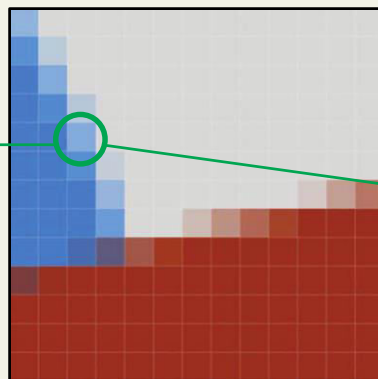
Indexed 6-bit color
value in file:
7 = 000111
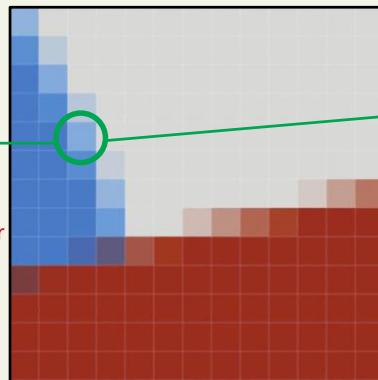
Position 7 in palette
color definition = 00000001 00000111 11111010
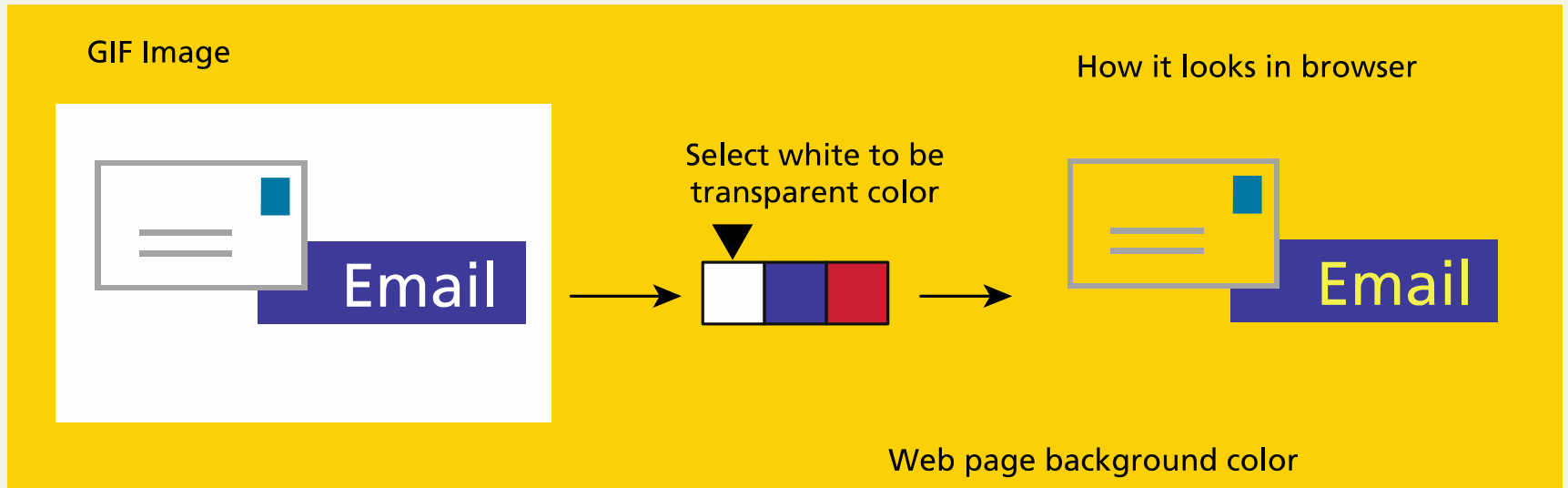
64-color palette = 6 bits per pixel
file size = (100000 pixels x 6) / 8 = 7.5K)

File Formats

GIF (Transparency)

GIF Image

How it looks in browser

Select white to be transparent color

Email

Web page background color

File Formats

GIF (Transparency)

Original GIF

The visual effect we want

What we actually see in the browser

Halo effect

The halo looks like it is the same color as the transparent background, ...
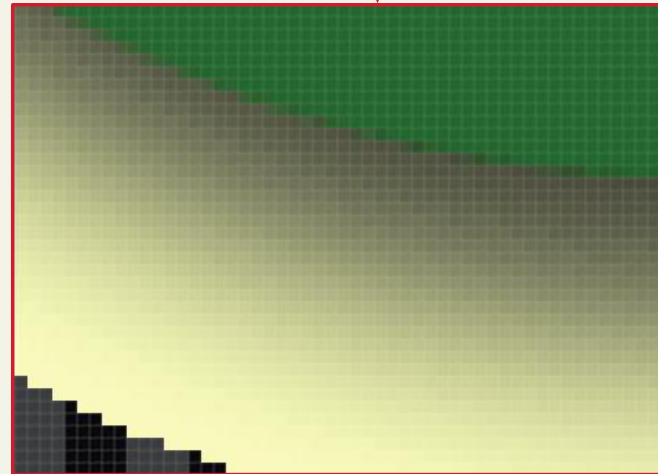
... but in reality, the anti-aliased edge contains pixels that transition to the background color.

Transparent color

Image background

The reason we get the halo effect is that GIF only allows a single color to be transparent. For images with anti-aliased edges, against a contrasting background, we will get a "halo."
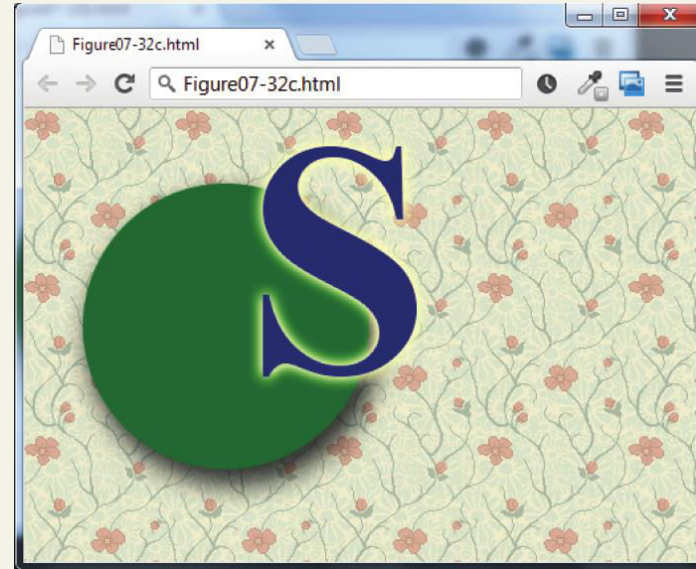
File Formats
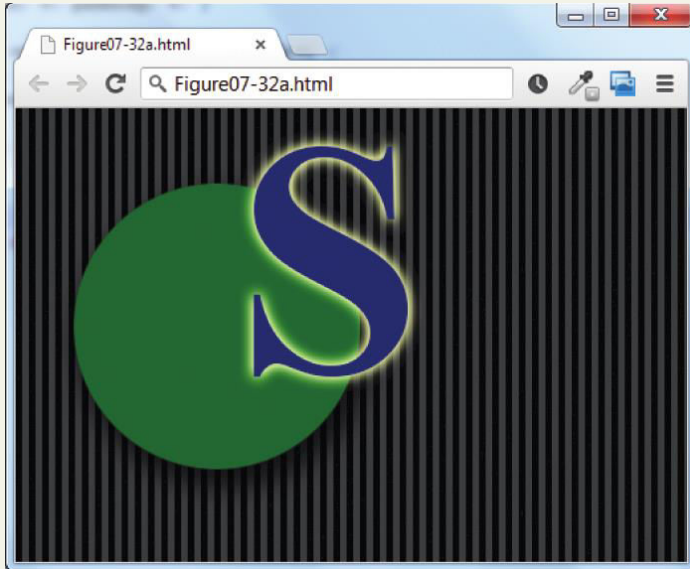
PNG
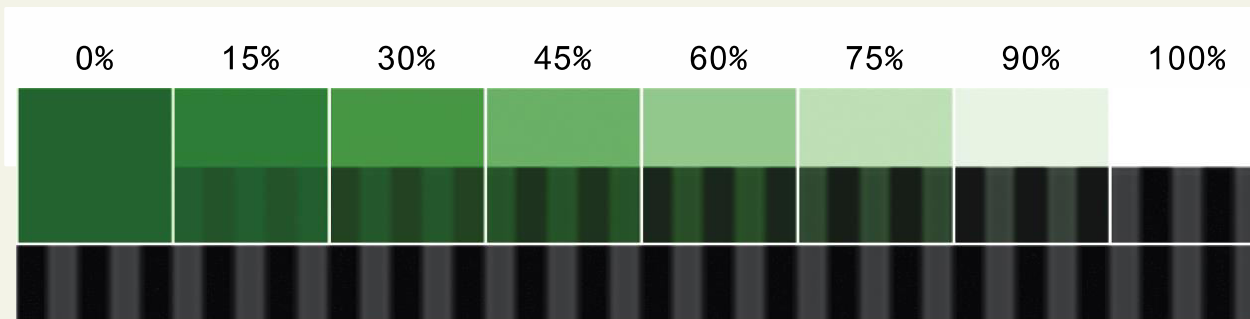
Portable Network Graphics

- Lossless compression.

- 8-bit (or 1-bit, 2-bit, and 4-bit) indexed color as well as full 24-bit true color (higher color depths are supported as well).

- From 1 to 8 bits of transparency.

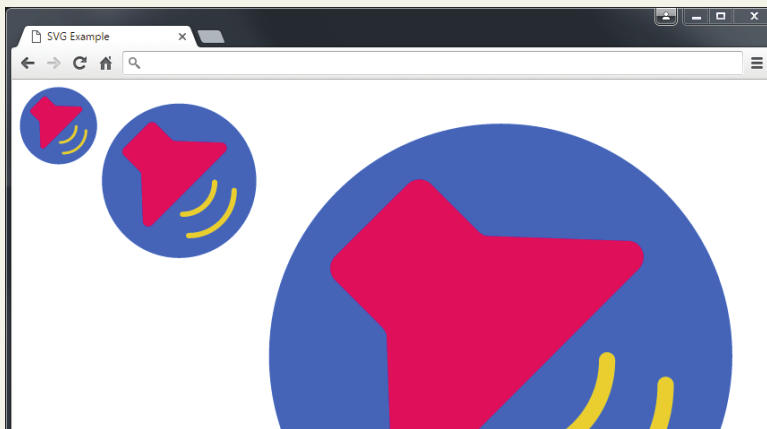# File Formats

PNG

PNG format with 256 levels of transparency

Transition showing six levels of transparency

File Formats

SVG

Scalable Vector Graphics


```
<img src="speaker.svg" width="100"/>

<img src="speaker.svg" width="200"/>

<img src="speaker.svg" width="600"/>
```

Because SVG is a vector format, there is no loss of quality when it is resized

```xml
<?xml version="1.0" encoding="utf-8"?>
<svg version="1.1" id="Layer_1" xmlns="http://www.w3.org/2000/svg" xmlns:xlink="http://www.w3.org/1999/xlink" x="0px" y="0px"
     viewBox="0 0 95 94" style="enable-background:new 0 0 95 94;" xml:space="preserve">
<style type="text/css">
    .st0{fill:#366BC9;}   .st1{fill:#E0105B;}    .st2{fill:#EFCE4A;}
</style>
<path class="st0" d="M92.7,46.9c0,25.1-20.4,45.5-45.5,45.5C22.1,92.4,1.7,72,1.7,46.9c0-25.1,20.4-45.5,45.5-45.5
    C72.3,1.4,92.7,21.8,92.7,46.9L92.7,46.9z M92.7,46.9"/>
<path class="st1" d="M42.8,22.5l-9.2-9.2c-1.3-1.3-3.4-1.3-4.7,0L14.7,27.4c-1.3,1.3-1.3,3.4,0,4.7l9.2,9.2c0.4,0.4,0.7,0.9,0.9,1.5
    l1,28.6c0.6,2.5,3.7,3.3,5.5,1.5l43-43c1.8-1.8,1-4.9-1.5-5.5l-28.6-1C43.7,23.2,43.2,22.9,42.8,22.5L42.8,22.5z M42.8,22.5"/>
<path class="st2" d="M51.7,80.3c-0.3-0.3-0.5-0.7-0.5-1.1c0-0.9,0.7-1.6,1.6-1.6C66.7,77.7,78,66.4,78,52.6c0-0.9,0.7-1.6,1.6-1.6
    c0.9,0,1.6,0.7,1.6,1.6c0,15.6-12.7,28.2-28.2,28.2C52.4,80.8,52,80.6,51.7,80.3L51.7,80.3z M51.7,80.3"/>
<path class="st2" d="M48.1,67.8c-0.3-0.3-0.5-0.7-0.5-1.1c0-0.9,0.7-1.6,1.6-1.6c9.5,0,17.3-7.8,17.3-17.3c0-0.9,0.7-1.6,1.6-1.6
    c0.9,0,1.6,0.7,1.6,1.6c0,11.3-9.2,20.4-20.4,20.4C48.8,68.2,48.4,68,48.1,67.8L48.1,67.8z M48.1,67.8"/>
</svg>
```

SVG is compressed XML

File Formats

Other Formats

The TIF (Tagged Image File) format is a cross-platform lossless image format that supports

- multiple color depths, 8-bit transparency, layers and color channels, the CMYK and RGB color space, and other features especially useful to print professionals.

WebP is a new image file format promoted by Google. It supports both lossy and lossless compression, and Google claims WebP compression results are superior in comparison to JPG or PNG formats.

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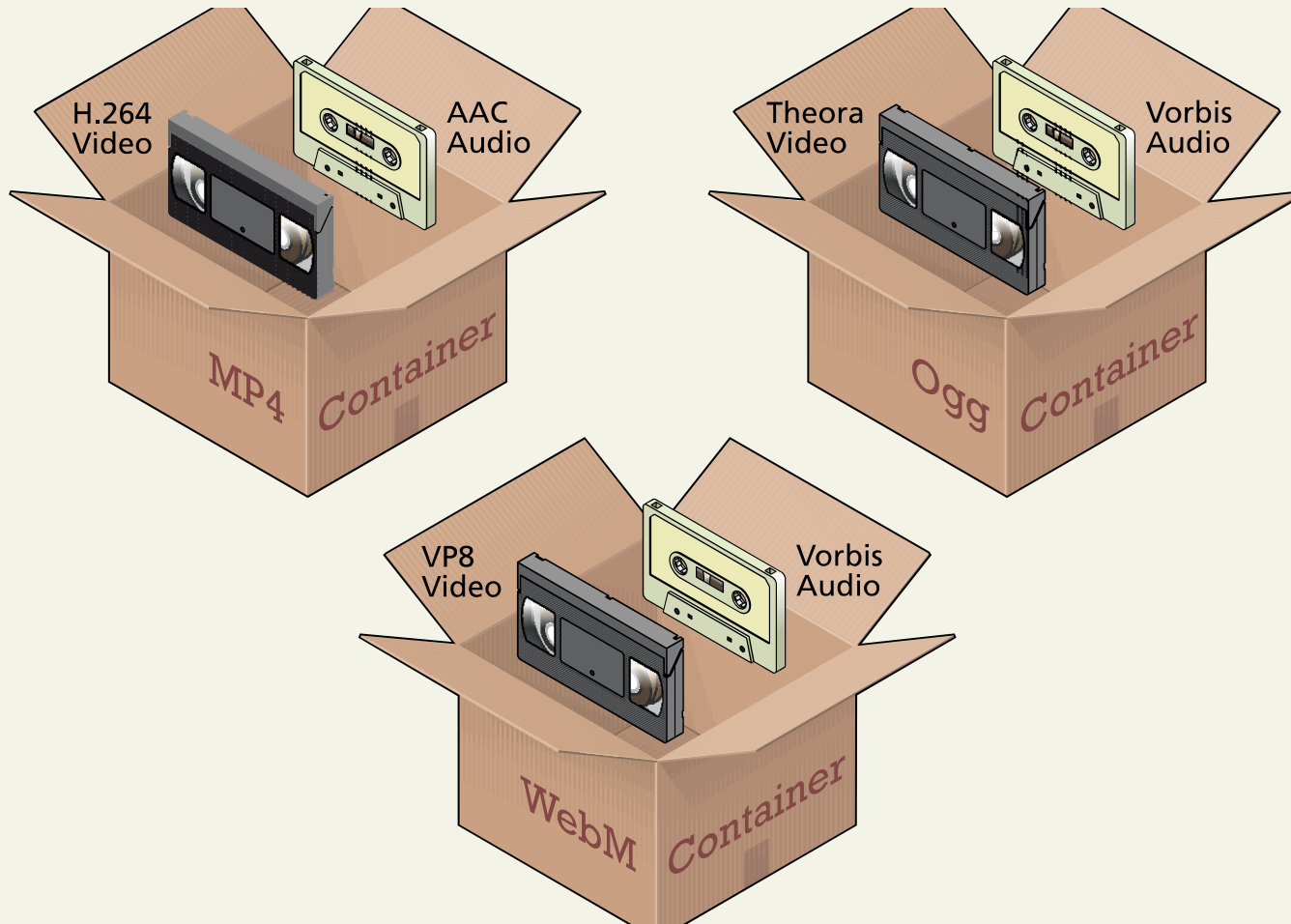|	
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Audio and Video

Media Concepts - Containers

Media is encoded using compression/decompression software, usually referred to as a **codec** (for compression/decompression).

The second key concept for understanding media formats is that of **container formats** .

Audio and Video

Media Concepts - Containers

H.264 Video

AAC Audio

MP4 *Container*

Theora Video

Vorbis Audio

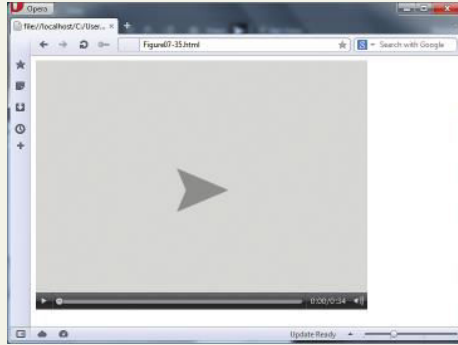Ogg *Container*

VP8 Video

Vorbis Audio

WebM *Container*
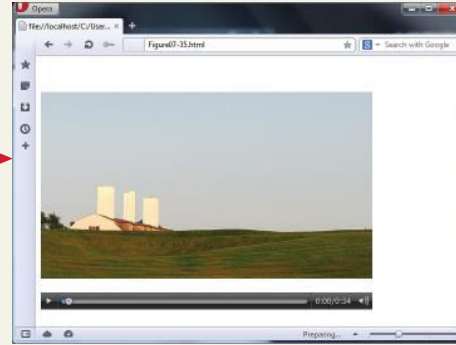
Audio and Video

Browser Video Support

- MPEG-4

  - MP4 container with H.264 Video and AAC Audio

- WebM container with VP8 video and Vorbis audio.

- Ogg container with Theora video and Vorbis audio
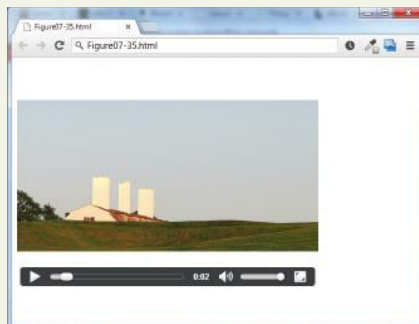
Audio and Video

Using the <video> element

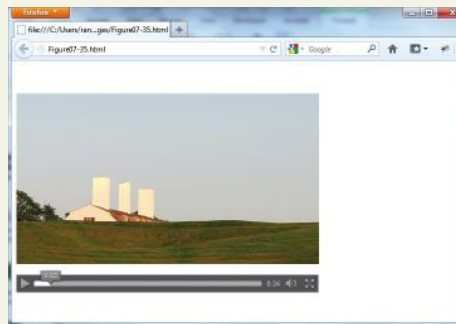Showing poster image before playback

After playback begins (Opera)

```html
<video id="video" poster="preview.png" controls width="480" height="360">
    <source src="sample.mp4" type='video/mp4; codecs="avc1.42E01E, mp4a.40.2"'>
    <source src="sample.webm" type='video/webm; codecs="vp8, vorbis"'>
    <source src="sample.ogv" type='video/ogg; codecs="theora, vorbis"'>

    <!-- Use Flash if above video formats not supported -->
    <object width="480" height="360" type="application/x-shockwaveflash" data="sample.swf">
        <param name="movie" value="sample.swf">
        <param name="flashvars" value="controlbar=over&amp;image=preview.png&amp;file=sample.mp4">
        <img src="preview.jpg" width="480" height="360" title="video not supported">
    </object>
</video>
```
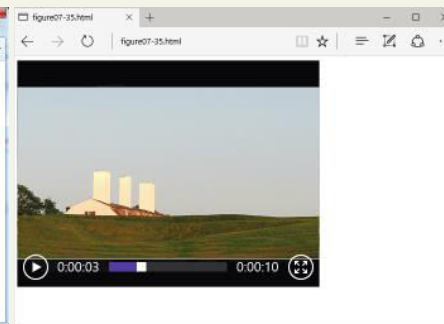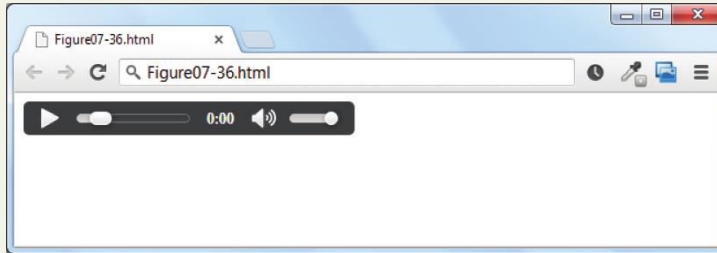

Chrome

Firefox

Edge

Audio and Video
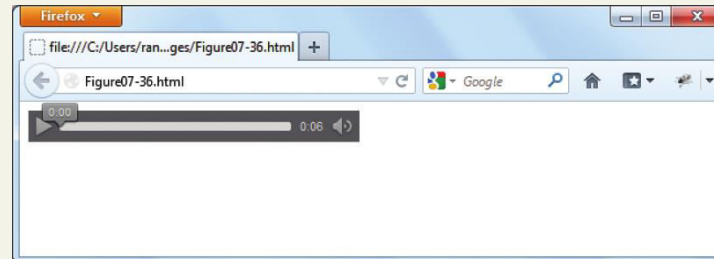
Browser Audio Support

- MP3.

- WAV.

- OGG

- Web

- MP4

Audio and Video

Using the <audio> element


```html
<audio id="example" controls preload="auto">
  <source src="example.ogg" type="audio/ogg">
  <source src="example.wav" type="audio/webm">
  <source src="example.webm" type="audio/webm">
  <p>Browser doesn't support the audio control</p>
</audio>
```
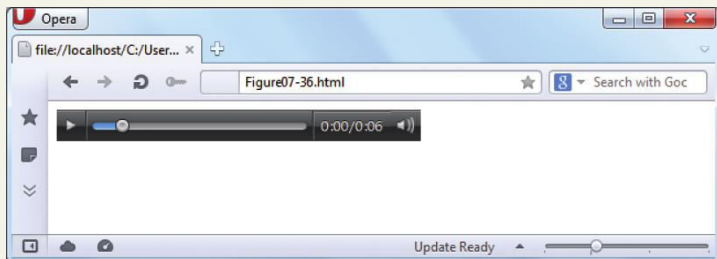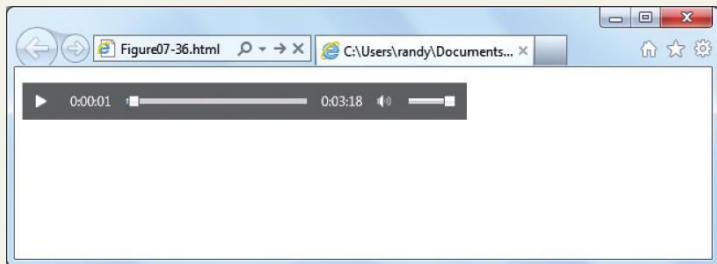
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Summary

Key Terms

- additive colors
- alpha transparency
- anti-aliasing
- artifacts
- bitmap image
- cinemagraph
- CMYK color model
- codec
- color depth
- color palette
- container formats
- device pixels
- digital representation
- display resolution
- dithering

- favicon
- gamut
- GIF
- gradient
- halftones
- HSL color model
- image size
- interpolate
- JPEG
- lightness
- lossless compression
- lossy compression
- LZW compression
- media encoding
- MPEG-4

- opacity
- pixels
- PNG
- raster image
- reference pixel
- RGB color model
- run-length compression
- saturation
- subtractive colors
- SVG
- TIF
- transform
- transition
- vector image
- web-safe color palette

Questions