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Lecture 24

Images

* Course logo spider web photograph from [Morguefile](#) openstock photograph by Gabor Karpati, Hungary.

Back to Basics

Pixels



About Low Resolution

a total aside comment

Recognition of Digital Images of the Human Face at Ultra Low Resolution Via Illumination Spaces

Jen-Mei Chang, Michael Kirby, Holger Kley, Chris Peterson, Bruce A. Draper, J. Ross Beveridge · ACCV · 2007

[View PDF](#)

[Cite](#)

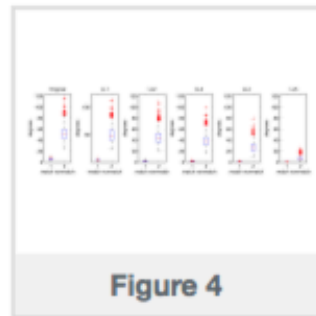
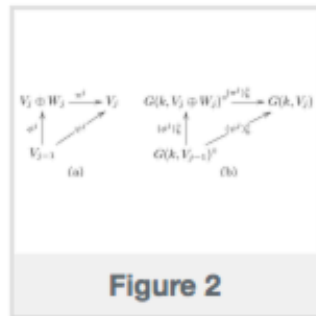
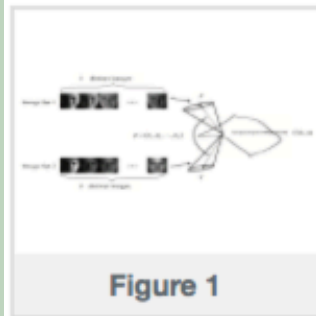
[Save](#)

Abstract

Recent work has established that **digital images of a human face**, collected under various illumination conditions, contain discriminatory information that can be used in classification. In this paper we demonstrate that sufficient discriminatory information persists at **ultra-low resolution** to enable a computer to recognize specific **human faces** in settings beyond human capabilities. For instance, we utilized the Haar wavelet to modify a collection of images to emulate pictures from a 25-pixel camera. From these modified images, a low-resolution illumination space was constructed for each individual in the CMU-PIE database. Each illumination space was then interpreted as a point on a Grassmann manifold. Classification that exploited the geometry on this manifold yielded error-free classification rates for this data set. This suggests the general utility of a low-resolution illumination camera for set-based image recognition problems.

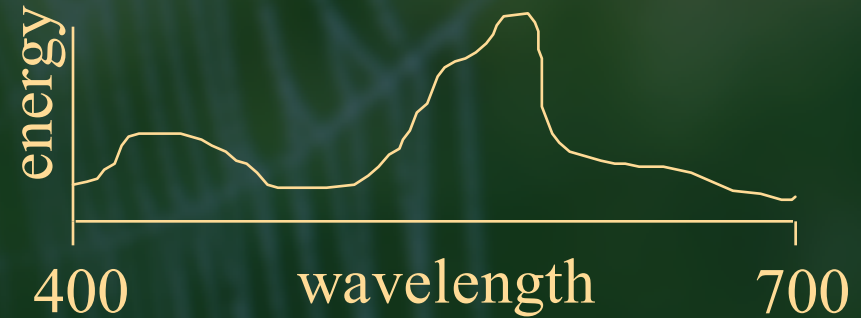


5 Figures and Tables



Colors (RGB)

- Visual range
 - red (700 nm) ...
 - to violet (400 nm)
- Ever wonder why?
 - Red, Green & Blue
- Physics?
 - Not really.
- Neural Biology?
 - Much Closer.



Morguefile image by Jane M. Sawyer

Tristimulus Theory of Color

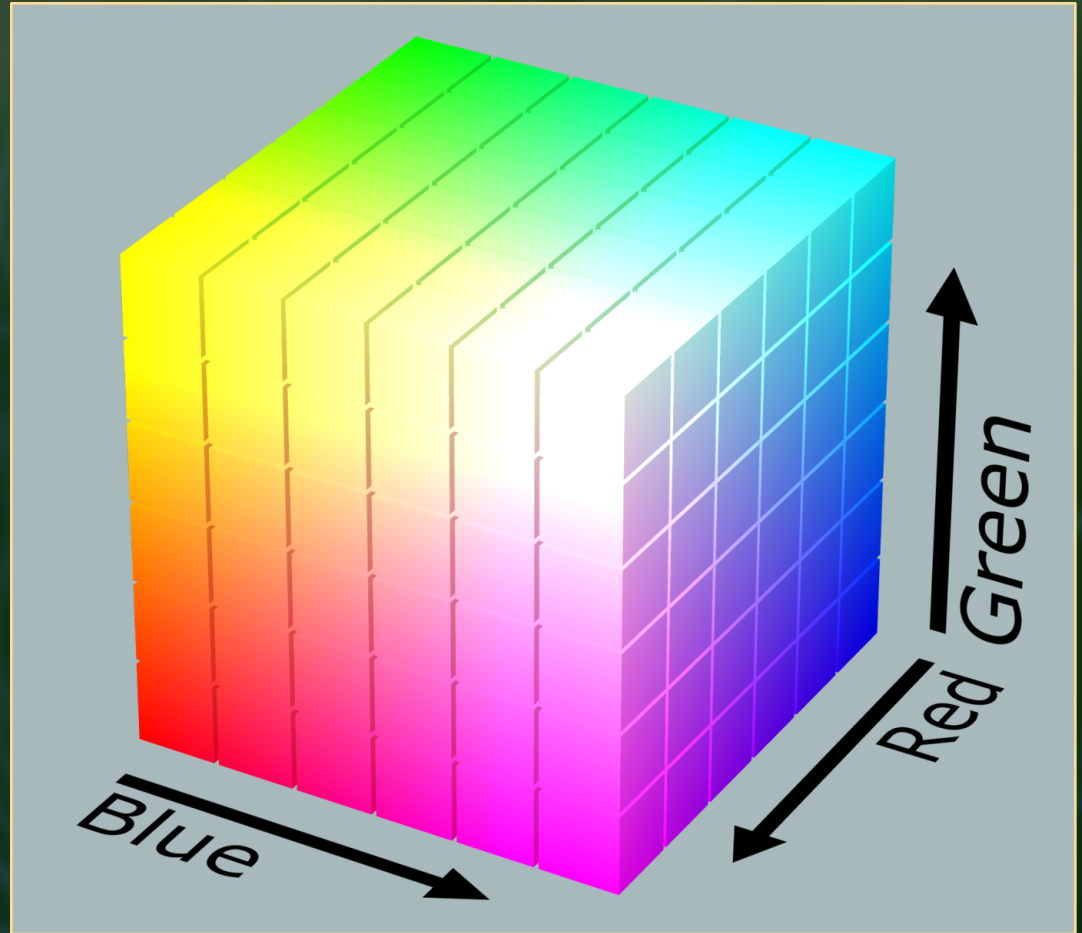
- The tristimulus theory says cones in the human eye detect 3 primitive colors:
 - red, green, and blue.
- Energy near red excites response.
- Same for green and blue.
- All the rest of the “detail” goes away.
- RGB Displays therefore cheat.
- Might be why dogs don't like TV

Why Don't Dogs Watch TV?



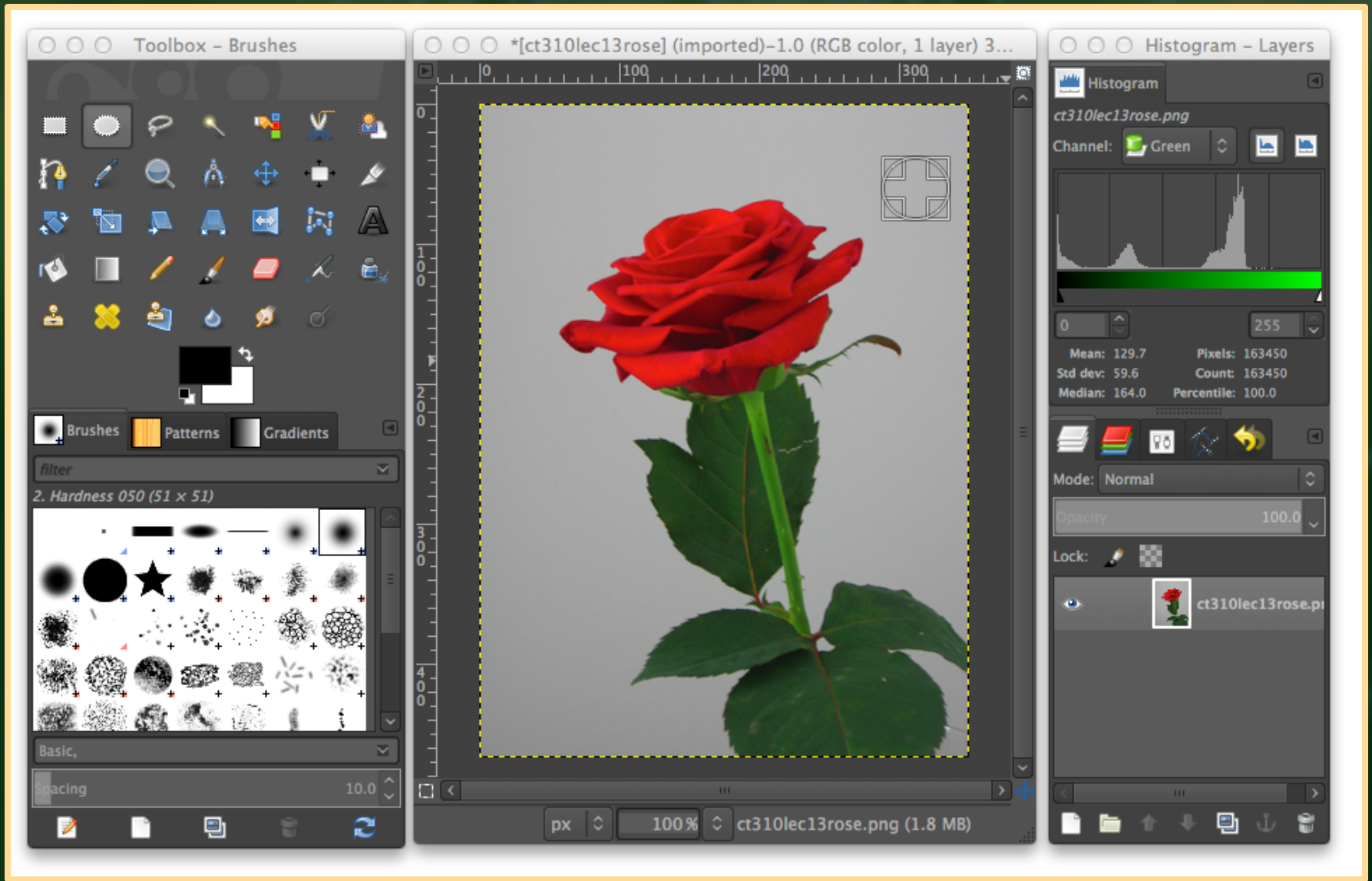
The RGB Cube

- 3 Dimensions
- Move along:
 - Red
 - Green
 - Blue
- Direct tie to tristimulus theory.

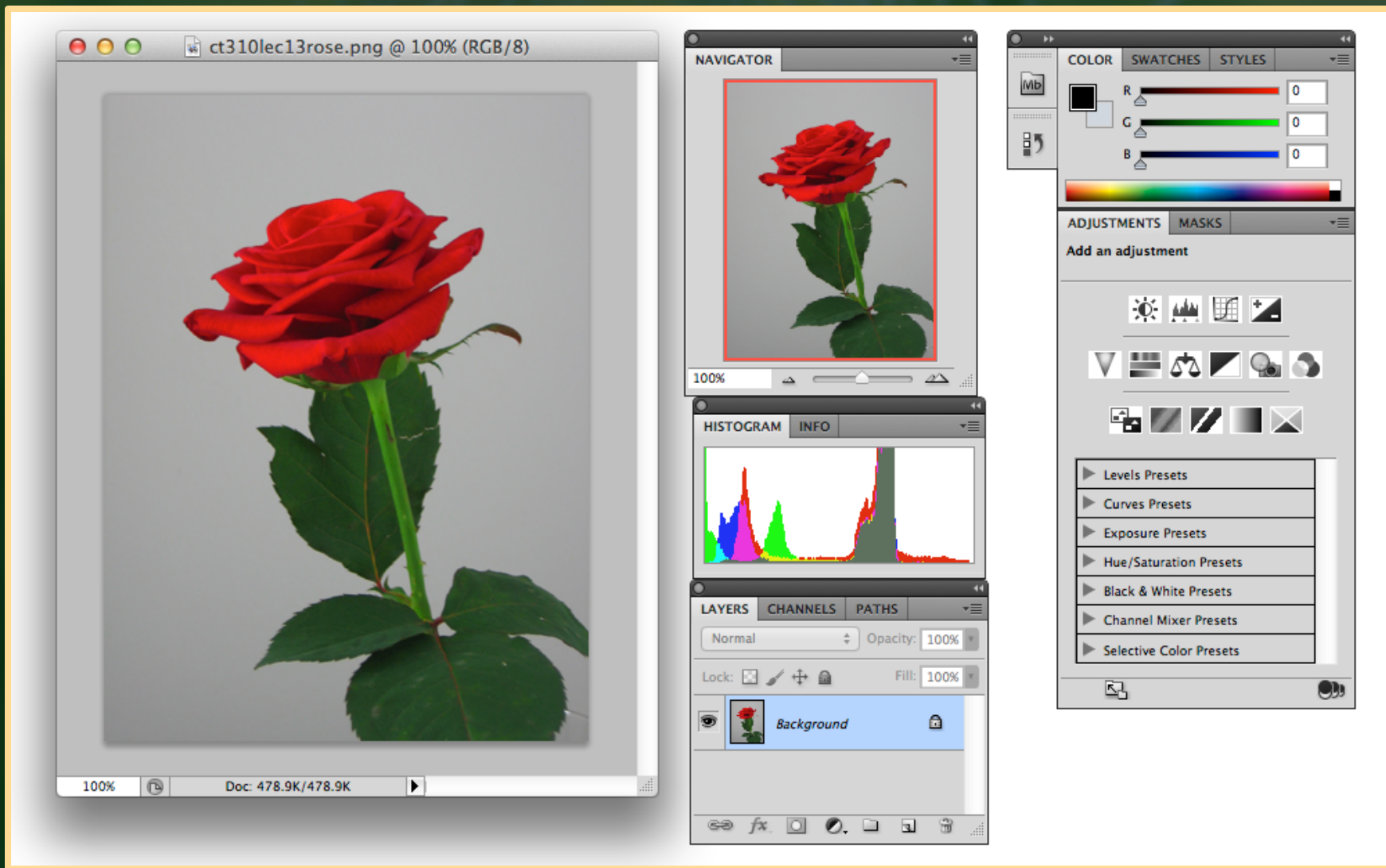


https://en.wikipedia.org/wiki/RGB_color_model#/media/File:RGB_color_solid_cube.png

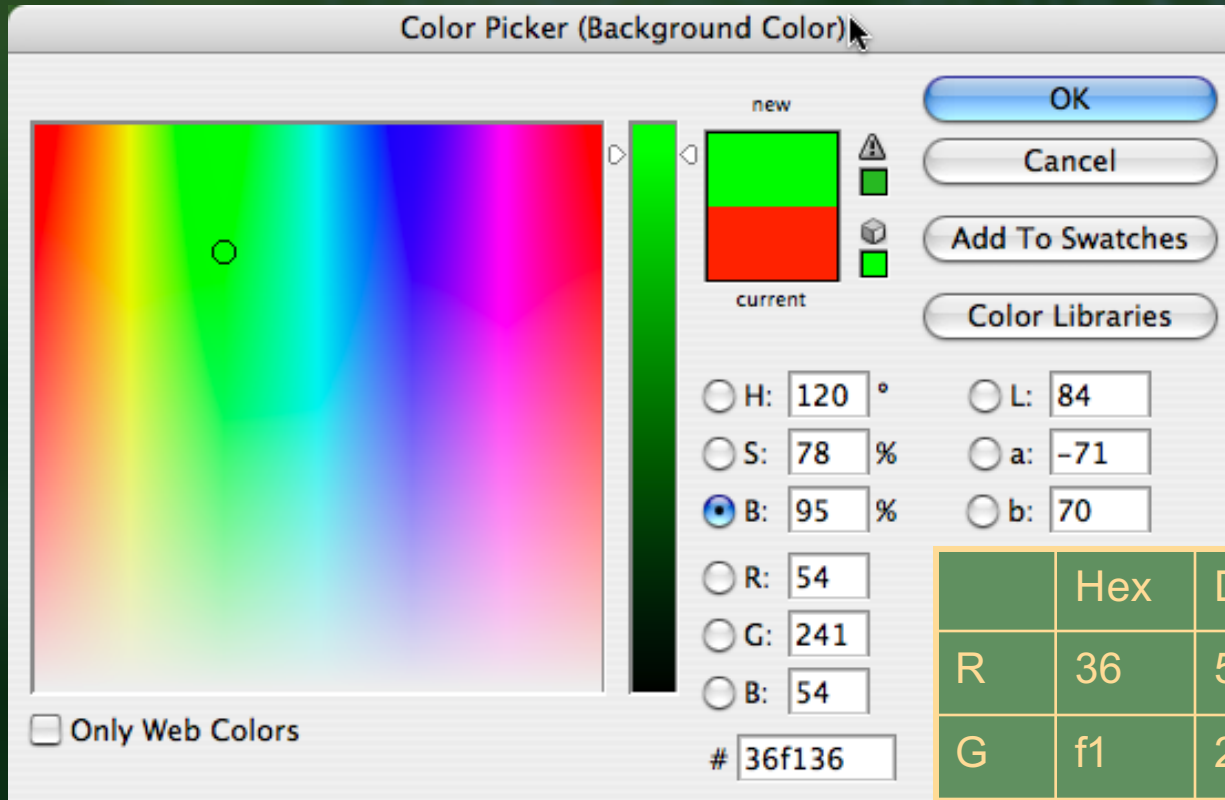
Photo Editing Tools - GIMP



Editing Tools - Photoshop



Back to specifying colors



	Hex	Dec.	Binary
R	36	54	00110110
G	f1	241	11110001
B	36	54	00110110

GIF Image Format

- Graphics Interchange Format
- Limited to 256 colors
- Designed for flat graphics
 - Not for photographs!
 - Uses color map, more in a minute.
- Superseded by 8 bit PNG
 - But it certainly is universal ...

Examples for this Lecture



localhost/courses/ct310/yr2016sp/aplay/lec24/

CT 310 Lec 24 Images

CT 310 Web Development

Computer Science Department
Spring 2016
CT 310 Lec 24 Images



Home Syllabus Progress Assignments Resources Canvas


Here are some examples that go with lecture 23 on images.

- [Example 1](#): Anti aliased text using transparency
- [Example 2](#): Anti aliased text using alpha blending
- [Example 3](#): Examples of transparency within an image
- [Example 4](#): Examples of transparency with styling

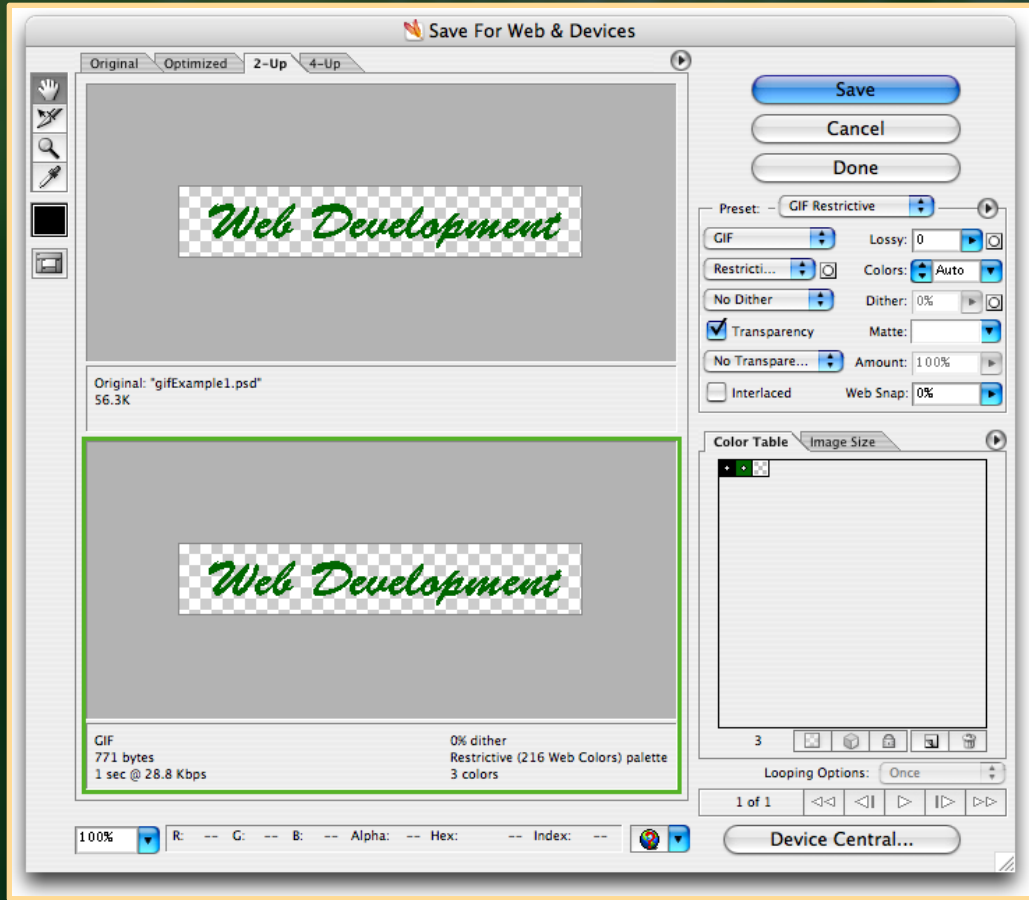
Here is a file you may download with source for images and all pages show here: [lec24.zip](#)

Session Time 1688 Secs.
Originating IP ::1
User: Guest

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Saving as Gif



- Color Table.
 - Entry 1
 - 000000
 - Entry 2
 - 006600
 - Entry 3
 - Transparent.
- Size
 - 56,300 bytes
 - To 771 bytes.

First Example Transparency

The image shows two side-by-side windows. The left window is an Emacs editor displaying HTML code for a web page. The right window is a web browser showing the rendered page.

```
<head>  
<title>CT 310 Lecture 7 Example 1</title>  
<meta http-equiv="Content-Type"  
  content="text/html; charset=iso-8859-1" />  
</head>  
<body>  
<h2>Gif Image with Transparency</h2>  
<div>  
<p>Here is a gif image with lettering and a transparent background.  
  The colored background comes from the background attributed of  
  the enclosing div.</p>  
<div style="background:#C96;width:288px;height:50px">  
 </img>  
</div>  
<p>Here is the same gif image with against a different color</p>  
<div style="background:#99F;width:288px;height:50px">  
 </img>  
</div>  
<p>These letters were generated WITHOUT anti-aliasing!</p>  
<p>The same example is now shown with anti-aliasing</p>  
<div style="background:#C96;width:288px;height:50px">  
 </img>  
</div>  
<p>... and again the lighter background.</p>  
<div style="background:#99F;width:288px;height:50px">  
 </img>  
</div>  
<p>Anti-aliasing is source of "halo" effect described in the text.</p>  
</div>  
</body>  
</html>
```

The browser window shows the rendered page with the following content:

Gif Image with Transparency

Here is a gif image with lettering and a transparent background. The colored background comes from the background attributed of the enclosing div.

Web Development

Here is the same gif image with against a different color

Web Development

These letters were generated WITHOUT anti-aliasing!

The same example is now shown with anti-aliasing

Web Development

... and again the lighter background.

Web Development

Anti-aliasing is source of "halo" effect described in the text.

Anti-Aliasing is usually a good thing! (But beware).

Gif and Compression

- Part 1:
 - Color Table
- Part 2:
 - Run Length Encoding
 - Lempel-Ziv-Welch
- Consider simple type
 - Note duplicates
 - Replace
- Lossless!

1	1	1	1	1	1
1	2	2	2	1	1
1	1	2	2	2	1
1	1	1	1	1	1

11111112221111

2221111111

(7,1),(3,2),(4,1),
(3,2),(7,1)

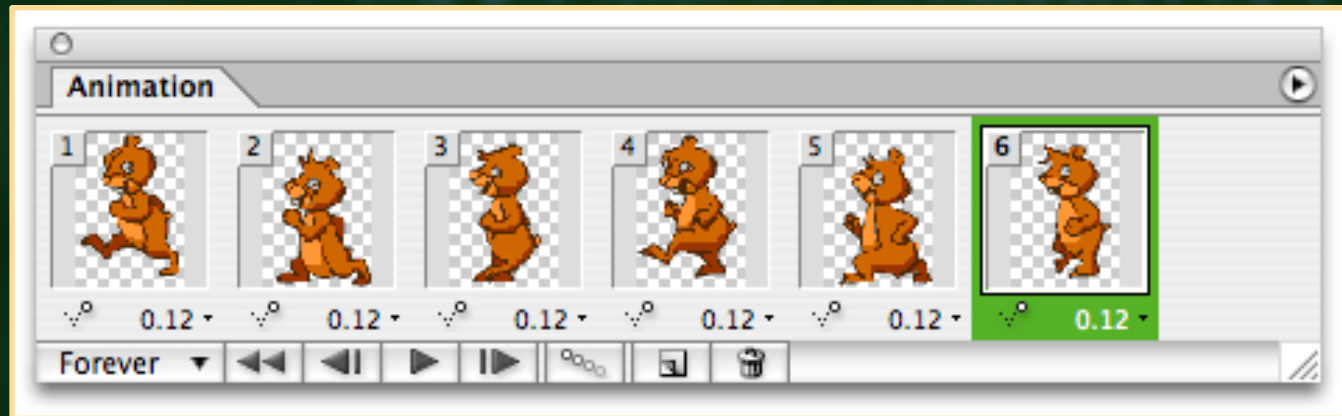
7132413271

GIF Animations

- GIF allows multiple frames in one file.
- Browsers sequence through frames.
- Result is a simple form of animation.
- Leads us to Deidre LaCarte's famous*

...

- Now <http://www.hamsterdance.org/hamsterdance/>



Thanks to Wikipedia for providing an [excellent history of hamster dance](#).

JPEG Image Format

- Joint Photographic Export Group.
- Full 24 bit color.
- But, Some information is lost.
- This is why one specifies quality level.
- Essence - Discrete Cosine Transform
 - Wikipedia (again), [very nice synopsis.](#)

Quality Level Examples



116KB



136KB



324KB

[Morguefile](#) image by Nanette Bartet.

JPEG and Plain Text, Note a Good Combination.

This is your text before jpeg

This is your text after jpeg

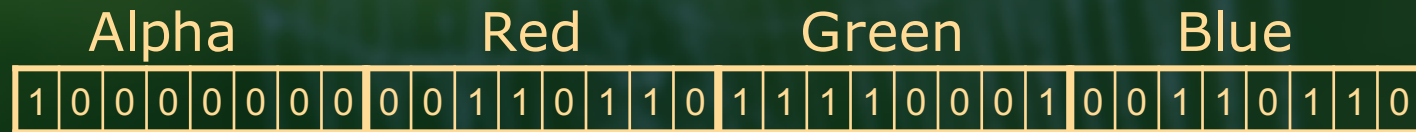
Notice artifacts in the white background!

PNG Image Format

- Portable Network Graphics
- Comes in two flavors
 - 8 bit color mapped, replaces GIF.
 - 24 bit full color, replaces JPEG.
- Includes an alpha channel
 - Practical transparency.

Alpha Channel Review.

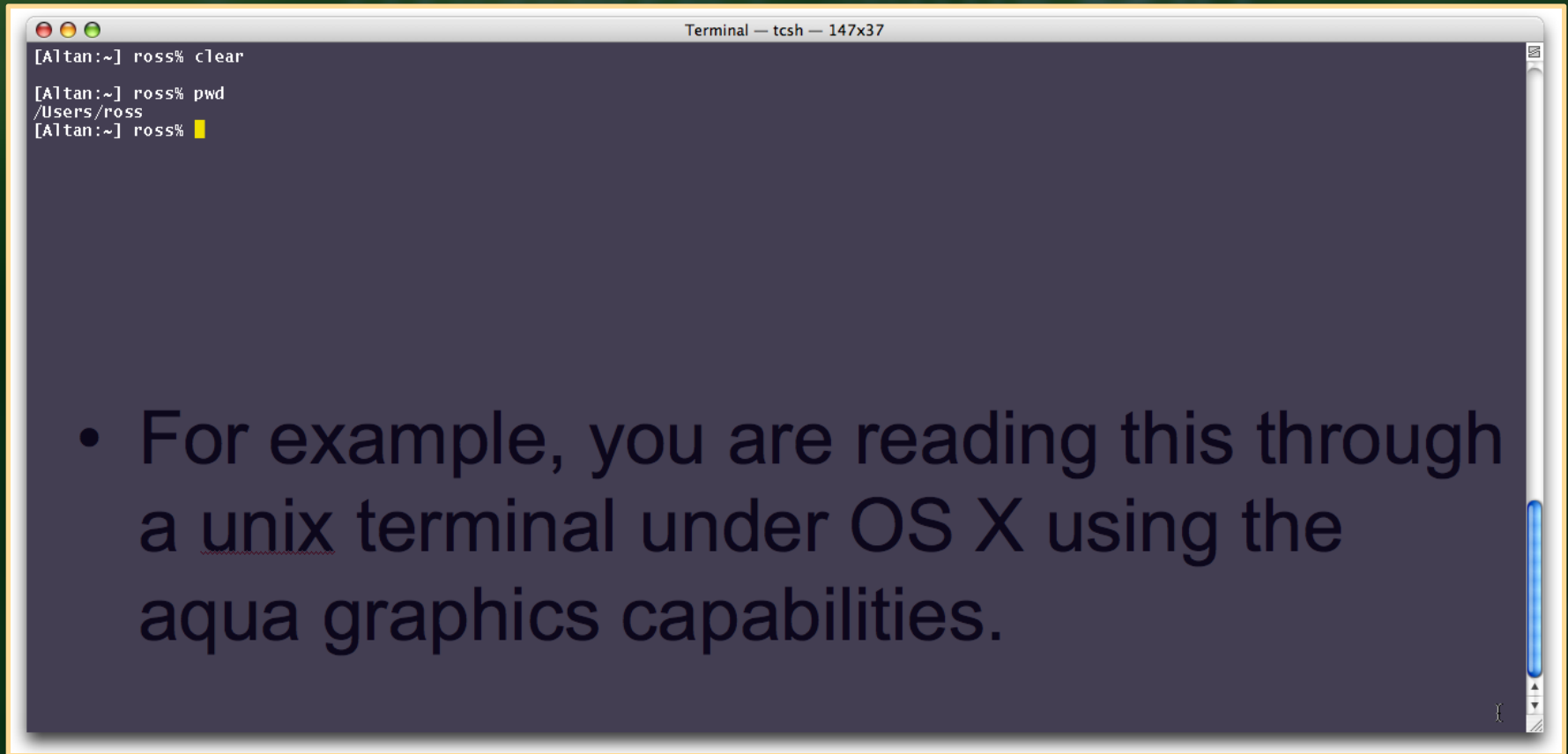
- A good way to use the last byte :-)
- Consider a 32 bit word ...



80 36 F1 36

- Alpha controls blending
 - Alpha = 0 (000) - transparent.
 - Alpha = 1 (255) - completely covers.
 - Alpha = 0.5 (128) - 50/50 blend.

Modern Operating Systems Support Transparency.



- For example, you are reading this through a unix terminal under OS X using the aqua graphics capabilities.

Anti Aliasing Revisited

```
emacs@Altan.local
File Edit Options Buffers Tools HTML SGML Help
<?xml version="1.0" encoding="iso-8859-1"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
<title>CT 310 Lecture 8 Example 2</title>
<meta http-equiv="Content-Type"
content="text/html; charset=iso-8859-1" />
</head>
<body>
<h2>Anti Aliased Text Using Transparency</h2>
<div>
<p>Here is the GIF image of text with anti-aliasing and transparency.</p>
<div style="background:#C96;width:288px;height:50px">

</div>
<p>... and another background.</p>
<div style="background:#99F;width:288px;height:50px">

</div>
<p>Recall from lecture 7 how anti-aliasing is source of "halo" effect
described in the text.</p>
<p>Now here is essentially the same example, but using a 24 bit PNG
image created in photoshop with anti-aliasing using the alpha
channel to gradually blend the text color into whatever background
is beneath it.</p>
<div style="background:#C96;width:288px;height:50px">

</div>
<p>... and another background.</p>
<div style="background:#99F;width:288px;height:50px">

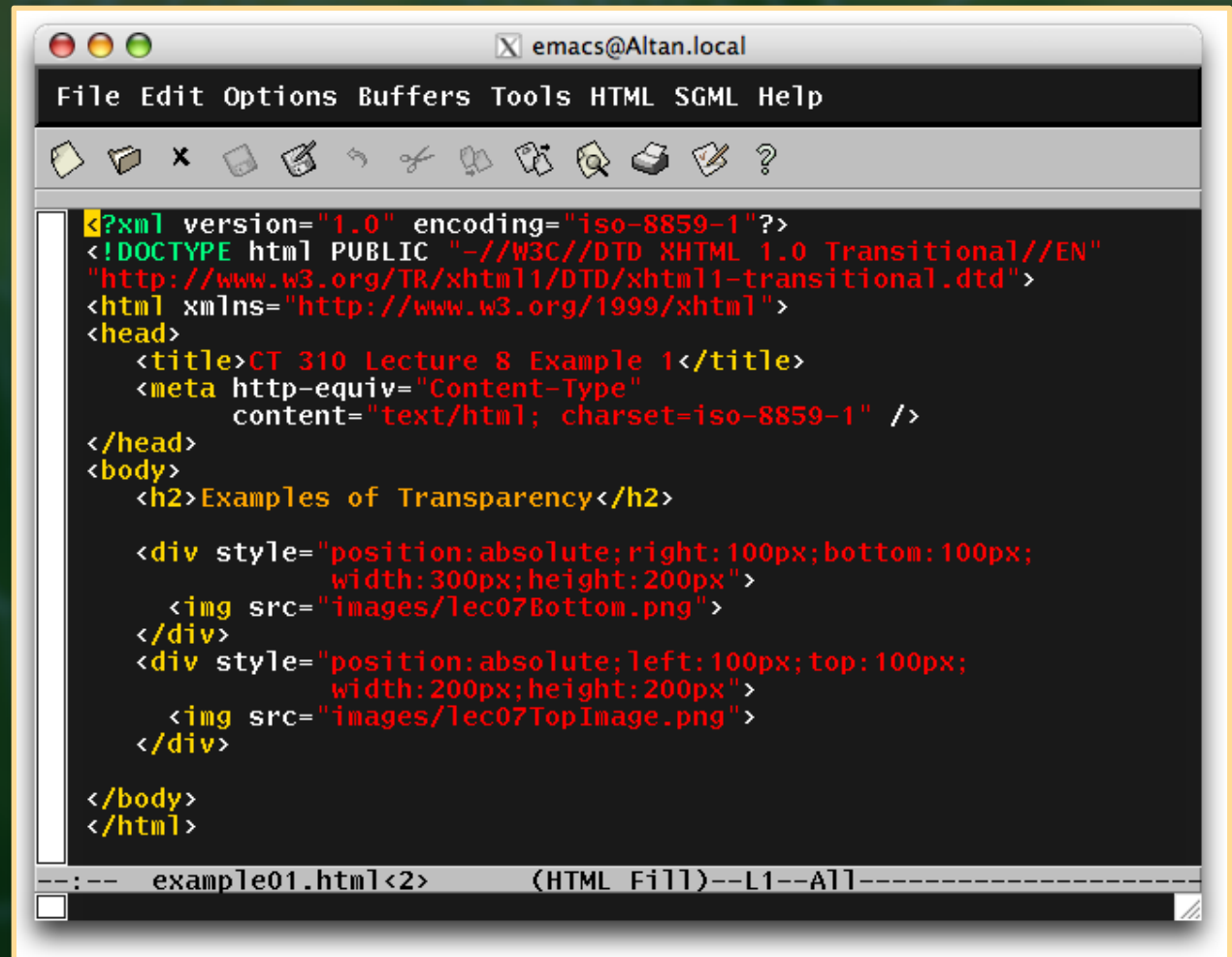
</div>
</body>
</html>
example02.html (HTML Fill)--L1--A11
Fill column set to 78 (was 70)
```



Semitransparent - image

The top image uses the alpha channel to specify opacity.

Photoshop Opacity is 75%



```
emacs@Altan.local
File Edit Options Buffers Tools HTML SGML Help
[Icons]
[?]xml version="1.0" encoding="iso-8859-1"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
  <title>CT 310 Lecture 8 Example 1</title>
  <meta http-equiv="Content-Type"
        content="text/html; charset=iso-8859-1" />
</head>
<body>
  <h2>Examples of Transparency</h2>

  <div style="position: absolute; right: 100px; bottom: 100px;
            width: 300px; height: 200px">
    
  </div>
  <div style="position: absolute; left: 100px; top: 100px;
            width: 200px; height: 200px">
    
  </div>
</body>
</html>
---:-- example01.html<2> (HTML Fill)--L1--A11-----
```

Semitransparent Images


CT 310 Lecture 14 Exampl x

localhost/ct310/yr2014sp/aplay/lec14/example03.html

Apps Google Weather Ross News PSD Misc. CSU

Examples of Image Transparency (and Placement)

In this example the top image was created with an alpha value of 0.75.



CT 310 Lecture 14 Exampl x

localhost/ct310/yr2014sp/aplay/lec14/example04.html

Apps Google Weather Ross News PSD Misc. CSU

Examples of Image Transparency (and Placement)

In this example both images are solid - not transparency. Transparency is determined by css 'opacity' attribute.

