

Digital Darkroom with the GIMP

Yoni Rabkin

yonir@actcom.com

Abstract

This lecture first talks about setting up our computer for working with digital images using the GIMP and GNU/Linux. Then we introduce a number of GIMP tools and editing techniques that we can use to improve our digital images.

Contents

- What is the GIMP?
- Why all the setting up?
- Monitor bit depth, color balance and gamma
- Monitor resolution
- The histogram
- Curves tool
- Unsharp mask
- HSV color model
- Contrast mask
- Soften
- Tungsten white balance
- Channel mixer B/W

What is the GIMP?

- “The GIMP” stands for “the GNU Image Manipulation Program”
- Web site [<http://www.gimp.org/>]
- As of 23/03/2004 GIMP version 2.0 has been released and is available for everyone to download. This lecture refers to GIMP 2.0 and not GIMP 1.x that comes with most of the current^(a) GNU/Linux distributions.
- GIMP 2.0 is a major step forward in both performance and usability, hence this lecture will focus on it solely.

^(a)April of 2004

Why all the setting up?

Before you begin to work in your digital darkroom there are some important things that have to be set up properly. These things are roughly equivalent to a traditional darkroom technician checking that all the chemicals are fresh, that the chemical baths are the right temperature etc. Setting up promises more consistency, quality and speed.

Bit Depth

Set your monitor to 24 or 32 bit color depth mode. In 24 bit color depth mode:

- Every pixel on the screen is made up of 3 color channels: Red, Green and Blue.
- Each channel is represented in the computer by 1 byte = 8 bits, allowing for 256 levels of that channel.
- Three channels per pixel. With 8 bits per channel is $8+8+8 = 24$. 24 bits per pixel.
- The number of possible colors is $2^{8*3} = 16,777,216$.
- GIMP Versions 1.x and 2.0 are natively RGB 8-bits per channel (24bpp)^(a).
- Native 16-bit and CMYK support coming in the future.

Bit depth cont.

Examples of bit depth modes besides 24bpp.^(a)

- 16bit/16bpp is 5bits red + 6bits green(eye more sensitive) + 5bits blue. $2^{5+6+5} = 65,536$ colors.
- 32bit/32bpp is 8bits red + 8bits green + 8bits blue = 24 + 8bits opacity per pixel. $2^{8*3+8} = 4,294,967,296$ colors.
- 48bit/48bpp is 16bits red + 16bits green + 16bits blue. $2^{16*3} = 281,474,976,710,656$ colors. Cinepaint [<http://cinepaint.sourceforge.net/>] is a GIMP based free/open source software project with the ability to support 48bit per pixel images. Cinepaint is used extensively in Hollywood.

^(a)bpp stands for Bits Per Pixel

Setup: Color Balance

- Set the black point with the “brightness” and “contrast” (misnomers).
- What is color temperature?
- Typical color temperatures:^(a)
 - 2800 °K 75 Watt bulb
 - 3100 °K sunrise, sunset
 - 5500 °K Standard daylight
 - 12,000 °K Clear skylight, open shade
- Set your monitor to the 6500K white point. Use Yoni’s “piece of paper and an open window” method.

^(a)Taken from the “Kodak Professional Photo-guide”

Setup: What is monitor gamma?

What is gamma? Why set it? Because monitors don't react linearly to increased voltage,

$$(1) \quad \textit{outputluminance} = \left(\frac{\textit{input}[0, 255]}{255} \right)^{\textit{gamma}}$$

$$(2) \quad \textit{outputluminance} = c + \left(\frac{\textit{input}[0, 255]}{255} \right)^{\textit{gamma}} + b$$

Is there more detail in the shadow areas of my photos that I'm not seeing? How about the highlights? How can I get predictable results?

Setup: Monitor gamma

- Typical gamma targets:
 - 1.8 - original Apple Macintosh
 - 2.5 - IBM PC compatibles
 - 2.2 - Microsoft/Hewlett-Packard/Pantone/Corel sRGB “standard Internet color space”
- Monitor age and quality
- View → Display Filters → Gamma

Setup: xgamma example

Follow the instructions at the Web site:

[http://users.dslextrême.com/~craig.lawson/linux_notes/color.html].

Craig Lawson has a wonderful page there with easy to follow instructions. The long and short of it is:

- Display the gamma pattern appropriate for your gamma target
- Read the existing gamma value with:

```
xgamma
```

Setup: xgamma example (Cont.)

- View the gamma pattern and then adjust the new gamma value toward the target, for example:

```
xgamma -gamma 1.3
```

- Add the gamma adjustment to your xinitrc or xsession scripts, for example:

```
/usr/X11R6/bin/ xgamma -gamma 1.43
```

- Test that your adjustment has been preserved after restarting your X session:

```
xgamma
```

Setup: Monitor Resolution

Monitor resolution and file sizes^(a):

- 1024x768 minimum
- Average 17" monitor 72ppi^(b)
- Image sizes for the Web vs. for printing:
 - The computer monitor is a low-resolution medium. A Web photo can be 100 to 200 Kilobytes in size as a compressed JPEG image.
 - The print is a high-resolution medium. A print can be generated from a 10 to 50 Megabyte raw (meaning uncompressed) image.

^(a)No such thing as "file resolution!"

^(b)PPI = Points Per Inch

Tools: The Histogram

- What is it? Control luminosity throughout
- Where?
 - Dialogs → Histogram
 - Layers → Colors → Levels
- When?
 - Large contrast adjustments
 - Cleaning homogeneous areas
 - Calibration (middle gray)

Beware the dreaded toothcomb aka. “fingers of death”

Tools: Curves

- What is it? Fine control of luminosity
- Where? Layer → Colors → Curves
- When?
 - Fine contrast adjustments
 - Localized adjustment
 - Images lacking “punch” (S-curve)

Always fix the 50 percent (middle) point, otherwise you might do violence to the image!

Tools: Unsharp Mask

- What is it? Brighten the bright and darken the dark at object edges, image appears sharper
 - Where? Filters → Enhance → Unsharp Mask
 - Ballpoint for 1024x768 image:
 - Radius: 1.0 (How wide edge becomes)
 - Amount: 0.50 (How much)
 - Threshold: 1 (How far apart values before applying)
 - When?
 - Scanned film/photographs
 - No perceptual sharpness
- Last, last, last thing you do to an image!

Tools: Unsharp Mask (Cont.)

- Ansel Adams^(a) once said: “There is nothing worse than a sharp image of a fuzzy concept.” Proof enough is Robert Capa’s “Omaha beach”^(b) from 1944. Don’t over-sharpen.
- How not to over-sharpen?
 - Always perform sharpening with the image at 100 percent magnification.
 - Hunt for artifacts.
 - Sharpen for perceptual effect, a sharp Web image does not equal a sharp printout.

^(a)Ansel Adams[1902-1984], Landscape photographer and inventor of the “Zone System”

^(b)Robert Capa[1913-1954], War photographer, his photo “Omaha Beach”,



Tools: HSV color model

- What is it? Transform colors in HSV space, Yet Another Color Model equivalent to RGB space
- HSV? Hue ($0 - 360^\circ$), Saturation (Purity 0-1), Value (Lightness 0-1)
- Where? Layer \rightarrow Colors \rightarrow Hue-Saturation
- When?
 - Wanting Fuji Velvia or National Geographic saturation
 - Lighting correction (see Techniques: Tungsten white balance)

Techniques: Contrast Mask

- What is it? Controlling contrast
- When?
 - Information hidden in the shadows (and highlights)
 - Sending to uncalibrated monitors / printers
- How?
 - Duplicate Layer (the following only on the top layer)
 - Layer → Colors → Desaturate
 - Layer → Colors → Invert
 - Filters → Blur → Gaussian Blur
 - Layers Mode: Overlay
 - Adjust opacity

Beware of boring “flat” images!

Techniques: Soften

- What is it? Softens the image
- When?
 - Portraits with problematic skin texture
 - Movie poster effect wanted
- How?
 - Duplicate Layer and set top layer to “Multiply”^(a)
 - Using Levels, set bottom layer gamma to 1.70
 - Using Levels, set top layer gamma to 2.70
 - Slightly over-sharpen top layer^(b)
 - Blur lower layer

^(a)Use the “Layers” dialog window

^(b)Filters → Enhance → Unsharp Mask / Sharpen

Techniques: Tungsten white balance

- What is it? Fixes orange color cast
- When? Tungsten lighting with no white balance
- How?
 - Layer → Colors → Hue-Saturation
 - Reduce the “Saturation” for yellow to -30
 - Reduce the “Saturation” for red to -30

If a known color exists in the image, create a reference square.

Beware not to create “dead” skin tones.

Technique: Channel Mixer B/W

- What is it? Allows for better black and white images
- When?
 - Turning a color image to black and white selectively
 - Choosing the best channel for scanned B/W negatives
- How?
 - Filters → Colors → Channel Mixer
 - Choose “Monochrome”
 - Mix amounts of RGB for desired affect.