1 Basics

1.1 Preface to the Extended Second Edition

A good three years have passed since the first publication of my book *GIMP 2 for Photographers*. In the meantime, the new GIMP 2.6 has become available. Essentially, the subdivision in separate dialog boxes has remained the same. However, there have been various modifications in the segmentation and layout of the menu bars as well as in the appearance, characteristics, and handling of windows. New tools and functions have been added to the menus. Some tools offer new additional functions such as scalable brushes and scalable options. In the future, the new graphics library GEGL will be quite essential in enabling GIMP to operate with greater color depth. That is to say that GIMP will be able to work with photos with more color information than before. Also, the choice of the color palette CMYK for printing in the four-color process will be available. However, the full integration of these functions won't be available until the next one or two versions.

This new edition of my book offers you a complete introduction into photo and image editing with GIMP. I will explain the new functions in GIMP, such as the new polygon lasso, the automatic free select tool, the healing and repair brushes, and the perspective-cloning tool. I have also added new chapters that will demonstrate the various techniques for correcting over- and underexposed photographs and for brightening darker sections of photographs and darkening brighter sections. This all will be illustrated in detail, which includes the introduction of the corresponding programs and plug-ins.

The additions and updates in GIMP 2.6 offer you an ever better opportunity to master the enormous possibilities of digital image editing. I wish you lots of fun learning these new techniques and putting your own ideas into action.

Klaus Goelker

1.2 Introduction

1.2.1 Using GIMP 2.6 – About This Book

If you are reading this book, you are probably interested in learning how to touch up your digital photographs or create your own graphics or logos. However, before investing hundreds of dollars on expensive software, you may want to make sure that manipulating digital photographs is something you truly enjoy. That's where GIMP 2.6—a free digital image editing program—comes in. You most likely would like to learn how to use this free software to improve your photographs.

This book is designed to facilitate your entry into the world of digital image editing with the help of GIMP 2.6. Using hands-on examples, this book will provide solutions to common problems encountered when editing digital images. The instructions are structured in a step-by-step fashion. Each editing tool and function of GIMP 2.6 will be explained in simple language. You will learn the fundamentals of digital editing, familiarize yourself with common image editing tools and their functions, and acquire a working knowledge of the GIMP 2.6 program.

This book is not a reference guide for GIMP 2.6. It was created to provide you with a set of "learning-by-doing" instructions that will explain how GIMP works, what the program's most important functions are, and how to easily locate and use these tools.

Since GIMP was born of the Linux world, it is free. On the CD that accompanies this book, you will find GIMP 2.6 along with several plug-ins (add-ons) for the application. You'll also find copies of the sample images used in the exercises contained in this book.

Digital image editing programs often seem more complex than the more common software programs, such as word processors. Sometimes you must perform a number of preparatory steps before you can see a result on the computer screen. However, if you're experienced with computers, certain commands should be familiar to you.

Whether you're a Windows, Linux, or a Mac OS user, GIMP works essentially the same way, with the exception of the installation process. GIMP is often distributed with Linux. If you use Windows or Mac OS, you will have to install the program. This book will show you how.

Once you have explored GIMP and learned how to use it, you may not need—nor want—to buy another image editing program. If you do decide to migrate to another program, you will have to familiarize yourself with a new interface. However, you'll quickly discover that the basic commands,

functions, and tools of alternative digital imaging software programs are similar to those of GIMP 2.6 in more ways than you might think.

GIMP 2.6 also contains a built-in help system. In addition, there are many existing books about the software, including several free online texts. Please refer to this book's appendix for a list of references regarding GIMP.

1.2.2 About GIMP 2.6

GIMP is an acronym for **GNU Image Manipulation Program**. GIMP was bred from the Linux world and is an open-source software program covered by the General Public License **(GPL**). **GNU** means "GNU's Not Unix" and refers to a collection of software based on the UNIX operating system and maintained by the Free Software Foundation.

GIMP is "the Photoshop of the Linux world"—it is *the* best free image editing program. GIMP 2.6 was introduced in October 2008. This enhanced version of GIMP meets the functionality requirements of even the most exacting digital photographer. Its interface is highly efficient and easy to use once you know your way around.

In fact, the book you are reading right now was created using GIMP version 2.6.2 (released in October 2008). From the point of view of the user, there have been no changes yet up to version 2.6.8 in January 2010. So for all general purposes, this book is current.

Image Editing

GIMP's primary function is to create and edit pixel or bitmap images, but it also can be used for other tasks. The program will help you touch up your digital photographs, create digital art, or author a new logo for your company's web page. And that's just the tip of the iceberg.

Vector graphics programs are often used to create original or complex images and/or animations. GIMP supports some basic vector graphic features. You can draw an image using the GFIG plug-in and the Path tool. However, you should be aware that GIMP was not designed to be a designated environment for creating and editing complex vector diagrams.

Video Editing

GAP stands for GIMP Animation Package, and with it GIMP offers a range of useful tools for creating small animations on a frame-by-frame basis. For example, you can use GIMP's GAP package to read or write AVI- and GIF-formatted videos and animations. You can also use GAP to open and read videos in MPEG format.

1.3 Introduction to Digital Image Editing

1.3.1 Characteristics of Pixel Images

GIMP is used primarily for editing **pixel** or **bitmap** images. Pixel images are made up of tiny dots called pixels; these images are somewhat like mosaics in structure. All photographic images captured by a digital camera or copied by a scanner are pixel images. The pixel image is considered standard.

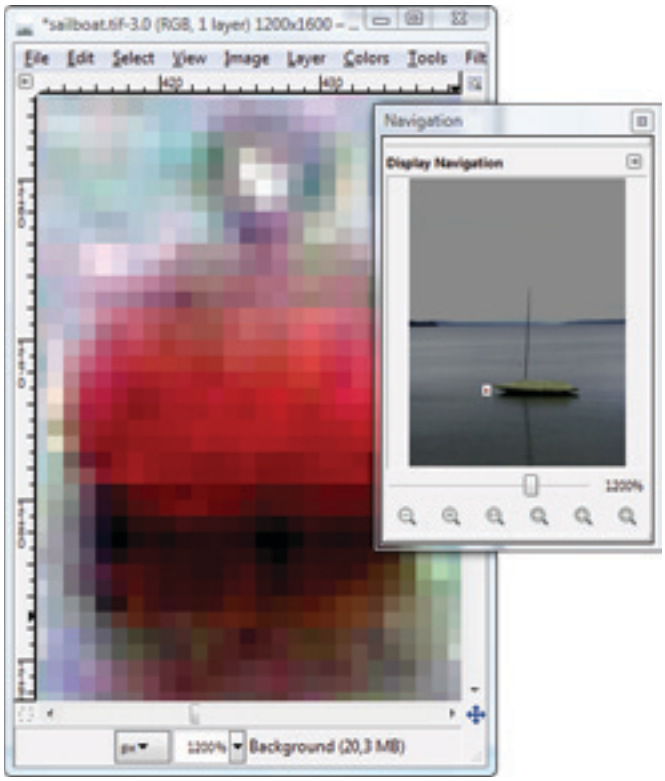

Figure 1.1
The image dots (pixels) become visible when a pixel image is overly enlarged.

Size and resolution are the most important characteristics to take into account when manipulating pixel images. Since pixel images are composed of tiny dots, it can sometimes be tricky to enlarge them. If you overdo it, the individual dots will become visible and the photograph will lose its integrity.

The size and resolution of an image also determines the file size (i.e., storage volume measured by kilobyte or megabyte) of any given image. Uncompressed pixel images normally result in very large file sizes.

Figure 1.2a-b
Comparing pixel and vector images

The manner in which you can edit an image is influenced by the structure of its pixels. Basically, each image dot can be edited in terms of brightness and color. GIMP 2.6 supplies appropriate and easy-to-use tools for editing single dots as well as groups of dots.

When you make a general change to a pixel image, usually the whole image will be affected. Therefore, if you wish to manipulate only a specific area of an image, you should use a *selection tool* to designate that area. You may even want to cut a desired selection from the image so you can work with layers (transparent "foils" containing distinct image objects that can be manipulated separately and are layered one on top of the other).

Selections, masks, and layers are advanced tools that are provided by image editing programs like GIMP for detail work. These topics will be dealt with extensively in the hands-on exercises that follow.

In contrast to pixel images, vector graphics are used when creating original graphics and logos. Rather than editing image pixels, you can use vectors to create novel image elements. Vector images are made up of lines, curves, circles, rectangles, and fills. The size of each of these elements can be scaled; the contour can be filled with color or gradients. For graphics, this is less data intensive. Vector or contour shapes can also be selected and edited individually. At any time, you can tweak the shape or change the color of a fill. However, this requires another type of image editing program, a so-called vector graphics program. For instance, Inkscape is the best-known free, open source vector graphics program (http://www.inkscape.org/). Commercial programs for this type of graphics work are Corel Draw and Adobe Illustrator.

You should know: Vector graphics are almost boundlessly scalable.

However: Editing vector graphics images requires different techniques and specifications than editing pixel images.

Bottom line: Photos and other pixel images can be converted to vector graphics only in an extremely simplified form, and sometimes not at all.

Figure 1.3a-d
Text without and with anti-aliasing

Problems with Pixel Images

You can add a text or graphic elements to pixel images. These are also displayed using pixels, but they have a disturbing element. For example, the edges of the letters appear serrated. This is called *aliasing*. Anti-aliasing is a countermeasure used to smooth the border of the pixilated, and therefore serrated, letters. Anti-aliasing adds pixels at the border of a letter, which are colored in the color of the text, but fading to transparency. In this way, a kind of blending is achieved. The edges of the letters lose definition and appear smoother (see figure 1.3d).

You can smooth the edges of pixilated graphic elements by choosing the feathered edges. Feathered edges of selections will be dealt with in great detail later in the book.

1.3.2 Resolution

Pixel images are rectangular images made up of little squares made up of image dots, or pixels. The density of the dots contained in any given pixel image is called its *resolution*. Resolution is normally measured in **dots per inch (dpi**). In the metric system, dpi is the number of dots per 2.54 centimeters. You can also refer to an image's resolution in pixels per centimeters (the standard measurement in most European four-color printing companies). Although dpi seems to calculate only the length or width of an image, changing the resolution of an image will influence its height as well. For example, doubling the resolution of an image will result in a fourfold increase of the number of pixels.

An image's size (the dimension in inches, millimeters, or pixels) is directly dependent on its resolution. If you transform an image with a resolution of 300 dpi to a resolution of 72 dpi using GIMP, the image size (width x height) increases more than fourfold, even though without interpolation the number of image dots remains the same.

300 dpi will produce an image of quality resolution. 300 dpi is recommended for a scanned image, especially if you intend to edit and print the image at a 1:1 scale.

If you want to enlarge an image, you'll want to scan it at a higher resolution. As a rule of the thumb, if you plan to double the image size (width or height), scan at twice the resolution desired for the final image. If you simply want to reduce an image's dimensions, the visible image quality will usually stay the same or get better, so you need not worry about increasing it.

Four-color printing uses various standard resolutions (e.g., 150, 300, 600, or 1200 dpi). These are indicative values.

Images on the **Internet** often use lower resolutions, mostly 72 or 96 dpi, values that correspond to the standard resolution of PC monitors. A low resolution keeps the file sizes of images small enough for the images to be efficiently and quickly transmitted over the Internet. Low-resolution images will still yield good-quality printouts on inkjet printers.

Bottom line: A higher resolution (i.e., higher quantity of finer dots) will result in an excellent image that can be enlarged to a certain extent without compromising quality. On the other hand, if you reduce the resolution of an image without reducing its dimensions, the image quality will drop. It is important to make a copy of the original image when experimenting with size and resolution because the process cannot be reversed.

1.3.3 Screen Colors – Color Models and GEGL, the New Graphics Library

GIMP's version 2.6 employs three color models: RGB (red, green, blue), grayscale, and indexed.

GIMP uses the **RGB colors,** or colors of light, as its default. Together, these colors form what is known as the **additive color model**. It uses the three primary colors—red, green, and blue—to create a color spectrum containing approximately 16.78 million colors. This is called *true color* because it represents the maximum number of colors that a computer monitor or television screen can display.

Mixing two primary colors in RGB mode will result in the creation of a secondary color, such as yellow, cyan, and magenta. No color (or the absence of light) creates black, while the sum of all colors results in white.

Figure 1.4
The RGB color model

Figure 1.5
The color spectrum of the RGB color model. About 16.78 colors are shown, with black at one extreme and white at the other.

Figure 1.6
Approximated representation of the set of colors in the RGB color model

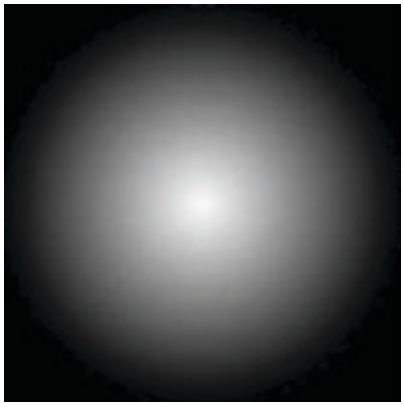

Figure 1.7
There are 256 gray levels in the RGB color model.

If you wish to specify a color for a printer or want to choose a unique background color for your web page, the following information should be considered.

Specific colors correlate to unique numerical values. In the RGB color model, each of the primary colors (red, green, and blue) has a decimal color value ranging from 0 to 255, with black as 0 and white as 255. Hence, there are 256 color values for each of the base colors red, green, and blue. The total number of potentially resulting colors is calculated by the following multiplication:

256 • 256 • 256 = 16.777.216 colors

To specify the number of colors of an image or color model, I use the term **color depth, which is specified in bits. The RGB color model has a color depth of 24 bits (24-bits = 2 to the power of 24 colors = 16,78 million colors)**

These values apply to color as well as black-and-white images. In the world of digital image editing, black-and-white photographs are called **grayscale images**. In addition to the black and white "colors", grayscale images contain all possible shades of neutral gray.

Since the color values of the three primary colors must be identical in order to produce purely gray levels, the number of gray "color" values amounts to 256.

Grayscale images have a **color depth** of **8 bits**.

In the RGB color model, the colors are normally defined in **decimal numbers**. As mentioned earlier, each single color can have a value between 0 and 255. You can use the eyedropper icon located in the Toolbox of GIMP to open the Color Picker to measure a color. The *Color Picker* will show you the number corresponding to a color's exact value so you can easily transmit the information to your colleagues or work partners.

Color			
Black	0	0	0
Red	255	0	0
Green	0	255	0
Blue	0	0	255
Yellow	255	255	0
Cyan	0	255	255
Magenta	255	0	255
Medium gray	128	128	128
White	255	255	255

The primary and secondary (mixed) colors in decimal notation

If you want to appropriate a color from an existing image as the background color for a web page, you will need to specify **hexadecimal numbers** (base 16). Convert the decimal numbers (see above) into hexadecimal numbers, which are simply denoted by adding a # symbol in front of the number. You can use any tool for this conversion, including the Windows Calculator (*Start* > *Programs* > *Accessories* > *Calculator* > *View* > *Scientific*).

GIMP conveniently performs this conversion for you. Its *Color Picker* tool will provide you with the hexadecimal number value for every color.

Indexed Colors

Many image file formats used on the Internet use indexed colors rather than RGB. Indexed color images don't save the color values in the pixels themselves, but add a defined color palette. The number of colors in this indexed color palette is limited to 256. Indexed images are usually smaller than RGB images since they possess a color depth of 8 bits instead of 24 bits. When an image is converted to indexed color, a predefined color palette or a set of colors derived from the image itself will automatically be formulated. The palette can contain a maximum of 256 colors. File formats that automatically create images with their own color palettes include the compressed GIF format as well as the 8-bit PNG format. Indexed images can also include gray-level images (with a maximum of 256 shades of gray).

However, you may find using an indexed palette cumbersome because it won't allow you to access all of GIMP's editing options. Indexed images are normally edited in RGB mode. After editing, the indexed palette can be selected and attached to the image before saving and exporting the file for use on the Internet.

The CMYK Color Model—Cyan, Magenta, Yellow, Key (Black)

Digital pre-press in **four-color printing** uses the **CMYK color model**. The CMYK model behaves quite differently than the RGB model. For one thing, CMYK has four color channels rather than three like RGB, so the nominal number of colors increases in CMYK. Nevertheless, the color *range* of CMYK is smaller than RGB. Thus, when you convert an image from RGB to CMYK, it may appear paler or darker due to the loss of image information or the insertion of additional black. To avoid fading or darkening, edit your image in the RGB mode before converting it to CMYK mode. Also, because changes often result

when shifting modes, you should avoid converting an image from RGB to CMYK, and vice versa, unless it is necessary.

Since the **CMYK color model** has four color channels, it possesses a total number of approximately 4.3 billion potential colors, which translates to a **color depth** of **32 bits**.

The colors of this model are subtractive primary colors. This means that the CMYK model behaves inversely to the RGB model. For example, if you apply the RGB model to CMYK, then 256 shares of cyan, 256 shares of magenta, and 256 shares of yellow *should* produce black. However, what you will actually see is a dirty dark brown. To obtain real gray and black shades, you have to add black. CMYK is actually an acronym for Cyan, Magenta, Yellow, Key, where Key = Black.

Currently, GIMP does not have a feature for converting and editing images directly in CMYK mode. However, it can produce the chromatic components necessary for use in four-color printing processes. If you want to edit in CMYK, you can use the *Image* > *Mode* > *Decompose* menu command to decompose your image into the four color channels. Each of these channels can then be saved, edited, and shared as separate images, which can be re-integrated prior to printing.

Alastair M. Robinson's plug-in **Separate+** offers a feature for color separation as well as additional features for soft proofing and duotone coloration. You can find information about the plug-in on the author's website: http://www.blackfiveservices.co.uk/separate.shtml. The improved version can be found at http://registry.gimp.org/node/471 and on the DVD at the back of the book.

After the installation, you will be able to separate an image into the four color channels of the CMYK color model by using the menu command **Image > Separate**. The separate channels will be generated as layers in a new picture and can be retouched individually.

At least GIMP can separate the colors for the four-color printing by using grayscale images from one image.

Note: Further information on plug-ins can be found in section 1.5.2. You can find the download addresses in the link list on DVD. Most of the mentioned plug-ins are gathered there as installable files.

1.3.4 Important File Formats for Practical Work

When saving an image, you should select a file format that corresponds to the requirements of the image as well as your stylistic intentions. This section will introduce you to the most commonly used file formats.

XCF: GIMP's Native File Format

GIMP's **XCF format** was created for the primary purpose of **saving images with layers**; however, it can also be used to save images that aren't finished yet. The XCF format saves image layers by employing a lossless compression method. So the file size of an XCF formatted image will be smaller than most other image file formats and about 30 percent smaller than the PSD format, described later.

Since overly large files are cumbersome and can be unmanageable, GIMP's native XCF format is the best choice for storing images with layers. The only drawback of GIMP's current version is that XCF files cannot be opened in another image editing program. If you want to export an XCF file into another program, you must first convert a copy of it into JPEG, PNG, or TIF. If you plan to consistently use other programs in conjunction with GIMP 2.6, you should save images with layers in the PSD format.

XCF Characteristics

- 16.78 million colors, 24-bit color depth
- Alpha transparency (color gradient from transparent to opaque)
- Lossless compression
- Supports layers

PSD: Adobe Photoshop's Native File Format

PSD (PhotoShop Document) is the native file format of Adobe Photoshop, one of the most popular image editing programs. This file format is considered a de-facto standard and can be used by almost all other image editing programs, including GIMP. It is a high-quality format that is frequently used to export images with layers.

The downside of saving images in PSD is that the files are often quite large because the format provides no compression options.

Since GIMP 2.4, Photoshop layer masks are readable, and it can even write in the PSD format. However, GIMP does not support some PSD formats such as smart objects or smart filters.

PSD Characteristics

- 16.78 million colors, 24-bit color depth
- Alpha transparency (color gradient from transparent to opaque)
- Supports layers

PNG: Portable Network Graphics

The PNG format is capable of preserving the transparencies of an image with full 24-bit color depth. Moreover, it uses a high lossless compression method that considerably reduces the image file size.

The PNG format is also suitable for Internet use.

PNG Characteristics

- 256 or 16.78 million colors, 8- or 24-bit color depth
- Alpha transparency (color gradient from transparent to opaque)
- Lossless, settable compression
- Suitable for the Internet
- Interlaced (immediate display, layered refresh rate in web pages)

JPG/JPEG: Joint Photographic Experts Group

Photographs and photo-realistic images with a color depth of 24 bits can be efficiently compressed with the JPEG format, which reduces image files to a fraction of the original size. However, the compression method used by the JPEG format is not lossless. This means that the image quality will suffer in correlation with the degree of the compression as well as the decrease in file size. The JPEG format was developed primarily as a way to quickly load photographs on the Internet. JPEG format should be avoided when archiving digital photographs. You should also refrain from repeatedly saving an image in the JPEG format because the quality of your image will drop with each subsequent save. To preserve the integrity of your images, use the PNG format to save when you are working with them and to archive your images after you've finished editing them.

For exporting images in the JPEG format, GIMP offers a programmable compression option with a preview feature. This option will display the file size of the compressed photo prior to saving it.

JPG Characteristics

- 16.78 million colors, 24-bit color depth
- High but lossy compression; settable by the user
- Suitable for use on the Internet
- Progressive (faster display in Web pages, layered image refresh rate, comparable with the *interlaced* characteristic

GIF: Graphics Interchange Format

Unlike other file formats, the GIF format requires a color palette. This means that a maximum of 256 colors can be saved in conjunction with an image. GIMP can create these color palettes automatically, but there is a major drawback to doing so. Converting images with an original color depth of 24 bits (or more) to GIF will usually produce an unsatisfactory result.

However, if you save an image with 256 or fewer colors (such as a simple logo) to GIF, the GIF compression is lossless. In addition, GIF files allow you to save one transparent color as well as simple animations (*animated GIF*).
The GIF format is often used to upload images to the Internet

GIF Characteristics

- 2 to 256 colors, 8-bit color depth (at least one, possibly transparent, color)
- Lossless compression for images containing up to 256 colors
- Suitable for use on the Internet
- One color can be transparent
- Interlaced (immediate display, layered refresh rate in web pages)
- Animated GIF available

BMP: Windows Bitmap

Microsoft developed BMP, therefore it is supported by most Windows image editing programs and is a suitable format for image sharing between different programs. BMP has a color depth of 24 bits and the image resolution remains unchanged when exporting. However, because the size of BMP files is normally quite large, the format is not particularly suitable for the Internet.

BMP Characteristics

- 16.78 million colors, 24-bit color depth
- Rather unsuitable for use on the Internet (for Microsoft Internet Explorer only)

TIF/TIFF: Tagged Image File Format

This is one of the oldest image file formats still in use. Almost all image editing programs can read and write a TIF formatted image, even if they're being run on different operating systems. For this reason, it is the best file format to use when sharing high-quality images *without* layers. Basically, the file format also allows you to save images in the CMYK mode for the four-color printing process.

The TIF format preserves all transparencies of an image with the full color depth of 24 bits. It uses a lossless, but not particularly high, compression method. With an adapted TIF format, you may save images with the 48-bit color depth (i.e., HDRI images). The major drawback of using TIF is that it doesn't support layers (except in Adobe Photoshop).

TIF Characteristics

- 16.78 million colors, 24-bit color depth
- Alpha transparency (color gradient from transparent to opaque)
- Lossless LZW compression
- Different settings for saving when used on IBM/Intel and Macintosh PowerPC computers

DNG: Adobe's Digital Negative

Adobe's DNG format was developed to replace the proprietary RAW files and create an open standard. It offers advantages in the long-term archiving of RAW files and provides photographers with a certain amount of freedom from the camera's own software. GIMP'S plug-in UFRaw can work with DNG and most cameras' RAW formats. Several camera manufacturers have introduced this format to save images in their cameras.