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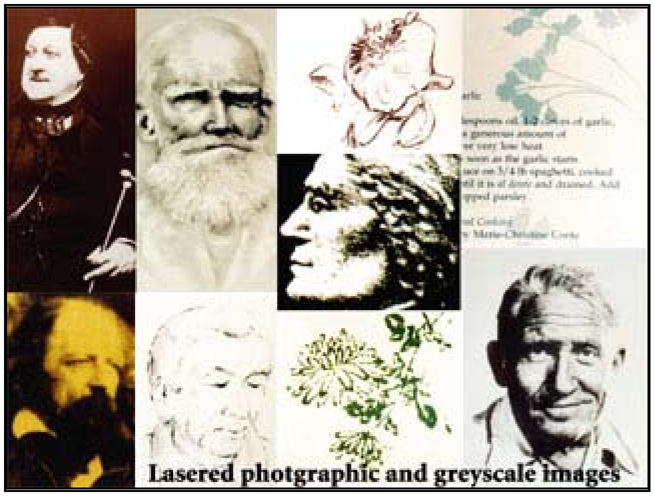
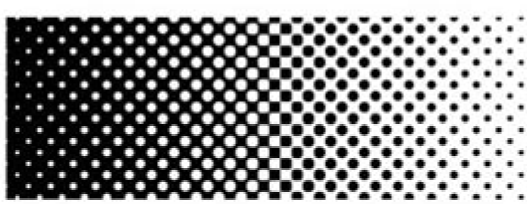


Lasered photgraphic and greyscale images

What is Photo Lasering?

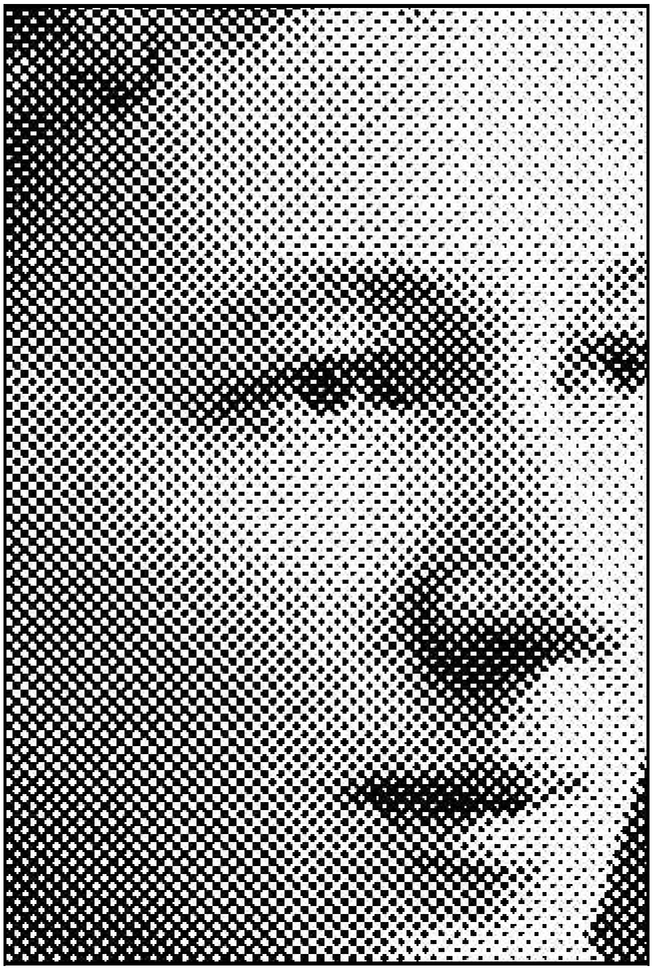
Photo lasering begins with a photograph. The photo is scanned, opened in an imaging program, adjusted for exposure and sharpness, and imported to a graphics program. It is then positioned and sized, perhaps with text or other images, and sent to a laser for engraving.

What makes this conversion from photo to engraving possible is the halftone screen. As in printing, the halftone screen converts the continuous tone gray values of the photograph to a series of large to small solid black dots that simulate the gray tones of the photograph. There are variations on the traditional halftone screen that will also work for photo laser engraving, but to avoid confusion, only the traditional screen method will be discussed.



Halftone Screen

When we look at a magazine photograph, we are convinced we see different shades of gray when actually we are looking at solid black ink only. This black ink is printed in the form of tiny dots in patterns that are usually invisible unless magnified. In a traditional halftone screen, the dots are evenly spaced. Because they vary in size, you experience the illusion of looking at shades of gray.



The laser, in its raster engraving mode, will engrave anything on the page that is read as black, including these tiny halftone dots. Because of this, it is possible to have a photographic or other grayscale (shades of gray) image engraved into the surface of a plastic laminate material. The result is quite unusual, because the engraving is permanent and not subject to fading since inks are not involved. The trick is rendering halftone dots accurately in order to achieve a good representation of the original. The following explains in greater detail how to achieve good results.

What You Need to Get Started

In addition to the basic lasering equipment, a flatbed scanner. Imaging software such as Corel Photo-Paint or Adobe PhotoShop can provide added control over the image.

Digital cameras that record an image as a file, and slide scanners and video devices that capture stills are also available. All of this equipment provides excellent ways to acquire images.

Beginning Techniques

Scanners convert photographic images into digital information. Visually, the transformation results in a horizontal/vertical grid of pixels (tiny squares of solid color) arranged in tones, shades, and colors to simulate the original. Once the image has been scanned, it is possible to change the color information in any or all of the pixels to alter the scanned image. This alteration can take place one pixel at a time. Considering that a 5" x 7" photo scanned at a resolution of 300 PPI (pixels per inch) would contain 3,150,000 pixels, it would be much easier to work with the alteration tools available in photo-imaging software such as Corel Photo-Paint. This is especially true considering that each pixel could be changed to any one of millions of colors.

These tools also make it possible to alter many of the photo's properties, such as brightness, contrast, and color intensity. Today's graphics software can take a very poor original and transform it into a high quality image. In addition, it is possible to completely alter the photo through the use of sophisticated selection tools and filters. These tools allow a subject in the photo to be silhouetted, reduced, enlarged, flipped, rotated, copied, and pasted into another photo. Learning to use such software can really increase versatility and productivity when working with images, and it sets the stage for creative exploration.

For the purpose of photo laser engraving, it is only necessary to convert a color image to grayscale, adjust the brightness, contrast, and sharpness, invert the image (turn it into a negative), and control the resolution. Most scanner software has the ability to do this and in a limited way can be used as an alternative to the more sophisticated imaging software already mentioned. The ease and depth of control provided in a software program, such as Corel Photo-Paint, makes it worth the effort to learn.

The original photo to be laser engraved can be either black and white or color. Regardless of the original image, however, it should be scanned as a grayscale image or scanned as color image and converted to grayscale using the imaging software. All scanning software is essentially alike, since the image is first previewed, the desired portion of the image is then selected using a cropping tool, the type of image is designated (color, grayscale, or black and white), the resolution is determined, and the image is scanned.

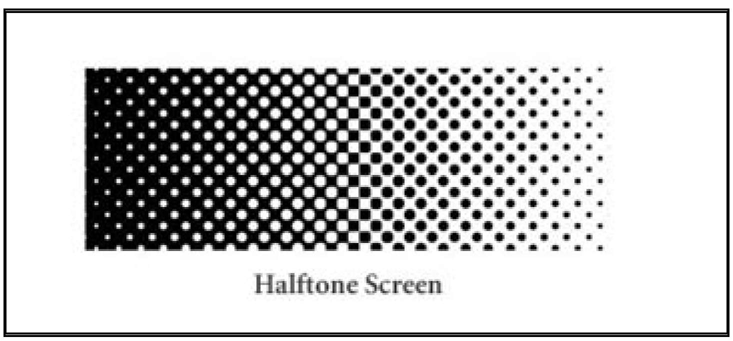
Resolution is figured by the number of pixels that can be counted linearly in an inch, that the scanner creates in order to represent the image. A resolution of 4 PPI (pixels per inch) means that each pixel is 1/4" in size. Since each pixel can only contain one solid color, then scanning a 5" x 7" photo at this setting will not produce anything recognizable other than a grid of colors. By scanning the same photo at 72 PPI, it will be recognizable and actually look pretty good at its original size; however, details will be lacking if the photo is enlarged. As the PPI number increases, the pixels become increasingly smaller and more numerous and the image more detailed. However, the electronic size of this file will also dramatically increase. Scanning a color 8" x 10" photo at 1200 PPI is ideal in terms of detail captured, but the file size might not be practical for your computer.

When the image is sent to the laser, any resolution over 300 PPI does not improve the rendering of the halftone screen. If an image is to be lasered the same size as it was scanned, the resolution should be 250 to 300 PPI (1.5 to 2 x 150 line screen desired LPI). If the image is to be reduced before it is lasered, the original resolution can be less. If it is to be enlarged, the setting should be higher. The actual PPI of the final image sent to the laser, after enlarging or reducing, should be between 250 and 300 PPI. If a coarser (90 LPI) halftone screen is desired, the resolution of the laser ready image should be between 135 and 180 PPI (1.5 to 2 x the LPI (90) = 135 to 180 PPI).

In most cases, the dimensions of the scan will automatically remain the same as the original and so will the exposure. However, both aspects can be changed using the scanning software or the higher-end imaging software. If only the scanner is used to adjust the image, it should be saved in a format compatible with the graphics software that will be sending it to the laser. If imaging software is used once the image is scanned, it will automatically appear ready to be adjusted or manipulated by that software. It should be saved in a compatible format as well.

In either case, the objective is to make the on-screen image look as close as possible to the desired outcome. Learning to use the imaging tools is a key factor to being successful.

Halftones



Originally, a halftone screen was a mesh screen through which a high contrast camera (capable of shooting black or white only with no grays) would photograph a grayscale image. The screen would force the camera to interpret light gray areas as various sized but evenly spaced tiny black dots. Midtone areas would appear as equally sized dots of black and white in checkerboard fashion. Dark areas would appear as mostly black with variously sized, evenly spaced tiny white dots. The lighter the gray, the smaller the dots would be until they disappeared into pure white. The darker the gray, the smaller the white dots would appear on a black background until they disappeared into pure black.

Coarse-through-fine mesh screens were developed, with the fine mesh screens capable of much better reproduction. These screens were designated in lines per inch (LPI) with most newspaper screens running around 60 to 100 LPI and most good magazines around 150 to180 LPI. Today the same effect is achieved digitally using no real screens or photography, and the outcome is identical. An image can be sent to the laser as a grayscale image, and it will automatically be converted to a coarse or fine-screen halftone. It can also be converted during scanning or in the imaging software and sent to the laser as if it were a normal black and white image.

The image should consist of black dots ready for lasering. Each sweep of the lens across the page will render portions of all the halftone dots in its path. It will take several sweeps before one halftone dot (depending on its size) can be rendered from top to bottom. A coarser screen contains larger sized dots overall that are easier to render clearly. The finer screens (180 LPI) contain extremely tiny dots in the light gray areas, but also produce a highly detailed natural looking image since the halftone dots are too small to be seen without magnification.

For quality engraving, the smallest available lens size is recommended. A 1.5" lens produces a beam that is only .003" in diameter, meaning the smallest dot size that can be rendered is .003". Every time the arm completes its sweep, it jumps down one notch. The distance of that jump is dependent on the DPI setting in the software (1000 DPI = .001" jump, 500 DPI = .002" jump, 250 DPI = .004" jump, etc.). The PPI setting (pulse per inch) indicates how many times in an inch the laser will fire (1000 PPI = .001" distance between pulses, 500 PPI = .002" distance between pulses, 250 PPI = .004" distance between pulses, etc.).

Since the beam is .003" in diameter (1.5" lens) and at 1000 DPI and PPI settings, it will fire at only .001" intervals in either direction. There will be an overlap of stroke diameter between both path sweeps (vertical) and pulse firings (horizontal). This combination of small beam diameter (small lens) with high DPI and PPI settings produces the greatest potential for success in rendering a fine (180 LPI) halftone screen. For coarse screens (larger dots), these settings can be lowered to 500 or 333 DPI and PPI.

The more accurately the halftone dot is rendered, the clearer and sharper the reproduction will be. Issues that can affect this rendering are lens size, DPI/PPI settings, power/speed settings, accuracy of the mechanics of the laser, and lens focus.

For a first attempt, it is probably best to choose photos that are mostly light. Use LaserMax White/Black and select a mid-range DPI setting (500 DPI). Scan the image at least 180 PPI (sometimes designated as DPI) or up to 300 PPI if it is likely that the image will be printed in the future at higher resolution and plan to print it at the original size. If possible, use imaging software to make the scan look as close to the original as possible in terms of exposure. Send this to the laser with the settings listed below. Be sure to indicate this is a halftone rendering in the print driver settings (see laser instruction manual). Place the material on the bed and begin lasering. You should get an excellent reproduction of the original except the halftone dots will be larger and visible to close scrutiny.

Advanced Techniques

Material Selection

One major difficulty when lasering photos is engraving too much of the sheet area. This is actually preventable by using some simple strategies, but it is important to first evaluate the photo being reproduced.

Photographs consist of very subtle shades of gray that can shift imperceptibly from one tone to the next. It is important to determine if the range of tone is evenly distributed throughout the photo or if the photo is predominantly dark or light. Since the laser only engraves what it reads as the black parts of any image, it will render anything it sees as black even if that means burning away most of the white cap material to match the onscreen image.

A predominantly dark photo will contain a majority of dark halftone dots covering most of the surface of the photo, meaning that the laser will have to burn all of that surface area. Too much burning may result in a degraded image and/or overheating and warping of the acrylic substrate. Photos with an even distribution of grays will work better but may still cause some distortion.

If you have further questions please contact:
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