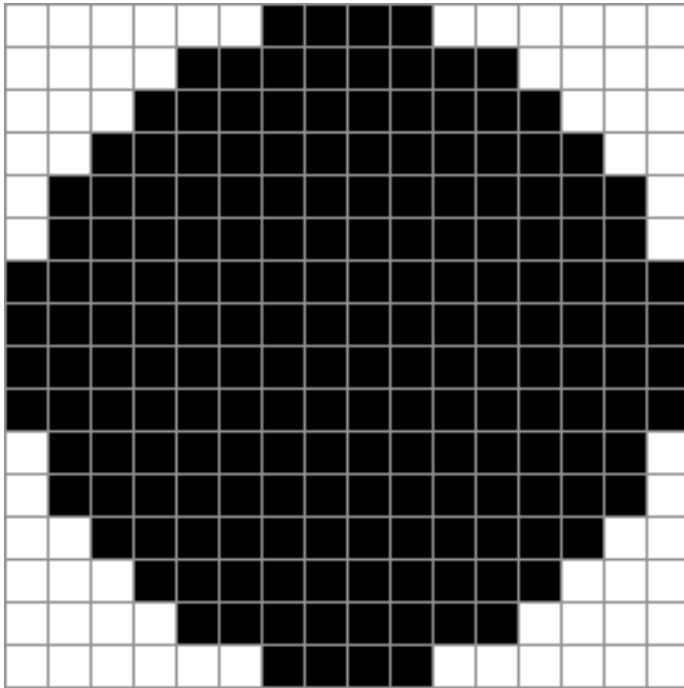


**More On Halftones:  
Process Color Halftones And Line Art**  
<http://www.sketchpad.net/basics9.htm>

How does the printer or imagesetter create a halftone from a color or grayscale image? The printer creates halftone dots by means of a halftone cell (below). A halftone cell is composed of a grid of pixels. Each pixel would be either solid black or solid white. The number of shades of gray which can be represented by a finished halftone image is limited by the number of pixels available in the halftone cell. Below is an example of a 16 x 16 halftone cell.



In the example above there are  $16 \times 16 = 256$  possible shades of gray. (There are 256 tonal values, but only 255 steps between them. Remember that the range starts at 0.) If all the pixels were black the halftone dot would be 100% black. If all the pixels were white the halftone dot would be 0% black. If every other pixel were black, the halftone dot would be 50% black, etc.

In the above diagram, there are 188 black pixels out of a possible 256 in the halftone cell. The dot would have a grayscale value of 73.4% black.

There is a formula for calculating the maximum screen frequency a printer can output:

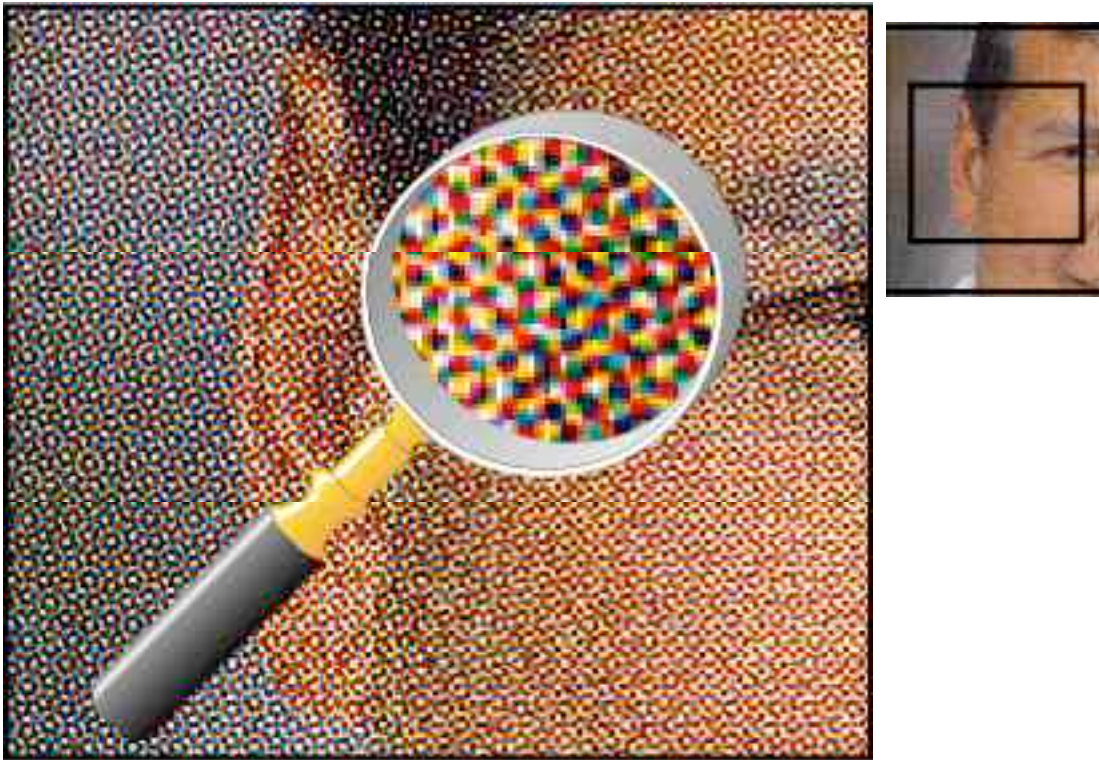
$$\text{Screen Frequency} = \sqrt{\frac{\text{Printer Resolution}}{\text{Gray Levels}}}$$

Thus, for a 1200 DPI Linotronic imagesetter, the maximum screen frequency for 256 shades of gray would be 75 and the maximum screen frequency for 64 shades of gray would be 150. ( $1200/16 = 75$  or  $1200/8 = 150$ ) ( $16 \times 16 = 256$  and  $8 \times 8 = 64$ )

In actuality, though, one can get away with as few as 32 shades of gray in most any image. Thus, for a 150 line screen halftone, you can reduce the number of grays in your images to 64 or less to achieve satisfactory output on a 1200 DPI machine.

## Process Color Halftones

Both color and grayscale halftone dots are created as shades of gray. "What?", you say. "Color halftones are shades of gray?" You see, even though the halftone will print using process color, each of the four color plates (cyan, magenta, yellow and black) is prepared from a black and white halftone negative. When printed and combined with their corresponding color, the result would be a color picture (below).



## Halftone Angle or "Slope"

Part of setting up the halftone in page layout is determining its angle or "slope". If the halftone were to be displayed with a slope of  $0^\circ$  it would be hard on the eyes. For this reason halftone dots are placed at an angle to each other to blend in better. The dots on a simple grayscale halftone need only be angled at  $45^\circ$ . But the dots on a process color halftone need to be offset from each other in a pattern so they appear harmonious. If you will notice in the representative image above, the cyan, magenta, yellow and black dots appear to form a circular group called a "rosette". The default angles vary with the separation printer selected for output. The default angles for cyan, magenta, yellow and black for a Linotronic 330 are:

Cyan  $15^\circ$   
Magenta  $75^\circ$   
Yellow  $0^\circ$   
Black  $45^\circ$

## Line Art Resolution Rule of Thumb

In the previous tutorial a rule of thumb was given for determining the resolution of a grayscale or color image. It is always better to use an EPS vector image for line art. However, if a bitmap must be used, the rule of thumb for line art is to scan or size it to 600 PPI to avoid the "jaggies". Line art bitmaps have to be scanned or sized at a much higher resolution than color or grayscale halftones.