NOTE: placing the mouse over italic words in green below displays additional information

DIGITAL ARTWORK

With the advent of affordable software and hardware, the number of digital files supplied for print artwork has steadily increased. Due to the many advantages associated with digital art, Elsevier is committed to working with authors to maximize quality and ensure accurate presentation of their material. This document explains the concepts involved in digital art as well as presents the requirements that the graphics and printing industry have developed for high-quality reproduction of digital artwork (see list of requirements).

Vector vs. Raster Artwork

Digital art can be put into one of two categories: **Vector** or **Raster.**

Vector artwork (also referred to as object-oriented) is made up of shapes that can be represented either as outlines and/or filled with color. Vector artwork is created in applications referred to as *drawing programs*. The shapes are defined mathematically and do not contain *pixels*; output quality is not dependent on *resolution*. Vector artwork is best used to represent *line art*. Vector file formats can contain imported raster images, but these must satisfy the same requirements for raster artwork below. All text created in a drawing program must be *converted to outlines*.

RESOLUTION: the number of pixels per inch (ppi) contained in a raster artwork file.

EPS is the only acceptable file format for vector artwork.

Raster artwork (also referred to as *bitmap*) is made entirely of pixels that are assigned colors based on the *color space or mode* of the file. Raster artwork is created in applications referred to as *photo editing or painting programs*. Raster artwork is best used to represent *continuous tone* photographs. Opening a vector-based file in a photo editing program *rasterizes* the artwork. All artwork captured with a scanner is raster-based.

TIFF is the only acceptable file format for raster artwork.

Resolution

Resolution defines the number of pixels making up a given raster artwork file, and hence the level of detail in the image. Resolution is most often referred to in *ppi*. Insufficient resolution is the most common reason for poor quality in printed images. While images may appear fine on screen, a minimum of **300ppi for gray scale or color images**, and **1200ppi for monochromatic(black and white)** images is required to adequately represent digital artwork in print. Higher resolutions do not improve quality and may blur details in the image.

An image's resolution is defined in relation to its physical size, and is inversely proportional to it. That is, as resolution goes up size goes down and vice versa, unless an image is *resampled*. Resampling changes the data in the image and can create either a blurry or *aliased* image. Therefore images must be supplied at the proper resolution **and** at the final printed size.

Color Modes

Color Modes define the number and type of colors that can be used to represent artwork. *Monochromatic* images contain one color (as well as white) and are most often used to represent line art images. *Gray scale* images contain 256 shades of black and are best used for black and white continuous tone photographs. Color images for print should be supplied as *CMYK*. Images intended for viewing in a browser, can be supplied as *RGB*, however, CMYK must be used for print and contains fewer printable colors than RGB. Therefore, a *color shift* is likely to occur when converting from RGB to CMYK.

GLOSSARY OF TERMS

ALIASING: Jagged appearance of pixels, which is more apparent in low-resolution files. *Anti-aliasing* compensates for this effect by changing the value of a given pixel, based on the average value of the neighboring pixels.

BITMAP: A grid of pixels of a given size (resolution) and color. Also used to refer to a color mode (see *Color Modes* on the first page above).

CMYK: Cyan, **M**agenta, **Y**ellow, blac**K**; the 4 printing inks used to reproduce color images.

COLOR SHIFT: A result of converting RGB to CMYK. CMYK cannot represent all colors available in RGB, especially bright, pure colors. Color to black and white conversions can also produce problems, mainly different colors mapping to the same gray-value.

COLOR SPACE: A mathematical model defining the number and type of colors available.

CONTINUOUS TONE: Artwork that contains an infinite range of tones (e.g., photographs, paintings).

CONVERT TO OUTLINES: A process by which a drawing program converts typographic characters into vector shapes. Necessary to avoid font substitution problems.

DRAWING PROGRAMS: Graphics applications that create vector artwork. This type of artwork is resolution independent. Adobe Illustrator, Macromedia Freehand, and Corel Draw are examples of this type of application.

EPS: '**E**ncapsulated **P**ost**S**cript'; a vector graphics file format (see *Vector vs. Raster Artwork* on first page above.

GRAY SCALE: A color mode that only allows for 256 shades of one color, usually black.

MONOCHROMATIC: An image composed of only black or white pixels. Also referred to as 'bitmap mode' or 'line art.'

PAINTING PROGRAMS: Graphics applications that create raster (or bitmapped) artwork. Adobe Photoshop and Corel Photopaint are examples of this type of application.

PIXEL: A *'***Pict**ure **El**ement*'* or the smallest defined part of a raster image (see *Vector vs. Raster Artwork* on first page above).

PPI: '**P**ixels **P**er **I**nch,' a measure of pixel resolution; can also be specified in 'pixels per centimeter.' Often used interchangeably with dpi or 'dots per inch,' which refers to output or printer resolution.

RASTERIZE: A process by which painting programs convert vectors into bitmaps.

RESAMPLE: Adding or removing data in a file by changing size or resolution independently. Changes in data are based on the average color of surrounding pixels (see *Resolution* on first page above).

RESOLUTION: The number of pixels per inch (ppi) contained in a raster artwork file.

RGB: '**R**ed, **G**reen, **B**lue'; the three primary colors for projected light (e.g., computer monitors).

TIFF: '**T**agged **I**mage **F**ile **F**ormat'; a raster graphics format.

REQUIREMENTS FOR DIGITAL ARTWORK

MONOCHROMATIC RASTER ARTWORK *(e.g., charts and graphs using one color)*

File Format	TIFF *(must have .tif as extension in filename)*
Color Mode	BITMAP for line art using only black *(no gray)*
Resolution/Size	1200ppi at final print size

BLACK AND WHITE RASTER ARTWORK *(e.g., b/w photographs or graphs using gray)*

File Format	TIFF *(must have .tif as extension in filename)*
Color Mode	GRAY SCALE for black and white photographs or medical imaging
Resolution/Size	300ppi at final print size

COLOR RASTER ARTWORK *(e.g., color photographs or multi-color graphs)*

File Format	TIFF *(must have .tif as extension in filename)*
Color Mode	CMYK (preferred) or RGB for photographs or medical imaging
Resolution/Size	300ppi at final print size

VECTOR ARTWORK *(artwork created in a drawing program; e.g., Adobe Illustrator)*

File Format	EPS *(must have .eps as extension in filename)*
Colors	All color should be specified as CMYK *(gray should be specified as a percentage of black only)*
Typography	All type must be converted to outlines/objects
Imported Raster Images	Must meet the above requirements for raster artwork

All filenames must contain the figure number and proper extension (e.g. Smith Figure 1.tif, Smith Fig1.eps). Note that only one period should appear in the filename to separate name and extension. Multipart figures are best supplied separately, and must be labeled appropriately (e.g., Smith Figure 1a.tif).

It is not necessary to compress files, however, TIFF supports a loss-less compression scheme (LZW). Do not send ZIP or Stuffit files. Supply all TIFF's with layers flattened.

Artwork will be assumed to be final size and cropped as supplied. All labels must be part of the file.

Files will not be accepted from programs that cannot meet the above requirements (e.g., Microsoft Powerpoint, Microsoft Word, Corel WordPerfect, Lotus Freelance Graphics).