Technospeak *for the* Digital Geek

A glossary of digital imaging terms.

Compiled by the staff of *Digital Graphics*.

Editor's Note: Defined terms appear in **bold**, while references to other listed terms within a definition appear in *italic*.

Absorption — The conversion of visible light into a different form of energy as it interacts with matter, decreasing the amount of light transmitted or reflected. The result is a modification of the matter's color.

Additive Color — An emissive color system used in image capture and display in which the additive primaries, red, green and blue (*RGB*), are combined to form all other colors. When *RGB* light comes together at 100 percent, the result is white (as in white light).

Addressable Resolution — The highest *resolution* that can be achieved by the imaging mechanism of a scanner or printer in reproducing an image. Also see *optical resolution* and *interpolation*.

Adobe Acrobat — Software for viewing and printing files in Adobe's Portable Document Format (*PDF*), intended to read documents without having the particular program or fonts used to create them. Adobe's PDF Writer and Acrobat Distiller are programs for creating *PDF* files.

Aliasing — Visual stair-stepping of edges that occurs in an image when the *resolution* is too low for the size of the output. *Anti-aliasing* is the removal or softening of the rough edges (or *jaggies*) by averaging or blending of surrounding colors. See also *jaggies*.

Alpha — In an imaging program, color channels in addition to those used for the *primary colors* (e.g., *RGB*, *CMYK*); usually used for masking or controlling *opacity*.

Aspect Ratio — The height-to-width measurement of an image. This can sometimes be altered when using a software's import/export feature or transferring an image from one computer to another. Ratio can also change with *pixel* size, although most computers use a 1:1 aspect.

Attribute — A distinguishing characteristic. The attributes of color are *hue*, lightness and *saturation*.

Anti-Aliasing — Process of mixing various amounts of surrounding colors to create fill *pixels*, which helps eliminate *jaggies* when enlarging low-*resolution* images.

Aqueous Inks — Inks that use water as a *carrier*. Typically, aqueous inks use either *dye* or *pigment* as colorants.

B

Banding — A pattern of parallel lines that occurs in solid colors, *continuous-tone* tints, *gradations* or images, instead of a smooth color or transition of colors. Banding can appear on computer monitors when viewing images with less than 24-bit information, or on printers due to problems with the *printhead* or media.

Beziér Curve — A type of curve defined by a line and a point, used in computer drawing programs to create *vector* artwork and type. Programs have two control points at ends of line segments used to define the shape of the curve.

Bio Ink — A type of *solvent*-based inkjet ink whose *carrier* is made from a renewable resource. Most such inks use corn-based *ethyl lactate* as the primary carrier because it contains very few harmful *VOCs*. Bio-inks can also be made from soy products.

Bitmap — A graphic file constructed of raster data, individual *pixels* arranged in patterns. Bitmap image formats include, by filename extension: BMP, EPS, GIF, JPEG (or JPG), TIF (or TIFF) and more. See *Raster Image*.

Black — The absence of light. A color produced when an object absorbs all wavelengths of light, rather than reflecting some, as with other colors. In printing, black can be created by using a black pigment (K) or by combining CMY at 100 percent.

Black Generation — Addition of a black layer to the *process colors* (cyan, magenta, yellow) when converting an *RGB* color image to *CMYK* mode. Usually handled in one of four ways: short-range black, used with camera/enlarger separations made through colored filters; long-range black, used in electronic scanners and separation software; *UCR* black; or *GCR* black.

Blooming — "Digital overexposure" caused by exposing a *CCD* element to too much light while capturing an image, resulting in color distortions and loss of image detail.

Bounding Box — A rectangle defining the area of an image. The area of an on-screen image at its maximum X and Y axes measurements. Altering the bounding box by moving its control points can change the shape or size of an image. Bounding boxes allow scaling of graphics in page-layout software.

Brightness — The property of light reflectivity in paper, or emission on a computer screen. Paper brightness (R457) is defined as reflectance of blue light at the 457nm wavelength on a scale of 0–100%. Monitor brightness is measured in candelas per meter squared (cd/m2). Media with different brightness levels can cause changes in the appearance of colors, requiring adjustments in *calibration*.

C

Calibration — Conformance of a device (scanner, monitor, printer, camera, measurement instrument) to known specifications. The process of bringing all devices in a digital imaging system into conformance with specification, in order to achieve accurate and consistent color reproduction.

Camera Raw — An image file format for digital cameras containing unprocessed data. Also called RAW (not an acronym) or *CCD*-RAW, the format is proprietary and differs between camera makers (and sometimes between models from one manufacturer). RAW image files must be processed and converted to an *RGB* format before they can be manipulated by a *bitmap* graphics editor, printed or displayed by a Web browser.

Carrier — Substance in which pigments in inks are suspended. *Aqueous*, *solvent, eco-solvent* and *bio-ink* carriers evaporate after printing. *Monomers* are considered carriers in *UV-curable inks*, but are transformed into solid *polymers* after curing.

CCD (Charge-Coupled Device) — A sensor used in digital input devices (scanners, cameras, measurement instruments) to record images. These consist of an integrated circuit containing an array of linked capacitors under the control of an external circuit.

Chromatic Adaptation — The ability of the human eye to vary color perception under varying light by adjusting to the *white point* of the illumination. Some colors look the same in different levels of light. This ability is not held by reproductive techniques such as printing.

Chromaticity — The quality of a color as determined by its purity and dominant wavelength, which is relative to *saturation* and *hue* as used in the *HSV* model.

Chrominance — The property of a color that describes its *saturation*, *intensity*, or colorfulness, used in differentiating two colors of equal *brightness* and *hue*.

CIE (Commission Internationale de l'Eclairage) — An international color-standards body based in Vienna, Austria. The CIE's *chromaticity* diagram is a two-dimensional reference for defining colors and color spaces based upon physiological measurements of human color vision. An abbreviation for the CIE *L*a*b** (CIELAB) *color space*.

Clipping — A loss of shadow or highlight detail due to the conversion of grey tones: lighter than a certain value to white, or darker than a certain value to black.

Clean Color — Color made from one or two *pigments*, usually of high *saturation*.

CLUT (Color Look-Up Table) — A digital color-processing tool for converting color from one *color space* or device to another, such as from *RGB* (scale, 0–255) to *CMYK* (0–100%).

CMYK (Cyan, Magenta, Yellow and Black) — The four *process colors* used by output devices such as *inkjet*, *electrostatic* and *thermal transfer* printers. Black is called "K" because in process printing it is the key plate or keyline color.

Color Calibration — The use of software and/or hardware to coordinate the color match between two or more digital devices.

Color Curve — A visual control used in photo editing and other graphics software to display color measurements and make tonal changes to an image.

Color Density - The brightness and ink limit of a media; the higher the density, the greater the contrast. Color density can be measured using a *densitometer* or *spectrophotometer*.

Colorimeter — An optical device that measures absorbance of light by filtering reflected light into regions of red, green and blue. While dedicated colorimeters do exist, most instruments are actually *spectrophotometers* that compute colorimetric values based on spectral reflectance or transmittance curves.

Color Management — Refers to coordination of color among input, display and output devices. In output, color management is often handled on a device-by-device basis by imaging production software (see *RIP*). In display and other tasks, coordination often comes via device-specific software such as Apple *ColorSync* or Adobe Photoshop.

Color Modes — Models of tones based upon different coordinate *values*, such as: *hue*, *luminance* and *saturation* (HLS); *hue*, *saturation* and *brightness* (HSB); *hue*, *saturation* and *value* (HSV); red, green, and blue (*RGB*); and cyan, magenta, yellow and black (*CMYK*).

Color Separation — Artwork that has been split into component color plates in preparation for process printing (*CMYK*) or spot color printing. Each separation prints a single color. Digital files can be composite separations (all information in one file) or pre-separated (each color on its own page).

Color Space — A definition of color by theoretical three-dimensional graphing. Colors are determined by plotting points using particular *values* (such as red, green and blue). Used in most cases to represent the range of variations of particular color combinations, such as *RGB* or *CMYK*.

Color Specification — Numeric *values* used to specify a color within a color system.

Color Theory — A set of basic rules for mixing color to achieve a desired result.

Color Wheel — The colors of the visible spectrum, arranged in a circular fashion. A traditional wheel features 12 colors: three *primary*, three *secondary* and six *tertiary*. Computer-based color uses a wheel based on the RGB model, in which the CMY model represents secondary colors.

ColorSync — System-based *color management* software developed by Apple Computer; manages the color between digital devices by comparing each device's color description to the standard *CIE* color mode.

Compression — Reducing the size of a file through an alternate encoding process.

Continuous Inkjet — Process where ink is pumped through inkjet printing nozzles at a steady pace. Droplets are either shot onto a substrate/material, or electrically charged and deflected away from the printable surface into a collection system.

Continuous Tone — Method of printing in which equally-sized color dots are placed in a variable-spaced pattern, creating the effect of more natural color transitions.

Contour Cut — With print-and-cut digital-printing devices, the ability to cut around the outlines of an image, both on the outer border and along any internal closed-loop borders.

D

Delta-E (ΔE) — Measurement unit in a uniform *color space* of the perceivable differences in color viewable by the human eye. The first noticeable change is 1 ΔE. Delta-E measurement is used, for example, by customers specifying and accepting color, and in manufacturer guarantees of colorfastness.

Densitometer — A device used to measure light reflectance from a substrate, or transmittance through a film, on a scale of 0–100%, which is converted to a logarithmic scale of 0–infinity (0–4 in practice) to correspond with human vision (density = log 1/reflectance).

Device-Independent Color (DIC) — Color-matching system based on a universal set of *values*, instead of being based on the color *gamut* of one particular piece of equipment.

Dielectric Media — A specially treated substrate that holds an electrical charge for direct printing by an *electrostatic printer*.

Digital Printer — A printing device capable of translating digital data into hardcopy output. Technologies employed in digital printers include *inkjet, thermal transfer, electrostatic* and laser photo-imaging.

Digital Contract Proof — A high-quality color sample suitable for predicting color appearance on a press or printer, produced on a lower-cost *inkjet*, *dye-sublimation*, or other *digital printer* for approval purposes.

Dithering — A process that simulates color variations or shades of gray by varying the sizes and shapes of *pixel* groupings, rather than an ordered array of *halftone* dots. This reduces the contrast between dots of different colors/shades and creates a more-flowing, natural look.

Dirty Color — Color made from three or more *pigments*. The third pigment functions to reduce the *saturation* of the color.

D-min/D-max — Measurement of the density range of a photo, transparency, film or printed sheet, indicating its ability to absorb light. On a scale of 0-6, D-min has the lowest absorption (as in white or clear), while D-max has the highest.

DOD (Drop-On-Demand) — Piezo-electric printhead technology in which inkjet nozzles fire ink only when color is needed, as opposed to *continuous inkjet*, which fires continuously and deflects unwanted ink away from the substrate.

Dot Gain — Effect produced when individual dots print larger than their intended size, resulting in the darkening of a printed image. A result of ink spreading as it soaks into a substrate, it is sometimes referred to as "tone *value* increase" in recognition of devices, like inkjet printers, that don't use conventional *halftone* dots.

DPI (Dots Per Inch) — Unit of measure used to describe the printing *resolution* of an output device, or the printed resolution of images, based on the number of separate ink droplets represented either horizontally or vertically in one inch. Also correlates to *pixels per inch* and *samples per inch*.

Drum Scanner — A scanner on which color prints or transparencies are mounted to a rotating drum. As the drum spins, light from the image enters a lens and is recorded by one or more photomultiplier tubes (*PMT* tubes). These devices usually record more digital information than a *CCD* device, allowing for better image manipulation and printing detail.

Dye — A colorant that dissolves in water. Vegetable-based dyes are often used to produce non-outdoor-durable inks for large-format inkjets.

Dye Sublimation — Color printing technology that creates a photographic-quality image by delivering gaseous *dyes* to a receiver polyester-based material using a thermal transfer system, usually involving transfer paper and a heat press.

Dynamic Range — The measurable difference between the brightest highlight (white) and the densest *value* that any system can create; also, the range of gray values that a system can reproduce. Higher values show greater ability of a product to effectively contrast highlights and shadows.

E

Eco-Solvent Inks — A type of *solvent ink* that employs a less-toxic *carrier*, generally glycol ethers. Printers using eco-solvent inks emit fewer harmful *VOCs* than standard *solvent inks*.

Electrostatic Printer — A printing device based on xerography (the process on which most paper copiers are based). Electrostatic (or e-stat) printers transfer toner *resin* or *dye* from an electrically-charged plate or writing nib to the substrate, then thermally sets it.

EPS (Encapsulated PostScript) — File type that allows different information, such as colors and fill patterns, to be carried between software programs. Files can include *raster* and *vector* information, including low-*resolution* files for thumbnail previews. Versions of this include variations from Adobe Illustrator.

Equalization — Image-processing technique in which the range of tones or colors in a file is expanded to produce a better image.

Error Diffusion — *Screening* technology used in digital continuous-tone printers where fixed-sized dots are placed based on image detail and tone *values* to enhance detail.

Ethyl Lactate — A *solvent* commonly derived from corn, sometimes used in *bio inks*, that contain no harmful *VOCs*.

Expanded-Gamut Color — System in which additional colors (usually *light cyan*, *light magenta*, light yellow, light black, green and/or orange) are used to supplement *CMYK* in order to reproduce a greater number of colors. Also see *Hexachrome*.

F

Film Recorder (CRT & Drum) — A device used to transfer digital files onto film materials at a photographic-quality *resolution*.

Fixed Array — A stationary arrangement of inkjet printheads not mounted to a shuttling mechanism. Generally, fixed array printheads span the width of the media and are arranged in bars of each color. Some fixed array printheads are used in *single-pass* printers, while others shuttle the media or use a rotating drum to achieve multiple *passes*.

Foil — Donor sheet of color used in *thermal transfer* printing.

Four-Color Process — Any printing method that utilizes the *subtractive* primaries (CMY) plus black (K) to create the illusion of different colors.

G

Gamma — The slope of the line that represents image output *values* versus image input values.

Gamma Correction — Non-linear tonal correction that edits an image's *gamma* curve.

Gamut — The scope of colors that can be reproduced by a specific display or output device, or by a *primary color* system (such as *RGB* or *CMYK*).

Gamut Compression — Reducing the color *gamut* of an image so it can be displayed or output within the limits of a particular device.

Gantry — The moving apparatus on *inkjet printers* upon which inkjet *printheads* are mounted, allowing them to shuttle back and forth over the substrate, depositing ink.

Grey Scale — A scale of neutral grey tones, from black to white, with an infinite range of grey in between. A grey scale "step wedge" is a specific number of grey tones between black and white. New-generation *printheads* are capable of true grey scale printing.

Gradation — Steps of transition between two colors or between black and white. This is performed by progressively mixing percentages of a dominant and secondary color in alternation. (Sometimes referred to as gradient.)

GCR (Gray Component Replacement) — *Color separation* process in which black ink is used to replace cyan, magenta, and yellow (*CMY*) in mid-tone and highlight areas where the three inks overlap, in order to reduce ink consumption and drying time. (Similar to *UCR*.)

H

Halftone — Process of reproducing an image using a series of various sized dots within a fixed spacing, measured in lines per inch (lpi). Also known as amplitude modulation (AM).

Hexachrome — A type of hi-fi color system developed by Pantone Inc. that uses *CMYK* plus orange and green to extend the available color *gamut* beyond ordinary *CMYK* in order to reproduce more *PANTONE* colors without using individual spot-color inks.

Highlight White — Printing application in which white ink is used to enhance an image, sharpen colors or add contrast.

Histogram — A graphical display that represents the distribution of tones within an image.

HLS (Hue, Saturation and Lightness) — A non-linear color space (also called HSL or HSI) that defines color using a double hexcone.

HSV (Hue, Saturation and Value) — A non-linear transformation of the *RGB* color space often used in describing the characteristics of how devices display color. The HSV model is also called HSB (Hue, Saturation, Brightness).

Hue — The property of color that indicates color name, such as purple, blue, or green, and can be specified by particular wavelengths or by *CIE* coordinates. It ranges from 0-360, but is normalized to 0-100% in some applications.

I

ICC Profile — A standardized description of the color *attributes* of a particular substrate, ink, *digital printer*, or imaging device, named for the International Color Consortium, a group formed in 1993 to standardize *color management*. Profiles are created by defining a map between the source and target color space using a profile connection space such as *L*a*b** or *CIE*.

Inkjet Printer — A device that drops liquid ink onto a substrate for printing. *Thermal inkjet* heats ink to approximately 400 degrees F inside a small chamber before shooting it through a series of nozzles. *Piezo*-based inkjet stores ink in a small chamber and sends an electric charge through a piezo-electric crystal lining the chamber to shoot ink through the nozzles.

Intensity — Degree of *saturation* or reflection of visible light.

Interpolation — Software technique used to increase the size of an image file by creating more *pixels* using mathematical averaging to increase tonal *value* and apparent *resolution*.

Invariant Color — A color that is not altered by a change in illumination.

J

Jaggies — The informal name for *aliasing* (visual stair-stepping) in *raster images* that occurs when the *resolution* is too low.

JPEG/JPG (Joint Photographic Experts Group) — Graphics file format designed for use with photographs and other color *bitmaps*. The JPEG format uses a mathematical compression technique to reduce file size by removing a user-selectable percentage of the image's data information.

L

L*a*b* — A *color space* calculated with *values* of lightness (L) and *attributes* of red-green (a) and yellow-blue (b). Most commonly associated with *CIE* for a non-device-dependent coordination of color, the two-dimensional reference defines colors and color spaces based upon physiological measurements of human color vision.

LED Array UV Lamp — A UV-curing lamp made from tightly grouped light emitting diodes (LEDs). It offers low heat-emission, instant switching properties, long component life and energy efficiency, but a very narrow band of lightwaves.

Light Magenta/Light Cyan (Lm/Lc) — Muted or diluted forms of two *subtractive primaries* that, when used with *CMYK* inks, enable finer highlight detail, expand color gamut and provide a less-noticeable dot structure for *continuous tone* prints.

Line Screen — The frequency of dots in a *halftone* screen, used to define the density of the screen. A 133-line screen has 133 *halftone* dots per linear inch. The higher the number, the higher-quality of detail reproduction.

Linear Scanner — A scanning device that uses a straight-line array *CCD*. The linear array captures one line of the image at a time as the CCD is moved over the entire image in steps.

Linearization — The process of calibrating tone *values* on a scanner or printer to create evenly-distributed tones capable of rendering detail throughout an image.

Luminance — The lightness or brightness of an image.

LUT (Look-Up Table) — A digital image processing tool for converting color data from one system to another (e.g., *RGB* color to *CMYK*), including compensation for the output characteristics of a particular device, ink and substrate.

M

Metamerism — A condition in which two colors appear to match under one light source but not another. The four types are Sample, Illuminant, Observer and Geometric metamerism.

MEMS (Micro-Electro-Mechanical Systems) — A manufacturing and fabrication process employing laser technology to micro-machine silicon in the creation of inkjet *printheads* that offer precision dot placement and a smaller overall size.

Mercury Arc Lamp — The most commonly used type of UV-curing lamps on *shuttling-printhead* inkjet printers. Some UV-curing printers use tungsten halide arc lamps instead of mercury.

Microwave UV Lamp — A more efficient, longer-lasting but heavier and more expensive lamp than commonly used mercury arc lamps. Better suited for high-speed single-pass fixed-array inkjet systems than on *shuttling-printhead* platforms.

Microstepping — Process of moving media through a printer in smaller-than-standard motions to improve *dot gain* and density when printing solid areas on film positives.

Mild-Solvent Inks — Also known as light-solvent inks. *Solvent inks* that use reduced concentrations of cyclohexanone as a *carrier*. Printers using mild-solvent inks emit fewer harmful *VOCs* than standard *solvent inks*.

Mirror Printing — Reversing type or an image in a design. This is often used in digital imaging to make transfer prints that are applied backward to a material, or backlit media that is viewed through the front.

Moiré Pattern — An interference pattern created when two grids are unevenly spaced, conflicting or present overlapping angles. Visual artifacting occurs between the dots of the different separations in the *halftone* images.

Monomers — A chemical compound in *UV-curable inks* that undergoes the process of *polymerization* and is transformed from a liquid to a solid (*polymer*) state when exposed to *ultraviolet* radiation.

N

Nesting — The ability of RIP software to intelligently arrange multiple print jobs efficiently in order to minimize substrate waste during printing.

Network — Connection of computers with cables and software for constant, on-demand communication. Networked computers can use or control software installed on a central *server* computer.

O

On-Demand Color (ODC) — Term used in short-run color printing to describe processes including *inkjet*, *electrostatic* and direct-to-press.

Opacity — Measurement of the resistance to light passing through a substrate, on a scale of 0–100%, indicating the propensity for show-through of underlying type or images. Computed by measuring the density of the substrate over a black background and over a white background.

OPI (Open Prepress Interface) — A *PostScript* operation that allows for the use of low-*resolution* images as placeholders during design and setup of a printing job, and inserts the actual high-*resolution* images when the job goes to output.

Optical Resolution — The maximum actual, or "true", *resolution* of a device without the use of *interpolation*.

Overprint — Standard in *process color*, the placement of one color over another to create varying tones and shades. Also used with individual *spot colors* to create other colors.

Overprint White — Printing application in which white ink is used as a background for reverse-printed transparent stocks, such as backlit images. White in this application should be somewhat translucent.

P

Panel — Division of a job based on the production area of a device when the job size exceeds the production area. Panels are divided within sign software and can be produced individually. See T*iling*.

Pass — Describes the travel of a *printhead* across media in inkjet printers with *shuttling printheads*. Each pass of the printhead increases *color density* and *resolution* of the image.

PANTONE Matching System — Numbering system for identifying 3,000+ colors created through combinations of 14 *primary color* inks. The Pantone company produces numerous color-matching systems for standard print and computer applications.

PDF (Portable Document Format) — An electronic document format from Adobe Systems for the distribution of files across platforms, that allows a document to be displayed as originally designed and formatted without requiring the original software application or fonts on the viewing computer. See *Adobe Acrobat*.

Phase-Change Printer — A printer that uses ink loaded and kept in reservoirs as a solid, that is liquefied by heat for printing onto a substrate.

Photoinitiator — A molecular ingredient in *UV-curable* inks that absorbs incident UV energy and becomes excited, triggering a chain reaction that converts liquid oligomers and *monomers* to solid *polymers* through *polymerization*.

Piezo Inkjet — An inkjet *printhead* design using oscillations of electrically stimulated piezo-electric crystals to force ink through inkjet nozzles and onto substrates.

Pigment — A colorant that is suspended rather than dissolved in an *aqueous ink carrier*. The opposite of a *dye*. Pigmented inks generally have greater outdoor durability and fade resistance than *dye*-based inks, but may not have as large a color *gamut*.

Pixel — A combination of the words "picture" and "element," denoting the smallest part of a picture that can be located and placed along the X and Y axes of a *bitmap*.

PPI (Pixels-Per-Inch) — A measurement of the number of *pixels* that will occur within the vertical and horizontal planes of a one inch area in a *raster image*. The higher the number, the greater the *resolution* and maximum viewable size without *aliasing*.

Pixelization — The result of simply enlarging *pixels* to increase image size, which lowers *PPI* without an increase in detail and leads to *jaggies* along diagonal edges.

Plug-Ins — Small, limited-purpose programs that work with and add capabilities to larger applications.

PMT (Photomultiplier tubes) — Light detectors used in *drum scanners*. PMTs usually accept four beams of light — one each for red, green and blue, plus one for image sharpness. Usually considered to be more sensitive and accurate than *CCD*, with a greater *dynamic range*.

Polyethylene — A polymerized ethylene resin, used (when coated) as a fully-recyclable, printable film.

Polymer — A stable chemical compound or mixture of compounds consisting essentially of repeated structural units. *Monomer*-based *UV-curable inks*, once cured, become a solid polymer. Plastics in printable films are polymers.

Polymerization — The process of combining unstable molecules to form solid *polymer* structures, specifically, in *UV-cure* printing.

Polypropylene — Any of various thermoplastic resins that are *polymers* of propylene.

Polyvinyl Chloride (PVC) — Thermoplastic *polymer* of vinyl chloride. Resins of polyvinyl chloride are hard, but with the addition of plasticizers become a flexible, elastic plastic used to make vinyl.

Posterization — The process of reducing the number of colors in an image, used to aid in speeding the *RIP* process for solid-color images. It can greatly affect specific color integrity.

PostScript — A device-independent page description language, invented by Adobe Systems Inc., optimized for printing graphics and text using a *vector* data model. Many digital printers have PostScript interpreter engines built in.

Preflighting — Checking a graphic file for potential problems before sending it for final output, essentially to find font, color and other problems.

Primary Colors — Color that cannot be created by mixing other colors in the gamut of a given *color space*, but can be mixed to create other color combinations within that space. Red, green and blue (*RGB*) are additive primaries of emitted light, while cyan, magenta and yellow (CMY) are subtractive primaries of reflected light. Black (K) is added to CMY to produce denser, truer black images.

Printhead — The device in an inkjet printer that sprays droplets of ink onto the substrate. Printheads contain nozzles (grouped by color), and typically shuttle back and forth across the substrate as ink droplets are forced out of the nozzles.

Print On Demand — Term that applies to a variety of short-run publishing processes that include copier technologies and direct-to-press applications.

Process Color — Cyan, magenta, yellow and black (*CMYK*), combined in a matching system, to recreate thousands of colors in offset and direct digital printing.

Q

Queue — Electronic holding area, usually in random-access memory (*RAM*) or on a hard drive, where data waits before being sent to a printer for output. Synonymous with *spooler*.

R

RAM (Random Access Memory) — The high-speed portion of a computer's data storage that is held on special chips for use in current applications or procedures.

RAS (Remote Access Server) — A *server* that allows access to various computers through modems.

Raster Image — An image comprised of a collection of *pixels* arranged in a rectangular array. See *Bitmap*.

Rasterization — Translating data to a specific *bitmap* pattern for use by a digital printing device.

Real-Time — The concept of seeing actions on a computer screen as though the activity were happening at a natural pace, as in "real-time proofing".

Reflective — When referring to color, the ability of a surface to return some or all of the wavelengths of light that strike it.

Resampling — Changing the *resolution* of a *bitmap* image file without altering the image's physical size.

Resin Transfer — Method of creating a color using resin-based polymers on a donor sheet, called a ribbon (or *foil*), and printing to a substrate using the *thermal transfer* method. The resin colors are fused onto normally-resilient materials such as vinyl, creating a more-permanent image with waterfastness and UV protection.

Resize — To change the reproduction size. Files can generally be resized so prints can be made smaller or larger. Significant up-sizing often results in *jaggies*.

Resolution — The number of *pixels* or *samples per inch* a device is capable of recognizing or producing, measured in horizontal columns (width) by vertical rows (height). Megapixels can be calculated by multiplying pixel-columns with pixel-rows.

RGB (Red, Green and Blue) — The three *additive colors* used by monitors and scanners for transferring and representing color data. The rule of thumb in imaging is that input and display are in RGB, while output is done in *CMYK*.

RIP (Raster Image Processor) — Software and/or hardware used to convert data to *bitmap* information for processing on a *PostScript* printer or other digital device. This computer-calculation-intensive process determines 360,000 combinations and color placements to print every square inch of a 300 *dpi* image using *CMYK* process colors. Each *process color* is a *color separation*. This action is referred to as RIPing or *rasterization*.

S

Samples Per Inch — Unit of measure used to describe the input *resolution* of a device, such as a scanner or camera, in one-linear-inch increments. Each data point in an *RGB* capture includes separate red, green and blue calculations.

Sampling — A computer process that selects the best pieces of captured data for representation. While 24-bit scanners use sampling to select the eight most-accurate bits each of red, green and blue, 30-bit scanners take the best 10 per color.

Saturation — The intensity of a specific *hue*, based on the color's purity, measured from 0-100% in the *HSV* color model. Highly saturated *hues* have vivid color, while less saturated *hues* appear grayish.

Screen Angles — In half-tone printing, the geometric intervals at which *halftone* screens are placed to eliminate the appearance of *moiré* on a print. Usually, these are black at 45°, magenta at 75°, yellow at 90° and cyan at 105°.

Screening — Method for positioning dots for reproduction of an image by a printer. The two basic methods are *halftone*, where dots of varying sizes are placed in an exact, evenly spaced order; and *stochastic*, where small dots of the same size are placed in a random-looking, variable-spaced distribution on an image.

Secondary Color — A color made by mixing two primary colors in a given color space.

Sequence — The order in which inks are deposited by a printing device. For example, *CMYK* inkjets use a sequence of yellow, magenta, cyan and black (Y/M/C/K) for actual printing.

Server — Computers used for limited tasks. In *networks*, servers may act as a hub for storing programs or files used by different workstation computers, and can act as the sole machine for *RIP* purposes in large-format color printing.

Shadow Point — The darkest and densest tone in an image that is not black; all tonal *values* beyond this threshold are black.

Sharpen — Process in imaging-editing software to improve contrast of tones within an image. This can be a universal (all tone) operation or target specific areas of an image.

Shuttling Printhead — A term used to describe a *gantry*-mounted inkjet *printhead* that shuttles back and forth above the substrate as it deposits ink.

Single-Pass Printing — An inkjet printing process that uses a *fixed array* of *printhead* clusters arranged across the width of the media, instead of a shuttling printhead. The substrate passes beneath the printhead array in a single pass.

Solvent Inks — Inks that use a solvent, generally cyclohexanone, as a *carrier* and are commonly used for printing onto vinyl, as they offer good outdoor durability. Printers using solvent-based inks emit *VOCs* and should be ventilated.

Spectrophotometer — A color measurement device using the distinct wavelength (spectral) *values* of light to indicate a spectral reflectance, emittance or transmittance curve along the visible spectrum (380–720 nm). A more sophisticated device than a *colorimeter*.

Spooler — Area where data used in printing is held before going to the printing device. See *Queue*.

Spot Colors — Specified color tones used independently in a printed piece for a specific need (i.e., Coca-Cola's shade of red), or in overlapping combinations (including those with *process colors*).

Spot White — An application in which white ink is used as an independent color (usually for printing text on a non-white surface).

Stepping — The process of moving media through a printer.

Stochastic Screening — A *screening* process that conveys the tone of a screened image by varying the number and location of same-sized dots as opposed to varying the size of dots within a rigid grid. Also known as frequency modulation (FM).

Subtractive Color — A reflective color system used in printing, in which the subtractive primaries, cyan, magenta and yellow (*CMY*), are used to create all other colors. When CMY are combined at 100 percent, black is produced. Most printing systems use a separate black (K) pigment to reduce ink cost.

SWOP (Specifications for Web Offset Printing) — Formulations of inks used in web-offset presses. Inks following these standards form the basis for color-matching systems such as *Pantone*. Different components of SWOP inks, such as those with fluorescence, expand the color *gamut* beyond the effective range of many *digital printers*.

T

Tertiary Colors — Colors created by combining a *primary color* with an adjacent *secondary color*.

Thermal Inkjet — Inkjet *printhead* technology where inks are heated in a chamber located above the *printhead* to a temperature greater than the boiling point of the liquid. Heat changes the characteristics of the fluid, causing it to expand and be expelled through the *printhead* nozzle and onto the substrate. Sometimes called "bubble-jet".

Thermal Transfer — Printing technology that uses heat to deposit *dyes* or *resins* from a donor sheet (often called a *foil*) onto a receiver material.

Thermal Wax — Phase-change technology in which colors are harbored in waxes and melted as needed for inkjet deposit on a receiver material.

Three-Dimensional Printer — A 3-D digital printer uses digital piezo-electric inkjet *printheads* to "print" three-dimensional objects. A CAD file of a 3-D object is printed one layer at time by jetting a hardening liquid onto a powder-flooded area. Used for producing prototype models.

Tiling — The process of dividing sections of an image that exceed the production area (maximum print width) into panels, which can then be individually printed. See *Panel*.

Titanium Dioxide (TiO^2) — Pigment used to make white inks (both *UV-curing* and *eco-solvent*). TiO^2 molecules are dense and heavy and have only recently been used in digital inkjet printing applications.

TRUMATCH — Color-matching system bearing the name of its developing company. The system uses *CMYK* color *values*.

U

UCR (Under Color Removal) — *Color separation* process in which black ink is used to replace cyan, magenta, and yellow (*CMY*) in shadow areas where the three inks overlap, since black (K) is the combination of *CMY*. (Similar to *GCR*.)

Ultraviolet (UV) - Electromagnetic radiation (light) existing in the bandwidth between 100 and 400 nm. *UV-curable inks* react to the ultraviolet light source in an *arc lamp* and are transformed into a solid *polymer*.

Underbase White — A printing application in which a solid field of white ink is laid down to be overprinted with an image, as when printing onto a non-white surface.

UV-Cure Printing — Inkjet printing process in which a lamp emitting *ultraviolet* (UV) rays is used to transform *monomer*-based liquid inks (deposited onto a substrate) into *polymer*-based solid inks.

UV-Curable Inks — *Monomer*-based liquid *inkjet* inks which, when exposed to a strong source of ultraviolet *(UV)* radiation, are transformed into *polymer*-based solids.

V

Value — Indicates the lightness or darkness of a color in relation to a neutral gray scale. The *HSV* color model uses a scale of 0-100%, with 100 representing pure white.

Vector Image — A computer image that uses geometrical primitives (such as points, lines, polygons and *Beziér curves*) to produce mathematical descriptions of paths for a graphic.

Viewing Booth — Enclosed area with controlled lighting that creates a stable environment for evaluating proofs and other printed materials and reduces the influence of *metamerism*.

Viscosity — The degree of fluidity of a liquid based on the resistance of adjacent levels of the fluid to flow under pressure and/or shearing forces. Regarding inks, a high viscosity indicates a thicker ink; a low viscosity indicates a more fluid ink.

VOC (Volatile Organic Compound) — Petroleum-based chemical compounds with high vapor pressure and low water solubility (evaporate easily) found in industrial solvents, including those commonly used as *carriers* in *solvent*-based inks. Harmful VOCs can be considered toxic, and airborne harmful VOCs are federally regulated in some industries.

W

Walking — The process of changing the charge levels of the printing nibs of an *electrostatic printer*. Adjusting to a lesser charge level, or walking down, an *electrostatic printer* reduces *dot gain* with overlapping images while printing and enables better color matching.

Wax Transfer — A method of heating a colored wax material and printing it onto vinyl. The wax colors rest on the vinyl, creating a less-permanent image on the material.

White Point — The lightest tone discernable in an image; all *values* paler than this threshold appear as white.

Y

YCC — *Color space* developed by Eastman Kodak that defines colors by *luminance* (Y) and two levels of chrominance (C and C).

Z

Zip — To reduce file size by using compression algorithm programs such as PKZIP or WinZIP; a file made with zip software.

Zoom — Making an image become larger (zooming in) or smaller (zooming out) as it appears on the monitor. A lens that changes magnification.