

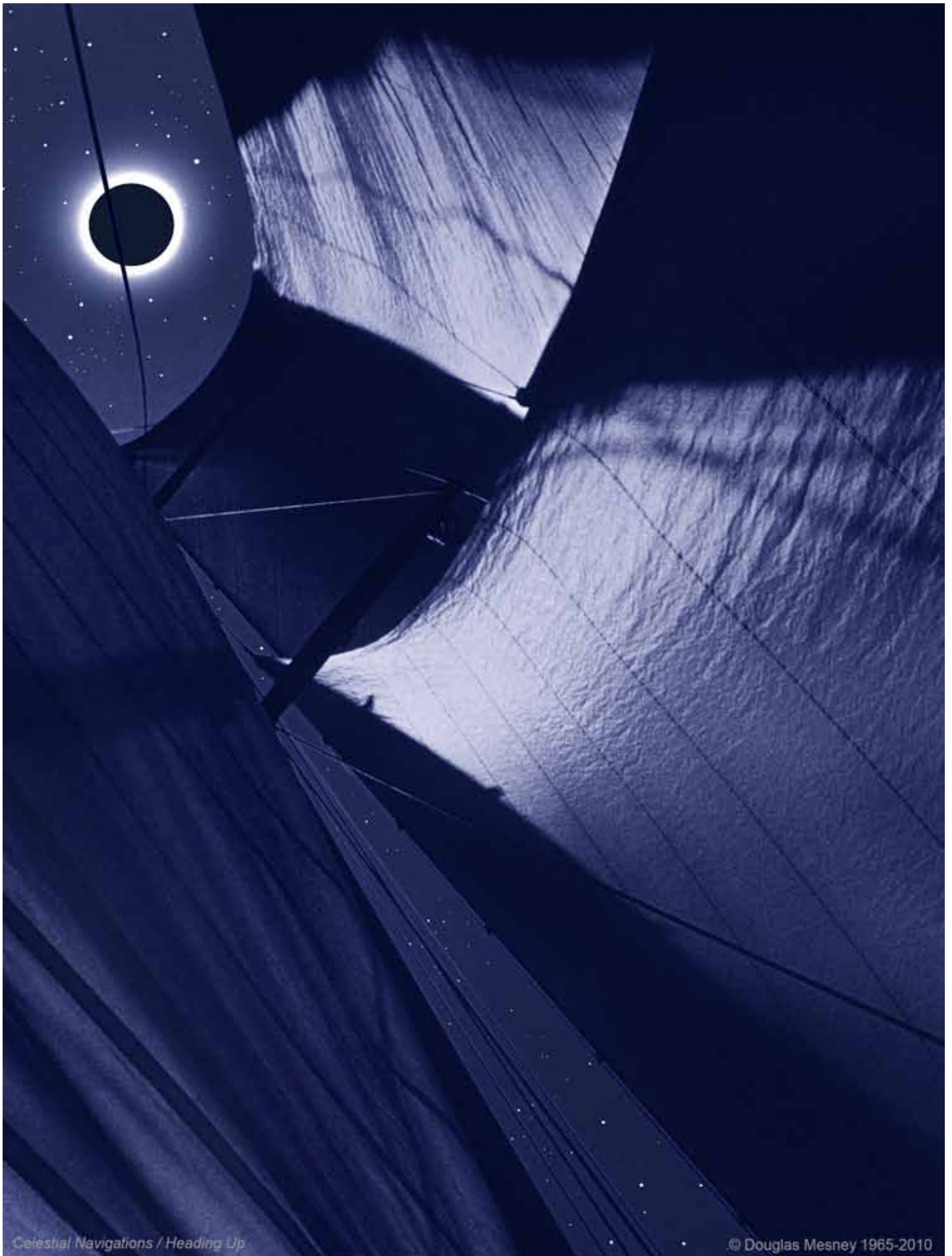
Giclée Prepress

The Art of Giclée

Theory and Practice of Giclée Printing

INTRODUCTION

Giclée Is A Sea Change



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Theory and Practice of Giclée Printing

INTRODUCTION

Giclée Is A Sea Change In Fine Art Printing

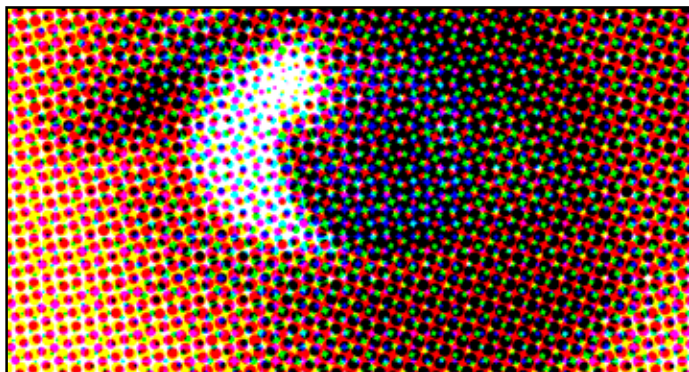


Giclée is a commonly used term in the art business today, but not so very long ago the word didn't exist. It's a French word that has come to mean 'ink jet'. But that term didn't exist either until the 1970's... ancient history now.

Compared to 'ink jet' the word *giclée* just rolls off the tongue, and that's the difference with the prints they make too. Giclée is high-end inkjet. Inkjet printers reproduce digital images by spraying variably sized droplets of liquid or molten material (ink) onto a page. There are three main technologies in use in contemporary inkjet printers: thermal, piezoelectric, and continuous.

The Difference Is In the Dots

All printing processes use dots to print pictures.



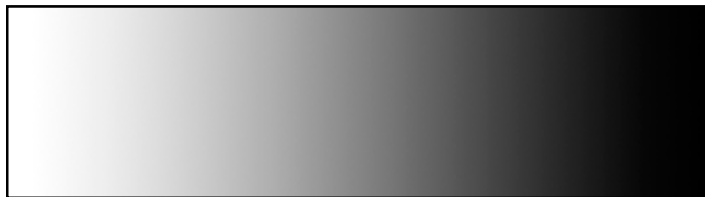
Look at this picture from 10 feet away and the eye will become clear because your eyes (probably) cannot resolve the individual dots from that distance. Resolution is closely linked to viewing distance. The closer the viewing distance, the finer the dots have to be.

Dots are necessary to get many colors from only four (Cyan, Magenta, Yellow and Black – known as 'CMYK' and also referred to as "process colors").

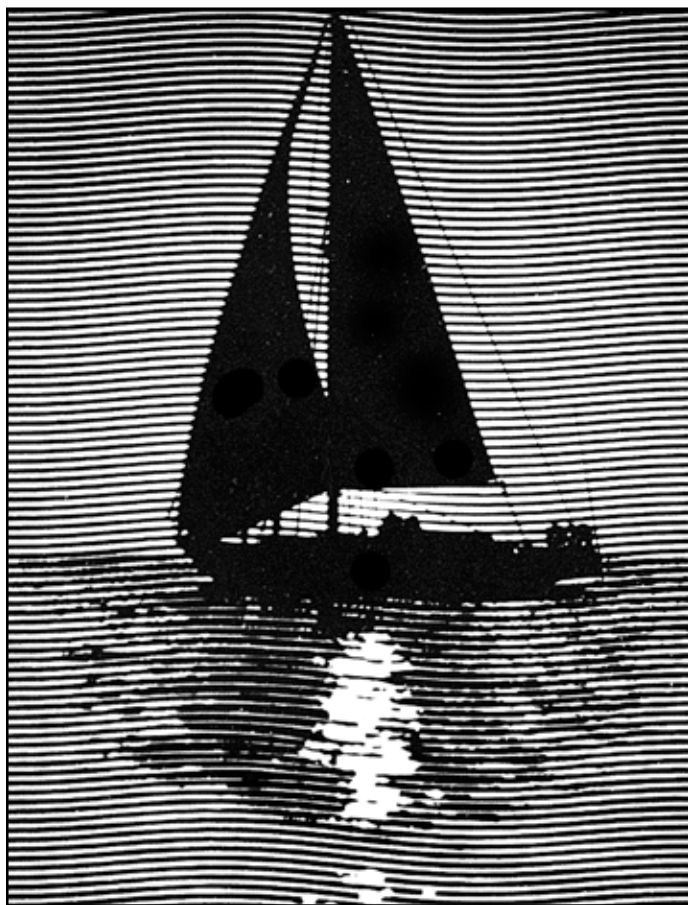
Using dots to mix colors relies on a form of "trompe l'oeil", which is French for "fool the eye".

Printing with dots is called "screen printing" because a screen is used to create the dots from photographs or other *continuous tone* artwork. Photos and artwork are "screened" for printing. The number of dots per inch is called the screen frequency, or just screen size.

Continuous tone comes from the gray scale.



Gray scales display a range of tones from white to black. For fine reproduction work, the more tones the better.



Before dots, printers obtained shades of gray different ways all called 'line art'. As can be seen in the illustration above, varying the width of the wavy lines creates the illusion of gray when viewed from a distance.

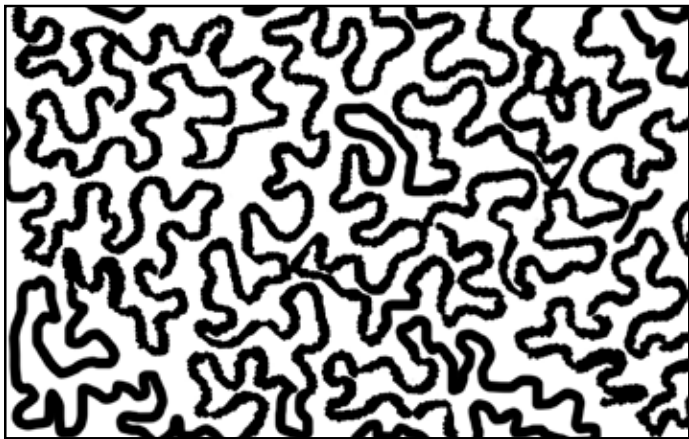
Solid color art with no shades is called "line art".

Line art can use different colors, although it is usually monochromatic. Etchings and steel engravings are examples of line art, as is calligraphy and drawings using a solid color.

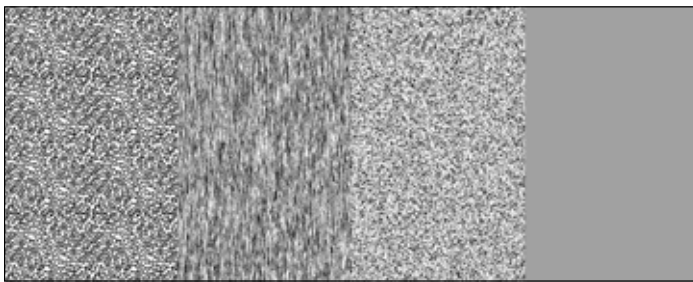
Giclée Prepress / Introduction

Before photography, how could you draw gray if you only had black ink? Only by using the illusion of *trompe l'oeil*.

Traditional artists created gray using black ink by stippling, cross-hatching, pointilizing, and squiggle pattern known as “Cornelli” that is popular with stone masons and cake decorators.



Cornelli lace is like a continuous squiggle which looks gray from a distance. Stonemasons use the cornelli pattern to decorate buildings and you also see the decorative pattern on expensive cakes.



Line art screens like Cornelli (left), brush lines (left-center) and mezzotint (center-right) create the illusion of gray using only black ink. A patch of gray ink is shown on the right for comparison. If you stand far enough back, they all look the same (more or less).

Later, photo-mechanical printing screen techniques like *mezzotints* became widely used. Today graphic artists reproduce pictures with line art techniques more as an effect than from necessity. Digital imaging has added newer looks like those produced by PhotoShop's pointilize, crystalize, mosaic, and fragment filters, to name a few.

Line art effects can play an important role in prepress for giclée as you will discover later. Solid areas of color will be used for a wide variety of masks and well as to add tints and tones.

But back to dots....

Recall that it was Gutenberg's printing press that changed everything. The Gutenberg press prints by stamping. The parts to be imprinted stand higher, just like a rubber stamp. It was the reverse of the intaglio technique that he was familiar with in which images are made by carving then *into* a plate. Instead, Gutenberg carved them *out* of the plate.



Metal type stands out in relief. Ink is put onto the surface and then it is stamped onto paper or some other substrate.

Early forms of printing used copper engravings which required a lot of tedious handwork. Lettering and decorations were hand-carved into copper plates,

Gutenberg invented moveable type to make words quickly and easily and a machine to do the stamping. Since then, printing presses have evolved into four basic types, differentiated by the way they transfer inks onto substrates.

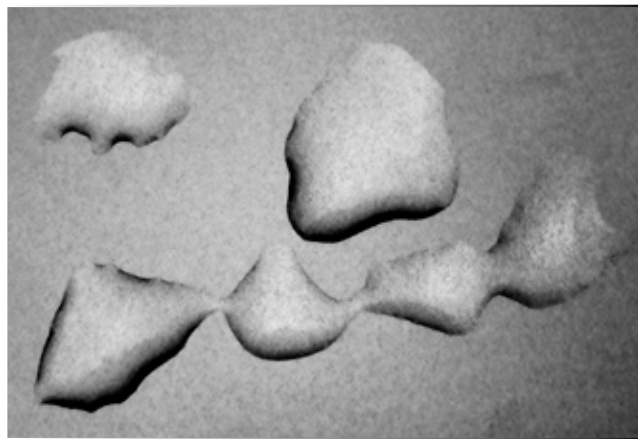
Types of Printing (Pardon the Pun)

Letterpress Printing

These presses work like the Gutenberg,, metal plates carry images on raised surfaces which carry ink to be 'stamped' or 'pressed' (as in the name "letterpress") onto substrates. Letterpress is an archaic form of printing which is not widely practiced anymore.

Lithographic "Offset" Printing

This process works because oil and water do not mix. If you drop water onto a polished metal or stone surface what happens? The water beads up and rolls off. But a drop of oil will stay in place. Hold that thought...



Water beads up on a waxed car because oil and water don't mix.

If you etch the surface by sandblasting or using a caustic solution like acid, a drop of water will spread by capillary action across the etched area and stay put... now, drop some oil on that and what happens? This time the oil rolls off.

Thus on a lithographic (offset) printing plate, the ink-bearing surfaces are not etched, everything else is. The ink is 'offset' onto the paper. The paper must have the right 'bite' to accept the ink without smearing, and a certain degree of absorbency.

Giclée Prepress / Introduction

Papers come in many different types. The qualities needed for one type of printing will not necessarily be appropriate for another.

There are two main types of paper, coated and uncoated. Coated papers are needed for fine arts printing because their hard and glossy surfaces produce good dot structure and contrast.

Dot structure refers to the crispness of the edges of printed screen dots. If the paper is absorbent, the edges of the dots soften, a situation called “dot gain” because as dots spread they get bigger. (See picture on page 16.)

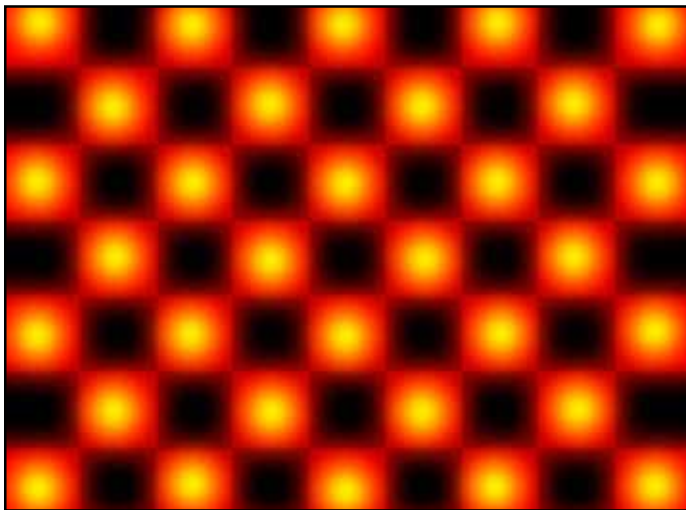
Soft-edged dots are actually a benefit for fine arts printing as you will shortly read about. Lithographic printing, also called just “*Litho*”, produces clean-edged dots and for that reason the dynamic tone range is somewhat limited.

Coating surfaces range from matte to high gloss. Uncoated paper is more matte and more Eco friendly.

The surface of papers defines their ability to print fine details. The harder the surface of the paper the smaller the dots that can be printed on it. More dots mean more tones. Thus, different papers offer different dynamic tone ranges depending on the kind of dot structure they support.

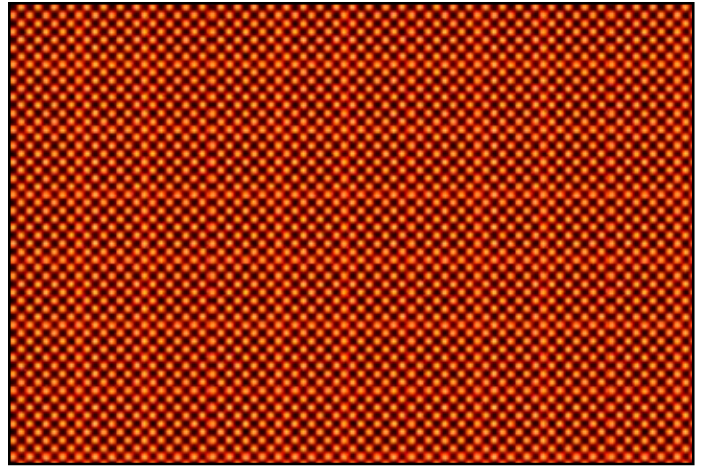
Xerography (“Xerox”) Printing

Electrostatic attraction makes “Xeroxing” work.



Imagine a checkerboard with an electrical charge on the red squares and no charge on the black. Now, sprinkle electrically charged powder (ink) over the checkerboard. The powder only falls on and clings to the red squares

When paper comes into contact with the charged “platen” carrying toner on the “hot” pixels, the electrostatic charge dissipates and the toner is released onto the paper, after which it is melted onto the surface as it passes under a heat coil.



Now imagine thousands of checkerboards arranged on a grid and shrunk down until you get 600 or 1200 squares (pixels) per inch. By comparison this display (above) shows only 24 dots per inch.

Melted toner infuses into the substrate which provides for durability, but the resolution and dynamic tone range suffers in comparison to other printing methods.

Laser Printing

Laser printing works the same as Xerography except that a laser creates an electrical charge on the platen optically. From that point on it's the same... toner powder on a pixel grid is then transferred onto paper and bonded by melting.

Intaglio Printing (also called “Rotogravure”)



Letterpress ink rolls onto raised surfaces that are etched away (left) Intaglio ink is caught in “ink wells” etched into the surface of the plate.

Inaglio is letterpress in reverse. “Ink wells” are cut into the plate surface instead of using raised surfaces. Instead of being stamped on the ink is absorbed out of the inkwells by the paper.

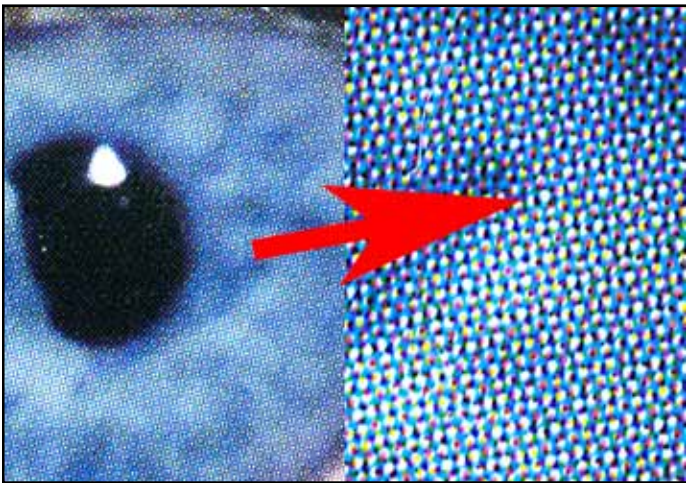
Special papers are required to absorb the ink, making the process more costly and thus generally reserved for art reproductions and special types of advertising materials.

The number of dots that can be printed in one inch is called “DPI”, (Dots Per Inch). The dots are arranged on a grid and the grid angle is changed for each different ink color so that dots don't print on top of one another. By varying the size of the dots on the grid, more or less of each color is printed.



Drops of ink on copy paper are smaller and have sharper edges than the same dots applied to absorbant paper towels which allow the ink to spread out making the dots bigger, called “dot gain”.

Printers have always struggled to get the dots smaller and smaller because that is the only way to get fine resolution and extend the dynamic tone range with lighter pastels.



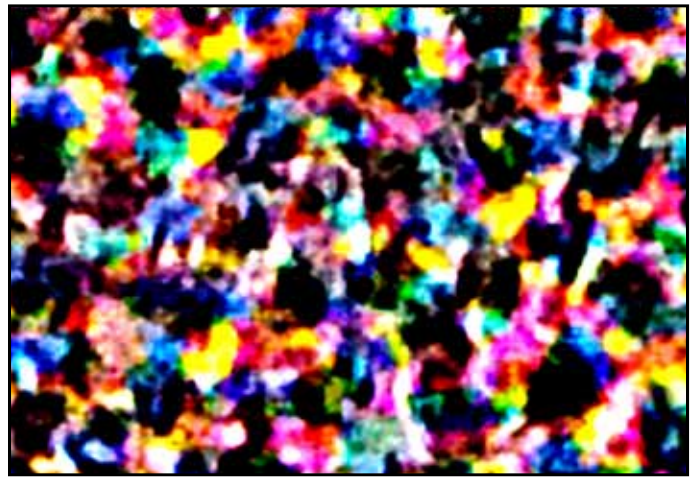
Offset dots have sharp edges so the spaces between the dots show as white (or the substrate color). Sharp-edge dots may be good for technical illustrations and business graphics, but not for fine arts.

In the beginning, small dots were especially challenging because printing plates were made from the metal lead. Although lead was easy to work with because of its low melting temperature, lead is soft so thin dots would deform when pressed against the substrate.

Copper plates provide greater dot strength. But even copper has strength limits. Small dots are like thin toothpicks and no matter how strong the plate material the limits are soon reached.

Rotogravure solved the problem by reversing the process, eliminating the toothpick effect by using ink wells.

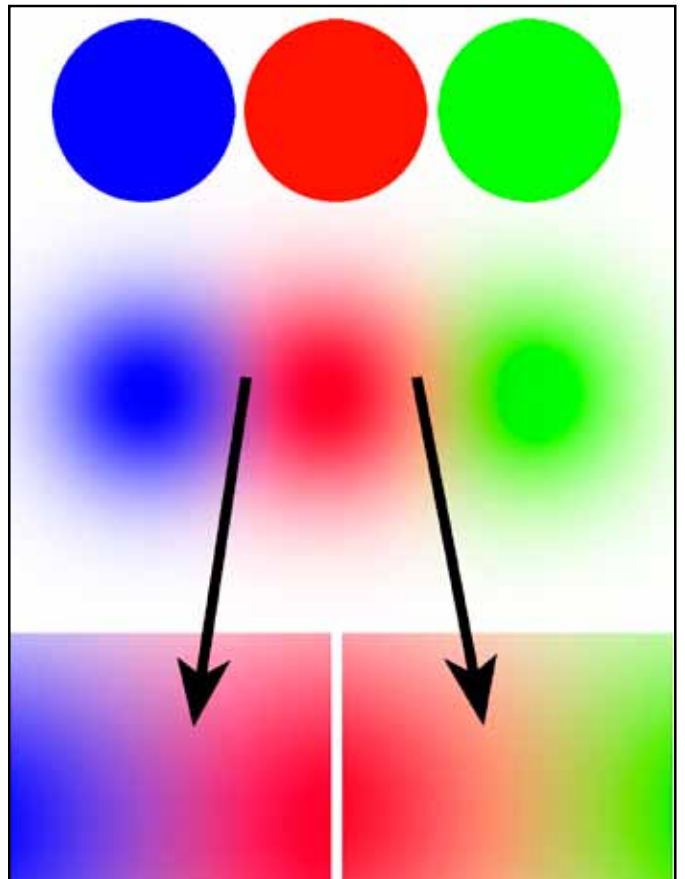
Rotogravure printing is finer than letterpress because the absorbed dots have softer edges than the stamped-on dots. Soft dots have less white space between them. Soft edges mean fine printing because they extend the range of colors that it is possible to print from the basic four process colors (CMYK).



Rotogravure dots spread together due to the absorbancy of the paper resulting in less paper show through than hard-edged dots.

Gradient-Edge Dots Extend Dynamic Tone Range

The dynamic tone range is extended because where the soft edges overlap a range of additional colors is derived from the blending of the gradients. The softer the edges the wider the tone range. Small dots with soft edges thus produce the widest dynamic tone range.



Hard-edge dots (top) have more “white space” between them than soft-edge dots. Sprayed dots are the softest of all and where they overlap additional tones are created. The extra hues and shades created by the overlapping gradient edges are called “rare tones”.

Giclée Prepress / Introduction

Inkjet dots have the softest edges of any printing process because they are sprayed on instead of being stamped or absorbed.

Giclée dots are the finest quality that the inkjet process can deliver. Their edges are so soft that compared to screen-printing they aren't really dots at all. Thus the traditional ways of thinking about dot resolution don't really apply.

Inkjet 'resolution' cannot be directly compared with traditional dots-per-inch measurement scale because the DPI scale counts distinct, single dots. Giclée dots are not single dots but instead a clusters of micro-dots.

Recall that peizo inkjet printers explode bubbles of pigment into bursts of droplets that are so small that up to 2880 of them land on every inch. That is a far cry from the 300 DPI that is considered high quality in the world of traditional screen printing.

The droplet size of a giclée spray is measured in picoliters which are tiny (1/1,000,000,000,000 of a liter). Some inkjet printers can vary the droplet size.

Early inkjet printers had typical drop sizes ranging between 30 to 50 picoliters. Compare that to today's tiny micro-drop sizes of only 2 to 4 picoliters that are the new standard. This is comparable to the size difference between a softball and a ping pong ball. Smaller micro-drops produce smoother-looking prints because they make softer dots on the paper producing a wider tone range.

When an inkjet printer crosses the line from 300 or 600 to microdots into higher quality ranges of 720, 1440 and 2880 micro-dots it then qualifies to be called a true giclée printing machine.

Giclée offers the widest dynamic tone range and the highest resolving power of any 'mass' printing method. The importance of a wide dynamic tone range can be demonstrated by examining a *gradient*.

Gradients are edges that are soft.



This gray scale has only 10 tones. You don't have to be a rocket scientist to understand that the more steps, the wider the dynamic tone range. The more tones available, the smoother transitions can be.



This soft continuous-tone transition from black to white is an example of a gradient. Gradients can be wide or narrow and transition between any colors, not just black and white.



Giclée Is A Sea Change In The Art World

Sea change is a metaphoric term for a gradual transformation in which form is retained but substance is replaced, as with wood petrifying into rock.

Back in his day, Gutenberg fundamentally changed the world of art by making it ...a 'world'. No longer were originals or etchings only to be seen by the well heeled. His printing machine put art and literature into the hands of almost everyone.

In a similar way, Canon and Ichiro Endo brought fine art to the people in a way never before possible when they invented 'bubble jet' technology in the late '70's.

Giclée Prepress / Introduction

By the 1990's inkjet technology was refined to the point that its dynamic tone range surpassed all other printing processes. That fact did not go unnoticed by artists and photographers who were themselves in the early stages of the transition to digital imaging.

By the end of the 1900's digital imaging rivaled film-based imaging and early in this decade even surpassed it in terms of image quality. Combining digital imaging and giclée printing there was suddenly a way to make copies of paintings, illustrations and other artworks that looked exactly like their originals.

Fine art reproduction has gone the way of desktop publishing. That is, companies like Epson, Canon, HP and others you'll never hear about have made high-end giclée printing inexpensive and ubiquitous.

Today the world is awash in giclée. Artists and photographers everywhere have bought giclée printers and are making limited edition prints. Oil painters even have reproductions of their works giclée'd onto canvas.

Giclée printing companies abound, along with an entire subset of industries making specialty papers and inks for giclée printing and finishing. Frame shops are getting in on the action by installing giclée printers for 'one-stop shopping'.

Like any other technology in the hands of the public, results are as various as the people who produce them. Technology is, after all, only that... technology. A laser drilling tool doesn't fix teeth, a dentist does that using the tool. There are good giclée professionals and others who may not be ready for prime time.

Having a good giclée-printing machine is mandatory but only the beginning. Being fluent in PhotoShop is a requirement, too. Even then, there's more to learn that is giclée specific.

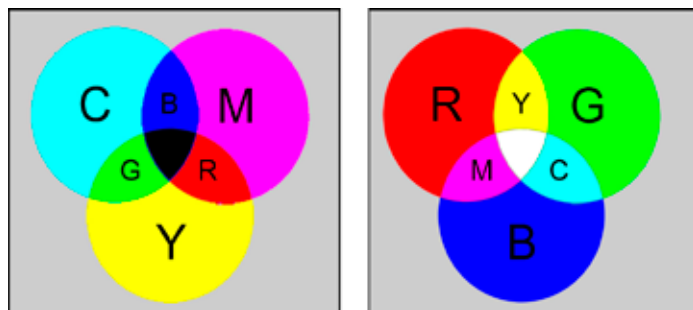
Today the biggest disconnect in digital imaging is between people and their printing machines. People have good cameras and they know how to perfect their pictures with programs like PhotoShop. So why are they so often disappointed with the way their pictures look when printed? It's because every output device needs a different version of the picture to maximize the 'look' within its own range of capabilities.

The image you make could be reproduced any number of ways. The printing requirements for a local newspaper picture are way different than for a canvas giclée mural. Likewise, different types of printing processes will deliver different looks. A picture printed by rotogravure will look different than if printed by offset or letterpress.

In the end, all depends on the dynamic tone range that a device is capable of displaying, it's color "gamut". Prepress is about adjusting the dynamic tone range of the image to fit into gamut of the printing machine or display device.

There is basic prepress and also a high-end variety that uses advanced techniques to bring out tones in pictures where once you might have thought there were none.

Nine times out of ten there's stuff in the shadows or highlights of a picture that won't be visible in a giclée unless adjusted and manipulated to work with the 'look' that the output media can produce. For example, more rare tones will show in a glossy picture than in a matte one.



The "mistake" many people unwittingly make is an inadvertent one caused by working in RGB and printing in CMYK. RGB uses 'additive' primary colors, which you see on 'glowing' displays of emitted light like monitors and televisions (right). CMYK uses 'subtractive' secondary colors seen by reflected light (left).

RGB can produce more tones than CMYK and the tones look different (more saturated) because of the physical-world differences between light transmission and reflection as well as between additive and subtractive color.

Put more simply, while people are working on pictures in PhotoShop they see RGB. RGB can produce more colors than CMYK so it is easy to start working with colors that are beyond the range of a CMYK printer if you are seeing RGB.

Basic prepress is a technical exercise about taking the RGB look of the digital image file and tweaking it to get the closest match possible using CMYK giclée printing inks and media.

High-end giclée prepress goes beyond that and is more creative than technical. Artistic prepress work involves the discretionary manipulation of image tones directed by an interpretation of the artist's intentions and preferences.

People have different color preferences. The look of many artists depends on the unique color pallets they work in. Some are muted and pastel, others saturated and vivid.

Perhaps your client likes solid shadows, or maybe bringing out shadow detail would be considered an improvement. Those kinds of creative and interpretive adjustments are what advanced prepress work is all about, and the subject of what you are about to read.

So let's begin... but where?

The Bible tells us that in the beginning, there was Light. We'll therefore begin with the study of light, which impacts everything you see and do as a giclée prepress artist intent on pixel-perfect printing.

Trio of 10-foot-tall illustrations made for the grand entry into an audiovisual firm's headquarters building in Reno, Nevada. Illuminated wall insets were made to frame the three pictures. They are themed on



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