sappi

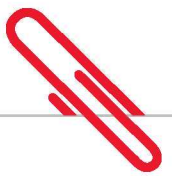
The 2 Standard

A Sappi Guide to Designing for Print:

Tips, Techniques and Methods for

Achieving Optimum Printing Results

MANAGING COLOR



This issue of *The Standard,* a technical publication on printing and design, focuses on "Managing Color." Brought to you by Sappi, maker of the leading coated printing paper brands in North America, including McCoy,® Lustro,® Opus,® and Somerset,® *The Standard* is part of Sappi's continuing commitment to serve as a valuable educational resource for professionals in the print communications business.

Managing Color is not a new challenge. **P**rinters and designers have been trying to control the effect of ink on paper since Gutenberg. **W**hat's different now is the extent to which they can. **W**ith the click of a mouse, it's possible to turn a blue dress red and adjust hues pixel by pixel. **F**or printers, computer-to-plate technology has made the film separation process obsolete. **T**his change has eliminated the generational loss of quality that resulted each time an image was converted

from one medium into another. But not everything is rosy. One dilemma is that the computer screens used to create artwork can see a broader range of colors than can be reproduced in print. The conversion from RGB to CMYK mode compresses the color gamut, leaving fewer colors available. This issue of *The Standard* presents a few techniques to expand the gamut on press and explains industry efforts underway to streamline workflow and establish a reliable **Color Profile.**

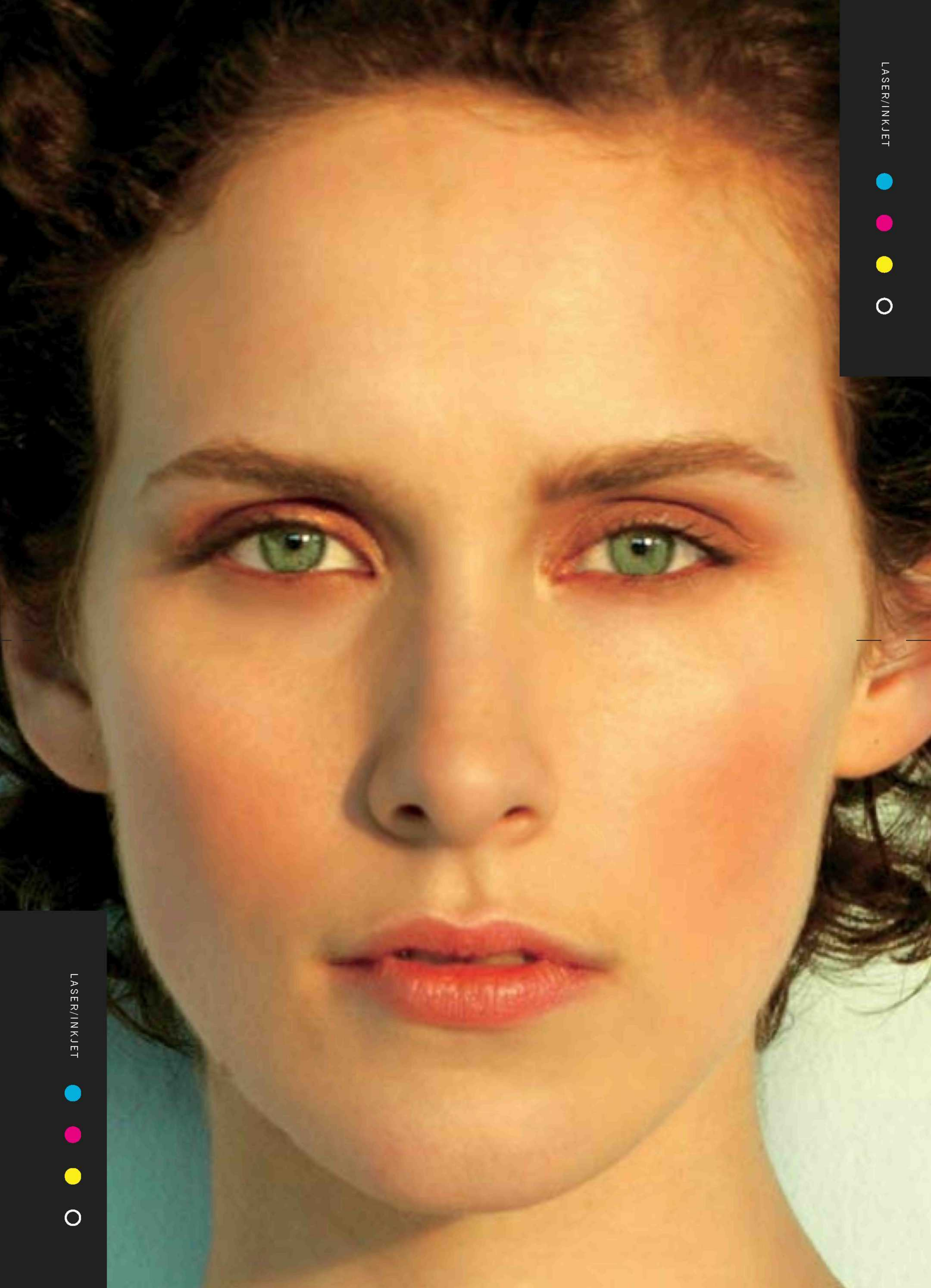
4 | Color Plus

One of the most difficult subjects to reproduce is the human face. Skin tones can go from too ruddy to too shallow. Complexions can appear flawed instead of flawless. Especially in the world of fashion, such impressions can impact product sales. A way to remedy deficiencies in the original artwork or achieve a different effect is by augmenting four-color process, as shown in this section.


laser/inkjet
conventional
stochastic
ink substitution
touch plate
hybrid six-color

Laser/Inkjet

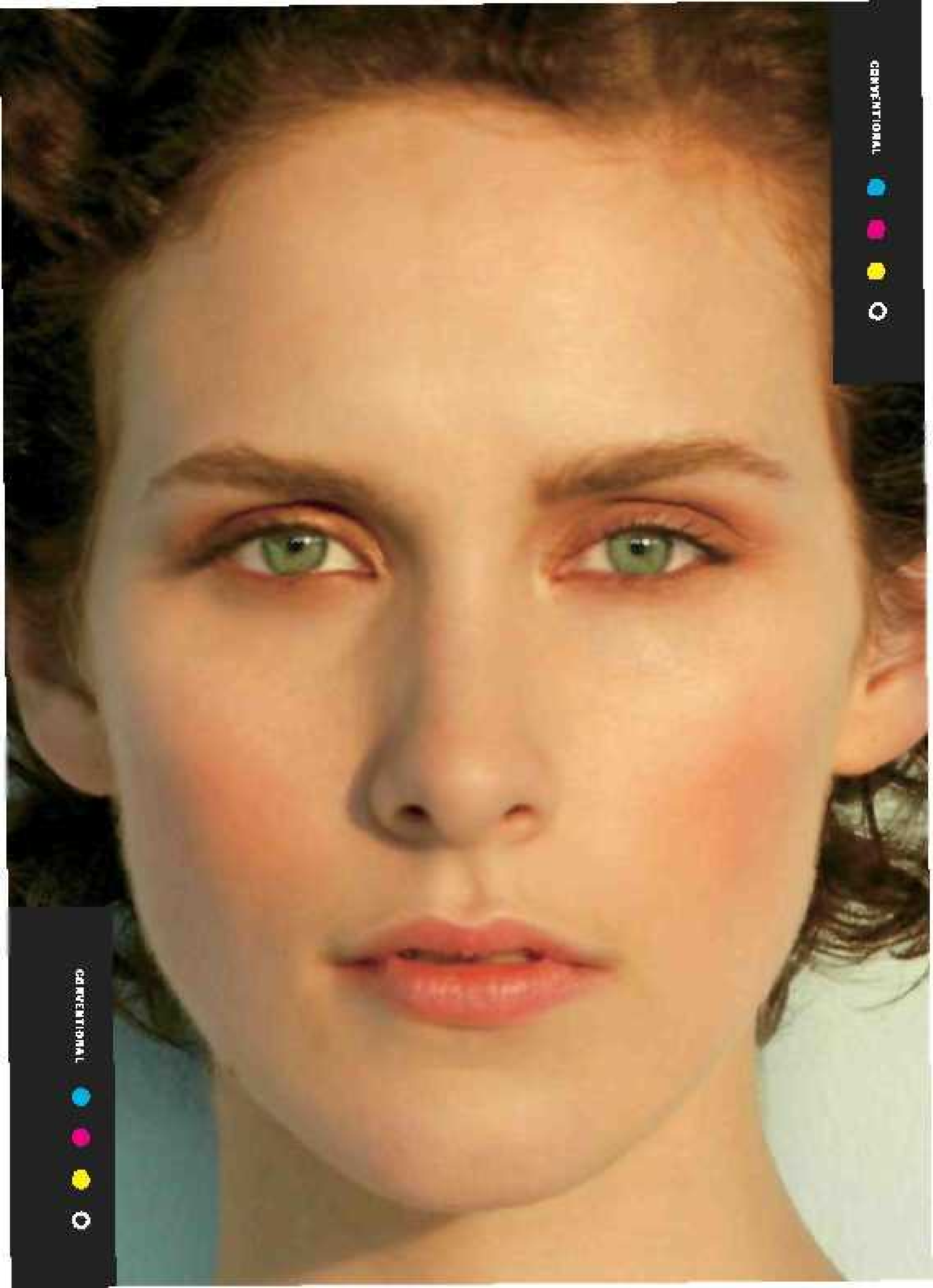
For most designers, the printout from an office laser/inkjet system is the first hard-copy look at what you have been viewing on screen. It is a useful guide to give to your printer, but the limitations of these proofs should be kept in mind. For one, colors will vary dramatically depending on the calibration of your monitor and office printing system. Also, unlike viscous inks used by commercial printers, office printers use toner which makes images look more contrasty and grainy. Then, too, office printers may not be able to output on the actual paper stock specified for printing, so the finish, shade and brightness of the paper will differ. Nevertheless, laser/inkjet proofs are a good starting point for evaluating the best way to print the job.



LASER/INKJET

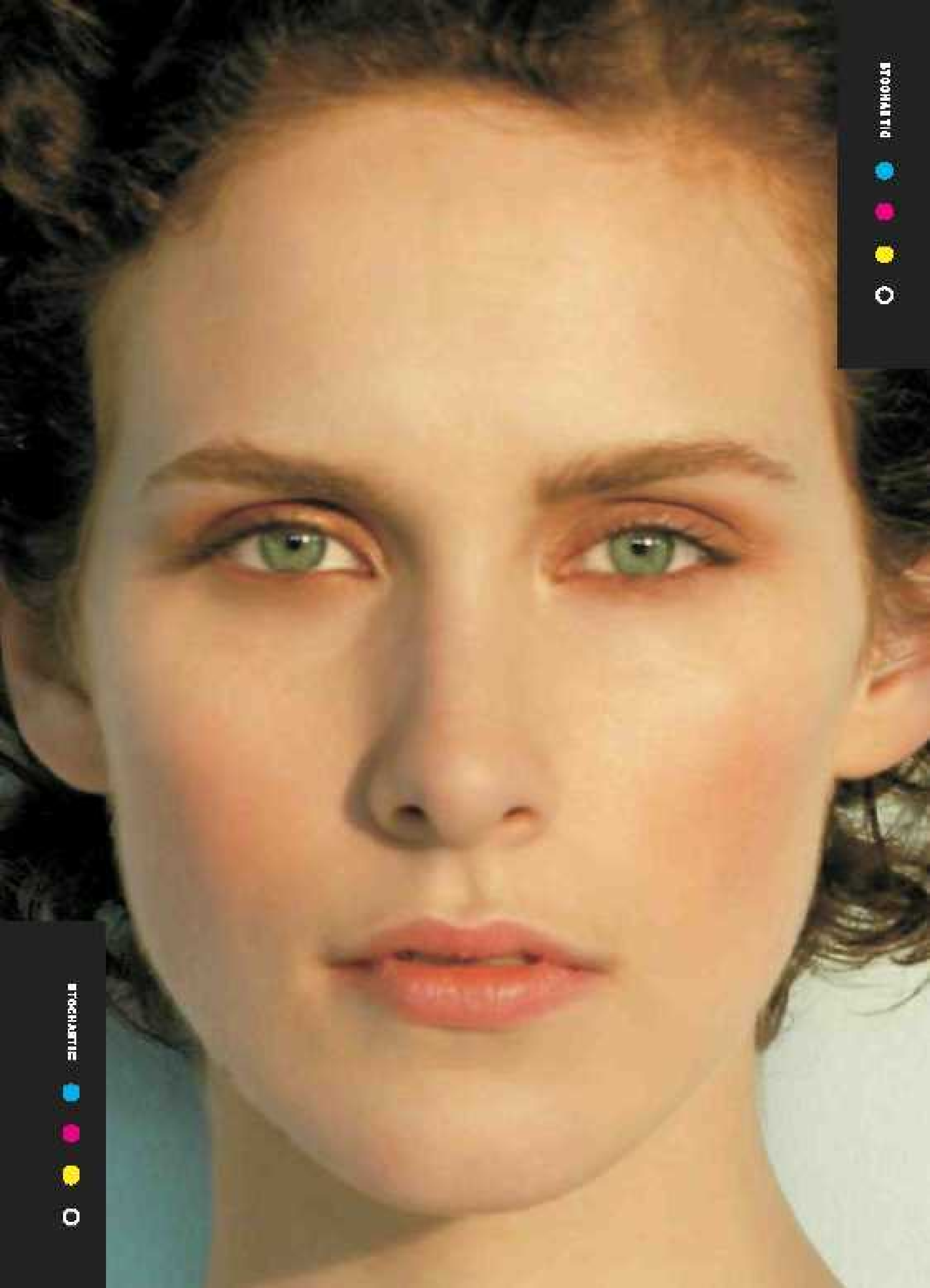
Conventional

Four-color process is still considered the standard in offset lithographic printing. Using cyan, magenta, yellow, plus black (CMYK), four-color process is able to approximate, but cannot replicate, all of the color in the original artwork. Not all four-color process printing is equal in quality, however. A major difference is in the fineness of the line screen which determines the number of dots per inch. The more dots per inch, the sharper the detail and smoother the color. Today 150 to 175 line screens are the norm, although many printers operate at much higher levels. The quality of the paper also determines the choice of line screen. Premium coated papers can handle finer line screens than softer, more absorbent papers.


CONVENTIONAL
CONVENTIONAL

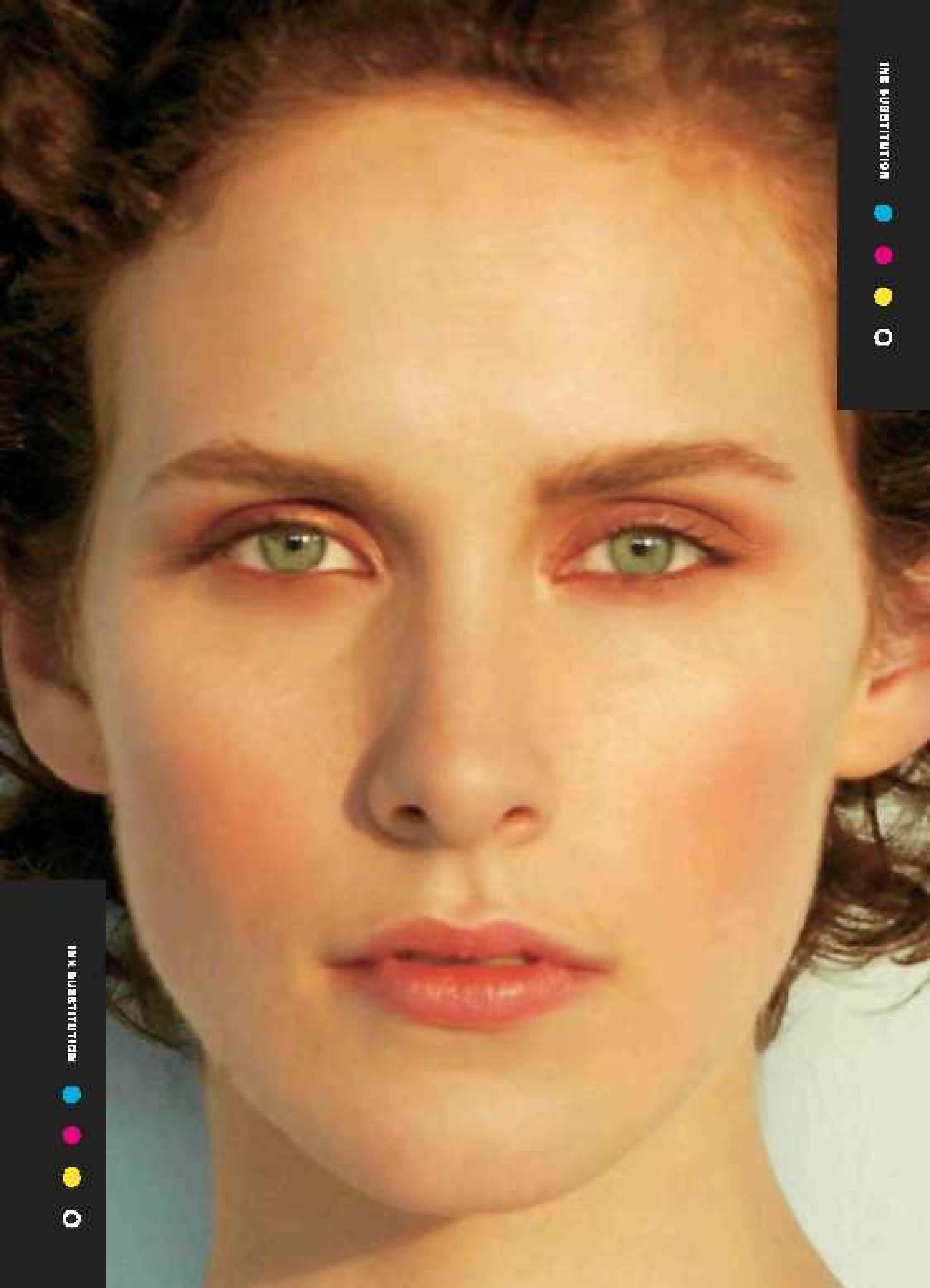
Stochastic

Direct-to-plate technology is enabling more printers to offer stochastic, a screening process that produces randomly spaced and irregularly shaped dots. Conventional screens separate the image into evenly spaced dots aligned on a grid. Compared to conventional printing, stochastic offers several advantages, including no moiré patterns nor sawtooth edges in screens, more open shadows, crisper details, and better simulation of continuous tone photographs. The down side is that stochastic is less forgiving on press; there is less latitude in adjusting color densities or applying heavy ink coverage. Also, imperfect flesh tones become more visible due to stochastic's ability to capture fine details.


STOCHASTIC
STOCHASTIC

Ink Substitution

A popular printing technique for giving a healthier glow to a face is substituting process yellow with a chrome yellow to warm up the overall skin tones. This switch frequently happens during press checks after the designer or client sees the first "pulls" and decides that the skin tones look "too cold" and that just pushing the magenta will not remedy the problem. Changing the ink to a more red-tinged yellow often does the trick without the time loss and expense of remaking plates. Keep in mind that substituting a match color for a process color will affect all of the images on that side of the sheet.


INK SUBSTITUTION
INK SUBSTITUTION

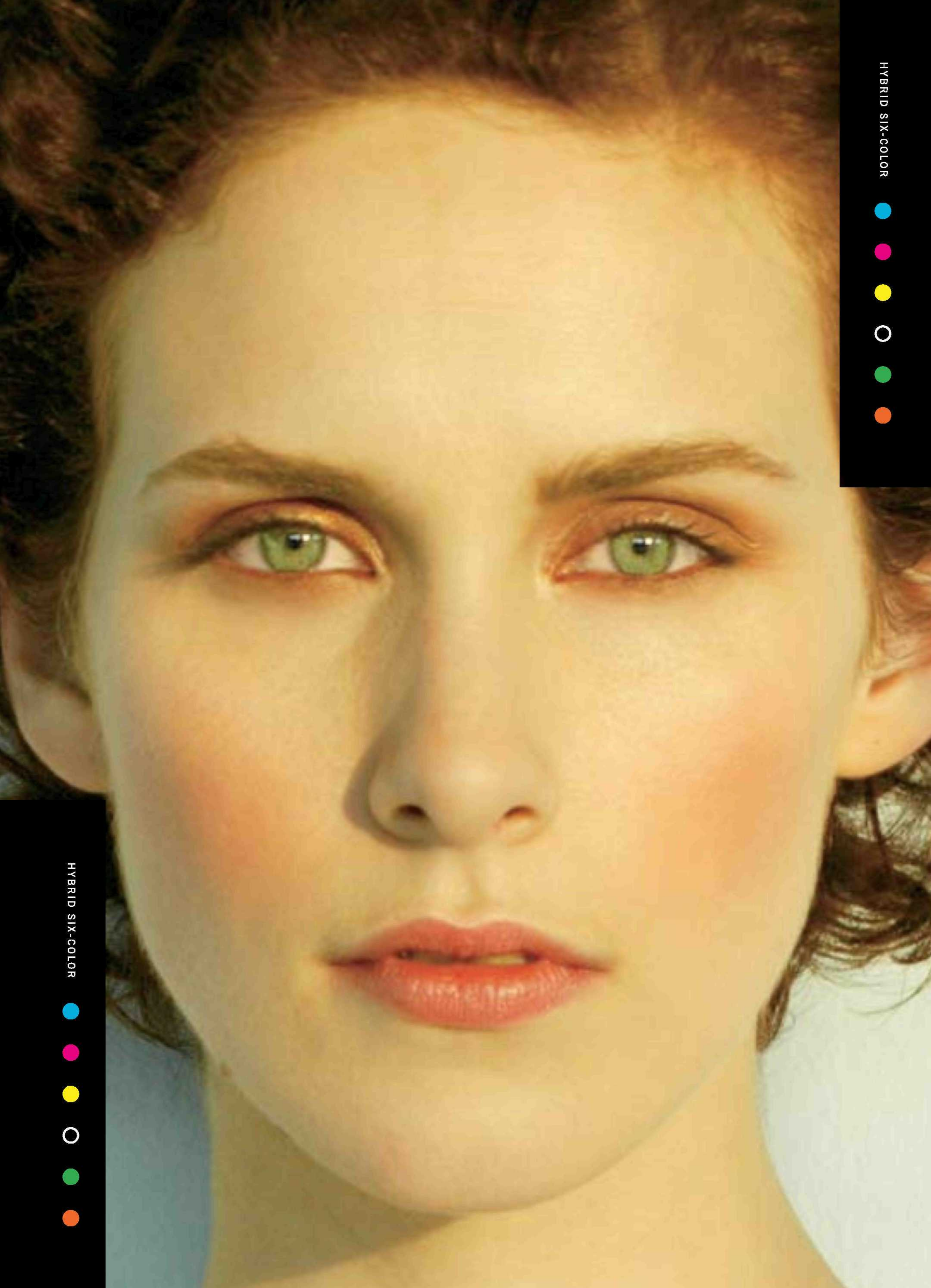
Touch Plate

Introducing a fifth color by adding a touch plate to a four-color process printing job can accentuate specific features and impart an element of excitement to an image. Giving a double bump of color to the lips can make them appear more lusciously red or make the eyes look more startlingly blue or green. A touch plate provides a means to expand the color gamut and create colors that cannot be achieved with one hit of four-color process inks. Shown here, a pink touch plate was used to give a rosier glow to cheekbones and lips. Because the pink is on its own plate, the color could be run up or toned down without affecting the entire image.

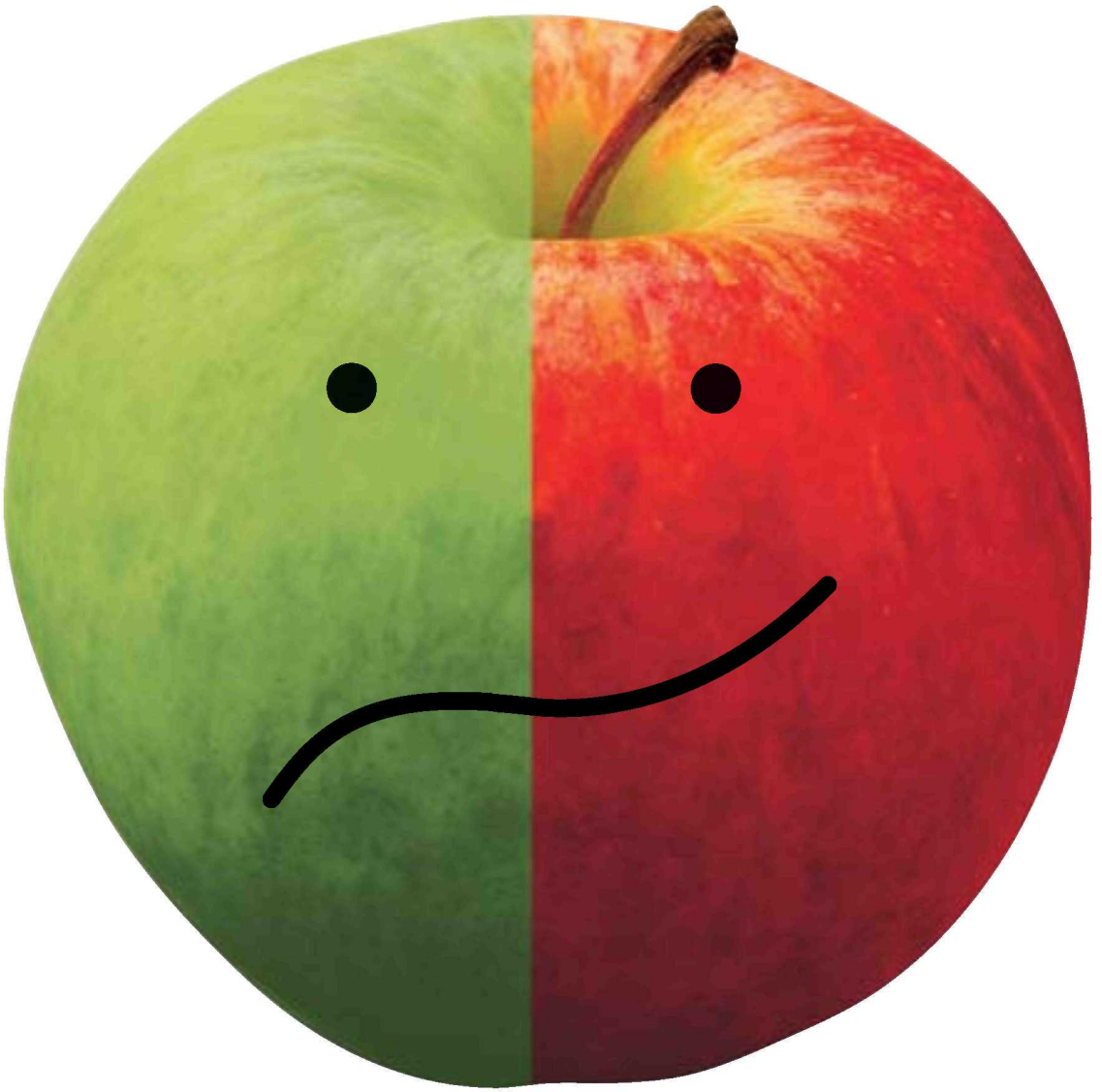

TOUCH PLATE
TOUCH PLATE

Hybrid Six-Color

Six-color separations offer the advantage of providing a wider color gamut than possible with conventional four-color process alone by adding two colors outside of the CMYK range. The resulting look can be more vibrant and cleaner than CMYK and truer to the color fidelity of the RGB original. This example not only uses six-color separations, but designates two match ink colors: a specially formulated orange to warm the skin tones plus a special green to accentuate the color of the eyes.


HYBRID SIX-COLOR
HYBRID SIX-COLOR

(BEFORE COLOR MANAGEMENT)



(AFTER COLOR MANAGEMENT)

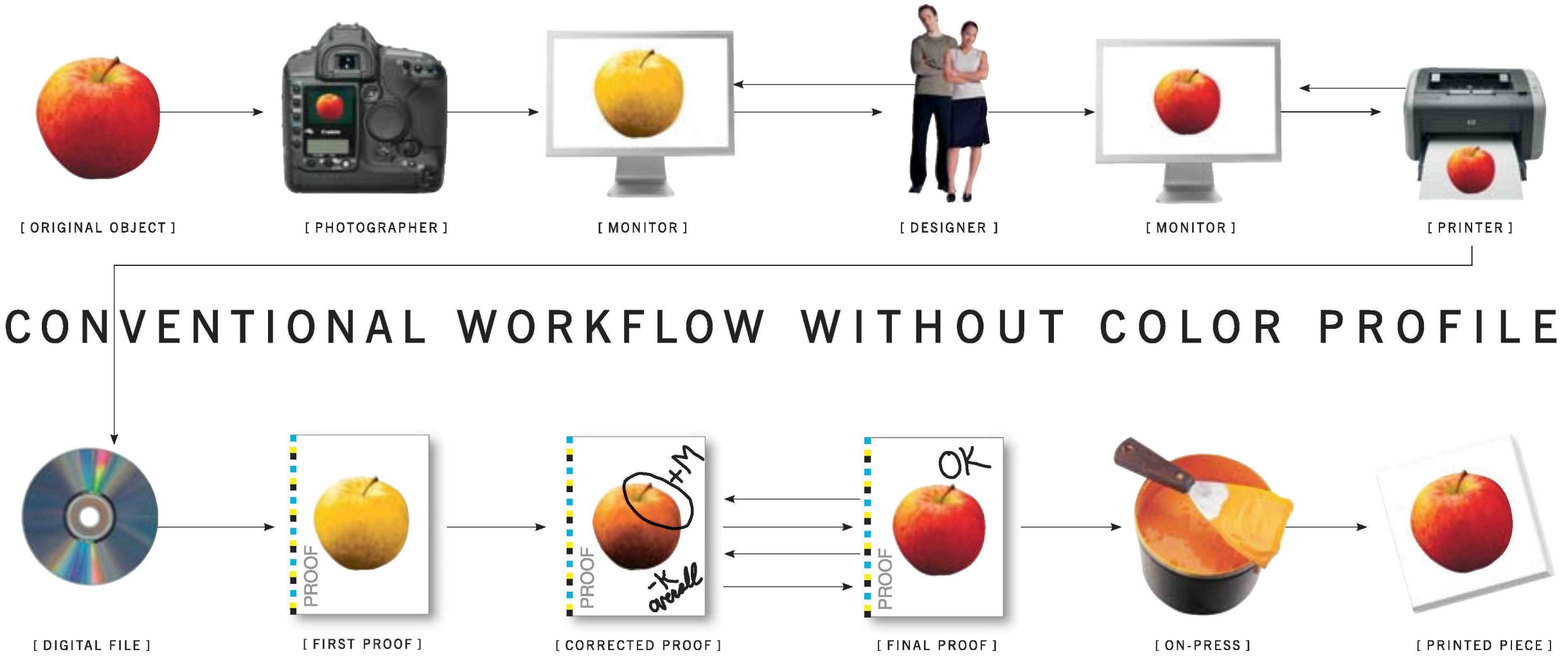
Apples to Apples

Three of the most vexing color management problems facing the printing and design industry today are 1) dealing with the disconnect between RGB and CMYK modes, 2) finding a way to calibrate digital devices so everyone is working in the same colorspace, and 3) widening the gamut to make the world of print more vibrant and spectacular.

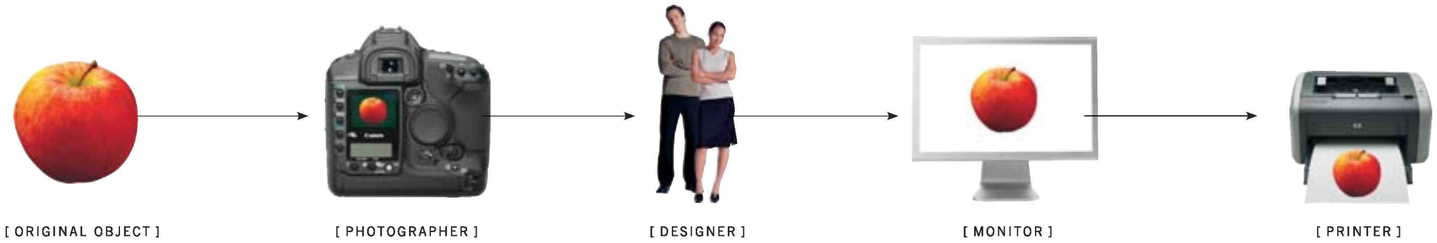
In the days before digital technology was introduced into the graphic realm, everyone, by default, worked in approximately the same color space. The photographer took the picture and handed off a film transparency that became the “master” to match for the designer, prepress and printer down the line. No longer. When a designer opens a digital photo file today, it may or may not look like what the photographer saw through the lens. The problem is that digital devices see colors as numbers and every device has its own quirky way of reading them. So without color corrections at each step, what a camera records as red-orange may be interpreted as purplish-red on a computer screen and output purple on an office laser and print mauve on press. Therein lies the need for universal color management, an initiative that hardware and software makers, printers, and others have been striving to achieve since the Macintosh® computer launched graphic communications into the digital age. Here is why you should care and what’s being done to establish a common standard.

Getting From Here

This is a sad but more or less **true tale** of what can go wrong when every digital device has its own color profile. Our fictional saga begins when an apple company commissions a product brochure. Using a digital camera, the photographer takes several shots of a red apple, selects magenta, too light in the shadows. Back-and-forth, back-and-forth–finally it looks good enough to send to the printer. **But wait!** The printer opens the disk and sees an apple that is decidedly YELLOW. A couple rounds of corrections ensue before everyone is happy. The job goes on press one, makes quick color adjustments and sends it to the designer on a CD. The designer looks at the file on the monitor and, **uh oh!,** the apple is yellow. The designer goes into Photoshop® software and adjusts curves and color balances, and prints out a laser proof. **Oops!,** not enough where more color adjustments are made and **voila!** It looks like the original apple. **Except!** the client points out that the printed apple is not an exact match to the laser proof he had okayed for color. Fortunately, the client agrees it does look better. **Whew!!**



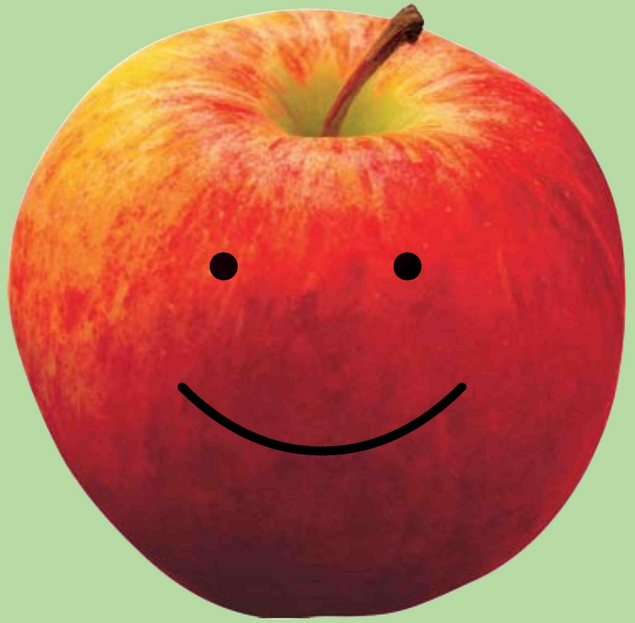
In an **ideal color** world–which, by the way, we are getting to–**harmony** prevails. All of the digital devices–camera, scanners, computer monitors, printers, presses–speak the same color language. The workflow is **seamless** from start to finish. No more back-and-forth, back-and-forth. No more protesting "It was right when I sent it over!" **Savings** in time



VS. RELIABLE WORKFLOW WITH COLOR PROFILES

are **impressive.** Clients are happy and grateful. Color is consistent whether the job is printed in Dallas, Milan or Hong Kong. Predictability is expected to soon lead to **convenient** soft proofing (right on your computer monitor) and remote press checks from the comfort of your office. **Thank you, thank you, thank you!**

→ to There



Why Color Management Is Everyone's Responsibility

"If we can send a man to the moon, why can't we get colors to match from one digital device to another?" is a question asked by many frustrated designers. The reason is because no one company or supplier can solve the problem alone. It demands the collaboration of software architects and developers, digital device manufacturers, offset printers and, yes, designers too. The issues are complex, but many great minds are working on solving the problem.

What the Industry is Doing About Color Management

Back in 1993 when digital technology was still in its infancy, a number of software and hardware companies saw a problem looming on the horizon and banded together to form the International Color Consortium (ICC). The goal of the committee has been to establish cross-platform standards for colors to facilitate consistent communication between devices.

In developing a color management program, the ICC adopted the numbering system for colors first created by the Commission Internationale de l'Eclairage (CIE) in the 1930s. This CIELAB color space was used to develop an ICC profile describing how a device reproduces color. The profile information is embedded in the graphic software program, so when you open a file, the device knows how to render it for its own particular color space.

Since different devices do not share the same gamut, the ICC developed the Color Management Module (CMM) to interpret and convert ICC profiles. When CMM encounters a color in a file that cannot be converted from one color space to another (i.e., out-of-gamut), it compares the two devices and picks a color value that is the closest match.This method works fairly well in most cases, but it still requires designers to proof carefully to ensure that in the transition nothing important was lost.

How Sappi Helps Manage Color

Sappi has long recognized that paper, even white paper, is the hidden "fifth" color in four-color printing. Its optical properties play a role in defining the color gamut and color space a paper can handle. Fluorescent brighteners change the hue of a paper under different viewing conditions. The shade of a paper will impact the look of an image, subtly emphasizing cool or warm tones. All of this affects the range of colors that can be reproduced on the sheet and how they will appear.

Aware that paper must be a critical consideration in color management, Sappi joined with the ICC four years ago to learn how software and hardware experts work with color space and apply that knowledge to expanding the color gamut of paper. To this day, Sappi is the only paper company in North America actively involved in this effort.

Through careful measurement and control of papermaking processes, Sappi has produced a selection of papers that are "color neutral." Lustro and Somerset are neutral on both the yellow-blue scale and red-green scale, which let designers and printers settle on a color space without compensating for the shade of the paper. McCoy and Opus cater to the current preference for blue-white papers by being neutral only on the red-green scale. This enhances cool tones and makes white spaces look crisp and clean. On the other hand, true color neutrals like Lustro and Somerset are wonderful for skin tones and reproduce all colors with exceptional clarity. Sappi's continuing focus on color management is aimed at expanding the allowable gamut on all of our papers to bring the look of CMYK into closer balance with RGB.

What Designers Can Do To Manage Color

- Ask your offset printer to provide their ICC color profile so you can view it on your system and match it to your color space.

- Keep your monitor and laser/inkjet printer accurately calibrated. Calibration should be done at least once a month, preferably every two weeks. A choice of monitor profiling software is available at affordable prices.

- Remember that every digital device has its own special color gamut with a limited range of colors. Even devices of the same make and model can differ from each other, which is why the color on your screen may look slightly different than the designer's next to you. Also, as digital devices age, their ability to render colors changes.

- Design in visually neutral surroundings; patterns and strong colors in the background affect how we perceive screen color. Ambient light, like sunlight on the screen, will also affect contrast.

- Remember that the quality and weight of the paper you use will affect color fidelity. The better the paper, the more ink it can hold, the finer the fidelity and wider the gamut.

- Consult with your vendor before you convert from RGB to CMYK so you can match their color profile and printing conditions.

- Think beyond print when preparing files. These days the same design may be used on different media – different types of paper, billboards, the Internet, plastic, etc. Always retain an RGB version of the original document for that eventuality.

- If printing in multiple sites, especially overseas, ask your suppliers beforehand if they are adhering to ICC color management standards and common practices.

Expanded Vision

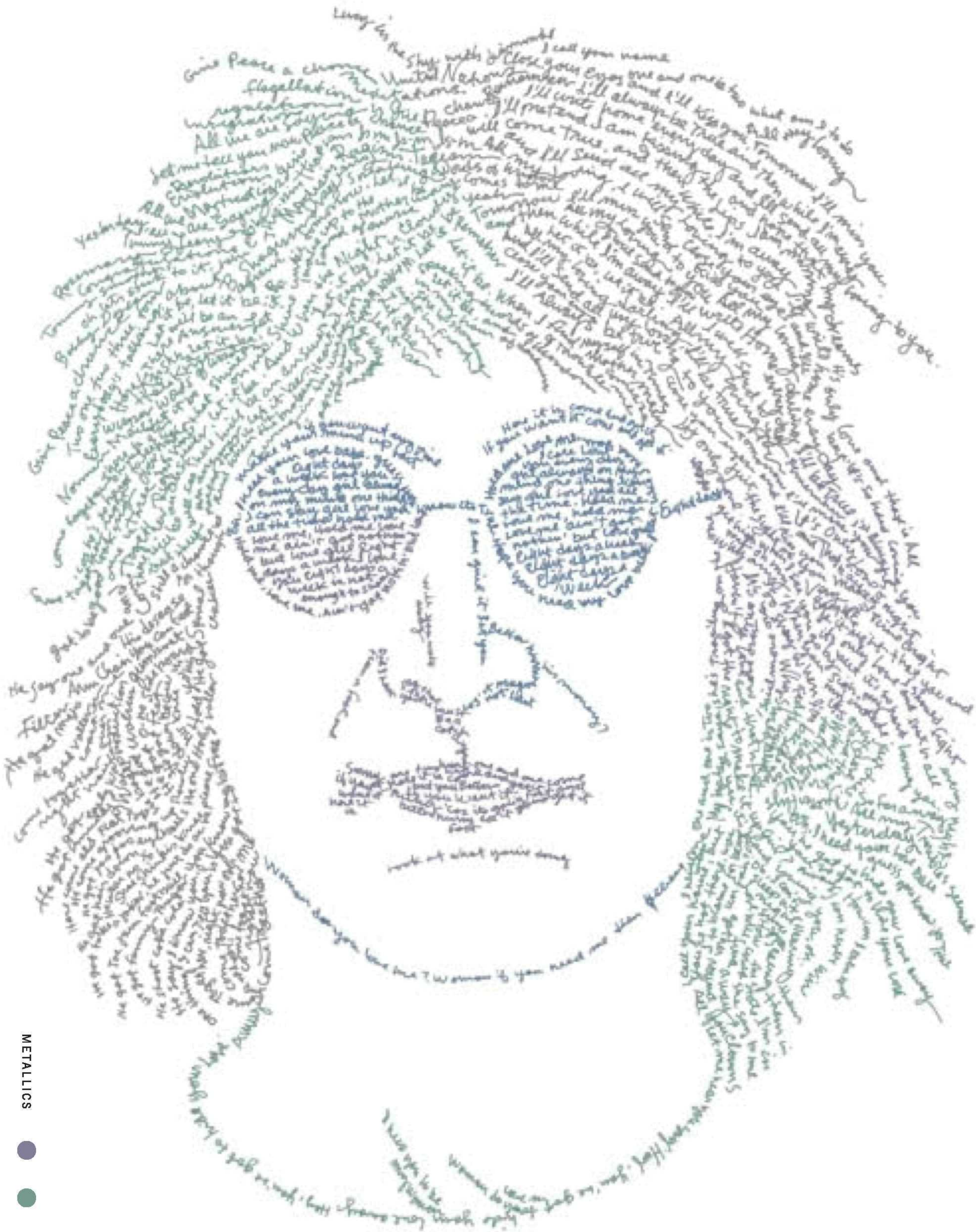
Just because a color is outside of the traditional CMYK color space doesn't mean it can't be reproduced on press. There are ways to expand the color gamut and achieve results that you cannot get through conventional four-color process alone. Here are some ways to enliven an image through various printing techniques. Note: Keep in mind that many of these effects are only visible when printed and cannot be previewed on your computer screen or on a laser proof.


APR 63

Metallics

This simple black-and-white ink drawing of John Lennon is given a slightly psychedelic look through the use of four metallic colors – purple, green, blue and silver. Made of pigmented metal suspended in a varnish, metallic inks tend to be opaque and require longer drying time. Any overprinted conventional ink such as black type should be drytrapped. Coated papers are best for optimizing the shiny luster of this technique. An inline spot gloss varnish was added to this drawing.

Pentagram partner Kit Hinrichs created a pen-and-ink portrait of John Lennon out of lyrics from Beatles songs. He then used an overlay to define where he wanted the metallic colors to go.

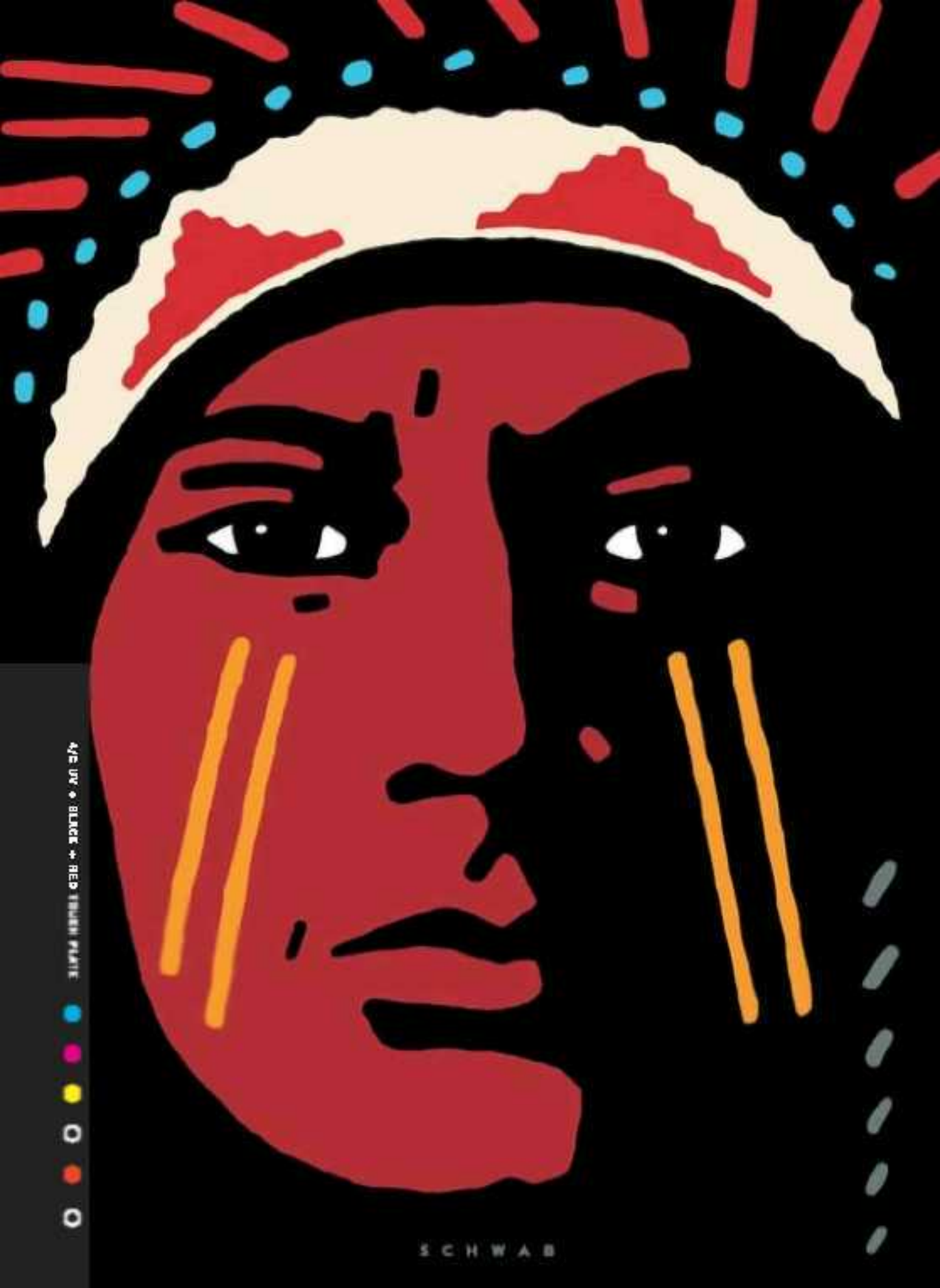


METALLICS

Four-Color UV Plus Red-Orange Touch Plate

Silkscreen is not economical for large runs, so the goal here was to create the look of silkscreen lithographically. Because of the large areas of flat color, stochastic was chosen as the screen process, and the image was printed on a UV press using four-color process screen tints plus a second black and a match red-orange touch plate. An advantage of a UV press is that it dries ink as the sheet moves between ink stations, thus virtually eliminating dot gain and allowing heavy ink coverage for more vibrant colors without offsetting. A UV matte varnish was applied to the image to protect it from scuffing.

Illustrator Michael Schwab is known for his bold drawings that iconically capture the subject. His style—flat graphics and heavy shadow—lends itself to silkscreen—a look simulated on a UV press.


4/C UV + BLACK + RED TOUCH PLATE
SCHWAB

Four-Color Process with Match Red Touch Plate

Increasing the ink density of just one color in four-color process will change the cast of the entire piece. In this case, the goal was simply to make the red areas leap off the page, so a match red touch plate was appropriate. It allowed the four process colors to be brought into balance, while the independently controlled touch plate red was used purely for accent. An inline spot gloss varnish was added to the image.

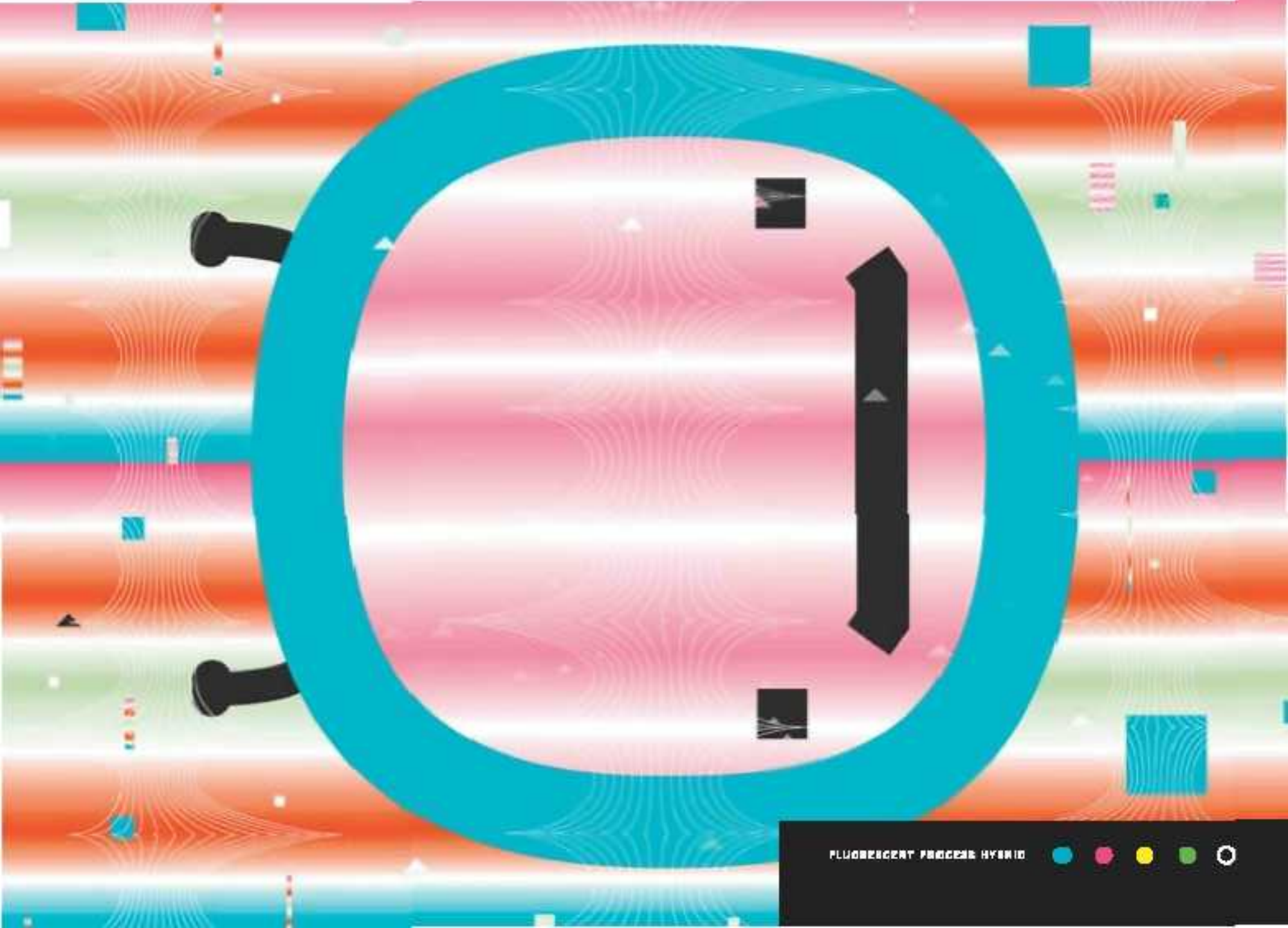
Alan Fletcher, a founding partner in Pentagram, has published numerous books on his collages and assemblages. This Chinese dragon is made from can labels, tickets and a Rolodex card.


APR 63
PRIVATE
TOMATO PA
WITH BASIL
POPE
PAPA
HOTEL·BADEN·BR
THIS

Fluorescent Process Hybrid

Fluorescent inks contain a resin that brings high-energy ultraviolet light into the visible spectrum. Especially with pastel shades, they add an intriguing vibrance. Fluorescents also mix well with process colors. This image is made out of fluorescent blue and fluorescent green, with fluorescent pink and process yellow combined to create a fluorescent red. Keep in mind that fluorescents are "fugitive" pigments that fade in direct sunlight and over time. An inline matte varnish was added overall to this image.

John Hersey, a pioneer in digital design and illustration, is known for his playful imagery, all generated on a computer. Here, he indicated how fluorescent colors should be used to bring this simple illustration to life.


FLUORESCENT PROCESS HYBRID

Extreme Silver

A new way to simulate metallic is one of the exciting innovations emerging from the printing industry. Still proprietary to specific printers, variations of this process go by different names. The silver process, shown here, is substantially more metallic than match silver ink. It also offers advantages over foil-stamping because it can be printed inline. This black-and-white image was printed inline on a UV press using a special silver, four-color black, plus an extra black. The combination of these inks deepens the contrast between the silver and the shadows. When using this process, it is important to choose a good coated paper with a smooth surface for best results. A spot inline matte varnish was added to this image.

Swiss-born photographer Francois Robert has made an avocation of finding and photographing "faces" in objects, and has several books out on his faces. This photograph of scenic binoculars was shot in black-and-white.

EXTREME SILVER

Color Augmentation

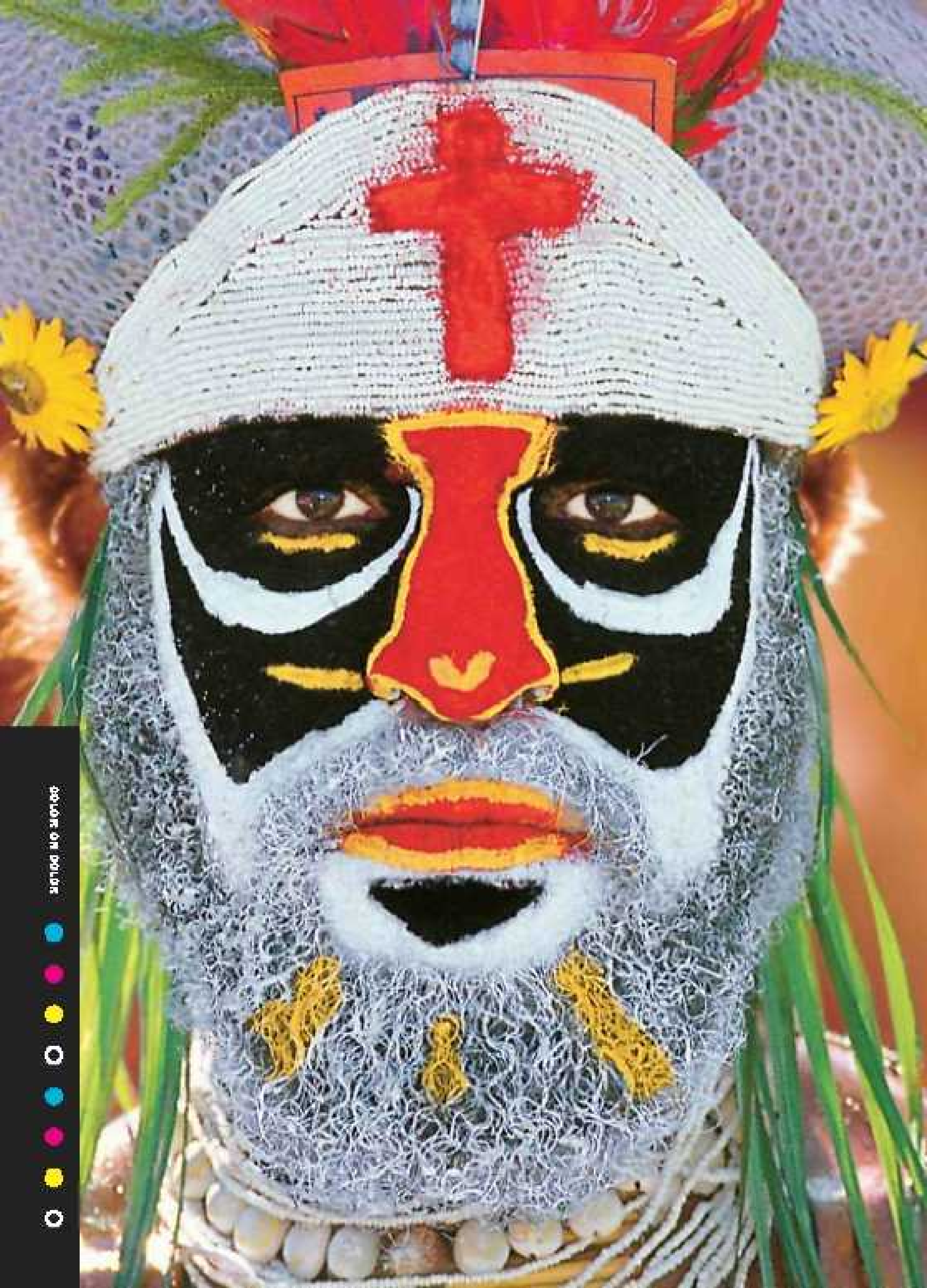
To achieve a color that is outside of the gamut of CMYK, this image was run in traditional four-color process, substituting a match pink for process magenta. The purpose for this move was to enhance the color to more realistically represent the paint on the mask. An overall gloss varnish was added to this image. Note: sometimes the need to make a substitution does not become apparent until viewing the printer's proof shown on the actual paper stock.

An artist with a camera, photographer Terry Heffernan is known for sculpting his subjects with light and shooting in 8x10 format. His fine art series, "American Icons", invites viewers to share his fascination with historic artifacts.

Color on Color

The desire to add extra saturation to four-color process can be satisfied with an inline "double-bump" of all four-color inks. Now that more printers have six-color, eight-color and even 12-color presses, this technique is being used more frequently. To heighten the dramatic impact of this image, it was printed inline using two hits of four-color process UV inks plus an overall matte varnish. Note: other match colors may be substituted for four-color process to achieve different special effects.

Editorial photographer Eric Meola has shot on assignment for major magazines all over the world. Drawn to exotic subjects, Meola intensifies the impact of the image by manipulating the film to saturate the colors even more.



Glossary of Color Management Terms

Achromatic

Hues made from black, gray and white.

Additive Colors or RGB

RGB (red, green, blue) uses additive color mixing, meaning that a kind of light needs to be emitted to produce a given color.

Calibration

Establishing a fixed, repeatable condition for a device.

Characterization

The process of creating a profile that describes the unique color conditions found on a particular device.

CIE (Commission Internationale de l'Eclairage)

The international standards organization responsible for setting standards for color and color measurement.

CIE L*a*b*, or CIELAB

A mathematical model that describes colors using three synthetic primaries: L*, which indicates lightness; a*, which indicates red-greenness, and b*, which indicates yellow-blueness.

CMM (Color Management Module)

A software component that adjusts the numerical values that get sent to, or received from, different devices so that the perceived color they produce remains consistent. This is considered the "engine" in color management systems.

CMYK

Cyan, magenta, yellow plus black – the colors used for four-color process printing. Also known as process colors.

Colorimeter

An instrument typically used to measure color from computer monitors. It optically measures the relative intensities of red, green and blue light reflected or emitted from a color sample.

Color Gamut

The range of color a device, or color model, can produce. If one device has a larger color range than another, it can reproduce more colors

CMS

Color Management System. This ensures color uniformity across input and output devices so that final printed results match originals.

Color Model

RGB, CMYK and CIELAB are all examples of color models. Each is a means of specifying color numerically, usually in terms of varying amounts of primary colors.

Color Space

The range of colors a color model can produce.

ColorSync

The color management system built into Apple's Mac OS.

Density

The ability of a material to absorb light. The darker the material, the higher the density.

Densitometer

An instrument that measures optical density.

Dynamic Range

The range of density that a film stock, digital camera, scanner or measuring instrument can detect, usually expressed as optical density (OD) units. The lowest density is termed dMin, and the highest is dMax. For paper, dynamic range refers to the whitest white of the paper and the blackest black that you can achieve with ink on paper.

Flat Color

Colors and tints that are not formulated from standard process colors.

Fluorescence

The ability of a substance such as paper or ink to absorb ultraviolet light waves and reflect them as visible light.

Gamut Compression or Mapping

The process of reducing a large color gamut to fit into a smaller gamut such as print.

GRACoL (General Requirements and Applications for Commercial Offset Lithography)

An alliance of graphic arts professionals (now called IDEAlliance) formed to develop general guidelines and recommendations for commercial printing.

G7

A methodology designed to reliably and efficiently match the visual appearance of multiple devices by defining gray balance and neutral print density curves instead of the traditional method of measuring TVI for color.

Gray Balance

Printed cyan, magenta and yellow halftone dots that accurately produce a neutral gray image.

Grayscale

Strip of gray values from white to black. Used by process camera and scanner operators to calibrate exposure times for film and plates.

ICC (International Color Consortium)

A group of hardware and software providers who have joined forces to develop cross-platform standards for color communication and consistency.

ICC Device Profile

The ICC developed this standard format for a data file that describes the color behavior of an input, display or output device, or a color model. The format is referenced to a device-independent color model such as CIELAB.

Match Color

In printing, the duplication of a specified color by using either multiple process colors or special flat colors. Match colors may be defined by supplied samples or by numbers from color matching systems.

Metamerism

The phenomenon where two color samples appear to match under one light source and differ under another.

Out-of-gamut

Colors from one device that are not supported in another device.

Profile

A data file that describes the color behavior of devices like scanners and monitors or defines the color of an abstract color space such as Adobe RGB.

Rendering Intent

A method of handling out-of-gamut colors when matching one color space to another.

Rosette Pattern

The desirable minute circle of dots that is formed when two or more process color screens are overprinted at their appropriate angle, screen ruling and dot shape.

SNAP

Specifications for Newsprint Advertising Production.

Soft proofing

Using your monitor as a proofing device.

Spectrophotometer

An instrument that measures the amount of light a color sample reflects or transmits at each wavelength, producing spectral data.

Stochastic Screening

A digital screening process that converts images into very small irregular shaped and variable spaced dots.

SWOP

Specifications for Web Offset Publications. Printing standards established by advertisers who had to send copy to multiple magazines and printers and needed to ensure an accurate match. SWOP now also sets precise color standards.

Workflow A path involving different devices and operations.

Work Space Choice of colors that are available to edit a graphic; includes both the RGB and CMYK color space.

Production Notes and Credits

Design
Pentagram

Copywriting
Delphine Hirasuna

Printing
Twelve and eight-unit 40" conventional presses, Twelve and eight-unit 40" UV presses with interdeck drying. All images are varnished inline.

Binding
Wire-O

Paper
Lustro® Dull Cover
100 lb/270 gsm
Lustro® Dull Text
100 lb/148 gsm

Cover
Two hits of black, match blue, purple, yellow, green, and red, satin varnish

Inside Front Cover
Two hits of black, satin varnish

Page 1
Four-color process, spot satin varnish

Page 2-3
Four-color process, spot satin varnish

Page 4
Two hits of black, overall satin varnish

Page 5
Four-color process with a variable line screen, match yellow, match pink, special match green, special match orange, overall satin varnish

Page 6
Black

Page 7-8
Four-color inkjet printed, plus die-cut

Page 9
Four-color process with a 175-line screen, overall satin varnish, plus die-cut

Page 10
Black

Page 11
Four-color process, stochastic, overall satin varnish, plus die-cut

Page 12
Black

Page 13
Four-color process with a 175-line screen and a chrome yellow substitution for process yellow, overall satin varnish, plus die-cut

Page 14
Black

Page 15
Four-color process with a variable line screen, plus a match pink touch plate, overall satin varnish, and die-cut

Page 16
Black

Page 17
Four-color process with a variable line screen, plus a special match green and orange, overall satin varnish

Page 18
Four-color process with a variable line screen, spot satin varnish

Pages 19-30
Four-color process with a variable line screen, combinations of spot and overall satin varnish

Page 31
Four-color UV process, with a second black, match red touch plate, plus special inline silver, overall matte varnish

Page 32
Four-color process, with a variable line screen

Pages 33
Match metallic silver, purple, green, and blue, spot gloss varnish

Page 34
Four-color process, with a variable line screen

Pages 35
Four-color UV stochastic process with a second black plus a match red-orange touch plate, overall matte varnish

Page 36
Four-color process, with a variable line screen

Page 37
Four-color process with a variable line screen, match red touch plate, spot gloss varnish

Page 38
Four-color process, with a variable line screen

Pages 39
Fluorescent pink, blue, and green, process yellow and black, with an overall matte varnish

Page 40
Four-color process, with a variable line screen

Page 41
Four-color UV process with a second black, special inline silver, spot matte varnish

Page 42
Four-color process, with a variable line screen

Page 43
Four-color process with a match pink substitution for process magenta, overall gloss varnish

Page 44
Four-color process, with a variable line screen

Page 45
Two hits of four-color UV process inks, overall matte varnish

Page 46-49
Four-color process

Page 50
Four-color process, spot satin varnish

Inside Back Cover
Two hits of black, satin varnish

Back Cover
Process black, match blue, purple, yellow, green, and red, satin varnish

Recommended Reading

For more in-depth information on Color Management, here are some sources that we recommend:

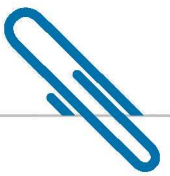
Sharma, Abhay. **Understanding Color Management.** Thomson Delmar Learning, Clifton Park, NY. 2004.

Drew, John T. and Sarah A. Meyer. **Color Management: A Comprehensive Guide for Graphic Designers.** RotoVision SA, Switzerland. 2005.

www.color.org/french/whycolormanagement.pdf

www.colormanagement.com

www.adobe.com



With Sappi papers, you can be sure the colors you choose are the colors you get. The color-neutral qualities of Lustro eliminate the need to compensate for the shade of the sheet in order to achieve critical color on press. Plus the optical consistency and uniform surface of Lustro optimizes the visible gamut so that you can not only see colors more vibrantly, you can see more of them too. For true color, Lustro is the one.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