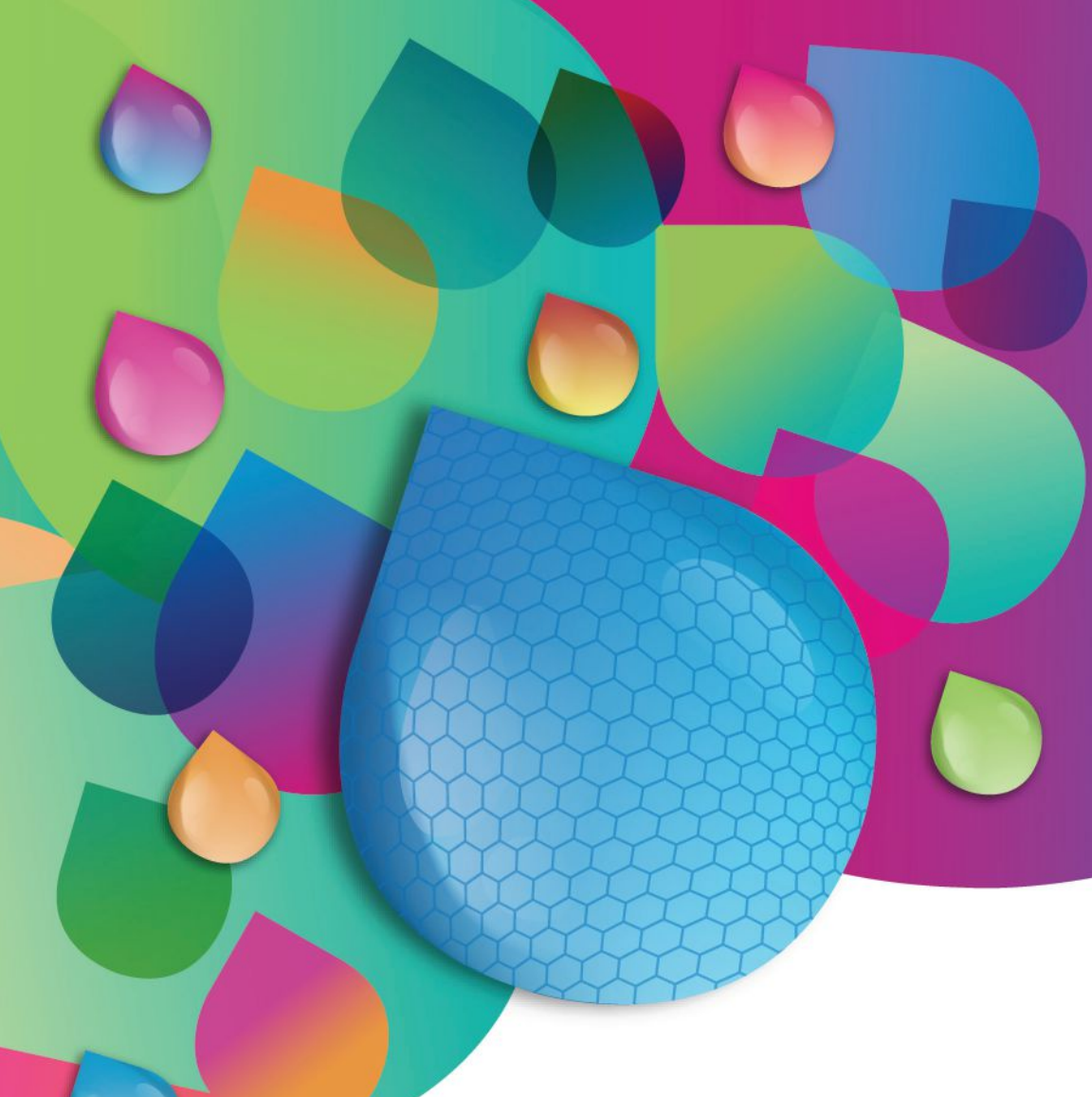


# DESIGNER'S GUIDE TO A NEW GENERATION OF INKJET

BY ELIZABETH GOODING & MARY SCHILLING

Canon | thINK.

## A NOTE FROM THINK AND CANON

With two successful editions of The Designer's Guide to Inkjet already completed, you might wonder why we decided that a third edition was needed. It would be equally relevant to ask why, with several successful lines of sheetfed and web-fed inkjet presses launched, Canon continued to invest in a new generation of technology. The answer to both is that there was a market need.

We know this because of the excellent feedback that we get from the thINK user community. thINK is an independent community of Canon Production Print customers, solution partners, and print industry experts led by some of the most successful inkjet service providers in the country. As members of our community push into new markets with their production inkjet presses, it's important that their customers are able to take full advantage of what the technology has to offer. When designers and print buyers understand what inkjet can do and how to tap into that potential, it benefits the whole industry.

Breaking down that technical information and explaining it in a useful way to non-technical audiences requires a rare mix of design, business, and technical expertise. We are lucky to, once again, have Elizabeth Gooding and Mary Schilling as authors of the guide. Our authors have a unique perspective gained from working on the design of graphics and communications projects, the development and testing of press technology, and working closely with printing companies who adopt the technology. They understand the value of great design as well as the need for efficient production. They have met our directive to deliver a guide that provides designers with a recipe for doing both, including an array of new illustrations and graphics. We are also pleased to have the continued support of Street Level Studio for cover design, editorial review, and continuity with our other industry publications.

We hope that this latest edition of the guide will inspire more designers to experiment with inkjet, personalization, finishing, and embellishments to create work that pushes the limits on what the latest generation can do. As designers keep pushing the limits on what they can do with inkjet, we will endeavor to continue raising the bar.

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# INTRODUCTION



Inkjet printing is now so fast, flexible, and colorful that it is opening up new opportunities for designers who work with print and even designers who didn't think that print had a place in their world. When you can change every color and every image to cater to an audience of one while embedding off-ramps to online content or augmented reality, the design possibilities are endless. That is what inkjet delivers.

## *But inkjet can't deliver without you, the designer.*

This guide is intended to help designers understand and embrace the creative potential of the latest generation of inkjet presses. These presses have not only raised but redefined the bar for print quality. Now it's time to raise the bar on print design.

First, we want to make you aware of where inkjet fits in the overall print design ecosystem and how its unique characteristics open up a range of opportunities to make your design more flexible, colorful, and impactful. Opportunities exist to bring more design impact to outdated customer communication or direct mail applications and to deliver best-of-the-best designs for marketing communications and graphic arts projects. There are few print opportunities out of reach for inkjet and the designers who understand its capabilities.

So that's how we kick off the guide, with understanding the possibilities and the capabilities of different inkjet technologies to deliver results in print segments like direct mail, publishing, marketing communications, and customer care. Then we dive into the project planning process with a look at the interconnectedness of media, press, and finishing decisions as well as the level of engagement required with your print provider. That engagement includes an understanding of the importance of creating design files that will drive the process efficiently for you and your print partner.

Efficiency becomes both more challenging and more important when adding variable data and imagery to color-sensitive projects. Designers have vastly different levels of experience with color and personalization. Some may

have experience with both color and personalization when using digital toner, while others may have expertise with color on static offset presses. Some may work in a monochrome production environment, making the requirements of color management completely new to them. Regardless of where you are starting from, you will find useful information here to guide you.

Even if you have worked with inkjet in the past and have experience managing your design environment for personalized projects, we would encourage you to take a second look. Not only have your inkjet options changed, but so have the color space definitions and the color matching systems used to design for inkjet. Also, the process and file setup now has to account for a wider variety of ink types, press formats, pretreatments, post-coatings, embellishments, and finishing processes. Plus, if you are working on high-end graphic projects like magazines or photobooks, you may want to take another look at how your images are managed and saved for optimum performance. Of course, the other big game changer is all the new material you can print on — every material will have its own settings for the target press. We encourage you to gather important information about your target production environment — paper, press, finishing, and production processes — as early in the design process as possible and to visualize the creative possibilities, along with production processes, laid out before you.



There are some spots along the way where we note that the technical knowledge is provided as "extra credit" for those who are interested. But to truly unlock the potential of the new generation of inkjet presses, designers must have a good understanding of the different ways that presses deliver quality on different materials and how that impacts compatibility with the rest of the production process. With this knowledge, designers can take advantage of all the amazing effects that can be created when design settings are adjusted based on an understanding of software, hardware, ink, and, most importantly, the media they print on. The information in this guide will help designers create better projects from concept to file preparation and make informed cost trade-offs along the way.

**From workflow and color management to new media and coating options, the inkjet industry has changed quite a bit.**

We also recognize that many creative teams work on projects that use more than one type of print environment, and that they must deliver a level of consistency across those platforms. We've provided guidance for cross-process print work as well as encouraging you to mix print with other channels.

We structured the guide to follow a logical design workflow, and then we used that workflow to design the guide. The last chapter talks about our design brief from the client, the design decisions that were made along the way, the setup of the design format, and the settings for the final print file.

We're very excited to have the opportunity to bring designers of every generation up to date on the latest and greatest that the new generation of inkjet has to offer.

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**You can download the helpful design tools referenced in the Guide at https://inkjetinsight.com/tdgresources Use the QR code for quick access.**

CHAPTER 1

# A NEW GENERATION OF INKJET



1

A NEW GENERATION OF INKJET

# IT'S ALL ABOUT MORE

In the past few years, inkjet printing has reached into more markets, like commercial printing, signage, graphic arts, and photobooks. It has evolved into more formats, including familiar offset sheet sizes, narrow web widths, and high productivity web widths. It has become compatible with virtually all the digital and offset papers designers love, as well as a whole range of specialty media. But wait, there's even more about MORE.

The new generation of inkjet prints delivers more color, more coverage, and more overall quality. Today we can confidently say there are inkjet presses that deliver better print quality than typical offset presses — and that's before considering the benefits of more flexibility in terms of run lengths, versioning, and personalization. Bottom line? The new generation of inkjet means more opportunity for you, the designer.

## TELL ME MORE

There are now a lot more inkjet presses installed at printing companies all over the world. As of 2022, research consultancy I.T. Strategies* counted over 7,000 production inkjet engines cranking out more than 500 billion pages per year. Both the number of presses and the productivity of individual presses is increasing. What does this mean for designers? It means a printing process that was already more cost effective than digital toner presses is narrowing the gap on cost effectiveness relative to traditional offset printing. It also means it is more and more likely that printers who reply to your request for a quote will have one or more types of inkjet presses available.

*"The Continuous Feed Ink Jet Production Market - 2022." I.T. Strategies, March 2022.

While the new generation of inkjet presses offers more possibilities for designers, at the same time it makes the world of inkjet more confusing. The options can be overwhelming. There are older inkjet press models still running strong. Your print provider may be running one of them, and it might work perfectly for your project and even cost a little less per piece. However, if you are designing for the best that print production can offer, you will want to see what the latest and greatest, best and brightest inkjet has to offer. To do that you need to know what you are looking for and how to tell the difference between the options available.

## What do I need to know?

Inkjet opens up a lot of possibilities for designers, but it also imposes constraints. To design effectively and get the best pricing for a production process that meets your needs, you need to understand your options. This means learning about a number of aspects of technology, how to design for them, and the economic trade-offs of your design choices. For instance:

- Web-fed presses are almost always much faster than sheetfed presses. This makes them more cost efficient to run, and that can result in savings for you. However, web-fed presses can only handle one paper at a time so they may not be as cost effective for a design that uses more than one stock.

**In 2022, over 500 billion pages will be printed on over 7,000 production inkjet presses. WOWZA!**

- Some sheetfed presses can handle two or even three types of media in a single job, making them very effective for books or booklets or magazine-style mailings. Other, larger format sheetfed presses only handle one at a time and target very different work.
- Different presses use different types of inks, ink colorants, and sometimes pretreatments drive everything from substrate compatibility to print quality and overall durability. They also may affect speed and production costs.

- The different types of ink and other press features make them compatible with different types of substrates. This may give you access to papers that are thinner or thicker, with different surface finishes or nonpaper media for your project. Each type of surface will perform differently with each type of (compatible) inkjet press.
- Some also have a higher number of channels for ink. This may expand your options beyond CMYK, offer specialty brand colors, or introduce processing and security features such as MICR or invisible ink.
- While more colors can be great, there are also inkjet presses that have been optimized for printing crisp black text for use in books, newspapers, and notices that need fine print that is easy to read.
- With any design, there are setup processes to be considered to ensure your intentions are communicated accurately by your design file throughout the printing process. With inkjet, there will be different settings for every type of press and substrate you use.
- As inkjet moves into new and challenging markets, like graphic arts and photobooks, more care must be taken in image setup and color management.
- The increased speed and automation of many new presses means that printing companies will expect their clients to deliver files that run efficiently as well.

As you can see, there are many exciting variations with inkjet presses, old and new. But you may not be working with inkjet alone. Either for cost or effect, you may choose to work with a combination of inkjet along with toner, offset, or both. Since all of those are completely different printing processes that can deliver a distinct result even on the same paper, careful planning is required.



## Inkjet is different from offset

The traditional offset process only produces static images. If you want to design a series of direct mail pieces on offset, each must be a separate job with its own films or plates. This makes any variation very expensive, and personalization is impossible without a separate overprinting process. For many reasons that we will talk about in the next chapter, it is becoming increasingly difficult to avoid some level of variation or versioning, and personalization continues to improve results in key print markets such as direct mail.

With inkjet, every page can be dynamically created with different text, images, and colors. This allows long runs with lots of variability and short, static runs to be produced more cost effectively on inkjet than on offset presses.

## Inkjet is different from toner

Color toner devices overcome the versioning and personalization challenges of offset. Top toner presses also can deliver great color and image quality. They just can't do it at the speed or capacity that inkjet printing can offer. High-speed inkjet presses turn jobs around in a fraction of the time that toner printers do at a fraction of the cost. Also, if you've ever had challenges with color drifting from one run to another in a toner environment, that problem will be virtually eliminated with inkjet.

1

## Inkjet is different from inkjet

With the many new presses making up the new generation of inkjet, there are many approaches to quality and productivity. Inkjet options are expanding more rapidly than any other print process. The range of production inkjet solutions on the market today, and promised in the near future, provide a vast array of options for the educated designer.

Many design decisions will come down to the capabilities of the specific press. However, some of the greatest opportunities for designers are found in the amazing array of inkjet-compatible finishing options on the market today. In addition to the great results that can be delivered from the inkjet press, designers can add coatings to create raised or textured effects. There are many options for building haptic (touchy-feely) response into designs, as well as the usual origami options for scoring, cutting, folding, and binding that designers and their customers love.

In the next chapter, we'll get you thinking about how press options and finishing come together to drive new design possibilities in direct mail, books, customer communications, and more.

CHAPTER 2

# POWER UP YOUR PORTFOLIO



2

POWER UP YOUR PORTFOLIO

# OPPORTUNITIES ARE EVERYWHERE

If you take the time to deconstruct your favorite examples of print design from the last decade, you may find that even the best could be improved upon today. The range of possibilities for materials, finishing, and embellishments—along with intelligent personalization and online integration—expand creative opportunities for designers with up-to-date skills. At the same time, the production speeds and cost effectiveness of inkjet have lowered costs and time-to-market, bringing creative innovation and efficiency together.

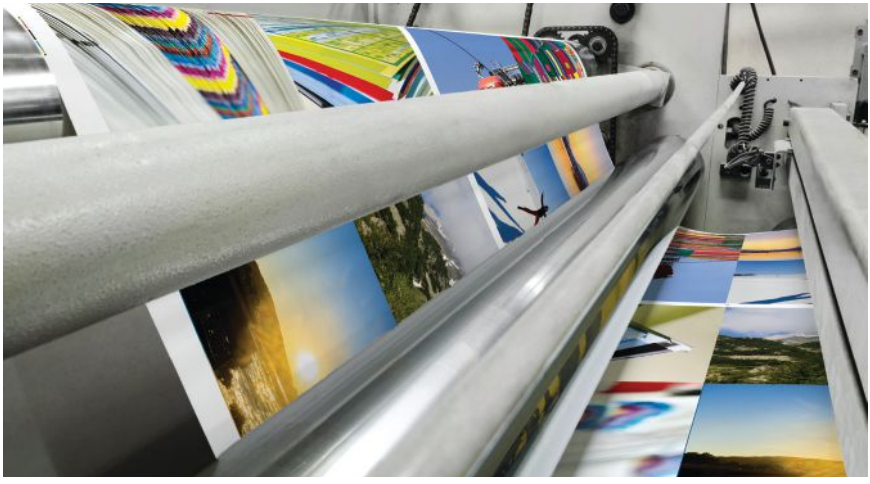
In order to power up their portfolios, designers need to level up their skills to include creative problem solving and visualization of innovative production techniques that can be a force multiplier for design effectiveness.

- **What's better than a single design?** Creative that offers versions to meet the needs of different audiences.
- **Want to capture attention with more than visuals?** Change the feel of the surface or embed personalized content that can be accessed with a phone, tablet, or computer.
- **How can you improve on design brilliance?** Produce it more quickly at a lower cost.

Inkjet opens up opportunities that are not possible with static offset presses nor cost effective on other types of digital printing equipment. In markets like book printing and marketing collateral, the majority of volume is not personalized and is still produced on offset technology. However, even in these markets, inkjet is a strong presence where:

- Versioning is required by region, language, distribution channel, or some other factor that prevents all of the volume from being produced as a single, high-volume job.
- Personalization of the material is needed, making it impossible to produce the pages on a traditional press.
- Printing in smaller quantities helps customers: manage cash flow, control postage or freight costs (e.g., batching and printing closer to the delivery point), or reduce environmental footprint.

While electrophotographic (toner) presses also can fulfill these needs, most inkjet presses can produce output at a significantly lower price than toner equipment and with faster turnarounds.



You may find a place for many different printing technologies in your portfolio. One of the interesting trends we have seen since the publication of the first edition of this guide back in 2014 is the prevalence of mixed printing environments. For many print providers, it is not a matter of inkjet or offset or toner: a provider may have all three. Even more interesting for designers is the potential to use all three in a single job.

As a designer familiar with the capabilities of production inkjet presses, you will have more creative options available to you and more opportunities to solve problems and improve results through design. In this chapter, we will take a segment-by-segment look at the opportunities that open up

when using high-speed inkjet devices to produce direct mail, customer communications such as bills and statements, commercial print, and books.

2

## A JOB WELL DONE IS A JOB WELL PLANNED

### What's happening with direct mail

Direct mail marketing continues to be a great outlet for a designer's creative energy and also one of the biggest tests of problem solving. Self-mailers and postcards can drive response with interest-grabbing folds, shapes, windows, and finishes. However, with rising postal costs, mailers want to avoid designs that cannot be machine processed. This means designers must understand and stay current with constantly changing mail automation standards.

As postal rates rise, direct mail users may try to maintain budgets by mailing fewer pieces, reducing the weight of mailed pieces, and reducing the cost per printed page. Inkjet can help in all of these areas through its ability to version and personalize as well as its lower production cost relative to digital toner and small-batch offset production.

**Invest in inkjet-driven personalization to take advantage of postal incentive programs.**

The USPS also has a bit of a carrot-and-stick approach these days. Costs may be going up, but there also are periodic discounts and incentives for those who invest in personalization, new cross-channel technology (like augmented reality), and even trend-setting post-coating capabilities. Inkjet variability and precision provides a cost-effective base to take advantage of USPS promotions.

### Direct mail the old way

A significant volume of direct mail still uses offset-printed shells as a base, with toner equipment used to add variable content. However, much

of this volume is being displaced by inkjet, either substituting the toner overprinting with lower cost monochrome inkjet or producing the whole piece on a full-color inkjet press.

The elapsed time for an offset-plus-digital process is quite slow, because it requires two passes on different equipment to complete the job—and sometimes shipping the shells between locations. Personalization is also extremely limited: you can overlay content using the digital toner or inkjet process, but you can't alter the number of pages or the position of variable content.

## Direct mail the inkjet way

With full-color inkjet, designers can create variable design frameworks that tailor color, messages, imagery, and even language to the intended recipient. While the cost per piece may be marginally higher than traditional printing for high-volume campaigns, this is usually more than offset by the lift in response rates gained from added color, relevant personalization, and the improved speed-to-market for time-sensitive material such as credit offers, investment rates, and retail sales. In addition, the focus on data management tends to improve targeting and reduce mail-piece volume. Since postage is usually a significantly higher percentage of the overall cost than print, a well-managed list pays dividends. Today, direct mail design is about helping marketers mail smarter—and full-color production inkjet is a great way to do that.



While the benefits of cost-effective personalization is one of the clearest reasons to design for inkjet, many direct marketers send static jobs to inkjet presses based on the order quantity. As the speed and web widths of inkjet printers increase, the size of the break-even order (relative to traditional presses) also moves up. Experts estimate that order quantities of fewer than 5,000 letter-sized images are more efficient on inkjet than traditional presses. Order quantities as high as 10,000 may be cost-equivalent on inkjet presses and traditional presses—depending on the specific equipment, size of the printed piece, and pricing strategy of the printing organization—even before considering personalization or versioning benefits.

The likelihood of your static design being produced on an inkjet press is growing daily, so be ready to take advantage of every inkjet opportunity and use inkjet as part of your portfolio.




You may design a program that has a large volume produced as a static mailer, another portion that is versioned, and a smaller portion that is completely personalized. Or, you may use a combination of printing technologies where certain pages are static and others are personalized. We will cover opportunities and skills for using multiple printing technologies in a single campaign in detail in Chapter 15.

The latest generation of inkjet offers more continuity with paper and alternative substrates available across other platforms. This opens up more choices for media and makes it easier to develop seamless cross-platform campaigns. In Chapter 7, we will explore how your inkjet-based direct mail

project can add interest with a host of exciting substrates other than paper, as well as efficient specialty media that enable integrated tip-on cards or formats that eliminate the need for a separate envelope.

**Inkjet is expanding design opportunities but can make campaign planning more complex. Plan wisely.**

With the new generation of inkjet, you will enjoy a much wider array of compatibility with finishing and embellishment as well. We will tackle opportunities with haptics, coatings, foil, and other embellishments further in Chapter 8. Use inkjet where it fits best in your portfolio and keep your eyes open for new opportunities like:

- Adding variable components to static mailers, catalogs, or "magalogs."
- Breaking larger jobs into smaller batches that can be versioned to meet regulatory requirements or add value to specific audiences.
- Expanding the use of relevant personalization by varying photos, graphics, color, text content, and preferred language.
- Extending personalized content to include links to online offers, expanded explanations, audio, and augmented reality via variable QR codes or other linking technology.
- Exploring and even combining new substrates like specialty media, magnetic paper, and synthetics.
- Adding layers to the offer with integrated cards for loyalty programs, dynamic perforation for tear-off components, or mixing media in a job (with sheetfed inkjet).
- Finding options to combine inkjet versioning and personalization with dynamic foil, coatings, and other textured embellishments that can't be ignored.

While the opportunities open to designers with inkjet are expanding, this also makes campaign planning more complex. Portions of a campaign may be scheduled for different production platforms based on timing, order size, quality requirement, finishing needs, and level of personalization.

Each platform will have some differences in papers and other substrates supported. The following chapters will help you understand how ink and print media work together in an inkjet environment and how this differs from other processes you may use. This need for compatibility makes planning, file management, and use of a color managed workflow more important than ever before.

Let's look at how opportunities with direct mail overlap with customer communications.

## WHAT'S HAPPENING WITH CUSTOMER COMMUNICATIONS?

The distinction between direct mail and customer communications is blurring. Direct mail can include everything from full-color, multi-panel self-mailers to monochrome letter mail. The latter looks a lot like the low end of the customer communications market, such as privacy notices and other relatively static regulatory mail. Direct mail is typically focused on new prospects but also may be sent to a company's existing customers—either intentionally or due to poor list management.



Customer communications as a market segment is referred to in the trade as transactional printing. It includes important documents—like statements, bills, policies, customer onboarding and notices—and is a major segment of the printing business.




You may have designed components of customer communications and not even realized it. That's because sometimes aspects of a direct mail or online campaign may be pulled into customer communications as messaging or ad inserts.

While many corporate mailers would like to transition their customer communications from print to online due to the postal cost increases mentioned earlier, many of their customers don't feel the same way. With conversion of customers to online channels stalled, large corporate mailers are revisiting their print communications to improve customer service and drive down cost through production efficiencies and reduced call center costs. This opens up tremendous opportunities for designers to improve the clarity and cost-effectiveness of customer communications through smart, process-friendly design.

2

By using full-color inkjet, the design frameworks for customer communications can take full advantage of sophisticated messaging tools and "big data" for increased personalization and customer engagement. And designers can help businesses use statements as a customer messaging platform that supports cross selling and upselling.

As the line between direct marketing and customer communications continues to blur, design and marketing support are becoming an ongoing part of the customer communications budget. Rather than designing a statement once every ten years and moving it into production for all customers, the new approach to customer communications is to provide a framework for continuous improvement and targeted communication with different customer segments. This approach takes advantage of full-color inkjet printing and requires ongoing input from designers who understand the marketing opportunities for the client as well as the technical requirements of inkjet.

**Help your customers use statements as a "must read" messaging platform.**

Within large companies, there may be many groups that would like to have their messaging ride along with the statement or invoice. Traditionally, companies would offset print "buckslips" or inserts with static and generic offers for customers. Using inkjet, more dynamic customer communication can replace the insert with a tailored "onsert" or deliver messaging that drives awareness of the ride-along insert. The many benefits of the inkjet approach include tailoring the message for every recipient, reducing preprint costs, and driving higher response.

While full redesigns of statements or correspondence programs don't happen often, when they do they represent large and lucrative projects for designers who understand the requirements of large-scale personalization projects. Meanwhile, companies need designers to keep statement messaging fresh, inkjet ready, and on point.

## Technical aspects of customer communications

Most transactional printing involves bills, statements, or letter mail, which are characterized by short text segments in headers and text with low overall page coverage. There is usually a logo with some dense solids in the header of the page. In the past, the logo and any color portions of the document would be part of a preprinted letterhead or form produced on an offset press and warehoused until needed. Then, data would be overlayed on the shell using black toner or ink.

Since full-color inkjet has taken hold in the majority of the customer communications space, bills and statements have experienced a transformation. While some companies simply converted their preprinted form to an electronic form and continued to lay black text over a static background, more and more companies are embracing the power of inkjet to transform their customer communications.

**Reduce costs for companies while improving customer service by:**

- Replacing static "backer" text for disclosures with targeted point-of-need disclosure language. Reduces page count while focusing on relevant information.
- Making branding dynamic to include corporate and local representation; for example, bank and branch, broker and financial advisor, insurance issuer and insurance agent.
- Tailoring marketing messages to specific client requirements, including variable images, text, and offers.
- Replacing preprinted inserts with dynamically printed offers, coupons, and onserts.
- Combining multiple mailings in the same envelope to reduce mailing costs.
- Creating self-mailers and postcards to augment electronic communications and move toward less paper, even if full paperless adoption is not achievable for many customer segments.
- Reducing the cost of customer service calls by improving customer retention through better design; this is where knowledgeable designers can drive big value for customers.

The color and personalization capabilities of full-color inkjet open up a world of possibilities for transforming customer communications. Keep in mind that this market is still extremely cost sensitive. Design initiatives should focus on measurable deliverables such as reduced call volumes related to confusion about bills and increased interaction around new offers.

Not all customer communications are letter mail. The prevalence and cost effectiveness of inkjet also has increased the use of tailored onboarding documents in many industries. Welcome packages for health or property insurance, utilities, wealth management, and professional services may look like high-end direct mail, but they are intended to reduce call volumes, build customer loyalty, and even cross sell new offers. Research from IT Strategies in 2016—when inkjet was primarily focused on transactional printing—indicated that 35 percent of inkjet pages were "net new," meaning they did not replace pages that were being printed on offset or toner. The flexibility that inkjet provided in this market was actually driving the customers of transactional printing companies to print things that they had not before. Many of these new customer communications related to customer onboarding and retention, and designers had to create them.

*Thank You, inkjet!*

## Tackling the high-end graphic arts segment

It took longer for inkjet presses to deliver the quality needed for high-color, high-coverage jobs like marketing collateral, magazines, catalogs, and other work known as commercial print. The majority of these jobs are still produced on full-color, traditional offset presses. But the new generation of inkjet presses is unquestionably delivering the color quality required, with added benefits only a digital press can provide.

Most often, armed only with CMYK ink options (cyan, magenta, yellow, and black), inkjet presses are competing for commercial print work against six-to-eight color cutsheet continuous feed offset presses, which produce a large color gamut and print on a wider range of media. Although there are still fewer papers that are compatible with inkjet than with offset, the color gamut of high-end inkjet presses has expanded to equal that of offset on equivalent stocks. And some inkjet presses are moving beyond four colors, which we will talk more about in Chapter 11.

As noted previously, for high-volume jobs, inkjet may cost marginally more than offset (but less than toner). If an inkjet press supports fewer substrate options, and potentially costs more to use, why would it be a good fit for commercial print projects? There are several reasons:

- New-generation inkjet presses have enhanced inks or have added additional ink stations to expand gamut and color-matching capabilities.
- The production quality of inkjet is continuously improving, and some inkjet presses actually rival some offset presses in terms of color gamut and image quality.
- Offset-coated papers are now being utilized on many inkjet presses with the use of primers and/or specially formulated inks, minimizing substrate compatibility issues relative to offset.
- Many inkjet inks and fluids are compatible with similar post-coatings and varnishes available for offset. We dive into new enhancement options in Chapter 8.
- Individual commercial print order sizes are falling, making inkjet economical for more work. (Makeready times for traditional presses make small order sizes unprofitable.)
- Most important, personalization and versioning have become more common and desirable in commercial work and can't be accomplished with a static offset press without the support of a digital process, like toner or inkjet.

Even if you are working with a commercial print shop that earns the bulk of its revenue from high-volume, static work on offset presses, chances are good that some of your work may be produced on inkjet purely because of the order size.

## Inkjet economics for commercial print

In the old days, print buyers would order in large quantities to get better per-unit costs, perhaps ordering the collateral needed for a full year (or more). But when printing in large quantities to get economies of scale, you also will incur storage costs if the material isn't distributed right away. Even with a large overall book of business, if production is made up of smaller batches shipped over a long period, the warehousing may be more expensive than the difference in production cost for just-in-time printing in smaller batches. Now, most print buyers understand the full impact of obsolescence costs due to branding or program changes, storage expenses, shipping costs, and time lags to deliver from a warehouse to multiple locations. From an economic and risk management perspective, inkjet is often the better platform choice.




Beyond decisions that are made from a purely economic perspective, savvy designers are making design decisions based on the characteristics and capabilities of different production platforms and mixing them up in new ways. You may see this in the form of catalogs with a large number of static pages produced on offset devices; a smaller number of pages that are versioned or personalized for the recipient using inkjet; and a cover produced on offset, inkjet, or even digital toner depending on the designer's vision for the feel of the cover stock. Mixed portfolio designs are becoming

more common and require careful planning and coordination with your print partner to deliver the quality and consistency that your customers expect. You may find that your print partner plans to produce portions of your order on traditional presses and the remainder, or certain versions, of your campaign on inkjet.

If your design will only be produced on inkjet, then your design process is a lot easier because you only have one set of rules to follow. When there are two or more platforms in the mix, maintaining consistency is more of a challenge. In Chapter 15, we will talk about how this should impact your planning process. However, if your commercial print project will be dedicated to inkjet, there are many opportunities to consider, similar to those discussed for direct mail. For example:

- Explore the versioning and personalization aspects of inkjet. This could be as simple as varying text or imagery in collateral or running business cards for multiple people in a single pass.
- Use variable data to make each page completely unique in your print run if that would add value.
- Vary content and response mechanisms to allow A/B testing and response tracking of different creative approaches.
- Embed cross-media content through QR codes or augmented reality markers using data-driven personalization.
- Use paper weights that are either heavier than (business cards, catalog covers) or lighter than (newspaper circulars and inserts) direct mail or customer communications. You can expand these options beyond paper to include leatherette and synthetics.
- Take advantage of new post-coating options to add shine, texture, and metallic or gem-like embellishments. The range of enhancement technology that is compatible with inkjet is astonishing.
- Save time and money by printing smaller batches closer to the location or branch where the material will be used.

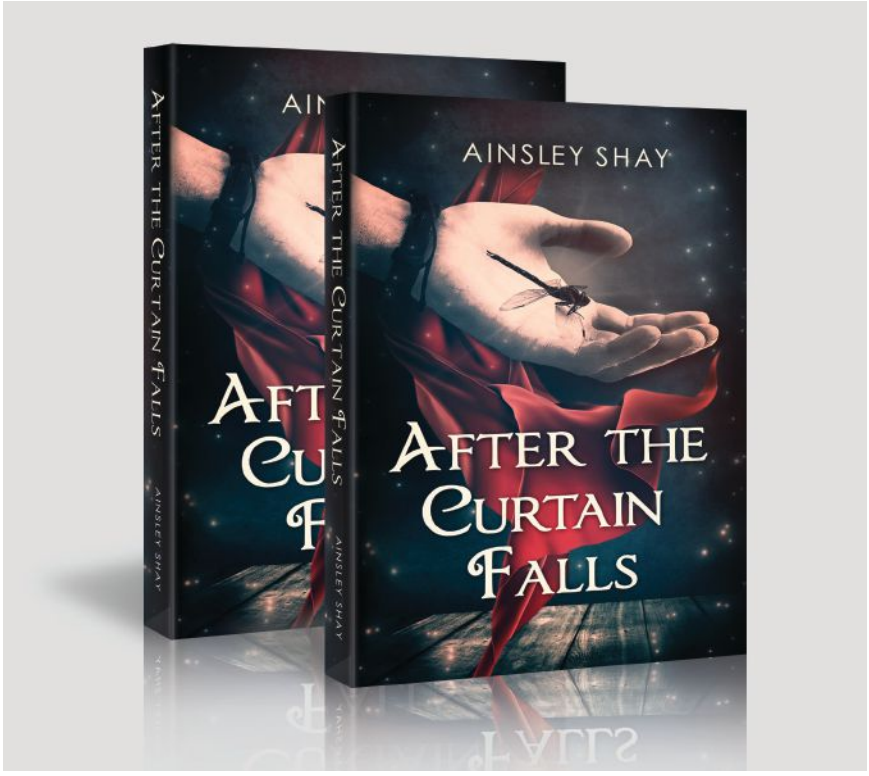
The trade-offs between design, production, and end-point delivery that apply to graphic arts projects also are critical to planning for design of direct mail as well as our next topic: books.

## Inkjet for all kinds of books

2

There are many types of books, from graphic novels and workbooks to paperback literature, hardcover textbooks, and coffee-table art books. It's a diverse market with a wide range of sizes, shapes, bindings, and tolerances for print quality. A unifying factor in this market is the dramatic shift in the publishing supply chain. Of the print markets discussed so far, books may have experienced the greatest level of change.

Catalysts for this change were the introduction of e-readers, the rise of online purchasing, and a slow realization by publishers that their whole publishing supply chain was highly inefficient. To determine economical order quantities for each title that weigh the benefits of lower per-unit costs against the potential for long-term storage and distribution costs, publishers now carefully examine every book release in terms of the



potential buying curve for the book along with distribution locations. This is very similar to the print buyer considerations for marketing collateral discussed earlier. Due to the prevalence of online book buying, many book orders are "jobs of one," taking the whole economical order quantity discussion off the table. It's pretty hard to be economical at an order quantity of one, but inkjet makes it work.

**Inkjet has improved overall publishing, distribution, and supply chain for book manufacturing.**

Inkjet is most often used for printing the body of the book, or book blocks, in black. (Say that five times fast!) Some book blocks might use an accent color, include color imagery, or be produced with full color throughout, but monochrome book blocks are the most common by far. It's also important to note that a book block must be a fixed thickness relative to the premade cover so it will fit into the binding exactly. If the thickness of the book block changes, the cover will be either too large or too small, resulting in an additional manufacturing step or an entire rerun of the cover. That can get pricey. So, once you choose a paper for a book, it is difficult to change without careful coordination.

Unlike book blocks, most book covers have been printed on devices other than inkjet. This is because, until recently, most inkjet devices were web-fed, and the thickness of cover stock requires the flat processing of a sheetfed press. With the introduction of sheetfed inkjet presses that can handle higher paper weights and produce high quality on coated stocks, however, more books are being produced entirely on inkjet presses.

Because "onesie-twosie" order quantities in the book market are becoming the norm, there also is increasing use of personalization and versioning. Personalization can be as nearly invisible as individual inventory codes printed on each book to prevent fraud and as overt as changing the name of the main character in a children's book to match the child who will read it. Versioning can be used to identify or promote the distribution channel, to

translate books into different languages, or to support readers who need larger fonts. However, to be cost effective, each small order has to be incredibly efficient.

## Standards for efficiency

Each small run or "job of one" must function as a seamless part of a much larger batch to be cost-effective. Managing these small, customized batches within larger print runs needs to be coordinated, processed, and distributed differently than traditional static book production. Inkjet is the platform that offers the necessary versioning, flexibility, scalability, and production quality. But even on inkjet, tightly integrated production workflow is required to keep small-run or versioning book printing profitable. This has led publishers and print providers to limit production to a small range of standard sizes.

Print providers specializing in the book market will typically provide designers with a cover template defining the back, spine, and front set up as a single page. The width of the spine must be calculated based on the thickness of the paper selected and the total number of pages in the book block. We will talk more about paper characteristics such as basis weight and thickness in Chapter 6. In addition to cover templates, there also are typically tight standards on the set up of margins and gutters for the book block.

While standardization in size and paper types is important for cost management and production efficiency, there is still vastly more flexibility when printing books on inkjet than on traditional presses. The leaps and bounds in production quality that the newest generation of inkjet has taken means that even photobooks are not out of reach. Want to highlight your graphic design portfolio? Create your own photobook and produce it on demand for clients. You can even link it to content on your multimedia projects that is relevant to a particular client using personalized links. That's just a taste of the power of inkjet.

Read on for the many ways you can power up your portfolio and plan for what's possible.

CHAPTER 3

# PLANNING FOR WHAT'S POSSIBLE



PLANNING FOR WHAT'S POSSIBLE

# 3 COMMUNICATE

Whether you've already selected a print partner or are shopping around for the right supplier, take the opportunity to talk to printing professionals right from the start. Most companies in the business of producing print will handle more projects in a month than the typical designer will complete in a lifetime. These organizations have the opportunity to see fabulous work from amazing designers as well as fix mistakes from some not-so-amazing ones. Chances are, they have some expertise that can save you time and money. Shopping for a supplier also provides you an opportunity to learn about new options and methods.



As you evaluate your options, realize that not every company has the latest and greatest inkjet, finishing, or embellishing solutions available. They also differ in the type of work they pursue. Some focus on a particular industry or area of proficiency while others are generalists. If you need expertise with inkjet for book printing or direct marketing, ensure that the company has experience applying inkjet technology to those specific markets. Also, some companies may have the latest equipment but are new to inkjet overall. Inkjet has gone through such an evolution that, in some cases, your print provider may be learning new things right alongside you. That's okay, if everyone is communicating well. Of course, there are quite a few companies

who have had inkjet presses installed for years and are expert users offering savvy inkjet options across many markets.

Even if your print provider is new to inkjet or working with a new system, they still have important information to share. The success of your project will depend on understanding the possibilities of inkjet as it is installed at your chosen print supplier.



Much of this guide will drill down on the details of variable workflows, print technology, and ink, as well as the papers used with production inkjet. We'll also look at how they differ from the offset and toner presses with which you may be familiar. In addition, we want to set the stage with the right questions to ask a supplier as you plan your project. These are the questions you want to ask every time you select a new supplier, plus it never hurts to repeat the process periodically with your current supplier. Inkjet technology is still evolving and expanding, so printing companies are constantly making updates. There may be more than one option for



your project, from press, to paper, to production workflow. Just because your print partner recommended a particular approach on your last project doesn't mean it's the best fit for your current magnum opus.

There's no better way to learn why various process components are important and how they influence each other than to see the process in action. The most successful designers understand printing processes and have open communication with the people who will ultimately make their designs a reality. Don't just buy print services—find the expert at your print provider who can help you fully harness the inkjet possibilities within their shop.

This chapter covers all the questions and tools that can help you understand the options your print service provider has to offer and how you can use them to achieve the best possible results.

3

## GETTING TO KNOW YOU

Communication with your print service provider is vital. You need to get to know them and they need to understand your priorities. People typically say that they want "top quality," but with such a range of high-quality inkjet you could end up paying for more "quality" than you need. Think about what aspects of quality matter most to you and have a detailed conversation that, ideally, includes measures of the quality you seek.

The partner you choose must understand your needs and expected outcome in order to bid effectively and service the business they win. Part of their ability to provide service is dependent on the designer's ability to communicate realistic requirements as well as create and prepare files accurately for the inkjet device. Developing a good relationship with your print partner will save time and frustration for both of you throughout the process. Here are some good tips for developing this important relationship.

**Set color and quality expectations with your print partner using existing print samples and paper or other media requirements.**

### Start with a tour

Even if you've worked with this company in the past, keeping up with the latest generation of technology in their facility will help you design for the capabilities of each piece of equipment. Chances are, they made quite a few updates when they adopted inkjet. There may be new finishing options as well as print capabilities to learn.

A lot of things happen between sending a design file and seeing it print. If possible, schedule the visit with your printer when the high-speed

inkjet device is running a job with requirements similar to yours. This will help you envision the print life cycle your job will go through, and it can be a truly eye-opening experience.

These days, you may not even need to tour the operation in person because many companies offer virtual tours that walk you through their capabilities online and allow you to speak with different experts—all from the comfort of your home or office. Some companies also offer "canned" tours online, but it's always better to have a guided tour so you can ask questions.



If you can, talk to someone who runs the press to get their perspective on differences between inkjet and other devices in their facility. If inkjet is just one part of the overall production portfolio, understand when and why they recommend using it. You may end up with portions of your project or campaign using multiple devices. That can make a difference in how you prepare files—a topic we will cover from multiple angles.

## Understand media options

Paper-based media is widely used in inkjet printing. More than with any other type of print process, selecting the right paper type, size, and weight is critical to meeting your creative expectations with inkjet. Your print provider may have specific paper recommendations for different types of jobs—such as direct marketing self-mailers, commercial marketing collateral, books, catalogs, bills, and letter mail—but ultimately you need to define your own requirements. Investigate all papers and weights that are available and suitable for your application. Your print provider can provide valuable guidance in this area.



You might find a different range of options than what you're accustomed to working with in an offset or toner environment. Always talk to your print provider about the paper types, sizes, and weights that will work best for your project and don't assume that what you have seen somewhere else or worked with on a different press will perform the same way. Keep in mind that your choices may not be restricted to paper-based media. Some inkjet environments also support substrates like synthetics and fabrics in addition to paper.

While it may seem obvious that you'd want to look at print samples from the target equipment on the chosen media, not all print samples are created equal. Just sending your current design draft or a previous project file won't help you prepare for all the awesome potential of the new generation of inkjet or uncover potential pitfalls in previous versions. You need a print sample that exercises the full range of design features as well as the impact of different press settings. Two critical testing tools are the reference chart and the tint book.

Most service providers have image files they use internally when testing substrates and calibrating their press, but these are not likely to meet all the criteria for your project, such as specific color matching and level of print coverage or typography constraints. Many customer-focused print providers create specific files, sometimes called reference charts or fingerprint samples, to help designers and paper buyers make objective and informed decisions about their projects.

## Reference charts highlight the details

A **reference chart** will help you evaluate the print quality of a particular paper on a specific press and determine boundary conditions for your design. Elements such as design color space, minimum text and line weights, **halftones**, solids, color fidelity, and show-through are important factors to review to see if a press and media combo will meet your needs.

Ask for a reference chart on each of the substrates you're considering for your job. Keep them on file for future projects and print quality evaluations. If this type of file is not available from your print provider, you will need to create your own.

# Reference Chart



Designing your own series of custom reference prints that have low, medium, and high coverage and include a variety of images, text, and line weights, as well as **vignettes**, will help determine the compatible media for your specific print requirements. It also will test whether the design will disrupt the structure of the chosen media, causing any of the nasty things we will warn you about in Chapter 5.



The reference chart print will look slightly different on each of the papers or other substrates on which it's printed. That is its purpose: to highlight the differences so you can select the appropriate media and make the necessary adjustments to get the best quality. See page 148 for a downloadable reference chart.

## PREPARE FOR ALL OPTIONS

To get a good understanding of the print quality that the inkjet printer, ink, and media will produce, ask your printer for images to be printed:

- On various paper types, such as uncoated, inkjet treated, inkjet coated, and offset coated to see which will best suit your print quality requirements.
- On different substrates, such as polyesters or plastics, if those fit your target requirements.
- Using all the available ink types, as some printers use more than one ink chemistry within their facilities for different purposes. Ask for tests of the inks that are suitable and recommended for your needs.
- Under resolution and speed conditions that represent how the job will run in production. Some inkjet devices use a lower resolution when printing at top speed, so if you are shown proofs printed at a lower speed, your results could change in production (and not typically for the better!)

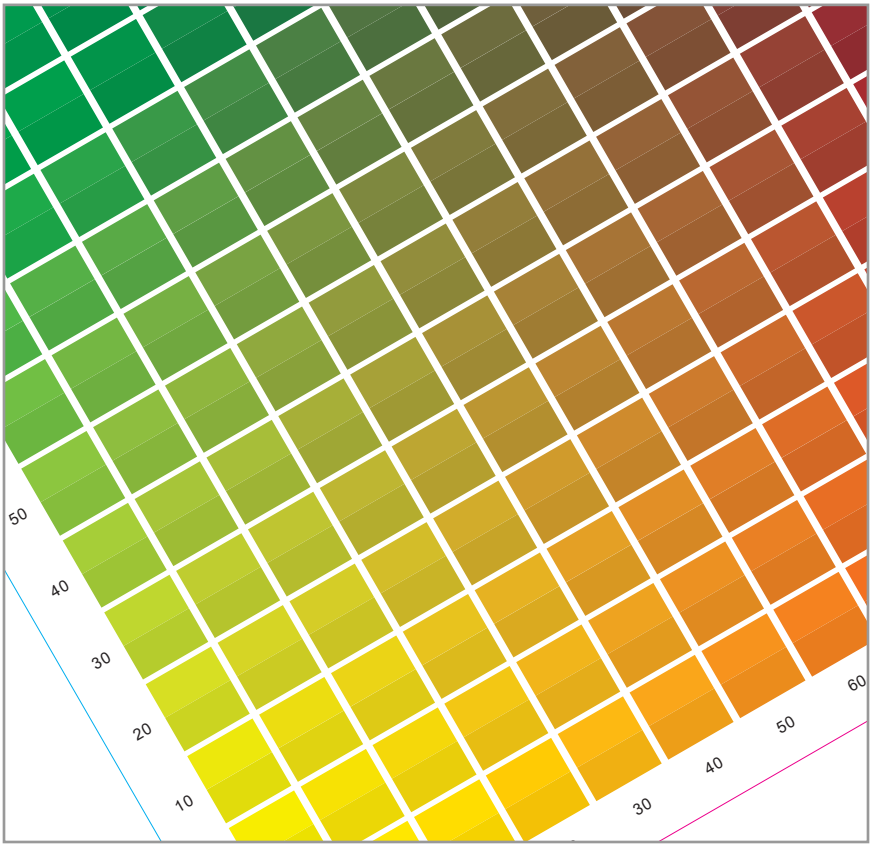
**Just remember MIM**

**Machine details, ink chemistry and compatible media—the trifecta of inkjet success.**

Make a note of the ink, media,resolution, **print speed**, and coatings on the finished print for future reference. Changing any of these will affect print quality and color.

## Tint books call out color differences

If your designs require any type of Pantone® or other spot-color matching system, it is wise to ask your print provider to print a **tint book**. If you are using a post-coating, make sure to have the tint book post coated as well, since coatings can affect the colors in the finished product. If you're working on a project that will use multiple technologies, request a tint book on all the presses that will be part of the finished piece to support color matching. Keep these swatches handy once they are printed on each of your selected paper grades.



Some printers already have coated and uncoated swatch files available representing the CMYK Pantone Library. If they don't provide these files, you can create your own. When generating your own custom book, be sure to make both coated and uncoated versions. Before creating a swatch book, ask your print provider if they prefer you use the Pantone spot reference library instead of CMYK. You can provide spot Pantone values in addition to CMYK percentage swatches as you would see them in the Adobe® Bridge® **swatch books**. Keep in mind that Pantone swatches and CMYK conversion values will be different for uncoated and coated references. You'll find these values are very important to understanding how colors are reproduced.

To make your design life easier, Chapter 12 includes a link to a handy CMYK **process color tint book** file that can be downloaded from https://inkjetinsight.com/tdgresources. That chapter also digs into color matching and making custom inkjet color libraries using many of the tools you'll learn throughout this book.

## BRING YOUR QUESTIONS

Think about the range of questions that cover the whole production process. While more and more projects are being converted to production inkjet, within many print operations, inkjet may be complemented by offset and toner presses.

Inkjet output might be enhanced with post-coating, embellishing, or die-cutting effects plus options to fold, trim, bind, or attach other materials. A broader portfolio for the print organization means a broader design palette for you, with the potential to create cross-technology projects (which we will cover in a later chapter).

Asking the right questions up front can open new possibilities for your design and ensure a completed design runs smoothly. You'll want to ask about printing processes and other devices in detail, including press, media, and finishing options plus software, as well as how all those things can work together—and when they can't.

Here are some key questions to ask about inkjet presses. As you continue through the guide, you will learn more about why these questions are important.

**Print**

- What presses are available? Ask for specific manufacturer and press names.
- Is the inkjet device single pass, flatbed, or wide format?
- Are the presses web (roll-fed) or sheetfed?
- What are the available roll widths and sheet sizes, including the maximum print area?
- What is the general ink type used: aqueous, UV, latex, or oil-based?
  - > If the ink type is aqueous, also ask whether it uses dye or pigment as a colorant.
- What is the maximum resolution or dpi of the inkjet devices?
  - > Ask if the press runs at more than one print resolution. If it does, ask if there's a price difference for running at top resolution.

**Paper**

- What papers and other media are avail able for the press I want to use?
  - > Are all of them compatible with target finishing devices?
  - > What are the cost differences between the options?
  - > Are primers used in the process? If so, are they required for specific media?
- Are there higher costs for designs with greater coverage? If so, how do you estimate print coverage prior to printing?

- What are the minimum and maximum weights (gsm) for each of the available media supported on press and in finishing?
- Are simulation ICC profiles available for press conditions or papers?
  - > If there are different profiles for different press conditions such as speed or ink usage, ask if you can get print samples on your target paper(s) that show the impact of these conditions on print quality.
  - > Is there a process for testing additional papers beyond the standard inventory? Is there a cost associated with this testing process?

**Finishing**

- What finishing equipment is available?
  - > Are all finishing options compatible with all the available presses? Tip: Make sure you know which components can work together.
  - > What are the capabilities and limitations of the finishing equipment?
- Are post-coating options available?
- Are there specialty post-print applications such as foils and UV textures available?
  - > If so, what types of effects can be created?
- Are all print devices compatible with post-coating or specialty application methods?
  - > Are there design requirements that should be noted for compatibility of coatings and specialty applications?

Don't miss out on options that could make your design stand out.



## Don't just ask. Tell!

You might forget to ask a couple of questions, but if you communicate your specifications clearly it should help your print provider spot potential problems or misunderstandings before they happen.

Since print specifications for high-speed and specialty inkjet can be a little different from conventional offset, we've provided some guidelines to help you capture key points that will help you get good estimates as well as good results.

We've also provided a reference list of the criteria typically required by print providers as part of a print job description.

With so many options available, reviewing your entire project with your chosen print partner (or multiple print providers) is the only way to ensure you know about all the special capabilities available.

3

## JOB DESCRIPTION

### Quantity

- ❑ Per job
- ❑ Expected total for all jobs
- ❑ Duration of contract (for program work)

### Overview

- ❑ Finished page size
- ❑ Pages per finished piece
- ❑ Print one side or both (simplex or duplex)
- ❑ Number of paper stocks used
- ❑ Flat size (with bleeds)
- ❑ Trim size (without bleeds)

### Project timing

- ❑ Date mailing is to be received by addressee
- ❑ Mail drop date
- ❑ Final art delivery date
- ❑ Date paper type and weight chosen

### Ink coverage

- ❑ Specific low, medium, or high coverage (total ink coverage or TAC)
- ❑ Note if spot color matching is required

### Color matching

- ❑ Note if there is a target print sample to be matched
- ❑ Level of tolerance for match in number of ΔE* (Delta E)

### Variable data requirements

- ❑ Define variable data and/or images
- ❑ File format for data
- ❑ File format for images

## Paper requirements

- ❑ gsm
- ❑ PPI
- ❑ Caliper, if relevant
- ❑ Finish: silk, matte, gloss, etc.

## Finishing requirements

- ❑ Score, cut, trim, die cut
- ❑ Fixed perforation position
- ❑ Variable perforation specifications
- ❑ Folds needed
- ❑ Inserting
- ❑ Scoring
- ❑ Binding
- ❑ Matching
- ❑ Postcoating
- ❑ Foil/textured

## Mailing requirements/special needs

- ❑ Water resistant
- ❑ No print show-through
- ❑ Scuff resistant

## Target color space of design file

- ❑ GRACoL®, SWOP®, FOGRA, etc.
- ❑ Rendering intent used for CMYK bitmap images
- ❑ Are press simulation profiles available?

## Type of proof required

- ❑ Soft proof (PDF)
- ❑ Simulation ICC requested for soft proofing (PDF)
- ❑ Simulation hard proof (proof from device other than production machine)
- ❑ Production color proof or "press proof" (proof from production machine with specific ink and paper)

**We hope you found this checklist helpful!**
**You can download this customizable template at**
**https://inkjetinsight.com/tdgresources**
**Use the QR code for quick access.**

## YOUR FILES ARE A BIG PART OF THE PROCESS

Keep in mind that your requirements and the printing company's processes combine to affect the way your design files should be prepared and submitted. One of the nicest things you can do for yourself and your print partner is to prepare files carefully. Each type of inkjet press has different image resolution, quality, and size requirements—all of which affect overall file preparation. It's especially important to design and save files according to the specifications of the inkjet press and the workflow of your specific print partner. File preparation is discussed in detail in Chapter 16.

**It's especially important to design and save files according to the specifications of the inkjet press and the workflow of your specific print partner.**

Here are key questions to ask your print partner, so you'll know which settings to use when saving the final files for your project.

### What resolution should be used for my bitmap images?

- If the job has variable content with many variable images and significant data requirements, your service provider may require images to be provided in 300 dpi or lower. For some device and media combinations, file sizes above 300 dpi may not deliver different visual results anyway.
- In other cases, print providers may require detailed images and barcodes to be delivered at 600 dpi. This is often the case if a job is fixed or has very few variable images and doesn't have large data requirements.



Did you know that image size and final PDF file settings can affect the resolution you should use for saving your images?

## What color space should be used for saving bitmap images?

- Not every printer will require the working color space of the photo image to be in CMYK.
- Some service providers prefer that all photo images be saved as CMYK rather than RGB when it comes to bitmap images. Others can convert RGB data to CMYK color space accurately. This is because each inkjet device's workflow rasterizes the file differently through RIP software. Be sure to ask your printer for compatible color space to prepare your Adobe Photoshop® images.
- If you are matching CMYK color space images to a specific target output destination color space (GRACoL/CRPC or SWOP) for the purpose of matching across inkjet and other devices, talk to your print provider to ensure they will maintain the target color space for your images. Some providers may ask you to save your images with ICC of your destination color space within Adobe Photoshop first or save the final PDF with tagged destination color space and rendering intent information.
- If your service provider does request that you use RGB, be sure you know the correct format. Possible formats include RGB, **sRGB**, and **Adobe RGB®**, so get specific instructions.

## Do you prefer native files in addition to PDF files?

- Be sure to ask your print provider about the best way to package your print files for exporting to PDF. The goal is to ensure that your images process correctly to the specified destination color spaces (if needed).
- Ask every time you submit a job, because some settings may depend on your print and finishing requirements.
- Package the files correctly by using the "package" command within the Adobe program. Packaging automatically includes the following:
  - > Reference files
  - > Hard copy of files (in color)
  - > Fonts (verify for Mac or PC)
  - > Adobe Native files
  - > Linked files

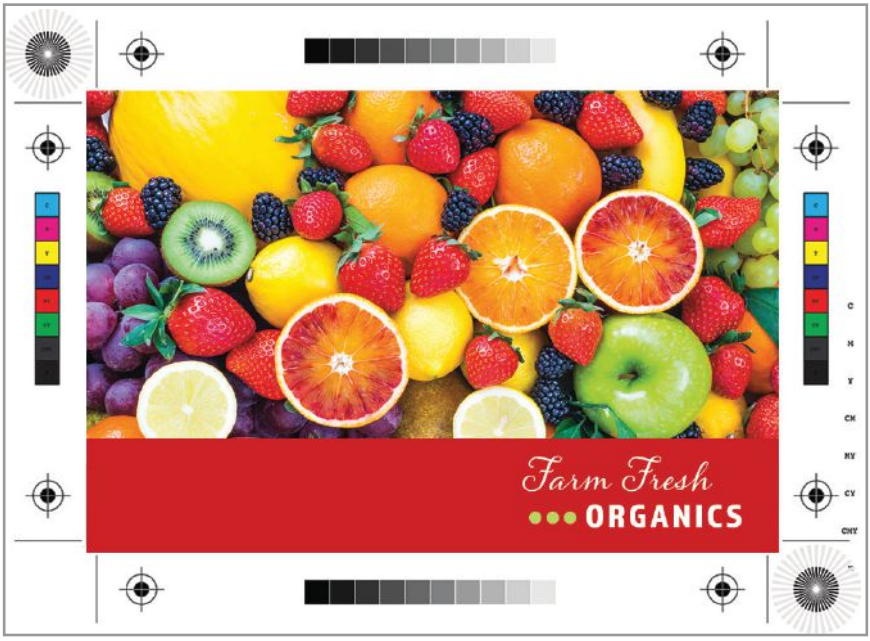
- Also, be sure to include:
  - > Any reference samples
  - > Color hard copies of the design files
- For variable text, verify the data-preferred format needed for your service provider's variable workflow.
- Designs with variable content (text or images) should be created on a layer separate from fixed content within the native file.
- For variable images, check if the images should stay in **native resolution**. Some variable workflows will downsize image resolution—this significantly helps speed up file processing but can also reduce the image and color quality of your images. Talk to the provider about the minimum resolution required for your images to be processed and printed.

## How should I indicate bleeds and gutters?

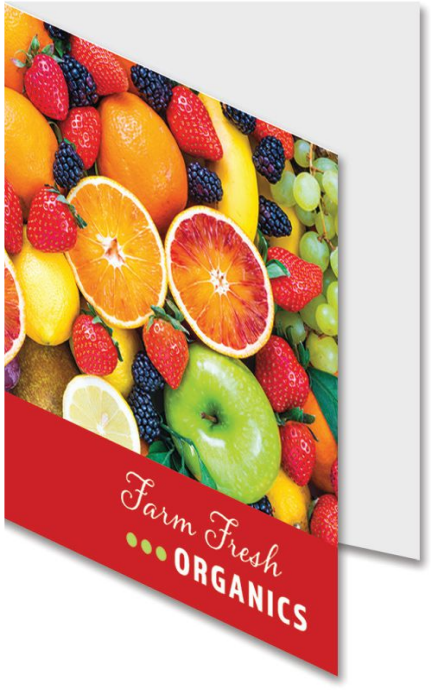
- Knowing the gutter and bleed requirements when choosing media is important for minimizing waste.
- A printer's minimum bleed requirements will add to the overall "flat size" of the print. Some inkjet environments will not support bleeds on all sides, depending on the layout of the piece.
- The minimum gutter space can vary by service provider and device and will add to the overall image area when the job is nested. Gutters are often used to show standardized job information for quality control and will be trimmed from the final print.

## Are standard templates available?

- Some companies offer starter templates that show key guidelines for direct mail pieces such as postcards and self-mailers, business cards, newsletters, flyers, posters, book covers and book blocks, and even different types of statements and bills.
- In book printing, the use of a supplied cover template, as well as target margins, are often required based on the book binding equipment used.




Printed piece showing registration marks




Finished piece after trimming



## What didn't I ask you?

If you really want to be open to new possibilities with inkjet, consider that new innovations are occurring all the time, making it impossible to know all the right questions in advance. There are always factors you know you don't know and ones you don't know that you don't know! Ask providers about the best projects they've seen on press and about approaches that haven't worked so well.

If you really want to seal the working relationship with your print partner, don't forget to thank them for the information and samples they provide. Printers are people too!

CHAPTER 4

# PREPARING PROCESS-FRIENDLY DESIGNS



PREPARING PROCESS-FRIENDLY DESIGNS

# DESIGN EFFICIENCY

4

So much of the design process happens on the computer screen that it's easy to get deep into the design before thinking about how your creation will be produced. Waiting too long to consider the whole design process can lead to lots of rework, compromises, unnecessary costs and potentially missed deadlines.

For any print project, the designer's job is not complete unless they have accounted for the entire production process, from packaged file to finished product. Every step in the process must connect with the next. Planned well, those connections are like friendly handshakes.

To create process-friendly designs that shake hands nicely between each step, you must think about the whole process. Look at every step that needs to happen, working backward from putting the finished piece in the mail or shipping to a personalization / fulfillment location. Then look at it again from front to back to make sure you haven't missed any steps.

Each step in the process offers a potential constraint to your design options, or perhaps an opportunity to do something different if you plan well. In this chapter we walk through the key components you will want to investigate early in the design process.

## FOCUS ON FINISHING FIRST

It's natural to think of finishing at the end of the process since that's where it actually happens. But it should be one of the first things you consider when designing for print. If you are using high-speed inkjet, aqueous inks, and lighter weight paper, there can be a bit more project preparation than with other printing processes or even other types of inkjet printing. Imagine you have a beautiful, innovative design that your

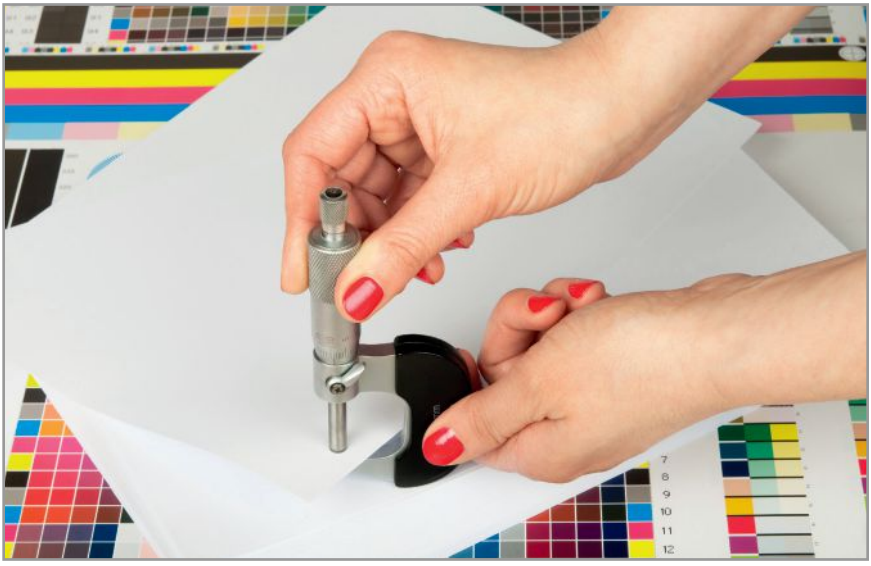
client loves. You've taken the time to consult with your print provider and have made test prints on various types of paper to get the best image and color quality. You print the job and, when it goes through finishing, it blows up the trim and fold process. Now half of the job has to be rerun and it will be late to the customer. Ouch!

This is not just a scary story—there are many design choices that can blow up the finishing process. We've found (from painful, personal experience) that the biggest considerations when designing for inkjet are ink coverage and paper basis weight—and, most important, the interplay between the two.



## Ink coverage and heavily saturated colors

How much ink is used and where are big factors when it comes to successful finishing. We aren't just talking about how many square inches (or centimeters) have some ink on them, but about the amount of ink on any particular square inch or across any part of the sheet. Any spot on the sheet that becomes sodden with too much ink may cause paper deformities that can stick or catch in the high-speed finishing process.



Papers of 90 gsm and lower tend to curl toward whichever side has heavier **ink coverage** if coverage is significantly heavier on one side of the sheet. Paper curl can cause entry jams on automated feeding, folding, and

inserting and exit jams on finishing equipment. Print operators may have to reduce the total ink coverage when printing heavy coverage pages to allow for inserting compatibility. If the operator reduces the ink being jetted, it changes your color settings and, therefore, also can reduce the overall gamut and color fidelity for the print job.

Even in relatively small areas, heavily **saturated colors** can cause finishing issues. When using polymer-heavy inks on higher basis weight papers with low porosity, such as inkjet coated or offset coated, the ink stays on the surface longer. The ink needs to be completely dry to ensure smooth finishing. If the ink's surface is still tacky or soft as the paper comes off the press, it can result in ink offsetting, sticking, and building on the rollers of the finishing equipment. Dirty rollers create image defects on the printed surface, such as streaks, indents, and scuffing. If design files contain heavily saturated colors, the print operator may use a lower Total Area Coverage (TAC) profile to compensate. This, as we discussed above, can reduce your overall color gamut and fidelity.



## Basis weight choices

The choice of paper basis weight will impact the level of ink coverage a design can support. This choice is complicated by the fact that the basis weight appropriate for a particular amount of ink coverage will differ based on the porosity of the paper surface. Porous offset papers lighter than 90 gsm may not be able to handle even a 240-percent maximum coverage. Heavier and thicker papers that are inkjet treated or inkjet coated may be able to handle a slightly higher TAC. Non-porous coated sheets may be completely incompatible with older inkjet models at any basis weight. For the new generation of inkjet presses that support coated offset stocks, the basis weight of the media is not the only limiting factor for ink coverage. It is the combination of basis weight, finish, and surface treatment that all work together to determine how much ink can be used and the color, clarity, and coverage each drop will deliver.

## THE SHAPE OF PAPER

The way paper flows through the press is a key aspect of printing that sets boundary conditions for follow-on processes. You can turn a roll into sheets, but you can't turn sheets back into a roll! Your choice of a web-fed press or a sheetfed (cutsheet) press also will determine the largest shape you can create on paper.





Early inkjet models were almost entirely **web-fed**, but now there are many **sheetfed** devices supporting different paper sizes. While some sheetfed presses use the larger B1 sheet format common in offset printing, it is more common to find a variant of the B2 sheet size (half the size of B1) or a variant of B3 (half the size of a B2). The B3 sheetfed devices may support more than one paper tray or feed, meaning that a finished piece can easily use more than one paper stock or more than one weight of the same stock in a single design. This is ideal for printing books, directories, and other bound materials with personalization or versioning. The installation of more sheetfed options creates more opportunities for designers.

The shape of paper is also an important consideration in web-fed inkjet. There is the width of the press, that can support anywhere from one to four pages across, but another important factor is how far along the roll a single image can print. Your "paper shape" could be very long indeed, with some printers supporting individual images of sixty inches or more in length along the web. This provides designers with a huge array of options for creating continuous images made up of multiple pages, shapes, or panels that can be scored and folded with interesting results.

## Going for efficiency

Different sheet and roll sizes also present options for design efficiencies by reducing paper waste. Remember, you are still paying for the width of the paper regardless of what you use. Talk to your print provider about their specific devices to see if designing to the usable roll width or the page size of a single sheet is more efficient for your print job. On web-fed devices, think about your individual finished size as well as how many items you can fit across the width of the roll to make more efficient use of the paper.

4




As noted above, also think about how you can make the most efficient use of the roll length. In some cases, printing on a high-speed web-fed press is more cost effective than a B2 or B3 sheetfed one because they are designed for high volume. However, because web-fed devices can only support one stock at a time, jobs requiring more than one paper stock may be more cost effectively produced on a sheetfed device that can handle two or more stocks in the same run. This is why it's important to think about the whole process. Understanding how your design will be laid out on the press is important for avoiding waste and for recognizing the potential for finishing compatibility and page bleeds.

## SET SOME BOUNDARIES

You may think you know your page boundaries, but there are several factors that may limit what you can print on. Some inkjet devices don't support edge-to-edge printing. While the requi red margins may be tiny, they eliminate the option to use full bleeds in the design unless you add a trim step. Paper weight choices can also be a factor that limits full bleed as an option if the ink coverage will cause the paper to curl, creating downstream finishing issues.



You also may be told that you can't have a **full bleed** if you are designing a piece that will be mailed. Bleeds must be reviewed for potential interference with **barcode clear space** for mail automation. Clear space is necessary along the plane that an optical reader will use to scan the barcode, controlling inserting and other quality functions. This also can come into play if you are designing a piece that needs to be automatically matched with other components during a fulfillment process or if you are using down-stream processes, like foil or variable post-coating, that require registration marks to keep the embellishment aligned with the print.

The option for bleeds comes back into the picture if the overall sheet size or page width used by the printer is larger than the finished page design, edge trimming is part of the production process, there is no issue of interference with barcode readers, or if the trimming can be completed after the barcode reader has done its job. If you find yourself in this situation, there are even more questions to ask before you take "no bleeds" for an answer.

First, ask if the issue with bleeds applies to the whole page or just to specific sides of the page. In the latter case, you will need to understand how the pages of your design are virtually laid out on the roll or sheet so you can visualize which sides of the finished page can bleed. If the restrictions are due to barcode placement, often there is more than one option—so be sure to ask.

Also keep in mind that if you make your design (and print provider) do backflips to accommodate bleeds, this may introduce a lot of waste and

cost into the process. Sometimes a little margin of white space isn't a bad thing when the alternatives are expensive. We all hate to have boundaries put on our creativity—but our budget is often the most important one.

## FOLDING AND INSERTING

There are folding and inserting considerations that apply generally to print projects and others that are specific to inkjet. Generally, the type of envelope, the potential size of the finished document, and the **inserting equipment** will determine the options you have for the type of fold.



Nested letter, or C-folds, are the most common folds for letters, statements, and bills, but documents longer than about six pages may be folded in half or mailed flat. This means that not everyone may be able to open the finished piece in the same way. If the way in which the final product comes out of the envelope is important to your finished design, make sure you understand the impact of variable length on folding and inserting.

If you are concerned about cost and speed, you should know that the Z-fold can be problematic for some inserters and is more commonly used for hand-fulfilled pieces, which are much more expensive than automated ones.

A common misconception about trifolds is that their panels are of equal size. For C- and Z-folds, one panel is smaller. If fold position is critical to your design, make sure you understand the specs.

With any type of  fold, the fold itself is critical. Pieces produced using aqueous inkjet are quite stable in the folding process—if the ink volume is appropriate to the chosen paper. However, with the UV-curable ink used in some inkjet devices, there is potential for cracking along the fold if the paper is not scored prior to folding. This cracking may be similar to effects seen when heavy toner coverage is used on digital toner devices.



Fold types and fold position can change on variable page count documents. Plan carefully for each option.

Also consider that some mailing shops do not nest folded pieces as part of their standard inserting process — each sheet may be folded and inserted separately. While this approach allows more pages to fit in a single envelope, research shows it is a great irritant to the recipient, who must unfold and assemble each page. Don't assume that because you have selected a type of fold that it will be nested—check with your provider to learn the whole process. Yes, we said it again, the whole process.

All these folding and finishing choices are vital to controlling what the reader will see first when they open the envelope. If you are trying to place key information "above the fold," it's rather important to know where the fold is. Keep in mind that a print operation may have more than one option available to choose from, and not all finishing options may be compatible with all print options.



Talk to your print provider about whether your piece should be scored before folding to ensure a clean crease, particularly when using UV-curable inks or heavy polymer pigment ink coverage.

## Cutting, scoring, and trimming

As discussed earlier, trimming capabilities can be important if you want to include bleeds in a design where the press can't print to the edge of the page. Some printing operations use trimming on every page to eliminate operational markings from the finished piece, trimming barcodes after they have done their important quality assurance or mail automation work.

Understanding the starting size for the sheet and the trimming process may allow for a larger design palette. For example, certain quality marks, such as those used for maintaining color registration, may be trimmed off the final mail piece. This equipment also may enable bleeds on portions of the page that would not otherwise be possible in an inkjet environment.

Ask your print partner if color registration and other marks can, or will, be trimmed during the finishing process. If they will not be trimmed, you may have options on the placement of those marks relative to your finished piece.

Of course, trimming is not the only option. Your printer may offer die cutting, laser cutting, and other options for creating interesting effects on your finished piece. Look at options for rounded corners, see-through booklet covers, or custom shapes.




Keep in mind that paper sizes, scoring, folding, trimming, and cutting must all work together when used. Understand the order in which the steps will happen and whether one choice automatically requires another—for example, scoring with folding or the trimming of bleeds or barcodes.

## DYNAMIC PERFORATION

First, let's define perforation. It's not cutting or scoring, but the little row of holes in the paper allowing it to be torn cleanly in a particular spot. You see this dotted line of holes every day on checks, coupons, and invoices. What you may not know is that usually the perforation process is fixed, meaning that every page in the print job gets a perforation in the same place. Most of the time that's fine, but if you only want certain pages to have the perf or if you want a different number of perforations on each page, you need a feature called **dynamic perforation**, and not everyone offers it. If available, this feature drives efficiency and allows designers the flexibility to add valuable perforation only when and where it's needed:

### For direct mail

- Produce pieces with a varied number of coupons.
- Incorporate convenience checks in mailings (also requires using inkjet devices with MICR capability).
- Create variable, self-contained pieces such as business reply mail or postcards for USPS mailings.
- Progvide detachable membership and ID cards.

### For books

- In the educational sector, include tear out pages in workbooks for class exercises.
- For marketing collateral
- Create brochures with optional tear-out sections.
- Design newsletters with tear outs on specific pages.

### For bills and statements

- Produce multipage bills in a web-fed environment where only one page has a perforated tear-off stub.
- Include one or more dynamic coupons on a page for specific recipients.
- Include one or more investment coupons on asset management accounts for new clients or those with a known propensity to reinvest.
- Dynamically produce checks inline on white paper (also requires using inkjet devices with MICR capability).
- If your printer offers dynamic perforation, ask for specific guidelines on perforating options and placement of perforations relative to folds and other artifacts.

## GETTING IT IN THE MAIL

The United States Postal Service (USPS) has become much more stringent in their guidelines for mail pieces in order to control handling costs. To get the best postal rates, mail must conform to specific finished sizes and envelope sizes. For transaction print applications such as statements, bills, and direct mail (other than postcards and self-mailers), an understanding of envelope options is an important part of the design process.



In addition to constraints from the USPS, choosing certain types of envelopes—such as flats— may force portions of your production into a hand-insertion process that could cost you more money. Keep in mind your print provider may not use the same inserting equipment for their inkjet printed materials as they do for other printer lines. The good news is, in most cases, a print provider will upgrade their inserting equipment to keep up with the speed of inkjet, and some of the things you thought you knew about your printing partner's processes could change for the better.

## Mailing and quality controls matter

The process of folding and inserting pages into an envelope and mailing it requires a series of controls that typically involve a postal barcode or an inserter or quality control barcode. Postal barcodes contain encoded address information for use by the post office, while inserter barcodes provide automated quality control in the inserting process.

Requirements also may include human-readable control codes that help the people on the production line do their jobs properly. All these controls must be placed in particular areas of the document and often require clear

space to allow equipment to read the marks without interference from other information. Ask your print partner for samples of these codes and specifications for positioning them on the page. Control codes are not inkjet-specific design issues; however, the clear space requirements and ability to trim barcodes off the finished piece may differ based on the process flows for different printing devices.

These types of quality controls also may be used for matching book bodies with book covers and enabling other types of matching where only portions of the finished piece are produced on inkjet. Understanding how your print partner tracks components throughout the job may get you thinking about other options for putting pieces together in a quality-controlled way.



## You have options for envelopes

Sometimes the mailing vehicle is chosen for you, but often you have choices. Getting samples of each envelope will tell you where address information needs to be placed, the requirements for clear space around the mailing address, and, if applicable, the return address. Sometimes your choices go beyond the size, shape, and color of the envelope. You may have choices for the placement of windows on the envelope or the choice of no windows at all. You may be able to extend your design to the outside, and even the inside, of the envelope.

Can the envelope be personalized? Inkjet has made a big splash in envelope printing by introducing the ability to include variable messages on the outside of envelopes. In some inkjet operations, the envelope can be dynamically constructed around the mail piece with the address printed directly onto the envelope along with personalized messaging. There are also options for specialty media and self-mailers (discussed in Chapter 7). Exploring the full range of envelope options gives the designer greater flexibility in the placement of customer address information, opening valuable real estate on the page that may expand to include space on the outside of the envelope as well. That's thinking outside the envelope!

Now that we have looked at the end of the process, let's go back to the beginning with a dive into some choices to consider throughout the printing process.

## Printing configuration

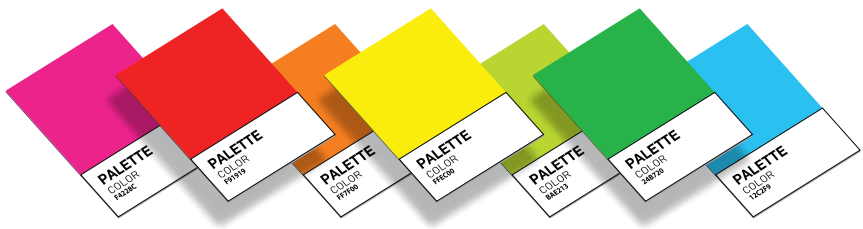
There are many different types of inkjet presses you can seek out for your project. You might work with more than one inkjet press or even multiple different printing processes within one project (we talk more about this in Chapter 15.) Each type and brand of inkjet press offers features that can impact print quality and production efficiency. Understanding the features of your target printing device will help you take full advantage of its capabilities and avoid designing for features it lacks or will make it incompatible with the next step in the process. We've included questions about the most important features as well as some technical aspects that could make a difference for very high-quality projects.

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## How many colors?

Usually, inkjet presses just use CMYK inks, but some press models offer the capability to add special colors to that fab four. Options may include specially mixed Pantone spot colors, **security inks**, or **MICR**—the magnetic ink used on checks and other security documents. A MICR-enabled inkjet press can produce checks and MICR-encoded coupons inline with other documents on white paper. This may not seem very exciting to a designer, but it's very exciting to your customers if it means they can combine mailings and save money.

You and your customers may be more excited about the potential for custom colors. With spot colors available, potentially out-of-gamut colors can be added back into the mix, allowing a near perfect match or a hard-to-achieve logo color.




However, this color matching will be tied to a specific paper and will not be an exact match if the color wasn't created for you. These colors typically come at a significant added cost, so many print providers may not have

this feature enabled—even if the device has the capability. But if you are designing for a big brand with deep pockets, it's worth asking about the availability of this feature.

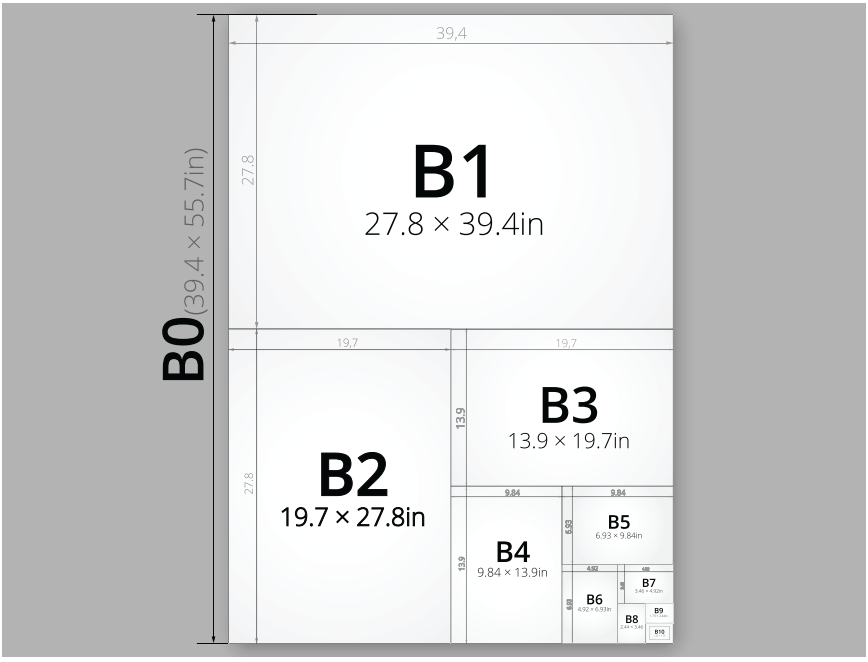
You may find a supplier with a cutting-edge press that uses more than four base colors. The latest evolution of devices coming to market are expanding the achievable color gamut with the addition of some combination of light cyan, light magenta, gray, green, orange, or violet. Expanded gamut presses will be covered in more detail in Chapter 10. As more of these devices come to market and advances in ink chemistry continue, there should rarely be a need for custom colors.



## Rolls and sheets and multi-sheets

The majority of inkjet presses installed today are web-fed, but the number of sheetfed installations is growing rapidly. The emergence of more sheetfed options and their wide adoption by printing companies is opening new opportunities for designers.

**B Series Format Sizes**



While some sheetfed presses use the larger B1 sheet format common in offset printing, others use a variant of the B2 sheet size that is half the size of B1. There are presses designed for the B3 sheet size (and similarly sized sheets), which is half the size of the B2 and a quarter the size of the B1.

These smaller format (B3) presses often support more than one paper tray or feed, meaning that a finished piece can easily use more than one paper stock or more than one weight of the same stock.



These presses are ideal for printing books, directories, and other bound materials with personalization or versioning that may require more than one media in the same job.

The different page size options for sheetfed printers present options for designing with efficiency, often with less paper waste. Remember, you are still paying for the total area of the paper, regardless of what you use. Talk to your print provider about their specific equipment and sheet sizes to see if designing to the usable page size of a single sheet is more efficient for your print job.

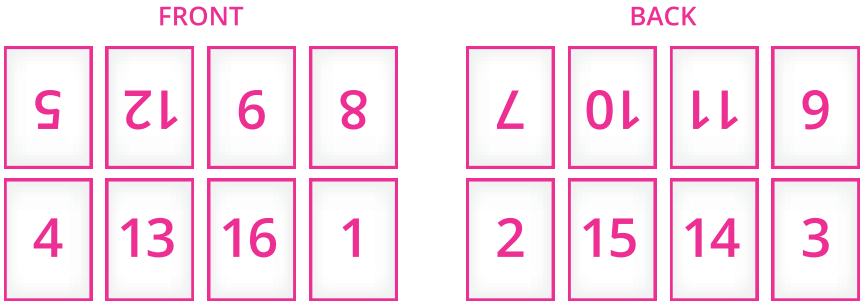
Web-fed devices can only support one stock at a time. Depending on the width of the roll, they may enable print jobs that will be ganged across the web to efficiently produce more pages in less time. You may be able to print a job 2-up or 4-up, making more efficient use of the paper. If your job is high-volume and time-critical, a web-fed printer may be needed to get the work done fast.

Whether roll-fed or sheetfed, the number of compatible paper choices differs by device. Ask your print partner how many paper or media types are available when discussing different press options. As noted earlier, understanding how your design will lay out on the roll or sheet can be important for avoiding waste and recognizing the potential for page bleeds.

## Nesting and imposition

Nesting is a layout technique that organizes individual pieces of content on the sheet or web to minimize waste. The size and shape of the page provide boundaries for the number of individual components that can fit on a sheet or across the web of the press.

## IMPOSITION






If you are working with regular-shaped components nesting is fairly simple, but if your finished design is made up of irregularly shaped pieces, this can be complex. Be sure to talk with your print provider before you decide to manually arrange these pieces on the sheet yourself as part of your design process. Some printing companies use imposition software that automatically arranges print files to efficiently maximize the number of components that fit the available space. Whether manually constructed or automatically imposed, you will want to look carefully at how nesting could create pockets of heavy ink coverage across the sheet or differences from one side of the page to the other, as described earlier.

The imposition process positions pages on a press sheet or roll so that when the sheet is folded and cut, the pages will be in the correct sequence. Many types of projects, from brochures to direct mail to books, require some form of imposition. In the past, this was usually done manually. With inkjet, the number of pages or the content on them can be variable, so imposition is often an automated process starting with a file of pages in sequential order.

Understanding the maximum image size available for a roll or sheet, along with the software options for supporting nesting and imposition, may open creative options for additional panels in a design or for introducing variable components to the process. While these considerations are not unique to inkjet, the extra step of determining how different levels of ink coverage may end up on the same page or on alternate sides of a page is important to ensuring proper processing all the way through finishing, as noted earlier.

## Type of ink used

This may seem pretty technical, but the type of ink used can have an impact on quality as well as on compatibility. The most commonly used ink types are aqueous pigment and aqueous dye. The variation between the results from pigment and dye are narrowing as ink formulation continues to evolve. However, the output of pigment ink still tends to appear more vibrant than dye ink, since more of the colorant sits on top of the page. Pigment is also more colorfast than dye and is therefore a good choice for projects where finished pieces will have a long shelf life or need to be water-resistant. UV-curable inks also maintain the colorant at the surface, providing vibrant color and excellent durability.

Ink chemistry also has an impact on compatibility and suitability for specific jobs. Within the realm of aqueous pigment, there are **high-density polymer pigment inks** that enable printing on a wider range of paper stocks and other media as well as delivering improved color gamut. UV-curable inks further expand media compatibility but can be a costlier option than some other formulations.

UV chemistry also can have a higher level of "Volatile Organic Compounds" or VOCs that are the target of environmental regulation in many countries.



However, newer generations of UV inks are making substantial chemistry changes to minimize VOCs. For now, if your project involves personal care or food-adjacent print designs, UV may not be an option. Aqueous inks are generally considered the "greenest" of the ink choices on the market today.

In the list of questions about the printing process in Chapter 3, there were a whole bunch that asked about compatibility. The choice of ink has a large impact on compatibility, along with post coating; embellishments; and even folding, scoring, and perforation. Generally, the biggest decision will be between aqueous or UV ink. But, even among aqueous inks, the differences between one type of ink and another can be quite dramatic in terms of the quality delivered and the compatibility enabled. You don't need to be an ink chemist, but you do need to know that inkjet inks keep getting better and better. Therefore, if you are not getting exceptional quality on an inkjet press, you should look at other options—because the new generation of inkjet is all about excellence.



## Availability of post coating and embellishing

In addition to major evolution in inkjet inks, the range of post-coating solutions has expanded in recent years—from the application of simple matte or gloss protective finishes to the creation of soft-touch or intentionally rough surfaces that produce a haptic response from handling the finished piece. Some coating devices can build layers of coatings to create a **raised** or **embossed** effect.

We will talk more about the many ways you can enhance a printed piece using coatings and embellishments in Chapter 8. Be sure to talk to your print provider about end-to-end compatibility for your specific project. If you don't plan ahead, you may have to use multiple suppliers to deliver the full project, adding unnecessary cost and delay. Or worse, you may find that certain options you wanted to use are not compatible at all.

## Do I really need to know about printheads?

We understand that many designers may not be interested in a deep dive into printhead technology, but it's important to understand that there are significant differences even if you don't know all the science behind them. Seemingly simple topics, like print resolution, that you may think you understand from buying your last desktop or proofing printer can get pretty complicated when comparing the capabilities of production inkjet presses. There are different roads to achieving fine detail with inkjet using tiny ink drops, multiple drops of different sizes, or a combination of both. The method used has an impact on control of fine text and gradations as well as halftoning, curves, and even color reproduction. For those interested in the "how and why" we will dive into more details in Chapter 5, but for the purpose of understanding your project's production process from front to back, don't rely on printer resolution as the sole arbiter of quality. Ask for reference charts and print samples as recommended in Chapter 3 to fully understand what your target print environment can offer.

CHAPTER 5

# LET'S JET



LET'S JET

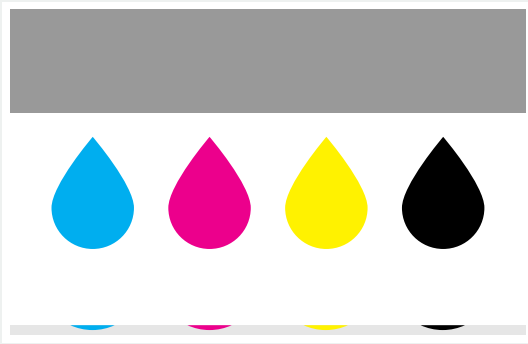
# THE POWER OF THE DROP

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This chapter is for designers who don't just want to be told how to do something—they want to understand why they need to do it. People who care about the why are often the ones blazing new trails and finding better ways to get the results they want. If this describes you, read on. If you don't find this technology as amazing as we do, just skim this chapter or move on to Chapter 6—but you will miss out on learning how amazing inkjet truly is.

Inkjet, as the name implies, involves jets. It's like rocket science for printing. Landing a drop of ink on a moving substrate takes the kind of precision used to launch satellites into orbit.

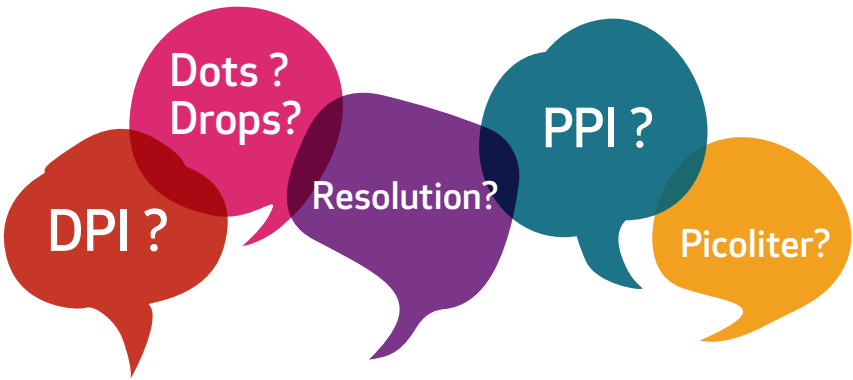
Printheads "launch" drops of ink that are smaller than the width of a typical human hair. They must control the volume as well as the consistency and shape of the drop as it flies through that tiny bit of space between the head and the moving target. The ink can't splatter when it hits the substrate. It needs to make a controlled landing at exactly the intended point. Every drop and the way it "sticks the landing" is fundamental to creating the overall image quality of the printed product. That's the power of the drop.



## DROPS, DOTS, AND IMAGE QUALITY

In the previous chapter we advised that shopping for a high-quality inkjet printing partner involves more than asking about the resolution of the press. The ways that inkjet presses achieve image quality go well beyond the number of dots. It is based on the ink volume of the drops jetted, the size of dots that can be created, the number of distinct sizes, the shape of the drops, and uniformity of the resulting dots on the page. There are several discrete approaches to achieving these aims and they are very difficult to boil down to a single overarching measure of image quality. Adding to the confusion are the different ways that quality is described across the print industry.






When attempting to describe print quality, a whole lot of terms get thrown around: DPI (dots per inch), PPI (pixels per inch), and LPI (lines per inch) to name a few. Often the terms are misused or misunderstood as they relate to inkjet resolution. For example, drops and dots are often confused. In simple terms, a drop of ink is what comes out of the printhead, and a dot is what the drop becomes when it hits the paper (or other media). Drops are measured by volume (picoliters or trillionths of a liter), while dots are measured by diameter (microns aka thousandths of a millimeter). It may seem counter intuitive, but the smaller the drops and dots, the greater the impact on quality.

Inkjet printheads jet millions of drops per second through very fine nozzles to create the dots that make up the printed image. The volume of an individual drop can be less than two picoliters, generating a dot of about

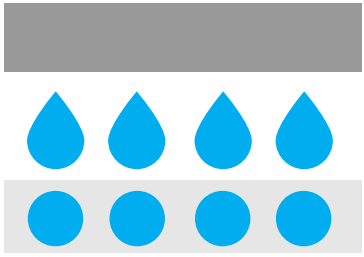
26 microns. For perspective, an average raindrop holds hundreds of picoliters and the width of a typical human hair is 80 microns. An inkjet dot can be less than half that size. As you would expect, the size of the dot generated on the media is dependent on the volume of the drop used to create it, but the same volume of ink can result in a different sized dot on each type of media. More on that in a moment when we discuss dot gain.

DPI is the most common term applied to inkjet print quality. However, DPI only tells part of the story when it comes to image quality. We're going to define a few more terms that serve as the building blocks for understanding the printed image, starting with more about the dots and drops.

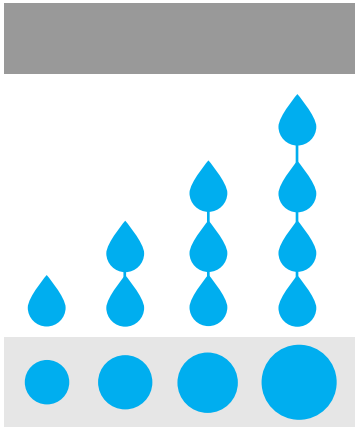


## Drop volume

The ability to dynamically control drop volume on an inkjet press is a big deal because it enables images to be created using different sizes of drops. Offering multiple drop volumes is one approach to optimizing quality levels for individual jobs and media types by adjusting these drop sizes. A smaller drop will allow production of a finer raster of dots on the paper. Printing with variable drop sizes can create more detail and depth in a printed image. Multi-drop or grayscale printheads automatically generate multiple drop volumes. Binary printheads generate a single drop size.



**Binary printhead: Dots are uniform in size**



**Multi-drop head: Larger dots are made by more drops**

However, even some binary printheads can fire two, or even three, drops to the same spot—effectively creating the same result as a multi-drop printhead. With the latest generation of inkjet, the minimum drop volume and placement accuracy of the drops are more critical than the number of distinct drop sizes.

## RESOLUTION

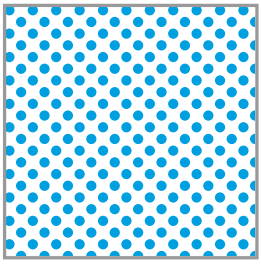
The **native resolution** of a device is just one measure of print performance—usually expressed as dots per inch (DPI). DPI expresses the number of dots in a square inch, but the vertical resolution and the horizontal resolution of a press may be different, particularly on ultra-high-speed printers.

**A higher resolution does not necessarily mean better print quality or clarity — unless the drop size is also reduced to efficiently add more dots.**

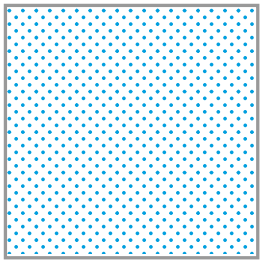


Whether we are talking about printing text or images, the overall quality of the output is influenced by the number of dots produced per inch, the size of the individual drops and dots, and the amount that the dots expand when absorbed into the paper. As noted earlier, the uniformity of individual drops and the accuracy of their placement also play a role.

Having a higher resolution printhead does not necessarily mean higher quality, as quality also depends on size of the drops that can be jetted.



**72 dots (pixels) per inch**



**300 dots (pixels) per inch**

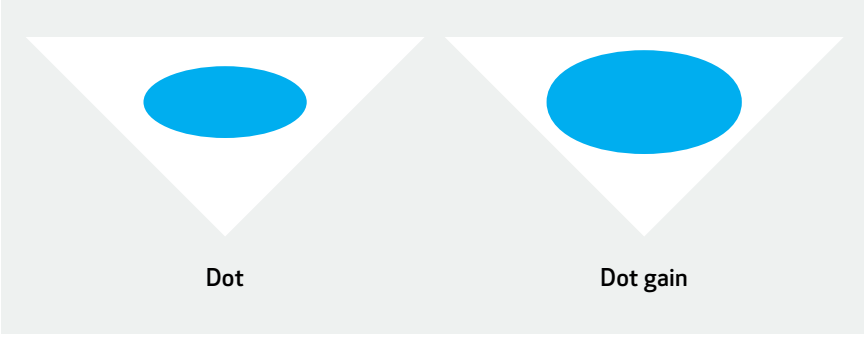
The lower the resolution, the larger the drops must be in order to achieve a proper solid fill. But when the resolution is increased, the drop size must be reduced to make sure the drops don't overlap and cause ink thickness problems. The number of drops and size of drops must be in perfect balance.

## Dot gain

A single drop of ink can result in a different sized dot on every type of media. The difference between the size of the dot when it hits the paper and when it is absorbed into the paper is called **dot gain**. If there is a lot of dot gain, the printed material will look darker and less crisp than when there is little dot gain. Keep in mind that dot gain is not always uniform.



If dots spread unevenly as they absorb into the paper, image clarity and text legibility may be diminished. Every combination of paper and ink produces a different amount of dot gain based on the paper surface and ink viscosity. Some combinations of paper and ink yield virtually no dot gain at all.




Sometimes dot gain can be a problem, but other times it can be your friend. We will talk about how to anticipate and control for dot gain using profiles later in the guide.

There are other ink-related factors that contribute to image quality. The ink that makes up the drops and dots has its own measures: density and coverage.

## Ink density

Printed **ink density** is measured by the amount of light that is reflected from the printed surface using a **densitometer**. Ink density represents the percentage of light reflected from the printed ink stated as a numeric value. The density of a particular ink printed on a particular paper can change based on the ink thickness or **Total Area Coverage** of ink.

## Total area coverage (ink limiting)

Even though the term "area' is used, when we measure the Total Area Coverage (TAC) for an inkjet job, we are not talking about the surface area of the page that has ink on it. We are talking about the amount of ink that can be in any one area of the page. TAC describes the highest total thickness of combined ink for the job. This is a very important topic with inkjet because each type of paper can only hold a certain amount of ink before it will fail to dry properly. High TAC with insufficient drying can cause problems like **coalescence**, **mottling**, **show-through**, and **paper curl**.

**When we measure ink coverage, we are not talking about the surface area of the page that has ink on it — we are talking about the amount of ink that can be in any one area of the page.**



In full-color applications, maximum ink TAC limits the total combined ink usage of cyan, magenta, yellow, and black. TAC is generally referred to as a percentage, such as 200 or 240, based on combining the total percentage of C, M, Y, and K required in a design document. The closest achievable color match is then calculated while limiting the ink to a TAC value that is compatible with the paper.

Maximum TAC represents the volume of ink that a paper or substrate can hold without causing print quality or paper defects. Think of this as the

maximum vertical ink thickness or the amount of ink that can be stacked in one spot on the page. All inkjet printers have a maximum TAC associated with each paper type. TAC can be controlled through profiling, and we will talk about how to do that in Chapter 14.





## THE RASTER PROCESS

Now that we've defined drops, dots, and density, we can talk about how all those "d" words are controlled to create quality images at high speed. It's a bit techie, but understanding the process will help you make better design decisions. We'll start by defining some important terms that will be needed when discussing proper file settings for your work later in the guide.

### Raster Image Processor (RIP)

A Raster Image Processor (RIP) translates your file type, such as PDF, into something that the press can understand: printer language. Almost every press model has its own printer language, which resides on the print controller. This process is often referred to as RIPing.

The offset printing process RIPs files to a platemaker to create the necessary plates to go on the press. The RIP on a digital press ingests production files in formats such as PDF, Adobe PostScript, or **AFP**, and RIPs the graphics file into a single composite raster pattern or multiple **color channels**. Once RIPed, the files become bitmapped data that can be directly communicated to the press.

## Dithering

**Dithering** is the part of the RIP process that applies a screening pattern to create a random distribution of dots. A dithered image, when viewed under a loupe, will show drops closer together for solid areas and farther apart for midtone and highlight areas, allowing more of the paper color to show through. Printed dots of varying sizes represent color intensities and print detail within the image. This dither pattern is creatively made to trick your eye into seeing tone values in a printed image.





There are five things that must be compatible with a print device before successfully RIPing a document: screening pattern, bit depth, gray levels, resolution, and the output profile. We will cover output profiles in Chapter 14. Read on for the rest.

## AM and FM screening

A RIP prepares an image by applying a dither pattern based on AM or FM screening. Screening, the way dots are placed on a grid, is another area where inkjet differs from offset.

Offset lithography uses **AM screening**, or half-toning, to reproduce images. With AM Screening, dot sizes placed on the grid can vary from 1% to 100% to adjust image density from highlight to shadow. Dots will vary in size, but not in placement. The addressable grid in this instance is composed of lines per inch (LPI) also known as the "screen ruling." AM Screening is very strong in reproducing mid-tones but fine details in darker areas can be challenging.



Inkjet presses use **Frequency Modulated (FM) Screening** based on a **stochastic** algorithm to randomize the placement of drops within a grid. Unlike AM Screening, all of the dots are assumed to be the same (or similar) size, but the distance between the dots is varied to produce lighter or darker tones. Randomizing the placement of drops smooths tones and avoids noise. With FM Screening midtones can be harder to control due to dot gain. When dots connect or overlap, mottle and noise can result.

**Due to plate impression, midtones and shadow areas are more prone to plugging with AM Screening (offset) than with inkjet.**

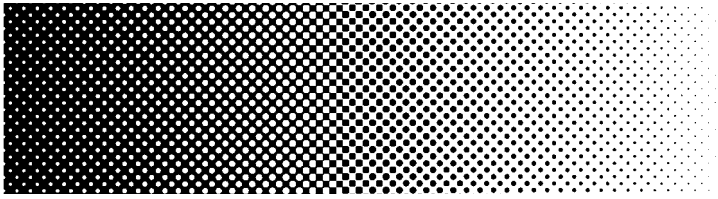
Due to plate impression, midtones and shadow areas are more prone to plugging with AM Screening (offset) than with inkjet. On the other hand, FM Screening may cause more graininess when printing highlight areas than AM Screening, unless using a drop size of 3pL or less.

Small dots are a big advantage. If the dots are small enough and the resolution high enough, the FM algorithm can create the optical illusion that there are no dots at all. However, unlike AM Screening, the placement

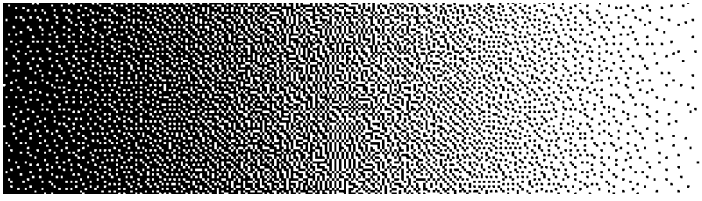
of small dots with more space between them to deliver lighter tones relies on the color of the substrate. This means that lighter tones with fewer ink drops can pick up the color of the media—for better or worse.

We mentioned earlier that FM Screening describes a process with a uniform drop size. However, most inkjet presses today can create two or more drop volumes (or deliver two drops to the same location to create a larger dot). When a press can produce more than one size of dot, it is called a grayscale, or multidrop printhead. Grayscale enables a multi-level screening approach. While they do not produce the number of differentiated drop/dot sizes of offset or some toner presses, presses equipped with advanced screening software can apply randomized screening in the highlighted and shadow areas and a non-randomized screening in the mid-tones by using more than one drop/dot size to transition more smoothly. Because the dot size—as well as the relative positions of the dots—can be varied, inkjet presses with multiple gray levels can create smoother halftones and continuous images than those with a single drop size. This is why the latest generation of inkjet can deliver print quality that rivals offset.





**AM Screening**



**FM Screening**

## Bit depth

**Bit depth** is critical in defining gray levels. Gray levels determine the number of color tones that can be processed and the number of color shades each pixel will represent when RIPed. Each On/Off instruction of a pixel, or bit, defines when a drop should jet from the printhead. With more bits, there can be more drop sizes. More and variable drop sizes improve the clarity of the print and create smoother tone values.

Improvements in inkjet presses have resulted in more robust printheads that deliver higher bit levels and produce higher image quality. Depending on the inkjet device, an inkjet RIP will process files at one, two, or four bits for each color. Each processed CMYK color channel created in the RIP will have the same bit level, creating a combined CMYK bit level of four, eight, or sixteen.

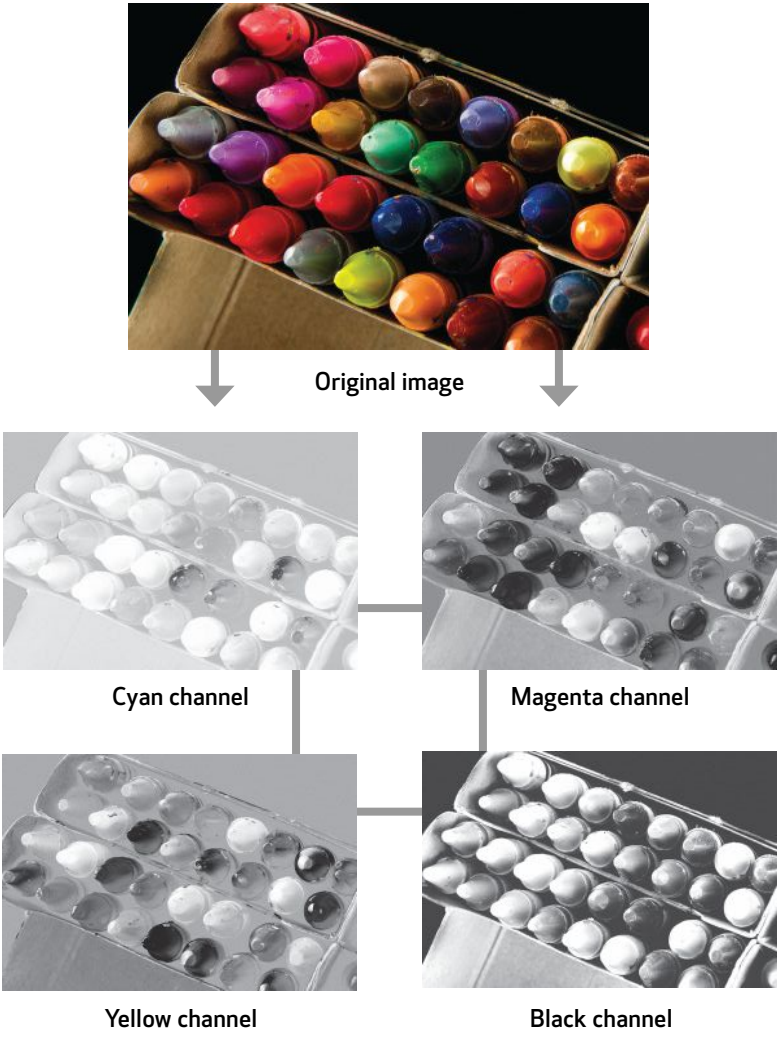


So, bit depth communicates how many continuous drops to jet, whereas grayscale, also called "levels of gray," tells the print engine what drop size the printhead must jet. Grayscale heads define the number of grays, or level of smoothness, produced between highlight midtones and shadow areas when each color channel is processed from the RIP.

**Bit depth communicates how many continuous drops to jet, whereas grayscale tells the print engine what drop size the printhead must jet.**

While higher bit depths for images have their advantages for delivering print quality, the disadvantage is in the larger file sizes generated and the increased processing speed at which the printhead must fire. Giving the press a lot of detail to work with means it can make a better conversion to the page, but it may take longer to RIP and process to the printheads.

FM screening was integrated into the process to allow inkjet devices to reach speeds of more than 1,000 feet per minute. Advanced screening software—combined with manageable gray values and



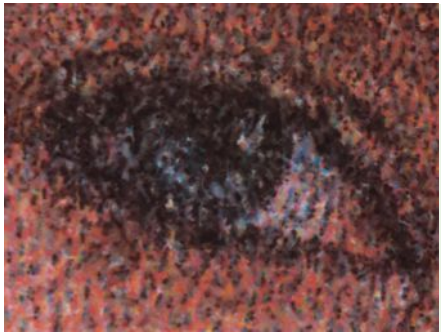



variable drop sizes—creates high-quality print with smooth gradation ramping, while keeping file sizes small enough for high-speed printing.

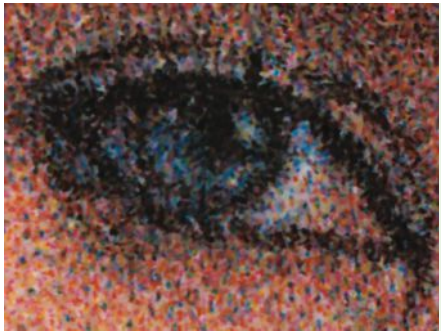
Putting it all together, the latest generation of inkjet can provide clearer small text, smoother curves, solid color fills, and allow more highlight and midtone detail for photos and gradations, as well as reproducing better color depth.

## Why should you care?

Because the use of variable drop sizes can provide clearer small text, smoother curves, solid color fills, and allow more highlight and midtone detail for photos and gradations, as well as reproducing better color depth.



**Binary 1-bit, 2-gray level scan at 2400x**



**Multi-drop 3-bit, 4-gray level scan at 2400x**

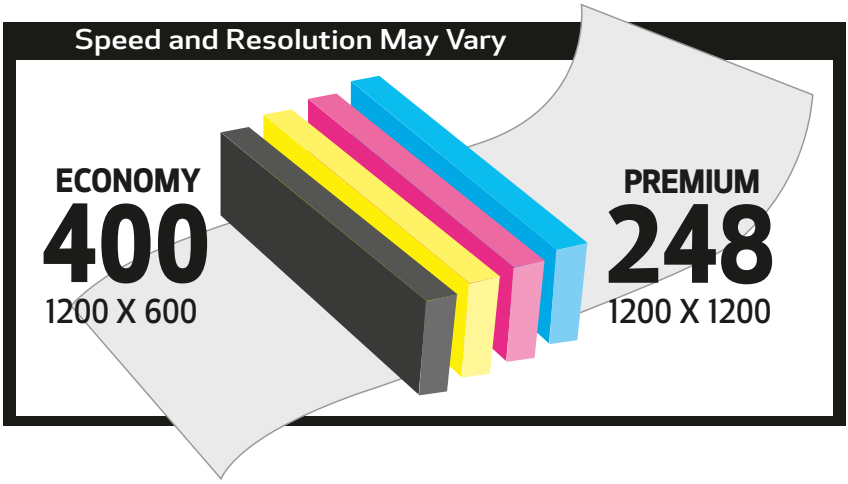
Ask your print provider for the DPI of the press that will be used for your work, as well as how many different drop sizes it can produce. While you don't have control of the drop size or type of printhead, being aware of the capabilities of the press will help you design within the capabilities of that equipment. Not all inkjet is created equal.

## YOUR RESOLUTION MAY VARY

To add another layer to a confusing topic, some inkjet manufacturers refer to "perceived resolution" instead of simple DPI (native resolution) to describe the print clarity of their press. This is an attempt to deliver a simple frame of reference for the combination of resolution, gray levels, and bit depth that contribute to image quality.

It's also important to know that some presses have more than one printing mode, resulting in more than one resolution. Some presses only produce their highest quality at a slower running speed and offer their highest speed at a slightly lower quality. Your print provider would like to run at the highest speed. Be sure to ask if your job will be running at the highest quality possible on the press or if your job was quoted in "high-speed mode."



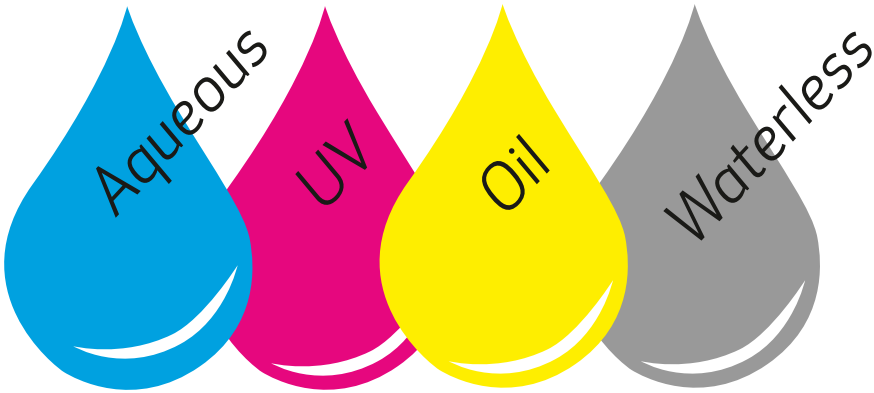



As mentioned earlier, a higher resolution does not guarantee higher image quality or better color. In addition to all the printhead and software capabilities described above, the particular ink and media used (and profiles and settings which we will cover in a later chapter) also affect quality. Remember that car buying disclaimer "your mileage may vary, see dealer for details?" The same goes for inkjet resolution, but see your print provider for details.

## UNDERSTANDING INK

Most production inkjet systems use aqueous, or water-based, inks. Don't confuse water-based inks with watercolors. These inks are packed with highly concentrated colorants specifically designed for inkjet. Using water as the carrier for the colorant allows the ink to be extremely thin and easy to jet at high speeds. However, that thin liquid also has to be dried. Aqueous inks dry using a combination of absorption into the media and evaporation into the air, so inks that allow excess water to disperse quickly—leaving the ink colorant on the printed surface—will create more color "pop." The type of ink and the type of media used will determine just how much pop is delivered.

5




As noted, the vast majority of production inkjet presses serving the applications covered in this guide are water-based. However, you may run across presses that use waterless, oil based, or, more likely, UV curable inks. Waterless (wax-based) inks and UV curable inks enable printing on a wider array of media than some aqueous inks. While early generations of aqueous inkjet presses had fairly limited media compatibility, the latest presses use a combination of advanced ink formulation—sometimes with a primer or conditioner—to vastly expand compatibility with offset papers and other types of media.

There are two main types of colorants used in inkjet ink: dye and pigment. The results achieved with any ink will vary based on the type of media used. Generally, dye inks will be absorbed more deeply into the paper, making

the results more scratch resistant than pigment. The colorants in pigment-based inks tend to sit higher on top of the paper and are more lightfast and less scratch resistant than dye. UV curable inks don't absorb into the media like water-based inks, so they bind more colorant to the surface of the media. This results in a color that is more visible, but the color is less scratch resistant than dye. Recent advances in high-density aqueous pigment inks allow an even higher volume of ink to be used on the page to really boost color results.

Inkjet printing and inkjet inks are different. It's important to know what you are working with to understand all of the possibilities—from the type of media you can print on to the kind of color you can expect on each type of media.



It doesn't require a physics degree to understand that spraying water onto a porous material like paper is going to get the paper wet. Therefore, the competitive aspects of aqueous ink relate to its ability to cause the water to evaporate quickly and leave sufficient colorant behind. Efficient evaporation leaves the colorant on the surface without disrupting the structure of the paper.

Early aqueous inkjet presses relied on papers that were formulated specially for water-based inks. These "inkjet treated" and "inkjet coated" paper grades are designed to remain somewhat porous (meaning they are not totally sealed.) This allows some ability for the ink to absorb into the sheet. Remember, absorption is a big component of how aqueous ink dries. Inkjet papers are formulated to dry fast and keep more colorant closer to the surface. While inkjet formulated papers help to boost quality on many inkjet presses, many newer presses can deliver top quality without their help. No matter what kind of paper or other media you are using in an inkjet environment, the surface will interact with each particular ink and deliver different results. Understanding your media options and how each will perform with the target inkjet press is fundamental to designing for inkjet.



In an inkjet environment, every paper will interact differently with the ink chemistry, delivering a different result.

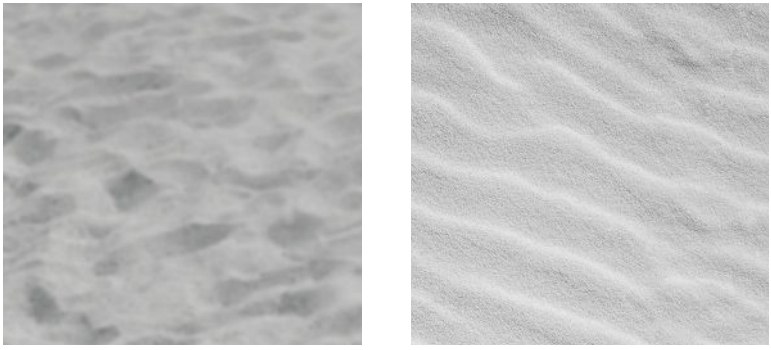
## UNDERSTANDING INK PLUS PAPER

We mentioned earlier that the evaporation and drying process should not disrupt the structure of the paper. But what does that mean? Well, when the carrying fluid of aqueous inkjet ink is not evaporated quickly, evidence of water damage can be seen on the surface of the paper in the form of nasty sounding things such as **cockle**, curl, **ink wicking**, **ink dive**, and **mottle**. When a design calls for more ink than the intended paper can dry effectively, ugly things can happen. Here are a few problems to avoid.

### Cockle



Paper cockle is the term given to the ripples that occur in an area of paper that was exposed to moisture. Paper is absorbent and, just like anything else that is absorbent, if you get it too wet and then suck all the water out quickly it will shrink. Since paper is a network of wood fibers that will absorb the ink carrier, if a printed area of the paper is oversaturated with ink, then dried quickly, those wood fibers will shrink up to cause a visual paper defect.



**Paper cockle is a print defect that looks and feels like ripples in the sand**

### Curl

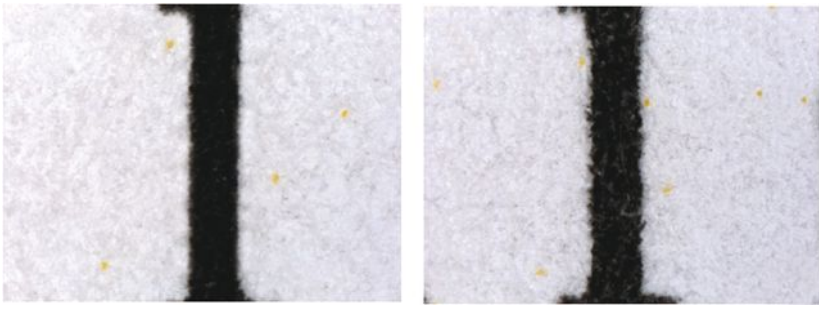
Paper curl also is caused by the paper being exposed to moisture, though it doesn't just affect an area of the sheet like paper cockle. Curl affects the overall structure of the sheet. It happens when large areas of the sheet become too wet. When wood fibers are saturated and dried too quickly, the whole sheet can curl up horizontally and vertically.

Paper cockle and curl not only impact the look of the finished piece but can cause costly post-processing issues if the sheet can no longer run smoothly through finishing equipment.

## Ink wicking

Ink wicking or **bleed** refers to the actual movement of ink when in contact with the paper. When ink wicks, it follows the surface fibers of the paper, creating a fuzzy appearance called **feathering**. Wicking happens vertically and horizontally on the paper surface and will cause printed text, lines, and images to lose their sharpness.

**Examples of ink wicking**



Inkjet treated — 5 µ/pixel

Untreated — 5 µ/pixel



## Ink dive

**Diving** is a lot like ink wicking, but instead of spreading horizontally and vertically on the paper surface, the ink dives down into the paper. Ink dive is caused by rapid ink absorption and can result in structural and print quality defects. When the ink dives, it is drawn into the paper's internal fiber structure, causing paper cockle, show-through, and/or mottling.

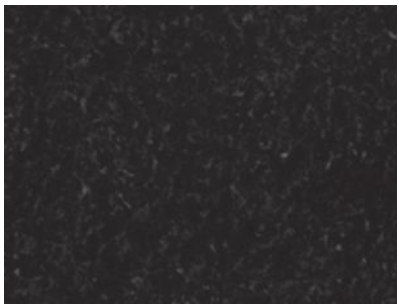
## Mottle

Mottling happens when ink wicking and ink dive combine, causing irregular ink absorption that can be seen on the paper surface. When ink colorant is absorbed at different rates into the paper, it can cause a blotchy or streaky look, as seen in the right-hand image on the next page.

This effect is mostly seen in solids and image midtones. The structure of some uncoated papers is predisposed to mottle because the paper structure does not have a good formation for aqueous inkjet inks.



**100% K printed on inkjet treated paper magnified at 5 um/pixel**



**100% K printed on inkjet untreated paper magnified at 5 um/pixel**



There are many formulations of inkjet ink as well as types of substrates. Finding the optimal combination to deliver the level of quality appropriate for a particular type of job at an acceptable market price is the challenge for every service provider who has adopted inkjet to serve their customers. As designers, it is important to understand the interaction of these ink and paper combinations to create cost-effective, high-quality prints.

**When a design calls for more ink than the intended paper can handle, ugly things can happen such as: cockle, curl, ink wicking, ink dive, and mottle.**

To further that goal, next we will talk about how to evaluate paper and other media to avoid these structural and printed defects and deliver the result you envision.

CHAPTER 6

# STARTING WITH SUBSTRATES



STARTING WITH SUBSTRATES

# MEDIA IS YOUR CANVAS

The media you select for your project provides the foundation for everything you do in print design, and we want you to have a solid foundation. Not all substrates, or even all papers, are compatible with all inkjet printing processes and—as we discussed in the previous chapter—even if they are compatible, there are many factors that can impact the final result.

6



In this chapter, we will focus specifically on that most popular of substrates: paper. We will discuss how to evaluate paper and how to plan for the interaction of ink and other processing steps on your chosen fiber-based building block. First, we'll talk about characteristics that apply to all papers, and then about the specifics of papers that are formulated for inkjet as compared to offset grades. Some earlier generation inkjet devices still require the use of inkjet-compatible paper to produce quality output, while others simply perform better on papers formulated for inkjet. In the next chapter, we will open your eyes to the wide range of other media, beyond paper, now available for inkjet projects.

## THE BIG PICTURE

Your paper choices should take into consideration the quality expectations and finishing requirements particular to the market for which you are designing. When choosing paper, it is good to understand relevant market expectations, such as:

- Print quality
- Color fidelity
- Color matching requirements
- Finish and feel
- Finishing requirements
- Mailing requirements
- Paper cost

More often than not, paper price is the first consideration used to limit your range of choices. However, choosing the lowest cost option before reviewing the impact on print expectations can cause unintended consequences. It is always best to request printed samples from your print provider and discuss print and color expectations with your paper buyer before finalizing your design. The architect and the builder both have a role to play in laying the foundation of your design project.



## PAPER CHARACTERISTICS TO CONSIDER

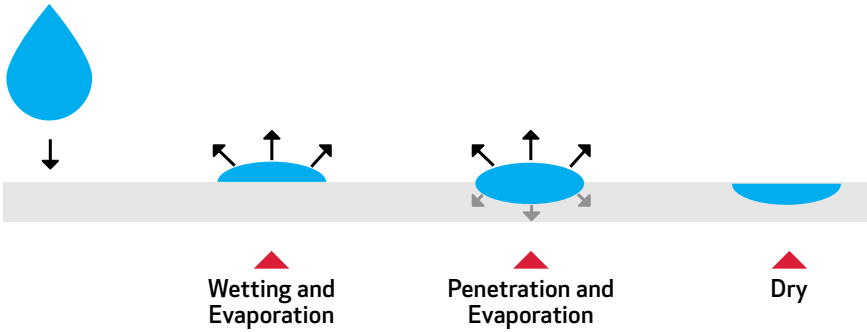
There are a surprising number of features that affect the performance of paper in production and many technical terms to describe them. If you want to have clear communication about your paper choices, you need to be able to describe the features you want and understand the relevant specifications given to you.

Porosity, opacity, brightness, and shade/whiteness are the first of the important properties to understand. These paper characteristics, together and separately, impact your perception of images and text.

## Porosity

Porosity measures the ability of the sheet to accept ink or water. Porosity is inkjet's friend, but it is a friend that must be closely managed. Inkjet papers need some way to allow the ink carrier to absorb into the sheet when separated from the colorant. Remember those amazing drops we talked about in the last chapter? Without absorption, the beautifully formed and aimed drops would just roll off the sheet. It's like putting a drop of water on a piece of glass: the water has nowhere to go. You will get the same effect and make an even bigger mess if you try to use standard offset coated paper, which has no porosity, in an inkjet press that does not have a compatible ink set.






Paper makers usually measure paper porosity by using a Gurley Densometer Test. Gurley measurements determine the time required for a volume of air to leak through a defined area of the paper. The longer it takes a set volume of air to flow through the sheet, the more tightly sealed the sheet. A sealed sheet, such as an offset coated paper, would be at the far end of the scale from a very porous sheet, such as an offset uncoated sheet. A typical Gurley porosity result for an uncoated offset paper would be 10–20 seconds, whereas the result for a coated paper formulated specifically for inkjet can be up to 60 seconds. In that example, it takes air three to six times longer to flow through the inkjet coated paper than to flow through the more porous uncoated offset paper. If you're thinking that since a less porous sheet traps more air, it will also trap more colorant—you are right.

Porosity affects color and overall print quality based on how, how much, and how consistently ink can penetrate the paper. The color of an image printed on uncoated stock changes as it dries. This color transformation is referred to as dry-back. Uncoated stocks tend to dry back more than stocks formulated for inkjet.

Sometimes porosity can affect the color on only one side of the sheet depending on how the paper is manufactured at the mill. Some paper mills use machines that have a wire side and a felt side. This causes the paper fibers to create a different pattern on each side during the forming process. The difference in patterns causes each side of the paper to absorb ink and dry at different rates. This can cause the printed color hue and density to differ from one side of the sheet to the other. This effect is called two-sidedness. If you are printing on two sides of a sheet, make sure to test both sides of the sheet or you might be in for a surprise. If you are only printing on one side of a sheet, are you getting its best side?



### Why should you care?

Porosity affects print quality. The ability of ink to penetrate the paper will affect color and print quality. Uncoated stocks tend to **dry-back** more than inkjet-treated and coated stocks, meaning the color appearance of the image changes as it dries over time. Porosity can sometimes affect the color on only one side of the sheet. Some paper mills produce their offset grades using paper machines that have a **wire side** and a **felt side**. This causes the paper fibers to create a different pattern on each side during the forming process. The different patterns cause each side to absorb and dry at different rates. When that happens, the printed color hue and density could look different from one side of the sheet to the other. This effect is called two-sidedness. If you are printing on two sides of a sheet, make sure to test both sides of the sheet, or you might be in for a surprise.

## Smoothness/roughness

You can touch a piece of paper and estimate how flat and even its surface is. But there are also a variety of technical measures of the smoothness (or its opposite, roughness). The common reference is the Sheffield test, which assigns a number to the roughness of the paper. A higher number means a rougher texture and a lower number indicates less roughness, or greater smoothness. A very smooth, coated paper might have a measure of 10–25, while an uncoated offset grade might have a measure of 250 or higher depending on the manufacturing process and the types of fibers (wood, eucalyptus, hemp, etc.) used to produce the paper.

The calendering process in paper manufacturing can produce a very smooth sheet with a coated feel. During the calendering process, the sheet is passed through multiple pairs of heated rollers (calenders). The more paper is calendered, the smoother and glossier the finish. The finish also is managed with various types of coatings or pretreatments. (See more on surface treatment later in this chapter.)



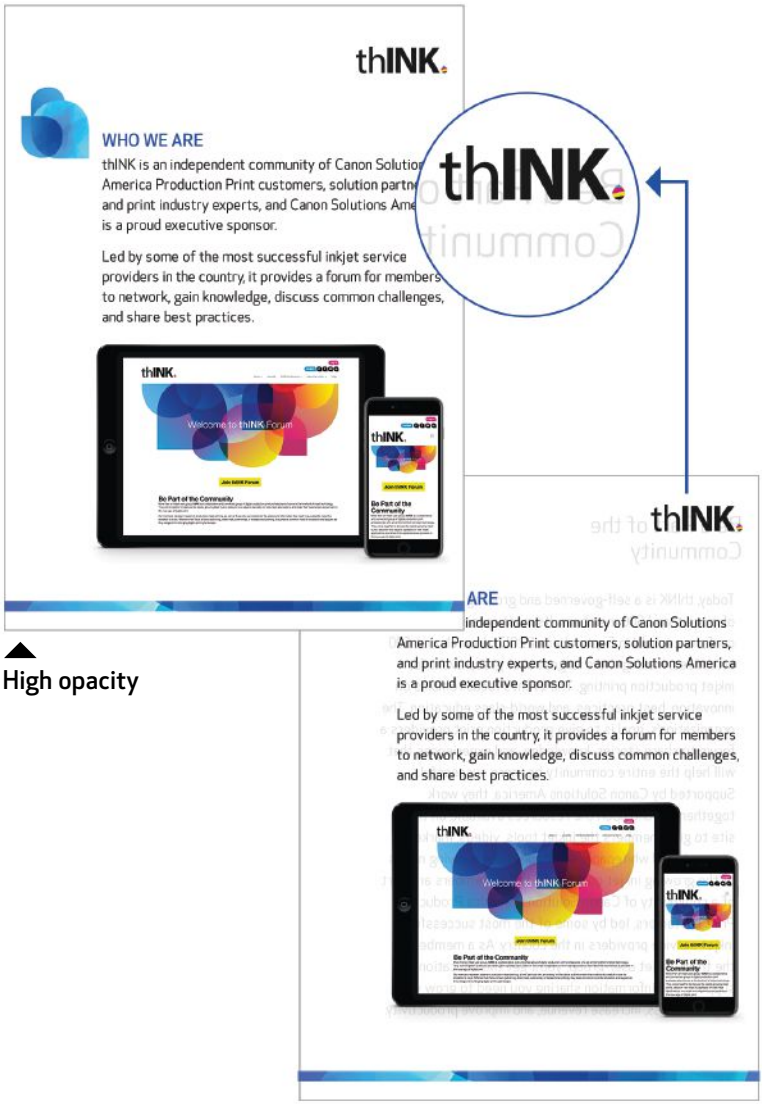
Why is managing smoothness so important? Smoothness is the cousin of porosity. A smoother sheet provides a more consistent base for the drops of ink, but it also has to be managed to ensure that there is some level of porosity. A very rough sheet is likely to be very porous, but there may not be a smooth enough finish to allow the drops to form into those consistent and well-formed dots needed to deliver crisp print and to prevent all the color from diving into the sheet.

## Opacity

Another important characteristic of paper is how it obstructs light and reduces show-through. Anything that doesn't let the light through is called opaque, but there are many levels of opacity. Paper opacity is measured as a percentage of light that cannot pass through the sheet. Therefore, 98 percent opacity means 98 percent of light cannot pass through the sheet and is absorbed by, or reflected from, the paper surface.

If a paper has a low opacity, that means the paper is more transparent. Opacity, or lack of it, is an important factor in text-heavy print markets such

as books, statements, and bills. If paper has a "see through" level of opacity, the text on one side of the sheet can be seen from the other. This text show-through can make both sides more difficult to read. High opacity will prevent show-through and becomes increasingly important when applications include graphics or large solid areas in addition to text.




High opacity

Low opacity

### Why should you care?

Opacity affects print quality, particularly when printing on both sides of the sheet. Good opacity will prevent show-through and becomes increasingly important when applications include graphics or large solid areas in addition to text. Remember, the higher the number, the better the paper opacity.

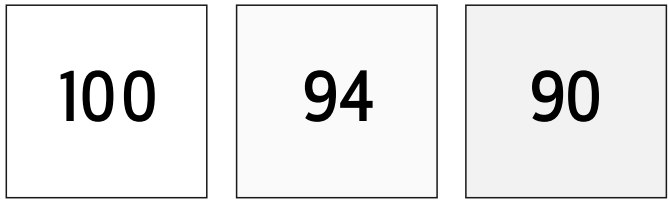
A paper's opacity also can affect the amount of ink that can be applied. In order to prevent show-through, ink levels may have to be reduced. But cutting back the volume of ink also can cut back on color, leaving your prints looking washed out and dull. It's important to talk to your paper supplier and understand the impact opacity will have on your final printed piece. Remember, the higher the number, the better the paper opacity.

6

## Brightness

While opacity refers to light passing through a paper, brightness represents the amount of light at the blue end of the spectrum reflected from the surface of the paper.

There are different industry measures for brightness. It is traditionally measured on a dull-to-bright scale of 0 to 100, but with the use of optical brightening agents (OBAs), paper manufacturers can now achieve a brightness value above 100. OBAs improve a paper's brightness and can make it appear  whiter. On very bright sheets, there is more visible blue light reflected from the surface of the paper, creating a measurement over 100. You can bet if the brightness value is over 100, the paper contains OBAs.



Think of the wattage/brightness of a light bulb — light colors in an image can appear washed out on the whitest papers.

Brightness affects how we perceive ink color on the sheet. The same ink printed on a dull (less bright) sheet will produce colors that appear dulled as compared to the same ink printed on a brighter sheet. Brightness is sometimes confused with whiteness, but they are distinct measures.

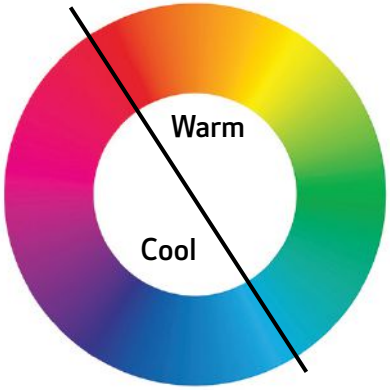
## Whiteness/Shade

Measures of brightness only consider blue light and other short wavelengths, such as UV. Whiteness and shade take into account all wavelengths of light. The extent to which a paper reflects light of all wavelengths throughout the visible spectrum is measured as whiteness. but is more commonly referred to as paper shade.



Although there are many shades of paper, there are three varieties that work best for high-speed inkjet: true white, cream white, and blue-white.

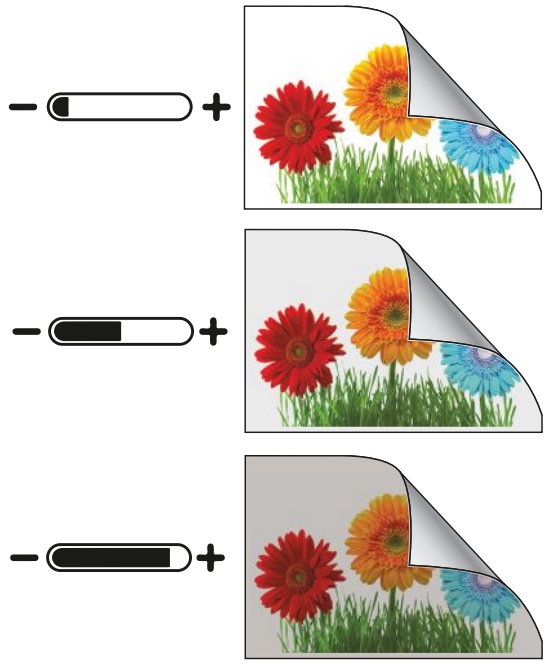
- A true white or "neutral" paper shade reflects the total color spectrum equally.
- A cream white shade absorbs the blues and cooler colors and usually will have a yellowish tint.
- A blue-white shade absorbs the warmer colors and reflects more blues and other cooler colors.



Have you ever noticed some sheets look more blue than others? Many papers are designed to be a blue-white shade to make the sheet appear both brighter and whiter.

The shade/whiteness of the paper is often referred to as the fifth color in a four-color inkjet system. That's because with inkjet, the color of the paper shows through the ink to some degree, depending on the level of ink coverage in your design. And, as you know, how we perceive any color is relative to the colors around it as well as the level and color of the lighting conditions under which it is viewed. The shade of the paper surrounds every color that is printed on it, changing how ink color is perceived.

Whiteness also affects the perception of ink contrast. Using whiter papers can improve contrast for darker images and show more vibrant colors. But beware of unintended consequences when using very bright white sheets, such as photographic images looking lighter or making warmer colors in the gamut (red, orange, yellow, and light green) more difficult to reproduce. A paper shade of "true white" will enable a color balance that makes colored logos, graphics, and photographs easier to reproduce.



All of these characteristics—porosity, smoothness, opacity, brightness, and whiteness—work together to affect the amount of ink that can be used, how much color will come from the ink, and how much color will come from the sheet. Another key factor in determining how much ink coverage your design can handle is the paper basis weight.

## Basis weight

You may think about paper in terms of thick or thin, but basis weight and paper thickness are two different measures. A mill's manufacturing process can take the same "weight" of material and compress it into a thicker or thinner paper. Let's start with the weight.

Basis weight is a confusing term, because a paper's basis weight is determined by dividing the weight of a ream (500 sheets) by the standard sheet size (area) of that type of paper. However, as you can see from the illustration below, the sheet sizes for different types of paper are vastly different. Dividing the same weight by a different physical size will yield a very different basis weight.

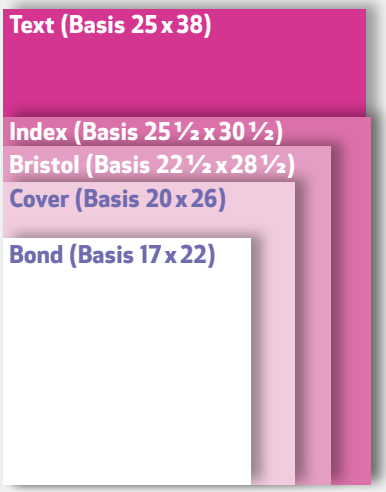
Because the starting base size is not the same between paper types, the basis weights do not correspond directly: 60# Text is much lighter than 60# Cover. This makes the basis weights of different categories of paper difficult to compare.



In addition to selecting a paper weight for the general feel of the design or target mailing weight, the paper basis weight you choose for your job is crucial to the color, image, and finishing quality. The basis weight also has

### Paper types are categorized by their base size in the U.S.

Base sizes are used to calculate a paper's basis weight. The basis weight equals the ream (500 sheet) weight of the base size, hence the term basis weight. Because the starting base size is not the same between paper types, the basis weights do not correspond directly (60# Text is much lighter than 60# Cover).



an impact on opacity, with higher weight paper increasing the opacity of the sheet. Sometimes a lower basis weight is chosen to cut costs, since lower paper basis weights can be less expensive and reduce mailing costs. But if the paper weight selected is too low for the intended level of saturation or color coverage, problems such as show-through, paper mottle, cockle, and curl—as well as web breaks and finishing issues—may occur. Remember, ink is mostly water, and you know what happens to paper when it gets too wet! Also, very light papers (below a 20# Text) can actually be more expensive than their heavier kin, but the trade-off is in the finished weight for shipping or mailing.

Mills refer to paper weight differently than paper suppliers and printers. From a designer's point of view, referring to and understanding grams per square meter (gsm) makes the most sense, as gsm refers to the actual weight of the sheet. Other terms may be used based on the segment you are designing for—such as transactional print, direct mail, commercial, books, packaging, etc.—but gsm is a standard term for basis weight that will apply across all segments. Now let's talk about how to avoid confusion when discussing paper thickness.



## Measuring thickness with precision

The thickness, or caliper, of a sheet is very important for any printed products requiring binding. In the case of books, paper thickness is usually referenced as PPI, which stands for pages per inch. PPI measures how many pages can fit within the cover that has been sized for a particular book.

PPI and gsm will correlate—with a higher gsm generally yielding a thicker paper—but gsm is neither dependable nor precise enough to use as a measure of caliper. Basis weight and thickness are two different measures and two completely different discussions to have with your printer. Most important for book block production is PPI, but this can be confusing because designers typically order paper for a book body based on text



Paper used for continuous inkjet can measure different thicknesses across the web. Measure three times on each side of the web and take an average.

weight. A 60# offset text paper should be 90.3 gsm, but it might actually be 89 or 91 gsm. Rounding is common when talking about text or tag or cover weight, but rounding is not acceptable when it comes to PPI. Without exact measurements, the finished book body won't fit inside the cover. To control your book block thickness and maintain compatibility with preprinted covers and final trim size, you will need to specify the PPI first and look for the gsm or text weight that conforms to the PPI.



In general, the higher the gsm of a paper, the thicker the paper will be and the more it will weigh, since gsm is a measure of weight. However, you can find papers with the same PPI that do not have the same gsm. Some papers are "fluffier" than others, giving them thickness without added weight. Said another way, papers with the same thickness may not have the same weight. Sometimes you may want to seek out a paper that feels thick but weighs less (for mailing purposes) or a dense, strong, heavy sheet that still delivers thinner caliper (higher PPI) to fit within your target binding.

It is very important to understand the impact gsm and PPI will have on design for different markets. Each application segment has very different needs and cost structures. As we discussed earlier, books require a carefully calibrated PPI for finishing control. Statements and other mailed documents require lower gsm to keep postage costs down while remaining within an acceptable PPI range. Direct mail such as postcards and self-mailers require higher gsm and PPI for successful fulfillment and processing through postal sorting equipment. It's all relative.

## Basis weight comparison

| # | Offset Text # | Cover # | Tag # | Index | Points | Caliper (inches) | Milli-meters | Metrics (gsm) |
|---|---|---|---|---|---|---|---|---|
| 12 | 30 | 18 | 22 | 20 | 2.4 | 0.0024 | 0.060 | 40.30 |
| 14 | 35 | 20 | 28 | 26 | 2.8 | 0.0028 | 0.071 | 50.15 |
| 16 | 40 | 22 | 37 | 33 | 3.2 | 0.0032 | 0.081 | 60.20 |
| 18 | 45 | 24 | 41 | 37 | 3.6 | 0.0036 | 0.092 | 67.72 |
| 20 | 50 | 28 | 46 | 42 | 3.8 | 0.0038 | 0.097 | 75.20 |
| 24 | 60 | 33 | 56 | 50 | 4.8 | 0.0048 | 0.120 | 90.30 |
| 28 | 70 | 29 | 64 | 58 | 5.8 | 0.0058 | 0.147 | 105.35 |
| 29 | 73 | 40 | 62 | 60 | 6.0 | 0.0060 | 0.152 | 109.11 |
| 31 | 81 | 45 | 73 | 66 | 6.1 | 0.0061 | 0.155 | 116.63 |
| 35 | 90 | 48 | 80 | 74 | 6.2 | 0.0062 | 0.157 | 131.68 |
| 36 | 90 | 50 | 82 | 75 | 6.8 | 0.0068 | 0.173 | 135.45 |
| 39 | 100 | 54 | 90 | 81 | 7.2 | 0.0072 | 0.183 | 146.73 |
| 40 | 100 | 56 | 93 | 83 | 7.3 | 0.0073 | 0.185 | 150.50 |
| 43 | 110 | 60 | 100 | 90 | 7.4 | 0.0074 | 0.188 | 161.78 |
| 44 | 110 | 61 | 102 | 92 | 7.6 | 0.0076 | 0.193 | 165.55 |
| 47 | 120 | 65 | 108 | 97 | 8.0 | 0.0078 | 0.198 | 176.83 |
| 53 | 135 | 74 | 122 | 110 | 9.0 | 0.0085 | 0.216 | 199.41 |
| 54 | 137 | 75 | 125 | 130 | 9.0 | 0.0090 | 0.229 | 203.17 |
| 58 | 146 | 80 | 134 | 120 | 9.5 | 0.0092 | 0.234 | 218.22 |
| 65 | 165 | 90 | 150 | 135 | 10.0 | 0.0095 | 0.241 | 244.56 |
| 67 | 170 | 93 | 156 | 140 | 10.5 | 0.0100 | 0.250 | 252.08 |
| 72 | 183 | 100 | 166 | 150 | 11.0 | 0.0110 | 0.289 | 270.90 |
| 76 | 192 | 105 | 175 | 158 | 13.0 | 0.0130 | 0.330 | 285.95 |
| 82 | 208 | 114 | 189 | 170 | 14.0 | 0.0140 | 0.356 | 308.52 |
| 87 | 220 | 120 | 200 | 180 | 15.0 | 0.0150 | 0.380 | 312.00 |
| 105 | 267 | 146 | 200 | 220 | 18.0 | 0.0175 | 0.445 | 385.06 |

*Paper specs are for example only and can change per manufacturing mill.

### Clarifying paper terms

For various stocks, the same paper "weight" in a roll or sheet can be called by different names, as well as different numbers. And, when we use the symbol # we mean pound, not hashtag! Common copy paper is normally referred to as 20# Bond, but when sold for different print markets, it can be referred to as 50# Text, 28# Cover, 46# Tag, and 42# Index. Wow, talk about an identity crisis! The chart on the previous page shows the different names used for each paper weight as well as the gsm equivalent.

**Stocks of the same paper grade and weight can be identified by different names as well as numbers.**



## PAPER COMPATIBILITY

Now that you have a common language for talking about the characteristics of the paper you need for your project, we can look at how those characteristics describe the main types of papers used for the target applications covered in this book.

At the highest level, there are papers that are formulated specifically for inkjet and offset grade, and papers that are not. While inkjet development has moved away from requiring special paper, some aqueous inkjet devices still require their use, and some simply perform better on papers formulated for inkjet. The new generation of inkjet presses supports printing on a broader range of media, including uncoated and even many coated offset-grade stocks.

Remember when we talked about controlling the porosity and smoothness of the media using coatings? Sometimes that coating is applied at the paper mill to create an inkjet formulated sheet, and sometimes it is applied by the press as a primer or pretreatment during the printing process. However applied, this is one of the ways the surface of the paper can be

optimized to receive those tiny drops of ink and control how they spread, absorb, dry, and leave color on the surface of the paper.

Pretreatment is not the only way to do this. We talked about how pressing, or calendering, paper improves the smoothness and finish of the sheet. However, some inkjet presses are less reliant on the smoothness and porosity of the sheet for compatibility. Using UV curable inks or specially formulated aqueous inks that are more viscous and highly pigmented, some devices are able to achieve more "stick" on a broader array of media.

Just because an inkjet device can print on a particular paper does not mean that it will deliver its best results on that media. It also won't produce the same result as toner or offset presses would on that media. Regardless of ink chemistry or pretreatment, the inkjet process is completely different from other printing processes so results are never identical. For some of the new generation of inkjet presses, print quality can be measurably better than offset in terms of the number and vibrancy of colors reproduced, as well as text and image quality on compatible media.



### Before selecting your media

Talk to your print provider about which types of paper are qualified for the inkjet device you will be using.

- What are your choices for uncoated, inkjet treated, inkjet coated, or offset coated?
- Are they compatible with the inkjet press you will be using?
- Is pretreatment applied during print production?

It is always important to understand the type of inkjet system your print provider uses before selecting your paper.

***It is particularly important if selecting a paper that is not formulated for inkjet.***

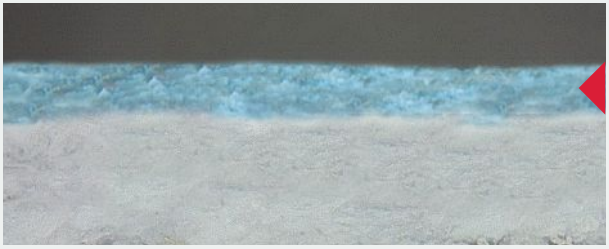
## Uncoated (offset) paper

As you might guess, uncoated means there is no surface treatment applied to the paper during manufacturing. Uncoated paper is more absorbent than the other paper types. Since there is no coating or treatment, there is nothing to help keep the colorant on the top of the sheet. The printable surface is less smooth and more porous than inkjet coated paper. This allows more ink to penetrate the paper, which can lower sharpness and lessen the color reflection. Bottom line: when using aqueous inkjet, uncoated paper delivers printed images that can be duller and a smaller color gamut than on other papers. Most offset or bond papers you may be familiar with are uncoated.

**Uncoated offset stocks are commonly used in the transactional and book printing markets where low paper costs are required.**



Scanning Electron Microscopy (SEM) cross section scan of **uncoated** paper printed with aqueous pigment ink.



**Picture A**
Uncoated allows colorant to flow deeper into the paper fibers.

As discussed, some inkjet processes apply a precoating or primer to the sheet prior to ink jetting to increase the print and color quality on offset grades. Picture C on page 112 provides a closer look at how this process works. The chemistry of pretreatment fluids slows the migration of aqueous ink colorant into the sheet, increasing color fidelity.

Uncoated offset stocks are most commonly used in the transactional and book printing markets where low paper costs are required but high print quality and color are not.

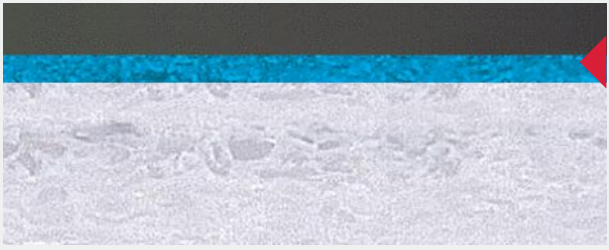
## Offset coated paper

Offset coated papers are the polar opposite of uncoated papers in terms of porosity and their challenges to the inkjet process. On offset coated stocks, a sealed, water-resistant surface is created by applying multiple layers of coating after the sheet is completely formed and off the paper machine. The resulting sheet has very low porosity and therefore low absorption. Rather than preventing the color from diving into the paper or failing to dry—as with uncoated offset—the challenge with offset coated grades is getting the ink to stay on the paper at all.

This is because the coating used on offset paper was developed to be compatible with conventional offset processes, not with inkjet. Offset presses use an ink and water balance process where excess water from dampening systems is either absorbed by the ink or returned to the dampener's water reservoir through a "squeegee" effect. Aqueous inks are made of water and need to shed water rather than absorb more. They also don't have the benefit of pressure from rollers to squish the excess water out. So, the coating designed for offset can be a real challenge for aqueous inkjet. Picture B below demonstrates how differently the ink reacts with a coated, non-porous surface than with an uncoated, porous one.



**Scanning Electron Microscopy (SEM) cross section scan of offset coated paper printed with aqueous pigment ink.**



**Picture B**
A low-porous offset coating layer with slow drying properties keeps colorant on top of paper surface.

Because the majority of printed pages are still produced on offset presses, offset papers are more widely used and available. That makes the ability to use them on inkjet presses very valuable. Many print organizations have both offset and inkjet equipment and want to use the same paper on

both to control costs and simplify inventory management. That's why overcoming the compatibility challenges inherent to offset coated stocks was a major focus of recent inkjet development.

**Offset papers are more widely used and available, making compatibility to both offset and inkjet important.**

Several options have been introduced to enable aqueous inkjet devices to use offset coated stocks: priming solutions, spot coating, and high-density pigment inks. (UV inkjet was already compatible with offset papers.)

Offset coated papers, when used under the right conditions, can provide direct mail and commercial markets a paper option with high print quality, color fidelity, and color matching that is comparable to the quality of inkjet coated papers at a lower cost.



## Inkjet treated

Inkjet treated papers may look like uncoated paper to the naked eye but are specially formulated for aqueous ink. They have surface treatments or coatings that contain fixatives to separate the colorants from their carrier liquid. This separation allows more colorant to stay near the paper surface while allowing the carrier to migrate into the body of the paper and then evaporate. The paper is still able to absorb liquid, but the porosity is reduced enough that the colorant does not absorb along with the liquid.

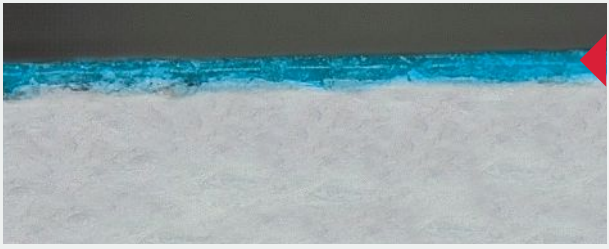
Inkjet presses may deliver a better result in terms of clarity and color gamut with less ink. Your print provider cares about using less ink because ink is costly. You may care about using less ink to deliver color quality, because it means that you can have lots of color without the potential for heavy ink saturation to gum up the works downstream in the process.



Inkjet-treated papers contain a silica additive to the paper chemistry, trapping the pigment flake, keeping it higher on the paper surface.

On the other hand, when using inkjet treated paper, some devices produce less dot gain or ink spread. Since the area of the dot is smaller, the combination of device and paper may require more ink to create the same visual coverage for solids on an inkjet treated paper than on uncoated paper. Once again, testing papers for your specific needs is important.

**Scanning Electron Microscopy (SEM) cross section scan of inkjet treated paper printed with aqueous pigment ink.**



**Picture C**
Treatment of surface and paper fibers traps colorant closer to the paper surface.

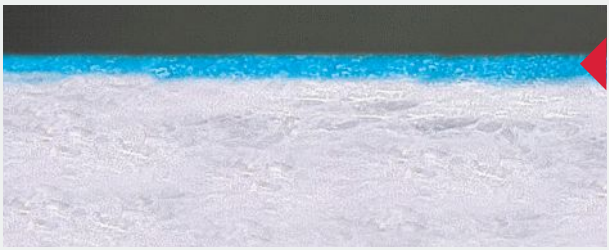


Treated stocks cost more than their uncoated offset equivalent and are generally used when an uncoated sheet cannot deliver the necessary color fidelity and print quality requirements. While uncoated may be fine for letter mail and customer communications with black only or very limited color, other projects will benefit from inkjet treated stocks. Such markets include full-color direct mail; educational books; and any customer communications with an emphasis on colored charts, graphics, logos, or brand colors.

## Inkjet coated

Inkjet coated paper is available in a variety of surface finishes that can be very shiny (high gloss) or have a low shine (matte), but all are formulated for inkjet inks. Shiny inkjet papers sometimes look like traditional offset coated paper grades, but they are very different. The coating of all inkjet formulated papers is designed for the fast drying of aqueous inks. Fast drying surfaces restrict the amount of ink that can be absorbed by the paper, keeping more ink colorant on the surface. Inkjet coated stocks have a very fast drying surface that results in a broader color gamut than either uncoated or inkjet treated papers.

Scanning Electron Microscopy (SEM) cross section scan of **inkjet coated** paper printed with aqueous pigment ink.



**Picture D**
A semi-porous coating layer quickly binds colorant on paper surface.

Inkjet coated paper is usually more resistant to dirt, moisture, and wear as well. The additional coating and calendering needed to create a smooth surface also make this type of paper more expensive.

Due to the additional expense, inkjet coated papers are used when both the highest print quality and color fidelity are required (and other compatibility enabled options such as pretreatment are not available). These papers are manufactured for their high colorant compatibility and fast drying time, which help improve print quality and color reproduction. Even when their presses are compatible with offset grades, some print providers elect to use inkjet formulated grades due to the consistent surface quality. Inkjet coated papers are most often used for high-end direct mail and commercial marketing collateral.



Before you design, request printed samples using each inkjet-qualified paper that your provider has available.

## Important subcategory: highly calendered inkjet treated

There is also a subcategory within the inkjet treated family of papers called highly calendered inkjet treated paper. Technically, it is an inkjet treated stock, but it behaves much like an inkjet coated stock. The calendering process applies alternating steel- and fiber-covered rollers at high speed after the paper is formed. The paper is moved through the rollers, creating

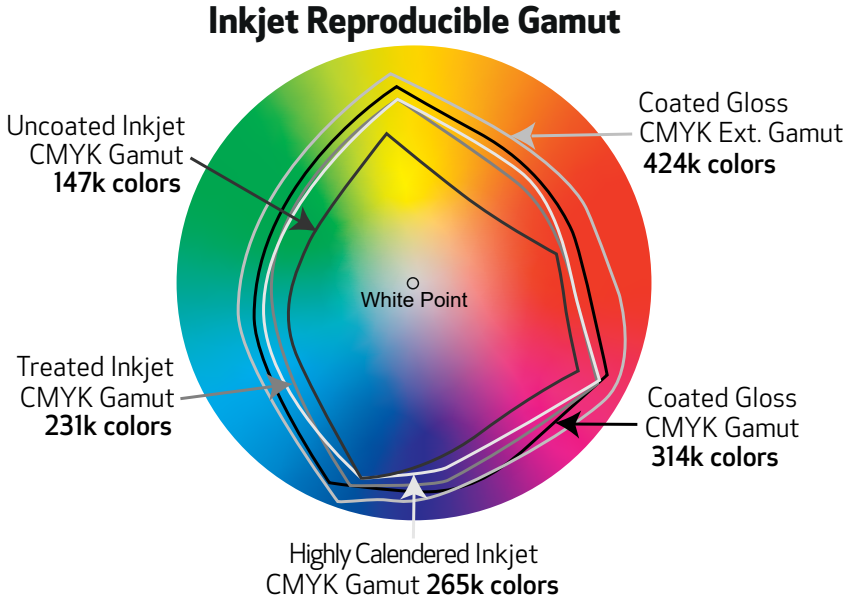
a highly compressed paper with a smooth matte or silk surface. The more calendering that is applied, the greater the effects of the process. These papers are sometimes called coated feel papers.

As a treated sheet, it has the formulation to keep the pigment higher on the surface. Plus, the surface of the paper has been smoothed and compressed to form a tighter sheet. The resulting paper surface is less fibrous, resulting in a slick, smooth surface with a tighter base and reduced porosity.

Highly calendered treated stocks have been developed to fill the print quality and color performance gap between inkjet treated papers and the much higher priced inkjet coated grades. Mills may refer to these stocks as super smooth or silk. Markets such as high-end color books, direct mail, and some commercial printing will turn to this paper option to meet demanding print quality needs at a lower cost than inkjet coated.

For each of the paper types discussed, there are trade-offs between a better surface, larger color gamut, ability to work across devices, and cost.






*Reproducible colors averaged across various mill grades
Printed with aqueous pigment inks

There is also the variable of using a lower cost paper plus the cost of additional fluid to enable the process. The example below shows how color quality can increase with different papers. Understanding these trade-offs will help you communicate more effectively with your print buyer or printing partner when choosing one paper over the other.

Don't be "penny-wise and # foolish." Your paper choice is certain to affect your creative design and print expectations. If any portion of your project will be printed using an inkjet press, evaluate your paper options before the creative process begins, always request a printed reference chart, and consider the impact of paper characteristics throughout the design process.



## BE READY TO EXPERIMENT

Many variables have come together over the past few years that affect the paper choices available to you. On the one hand, the new generation of inkjet presses is compatible with more types of paper. On the other, this change has shrunk the market for inkjet formulated paper grades, and fewer mills are producing them.

Even if you followed best practices and requested samples from your print provider in the past, swatch books from even a few months ago could be out of date. Even if a paper is still being produced, limited inventories may mean that a particular paper is not available when you need it.

When communicating with your provider about the paper you want for a job, you can certainly reference a particular paper, but it is also a good idea to describe what you like about that paper to make it easier to find suitable substitutes quickly. Keep in mind that it will be much more useful if you describe the paper in terms of the measurable characteristics discussed in this chapter rather than saying "I love the color and feel. It's so nice and heavy." Communicate your requirements as basis weight, thickness, opacity, brightness, and whiteness or shade as well as the desired finish: gloss, silk, matte, etc.

CHAPTER 7

# BEYOND PAPER



BEYOND PAPER

# SO MUCH MORE TO PRINT ON

Technical advances have brought printing on almost any paper within reach of designers seeking the benefits of inkjet, but the progress doesn't end at the tree line. While we won't get into all the inkjet compatible materials available for packaging and industrial applications—like glass, wood, ceramic, corrugated cardboard, and such—there is still a whole world of options for you to consider beyond paper.

Because we aren't just talking about paper, we will refer to the base material that you print on as the substrate. Printing on substrates other than paper has a range of benefits, from adding impact to your design to adding durability to the finished piece, simplifying the production process, and lowering your costs. Let's talk a bit about why you might want to move beyond paper, and then we'll look at specific materials and questions to ask when evaluating your options.

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## Adding impact

Textured and synthetic media can create a "touchy-feely" layer to your design that makes it memorable, otherwise known as "haptic feedback." Texture also can add visual depth to the graphic design. While visual texture can be simulated through rich, layered graphics, physical texture only happens on the printed piece. Haptic print experiences have a physical impact that traditional flat materials can't match. When the reader can



Mixing substrates and textures within the same project conveys a message beyond words.

actually feel the dimensions and textures of the printed material, they are more likely to pay attention and receive the message you are trying to deliver.

The actual "feel" of a design is closely tied to the perception of quality, such as the roughness or smoothness of paper discussed in the previous chapter. For example, embossed business cards are usually considered to be of higher quality than unembellished cards. Texture also can be used to bolster the impact of a printed graphic. In addition to the texture built into certain substrates, we also will talk about adding variable texture in Chapter 8.



**Printed embellishments for haptic effects**

Beyond texture, varying the substrate can add dimension to your design. For example, transparent media can create an overlay effect, bringing depth to the design. Using multiple substrates in the same design can bring tactile and dimensional qualities together. This is easier to do with certain sheet-fed presses that allow two or more substrates to be used seamlessly in the same process. You may also want to add a specific capability to your finished piece that makes it a "saver," like adhesive or even magnetic media, to earn your promotional or reference design space on the front of the refrigerator.

### Adding durability and simplifying production

Projects like menus, display graphics, and direct mail can benefit from the extra layer of durability offered by synthetic media. Synthetic materials such as Teslin® are more resistant to water damage and tearing than paper. Material with a higher level of rigidity also can provide a stronger structure for mailed pieces or designs that need to stand up to heavy handling. These substrates might be used alone for applications such as menus, signage, or ID badges, or in addition to paper for direct mail or books.

Sometimes paper and synthetic media are combined to form specialty media that saves a step in the production process. If you can start with print-ready ID cards, tab separators, or pressure-seal mailers, you can avoid paying for a separate finishing step, which can save both money and time.

## WHAT CAN YOU PRINT ON?

The ability to use many of the materials we talk about in this chapter will vary by printer, intended use, and the need to combine with other materials or post processing. General categories of substrates include:

- Plastic and synthetic media
- Magnetic media
- Pressure-sensitive and specialty/integrated substrates

Plastic substrates you may have heard of include PET (polyethylene terephthalate) and PVC (polyvinyl chloride), as well as RPET, which is the recycled version of PET. These are all clear plastics that allow you to print on the reverse or interior of the material so the printed surface is completely protected by the exterior of the material. If considering this type of design, note that recycled PET (RPET) typically has less clarity than regular PET. These substrates are available in many weights (or gauges when referring to plastics), offering varying levels of rigidity.

One downside to working with clear plastics is that they can require much higher coverage to achieve opacity. They also need to be dried with care to avoid heat distortion and may not be compatible with post processes that apply heat or pressure to the surface.

Widely used synthetic papers include PPG Industries' Teslin and Dupont Tyvek®, both of which are notable for their ability to make printed designs almost impervious to abrasion and tearing. Unlike plastics, which are non-porous, these synthetics are engineered to absorb and lock color into the material. Their durability, scratch resistance, and colorfastness make them suitable for indoor, outdoor, and heavy-duty applications. They can even be wiped clean after use, which is great for menus and point-of-sale materials, particularly those used in outdoor locations.

Less well- known for print production is leatherette, which offers the grain and texture of lizard, crocodile, or other animal skins in fully vegan form. It may be available in white or other, more natural, colors. When considering leatherette as an option, keep in mind that tight patterns will be easier to work with than large, open patterns when reproducing text or graphics. The more open, deep, and differentiated the pattern, the more difficult it will be to achieve consistent ink laydown and image reproduction. Leatherette is an interesting option for book covers and promotional items.

Magnetic paper is a laminate of paper and magnetic sheeting. You can use this material for applications such as promotional magnets or magnetic display graphics. While this material can be printed with inkjet, handling it is very difficult without the proper process. Think about it—magnets stick to metal and other magnets. So, a stack of magnetized paper will stick together. In a sheet-fed environment, magnetized sheets will not automatically feed if they are all clumped together. This issue can be overcome by magnetizing these specially formulated papers as a post process after printing and prior to finishing steps like die-cutting. Once magnetized, the cut material will then stick together, limiting further automated handling. On a roll-fed press, the magnetic paper may be too thick to wind and unwind properly.

Before considering magnetic paper, make sure that you understand the full path it will travel. You are likely to see this type of substrate used on a flatbed or wide format inkjet press, but it is also available for some production sheet-fed inkjet presses that have a post-print, magnetizing step. Keep in mind that printing will likely only be possible on one side of the material.

## QUESTIONS TO ASK

When considering the opportunity to move beyond paper or add new materials to a paper design, there are many questions to ask. As with all substrates, you need to consult your print provider on the availability and compatibility of the substrate you are interested in.

- Do they have the specific material you are looking for, or do they recommend an alternative?
- Is there a minimum order quantity for the substrate?
- What weights, thicknesses, and other options are available?
- What type of inkjet printer will be used for this substrate?
- Will the ink be aqueous or UV? If UV, will there be a raised feel to the print?
- Is white ink available?
- Are postcoats, varnishes, or embellishments compatible?
- Are there any print or finishing limitations associated with the material, such as heat sensitivity, folding issues, or cracking at score lines?
- If working with specialty media featuring die-cuts or clear windows, are there guidelines on compatible window placement?
- Is the material recyclable, reusable, biodegradable, or compostable?
- Is the cost of the substrate offset by savings elsewhere in the production process?



As we discussed earlier, just because you can print on one of these substrates does not mean the output will look the same as it would if produced using another printing process or if printed on paper. It's very important to test new substrates or combinations of different substrates in the same design to understand the effects you can achieve.

CHAPTER 8

# COATINGS MAKE AN IMPACT



COATINGS MAKE AN IMPACT

# PROTECT AND EMBELLISH

The new generation of inkjet has brought compatibility with an array of new substrates to print on plus a whole new layer of coating options to put on top. Designers usually consider adding a coating to protect the print, enhance the print, or both. The good news is that there are a lot of choices for protecting, enhancing, and embellishing your projects. The level of control with which you can add shine, texture, and contrast to your projects is amazing. Foil? Check. Spot Cast & Cure®? Check. Overcoat varnish? Check. Personalize using coatings? Check plus!

Coatings can be applied before or after inkjet printing, sometimes both. As we discussed in Chapter 5, a priming or pretreatment layer may be applied before printing in order to drive compatibility and improve print quality. The focus of this chapter is on the coating that happens after printing, called post coating. This layer of coating affects compatibility among all layers in the process. Coatings, like ink, will perform differently on each type of substrate based on porosity. Certain types of coatings may be less effective on uncoated stocks than on treated or coated ones.

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It can be challenging to navigate all the choices and understand which options can work together and with your chosen substrate. In this chapter, we will look at the pros and cons of different coating options and how to set your project up for success.



Adding coatings and embelishment effects expands light reflectance and adds depth to the printed piece.

## WHAT ARE COATINGS?

The most commonly used coatings are UV and aqueous, but when we talk about adding special effects to inkjet design, we will talk about film and foil as well. There are many factors to consider when choosing between UV and aqueous coatings.

UV coating is typically chosen for its high gloss and protective qualities. The UV coating itself can vary in thickness and gloss level depending on how it is applied and the surface on which it is applied. UV is most common in premium printing applications like self-mailers, postcards, brochures, magazines, and packaging. While UV coatings are not completely waterproof, they are highly water resistant, as well as providing strong scratch and rub resistance. The downside of UV coatings is that they are substantially more expensive than aqueous and can contain higher levels of environmental toxins.

Like aqueous inks, aqueous coatings are water based. They are attractive for both their environmental friendliness and lower material cost. Aqueous coatings may not produce a finish that is as high gloss as their UV counterparts, but they deliver a protective layer at a fraction of the cost. To see if the finish provided by aqueous coatings meet your needs, test samples on your chosen paper. Of course, UV and aqueous coatings are not just used to deliver shine; these coatings can be applied in different ways to create different finishes and effects.



### How to apply

Coatings can be applied as a flood or spot coating. While flood coating evenly covers the whole surface, spot coating is a more advanced and controllable technique where fluid is applied only on the spots specified in your design file.

While flood coating can provide protection as well as increased visual appeal, spot coating is used primarily for aesthetic purposes. A spot coating can be used on top of a flood coat for contrast and embellishment. For example, placing a spot matte coating on top of a gloss flood coating delivers both protection and eye-catching embellishment. Spot capability is

a great partner for inkjet personalization, allowing different aspects to be highlighted on every page.

The way that the coating is applied creates different finishes on the surface. If your provider has the capabilities in house, some of these effects can also be layered.

**Gloss:** Produces a smooth, reflective, high-luster surface. It can increase the color depth and detail of the print, but its highly reflective nature also can interfere with text legibility and show fingerprints.

**Matte:** Produces a nonreflective surface and makes text easier to read. It provides protection without shine, so it doesn't pick up fingerprints as easily when handled.

**Satin:** Combines matte and gloss varnishes to achieve a balance between a bit of shine and wear resistance. The effect of a satin varnish creates a subtle aesthetic. It almost looks as if there is no protective layer on the substrate.

**Soft touch:** Offers a richer, matte surface combined with a velvety feel that increases tactile sensory appeal. It provides protection that won't turn yellow over time, and it is more fingerprint resistant than its shiny friends.



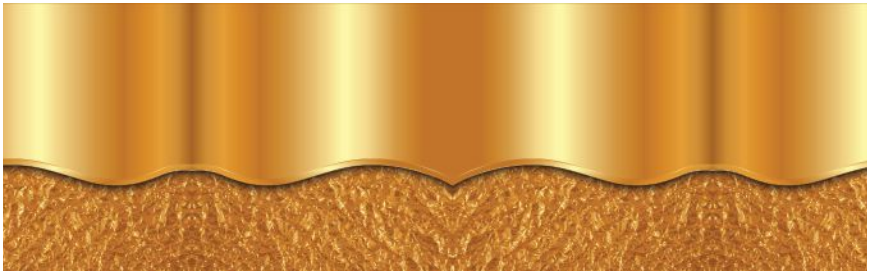
Coatings, along with film, can be used for many other special effects to add value to a printed piece. In addition to the finishes described above, you may want to investigate compatibility with more challenging finishes like sandpaper, grit, nonskid, or scratch-off coatings or embellishments described on the next page.

## NOW ISN'T THAT SPECIAL

In addition to sealing, protecting, and changing the finish, coatings can be used to create multidimensional and/or metallic effects on the sheet. There are many opportunities to add texture to a whole piece or raise elements up off the sheet.

### Cast and cure

Sometimes called film casting, this decorative process combines coating with specialty film to deliver a holographic effect. The coating is applied to the sheet, and then the film is nipped into the coating, leaving a pattern in it. When dried or cured, this creates a multidimensional effect that changes based on viewing angle. Since it uses a clear coating, it doesn't obstruct



the graphics or copy beneath. It can be spot applied to only the places specified in the design file, and the film can be reused many times, making it more sustainable than you might think when adding a synthetic to the discussion. The resulting surface can work on a variety of substrates with finishes ranging from matte to high gloss—plus those nifty holograms. The holographic effect is eye catching and useful for fraud prevention and security applications. It also can be combined with RFID tags.

### Foil

Similarly, foiling fraudsters is also one of the benefits of foil finishes. The effect can't be reproduced by scanning or photographing, making it useful for items like tickets and other frequently counterfeited items. But for most designers, foils are great because they just look amazing.

You may be familiar with hot foil processes, but within inkjet you are most likely going to use cold foil because it can run at higher speeds and support

variable printing. Foiling is a way of embellishing print that could add a hard-to-match color, a mirror-like metal finish, or a holographic effect. You might see anything from silver to hot pink delivered as a foil embellishment—maybe even in the same piece. Like the cast and cure process, foil can be introduced as a variable element in your design.

## Build up effects

Coatings also can be layered to create dots, waves, and ridges simulating embossing. These tactile effects add a touch of luxury to any printed material and can deliver functional value in protecting the print. It's also possible to use coating build up effects to encode braille.





If you are considering using these coating effects and embellishments in your next masterpiece, it's important to understand the process used by your service provider. Some of these effects may be available inline with the printer, while others may be a separate, offline process. Since multiple processes could mean multiple passes through finishing, where the process happens can limit or expand your options.

## OPPORTUNITIES FOR COATING-BASED EFFECTS

A protective coating should be considered for any print project that will be handled and needs to be protected from fingerprints and soiling. Dark, solid ink areas are more susceptible to showing fingerprints, but a nice matte coating can keep them looking clean. Coating is also recommended for prints that will be put in the mail without an envelope. The machinery used to sort and process mail is efficient for its purpose but fairly brutal on printed surfaces.

But that's just the purely functional rationale! One positive side effect of many coatings is that they will actually boost the color of the print underneath. Coatings and embellishments can be used separately and together to drive pop, wow, and, most important, response rates. Memorable creative is actionable creative. These effects are not only beautiful, but they can also be variable. They let you add personalized sizzle to direct mail, postcards, magazines, catalogs, invitations, point-of-sale materials, book covers, and anything else you run through an inkjet press.

If you are more focused on cost control, it's important to know that inkjet inks have come a long way. A few years ago, we would have recommended a protective coating for anything that was going through the mail. With a new generation of inkjet presses using advanced inks and priming, the surface is much more durable than previous presses, and the ink is already shiny without a coating. If you have heavy ink coverage on the sheet, you may be able to get by without a post coating. Of course, you also will miss out on a lot of fun options.

**Great side effect of adding coatings to inkjet is it can boost the printed color underneath as well as add depth to the printed piece.**

## Playing well together

While most inkjet-compatible papers can have an aqueous or UV coating applied to them, the results will vary based on the surface of the sheet—just like with the inkjet inks. This is why we emphasized the planning process in previous chapters. You could easily select a paper or other substrate that is compatible with the press but not with a subsequent finishing process.

You also will want to identify any limitations of coating effects on folding, creasing, trimming, or die cutting. Application of foil, build up, or cast and cure effects should stay clear of folds, die cuts, and edge trimming. The finish could break or peel off from the pressure of the cutting process.

The coating you choose also will affect your final color. Using a gloss coating on a solid black area will create a deep, rich black, while a matte finish will dull the black to a more subtle, charcoal shade. Colors will shift with every coating option, from gloss to soft touch.

If you are considering using multiple treatments or effects, make sure that you understand the order in which the processes will happen. If your process requires multiple passes through the finishing process to deliver coating, foiling, and a cast and cure effect, make sure that this will not result in edge damage that could trip up processing during binding or mail processing steps.



While you can get almost as much control of a spot UV or aqueous coating as you would with a spot color, other effects are not as fluid or flexible. High contrast color combinations are more likely to highlight small registration discrepancies when applying foil or cast and cure effects. When using any variable effect with text or graphics, registration is critical, and it's important to test for edge clarity. You may also need to reserve space for registration marks to help manage the process.

## DESIGNING YOUR LAYERS

If you are just applying a flood coat to the whole design, no special setup is required. If you want to apply one or more spot effects, then you must create a layer in your design for each.

When creating each layer, only include the elements for which the coating or effect needs to be applied. For any Adobe Photoshop bitmap graphics used for the special effect, each effect should be placed on its own layer and converted to grayscale. This is because each effect is treated as a single color. Flatten only if there is one effect to be used.

For multiple effects, keep your layers separate for the Photoshop image and consult with your print provider about the best way to convey your multi-coating intent, as each process may vary in terms of the settings used.

Coating graphics from Photoshop or custom vector patterns can then be added to the Adobe InDesign® or Illustrator® file, assigning the image or pattern as a custom spot color channel on its own layer. In whichever design program you are using, always name the related layer and color channel with the name of your effect. Remember, alignment is everything when placing images into layers. If an image is not aligned properly, your coating effect won't be aligned over your graphics either. So check and double check (and triple check) positioning.



As different processes may have different requirements, ask your print provider for specifics on how the layers and files should be configured for the equipment they are using.

- What is the bitmap image resolution of Photoshop image?
- Can the coating channel be halftone or solid fill only?
- What is the saved file format for Photoshop layer?
- What are the naming rules for coating layers if adding them to Illustrator or InDesign?

## Creating a layer from a Photoshop image

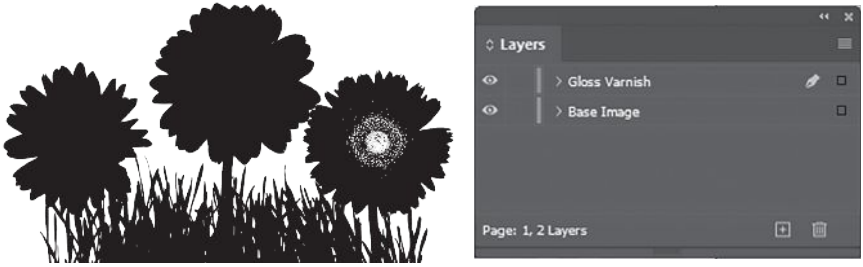



**Coating layer created in Photoshop for gloss varnish assignment**
**Screen capture: actual PPI 72, effective PPI 258**

## Adding coating layers to Illustrator or InDesign

Every great opportunity requires an equally great planning process. That's why we always say, "Think finishing first." Designers have a huge array of protective and special effects to choose from for their projects, and they have two huge advantages over offset projects: they can be produced in small batches and every page can be unique. Now that's a special effect.






**Applying a Photoshop mask in InDesign/Illustrator for gloss varnish assignment**
**Screen capture: actual PPI 72, effective PPI 258**

CHAPTER 9

# RECIPE FOR QUALITY



RECIPE FOR QUALITY

# EVERY PIXEL TELLS A STORY

Color, clarity, imagery, and typography all play a part in quality print production. For inkjet, the way a pixel or dot of ink is delivered to the page can affect all of those parts. Let's start with color.

All the colors in your printing palette are made from a recipe of their ingredients. If you are designing for high-speed production inkjet presses, your color ingredients may be limited to Cyan, Magenta, Yellow, and Black (CMYK). In that case, all the colors you are trying to "hit" in your design must be made of some percentage of C+M+Y+K. Some inkjet devices are going beyond CMYK, adding additional colors to improve print color and Pantone target values. We'll talk more about the potential for additional colors later in the guide. For now, let's talk about getting the most out of your four base color ingredients.

Since you are designing for Cyan, Magenta, Yellow, and Black, your first challenge will be viewing those colors on a monitor that renders colors in Red, Green, and Blue **(RGB)**. This makes your job as a designer a little complicated.

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We certainly wish that every graphic designer had a calibration device to properly color calibrate their monitor and used it at least once a week. We also wish that all graphic designers used a **light booth** with **D50 lighting** to view prints and color matching samples in a controlled environment. But wishing doesn't make it so. If you are one of the elite designers who diligently follow this process, we applaud you! (And you may want to skip ahead.)

Unfortunately, in the "real world," most monitors are never changed from the default calibration settings they came out of the box with, and the lighting

conditions for viewing printed pieces are the fluorescent bulbs above the designer's desk or pressroom floor. For any printing device—inkjet, toner, or offset—this is a recipe for disaster when designers are expecting printed results to match what is on their monitors.

## MANAGING COLOR EXPECTATIONS

The colors you see on your monitor and the color you get from an inkjet device will differ to varying degrees based on the:

- Calibration of the monitor
- Specific inkjet equipment
- Printer calibration
- Color management
- Target color space of the printer vs. your monitor
- Ink type used (dye, pigment, UV, waterless, or hybrid)
- Media
- Post coatings applied

As discussed earlier, high-speed inkjet ink offers a variety of ink chemistry options. Colors produced using inkjet presses may be more or less vibrant than those produced by offset printing because the ink




Photograph taken at 300dpi of printed aqueous pigment inkjet image

dries by absorbing into the media as well as evaporating from, or curing onto, the media surface. The amount of ink absorption can change the appearance of the ink color as colorant is dispersed and more of the media's color is revealed. As the ink is applied to the media, the shade, **brightness**, and saturation of the printed color can change. The deeper an ink absorbs into the media, the more muted the color becomes. Different types of inks will absorb more or less deeply into the media.

Understanding these printed color differences, as well as how a monitor displays color, is the foundation for controlling design-to-print color expectations and getting the most out of a CMYK environment. Since we start the design process on our computer monitors, let's start our discussion there as well.

## COLOR SPACE AND GAMUT: WHAT WE SEE AND WHAT WE DON'T

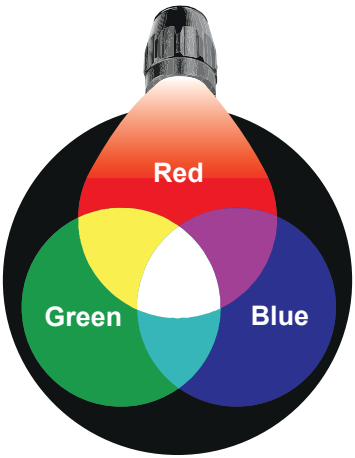
The term "color space" (or "color profile") simply describes the range of colors, or gamut, that a device can display or print. Think of each device as having a different number of colored crayons available in its box.

Your monitor uses a type of profile called an Input Profile to display a standard printing color space. Standard input profiles commonly used in the U.S. are currently based on GRACoL standards. These simulate color spaces of conventional offset environments and media, as well as target the varying color spaces of inkjet presses. These profiles allow an RGB monitor to closely render the CMYK, spot, or L*A*B* values you choose, simulating the color space of the print device if you are using the correct target profiles.

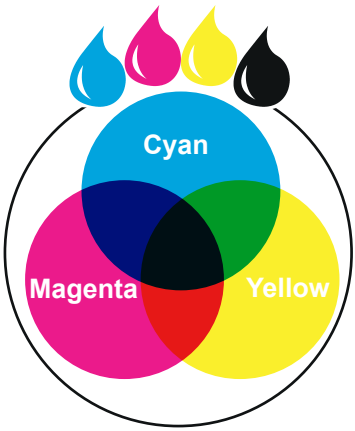
If the monitor is using a different color space than the target space of the inkjet device, the color difference between the designer's calibrated color display and the printed output will be greater. We talk about setting up correct Adobe Bridge settings using these input profiles in in Chapter 10 and take a deeper dive into ICC types and definitions in Chapter 14.

The color space for monitors is Red, Green, and Blue (RGB) while inkjet devices and **process color** offset printing starts with Cyan, Magenta, and Yellow and then adds Black. CMY contains the opposites of RGB on the color wheel. And that's not all that's "opposite" about the color spaces for your monitor and your print device.

A computer monitor projects light, meaning that you see the graphic on the monitor based on the colors that are "projected" to your eyes. This is described as **additive color** because colors can be "added" to intensify the color space. Monitors produce colors with red, green, and blue light, creating a much larger color space than the CMYK inkjet printing process, as shown in the illustration below.



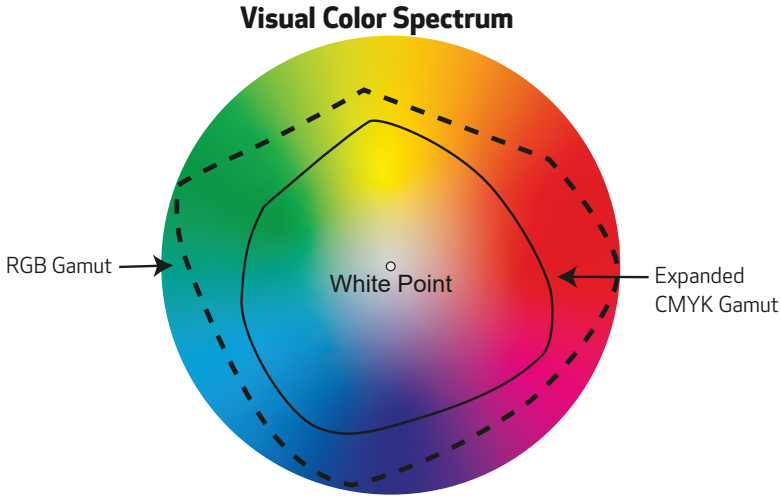

Projected Colors = Additive Color




Reflective Colors = Subtractive Color

CMYK printing processes use the opposite of projected light and additive color. Instead, they use "reflective" light or **subtractive color,** meaning that CMYK inks "filter" the available light and what you see is the leftover light "reflecting" back off the printed page. With subtractive color, you can't add colors to the color space—only take them away. The CMYK color space is a smaller subset of colors that fit into the RGB space. The CMYK printing process will never accurately print the entire RGB color space.

This can create a big difference between what we see on the monitor, or your desktop proofer, and the actual printed piece produced from any of the current CMYK printing processes we use today.




As you can see, from the image above, monitors have the largest color space of any print device. Monitors have the most crayons in their box.

Depending on the inkjet technology and media chosen, inkjet can produce a smaller or much larger color space than toner or offset. This is because the subtractive CMYK inks used in this printing process have different **hue** values and react differently to the media surface than toner or offset inks. Some of the new generation of inkjet devices have a very wide color space that can exceed offset. Older models, or presses targeting less quality-intensive jobs, may not even come close.

That's why you need to understand the specific color space for each press and media you work with and not just rely on "inkjet or not inkjet."

If you don't consider the color space, you might select colors for your design based on what you can view on your monitor and find they are not reproducible in print. What can be harder to understand is that, even when selecting colors that are reproducible in print, they may not look exactly the same when you compare the printed piece to the monitor. This is because the monitor projects light and the media absorbs light. A monitor will never show the high-speed inkjet CMYK color space completely accurate. It is not physically possible for the monitor and the media to look the same, but can look simular.

## WHAT DOES OUT-OF-GAMUT MEAN?

If the color space you design in (the monitor's color space, for example) is larger than the color space of the printer, you may design with colors that are within the monitor's gamut but not within the subset of colors available to the printer. You've chosen a recipe for which you don't have all the ingredients.

The image below shows the difference between the color space of a color monitor and an example of an inkjet press and media combination. Any out-of-gamut colors (shown in gray in the illustration below) used in the print file will not be reproduced accurately by the press.



In gamut colors for Adobe RGB



Grey swatches = Out of gamut colors for CRPC3

This is especially true for PMS spot colors that are created with a palette of fourteen base colors plus white. Out of Pantone's full swatch color library, 1,114 cannot be reproduced accurately by the offset CMYK combination. The base Pantone inks used to mix all the Pantone colors are: Pantone purple, violet, reflex blue, process blue, green, yellow, warm red,

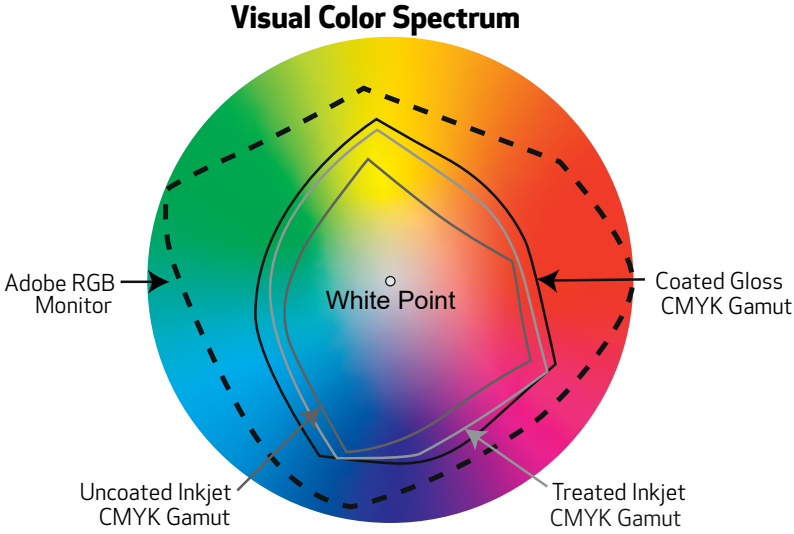
rubine red, rhodamine red, black, 012 yellow, 021 orange, 032 red, and 072 blue. That's a lot more crayons than the ones that come with the typical "inkjet box."

Now you see why it is hard to match a Pantone color swatch using just four process ink colors!

**Did you know Pantone uses around 14 base colors to develop their inks and NONE of them are the CMYK process colors we print with.**

For inkjet presses, the color space is also affected by the press type, media pre-coating (if used), ink formulation, and media. The illustration below compares the color space of the monitor to the color space of an inkjet press using coated inkjet, inkjet treated, and uncoated offset media to show the differences in out-of-gamut color values between the media grades.

The inkjet coated media has the widest gamut and fewest out-of-gamut colors but still represents a much smaller color space than the color monitor.



## PROPER LIGHTING FOR CONSISTENT VIEWING

Light is the key to seeing the world. All colors are in the light, and not all light is the same. Sunlight is different from artificial light and, as you walk from room to room in your home or office, you will see that there are many different types of artificial light. Change the lighting and you change the colors you see. So, when you are viewing or proofing for any printing processes, the quality of light needs to be consistent. If you are lucky enough to have controlled lighting conditions such as an ISO-compliant D50 light booth, congratulations.

If you don't and have been proofing colors at your desk, various areas of your office building, and at your printer, you have probably seen some of the interesting effects that different light sources can have on a print.

Let's look at a simulation of the same image under different lighting conditions.



Natural Outdoor | Florescent | D50 Daylight

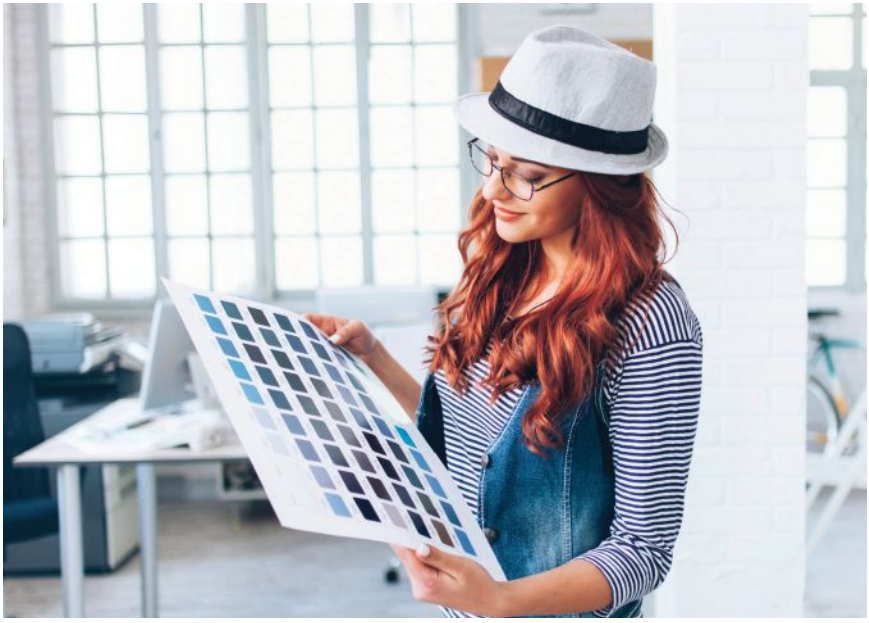
The image above shows a picture viewed with natural outdoor lighting. The center image shows the same picture in standard office lighting. The image at the bottom shows what the picture looks like in a controlled D50 daylight viewing booth. Depending on the lighting the picture is viewed under, it will look different!

Having the same colors look different because of lighting conditions can become problematic when trying to please your customer.

So, if you have a D50 daylight setting light booth in your facility, use it. That should be where you go for all review, color matching, and customer approvals.

If you don't have a light booth and lack the funds to purchase one of these handy items, there are some manual workarounds that can help:

Do all your color matching and proofing in the same place, preferably a spot with lots of windows that provide good, daylight lighting.



Create a proofing station in an area where the lighting stays fairly consistent to use for all viewing, proofing, and color matching.

Purchase D50 daylight bulbs that can replace small areas of your office space lighting. This will help remove some of the drastic color shifts seen under various office lighting.

While these workarounds don't offer a perfect solution, when used consistently, they are certainly better than no solution at all.

## MEDIA AND SURROUNDING GRAPHICS AFFECT VIEWING

Lighting is not the only thing that affects color perception. The color of the paper or other media (however subtle it may seem) and the interaction of colors within a graphic can also make a difference. A color can look different in the context of its surrounding elements. For example, a slightly yellowish media makes matching printed blues more difficult because yellow and blue are opposites. So, when trying to match a color, it is best to mask out the area surrounding the target color, so it is not affected by the media color or graphics.

If you are trying to color match an inkjet-printed color swatch to a color that has been printed with a different process, such as a preprinted customer sample or a **Pantone Color Bridge®** swatch, create a color mask for viewing (more on this in Chapter 11.)

## IMAGE COLOR SPACE AFFECTS VISUAL EXPECTATIONS

Now that you know CMYK high-speed inkjet presses print in a smaller color space than what you view on your RGB monitor, how does that affect the color space you use to prepare your images?

When preparing images, you want to use the color space that will allow the monitor to most closely represent the printed piece—knowing it is impossible to be exact. It makes sense to save your images as the same color space as the device, right? Well, it depends. Sometimes the correct color space to use can vary based on the image type and the printer's preferences.



## COLOR PICTURES

Each print provider's workflow and **Raster Image Processor (RIP)** processes picture images a little differently. Some printers prefer these images to be in CMYK color space because they don't have an accurate way to translate from RGB to CMYK. Others can convert RGB images to CMYK accurately,

lessening the color shift when printed. Most RGB images, when printed in the smaller CMYK gamut, still offer "pleasing color" if they are color-managed properly. All of this has to do with the RIP processing on the specific press. So, always talk to your print provider prior to saving images.

## Vector images

Your print provider may also prefer that colors be assigned in CMYK for logos and solid color areas instead of Pantone spot colors. Talk to your print provider before applying any custom spot or Pantone colors to your design. Workflows have changed in the last few years, and more workflows have Pantone-to-CMYK conversion libraries that enable improved accuracy of processing to CMYK. If your printer requires all colors to be created in CMYK, we have some tips in Chapter 11 that will help with finding CMYK recipes for colors that will print accurately.

**Avoid assigning RGB colors to fill vector images, as the RGB to CMYK conversion can create unexpected color results.**

If you are designing for variable print, consider that variable data can come from different sources and formats. You will want to talk to your print provider about the software that will be used to add **variable text** and images to produce the final print. They may require different file settings for compatibility, and this may affect how the color is rendered for color matching as well as the file processing. Preparing for the world of variable printing, see Chapter 16 on preparing files for compatibility with composition tools.

Using variable images within your design can add powerful personalization to your marketing message, but it can also slow down or choke the data processing if images are not prepared correctly. Here are a few good tips for preparing variable images:

## Color space

Bitmap images should be in the correct RGB or CMYK color space for your workflow prior to variable processing, where as vector images should only be assigned as CMYK color. This will help reduce time and image processing requirements for the printer.

## Quantity of images

If you are processing large quantities of variable images, keep variable images and text separate. Overlapping text and image elements will increase file processing requirements.

## Variable and fixed combined

Please note that a fixed image with variable data text included in, or extended from, the fixed image is considered a variable image. The image will be processed each time with the variable text affecting file processing time.

Adding properly prepared images to your color-managed document workflow is key to the proper color conversion of images when printed.






Now, let's add your properly prepared images to your color-managed document as we did earlier:

- ❑ Ask your print provider about color space and file formats
- ❑ Ensure correct resolution
- ❑ Assign correct color space
- ❑ Add any image filters or plug-ins
- ❑ Color correct or edit
- ❑ Flatten image (if necessary)
- ❑ Save in preferred file format (and compression setting)

## ADDING MORE INGREDIENTS

Everything we just talked about for cooking up great colors with CMYK still applies when you have a few more colors in your list of ingredients. Innovations in production inkjet have enabled an even wider print gamut, making it possible to match more Pantone colors, achieve richer blacks, create more balanced grays, and attain better overall image quality by moving beyond CMYK. Depending on the colors added, you may see more vibrant color, more realistic images, or both. We'll talk a little more about the types of additional colors being used in Chapter 11.

What is really important to understand is that color and quality are measurable! You don't have to say you only want great production quality—you can set your standards and measure to them.




We've talked about all the things that can affect your perception, from the differences between RGB monitor and CMYK print color space to how the combination of machine, ink, and media creates image and color differences, as well as how surrounding graphics and lighting can affect our viewing experience. But, seeing is believing.

### Creating a power print reference image

Request an inkjet sample off the actual press, under production conditions, to understand what your design file looks like when processed through the complete workflow from RIP to print manufacturing.

As discussed in Chapter 3, designing a reference image—that allows you to visually assess the RIP conversion, machine, ink, and media—is crucial to truly understanding the production inkjet printing environment you plan to use.




The reference image file should contain the same elements you most often design with:

- ❑ **Bitmap images**
- ❑ **Vector images**
- ❑ Solid and reverse strokes
- ❑ Solid areas
- ❑ **Gradations**
- ❑ Small positive and reverse black and color text
- ❑ RGB, CMYK color, and **grayscale** bitmap photos in different sizes and **resolutions**
- ❑ Flesh **tones** with and without Adobe Photoshop filters applied

Since it takes some work to create this yourself, we have included the power print above for reference.

The finished print will represent the reproducible color gamut of the machine, ink, and media combination, as well as show you the levels of text and line densities you can expect.

Set your print expectations by printing on different inkjet presses and medias to create a printed reference library (to be viewed under proper lighting conditions, of course.)

**You can download the helpful design tools referenced in the Guide at https://inkjetinsight.com/tdgresources Use the QR code for quick access.**

## File formats matter

Image file formats differ in the way they compress files and how well they retain the color and image data in the saved file. Different file formats compress bitmap data in different ways, some at the cost of image quality.

Think of file compression as a sweater in a bag that has all the air sucked out. The bag is smaller than it was before the air was sucked out, but what will the sweater look like when you open the bag? Will it be wrinkled and messy or perhaps damaged in some way, or will it puff right back up and look great? Some compression algorithms will give you a sweater that looks like you slept in it for a week.



The most common image file formats for fixed bitmap images are JPEG and TIF. For transactional markets, JPEG is used for its compression and file size features. But transactional markets also use a lot of solid and logo colors that JPEG does not convert very well.

**Did you know each time a JPEG is compressed the file's image quality is reduced? Assign "lossless" compression to keep images free of artifacts.**

Each composition workflow has a preferred file and compression format for images, so check with your print provider before applying variable data images.

## JPEG (Joint Photographic Expert Group)

This is a very common file format for workflows that have to process a large number of color images at a high rate of speed. JPEGs use adjustable compression (low, medium, high, and maximum), sometimes called "lossy," that allows a selectable tradeoff between storage size and image quality.

Continuous tone photo images stored as JPEGs (.jpg files) are very small and efficient, but JPEGs do not work well for solid image graphics such as logos.

For all JPEG images, do not repeatedly edit and save your JPEG images, as artifacts are added each time and quality is lost. Repeat: every time you save a JPEG file, quality is reduced. Complete your edits using a lossless file format (see below) and then save as a JPEG when final. If further edits are required, use the original file format and create a new JPEG.



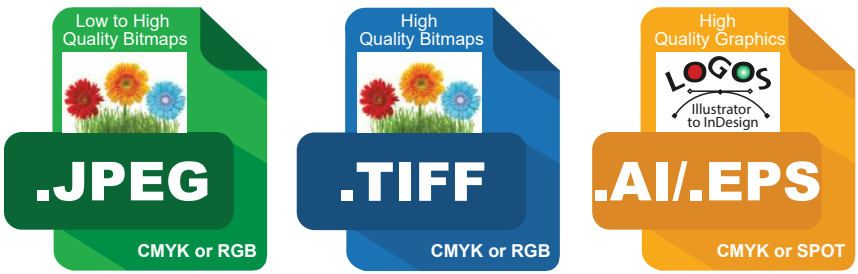
If you are planning to assign PMS colors to your bitmap and/or vector images, and your print provider's workflow supports it, do not use JPEG, as it does not retain the PMS data and automatically converts to CMYK or RGB.

## TIFF (Tagged Image File Format)

TIFF images stored as .tif or .tiff files use "lossless" (meaning no loss) compression, considered the highest quality format for print work. TIFFs are not "higher quality" images. TIFF just means that, upon compression, there is no loss of color data or added artifacts that degrade the image like JPEGs. TIFFs are larger than JPEG files and work with both in RGB and CMYK bitmap and vector images.

## Vector EPS (Encapsulated Postscript)

EPS is the format for graphic elements that are created and exported from Adobe Illustrator or Adobe InDesign and shared across all Adobe programs. Many designers work with EPS files until they are ready to save final files in the format best suited to the production workflow.

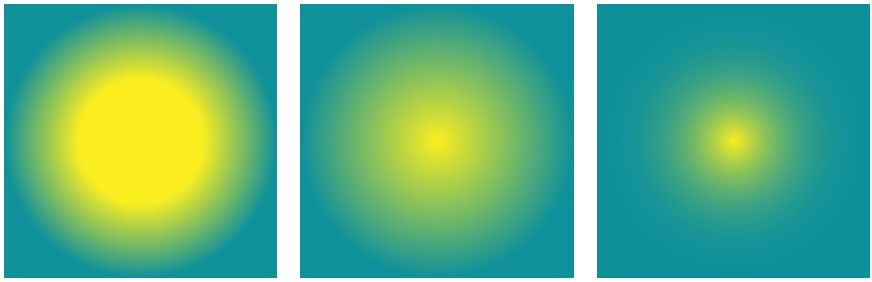



To sum it up, we recommend using:

- **JPEG for variable bitmap images.** Choose a "low" or "medium" quality setting if you need small files and are not very concerned with image quality.
- **JPEG for static bitmap images.** Choose a "high" or "maximum" quality setting for static images that need to be smaller in file size but better in quality.
- **TIFF for static bitmap images.** These are RGB or CMYK bitmap images that require the highest print quality.
- **AI for InDesign composition.** Use Illustrators native format for the smoothest solid CMYK, spot fills, vignettes and graphics.
- **EPS for static solids and logos.** Use this option for the smoothest solid CMYK or spot fills and vignettes.

## Vignettes

When creating vignettes as bitmap or vector images, be sure to allow enough room for the gradation to smooth between colors. Too many color transitions in a short area can cause banding effects.



**Gradation becomes banded when too many color transitions are included**

**Your vignette should appear smooth from the highlight through the shadow**

**Color gradation is smoother when space is given for the transitions**

When creating and saving vignettes in Adobe Photoshop, they are treated as bitmaps and should follow the same Photoshop image requirements outlined earlier.

## Diagnosing vignette problems

Blotchiness and banding in printed vignettes can also be caused by the profile, print heads, media, or resolution. A vignette's mottling or blotchiness may be due to applying too much ink within the profile combined with using an absorbent media. Banding in the cross direction of the media may be due to low resolution at the RIP. These effects may only be visible in certain sections of the vignette.

## NOW LET'S ADD SOME DOCUMENT COLOR

So far, you have learned how to apply color management to an Adobe-based design workflow, how to work in the correct CMYK document color space, and how to add images with the proper Adobe Photoshop image and color space requirements. Adding colors to your document or vector images is the next element that requires attention to correct values.

Each press workflow handles color differently and the RIP process used may or may not understand how to assign anything other than process colors. Some presses have customized lookup tables in which they have conveniently converted Pantone spot colors into CMYK values or the closest achievable match on various medias. These defined spot colors will use a custom CMYK value instead of the process values Pantone requires. These tables take a lot of guesswork out of assigning color values, but not every press or printing company has them.

**Here's another public service announcement: talk with your print provider before starting this process.**

If lookup tables are not available, be sure the "Color Type" is set to "Process" and that "Color Mode" for the CMYK process or PMS swatch value is set to "CMYK" when adding color blocks to a document or vector image. Use the **Adobe Bridge swatch book** or the library contained within your Adobe program when initially choosing the document's PMS colors. These tools show the corresponding CMYK process values for the document's PMS colors. Be sure to verify that Adobe's CMYK color values match Adobe's printed Color Bridge swatch book, as older versions have different color values. If color values are different, use the CMYK numbers from the printed swatch book.

You will need to tweak some document color values when assigning colors for color matching. We included a detailed process in Chapter 12, Testing Your Color Choices, that will help you achieve a closer color match when printing.

## MANAGING DYNAMIC BLOCKS OF COLOR

Blocks of color can direct your reader's eye and give a dramatic effect to your design. But they also use more ink and, if used too much, can create media saturation and finishing issues. There are a few things to keep in mind when designing with blocks of color:

Dark, solid colors use more ink because they require a higher amount of each process color to create the dense solid. When printing dark, solid color blocks on uncoated or inkjet-treated media, a heavier basis weight is usually required to help avoid oversaturation.

Lighter solid colors that will use less ink help avoid any media saturation issues. "Backing up" images on the reverse of the media will balance side-to-side coverage differences and can also help reduce media curl. Also, try vignettes or blends instead of solid-colored blocks or bars. Another trick is to put "noise," or patterns, into the solid block of color to better distribute the ink. Experiment with combinations of "lightening up," backing up, blends, and noise to see if you can get the effect you want without oversaturation.

**If using solid blocks of color in a design, experiment with lighter solid colors, which will use less ink and help avoid any paper saturation issues.**

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If using a lighter weight of uncoated or treated media, the best practice is to limit the use of blocks and bands of light and dark colors. Keeping them small and away from document edges will allow some limited usage. Large bands within and along the side of lightweight media can cause the media to curl. Media curl can cause finishing and inserting issues downstream. One of the keys to a successful inkjet design is to be sure the media chosen can handle the ink volume used.

Another problem with using solid blocks or bands of color or rich black on thin medias is the appearance of media mottle and saturation. But,

for heavier weighted medias, sometimes using rich blacks will add density and actually hide mottling or banding. Be sure to test different "enhanced blacks" (rich black CMYK combinations) before adding them to your design. Different media types and weights will handle rich blacks differently. In some cases, defining a black that uses 100 percent black (K) plus 20 to 40 percent cyan could improve results. You will need to test the impact on a case-by-case (or media-by-media) basis.

### Tips and techniques for reducing coverage

Using lighter-colored images and reducing solid backgrounds will help avoid media oversaturation. Any medias you use should have a custom output profile created with the proper TAC setting applied when printing. Your print provider can also reduce a TAC setting within a profile to help with issues caused by ink and media saturation. But be aware that reducing the TAC limit can also reduce the darker shades reproducible in your color gamut.





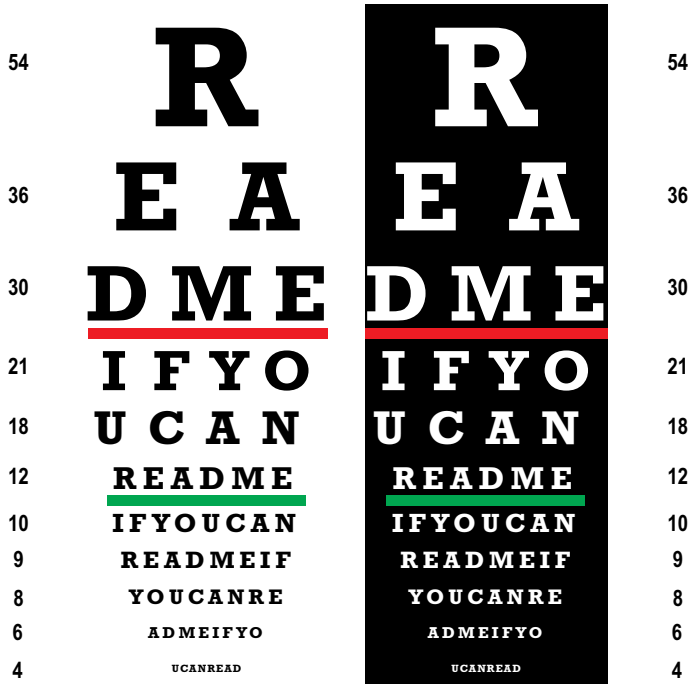


## READ THE FINE PRINT. IF YOU CAN.

Quality shows up quickly in the legibility of fine print. Because ink is absorbed differently depending on the media's surface, one dot of ink can spread a little or a lot. A tiny bit of dot gain can drastically affect the clarity of small or fine text. Text at 4, 6, 8, or even 10 points can be unreadable with certain ink and media combinations.

Remember the reference chart we talked about earlier? It helps with more than color. If you had it printed using the ink and media chosen for production showing different type sizes and treatments, you should easily be able to see the **minimum text sizes** that are appropriate for your project. Those minimums will vary widely by media and press.

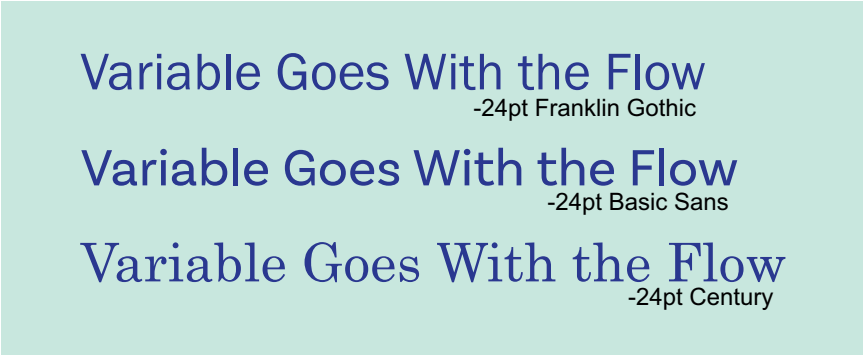
Most design projects use positive type for any long passages of text. Inverse type, sometimes called reverse text, printed in aqueous inkjet should never be used for body copy or text that requires extensive reading. **Inverse type** is commonly used for headline or callout copy that is larger than 14 points for serif and 12 points for sans serif fonts. Since inverse type is a challenge visually, adequate letter spacing (kerning) is important for maintaining clarity (see section "Kerning and leading").




Dot gain affects the readability of inverse type even more than positive type. Reversed-out text is essentially a hole in a block of color. When ink drops spread in the X and Y direction of the sheet, filling in those holes, the letters can become unreadable. Dot gain filling in the letters of inverse text

is called plugging. It's good practice to set text size for inverse text a point size larger than positive text when using aqueous inkjet and to always refer to a printed sample for the best text size.

Know your minimum sizes for inverse text and apply adequate spacing for legibility to allow for dot spread and absorption into the media. Talk to your print service provider and run some test prints if you are considering using inverse type smaller than the suggested minimums.




Variable text is a dynamically flowing element of the design. It will flow differently as copy content changes within its intended boundaries. Naturally, the same text will also flow differently if a different font is applied. Review the text and identify the data that contains the largest number of characters. Sample this data with the actual font, leading, and kerning that will be used in the final artwork so enough room is allotted to the assigned white space.

The image above shows how text can flow differently just by changing the font style. If your assigned bounding box is not large enough for the new flow of text, the copy can be cut off or "clipped." Customers sometimes ask if the variable text can be automatically sized to fit in the assigned space. This is generally not a good idea because with automatic sizing you may end up with mixed, random-looking text sizes, including text sizes smaller than the minimums recommended for your target press and media combination.

## Kerning

Kerning and leading are two wonderful typography adjustments that can be used to open solid body copy and reverse body copy for better legibility. They also can be used to compensate for dot gain.




Kerning is the adjustment of the space or "elbow room" between the letters in a line or within a block of type. Reducing kerning fits more letters on a line but decreases legibility.

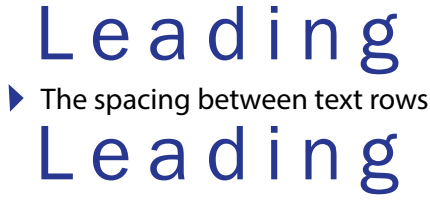



Adding kerning gives a sense of airiness and openness between letters but will increase the space needed for the text block. When printing with uncoated or treated media, adjusting the kerning helps to better define letters to improve clarity. Increased kerning also will command attention, providing "boldness" to an area.

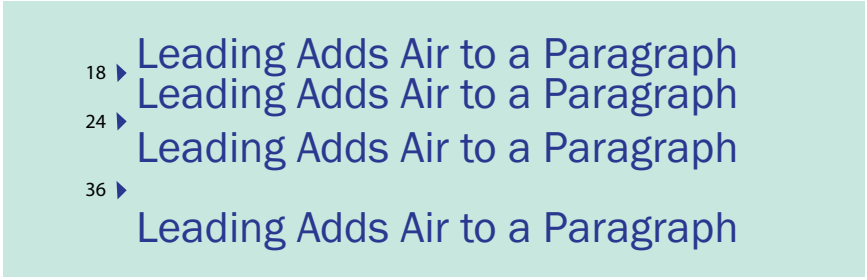
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## Leading

Leading is the distance between lines of type as measured from baseline to baseline.



Closer leading fits more text on the page but decreases legibility.




Looser leading creates more space above and below the lines of text and makes the document easier to read but requires more dedicated space for the text block. See what we did here?

## TrueType fonts vs. vector

As we mentioned, in the world of variable printing, the file needs to look good and run well too. That's why it's best to use a TrueType font for variable applications. This means you depend on the font data (code) to modify the font for flush left, right, and center; type size; leading; kerning; reflow; etc. A TrueType font is needed when text is variable and needs to automatically reflow for copy differences, and flowing with TrueType results in a smaller file. A smaller file will process more quickly.

**When designing for inkjet, rich blacks should never be assigned to body copy.**

## Text colors

Using color in text is a great way to help the reader navigate the page—or add a little visual excitement. Even when text is black, many designers still like to use color to create a "rich black." Rich black uses additional process colors to achieve a darker, denser black color. When designing for inkjet, rich blacks should never be assigned to body copy. Rich blacks can cause media saturation, text raggedness, and possible registration issues for very small text. Overall, it is safer to specify black as 100 percent K instead of

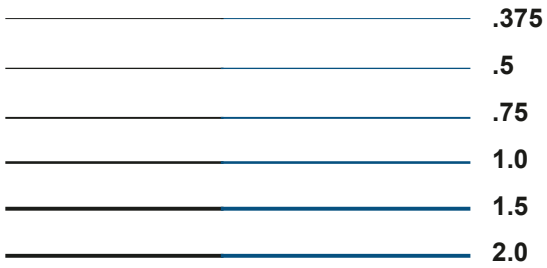
rich black for inkjet devices. And by now it should go without saying—never make text or any document color with RGB. Black created in RGB will automatically convert to rich black. If you require rich blacks for certain treatments, make sure to include a sample on your printed reference chart. Some of the new generation of inkjet presses have enhanced black inks designed for books and other text-centric applications. You may find that K alone does the job on newer models.

## MINIMUM LINE WEIGHTS

Solid or reverse minimum line weights are another design factor affected by the wonders of dot gain. In addition, some ink color combinations and media will cause solid lines to widen and spread and cause reverse lines to close up based on their different rates of absorption into the media. This absorption variance can increase or decrease the size of printed lines as well as cause them to become ragged on the edges.

### Solid line weights

Lines printed on uncoated stocks with a single process color (e.g., black) should use a line setting of 0.375 points or higher. If a line contains multiple process colors to make up the line shade, the minimum should be 5 points. This will help with line raggedness as well as **fine trapping**.



## Reverse line weights

Reversed lines should be 0.75 points or higher when using uncoated stocks. As mentioned above, multiple process colors in a printed color block can absorb at different rates, causing a reverse outline to shrink and become jagged. The thicker the reverse outline, the less visible the ragged effect will be.

These line weight recommendations are based on fairly extensive testing, but nothing beats running your own samples on the target press.




# PUTTING THE FLOW IN COLOR WORKFLOW

One of the key things to understand about a color-managed workflow is that the decisions you make about color, in the form of settings in your file, will flow throughout the whole process. On a smaller scale, the decisions you make to control one aspect of print can flow and affect other aspects of your design. For example, if you have your heart set on using a large area of rich black in one part of the design and your media can't handle the level of ink that is required, the TAC settings in the document will dial back coverage to the degree necessary to avoid mottling or other media damage. This TAC adjustment can flow to other colors on the page, reducing the overall gamut and possibly making certain colors less vibrant or a poorer match to brand targets. So, instead of making large changes that flow throughout the whole process with major impact, try making changes that

limit the impact to the intended artifact whenever possible. In the case of rich blacks, for example, rather than adjusting TAC for the entire document, create one or more custom black recipes that use the minimum additions of cyan (and magenta or yellow if needed) to improve image contrast. In general, avoiding global changes in favor of localized "tweaks" will offer better control.




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## Why should you care?

Because the care and effort you put into all the elements of your design determines what you will get out of it. Remember the old saying, "You only get out what you put in?" It's true!

CHAPTER 10

# SETTING UP FOR SUCCESS



SETTING UP FOR SUCCESS

# CONFIGURATION FOR DESIGN

We've demonstrated the many ways that process-friendly designs help eliminate print quality and finishing issues, reduce testing times, and avoid the need for design rework. Prepared with a better understanding of the print process, the next step is to learn the best practices for setting up your design tools before you start designing. This includes aligning the display and image color settings for your monitor with the print workflow, saving time and ultimately increasing the value of your final product. Some design process considerations directly impact the inkjet workflow and others are related to the overall process.

This chapter will cover the main settings in your design tools that should be checked before every project and how they apply to inkjet.

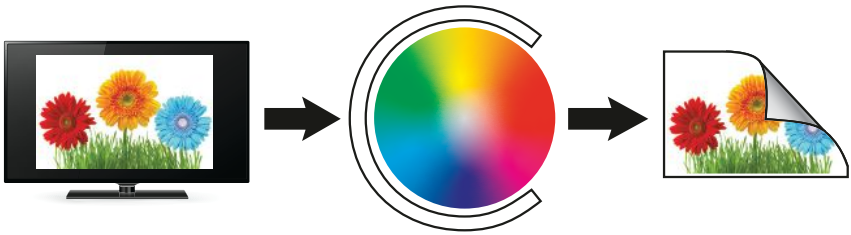
## ALIGNING WORKING COLOR SPACES

As a designer, you might work on a variety of print projects—books, brochures, posters, calendars, folders, signage, direct mail, bills, ID cards, and even marketing trinkets. Print providers who deliver these projects may use different printing processes, such as toner; offset; or high-speed, flatbed, or wide format inkjet. Even if all these processes use CMYK, each will produce a different color gamut. It is important to set proper document profiles across all design programs before starting any design.

Document profiles, also called input or working profiles, are automatically assigned to your project based on your application settings if they are set up correctly using Adobe Bridge. Document profiles create a visual display and image color reference point for RGB or CMYK color space elements.

Once document profiles are assigned to your design template, you have defined your "working color space." Your assigned working color space tells your monitor how to accurately display color and creates the color management foundation for proper device color conversion. Your setup process also helps to align your working color space and the color space of the printer. The settings will differ depending on the type of project.

If working on a single piece that will stand alone (not be merged with other printed pieces) the working color space should target the color gamut of the print device. Many inkjet devices target international color standards, such as GRACoL, but some devices offer a wider gamut, producing many more printed colors than referenced in standards.



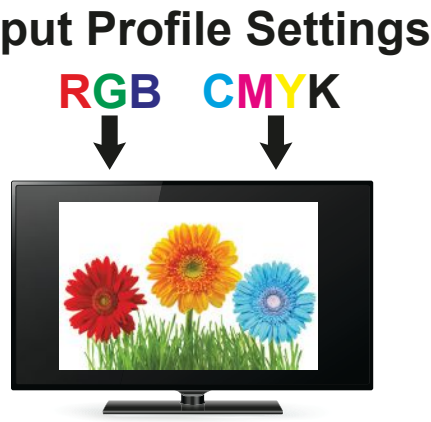

When working on projects that span multiple printing processes, your design document should use a color space that can represent a common reproducible set of colors for all machines, substrates, and inks used for the project. We talk more about combining inkjet with other processes in Chapter 15.

## Apply working color settings with your print provider

Remember earlier when we said your design working space and the target color space of the printer can be aligned? Your print provider can provide input profiles and color intent settings that can be used to align all your Adobe design programs with their press and your selected media. Using these profiles and settings in Adobe Bridge will create a closer on-screen

representation of the final printed piece. Let's look at the profile settings you will need to align your work environment with your print provider, starting with:

- Input RGB Profile and Rendering Intent
- Input CMYK Profile and Rendering Intent




We will talk more about the importance of different types of profiles and rendering intents in Chapter 14.

## Update your Adobe CMYK input color profiles

One reason for writing this guide is that there has been a huge expansion of the color range inkjet devices can achieve. Some of the newest generation of inkjet presses have expanded their print gamuts beyond conventional commercial offset. This increase in color quality has required the industry to update their color space standards. Many printing companies currently implement color targets based on GRACoL specifications into their color workflows. This process, also known as G7® gray balance, works by adjusting C, M, and Y values on a tonal scale, creating a neutral or visually similar appearance across processes that use different ink and substrates.

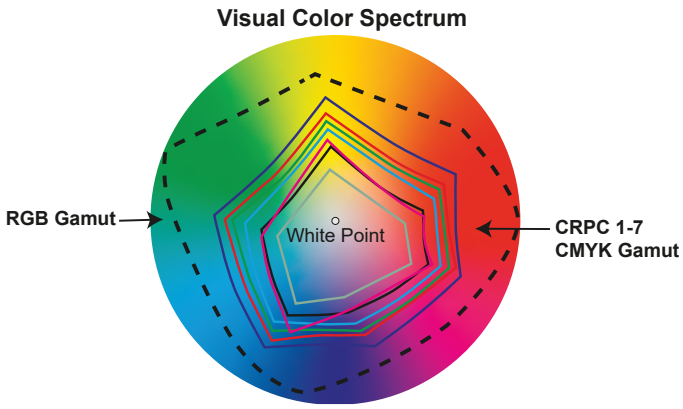




Did you know G7 is not a standard, but a process which specifies a common gray balance value, delivering a common appearance across all print devices?

## CMYK color space for bitmap and vector images

Many designers are still using older, default ICC input profiles such as Web Coated SWOP 2006 in their Adobe CMYK color settings. CMYK ICC input color profiles are now based on GRACoL industry standards for color. These updated CRPC (Characterized Reference Printing Conditions) represent CMYK color space targets that are now listed under the name of CGATS_CRPC#. These new profiles are created for specific media types such as newsprint, uncoated, and coated substrates for commercial and inkjet print. If used as an input profile when designing, the display's representation will be closer to the color space the printer is targeting.




Though **FOGRA** profiles are still popular in Europe, printers in the

| ICC Name | Substrate Type | Reproducible Colors* |
|---|---|---|
| CGATS21_CRPC1 | Newsprint 1 | 84,280 |
| CGATS21_CRPC2 | Newsprint 2 | 151,311 |
| CGATS21_CRPC3 | Matte Uncoated Media | 165,763 |
| CGATS21_CRPC4 | Calendared Uncoated Media | 253,713 |
| CGATS21_CRPC5 | Matte Coated Media | 331,416 |
| CGATS21_CRPC6 | Gloss Coated Media 1 | 389,023 |
| CGATS21_CRPC7 | Gloss Coated Media 2 | 525,552 |

*CGATS color space reproducible colors are estimated and will vary based on ink, substrate, and RIP conversion by the inkjet device
CGATS_CRPC 1-7 are based on GRACoL industry specifications

United States are currently implementing these new targets into their color workflows:

CRPC profiles are not just used for paper-based media but encompass a host of color spaces for porous and non-porous substrates, such as: wood, glass, plastics, and metal used for signage, packaging, and **industrial printing**.

Using the correct CRPC type is important if the inkjet press is targeting one of these spaces. However, inkjet devices that use unconventional inks (non-CMYK) or have a larger gamut than CRPC may have an associated simulation profile. Simulation profiles will be explained more in Chapter 14.

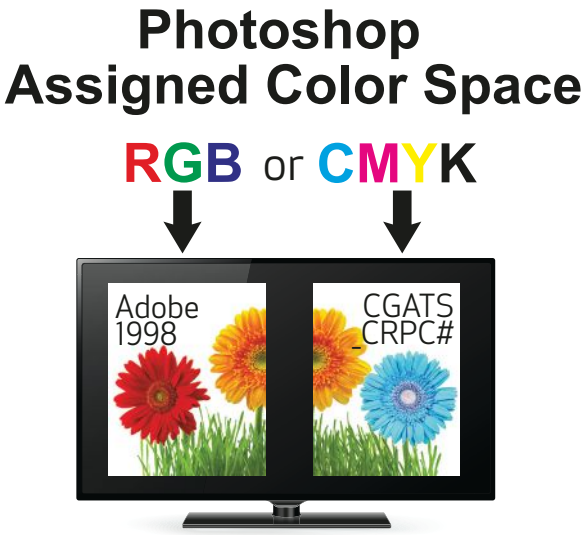
The list of standards and profiles is continuously being updated to keep up with advancing print technology and improvements in color management across processes. We will provide more information on working with large gamut presses and multiple print processes in later chapters.

If your print provider suggests an input profile you aren't familiar with or don't have listed in your working profiles, ask them to supply it or update your list of profiles from those available at Idealliance.org.

## RGB conversion for photographs (bitmap images)

For **bitmap images** to convert properly from one space to another, both RGB and CMYK settings must be accurately assigned. In Adobe Photoshop, bitmap images can be assigned to either an RGB or CMYK color space based on the requirements of your print provider. Whether or not the bitmap will be converted impacts the decision of which input profile to use. If converting an RGB image into CMYK, the CRPC profile assignments discussed earlier will be assigned. If the image is to stay in RGB, know that Adobe programs include ICC RGB standard profile options. Since there are multiple RGB color spaces, including RGB and sRGB, it is important to choose the one that matches your target press. Adobe RGB (1998) is used most often for inkjet print workflows and should be your standard unless your print provider has specified a different RGB profile.

If your print provider requires bitmap files in CMYK, remember that when




you convert an image from RGB to CMYK in Adobe Photoshop, the input profile and rendering intent assigned in Adobe Bridge will be applied.

If a smaller gamut CRPC profile (such as 3 for uncoated media) is used for the conversion, the color space for the image will also be smaller. Keep this in mind when using CRPC settings for conversion. It is best practice to convert using CRPC6 for coated media because it is the largest of the spaces. Then, let the RIP workflow of the inkjet press convert to the smaller space if a smaller color space is needed.

Since assigning the correct document profile to your document's working space is pivotal to color management, it is best practice to talk to your printer about your project requirements before starting the design process so you can start with the proper Adobe Bridge settings.

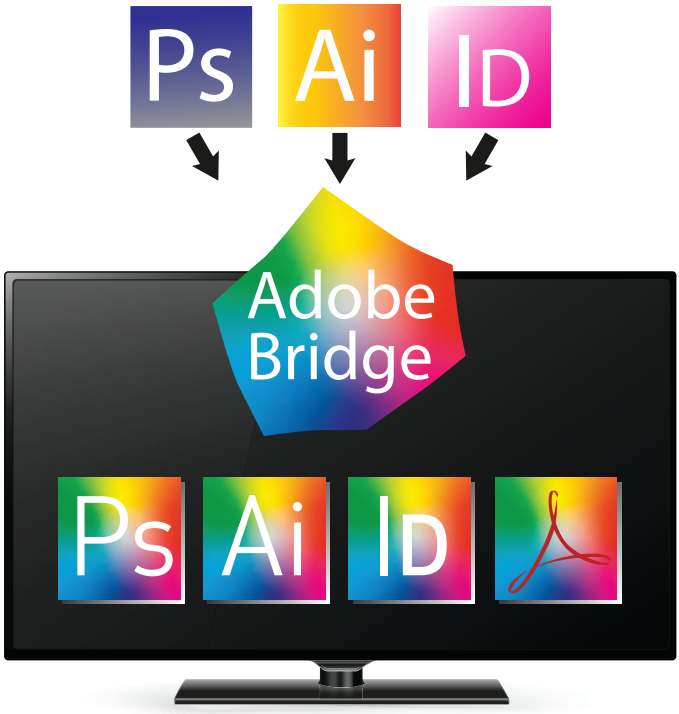


## CONFIGURING ADOBE BRIDGE



Did you know that color assignments in your designs have no true color value to display until an input profile is applied? Choosing the correct one sets closer print expectations.

In case you are not familiar with Adobe Bridge, think of it as a "translator" of color spaces between programs. It will automatically synchronize the color space for all your Adobe programs by creating a color-managed workflow. An Adobe Bridge color-managed workflow translates the rendering of image and color data to your display, setting a color reference point that enables conversion to the output color space for a target press across multiple programs. It will synchronize all your design programs, documents, images, vectors, and text colors to the same color language.





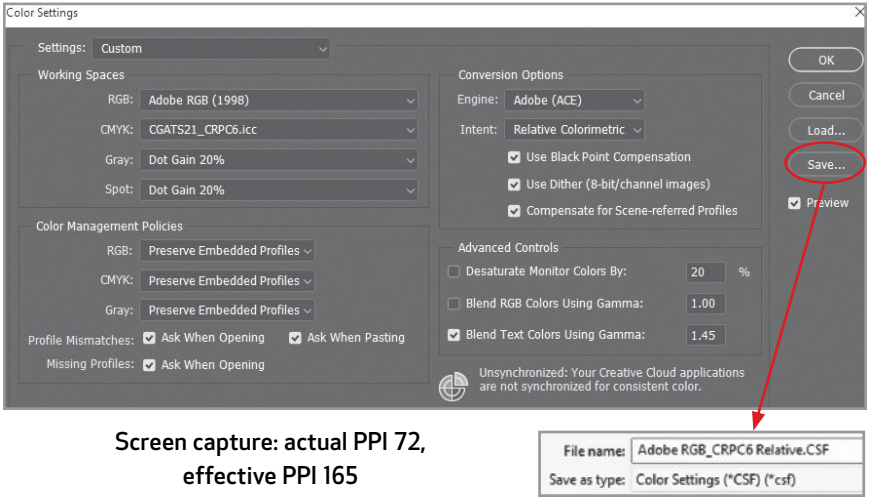

Assigning the same working spaces and color conversion in Adobe Bridge helps provide a screen rendering of the colors closer to how they will appear in print, as well as ensuring that the correct source profiles will be assigned for tagging at the final PDF stage. Let's look at the process.

To guarantee that all Adobe programs are using the same color settings, apply settings in Adobe Bridge by loading a custom .CSF file (Color Settings File) created in Adobe Photoshop. When creating the Adobe Photoshop .CSF file, there are a couple of settings which directly impact how your display will simulate the printed piece.

### Creating the .CSF settings for Adobe Bridge

- Launch Adobe Photoshop
- Configure Edit > Color Settings in Photoshop using your preferred working color space and conversion options.
- Save with a custom name within specific PC or Macintosh folders.

**The screen image below shows the compatible setup for using a coated media.**

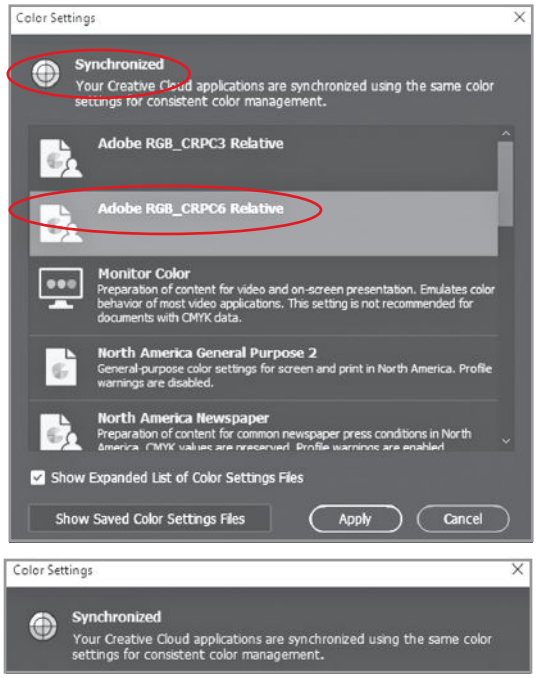



**Screen capture: actual PPI 72, effective PPI 165**

### Configuring Adobe Bridge Color Settings

- Launch Adobe Bridge.
- Select Edit > Color Settings and assign your new settings.
- If you don't immediately see them, click on the bottom check box, Show Expanded List of Color Settings Files, and your new setting should then appear.
- Select Apply

All Adobe programs which are compatible with Adobe Bridge will now show color settings as synchronized when launched.




**Sample color settings from Adobe Photoshop CC used in Adobe Bridge**
**Screen capture: actual PPI 72, effective PPI 165**

## UPDATING PANTONE LIBRARIES

While color space standards have been changing, Pantone also has been busy adding and retiring colors in its swatch books.

Pantone colors assigned in a design program list both L*a*b* and CMYK values. L*a*b* values will produce more accurate color conversion when used in an inkjet workflow. But, if the Pantone color name is not found in the color lookup table for the press, the CMYK recipe value will be used instead.

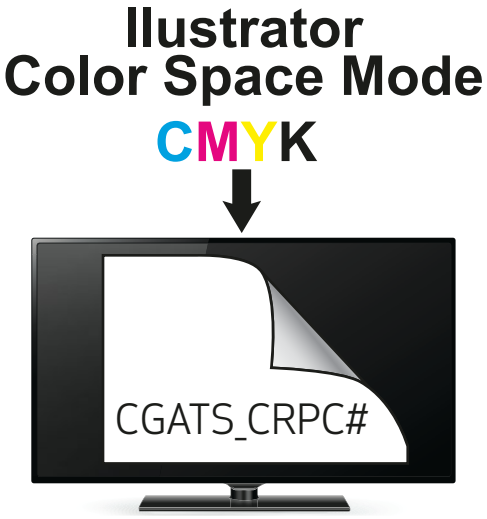
To avoid unexpected substitution of CMYK for your intended L*a*b* values, you need to make sure that your color libraries are up to date.

Unfortunately, Pantone is no longer offering libraries for free as part of Adobe program updates. They now offer a fee-based service to link color communication between designers and print providers. It's important for designers who assign Pantone colors to update their libraries with these new methods to keep in sync with their in-house and service provider print processes. These tools will be covered in more detail in the next chapter.

**Pantone is offering a fee-based service to integrate their color library into Adobe Creative Suite® programs.**

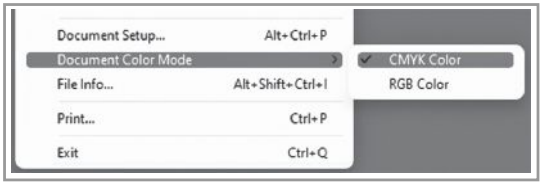
## CHECKING ADOBE ILLUSTRATOR COLOR MODE

If Adobe Illustrator is your program of choice and Adobe Bridge is set up correctly, the Color Mode will default to CMYK Color when you create a new Illustrator file.



The working space for inkjet must be in CMYK because Adobe Illustrator vector images designed in RGB or vector elements with assigned RGB color fills will not convert properly, resulting in unexpected color production on the press. We talk more about managing color in vector images in Chapter 11.

To ensure color management settings from display to print are honored, only create vector graphics within Adobe Illustrator in CMYK color mode or check them by selecting Edit > ColorMode before designing or editing any Adobe Illustrator document.




**Always check Color Mode in Illustrator to ensure CMYK is assigned**
**Screen capture: actual PPI 72, effective PPI 165**

## Color space checklist

Let's recap the steps for configuring color settings before design begins:

- ❑ Get input and rendering intent settings for RGB and CMYK from your print provider or a .CSF file
- ❑ If a .CSF file is not offered, create and save your own .CSF in Adobe Photoshop
- ❑ Apply settings in Adobe Bridge for automatic program color synchronization
- ❑ Make sure that Adobe Illustrator documents are in CMYK color mode before designing

CHAPTER 11

# TAKING COLOR TO THE NEXT LEVEL



TAKING COLOR TO THE NEXT LEVEL

# EXPANDING YOUR COLOR OPTIONS

When designing for inkjet, how you choose a color can be just as important as the color itself. We talked about managing color in Chapter 9, but let's drill down a bit into why Pantone spot color assignments are more accurate than using a CMYK recipe for your most critical colors. Remember to check with your print provider before assigning spot colors to ensure they can convert them correctly and to understand how they will be converted.

## ASSIGNING SPOT COLORS

Most inkjet presses and their RIP systems have Color Lookup Tables. These tables are a simple library of Adobe's Pantone libraries and their reference CIELAB values (L*a*b*) representing the three-dimensional values of a color within a color space.

Each Color Lookup Table contains color data for a specific inkjet manufacturer and device. The tables and data are different for each printer and its configuration. Each table is calculated using variables for production requirements, RIP, ink values, color space (ICC profile), and media selection; and reference the coated and uncoated versions of Pantone books. Think of a lookup table as a color translator between your design and the ink values to be printed.

Keep in mind that many Pantone colors cannot be reproduced by any combination of just C, M, Y, and K whether you are using inkjet, toner, or offset. Pantone colors are custom designed for ink manufacturers and

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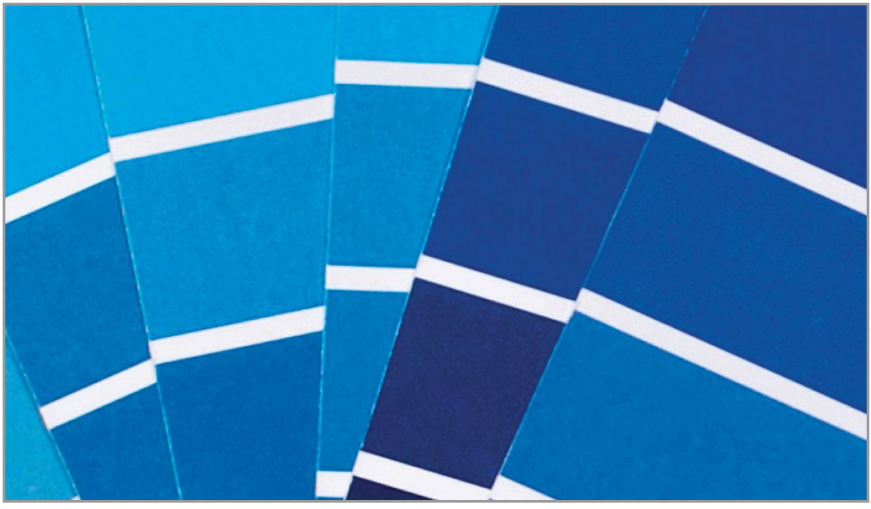


Did you know that roughly 45 percent of Pantone colors require a recipe of more than four colors?

each color is mixed from a precise recipe to be compatible with specific equipment. Roughly 45 percent of Pantone colors use a recipe with more than four colors. Trying to match one of the Pantone colors in that group is like trying to bake your grandma's cake without some of the key ingredients. You can get close, but it will never be quite the same unless you start with the same stuff. So, for many colors—unless you are using Pantone inks—you are not really Pantone matching. What you are doing is Pantone simulating—getting as close as you can with the four basic ingredients you have. Keeping your Pantone libraries up to date and using a common color space between your Adobe programs will help you get as close as possible with the least amount of effort.

## Updating Pantone libraries

The best way to assign and simulate Pantone colors accurately across inkjet is to use spot colors in L*a*b*. However, Pantone has been changing the way it interacts with Adobe Creative Suite programs, which can make keeping up on the latest swatches frustrating if one of your critical colors is not in your library or becomes obsolete. Pantone is continuously making new colors and retiring old ones. Keeping up to date is important for connecting with your clients. Currently, Pantone does not keep Adobe programs current with its well-known (free) Pantone Digital Library Installer, having changed to paid, cloud-based exchange membership models.



Through **Pantone Connect®**, designers can purchase printed books to reference new colors visually and add them to their current Adobe color library. New colors will not be added automatically to Adobe programs but will need to be added individually by the designer. There is a basic level of free access to Pantone Connect, but it doesn't include all the capabilities needed to keep your libraries synchronized for print.

It's not just Adobe that needs to keep up with Pantone's changes. Other inkjet raster software such as front-end RIPs also must be updated. This can create headaches for large brands or any customers or designers who need their color values to be accurate across all platforms.

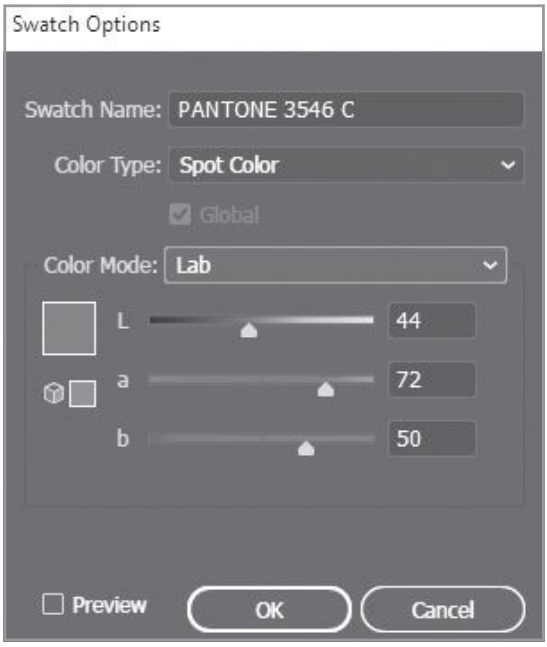
**Inkjet front-ends must also keep up to date with Pantone color listings to assure the proper color values are assigned when converting to CMYK.**

Pantone has created a service, **PantoneLIVE®**, to help meet these needs. This offering is a membership platform that creates color collaboration between brands, designers, and print providers, linking them to a cloud-based central library. This program helps ensure color assignments accurately use the same CIELAB measurements throughout the printing process, regardless of substrate or color space. Designers with access use Pantone colors from PantoneLIVE, not from Adobe's internal color library.

## Overcoming color matching challenges

Pantone uses different translations for colors selected from their color libraries depending on the target press. A PMS color can be assigned as L*a*b* (book color) or CMYK when working with an inkjet press. The RGB color assignment will never be used when selecting Pantone colors for inkjet. L*a*b is the most accurate mode when translating a Pantone color because it allows different inkjet processes using different papers and inks to consistently simulate the same color. Assigning spot color swatches will preserve definition and color modes (CMYK, RGB, LAB, HSB, or **WebSafe** RGB).

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**Screen capture: actual PPI 72, effective PPI 165**

When you manually define a CMYK recipe rather than letting the system simulate it for you, that recipe is fixed and won't be adjusted for different production processes. Since colors for inkjet must be adjusted for different inks and papers, closely reproducing a color simulation across different processes requires testing and defining a different CMYK recipe for each one. This also means that the design file will need to be changed for each process. Maybe you think you are only running on one type of paper and one type of press, but you don't always know exactly where your print job will run, so it's best to play it safe. As noted in Chapter 9, there are situations where you may want to build your own CMYK recipe for large blocks of color or to control the closest matches for brand colors. But this can create more work for you, so avoid it if you don't absolutely need to manually adjust the simulation.

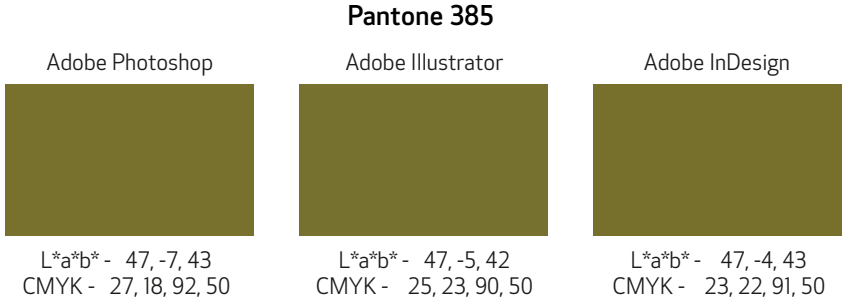
Using L*a*b* values for spot colors also provides a closer on-screen simulation across Adobe programs and helps reduce the difference in appearance between the Normal and Overprint Preview viewing modes if you use those in your design process.

So, avoid a headache and ask your print provider if they use Spot Color lookup tables before starting the design process. It will save you time and effort and give you a better on-screen preview.

## Color assignments in Adobe Creative Suite

If you have worked with Adobe products such as Photoshop, InDesign, and Illustrator, you may have noticed that color selections, L*a*b*, or CMYK recipes can show different values in each product. This is because each uses its own Pantone library and because color translation is based on a specific assigned color space. It's very likely that your Pantone library, color space definitions, or both are out of date on one or all of your Adobe systems.

Remember in Chapter 6 when we talked about the impact of paper? We covered paper color, surface, type, absorption, and how the ink's reaction greatly impacts the final printed color. A change in any of these variables will produce a different color translation. The color simulations also will change based on the color space for which they are defined. If you have not consistently defined your color space or are using an outdated one, you will not be able to take full advantage of what Adobe or your inkjet press can do.



Adobe Color Bridge synced to CRPC6 across Adobe programs

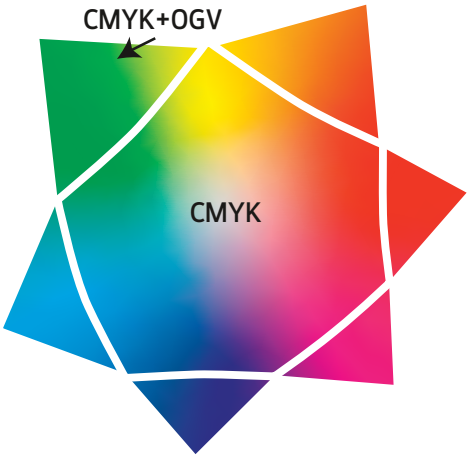
11

It is a best practice to sync all your Adobe programs using Adobe Bridge to reference a common color space such as a press condition simulation profile or CGATS. This will align Pantone's CMYK recipes more closely when utilizing multiple programs in the design process.

The previous example above shows how Photoshop's spot L*a*b* and CMYK color values differ from Illustrator and InDesign. All three programs still vary in their color translations, even when the color space is properly defined. This is due to Pantone libraries not being updated across Abobe Creative Suite creating slight differences between programs; a big reason PantoneLive was introduced. These differences can be so slight they may not be noticeable when printed.

## Wide-gamut CMYK+

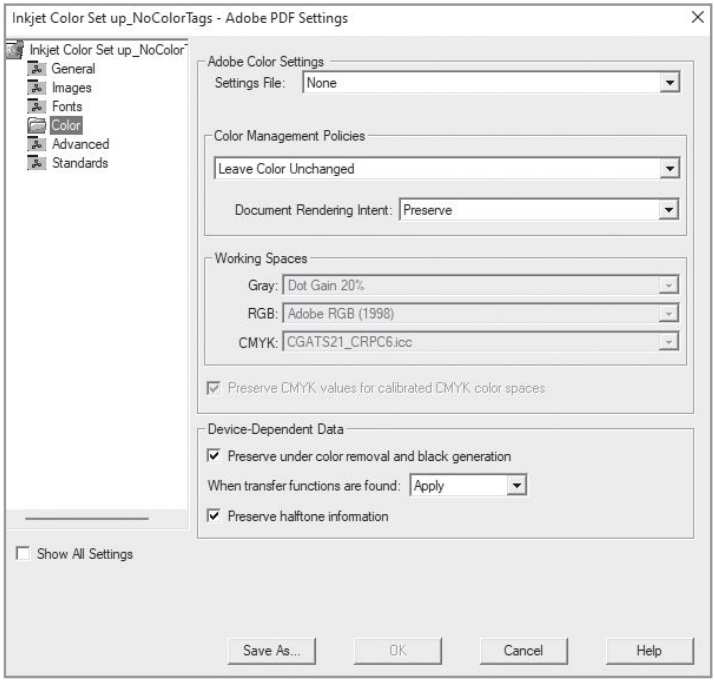
Now that we've covered the fundamentals of color management using four colors, let's throw some more ingredients into the cake batter. You may have heard of inkjet or toner presses referred to as CMYK+. This means the press is using more than CMYK to create its color gamut. Mostly used in flatbed and wide format inkjet printing, additional colors are now migrating into high-speed inkjet. Adding colors can expand the color gamut in different ways:




- CMYKLcLm (light cyan and light magenta) expands areas in the L* (lightness) range. This helps smooth highlights, details, and fleshtone areas, resulting in less graininess.
- CMYKOGV (orange, green and violet) expands the overall L*a*b* by increasing color chroma in the a* and b* values as well as expanding color depth in the L* value. CMYKOGV expands the overall gamut and increases the number of Pantone colors it can reproduce accurately.

More ingredients means more available recipes, but how do you design for extended gamut when you only have the CMYK working color space in Adobe? Luckily, no extra work is needed. The colors you choose within your design file will be processed with an ICC profile that accounts for this extended color space, automatically applying it to the design file.

In Chapter 15, we will dig into designing campaigns that will be produced using multiple printing technologies, including assigning a common color space to ensure similar colors are delivered consistently. However, if you are working on individual designs to be printed on an extended gamut press, the printer will need PDF files that have not been pre-converted to a particular color space.




**Screen capture: actual PPI 72, effective PPI 165**

If a PDF is preconverted to a target color space, the file is now limited and will not utilize the extended gamut. Always talk to your print provider before saving your PDFs to ensure you are taking advantage of the largest color space possible.

CHAPTER 12

# TESTING YOUR COLOR CHOICES



12

TESTING YOUR COLOR CHOICES

# READY. SET. TEST.

Earlier in this guide we discussed how to set up your design environment to achieve consistent color quality and how to squeeze the most color out of your selected printing options. In many places along the way, we have recommended that you request reference print or tint book samples to guide choices or validate the results of your efforts. Now we are going to show you how to use a custom tint book to expedite and control this process.

There are many scenarios where you may need to request a printed tint book sample:

- Evaluating press and media options at the start of a project
- Identifying the closest CMYK recipe to meet brand or other color matching requirements
- Working with clients to validate your media or color matching recommendations

This is also a great way to establish your working settings and relationship with your print partner.

You may be able to work through the color matching process without using a tint book. For instance, if your print provider's workflow includes a large Pantone color database or lookup table library, it can convert the assigned Pantone Spot Color to CMYK color values to estimate the match for a particular ink and paper combination. This table uses a custom color list containing calculated CMYK color values that fall within the gamut of the press and selected media to target industry standard color spaces like GRACoL/CRPC. If the inkjet device uses a lookup table, a lot of the color matching guesswork can be eliminated. But not all inkjet presses have this capability.

However, even if library-based matching is available, it doesn't solve for making decisions about out-of-gamut color adjustments or color matching across processes. Also, the CMYK values assigned to Pantone colors in your Adobe library may not represent the closest possible match to the intended color on your media. Remember when we talked about different ink chemistries producing different color values on different substrates? The CMYK conversion values in the Adobe Pantone library are always based on specific (coated or uncoated) paper and conventional (non-inkjet) ink that can be very different from the inkjet press and media you'll be using.

**The CMYK recipes in the Adobe Pantone library are based on offset ink and paper which is very different from inkjet ink and papers formulated for inkjet.**

If your print provider requires your swatch colors to be assigned as process CMYK, they should have a media-specific tint book available or at least be willing to print one you provide.

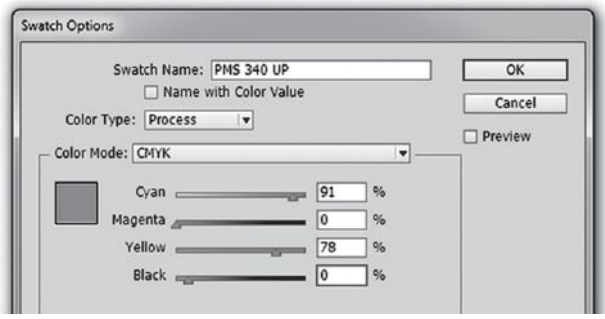
Since we're always looking for ways to make life easier for you, we have created a tint book for you. Go to https://**inkjetinsight.com/tdgresources** to retrieve this 84-page PDF file showing mixes of CMYK values in five percent increments. Use the QR code for quick access. This approach provides more matching options and helps highlight the direction in which a color may need to be tweaked.

## NO PANTONE, NO PROBLEM

If your print provider's workflow does not include a Pantone lookup or you want tighter control over your color decisions, finding the right CMYK recipe to best match a Pantone color takes a little more testing—but the results are worth it.

You will need to configure each color swatch with the custom CMYK recipe that provides the best match to your target when printed. Pantone colors being adjusted for the closest CMYK match should be assigned as "Process" with "Color Type" and "Color Mode" as CMYK. This means the printer will process the color using custom CMYK process values and won't use the CMYK values of the spot color.

If a color is assigned as a Pantone Spot Color and the press doesn't have a custom Pantone Look-Up Table, the spot color will be converted to the assigned Pantone CMYK values linked to that swatch. Assigning the "Color Type" as "Process" is critical to the color matching process.




**Screen capture: Actual PPI 72, Effective PPI 182**

**It is best to reference a printed production inkjet tint book with the specific ink, paper, and press settings before choosing colors rather than just specifying a Pantone color when designing.**

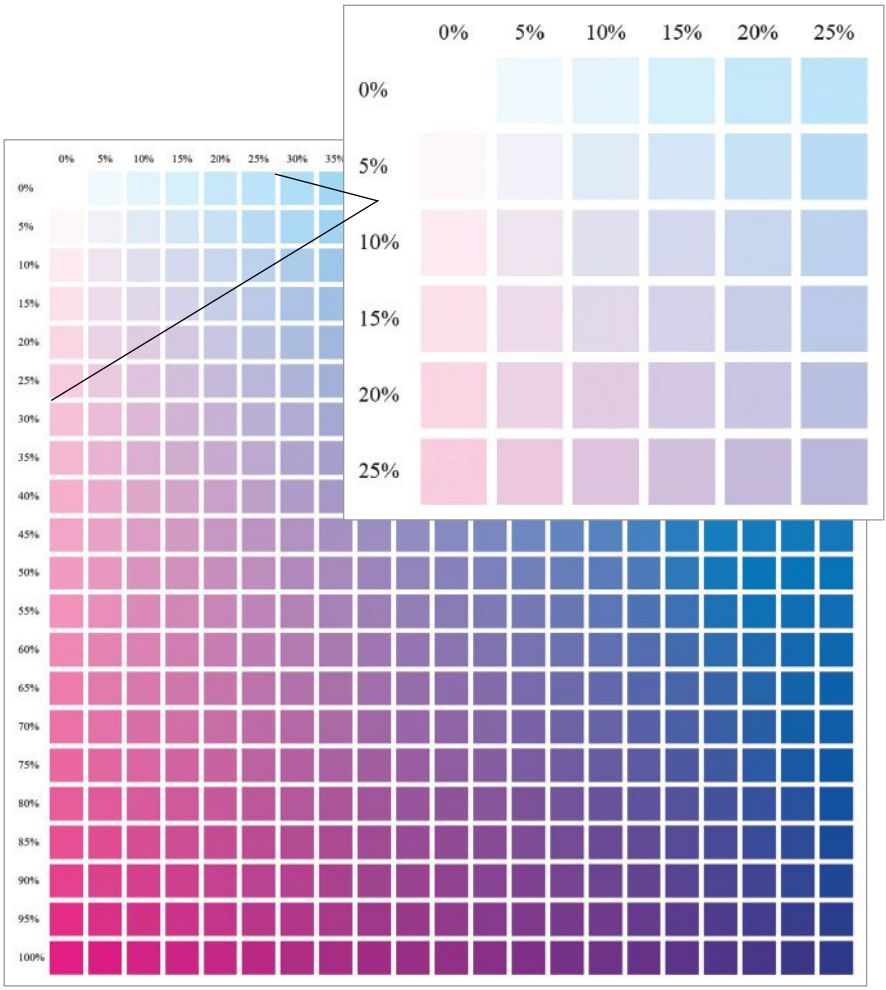
With a tint book, choosing accurate colors can be easy as **PIES:**

- ❑ **P**rint an inkjet tint book
- ❑ **I**dentify closest matching color
- ❑ **E**nter CMYK values into an Adobe swatch color
- ❑ **S**elect and share an Adobe swatch library

## USING AN INKJET TINT BOOK FOR BEST RESULTS

Once your tint book is printed on the target inkjet device with the ink and paper that will be used in production or with the multiple options you are comparing, follow the steps on the following pages to find the closest color match to your desired color.

- First, take the samples to your controlled lighting area.




**Sample page from a tint book**

- Using the unprinted stock paper chosen for production, cut out a square window the size necessary to show a single inkjet-printed tint swatch to make a mask. It doesn't have to be Picasso-perfect — it just needs to allow you to look at one color at a time.
- Visually find the closest match by overlaying either the Pantone solid or CMYK Color Bridge swatch over the inkjet-printed color. Think it's close?
- Now, place the mask you made over the colors and see if they're still the best match. Some colors trick our eyes when visual tonal shifts occur in relation to their surrounding colors. This quick mask effect helps eliminate visual color shifts caused by the surrounding paper or graphics. This technique is also handy when explaining to customers why the same colors look different when printed on the same page.




You also can compare using Pantone's Color Bridge book. Either the Pantone Spot Color or the Color Bridge CMYK swatch could be a closer match, as ink set values are different for different inkjet devices.

Make sure each color being compared is equal in size. Colors can spread at variable rates into absorbent papers, causing slight tonal shifts across large solid color blocks. For areas that are color critical and differ significantly in size, you may need to apply slight CMYK percentage value changes. To plan for this, print both small and large areas so they can be color matched separately. The tint book provided can be opened in Adobe Illustrator and the color blocks increased to adjust for matching larger bands of color.

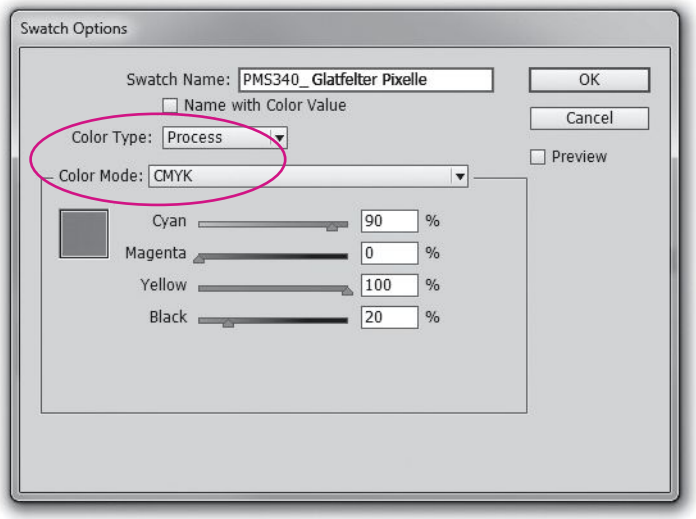



**Use the CMYK value swatch for comparison, not the spot**

## Enter the CMYK values into an Adobe swatch color

- When adding a custom swatch to Adobe, be sure to name each color by the PMS color, paper name, and weight it represents. The ink values used for one paper and weight may not look the same on others, so identify each swatch separately.
- Example: Your printed inkjet color matched PMS 340 printed on Pixelle paper at 90% C, 0% M, 100% Y, 20% K percentages. If you print to different production inkjet printers with different pigment and dye inks, be sure to add this data into the color swatch name as well.

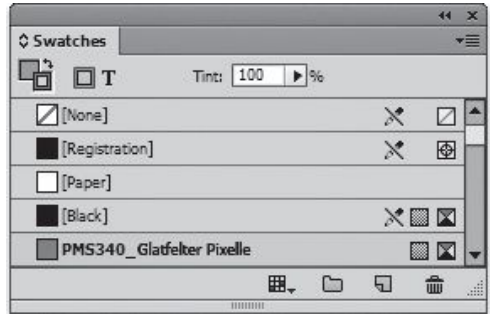
- Swatches should be created as “Color Type: Process” and “Color Mode: CMYK.”




**Screen capture: Actual PPI 72, Effective PPI 171**

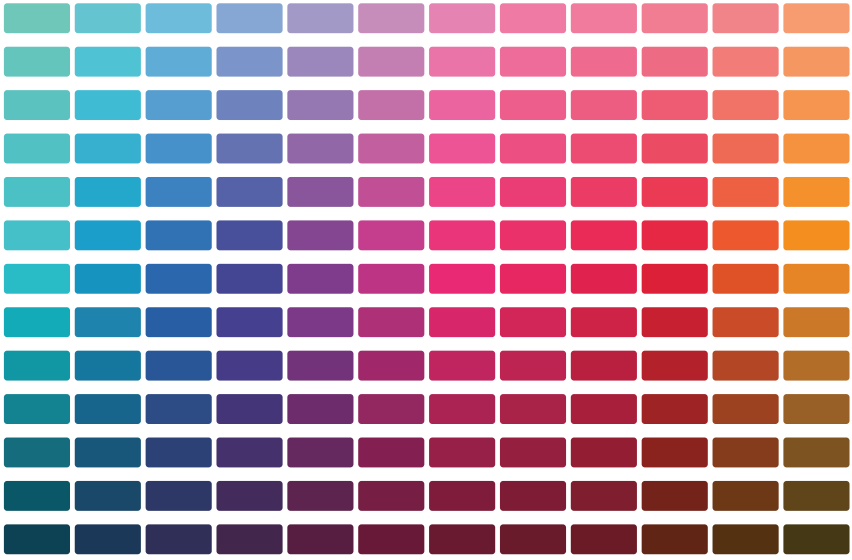
## Select colors and share an Adobe swatch library

To save colors as a shareable custom inkjet color library, select and save the swatches you would like to include. Be sure to include the machine, ink, paper type, and weight in the name when saving the library.




**Screen capture: Actual PPI 72, Effective PPI 136**

The library is saved as an Adobe Swatch Exchange (ASE) file and can be used in any of the Adobe Creative Suite programs. This creates a standardized color swatch library for a specific ink, paper, and machine combination that communicates color information across applications and processes. Be sure to include the machine, paper type, weight, and ink in the name when saving your ASE file.



## Sharing your custom Adobe Swatch Exchange file

Share this file with other designers who are using the same machine, ink, paper type, and weight to standardize your approach to a particular customer's brand colors. If you are designing within a service provider organization, you can save your customers some time by providing this ASE file to their designers for each paper type you support.

Anyone using the file can now load swatches in any Adobe program and choose the custom color library that corresponds with the ink, paper, and press they are using, and design with confidence knowing that the colors used will print as expected.

Now you, your colleagues, and your clients can choose tested color values for a particular ink, paper, and machine from your new library when designing. Your colors may not look totally accurate onscreen, but they will print as expected—and setting proper expectations is the first step in keeping customers happy.

Be sure to talk regularly with your print provider if you are using this process. If the printer changes ink, paper, or profile settings on the machine, this could change how the CMYK values print.

## What about out-of-gamut colors?

Some Pantone colors may not have a good printed match and would be considered out-of-gamut. These colors could be unachievable using the ink, paper, and machine combination you chose for your design. If the colors you see in your printed tint book are not close enough and you want to try to achieve colors closer to your Pantone target, try test prints on a different paper that has a surface formulated for the aqueous ink type you're using. The right paper can bring hundreds or even thousands of colors back into gamut. If you still can't achieve the results you're looking for, check to make sure that you are working with one of the newest "gamut- busting" generation of inkjet presses. If you are not, try testing on a different press (that may require a different provider) and see if the results merit a new print relationship.

CHAPTER 13

# BRINGING PHOTOS TO LIFE



13

BRINGING PHOTOS TO LIFE

# IMAGES THAT POP

You may have noticed with your desktop printer that sometimes you start with a great, sharp, colorful photo and end up with printed output that looks flat and lifeless. The results you get are, of course, influenced by the printer and media you use. Higher-resolution desktop printers using photo paper will deliver much better results than low-resolution units with plain paper. Proper file preparation also has a big impact on output. The same range of results can be seen in a production inkjet environment but, with proper preparation, the photo opportunities have never been greater.

The newest generation of inkjet presses have broken through quality barriers and are now often the go-to choice for printing photos, photo books, high-quality calendars, and other "photo-quality" printed products. This is because of inkjet's ability to produce short or personalized jobs in ultra-high quality at a lower cost than other types of digital presses.

When you buy printing services you may be able to choose your media, but you don't always have control of the press that gets used for your work. If you do have the opportunity to shop around, it helps to understand the impact of the technology on your work—particularly when it requires photo-quality reproduction. As discussed in Chapter 5, the size of the ink drops and number of drop sizes used has a big impact on fine detail. Printheads that produce or simulate multiple drop sizes can add depth and detail to photos, but tricks exist for working with photographic images that can ensure your images "jump off" the media regardless of the type of printhead.

## RESOLUTION MATTERS

Although high resolution adds to the overall size of press-ready files, keeping the resolution of any photos or bitmap images consistent with press resolution is important if you need to reproduce them with the highest detail possible. For higher-end jobs, some printers will request scanned or bitmap images be over 300 dpi because the resolution of new inkjet presses may be more than two or even four times greater than 300 dpi.



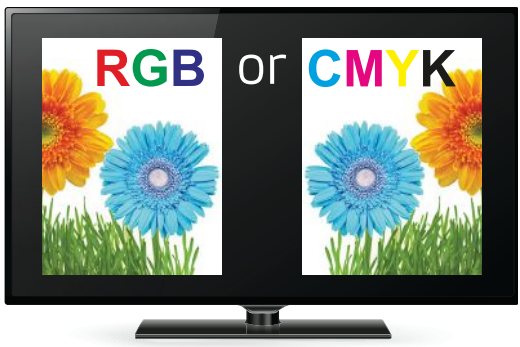

**Image printed at 600x600 dpi**

Saving the bitmap image at, or very near, the resolution of the printer will allow the printer to convert pixels to dots without limiting the production resolution. This method is best for projects requiring top-quality production, like marketing collateral and direct mail, and not recommended for projects such as customer communications, where speed and efficiency is more important than production quality. This is because higher resolution photos may produce larger files and longer processing times. In a personalized environment, this additional processing time can increase costs if the printer can't operate at full production speed. You also will want

to ensure that, after taking care to save your photo images the way you want, your print provider does not automatically downsample the resolution through their prepress workflow to improve production efficiency.

## CHOOSING RGB OR CMYK COLOR SPACE FOR IMAGES

Your project can include images in different color spaces. Although you are printing in the CMYK color space, images scanned and edited as RGB, in Adobe Photoshop for instance, allow a larger color space for editing. The inkjet RIP or DFE (Digital Front End) processing the image will convert an RGB image more accurately to the CMYK color space of the printer using a perceptual rendering intent, a concept we will cover in more detail in the next chapter.




The correct color space for your images should be determined based on your print provider's workflow. Even though your document will accept both RGB and CMYK images, your print provider's workflow will be configured to one or the other. If you're working with one of the newest generations of inkjet presses, see if you have the option to leave photographic images in RGB. This will enable access to the greatest number of colors within the gamut of the inkjet press. Because the gamut of the newest presses may be wider than GRACoL or SWOP gamuts, maintaining images as RGB avoids unnecessary color compression.



Most often, statement printing requires images converted to CMYK, while high-end commercial print prefers RGB.

## FUN WITH FILTERS AND PHOTO EDITING

When you're trying to get the best image and color quality out of an inkjet press, a photo editing tool is a huge help. When used in a color-managed workflow, a tool like Adobe Photoshop can simulate the color space of your inkjet device.. In addition to supporting soft-proofing to help with color correction, it has wonderful filters and effects that make images and colors pop—even when printed on uncoated and treated media. When using photo editing tools for print design, there are golden rules to follow.

### GOLDEN RULES

**1st** **Always apply filters and image adjustments in the correct image resolution and final color space recommended for the target print environment.** Any color correction effects or filters applied will affect color in a manner specific to your color space. Some Adobe Photoshop filters can only be applied to an RGB or a CMYK color space image, so be sure to review filter rules before converting the color space for an image.

**2nd** **Be careful with double converting. If an image has previously been converted to CMYK and a filter or effect can only be applied to an RGB image, it is possible to convert the image back to RGB.** However, always preserve your original color definitions upon RGB conversion — then convert the image to the preferred production color space before final color correction and soft proofing.

**3rd** **Test any adjustments against your color reference document before applying them to your design project.** Filtering and image adjustment are complex processes that can yield unexpected results in a production inkjet environment. You can't use your monitor as the visual proof for complex changes and layered effects.

Apply these rules to some of our favorite filters and plug-ins and see how you can bring your photos to life.

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**Brightness and Contrast** can give more pop to images. Adding brightness will affect the overall lightness or darkness of an image, creating brighter highlights. This can help if the original photo is a bit flat. Adding contrast will adjust the range of dark to light tones, adding more depth. This also can help when trying to control the level of ink saturation. Note: this filter is best used for images without skin tones.

**Photoshop is your friend offering a wide range of filters and plug-ins for use with process bitmap images.**

**Exposure** will increase midtone and shadow color saturation in areas that are flat.

**High Dynamic Range (HDR) Toning** intensifies the image's detail and sharpness with color saturation adjustments. You also can combine multiple exposures of the same image.

**Photo Filter** colorizes highlight and midtone areas that are likely to take on the media's color. Choose a hue that adds color to areas that may be dulled or dirtied by the media color.

**Selective Color** allows color hues to be adjusted separately. For example, if you seem to be losing magenta color intensity, you can crank up the reds in your image.

**Vibrance** Is a subtle image adjustment for very busy photos that also have light highlight areas such as skin tones. Vibrance adjustment intensifies color while protecting light highlight areas.



When using uncoated, treated, or coated papers, don't be shy about using Adobe Photoshop and image effects.



Original



Contrast applied



HDR toning added



Sharpening

**Various Sharpening Options** increase pixel detail without large differences in color saturation and can be great for images that are flat and lose image detail. Use them in combination with any of the above. They're also great for uncoated and treated media.

**Smart Sharpening** is the ultimate go-to adjustment for any color or halftone image that needs subtle to strong sharpening for top results on inkjet presses. Sharpening effects will make any image pop on absorbent media and create intensity on low absorbency, high holdout media. The key to smart sharpening is adjusting the radius of shadow areas separately after all other adjustments have been made. By tweaking the radius effect, the remaining dark areas of shadows will intensify. This results in sharper definition between the full and midtones of the image, leaving the image looking a bit three-dimensional. Keep in mind that the inkjet process and media you use will affect the final printed intensity. Remember rule number 3? To test this effect, print on your desktop inkjet printer using different settings and various types of media. Uncoated media will represent absorbent media and gloss coated media will simulate a high holdout.





**Original** **Smart Sharpening**

## APPLYING SPOT COLORS TO A CMYK IMAGE

Let's revisit the subject of spot colors. If Pantone spot colors are applied as elements or spot color layers to a CMYK image, the spot color will be converted to target the assigned output color space when the file prints in CMYK. When converted to CMYK the spot color recipe will be automatically adjusted, if necessary, to a color that falls within the gamut of the target press. As colors that fall outside the gamut of the press are adjusted, the RIP will flatten the image to include all color assignments into the CMYK conversion. If you haven't tested this in advance, you may be disappointed in the look of the converted color and the photo clarity.

This caution also applies to spot colors that have been used for ghosting effects applied over CMYK images. You may not get anywhere near the color you're trying to achieve if the color workflow doesn't know how to

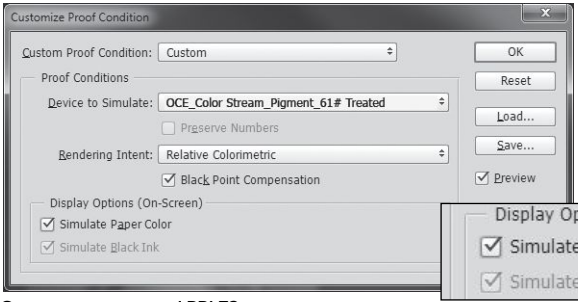
convert multilayer colors. Be sure that any ghosting effects are flattened and the color space for the image converted to CMYK so you can proof these merged colors and adjust prior to printing.

## Photoshop color correction in Proof Mode

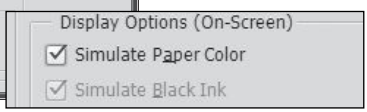
Applying color corrections to your images can be time-consuming and frustrating if you are not working on a profiled monitor with a color managed workflow. Using on-screen soft proofing can be helpful with image color correction if you are familiar with how the printer, ink, and media represent what you see on your display. We will cover soft proofing best practices in detail in Chapter 14.

For now, consider that the color difference between your display and the printed image is based on the difference between the color space of the printer and the CRPC/GRACoL color space profile assigned in your color management settings. These are the same settings introduced in Chapter 10 to set yourself up for successful printing in your target environment. However, when you soft proof, you may want to temporarily change the working document color profile from GRACoL to the printer profile. This will help the display more closely render the document in the color space that the printer, ink, and media can produce.

If the printing company you're working with can supply the output profile, or simulation profile, of the inkjet press tuned for the media and press settings used in production, you may apply this profile to Photoshop and view in Proof Mode. If an output profile for the target environment isn't available, using the CRPC settings suggested by the provider for the press/media combination used is the best option for color correction.

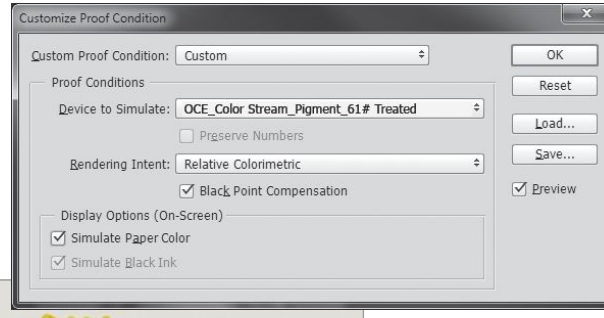



**Screen capture: actual PPI 72, effective PPI 168**




**Screen capture: actual PPI 72, effective PPI 112**

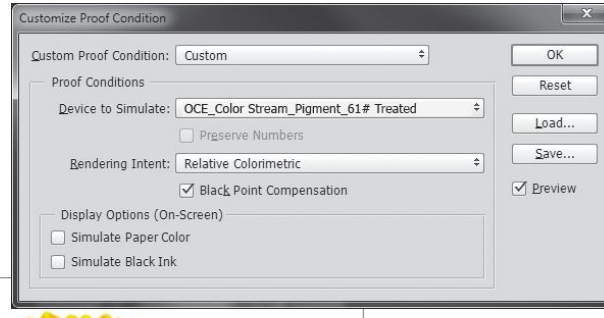
Screen capture:
actual PPI 72,
effective PPI 188






Soft proof with
simulate paper
color turned ON

Screen capture:
actual PPI 72,
effective PPI 189



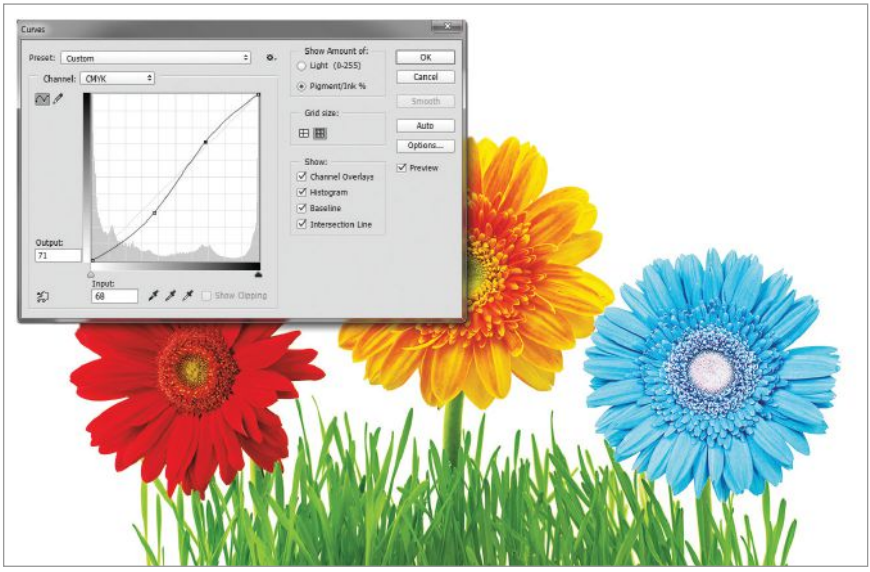



Soft proof with
simulate paper
color turned OFF

Assuming that your monitor is calibrated correctly AND utilizing the output profile for the target press, you are ready to adjust color on screen. (See Chapter 14 for step-by-step instructions)

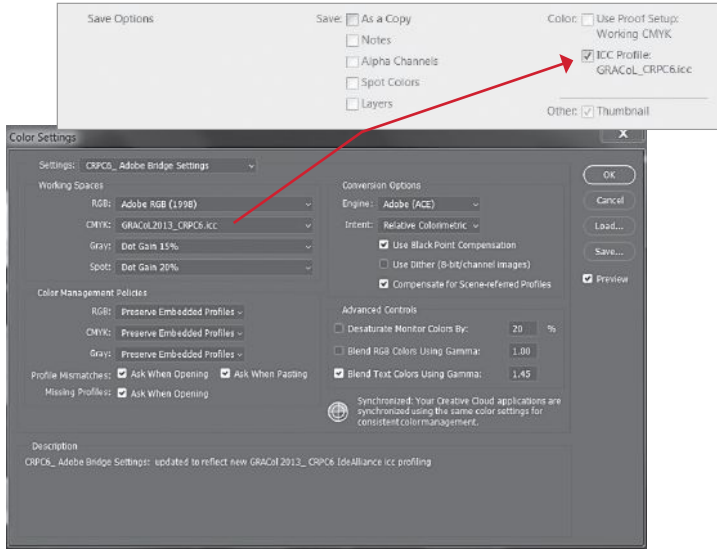
There are many ways to adjust color in Adobe Photoshop. The most common, when adjusting color to compensate for absorbent media, is by selecting Image, Adjustment, and Curves.

Color curves allow you to modify RGB or CMYK bitmap images. You can edit the combined color channels or edit each color separately based on a 1–100 percent editing curve. Using curves will help open up midtone or shadow areas if they become too dark and lose detail.




**Screen capture: actual PPI 72, effective PPI 258**

When saving any Adobe Photoshop file, don't forget to save the working profile color space of your design. This color data will be attached to the file all the way through the print provider's workflow, targeting that color space.




**Screen capture: actual PPI 72, effective PPI 178**
**Color settings applied to a saved Adobe Photoshop image**

Use caution when correcting an image because the difference in color spaces can amplify changes in print. Imagine you are color correcting a CMYK (four color channels) bitmap image, with 99 points of color that can be adjusted for each channel. Each color channel also will affect the others. This means there are 96,059,601 ways (99 x 99 x 99 x 99) to manage color in a single file.

This also means there are more than 96 million ways to mess up the color of an image! That may sound dramatic, but it's true.

Even with fine control of the 96 million points of color data you modify on screen, you still will not create an accurate representation of the dot spread of aqueous ink when absorbed into the media. However, it is a good step toward understanding the differences between what you see on screen and in print.

Here is another opportunity to mention that requesting a reference print is the best way to see how the inkjet machine and media perform together.

CHAPTER 14

# CONTROLLING COLOR WITH PROFILES



14

CONTROLLING COLOR WITH PROFILES

# SYNCHRONIZATION

From the creative stage to inkjet print production, there are many factors that affect how the colors in your design software are converted to inkjet press-compatible CMYK color values. Because media types and weights behave differently when printed with different kinds of inkjet inks, the amount of ink each combination can handle without creating surface issues is different. Every combination also results in a different range of colors that can be produced and a different CMYK recipe for the closest match to your target colors.

With so many possibilities, it's impossible to find the right color without a map. A color profile is essentially a map of the behavior of various media and ink combinations. Color profiling is a technical concept, but also quite powerful and worth the time to understand fully (we promise).

Profiles give you the greatest possible control of how close color is simulated on screen and how accurately your intentions are represented in print. This chapter covers the different profile types used in inkjet design and printing and how to use them to synchronize and control color in your design workflow.

## WHAT PROFILES DO

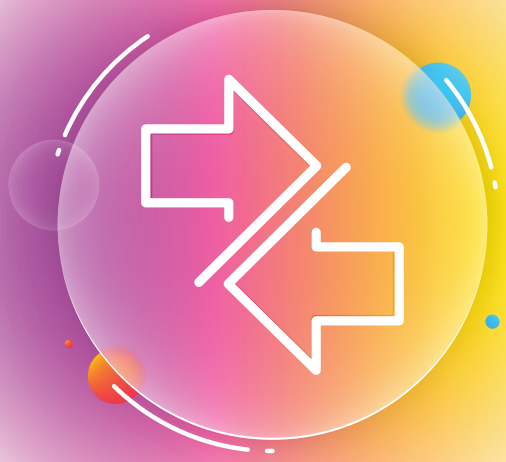
Color profiles are vital to the color reproduction process. RGB or CMYK values assigned in an Adobe graphic file holds no true color value. Colors are only represented visually once a profile is associated then the relationship between the color values and human vision is established.

Profiles don't just prepare colors for viewing on your display but convert the colors and images in your design file to the color space of the press

by modifying **color curves and values**. They work with other settings, like Rendering Intent, to enable the press to print to its greatest color potential.

When used properly, profiles can seem like magic. Like a lot of useful design tips, the magic of profiles is just a combination of math, science, and good planning. There are different types of color profiles used at various stages of the color management process. Here are the ones you should be aware of as a designer:





## Monitor profile

All color profiles are essentially look-up tables that describe the properties of the color gamut of a particular device. They rely on mathematical functions to properly map each color to its closest in-gamut representation. Simply put, monitor profiles allow you to design and view color on a color display in a way that simulates the printed color as closely as possible as well as adjust the color space of the production file to prepare it for printing. Adjusting desired colors on screen to reproducible ones in print within a specific production environment is like working with just the available crayons you have in the box labeled "inkjet press."

## Input device profile

**Input profiles** mathematically define the characteristics, or color space, that an input device such as a digital camera or scanner is capable of capturing. In some systems, the monitor is also managed under the input profile.



## Document profile

**Document profiles**, or "working profiles," are input profiles assigned when creating a new design document specific to your application settings. When input profiles are applied, they create the color space of your design file and the inkjet device, if using the same target. As part of a color-managed workflow, document profiles create a reference point for the specific RGB or CMYK color space in which the document is designed.




If document profile settings are not assigned correctly, colors used in the file are just a set of numbers without a fixed reference point. This can become an issue when working across multiple design applications—within Adobe Creative Suite for instance—as each program can render a color different ways onscreen and render it differently again when its final color assignment is sent to the inkjet press. By contrast, when a specific CMYK color space is assigned, the numbers relating to each color will specify the actual wavelength of light for that color. Referencing colors by a measurable criterion— their wavelength—creates a more accurate

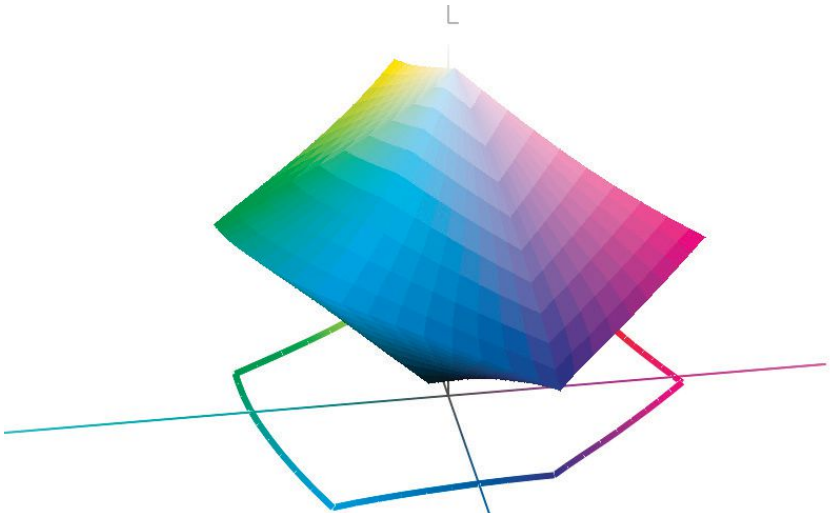
rendering of colors on your screen. If you are working within Adobe Creative Suite, assigning your document profile settings in Adobe Bridge will ensure that all Adobe software programs used in your design process are pointing to the same color settings. We will show you how to assign standard or simulation color space profiles later in this chapter.



## Output profile

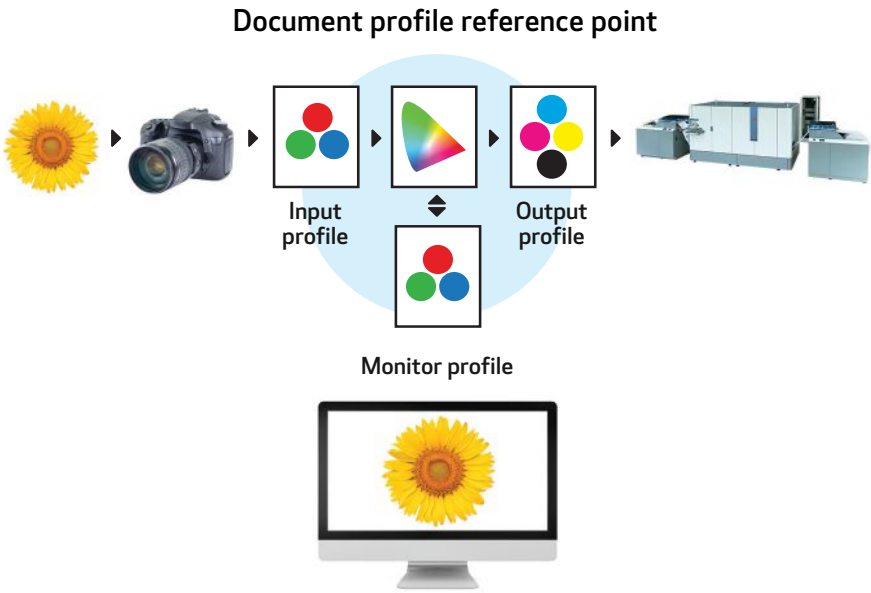
Sometimes called a **machine or profile**, the **output profile** is applied during rasterization. Rasterization occurs when an image described in vector graphics is converted into a raster image (dots or pixels) for output. You may have heard this called RIP or Raster Image Processing. To convert the color values assigned in the design file to the color space of a machine or output device such as a desktop printer or a digital or offset press, the output profile must be translated. When performing this feat of translation, the output profile takes into consideration all the specific print conditions for which it was defined, such as the type of media, ink, and individual press settings. Settings such as maximum ink coverage (TAC) are imperative to the creation of accurate profiles. Keep in mind that the profile may differ for each media weight as well as each media type. Always require your print testing and production jobs to be run with the proper color profile for that particular media type and weight.

**3D color gamut plot of aqueous pigment printed on coated gloss media**



## Simulation profile

One of the most useful tools in your bag of designer tricks, a **simulation profile** "simulates" the entire process needed to produce your design job. Unlike using a standard industry color space target such as CRPC_GRACoL, a simulation profile characterizes the entire custom process from RIP to press settings for your job, all of which can affect final color and image expectations. This type of profile provides a close representation of the final printed output and its achievable color space when applied in Adobe Photoshop. It is particularly important to use simulation profiles when designing for gamuts larger than standard target CRPC or GRACoL color spaces. They can help you visualize onscreen colors, identify extended color ranges, and adjust colors that may be out of gamut before the job hits the press.




All color profiles are essentially look-up tables that describe the properties of the color gamut of a particular device. They rely on mathematical functions to properly map each color to its closest in-gamut representation. Simply put, profiles allow you to design and view color on a monitor in a way that represents the printed color as closely

as possible as well as adjust the color space of the production file to prepare it for printing. Adjusting desired colors on screen to reproducible ones in print within a specific production environment is like working with just the available crayons you have in the box labeled "inkjet press."





### Device link profile

As the name suggests, **device link profiles** "link" or transform the color space of one device directly to another without using an intermediate color space. A device link profile always contains a source color space and a destination color space. The profile moves in one direction, converting the source color space to the destination color space. While not universally supported, these profiles are useful when specific device mapping values (such as 100 percent black or gray) are required.

If you have access to a high-end proofing printer to run samples of jobs targeted for production inkjet, device link profiles allow the proofer to more accurately simulate the inkjet device. This process converts the profile of the proofer into a color space that simulates the output profile of the inkjet printer.

## PROFILE CONVERSION AND RENDERING INTENTS

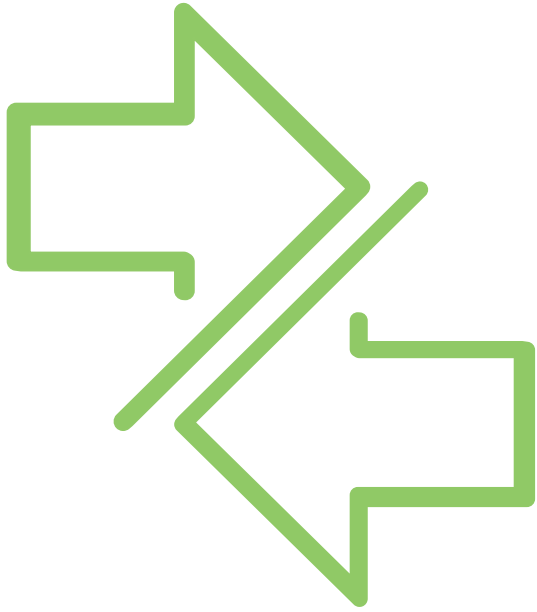
Think of rendering intents as the rules followed by color management systems to formulate color conversions between different gamut color spaces. This is particularly important when converting colors from a wider-gamut color space, like your design or image editing environment, to the smaller-gamut color space of aqueous dye inkjet on uncoated media, for instance.

Different rendering intents offer different ways to adjust colors from the larger gamut to fit within the output device's color space. Each type of rendering intent provides a different set of rules to follow for the same color space conversion. So, even when using the same output printer profile, your choice of rendering intent will yield different results.

14

## The art of color conversion

In Chapter 10 we talked about synchronizing the rendering intent for your Adobe Bridge settings with the settings of the inkjet print process. This assures the color space and conversions made in the design process (RGB to CMYK) are rendered using the same rules as the inkjet production RIP. The question is, which rendering intent should you apply?

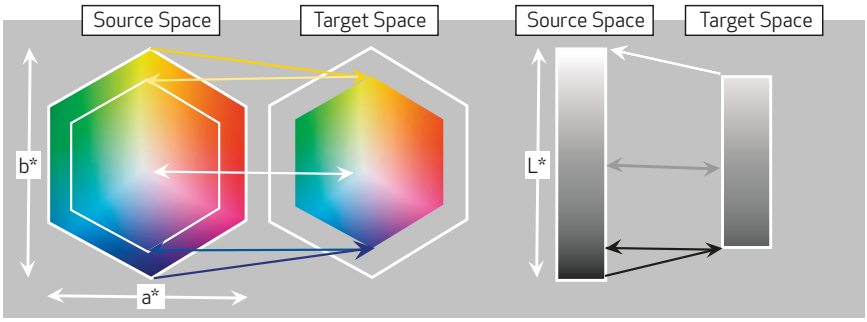


You have four choices of rendering intent: relative colorimetric, perceptual, absolute colorimetric, and saturation. Each of these fit a particular design scenario, but relative colorimetric and perceptual rendering are the ones typically used for high-speed inkjet.

## Relative colorimetric

Apply the relative colorimetric rendering intent for converting CMYK colors to other CMYK colors when the luminosity and color accuracy of in-gamut colors is the most important aspect to control. When applied, dense or dark colors falling outside the gamut may become less saturated, but bright color values will be more accurate. It offers stabilization of brightness values and is an ideal choice for black and white or near-neutral color palettes.



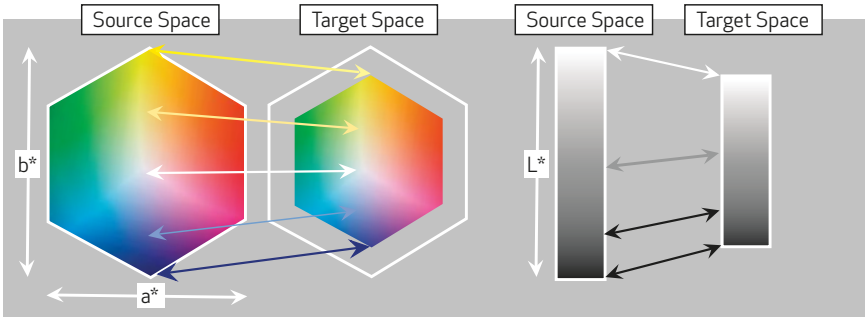



Relative colorimetric is used for inkjet workflows that target CRPC_ GRACoL gray balance color space. It reproduces in-gamut colors exactly and clips out-of-gamut colors to the nearest reproducible color.

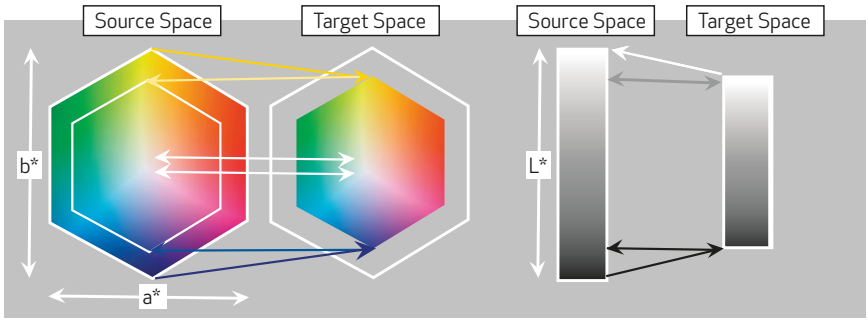
Think of the rules used for relative colorimetric as compressing the edges of the gamut plot without shifting the center or body of the gamut. This will replace smooth, dense areas with smaller steps that may cause dense, rich colors to flatten. This rendering intent maps the white of the source color space to the white of the media, helping balance colors that may become muddy or too bright because of the media shade.

## Perceptual (photographic)

Apply the perceptual, or photographic, rendering intent when converting photos or other images with highly saturated RGB colors to CMYK. Use it when keeping the image color vibrant is more important than exact color reproduction.




Think of the rules for perceptual rendering as evenly shifting all colors from one space to fit into the other. The use of perceptual rendering may lighten an image or shift the hue of specific colors. Additional adjustments to compensate for shifts in specific assigned colors may be needed as described in the previous chapter.




## Absolute colorimetric

While this should not be used for production, you can apply the absolute rendering intent when creating a proof on a printer other than your production press — for example, proofing your inkjet project using a wide-format plotter. In relative colorimetric, the conversion rules shift or map the white point of the source color space to the target color space, while absolute colorimetric does not.

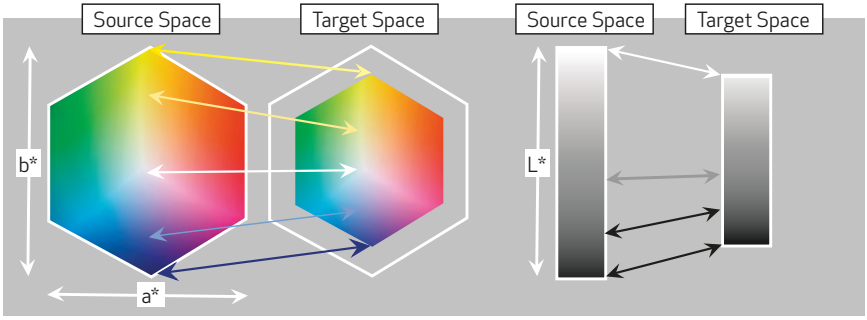
This setting is not used for production inkjet printing because absolute colorimetric rendering intent references a set white point that will not match your production media grades. It offers rules to a game that you're not playing with inkjet! It is designed for printing to a wide gamut color plotter using proofing media.

## Saturation

Use a saturation rendering intent where color impact is more important than color accuracy. Solid vector graphics such as cartoons would be a good fit for this rendering intent. Color vibrancy will be boosted at the expense of accuracy in hue and luminosity.

Saturation intent should not be used with photo images because the boost in color saturation will distort any continuous tone images.






## There can be more than one

When applied in Adobe Bridge, the color settings discussed assign a working space to your document and define color management rules and conversion settings for your images. This is a critical part of aligning with the workflow for your target inkjet press.

Most press workflows apply a rendering intent to RGB conversions separately from CMYK. Others use the same rendering intent for both color space conversions. If you don't understand the workflow your print provider is using, it could change the outcome you expected when you applied your color settings.

Always consult with your print provider to ensure the settings you use are correct for that company's workflow conversions. They may even provide you with the customized CSF file to load into Adobe Bridge that will save you time and improve your odds for accurate document and image color reproduction.

## WHAT PROFILES DON'T DO

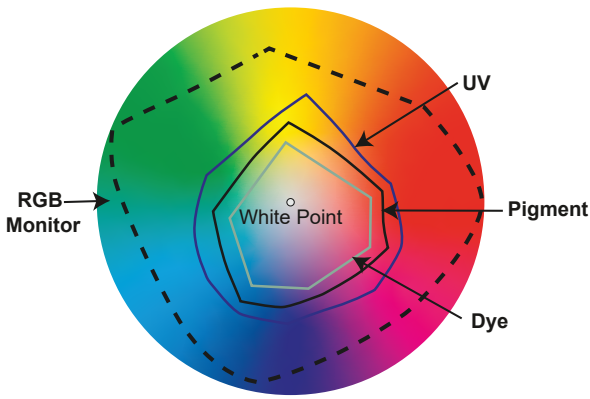
Profiles handle incredibly complex calculations, but they aren't magic. They can help you target colors more accurately, but they can't convert from a smaller gamut into a larger gamut or deliver more saturated colors than the press can produce on the target media. Profiles can't add colors to that inkjet box of crayons.

Profiles will attempt to simulate colors assigned in the design file, including spot PMS colors, by converting them to the ink values of the inkjet device. Going back to our box of crayons, profiles will help you find the crayon mix closest to the color you are trying to match, even if you don't have a crayon of that exact color in the box. Be aware that some color values may not have a close match because they fall too far "out-of-gamut" when mapped to the output profile.

## BREAKING DOWN THE OUTPUT PROFILE USED BY THE PRESS

Here's a fun fact: an inkjet press, by itself, doesn't have a color gamut. It's the combination of the press settings, ink, and media that do: media + ink + press. That's the trifecta of inkjet color management!

Look what happens to the color gamut when different inks or different media are used on the same press.




**Different ink chemistry printed on inkjet coated media**

## Inkjet coated media—different CMYK inks

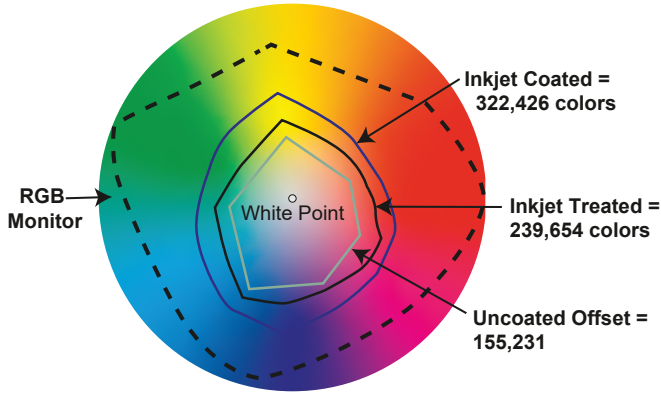
When using high-end, inkjet coated media that are mill formulated (or primed directly on the press) for the ink type, you will see a difference in color gamut between print using dye, pigment, or UV ink. The color gamut example below show that the inkjet color space for different ink types are different, even when printed on a similar high-grade media. Note that the media may be pretreated differently to optimize for dye or pigment ink, so they are very similar but not the same.



Why don't the inks look the same on a similar media? Because even small differences in individual components combine to affect the results. For the examples above, the ink, its colorants, additives, and the amount of water used is different, as well as the speed needed for it to dry properly. The surface of each media used in this example is manufactured and primed inline to keep more of the ink colorant on the surface while drying quickly. Even though each example shows the same "type" of media, ink volume varies enough that the maximum volume applied to the surface will be different. In other words, each has its own color profile with a different TAC setting, resulting in different color gamuts.

## Same ink, different media

Now, let's look more carefully at how the same ink performs on different




**Printed on coated, treated and ucoated media with aqueous pigment ink**

media. Rather than looking at two similar media, we want to show how dramatic the differences can be when the media type changes.



**Changes in media properties can change the reaction of the ink as well as the number of reproducible colors.**

The picture above shows the color gamut resulting from printing on three different media types, each using the same aqueous pigment ink. Look at the difference in color gamut and number of colors each can reproduce. An inkjet press produces slightly different results on each media. This means the number of reproducible colors or the number of "crayons in the box" will be different on each media.

Why does this happen? Remember the earlier discussion of how the media absorbs light and reflects the color you see, including the color of the actual media? The whiteness, brightness, porosity, opacity, shade, gloss value, and the level to which ink colorants sit on or absorb into the media all affect what colors are reflected. So, any change to these media properties can change the reaction to the ink as well as the number of colors that are reproducible—represented by the size of the color gamut for that press, ink, and media combination.

## Printing with more than CMYK

The evolution of inkjet marches on. In addition to improvements in ink, resolution, and the use of coatings, the technology also is continuing to expand beyond the four standard color channels of CMY and K into secondary colors such as light cyan, light magenta, orange, and violet. Adding special colors to the CMYK base expands the color gamut, allowing a broader range of Pantone colors to be reproduced as discussed in Chapter 11. This adds more color possibilities to the mix and increases the need to ensure the proper color space, profile, and rendering intents are specified to coordinate the new colors in your palette.

## Post-coatings affect color

If your print provider has prepared standard target or simulation profiles

for you, be sure they create your profile to account for all elements of the process, including any post-coatings or effects.

Although the difference may be slight, post-coatings (or post-applied effects) also can affect color. Changes are most noticeable when certain types of post-coating get applied on top of inks with colorants that sit higher on the media surface. The coating can cause ink dots to expand if the ink isn't dry when the post-coating is applied. This dot gain can make mid- and three-quarter tone areas become darker. This effect is called **plugging**.



## SOFT PROOFING USING ILLUSTRATOR AND INDESIGN

Because a monitor and inkjet press have different color spaces, the colors we use in designs, characterized within the document profile, must be communicated correctly through our monitor or input profile. Proper communication allows the design document to be easily and automatically adjusted to the color space of the press using the target

**Images show visual color shift between different simulation profiles**



Simulation profile for gloss media



Simulation profile for uncoated media



Monitoring soft proofing using a simulation profile of the output device will show color shifts that can happen on press.

CRPC, simulation, or output profile. An output profile also allows colors to be viewed more accurately (relative to the printed piece) on a monitor. This process of color management between the input profile and the output profile is called **soft proofing**. We color corrected bitmap images using soft proofing in Chapter 13.



When soft proofing for media, there are inherent limitations with using a monitor. The software will try to compensate for the dullness of an uncoated sheet by adjusting the actual color of the media—however, a monitor can never truly be dull since it is made up of lights that shine in your face.

## Using soft proofing

Your print provider may be targeting a CRPC color space or have created a simulation color profile from their inkjet workflow based on your specified media and ink. These profiles incorporate the entire inkjet workflow and, used with Adobe Creative Suite, can attempt to display color shifts between your working color space and the simulation profile. The accuracy

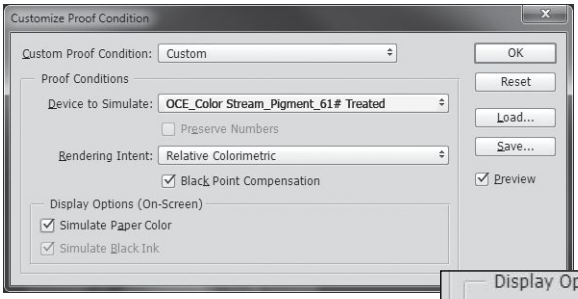



of the soft proof will vary considerably from media to media based on the calibration and quality of the monitor you're using.

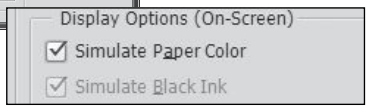
## Soft proofing in Adobe Photoshop Adobe Illustrator or Adobe InDesign

You also can use Adobe's layout programs to visualize color shifts that occur when converting from your working space to the color space of the print device.

If working with inkjet devices that have large gaps from machine to




**Screen capture: actual PPI 72, effective PPI 168**




**Screen capture: actual PPI 72, effective PPI 112**

machine, it is best to align your Adobe Bridge settings with the largest gap (smallest gamut) then use the Proof Setup Mode within the program and design with Proof Mode on and assigned to the smaller output color space.

1. To start, get a CRPC target or simulation profile from your print provider and save it in the proper folder location for Adobe Bridge (or the design program you are using). Note: Macintosh and PC profile location requirements are different, so double-check the location needed for Adobe Bridge to see the profile. You can soft proof in any Adobe software program by going to View/Proof Setup.
2. For example, in Photoshop, go to View, then Proof Setup, and then Custom.
3. Under Device to Simulate, choose the printer profile you saved in step 1.
4. Under Rendering Intent, choose Relative Colorimetric.
5. Check Simulate Media Color (optional).
6. Check the box for Black Point Compensation.

If you want to use soft proofing for more than checking out-of-gamut colors, be sure to use the Simulate Media Color option. This feature maps the **white point** in your profile. When this option is left off, the maximum white (RGB = 255) in the file is mapped to the maximum white of the monitor (Monitor RGB = 255). So, the white you'll see is the white point of

your monitor, not the media.

If you are seeking a closer media white point, you can turn Simulate Media Color on. You still are not going to get a fully accurate proof, but the software will attempt to show how the colors and brightness change when the ink absorbs into the media.



Note: Simulate Black Ink is automatically selected if you choose Simulate Media Color. It maps the **black point** inside your profile to the monitor display to try to reproduce the actual black density of your print.

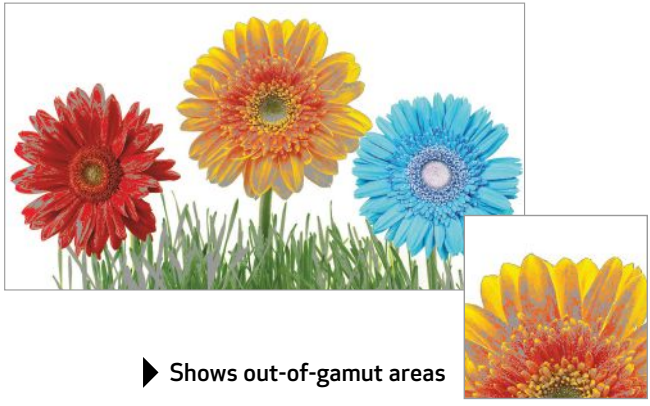
## Adobe Photoshop Gamut Warning

Another nice feature in Photoshop is the Gamut Warning. This setting calls out RGB working color space bitmap colors that fall outside of the CMYK target color space or simulation profile. The gamut warning will only show RGB colors that are out of gamut based on the CMYK color space assigned.



**Gamut warning OFF**

**Gamut warning ON**



**Shows out-of-gamut areas**

Before any alterations can be made, be sure your monitor is calibrated and the inkjet device simulation or target profile is applied—otherwise, the gamut warning will be inaccurate.

You can apply various tools within Photoshop, such as Saturation Control, to bring individual colors within gamut.



While soft proofing is enabled, the gamut warning can be turned on by selecting Gamut Warning under View. Colors that are out-of-gamut will be indicated by a gray mask, as shown below.

The example "out-of-gamut" image is printed on a very absorbent uncoated media and indicates the highlight to midtone bright red and orange areas are out-of-gamut. This means these colors will be shifted to bring them within the color gamut of the inkjet machine. Often, when you see a large color value range that is out-of-gamut, it means that a particular ink colorant (in this case magenta) is absorbing quickly into the sheet and taking on more of the media's color.

## Dealing with out-of-gamut colors

You may want to adjust the colors included in the gamut warning, but you don't know how far out-of-gamut they are. Just because a color is out-of-gamut doesn't mean it is unacceptable. Some colors may be barely outside the gamut with little visual color difference. Others could be much farther out, showing a drastic color change. Globally correcting the gray areas can lead to **desaturated** areas in the image. Understanding how the ink colorant reacts to the media takes some time and experience.

Your best bet is to ask your print provider for a color reference chart from the target press to get a better understanding of what the differences are between the printed output and what you see on the monitor. You can use this as a guide to correct areas of color that show undesirable color shift, either by changing your design or applying tools in Photoshop—such as **hue** and **saturation** adjustment—to individual colors.

If you're printing to multiple devices and editing color values and images for high-speed inkjet, it's important to keep these images and documents

separate, as they now contain color modification for an exact high-speed inkjet press, ink, and media and will not print as expected on any other device.

If you are really committed to using **soft proofing**, take the time to make a custom monitor setting for the specific inkjet machine's color management settings, ink, and media combination. Every monitor is a bit different, but all will have a feature that allows custom settings. This can only be done if you have a print sample created under the same machine, ink, profile, and media conditions to use for comparison.



## The benefits of qualified inkjet media

Press manufacturers invest heavily in testing and qualifying media for use with their inkjet devices. This could include paper formulated for inkjet, offset grades, and other types of substrates and specialty media described in Chapter 7. The important thing is to make sure the media you select has been tested and approved by the press manufacturer. Your print provider will want to do this because it is important to maintaining their warranty with the manufacturer. You, as a designer, should care because sticking to



qualified media is another way to keep color and image quality consistent from run to run. By choosing just a few house stocks, project color and print requirements will become easier to manage.

Each inkjet manufacturer—as well as your print provider—has completed a series of qualification tests on a wide range of media stocks and weights to ensure quality results and avoid production issues. Your print provider should have these printed samples, as well as information on any other testing they have completed, to help you choose the right media at the right cost for your project.



## Managing expectations

Let's imagine you have followed all the steps above, received samples from your print provider, and completed your media homework for your latest project. The media has been chosen based on characteristics that best suit your vision, and you know what the color and image quality will be when printed. Your design is complete. You showed it to the customer under controlled lighting conditions, and you and the customer are positive about the print expectations. You have project sign off. Life is good.

You can enjoy that moment—however brief—until the customer says they found a cheaper media that is "just as good." Or you find out the media you so carefully selected is no longer available. You probably want to scream—but this happens a lot (the media issues, hopefully not the screaming). After you successfully navigate the five stages of grief, you are left with a couple choices:

- Restart the process by getting printed samples and modifying the design.
- Run the production job "as is" on the new media.

Either way, you must talk to your customer about how changing media will affect color and image quality before moving forward. Request printed samples on both media to support your discussion.

If you are dealing with a "media no longer available" scenario, you may have

to compare multiple options to find a cost and quality fit for your customer. If you are dealing with a customer- requested change, this process should show that customer the less expensive paper they picked is not "just as good." If they want to use it anyway, then make sure the customer signs off on the sample and acknowledges they understand it is different than the media you recommended. Not that your client has a bad memory, but clients never seem to remember the conversations about media and design options when someone starts complaining the brand colors aren't right. Consider giving your customer a copy of this guide and help them avoid being pennywise and # foolish.

Let's imagine your client doesn't listen to your recommendation and signs off on using the "just as good" media. Now you must also make sure your print provider is willing to run the media your client wants. You might have already uncovered this as an issue when you requested a sample. If it isn't an OEM-qualified media and hasn't been tested on the press, it may not work all the way through the finishing process. If it hasn't been previously tested by your provider, it's possible the media may work, but there may be a cost to put it through the in-house testing process. The testing process requires production downtime on some very expensive print and finishing equipment. Suddenly, your customer's "cheaper" media may not be so cheap after all.

In the past, many customers—particularly those in the direct mail and transaction printing segments—did their own media buying and supplied their own paper to their print provider. In the evolving era of inkjet, the print provider has been obliged to take the lead on testing, approving, and managing media options for customers. This is a change that can take some getting used to for customers and designers, but is the fastest path to quality, consistency, and best pricing. Helping to educate your customers on this will make projects run more smoothly for everyone. Your print provider may have customer education tools that can help you communicate with your clients about inkjet and media—one more reason to work closely with your print provider from the start.

CHAPTER 15

# COMBINING INKJET WITH OTHER PROCESSES



COMBINING INKJET WITH OTHER PROCESSES

# CROSS-PROCESS CAMPAIGNS

15

These days, it's rare for a marketing project to contain just one form of communication. Print, online, and other forms of communication all enjoy markets and scenarios in which they are particularly effective. But studies show multiple touchpoints and multiple communication methods are generally more effective than an "all eggs in one channel" approach to marketing. Designing integrated campaigns across multiple online and print platforms—as well as across multiple types of printing processes—creates unique challenges.

A campaign may start with print that contains links to online content, drives response to an online channel, or offers a phone number or website for requesting print fulfillment of detailed information. Or you might have multiple components of your campaign that are printed and fulfilled separately—think business cards, letterhead, marketing collateral, direct mail, packaging, labels, and customer welcome kits. In each case, you want the colors to match as closely as possible across different print technologies and online channels and be as consistent as possible with the company website.

Of course, marketing is not the only place where a project may involve multiple media and more than one type of printing process. Publishing—from books to newspapers to magazines—often relies on an initial production run on offset presses with localized versions or follow-on orders produced digitally. Like marketing collateral and direct mail, publishing also may call for multiple printing processes within the same finished product. Examples include books with inkjet-printed bodies and toner-printed covers, magazines and catalogs with digitally-printed sections, and inkjet covers or ride-alongs merged with offset. Many printing companies use multiple types of printing technologies and see those capabilities as complementary. You should too.

## CONTROLLING COLOR ON MIXED MEDIA PROJECTS

With so many exciting methods to design for, how can you ensure colors are reproduced consistently for a cohesive look? Color looks different on a monitor or phone than it does in print. Printed materials, from signage to banners to direct mail to packaging, all may use different substrates and ink chemistries. Aligning different processes and media can be confusing when trying to simulate a common reproducible color scheme. Controlling the final PDF settings and the color gamut achievable by the press is critical to ensuring your campaign contains printed pieces that look consistent. Let's look at some of the choices you'll need to make.



### Assigning critical colors — CMYK or L*a*b* or RGB?

It may seem logical that colors for online and print would be assigned as RGB, since both can use or convert the RGB color space. But this is only half correct, because RGB conversion only applies to bitmap images, like photographs, and not to the vector elements in your design.

As discussed in previous chapters, critical color elements such as corporate color schemes and logos should be designed as vector graphics and, therefore, never be assigned as RGB color. Vector graphics assigned as RGB will not convert correctly for CMYK print methods. This is because the RGB color space uses a perceptual rendering intent which converts to "pretty" color based on the color values of the particular ink set, making corporate color assignments look different across various devices and media. When colors for vector images are assigned in L*a*b* mode they will be converted using a Relative Rendering Intent which calculates the printer's CMYK recipe based on the color value of the ink as well as the substrate color.

That is why it is considered a best practice to design critical color vector elements using Pantone spot color assignments in L*a*b* mode, also called book color. When you do, each printer will convert the Pantone spot color using a lookup table within the printer's RIP or DFE output profile, rendering the color more accurately than using CMYK recipes or RGB conversion. So, remember, if you have vector images with colors assigned to simulate a Pantone spot, always use L*a*b, not RGB or CMYK.

**Images show printed color shift between L*a*b and CMYK profile color space**



Spot color assigned as L*a*b*



Spot color converted to CMYK CRPC6



## FINDING THE RIGHT COLOR SPACE

Any mixed media designs containing bitmap, text, and vector elements should target a common color space so all colors render consistently across all devices. This becomes especially difficult when media of different types, surfaces, and color shades are used, because the reproducible color space for each print process and substrate may be larger or smaller than another in the project. If there is a significant difference in color gamut between print processes, the campaign will not have common color values without some planning and conversion.

Another factor in the planning process is how many suppliers are involved in the production process. You may have one print partner with a range of equipment or you may be working with different suppliers for offset, toner, wide format, or inkjet printing, and perhaps a marketing partner handling your email and online ads.

It is best practice to always talk to each production partner very early in the design process—particularly with respect to print. Each can tell you the color space in which they can deliver the best results for the product you are printing on the equipment they are using. It's also important to tell them if you are trying to match colors across different processes. They should provide you with the specs or Adobe Bridge color settings file to apply to your Adobe workflow.

To check if critical colors are in or out of gamut and how they will shift in color, your print partners may provide ICC simulation profiles for you to use for previewing in Adobe tools such as Photoshop, InDesign, Illustrator, or Acrobat. Once you look at the previews for all the different processes you will be using, you can choose a color space common to all print processes which fit your required colors. If you find that some critical colors are out of gamut (shown in gray below), review the information on using simulation profiles in Chapter 14.

**CMYK swatches showing out of gamut colors in Photoshop**



CMYK CRPC6 profile assigned

Inkjet treated simulation profile assigned

**Screen capture: actual PPI 72, effective PPI 258**

## Results may vary

Even if you standardize the color space and use the same paper on an offset printer that you use on an inkjet press, the color will not be exactly the same. The reproducible color space is determined by the device, ink, and media you choose. A design project that includes different substrates—imagine brochures, direct mail, signage, packaging, and maybe even aluminum water bottles—will provide a large color gap between printed elements if the reproducible gamuts are not close in size.

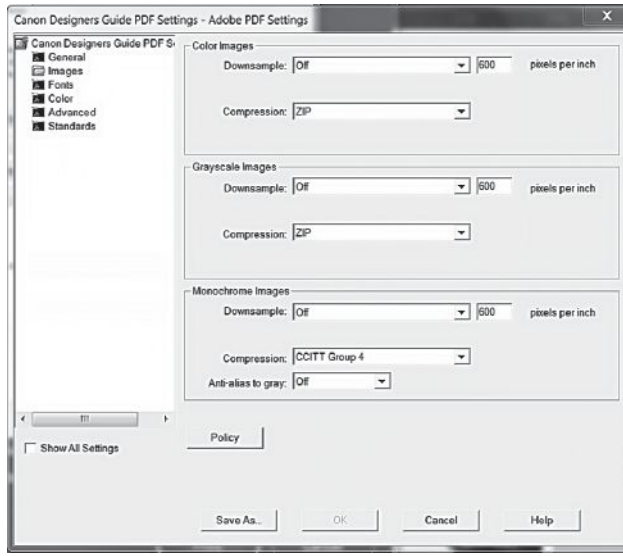
Campaigns requiring widely varying substrates will produce widely varying color gamuts as well. If you want consistency, you need to look for the print process with the smallest gamut and use that for color matching. Based on everything you've learned so far, you should understand this means there may be fewer colors in the gamut, which can shift the accuracy of the spot colors you are trying to match. This is the trade-off for getting all elements in the campaign to have similar color values. Now is a good time to talk to your customer about whether you have more flexibility with some aspects

of the campaign than others. Are they more concerned about the postcard or the water bottle? Is the cover of the book the priority or is it the chapter headings inside? You may decide that the materials you produce on the press with the smallest color gamut should not limit the rest of the campaign. In that case, you will look at the next smallest gamut and use that as your base. Test, lather, rinse, and repeat until you have the level of consistency and critical color matching that will satisfy you and your client.

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## CREATING CAMPAIGN-READY PDFS

In Chapter 16 we highlight the importance of delivering properly packaged, print-ready PDFs to your print partners. Correct settings for a PDF are important for a single brochure, but even more important when coordinating multiple pieces that need to have a cohesive look. Using the common color space determined by evaluating your campaign print processes when saving the PDF will help ensure your file is ready.




**Screen capture: actual PPI 72, effective 165**

As we mentioned earlier, talk to each print provider before starting the designs for the campaign. Be specific as to what the project's goals are and the importance of matching the look and critical colors across various print platforms.

CHAPTER 16

# PACKAGING FILES FOR PRODUCTION



PACKAGING FILES FOR PRODUCTION

# THE HANDOFF

16

We've covered a lot of information on planning your design process to get the most out of the latest and greatest inkjet presses. There are a lot of decisions to make along the way, from what to print on to how to select the right color space or file format.

We have talked extensively about the importance of design file composition, graphic elements, and color space assignments to a flawless printing process. If you've followed the guidelines supplied by the print provider and the rules of thumb in this guide, your files should be inkjet production-friendly. The next step is packaging these files in an organized fashion so nothing is lost in translation for your print provider.

Delivering all the packaged elements properly can eliminate confusion and wasted time for you and as well as the print provider. When your print provider doesn't need to rework your files, hunt for missing fonts, or clarify finishing instructions, you're more likely to achieve your deadlines and avoid extra support costs.

Remember, handing off your files may be the end of your design process, but it's the beginning of a whole other production process. In this chapter we will recap some of the earlier decision points on settings and look at how your files should come together to sail cleanly through the production process.

## RESPECTING THE PROCESS

Your print provider has a bunch of very expensive equipment and a finite number of staff to keep that equipment running. They plan out their day with an understanding of how quickly they can prepare jobs to run and how

quickly those jobs should process through the equipment. Inkjet presses may turn design files into printed products more quickly, but printing isn't the end of the process.

Working with the cool coating, finishing, and effects we talked about in Chapter 8 will add to their production planning effort and overall production time. It may even require multiple passes through certain equipment.

When the provider receives a file that conforms to their specifications, processes, and understanding of customer requirements, life is good. When they receive files that don't conform to their specifications or are missing elements, those files can cause delays, adding time and cost. If this happens before the job is on press, it's a delay to you. If trouble happens on press or on the way to the press, it can cause larger problems and can get expensive.



The fact is your file inefficiency hits their bottom line. When the files a print provider receives need work, it costs them money that often isn't directly charged to the customer who caused the problem. When files slow the printer down or cause delays at the start of a job, it eats away at their profitability—a particular problem for inkjet printers, due to their high processing speed and proportionally high cost of downtime.




**The right packaging for your files keeps your design looking the way it should**

## Lost speed means lost money for service providers

Let's say you have a direct marketing project printing on an inkjet printer that processes at 800 feet per minute, two pages wide. That means the controller—or **Digital Front End (DFE)**—sending data to the printer must RIP at least 1,600 images per minute or about 27 pages per second. That's one page every 3.7 milliseconds. Keep in mind that some pages are more complex than others, meaning the RIP must do more work on complex pages than simple ones. So, the RIP in our example may be capable of processing far more than 27 simple pages per second.



Files that are unnecessarily complex or faulty create inefficiencies in the RIP, adding anywhere from a few milliseconds to maybe two or three seconds per page! So, if you have a 100,000-page job that takes an extra tenth of a second per page to RIP, you wasted 2.7 hours of the print provider's production time. Some presses can print while the job RIPs, but there can be downtime if the job can't RIP as fast as the printer can print. This might cause the print provider to kill your job and send the files back, process the job and charge more next time, or eat the cost of fixing customer mistakes. All this can have a big impact on the provider's bottom line.

The example above was not based on the fastest, most productive presses on the market. Currently, there are presses on the market that can produce over 5,000 letter images per minute, making an hour of downtime a very expensive problem.

Let's recap some of the key decisions that affect the efficiency of your finished file:

- Providing images in proper resolution
- Selecting the right document color space
- Assigning CMYK color values from a printed image using correct paper, ink, and output profile
- Preparing static and variable images
- Selecting an appropriate image file format and compression setting
- Saving to the correct PDF settings

While these factors have an impact on high-quality, static jobs, they are of even greater concern when running jobs with variable content. Every inefficiency is multiplied by the number of pages with variable resources that must be individually processed by the RIP. Let's look more closely at the production processes for static and variable files.

## STATIC AND VARIABLE DATA FILES ARE HANDLED VERY DIFFERENTLY

### Static designs

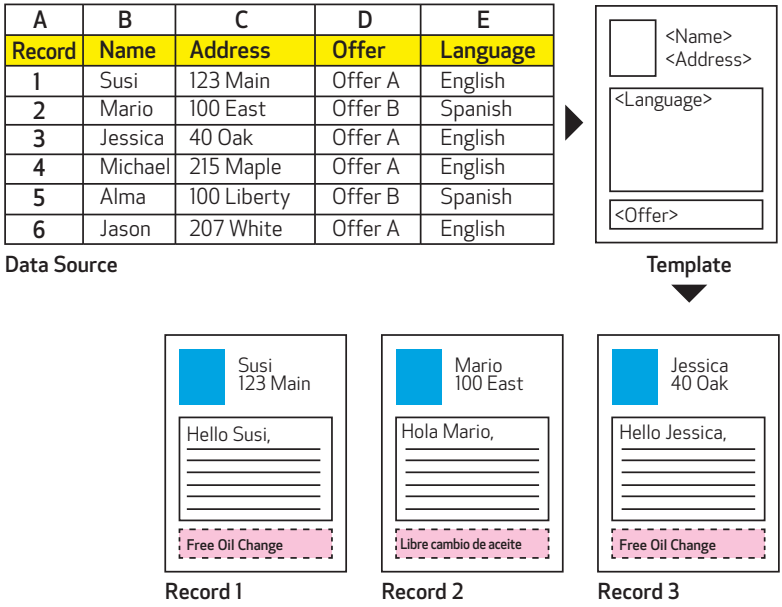
Designs that don't require any variable processing can be run through a preflight process to automatically detect any color, font, or image assignment issues. Colors defined with PMS color numbers will convert to CMYK values. The entire file is then processed by the RIP (ripped) and sent to the printer, followed by any required post-print finishing operations. The file is only ripped once and essentially copied for every page of the finished job. This means that all the file processing work is complete before the first page prints.



### Variable designs

Designs with variable data or images are processed quite differently. Variable printing files must break out static elements and variable areas separately for each printed piece. While the static elements appear the same on each piece, the variable areas are filled in with text or images as directed by information from a data sou rce such as a spreadsheet, CSV file, text file, or copybook. While the original design file includes only one copy of each element, those elements are combined in different, data-driven ways on each finished page. The original design file can go through a preflight process just like a static file, but this may not identify all the potential issues that could cause a bottleneck in production as different elements are combined on a page.

**Dynamically handled variable content overview**




Depending on the type of press being used, a print provider may process variable data printing in one of several different ways:

## Streaming variable content only

One way to process variable data is to load a static document into the printer's memory. The printer will always print the static document when sending pages to the printer driver or RIP. Variable data is then added on top of the static document when the files print, sometimes referred to as a "form flash." Think of the static document as a fixed form with variable data added on top: an electronic equivalent replaces a preprinted form or letterhead. This approach to handling variable data is only appropriate when text with limited formatting overlays a static background. When variable content and formatting becomes more complex, another level of processing is added to create a combined variable file.






## Combined variable file

For any but the most simplistic variable designs, the static and variable elements are combined into print files prior to ripping using specialized Variable Data Processing (VDP) software—sometimes called automated **composition software**. This process produces optimized print files—such as a **Postscript Page Markup Language file (PPML)**—that maximize print speed, since the RIP only processes static elements once. It also may produce a **PDF/VT** file, which is a standard PDF file containing all the variable information for each page. For transaction documents, the print files often are delivered in Advanced Function Printing (AFP) format. While the composition software will do a lot of the heavy lifting by combining design instructions and data sources into composed pages, each page still must be ripped individually in order to print.

## WHAT STANDS BETWEEN YOUR DESIGN AND THE PRESS?

If your project involves bills, statements, or direct mail with variable data, the chances are good there's a VDP or composition tool sitting between your PDF file and the pages run through the press. While that software takes a lot of the heavy lifting off the RIP when it comes to combining variable data with static components, it also requires another layer of commands that may interpret your PDF settings differently than the printer would. To ensure that your design intentions can pass cleanly through the filter of the software, here are a few things to consider related to fonts, colors, and proofing:



### Fonts

Make sure that the complete font sets are available for every single font used in your design, even if embedded. Often fonts are loaded as "restricted," meaning that they only embed the actual characters used in the PDF file. If you marry the PDF with text from an external data source, you could call for characters that were not used, and therefore embedded, in the PDF template. If those characters are not part of the embedded fonts, your job will fail in production—or worse, run the whole job with letters missing.

**Never outline fonts which include variable data. Only large static text used as a graphic element should be outlined.**

Printers sometimes ask for fonts to be outlined before saving to avoid font compatibility issues. If a document includes variable data, never outline the font for readable text within the document. This rule also holds for static documents that are text-heavy. Rendering text from the actual font will provide better print clarity. The only exception is large text elements that are used as graphics.

## Colors

You took the time to soft proof on your monitor; hard proof with your printed reference chart using the target ink, paper, and printer combination; and compared the soft proof and hard proof. If you made color corrections and set CMYK values with this proof process, be certain this color information is applied to the entire workflow. Many composition tools have a setting that tells them whether to use the color definitions from the input file or to override them with the software's own color management settings. If you actually want to use the settings you so carefully specified, make sure this is clear to your print provider.

## More testing



Ask your print provider for a soft proof showing your design with variable data applied. This test file is usually a PDF generated from the composition software using the PDF you generated from your design software as input, along with a variable data test file. You can ask for the first few records from the live data or provide a test file.

While the soft proof may not be an exact match for the press output (note our previous apologies on the limits of soft proofing for color management), the color should be consistent. It also should surface any layout issues from fitting variable content.

Use Adobe Acrobat Reader® to compare the two soft proofs—your original document and the PDF created by the composition tool. If the colors in the two PDFs don't look the same when viewed side by side, your settings have not been carried through the composition portion of the workflow.

## BRINGING THE PROCESSES TOGETHER

Naturally, your priority is to deliver the results that your customers expect. But now you also understand how important your files are to making your provider's operations run smoothly. The key to doing both is communication. In addition to talking with the print provider before, during, and after completing your design, provide written instructions that accompany your files. The more information you give the print provider, the fewer questions, delays, confusion, and headaches you will have when it's time for them to process and print the file. A good file is a no-drama file.



## GUIDELINES FOR CLEAR SPECIFICATIONS

### Provide a PDF prototype

Sometimes called a functional prototype, this PDF file is not a high resolution, press-ready file with all the elements prepared for final printing. This is an instructional document the printer can use to visualize the concept and get a general understanding of where variable data and images will be placed—there may even be comments embedded in the file. Always include "Low-res Proof" in the file name so it will not be mistaken for the correctly prepared print file.

## Document all settings used

Yes, the person receiving the file can open the file and check your settings, but that takes time. Also, it is useful to indicate your intentions, which may not be evident from the settings alone. Documentation can help save time for the print provider, trap any unintended settings on your side, and quickly flag any miscommunications on preferred file formats or settings for optimal performance on the printer.

Remember to indicate whether you have used the print provider's preferred PDF format setting or a custom PDF setting in your final "process-friendly" file (see below).



## Creating friendly, press-ready files

As you know, a project can change dramatically from the beginning to the end of the design process. Even if you consulted with your print provider at the start, it is good to review project requirements when the design is complete. Changes may have occurred that affect how the design should be prepared, even if they don't seem significant to you. Depending on your revised design requirements, the file may take longer to prepare or process or may need more finishing time, which impacts the print provider's scheduling and workflow.

The way the print provider intends to process the file determines whether they ask for a print-ready PDF file or the native design files with all the fonts and high-resolution images included. It is best to have both prepared in case of problems. The native file can be used to diagnose issues.



Each company may have different requirements for file preparation. Before preparing any files for production, follow the tips below and be sure to consult with your print provider on what a "press-ready" file means to them.

- ❑ Clear out any unused fonts. Take pride in a clean file!
- ❑ Remove extra layers. Unused layers take processing time.
- ❑ Remove elements in the gutter. Remove any extra marks, lines, or notes from the document's surrounding area. If notes are required, place them on a separate layer and select the "do not print" option for the layer.
- ❑ Remove unused colors. Review your color library to include the colors applied to the file.
- ❑ Check for missing elements. Review the document to ensure all fonts and images are linked or embedded.
- ❑ Replace "For Position Only" images. Check that the final, high-resolution versions replace all low-resolution placeholders.



## CREATING A PRINT-READY PDF

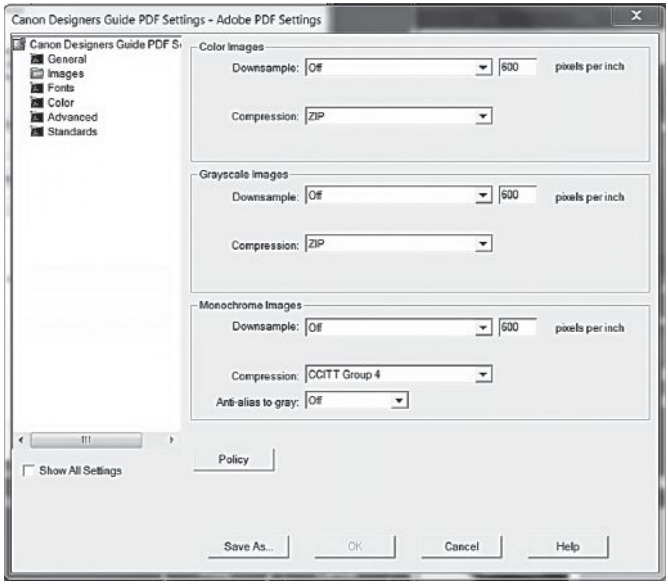
Each press requires different PDF settings. Ask your print provider for their preferred PDF format setting or a custom PDF setting file that you can apply to the workflow for your design software. This will streamline your PDF management and ensure that you save your PDF files correctly each time.

We've compiled a list of important settings you should know when printing or saving a PDF file and questions to ask your print provider regarding their use.

## Image settings

- **Turn off *Downsampling Color Images*** when saving a PDF for print. Do not **downsample** your images at this stage of the process. Your images should already be saved to the resolution specified by your print provider.
- **Compress images.** Select ZIP compression as it will compress without downsizing the pixel depth of the image.
- **Remember:** Apply the resolution of the machine when creating your PDF and allow the inkjet RIP to process the images to a lower dpi if needed for proper output.

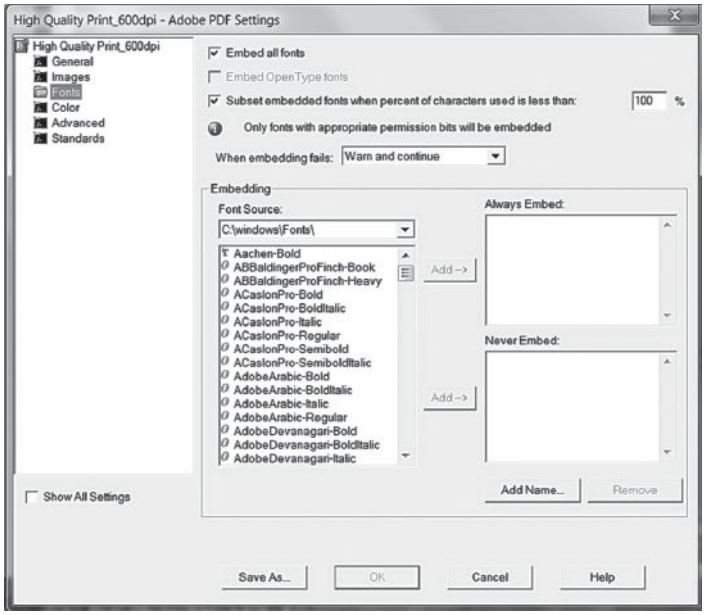





**Screen capture: actual PPI 72, effective 165**

## Font settings

Embed all fonts. If using variable data, ensure the fonts are not restricted to the characters used in the PDF. Embeding the full character set will be based on the printers inkjet workflow. Large fully composed files which merge with variable data may require just embedding the subset of the font family and not embed all fonts. Your printer can advise you on these settings.



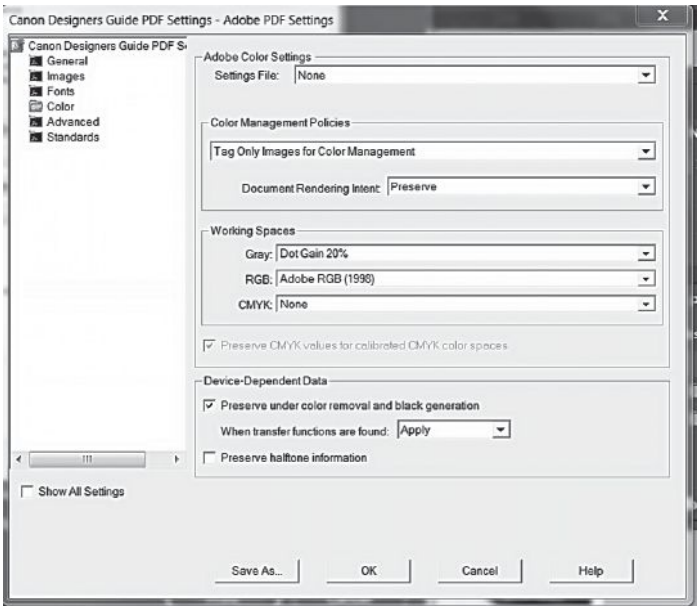

**Screen capture: actual PPI 72, effective 165**

## Color management settings

Proper settings must be applied when converting rendering intents and image color space from the input profile to the device output profile. Applying color management at the PDF level is called **early binding** and is a very important part of saving a PDF for production.

If you followed the process for saving images from Adobe Photoshop with attached color management described in Chapter 13, *select Tag Only Images for Color Management as shown on the next page*. This will keep

all the images color managed according to the settings applied through Adobe Bridge without changing CMYK- or Pantone-assigned vector elements. Vector colors will be processed by the inkjet device's output profile and DFE settings on the press, allowing a closer color conversion within gamut to the expected color.




**Screen capture: actual PPI 72, effective PPI 165**
**Use proper PDF color management policies for your inkjet process**

Remember to consult your print provider for preferred PDF settings, as different color management policies can alter your expected print outcome.

## Color management policies

As discussed, some colors can be assigned as CMYK or Pantone. PDF color management settings should be applied differently for each instance in which the printer handles CMYK or spot colors. Each color management policy option will process color differently.

The settings below provide different color management policies to images and assigned colors. If you want to match the color space for another print process, such as SWOP or GRACoL, talk to your service provider to ensure they will honor your PDF rendering intent and color space settings.

**Leave Color Unchanged** will use the color assignments in your Adobe program and allow the inkjet device to perform all color conversion. Use this option if your provider tells you they will do all graphic element color management, as they may use different color space settings than those applied.



**Tag Everything for Color Management** will convert all colors used in images and graphics to the CMYK working color space assigned (SWOP or GRACoL). Use this option if you require your photographs to simulate other print processes with the same color space and if your provider calls for all colors to be CMYK. Double-check that your provider does not require you to use Pantone colors in your document.

**Tag Only Images for Color Management** only converts bitmapped images to the assigned color space settings, leaving CMYK and Pantone colors assigned in your Adobe layout program untouched. Use this option if your provider has a Pantone conversion library within their workflow. *In most cases, this is the most compatible setting.*

**Convert All Colors to sRGB** is not suited to the inkjet process, so you should not use this setting. Remember, we print in the CMYK color space, not RGB.

**Convert All Colors to CMYK** will convert all RGB and Pantone colors used within the document to CMYK. This allows the Adobe PDF engine to convert all colors and may cause an unexpected outcome for some colors. Only use this option if specifically directed by your print provider.

## DELIVERING NATIVE FILES

If you package the file using design software, such as Adobe InDesign or QuarkXPress®, ensure that images are updated and include all images and fonts. Double-check colors are specified as CMYK (or as PMS/Process, if instructed by your print provider).

Don't embed images into the files unless the print provider requests this. Print providers have ways to enhance images that could otherwise look flat on your selected media—but they can't make those improvements to embedded files. On the other hand, if you don't want anyone to "enhance" (or generally mess with) your images without an opportunity to review, make sure to include this in your instructions.



Fonts should be provided for the platform on which the design was created. So, if you have designed your file on a Mac, provide the Mac fonts that were used. If you design on a PC, provide the PC-based fonts.

## PACKAGING NATIVE FILES

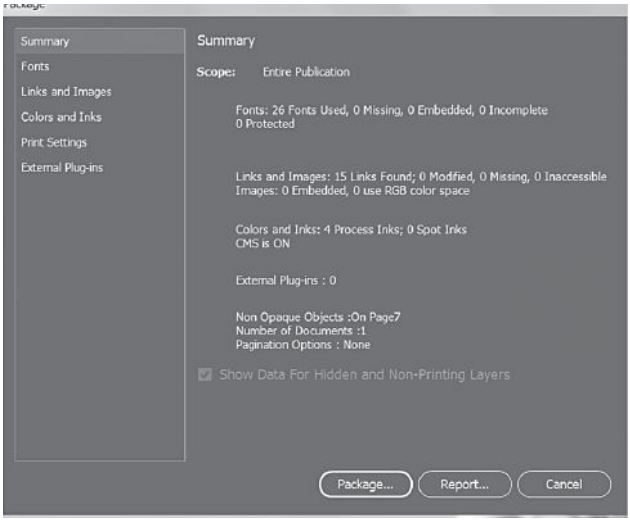
If you need to provide both native design files and a high-resolution PDF, the process can be cumbersome if the native file contains multiple supporting fonts and links.

Adobe's InDesign and Illustrator products both contain a handy utility that automatically packages all your supporting files. It creates a custom folder and places a copy of the design document with all necessary fonts and linked images into it. Once the packaging is complete, compress the file and send it on to the printer with your high-resolution PDF, sample print, and job request.

**Never again forget a font or linked file when sending files to your print provider. Using the "Package" option is easy and efficient.**

Just follow the simple instructions below:

- ❑ Open your INDD or Illustrator file in Adobe InDesign.
- ❑ Review the preflight panel at the bottom of the screen and verify all elements are linked and there are no missing links or fonts.
- ❑ Go to File: Package.
- ❑ Click the Package button at the bottom of the Summary window.




**Screen capture: actual PPI 72, effective PPI 165**

- ❑ Click Continue on the Printing Instructions window.
- ❑ Browse the locations for where you'd like to save the package folder on your computer.
- ❑ Make sure the Copy Fonts, Copy Linked Graphics, Update Graphic Links in Package, and Include Fonts and Links from Hidden are all checked. Other boxes should be unchecked.
- ❑ Click the Package button.
- ❑ Find the new folder Adobe InDesign created and verify it contains copies of all required files.
- ❑ Now, compress the file for easy sending by right-clicking the folder and choosing Compress.
- ❑ Send the file to your print provider along with your job specifications.

All design files and supporting design elements are now in one packaged folder—easy peasy!

## COLOR SETTINGS

Your print provider may require machine output profiles to be attached to the PDF if files will be processed through a composition tool or **Customer Communications Management (CCM) solution**. Early binding requirements are customized depending on how the file is processed, so proper document preparation is necessary to ensure a consistent result.

Ask your print provider if the software they use for formatting files has the option to work with attached profiles from your document. If yes, they will advise you on the proper settings.



In any case, you should always ask your print provider for the specific PDF settings needed to optimize their workflow, since color management policies are constantly being enhanced, particularly in the world of inkjet.



## A SUCCESSFUL HANDOFF

After all the hard work you put into your design, the success of your project shouldn't depend on heroics from your print provider. You don't want to look bad in front of your client if your files require rework, won't run at all, or cause missed deadlines.

That's why you shouldn't just email or upload your files, cross your fingers, and hope everything will be okay. Double-check your process and ensure all preparation for the handoff is complete. Review the written instructions and the PDF prototype with your print provider and make sure everything has been received and understood. Then check again, just to be sure.

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If you followed the guidelines from this book and listened to your print provider, your project should process as smooth as silk. That will earn the gratitude of your client and your print partner.

# Success!

CHAPTER 17

# IN-HOUSE DESIGNERS DO MORE



IN-HOUSE DESIGNERS DO MORE

# TAKE CONTROL

The introduction of digital printing has expanded opportunities for designers to increase their value and visibility within their organization. By integrating design into the entire print process, designers can influence overall project cost and efficiency. While not all designers welcome this additional responsibility, there is no question that having technical knowledge will make them more valuable to their company and boost career opportunities. Even if you don't work in a printing environment, understanding cost drivers can help you expand your palette as a designer and negotiate more effectively as a print buyer.

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Across the spectrum of graphic design-related jobs, designers are being asked to learn about a growing number of channels for reaching customers and are expected to have some technical knowledge about each channel. This is true whether you work in print, web, mobile, packaging, industrial, or product design. Designers are expected to know how their design decisions impact quality, cost, sustainability, and, of course, customer satisfaction.

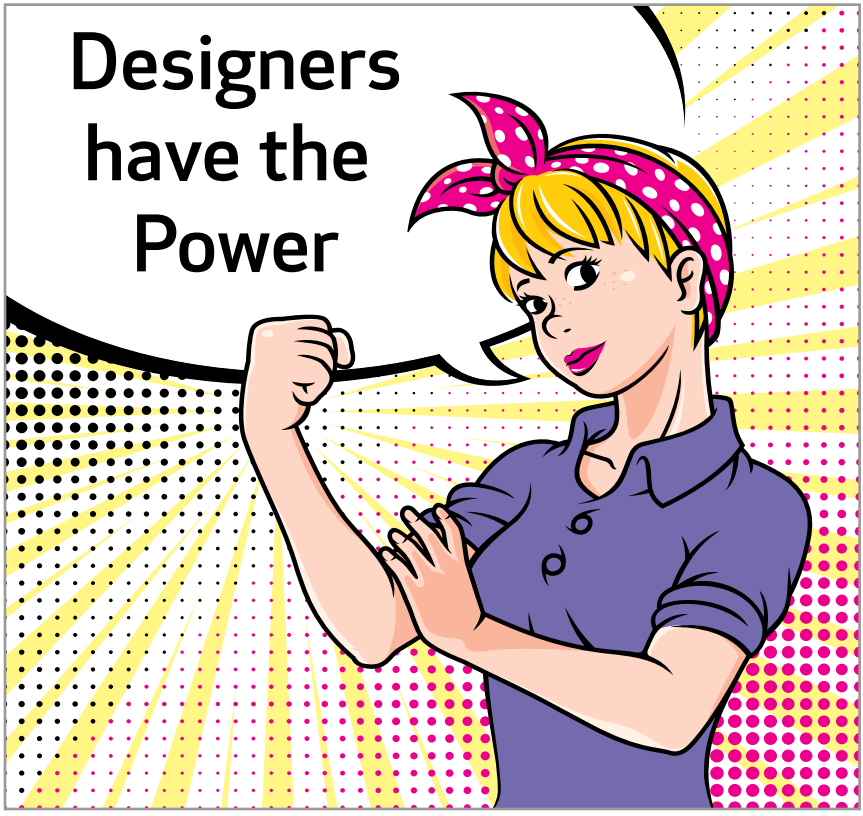
However, graphic designers who work within a printing organization are often expected to take on an even greater level of responsibility. They may design campaigns for their own company, as well as designing, validating, or optimizing work for clients. In-house designers are both gatekeepers and a critical initial step in a well-tuned production workflow.

This means that all work that passes, physically or electronically, through designers' fingers must emerge as files that run seamlessly throughout the entire process. These designers are also the gatekeepers on cost and are expected to recognize the impact of their and their client's design decisions on internal production costs.

An understanding of costs in an inkjet environment is particularly important because so much of the cost is variable. Unlike other print processes, ink is a big cost driver for inkjet and the substrate it is printed on has a major impact on the amount of ink used. But here's the really interesting part—the amount of ink used can be largely controlled by the designer.

## DESIGNERS TAKE CONTROL OF INK

When you work inside a printing organization, you can learn exactly how much each ink (C, M, Y, and K), as well as primers and post-coatings, costs. You have already learned how to manage design files to control the color you deliver. Now, you also can make decisions about how much you want to spend to get to a particular level of color match. Often you can get the same, or nearly identical, color quality using a lower volume of ink.



How the design is created is crucial for balancing client acceptance with the profitability of the project for your company. Let's talk about how you can measure the cost performance of your ink usage.

## Ink usage

As discussed, savvy inkjet designers work with color simulation profiles. Viewing a representation of the color space of the press and paper combination on screen provides a better representation of the printed output and also can be used as a baseline for ink usage estimations. Most inkjet environments have some type of ink estimation software—sometimes even more than one! These tools use a design file as input to calculate how much of each type of ink and primer will be used to produce the job, along with the cost of each. In the past, these tools were often used only by technical staff or estimators, but today, many tools are made available to both sales and design teams to help improve the profitability of customer quotes.



**The design file is the key to the print process and ink savings.**

If you haven't been exposed to ink estimating solutions in your print environment, ask what is available and for access to the solution. If you don't have the ability to run estimates yourself, make it part of your process to ask the appropriate person to run the estimate for you on different types of paper and with different ink assumptions.

This is not just an academic exercise. Designers can impact the amount of ink required for a job in many ways, including through color definitions, the size of solids, the types of images selected, and overall ink coverage decisions. One simple tradeoff that can have a big impact is the use of black instead of a rich black mixture for large blocks of text or solids. Let's look at some additional design decisions that can impact cost.

## Adjusting large solids

Large solid areas use a lot of ink. The amount of ink used depends on the percentage of C, M, Y, and K used to create the solid. Design choices that reduce the size of solid blocks, use a lighter color (lower ink percentages), or both can reduce ink consumption.

Since solids use a lot of ink, you also can expect photos and images with dense backgrounds to operate the same way. Selecting images with lighter backgrounds or clipping the background can reduce ink use.

Your choice of colors (dark versus light) as well as the level of matching required also will affect ink usage. You can follow the color matching steps described in chapters 12 through 14 and then experiment with ink limiting to find the tradeoff between using less ink and achieving the color pop you need for your customer. You can run ink estimating calculations using profiles adjusted to limit ink and see what you get. Some inkjet systems also will allow you to run your job without a priming solution. These fluids cost money too, so if you can get the quality you need without priming, it's worth testing. This is expert-level design and analysis work, so you may need to work with a partner in your production department to get the results you want the first few times.





## Overall ink limiting

For some jobs, it may make sense to look at the effect of cutting back overall ink percentages to see the tradeoff between cost and quality. This is called ink limiting. This process limits ink volume globally for colors using more than a designated, combined amount of ink. If a job does not require the top color fidelity that a press offers, why pay for more ink than you need if the average viewer can't see the difference? You can generate objective comparisons of quality at different ink levels to use when validating color requirements with customers. If you have access to an ink estimating solution, you also can see the impact on your production costs.






## Selecting ink-efficient paper

Another way of controlling ink use is to print on a higher quality paper. We talked previously about how paper and other substrates impact the level of quality you can achieve, but the cost calculation is about how much ink it takes to get that level of quality on the selected media. The surface smoothness and uniformity of the substrate, as well as any treatment or coating that is applied, have an impact. Sometimes, just selecting a smoother paper can improve your ink results without the extra cost of an inkjet-formulated paper. Working with an ink estimator can help

you quantify the impact of your paper choices on ink costs. While this is essential for an individual design project, it is even more important when selecting "house papers" as standards for particular design projects. If you are involved in selecting standard papers for your organization, make sure that ink and primer consumption is on the list of factors for evaluation.

As an in-house designer, you also need to consider that certain design decisions you make, like opting for very high coverage or very thin papers, may require running the press at less than its full potential speed. Reducing the productivity of the printer also reduces the amount of print that can be sold. Any job that runs at a lower speed needs to be priced to take the lower productivity into consideration. In-house designers who understand the complete workflow for projects can have a big impact on profitability.

## Supply chain flexibility



Being engaged in the overall process of print production will keep a designer in the loop when the unexpected happens. Sometimes, the paper you intend to use must be swapped out for another paper grade or weight. This might be due to supply chain issues or because purchasing got a great deal by working with a particular mill or merchant. Situations like this are unfortunate, but not unusual. If designers are not made aware of these changes, they won't have the opportunity to adjust their designs, advocate for different choices, or educate other stakeholders about the potential impact of the changes. As noted, paper choices impact ink consumption and productivity, but often, procurement personnel are not aware of these tradeoffs. The "great deal" from Purchasing could have costly ramifications.

**Designers should stay in the loop when selecting and ordering paper. A paper change can have impact on print quality.**

Today's in-house designers are stakeholders in the internal and external value of print. This means they should understand how paper and ink affect productivity and profit and use that knowledge for their own designs to optimize customer files and promote good decision-making around substrate choices. If you are an in-house designer or a designer producing graphics for contract printers, be sure to learn everything you can about the process. The design you create doesn't end with the PDF—the final printed material and its price tag represents your work as much as the initial design file.

## *Success = Taking Control*

CHAPTER 18

# APPLIED TO THE GUIDE



APPLIED TO THE GUIDE

# DESIGNING THE DESIGNER'S GUIDE

Like all designers, we had a brief from our client for the development of this book. Canon and thINK gave us the opportunity to write about the next generation of inkjet, including advancements across the spectrum of production inkjet solutions. Naturally when it came to the design of the guide, we wanted to show off the capabilities of the latest in the Canon inkjet portfolio.

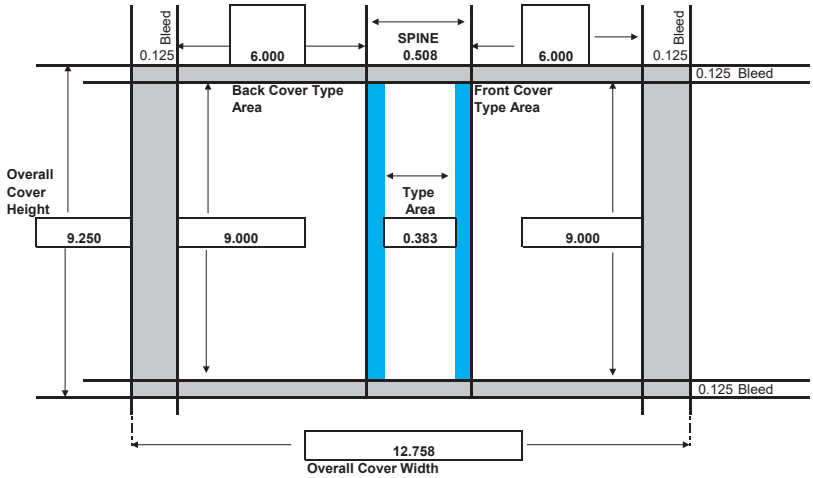
Canon has launched an impressive number of new presses since the previous book was published, including both sheetfed and web-fed presses. We had an array of presses to choose from and, in fact, some versions of this guide will be produced on different Canon Production Inkjet presses in an "on demand" fashion.



## Production expectations

When large batches are required, book blocks will be produced on the Canon ProStream 1800, a web-fed inkjet press using aqueous inks and integrated priming fluid to drive compatibility with coated and uncoated stocks. This press operates at up to 1200 dpi using three different drop sizes, producing four gray levels. Because the press can work with papers as heavy as 300 gsm, the covers could also be produced on the press. However, since the job size, in terms of total images, for covers is so much smaller than the job size for book blocks, the covers will typically be produced on a sheetfed press.

The first run of the guide will be produced completely on the Canon varioPRINT iX 3200 sheetfed press. This is also an aqueous pigment press with the option to pull more than one type of stock from different trays in the same job. The iX 3200 produces 1200 dpi output using two drop sizes. Many companies have the varioPRINT iX 3200 installed with binding inline, so the design goes in the front and a book comes out the back.




For this order, however, our printing partner is printing the book covers and book blocks separately because we had the completed files for the book cover available sooner.

The cover layout had two sets of sizing requirements. First, it needed to be consistent with the series of volumes previously published by Canon and thINK to support their production printing customers. Second, it needed to fit within the layout template provided our print partner. The template provided guidelines to adjust the spine and bleed measurements based on the cover media thickness (number of pages times the caliper of the paper.)



## Importance of paper

When looking for the right papers for this project, we needed different weight cover and body stocks. Each of the papers needed to be qualified on the target press and proven to deliver a large color gamut. We needed these stocks to support precise image detail and text clarity and support heavy coverage. At the time we were making these decisions, paper choices were very limited due to worldwide supply chain challenges, but we were able to work with our print provider to find a good option.

For the book body, a 80# text recycled matte stock was selected. It has a brightness of 95 and an opacity of 93.5, and the caliper measure of 4.5 mil was used to calculate the spine width for the cover. We chose an 11pt one-

side coated gloss stock for the cover of the book. This sturdy paper has a heavy 260 gsm basis weight with a 92 brightness measure. These papers met all of our qualifications and had been tested previously for inkjet print performance.  We also ran a proof of the cover and a portion of the book through the printing process for review by the entire team.

## Composition and print

Being responsible designers, we talked to our print provider about their standards and used that to guide our process. We followed the steps outlined in the guide and configured an Adobe Color Bridge color-managed workflow to GRACoL_ CRPC6, and assigned the relative rendering intent.

As images were sourced and considered, we discarded or edited any with areas of fine detail smaller than one square inch because they would not have reproduced well. We also avoided pictures with blurred backgrounds.

Here are the specifications we used for this guide:

- Bitmap images created in Photoshop at 300dpi with TIFF compression and tagged with the GRACoL_ CRPC6.icc profile.
- Vector images designed in Illustrator CMYK color space, with the .ai file directly linked into InDesign for composition.
- Page setup 6" x 9" with .125" bleeds.
- Minimum line weight .5 stroke weight.
- 10-point body copy and 14-point leading. Kerning is 0 to -10 throughout and minimum line weights have 0.5 stroke weight.
- All text set to 100 percent K color.
- All colors built from process CMYK.
- 72 dpi screen captures converted to black and white halftones with sharpening applied.

In order to deliver the best image quality possible with the paper, ink, and printer combination used, the PDF settings were submitted by the printer and used for PDF generation.

## The handoff

Once the proof was approved, we sent the final files to our print partner. Production files were run on the Canon varioPRINT iX 3200 and trimmed using a Müller Martini InfiniTrim trimmer. We were also able to take advantage of an offline Nobelus® laminating machine to add a soft touch coating to the cover. (Feel it. Isn't that a great addition?) Then the covers and book bodies were loaded into the Müller Martini Vareo perfect binder to deliver the complete, finished, and trimmed books.

We have given you the high points of the process. In addition to the decisions and process outlined above, we had several calls with Canon, Street Level Studio, and our print partner to discuss various production options, paper availability, and timing. A key driver in a successful handoff was having all the players involved early and consistently throughout the process. We hope you agree that the results were successful.

# GLOSSARY AND INDEX



# A

**Additive Color** — Additive color is created by mixing light of two or more different colors. Red, green, and blue are the primary colors used in additive color system. A color monitor is considered additive color.

**Adobe Bridge** — Adobe Bridge is a digital asset management program developed by Adobe Systems and first released with Adobe Creative Suite v2. Bridge offers "Color Management" settings that synchronize the document and working color space across all Adobe programs to create a **Color Managed Workflow**.

**Adobe RGB** — Color space designed to encompass most of the colors achievable on CMYK color printers by using RGB primary colors on a device such as a computer display.

**Adobe Swatch Exchange** — A custom Adobe library of color swatches created in Adobe programs and stored as an ASE file.

**AFP** — Advanced Function Printing (AFP) is a page definition language (like PDF) that is used primarily in large production print operations for variable data printing (VDP).

**Artifact** — An objectionable visual effect either within a rastered image, through compression, or on a printed image that was not in the original processed file such as banding, jaggedness, mottle, or satellite drops.

**ASE File** — An Adobe Swatch Exchange file. A shareable custom color matching library created within the Adobe Creative Suite.

# B

**Barcode** — Barcodes are machine-readable numbers and various patterns (consisting of parallel lines of varying widths or shapes) that are printed on a product to identify it. Common barcode types include 2-D, 3-of-9, and IMB.

**Binary Printhead** — Inkjet head that uses a fixed drop size (as compared to multi-drop or level, grayscale printhead).

**Bit Depth** — Defines the extent of color tones that can be processed by a printhead as measured in bits. A single bit can be best described as an on/off instruction to the computer or printer where the printhead will shoot only one size drop. As the number of bits increase, the size of the drops varies, which affects the clarity of prints as well.

**Bitmap Image** — Also known as **Raster Images**, bitmap images are made up of pixels in a grid. Pixels are picture elements: tiny dots of individual color that create what you see on your screen.

**Black Point Compensation** — A feature found in Adobe design software, including Adobe Photoshop. Adobe Systems implemented Black Point Compensation (BPC) to address color conversion problems caused by differences between the darkest level of black achievable on one device and the darkest level of black achievable on another.

**Bleed** — Movement of ink within, or on, the surface of the paper. Ink can bleed vertically and horizontally on the paper by following paper fibers, causing plugging and wicking. See also **Plugging** and **Ink Wicking**.

**Brightness** — The volume of light reflected off the sheet of paper. Brightness is a measure, on a scale of 0 to 100, of the amount of light reflected from the surface of a paper.

# C

**Carrier** The base solution of an ink used to distribute dye or pigment color. Water is the carrier for aqueous inkjet ink.

**Clutching** A problem that occurs when data files can't be processed as fast as a printer prints, forcing the print engine to "downshift" to a slower speed or stop while waiting for input.

**Coated Feel** Are uncoated papers that have a slick feel to their surface but are not manufactured by coating application. Coated feel papers are produced by adding surface calendering during the papermaking process. See **Highly Surface Calendered**.

**Cockle** Cockle (or "cockling") is the term given to the ripples that occur when a sheet gets too much moisture applied. See **Paper Cockle**.

**Colorant** Colored particles or dyes added to inks to give them vibrancy and hue value. Properties such as optical density, vibrancy, color gamut, dry time, and color-to-color bleed are partly controlled by the particle chemistry within the ink formulation.

**Color Channels** A CMYK image has four channels: cyan, magenta, yellow, and black. These channels are combined to produce printed color image. Also referred to as a **Color Plane**.

**Color Correction** Process of making shade, tint, and tone adjustments to a hue in order to achieve a desired target.

**Color Gamut** Mapping the range of colors that can be accurately achieved by viewing a print device. In the context of inkjet, color gamut refers to the range of colors that a particular combination of inkjet machine, ink type, and paper can accurately produce relative to the number of colors the human eye can perceive.

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| **Color Managed Workflow** | A method for providing color consistency and predictability throughout the entire pre- and post-production processes by synchronizing all programs used for the design process. |
| **Color Plane** | Describes the jetting of one process color. Cyan, magenta, yellow, and black are considered separate color planes. Multiple color planes are combined to create a printed color image. See **Color Channel**. |
| **Color Profile** | Describes a range of colors, or gamut, that a device can display or print. See also **Profile, Input Profile, Machine Profile, Document Profile,** and **Output Profile**. |
| **Color Tint Book** | A reference source of CMYK printed colors produced by a specific production machine, ink, and paper combination. |
| **Composition Software** | Software that combines an incoming file format such as PDF and variable data and/or images into a composed print stream for print production or electronic delivery. |
| **Continuous Tone Image** | A photographic image that has not been screened and contains gradient tones. |
| **Copybook** | Documentation of older file formats produced in COBOL programs and delivered as ASCII text or EBCIDIC files. XML is the primary replacement of these files. However, many large corporations still rely on copybook formats to drive customer communications data. See also **Extensible Markup Language (XML) File**. |
| **Customer Communications Management (CCM) Solution** | High-volume composition software that combines an incoming file format such as XML, ASCII, EBCIDIC, or PDF and variable images into a composed print stream for print production or electronic delivery. See also **Composition Software**. |

# D

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| **Densitometer** | A device that measures the light reflected from a printed surface. |
| **Desaturated** | Desaturation of color is achieved by adding white (light) to a color. A desaturated color will look dull, muted, or have a grayish appearance relative to a fully saturated color. |
| **Designer** | A creative genius who seeks to bring ideas to life in the visual world. |
| **Device Link Profile** | A device link profile is a special kind of ICC profile that converts the color space of the input device directly into the color space of the output device, whereby the output device can be either a physical printer or a file format. |
| **Digital Front End (DFE)** | The Digital Front End (DFE) is the workflow touchpoint that accepts a print file, commonly a PDF or Adobe PostScript file in today's print environment, and turns that file into a format that the print engine can use to lay down the ink on the substrate. The DFE is the Raster Image Processor (RIP), but it may be a whole lot more depending on the type of device you have. |
| **Dithering** | A printed pattern in which dots are placed closer together for solid areas and farther apart for midtone and highlight areas, allowing more of the paper white to show through. The printed dots of varying sizes represent color intensities and print detail within the image. |
| **Diving** | The X-direction in which aqueous ink flows when absorbing into porous media. |
| **Document Color Space** | Color space setting assigned by the document profile that determines onscreen color rendering. |

**Document Profile** A reference point for the specific RGB or CMYK color space in which a document is designed. If a document profile is not assigned, colors used in the file are just a set of numbers without a fixed reference point. See also **Color Profile**.

**Dot Gain** The amount by which the diameter of a dot of ink increases when it hits the paper. As dot gain increases, the printed midtones will become darker and less crisp since the dots become irregular and bridge as they absorb into the paper and spread.

**Downsample** The process of creating a reduced resolution or miniaturized duplicate copy of a master image.

**DPI — Dots Per Inch** The most common measure of print resolution. Described as the number of dots in a square inch. See **Resolution**.

**Dry-back** An ink's printed color appearance and density changes as it dries over time.

**Dye Ink** Dye inks are made from colorants that completely dissolve in solution. A dye colorant is a single molecule, typically made of an organic chemical compound. Dye-based inks are more fragile and have less resistance to UV light and will rewet and dissolve in water if not bound by the chemistry of the paper surface.

**Dynamic Perforation** Adding perforated areas to a sheet in various locations.

## E

**Early Binding** The process of applying color management to the document prior to the device's RIP.

**Embossed** Embossing refers to a method of pressing an image into paper or cardstock to create a three-dimensional design. Text, logos, and other images can all be formed by the embossing method. Embossing results in a raised surface, with the design higher than the surrounding paper area.

**Extensible Markup Language (XML) File** — XML files are the most common type of file used to transmit data for customer communications and complex direct mail campaigns. While simpler projects may use a simple text file (.txt) or Comma Separated Value file (.csv), complex date requires the data layout capabilities of XML or the more dated EBCIDIC file format. See also **Copybook**.

## F

**Feathering** — The fuzzy appearance that happens when aqueous ink flows along the X-Y direction of the paper fiber and formation.

**Felt Side** — In papermaking, the top side of the sheet formed away from the papermaking machine's forming wire that typically contains more fillers and sizing than the Wire Side. See also **Wire Side**.

**Fine Trapping** — Process of taking multiple CMYK colors and making a perfect alignment to create small areas of color.

**Fingerprint** — Test image used for creating output that tests minimum text and line weights, halftones, solids, color fidelity, and maximum TAC to create standardized comparison across paper types and weights. Also called a **Reference Chart**.

**FM Screening** — FM screening randomly spaces consistent (binary) and varied (multilevel) dots to get darker or lighter shades. It's also known as frequency modulation or **Stochastic** (Greek for "random") screening.

**FOGRA** — The Fogra Graphic Technology Research Association is a German-based research institute for the graphic arts. FOGRA is a European color space based on ISO standards and certifications for print providers.

**Full Bleed** — An image that allows the print to continue past all four corners of the sheet size.

**Functional Prototype** — A design document used to describe the behavior of variable text and/or images placed in a finished document, based on data-driven rules. A functional prototype is primarily used to provide requirements to the programmers or business analysts who will develop the variable data application. This should also be part of the instructions provided to the print provider so they can visualize the concept and understand where variable data and images will be placed.

## G

**Gamut** — Representation of the range of colors reproduced on a specific device. See **Color Gamut**.

**GRACoL** — Is an acronym for General Requirements for Applications in Commercial Offset Lithography and is the standard working color space used by most North American printers. GRACoL profile standards are referred to as CRPC.

**Gradation** — A vector or bitmap image that fades into its background without a defined border. Also called a **Vignette**.

**Gray Levels** — The number of density levels in an image. Offset and toner typically contain eight gray levels per color channel (CMYK = 64), whereas production inkjet printing contains two and four levels of gray per color channel. Together with error diffusion (dithering), this simulates a continuous tone image.

**Grayscale** — Grayscale images are one-bit bitonal monochrome images with only two colors: black and white (also called *bilevel* or *binary images*). Grayscale images have many shades of gray in between.

**Grayscale Printhead** — Also called a **Multi-drop Printhead**, a grayscale printhead uses varied drop sizes to print images that have smoothness and detail in printed halftone images.

## H

**Halftone** — A halftone image is made up of a series of dots rather than a continuous tone. These dots can be different sizes, different colors, and sometimes even different shapes. Larger dots represent darker, denser areas of the image, while smaller dots represent lighter areas.

**Headache** — The pain experienced when the printer rejects a job prior to production or when the job prints with lower than expected print and color quality.

**High-density Polymer Pigment** — A high-density ink that has various levels of polymer chemistry incorporated into its ink composition. Also called "resins," polymer chemistry added to ink to create a string structure to assist with drop formation, reducing satellite drops from a printhead.

**Hue** — Describes the color family on the basic color wheel that is in its purest form without any tinting, toning, or shading. Also referred to as **Color**.

## I

**ICC Profiles** — A data set that characterizes a color input or output device, or a color space. See also **Profile**.

**Ink Coverage** — The amount of ink in one area of the page. Sometimes referred to as Total Ink Coverage (TIC) or **Total Area Coverage** (TAC), it controls the total combined printed ink usage of cyan, magenta, yellow, and black in full-color inkjet applications.

**Ink Density** — The percentage of light reflected from a color. Using a densitometer, a mathematical value of the lightness or darkness of a particular printed color can be measured. Lower densities cause light or washed-out prints, whereas high densities create rich, vibrant colors and images.

**Ink Dive** — When ink dives absorb vertically into the paper, causing structural and print quality defects. Ink is drawn into the paper's internal fiber structure, causing paper cockle, show-through, and/or mottling. See also **Cockle**, **Show-through**, and **Mottling**.

**Inkjet Coated Sheet** — Paper with a smooth surface that contains a coating chemistry designed for the fast drying of aqueous inks. These fast-drying surfaces restrict the amount of ink that can be absorbed by the paper, which allows the ink colorant to stay on the surface.

**Inkjet Treated Sheet** — Paper with a surface or internal fiber chemistry that contains a fixative treatment to separate the colorants from the liquid carrier of the ink. This holds more colorant near the paper surface.

**Ink Wicking** — Movement of ink when in contact with the paper fibers. Wicking happens vertically and horizontally as it follows the pattern of the paper fibers, thus causing printed text, lines, and images to lose their sharpness.

**Input Profile** — A profile that mathematically defines the characteristics or color space of an input device such as a digital camera or scanner.

**Inverse Type** — Area of color that has the image of a letter formed by the paper color. Also called **Reverse Type**.

## K

**Kerning** — The spacing between letters of text.

## L

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| **L*A*B*** | Expresses color as three numerical values: L* for the lightness, and A* and B* for the green-red and blue-yellow color components, creating a three-dimensional color space reference. |
| **Leading** | The spacing between the lines of text. |
| **Light Booth** | A controlled environment for viewing printed output under color-neutral lighting. (A highly recommended tool for designers!) |
| **Lightfast** | The ability of a color or ink to resist fading on exposure to light, especially sunlight. |

## M

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| **Machine Profile** | Characterizes the color reproducible by a desktop printer, digital or offset press, or a production inkjet device. The machine profile describes the color gamut of the specific printing conditions, such as type of paper and ink. Also referred to as **Output Profile**. |
| **Media** | Any printable surface such as paper, plastic, or vinyl. |
| **MICR** | Magnetic Ink Character Recognition. MICR ink is specially formulated for compatibility with MICR readers to enable automated capture of information from checks, coupons, and other documents necessary to process them. |
| **Minimum Text Size** | Smallest size of text that can be printed clearly using a specific printer, ink, and paper combination. |
| **Monitor Profile** | A profile that mathematically characterizes the way that the monitor reproduces and displays color. |

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| **Mottling** | A visual print defect caused when ink wicking and ink dive are combined. This causes visible non-uniform ink absorption on the paper surface in the form of blotching or streaking. See also **Ink Wicking** and **Ink Dive**. |
| **Multi-drop Printhead** | An inkjet head that uses varied drop sizes to produce smoother halftone transitions than a binary printhead. |

## N

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| **Native Resolution** | The original pixels per inch in an image or the number of nozzles per inch on a printhead. |
| **Noise** | Random pixels added to an image to hide defects such as cross-process print unevenness, banding, and mottling. |
| **North America Prepress 2** | A generic working color space that represents general settings for general offset printing. |

## O

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| **Opacity** | Property of paper that obstructs light and reduces show-through. Opacity is expressed as a percentage of light that cannot pass through the sheet. |
| **Optical Brightening Agent (OBA)** | Additives paper manufacturers put into paper to help a paper look "whiter." |
| **Out-of-Gamut** | A phrase that refers to a color or range of colors that cannot be properly reproduced by the output device. See also **Color Gamut**. |
| **Output Profile** | Characterizes a desktop printer, digital or offset press, or a production inkjet device. The **Machine Profile** describes the color gamut of the specific printing conditions, such as type of paper and ink. |

## P

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| **Pantone Color Bridge** | A printed color swatch book developed by Pantone that represents both the spot PMS color as well as the reference CMYK process mix. |
| **Paper Basis Weight** | Basis weight is a term that refers to the thickness and sturdiness of the paper. |
| **Paper Curl** | When large areas of the sheet become too wet, and the wood fibers are saturated and dried too quickly, causing the whole sheet to curl up horizontally and/or vertically. |
| **PDF** | PDF stands for Portable Document Format. It was introduced to ease the sharing of documents between computers and across operating system platforms. The PDF file format enables all computer users to be able to open, review, and print the documents saved in PDF format using a "reader" program. |
| **PDF/VT** | Defines the use of PDF as an exchange format optimized for variable and transactional printing. |
| **Picoliter** | The unit of measure for the volume of ink contained in a drop of ink. A picoliter equals one trillionth of a liter. |
| **Pigment Ink** | Water-based ink that contains solid, opaque pigment particles suspended in ink to provide color. Pigment particles tend to sit higher on top of the paper and are more fade and light resistant but may be less scratch resistant. Pigmented colorant made of tiny insoluble particles suspended in a solution that will not rewet or dissolve. |
| **Plugging** | Plugging is when image areas begin to fill from ink bleed or wicking, causing text, lines, and images to lose their sharpness. |
| **Plug-ins** | Adobe add-on programs aimed at providing additional image effects or performing tasks that are impossible or hard to fulfill using Adobe Photoshop alone. |

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| **Porosity** | Porosity comes from random fiber layers within the paper that have varying degrees of absorption. Porosity is an indication of the ability of the sheet to accept ink or water. |
| **Positive Type** | Text within a solid image area and produced with solid color. Positive type is the opposite of **Reverse Type**. |
| **Postcoating** | Printers and presses add postcoating after all ink has been applied and dried. These coatings serve as print protection from abrasion or moisture to matte and high gloss effects to accent a region of interest. Postcoating is applied by jetting or roll application. |
| **Postscript Page Markup Language (PPML)** | PPML is a standard printer language defined by the Print On Demand Initiative (PODi) specifically for Variable Data Printing (VDP). |
| **PPI** | Known as Pages Per Inch. PPI is a term used by book printers to describe how many pages will equal an inch when stacked. |
| **Precoating** | Precoating is coating applied before any ink contacts the substrate. Plate, roll, or jet can apply precoating from an inkjet printhead to create a compatible substrate surface for ink application. |
| **Preflight** | Process that confirms digital files have the correct format and type. Preflight can either be a manual or electronic software process. |
| **Primer** | To intentionally jet or apply a clear coating to the paper surface before printing CMYK inks to improve colorant holdout. Also called **Precoating**. |
| **Print Engine** | Custom designed software and mechanics that control proper printhead operation. |
| **Printhead** | The component of a print device from which the ink fires. |

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| **Print Service Provider** | A business that produces printed output as their primary service. Referred to as PSPs, they require open communication to provide efficient service. |
| **Print Speed** | The speed at which the printheads and printer can print. |
| **Process Color** | A printed color created from the combination of four subtractive colors (CMYK). |
| **Profile** | In the context of inkjet, the profile refers to the input or output machine's reproducible color space. See also **Input Profile, Output Profile, Machine Profile, Machine Monitor Profile, Document Profile,** and **Paper Profile.** |

## R

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| **Raster Image Processor (RIP)** | Produces a raster image, also known as a **Bitmap Image**. The input may be a page description in a high-level page description language such as Adobe PostScript, PDF, XPS, or another bitmap of higher or lower resolution than the output device. |
| **Raster Images** | Images made up of individual dots or pixels that have a defined value to identify specific color size and place within the image. Also known as a **Bitmap Image**. |
| **Reference Chart** | Test image used for creating output that tests minimum text and line weights, halftones, solids, color fidelity, and maximum TAC to create standardized comparison across paper types and weights. Also called a **Fingerprint**. |
| **Rendering Intent** | Rendering intents are components of the ICC profile. They allow options in how color transforms convert one gamut to another. Different input and output devices have different physical properties. Custom rendering intents can be applied based on color accuracy or color saturation requirements. Intents are relative, perceptual, absolute, and saturation. |
| **Resolution** | A measure of text or image quality, usually in **Dots Per Inch (DPI)**. |

**Reverse Type** An open space in an area of color in which the paper color outside the print area forms the letter image. Also known as **Inverse Type**. Reverse type is the opposite of positive type.

**RGB** Short for red, green, and blue — the primary additive colors used to simulate natural color on computer monitors.

**Rich Black** Values of CMYK are combined to create a denser "black" color than can be achieved with K (black) alone.

**Rosette Pattern** A rosette pattern is a moiré pattern whose high frequency reduces its visibility. Typically formed by only the cyan, magenta, and black halftone screens rotated at varying degrees. There are two types of rosette: dot-centered and clear-centered. When halftone screens rotate to their standard angles, they form a dot-centered rosette.

## S

**Satellite Drops** Unintended drops that jet between or around intended drops. Satellite drops can cause areas of detail to become blurred.

**Saturated Colors** Colors that print in their purest form. Saturation describes the intensity of a color, along with hue and value it represents to one of the three properties of color.

**Saturation** Saturation describes a range from fully saturated, pure color to unsaturated (gray). It is also described as the darkness of a color relative to its own brightness. **Saturation, Hue,** and **Brightness** are the three terms generally used together to describe a color or tint.

**Security Inks** Security inks, also called "invisible inks," are available to protect printed materials in different guises. One of the most widely used inks is invisible ultraviolet, which reveals itself when the print is under a black lamp (or UV light source). The ink is invisible to the eye (covert) under normal lighting conditions.

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| **Shade/Whiteness** | Refers to the quality of light — specifically the extent to which a paper reflects light of all wavelengths throughout the visible spectrum. |
| **Show-through** | Text or imagery visible from the back side of the printed sheet when ink penetrates into the substrate. Caused by ink volume, sizing levels, high porosity, or low opacity of the substrate. |
| **Simulation Profile** | A color profile that represents the entire workflow, including software, RIP, DFE, and output device. Simulation profiles are for soft proofing or printed proofs that simulate the ink, paper, and process. |
| **Soft Proofing** | The process of applying an output profile to visually see an image and color representation from a display closer to the device, ink, and paper. |
| **Specifications for Web Offset Printing (SWOP)** | A set of specifications and tolerances for publication printing that ensures measurable, consistent reproduction along each step in the printing process. |
| **Spot Color** | A printed solid color not made from process CMYK. Also called a **Demand Color**. |
| **Spot Foil** | A print effect that includes adding a colorized or metallic film to an area of the preprinted product. Spot foils are used to attract attention to an area of interest on commercial and packaging products. |
| **sRGB** | Is a red, green, blue color space created to use on monitors, printers, and the internet. Often the default color space for images that contain no color space information such as digital cameras. |
| **Static** | Pages, text, or images that stay the same throughout the printing process. Opposite of **Variable**. |
| **Static Text** | Text that stays the same throughout the printing process. Opposite of **Variable Text**. |

**Stochastic** See **FM Screening**.

**Subtractive Color** Subtractive color is the reflective light that is absorbed into the printed surface, subtracting colors by absorbing and reflecting the unabsorbed colors. The sum of all subtracted colors is black. Printing is a subtractive color process. See also **Additive Color**.

**Swatch Book** See **Tint Book**.

## T

**Tint** The process of lightening one of the basic hue colors from the color wheel or a custom color by adding white.

**Tint Book** A book of various CMYK color blocks printed from a specific device, ink, and paper to represent reproducible colors or color match.

**Tonal Range** Range of reproducible highlights, midtones, and shadows in a halftone image. Density and gray levels measure areas of tonal range.

**Tone** The process of "graying down" a color by adding both white and black to a hue.

**Total Area Coverage** Referred to as TAC. This term refers to the maximum combined CMYK ink thickness set in a color profile when printed. Also known as Total Ink Coverage (TIC).

**Transaction Print** A segment of the printing industry producing customer communications such as statements, bills, letters, notices, and policy documents that typically use high-volume batch processes.

**True Resolution** Refers to the inkjet printer's resolution measured in dots per inch (DPI). A 600 dpi printer means that each dot is actually 1/600th of an inch in size, placed in a 600 space/in. x 600 space/in. grid.

## U

**Uncoated Sheet** — Paper that does not contain any special treatment or coating on its surface. Uncoated papers are considered "open fiber" or "naked" papers.

**US Web Coated SWOP** — SWOP stands for Specifications for Web Offset Publications and is a set of specifications used in the US, intended to improve the quality of printed material. It also refers to the organization that produced the specification.

**UV Curable** — UV curable inks are a chemistry of ink that cure (polymerize) by applying ultraviolet wavelength light energy.

## V

**Variable Drop Printheads** — Variable drop on demand printheads, also called grayscale heads, place variably sized drops of ink onto media in a controlled manner. The placement of drops of variable volume produces a range of different dot sizes on the media.

**Variable Images** — Images that change with each page printed. Variable images are part of a variable printing process. Opposite of **Static Images**.

**Variable Text** — Text that changes with each page printed. Variable text is part of the variable printing process. Opposite of **Static Text**.

**Vector Image** Images that are made up of points, curves, and lines. Vector images are on paths or strokes containing control points that can be edited in X and Y coordinates to custom modify an element. Vector elements are not resolution dependent and can be increased without any image degradation.

**Vignettes** A vector or bitmap image that fades into its background without a defined border. Also called **Gradation**.

## W

**Waterless Ink** Waterless inkjet ink contains polymer in the place of water as its pigment carrier.

**White Point** The reference or target white in an image. White point is the point of the whitest value in an image that can define a substrate color or a preprinted white ink. White point measurement is the value for all areas of highlight, midtone, and color that will appear properly when printed. Adobe Photoshop uses white point to show color shifts when printing on different shades of substrates.

**Wire Side** When making paper, the side of the sheet that formed when coming in contact with the papermaking machine's forming wire. Opposite of felt side. See also **Felt Side**.

**Working Color Space** The color space a designer works in when the document color space of the design or image editing software is applied. Defines monitor RGB and CMYK color rendering data.

**Wrap Envelope** An oversized printed piece that is folded around itself to make a self-contained envelope.

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# ABOUT THE AUTHOR



**ELIZABETH GOODING** lives in Newton, Massachusetts, where she delights in making the business world more interesting, enjoyable, and efficient. As a master of many creative endeavors and a natural problem solver, Elizabeth is driven to improve experiences and outcomes. She has applied her golden touch professionally to designing, writing, public speaking, management, consulting, and cooking.

Ms. Gooding is the president of Inkjet Insight, which she co-founded with her esteemed co-author Mary Schilling, and Adam Dewitz of WhatTheyThink. On InkjetInsight.com, she turns her authoring and editorial focus to helping print organizations evaluate, optimize, and grow their businesses using production inkjet. Known as a "Curious Consultant and Professional Problem Solver," she is widely sought after for her down-to-earth approach toward highly complex business communications and process design initiatives.

Nurturing the evolution of production inkjet platforms and evangelizing for inkjet-friendly design are just some of the ways she has helped raise the business communications bar. Over the past twenty years, Elizabeth has had the opportunity to implement major design and automation projects for many of the world's leading brands in finance, healthcare, telecommunications, and insurance. While improving communications such as statements, bills, policies, and other regulated customer communications may seem pedestrian, she raises those endeavors to a strategic level—allowing enterprises to dramatically improve the efficiency and effectiveness of their communications initiatives.

She wants you to know that she has a B.S. in economics from Northeastern University, has owned and sold successful businesses, is a certified design and print geek, loves a colorful world almost as much as her colorful daughter, and has a quirky sense of humor that is dryer than ink on a page.

# ABOUT THE AUTHOR



**MARY SCHILLING** hails from the tiny town of Fountaintown, Indiana, where she has established a world-class print quality testing lab. When not surrounded by spectrophotometers, densitometers, and vast cornfields, Mary travels the world, helping companies to optimize print quality on their inkjet devices.

Mary is a cofounder of Inkjet Insight, where she shares her deep insight on paper evaluation and inkjet print quality. She is also the CEO of Schilling Inkjet Consulting and has been dubbed the "Inkjet Genie" by her peers.

Mary's infatuation with print began while running conventional offset presses in vocational school. She developed her creative design skills while attending Heron School of Art as a visual communications major and working for a Fortune 200 packaging company whose clients included top liquor, junk food, and agricultural producers.

Seeking opportunities to push the boundaries on print design, she rejoined the machine design side of the creative industry and began consulting with printhead, ink, RIP, and machine manufacturers. Mary's consulting practice initially focused on print quality for label, packaging and commercial markets to ensure the new wave of single- pass and flatbed UV and aqueous industrial inkjet devices were simple and easy to use for printers. She received several awards for the development of the JetPac single-pass inkjet packaging press which integrated the first internet-based automated design to press workflow called Package Genie.

Mary's down-to-earth training and whimsical spirit have eliminated drama from numerous inkjet installations. By working with designers, prepress professionals, pressman, and sales organizations, she has ensured that customer expectations are properly set and that print quality and color implementation are synchronized across print devices. For Mary, G7 is a methodology, a mantra, and a way of life.

During her career Mary has invented and optimized technology, founded companies, written books — receiving recognition and awards in all those roles. With all of those career accolades, the achievement she is proudest of is her son Christopher.

# NOTES

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