

Technical	
Information	Trapping

One area of persistent difficulty for electronic publishers has been in the creation of traps: slight overlaps between adjacent colors. No matter what you call them — spreads and chokes, shrinks and spreads, fatties and thinnies, or grips — trapping is a key issue in the process of creating fully-electronic, color pages. There are ways to handle trapping electronically, but they are by no means totally automatic. This article will cover the issue of trapping, and give tips on how to best handle it.

Note: Don't confuse the term *trapping* with the term *ink trapping*. Ink trapping refers to the ability of ink to stick to paper that already has ink on it. Poor ink trapping may cause color shifts (i.e., unexpected changes in the color of an image).

## Trapping



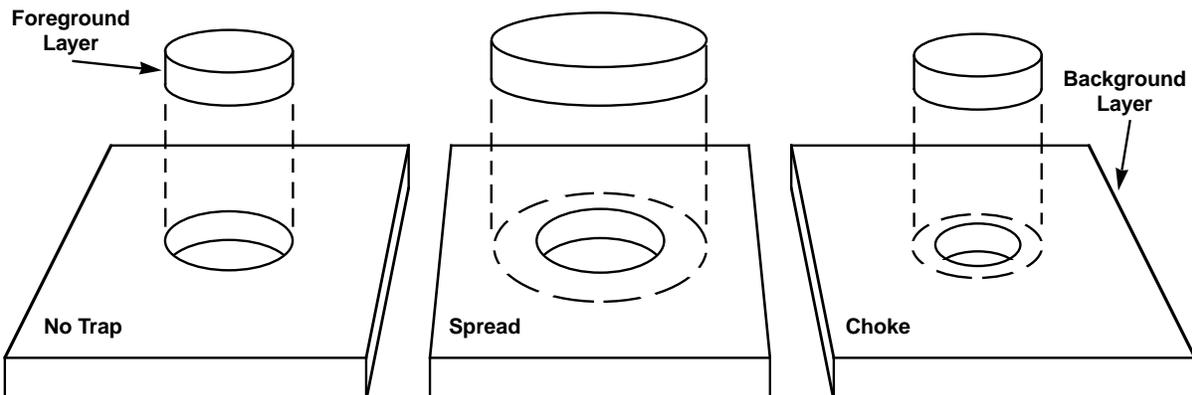
Figure 1 - The consequences of no trapping, where the black background represents one color, the gray letters represent another, and the white gap represents where the paper shows through.

Trapping is required because you cannot always expect perfect registration on a printing press. If you tried to print two colors side by side without any overlap, a gap might appear between the two colors at some point in the press run. (See Figure 1.) This gap would show up as the white of the paper, and would be extremely noticeable. To avoid this, an overlap is built in so that even with press variations no unsightly gap will appear. These overlaps are kept as small as possible because in the area where the overlap occurs, a darker color is formed. Think of it this way: If you were putting an area carpet in your living room, would you cut the underlying padding to exactly the same size as the carpet? Of course not. You would make it small enough not to be visible even if the carpet shifted, but large enough so that it wouldn't be noticeable as a separate shape under the carpet.

**Chokes** and **Spreads** are types of traps. They refer to the adjustment in size of an object or background to form a trap. A choke shrinks the open area in the background to create a trap, while a spread enlarges the object to create a trap. (See Figure 2.)

Originally, traps were created photographically by overexposing when a contact of a film was made. The difference between a choke and spread depended on whether you overexposed a positive or a negative film. With electronic trapping, we only need to decide whether to create the trap in the foreground or in the background. Remember that whether you are spreading or choking, you are still creating an overlap. The difference is that you change the size of the object to create a spread, and the background to create a choke.

Figure 2 - No trap, a spread, and a choke, each shown as two layers.



## Overprints and knockouts

An **Overprint** occurs when one color is printed directly on top of another. (See Figure 3.) No trapping is required. Overprints are often used with black or opaque spot colors (these colors aren't affected as much by the underlying color), or when a mixture of two overlaid colors is desired.

A **Knockout** (also known as a dropout or reverse) describes what happens when the image area on one separation is left open on another separation. (See Figure 3.) For example, to display yellow type on a black background, the type must be knocked out of the black. Otherwise, the yellow type will be obscured by the black background.

Overprints and knockouts are extremely important concepts in trapping.



Figure 3 - An overprint (left) and a knockout (right) shown as two layers.

## Electronic trapping concerns

When you create a document in an illustration or page layout program, there will be times when you stack various elements on top of each other. The way that these objects relate to each other is very important in understanding how electronic trapping works. There are several things you should find out about your program:

**How can you control whether an object will overprint or knock out whatever falls beneath it?** Do you select it when you create an object, or do you choose it in the print menu? What is it called?

**How are multiple layers of color handled?** The general terminology for layering is as follows: the background color is the color used to fill a graphic or text box within a page layout program, while the object color is any color that is printed against a background color. Colors that fall in layers between the object and background may be affected by the layers that are above them, and likewise may affect the layers below.

**How are rules around objects handled?** The way that rules are handled plays a key role in creating traps. (See Figure 4.) Some programs center a rule on the edge of an object so that half of the rule extends into the object and half goes into the background. Some programs give you the option of building rules either on the outside of the object or within the object. This is handy if you don't want to affect the size of a box by adding a rule to it; instead, you can build the rule within the object. QuarkXPress\*\* 3.0, for example, gives you the choice of stroking the rule on either the inside or outside of an object, but not centered on the edge of the object itself.

Figure 4 - When the stroke is centered on the edge of the object (top), half goes into the object, and half into the background. If the stroke is on the inside (bottom left), the size of the object remains the same. If the stroke is on the outside (bottom right), the object increases in size by the width of the stroke.

## Layering terminology

Most programs handle layering in the following way. An object can be made to either knock out or overprint what is beneath it. However, the terms to describe layering may vary from application to application.

**Stroke** is used to describe the width of a rule. When a stroke is chosen for the edge of an object, you usually have the ability to choose the width of the stroke, and whether or not it will overprint. If no stroke is chosen, it is as if the rule did not exist. It won't print and it won't drop out anything beneath it.

**Overprint**, as described above, may be displayed as a checkbox in a program menu. If you check the box, the object will overprint. If you don't check the box, the object will knock out of the background.

**Knockout**, as described above, appears only in a few programs (the Aldus FreeHand\*\* print menu for example). Usually, not choosing overprint is the same as choosing a knockout.

A **Fill** refers to the color assigned to an object. **No Fill** is similar to not having a stroke. The inside of the object might as well not exist. It will not knock out layers below it, and it will create no color of its own.

**Paper** and **White** are terms used to describe a layer that will not print as a color, but that will drop out layers below it. If you want the color of the paper to show through an area of color, you may want to create an object with a paper or 100% white fill.

**Runaround** and **Transparent** are terms used to describe whether or not text will flow around an image or text block. These functions also allow the background to show through the object as long as the object has a 0% fill. This has the effect of making a no fill when 0% of a color is chosen.

## Creating traps

When you are deciding if a trap is necessary, look at your image and then answer the following questions:

**Do adjacent colors touch?** If they do not touch, then no trap is needed.

**For process colors, is there a color that the adjacent colors share?**

When red and blue are created with process color, they do not really need to be trapped because both colors contain magenta. (See *Color in Printing*, technical information document #3056, for more information on color mixing.) Even if there is misregistration, the worst that will happen is that there will be a magenta line showing through between the red and blue (not nearly as visible as a white or yellow line).

**Does the design include fine linework or small serified type?** Since a choke or a spread changes the size of an image, it may affect the overall look of a piece. Therefore, you should carefully plan any traps that involve fine linework or small serified type. Possible work-arounds include using opaque spot colors in an overprint, or seeing that the background and the foreground share some of the same color.

**Which color is darker?** The darker colors usually carry an image. If you change the size of the darker colors to create a trap, you make the darker part of the image look larger. In the case of complex synthetic images (from Adobe Illustrator\*\* or Aldus Freehand, for example) there may be such an intermingling of colors that you can't decide which one carries the image. This is where truly automatic trapping would be useful, so that in each individual instance adjacent colors would be compared and the lighter one spread or choked.

*If the foreground is lighter,  
then spread the foreground.*

*If the background is lighter,  
then choke the background.*

**Do some objects overlay multiple backgrounds?** If this is the case, the trap may vary along the edge of the object. For example, an object may overlap two separate background colors. If it is darker than one and lighter than the other, its border with the darker color will need to be spread, while the border with the lighter color will require a choke of the background.

**For opaque spot colors, what is the order in which the colors will be printed?** With opaque spot colors, the order of printing determines the difference between an overprint and an unfortunate underprint. In addition, it may make sense to spread the first color printed instead of choking later colors because adjusting the size of later colors will be more visible.

## Which color is darker?

To do trapping manually you need to know which color is the darker color. For the process colors, black is the darkest, followed by magenta, cyan, and yellow. Including the secondary colors, the ranking is as follows (from dark to light): black, blue, red, magenta, green, cyan, and yellow. This is based on solid color and two-color overprints. If several colors overprint (either as solids or percentages of solid colors), the relative darkness must be deter-

**Darkest**  
 Black - K  
 Blue - B  
 Red - R  
 Magenta - M  
 Green - G  
 Cyan - C  
 Yellow - Y  
**Lightest**

mined on an individual basis. You could do this visually based on what you see on the screen or in some already-printed material, or you could compare CMYK values to see which contains more of the darker process colors. (See chart at right.)

Because process colors are formulated to be as transparent as possible, overlaying two or more process color inks creates new color mixtures. Some spot color inks, on the other hand, are virtually opaque. (Check with your printer to see if the spot colors you are using are opaque.) What this means for trapping is that opaque spot colors may be overprinted, eliminating the need for a trap. However, trapping is still a concern where colors butt because an overlap must still be built in.

**Comparing CMYK colors:**

	C	M	Y	K
<b>Frgnd</b>	40	70	0	20
<b>Bkgnd</b>	30	0	90	10

*In this case (a bluish magenta and a greenish yellow), the greenish yellow background color should be choked because it contains less of the darker process colors. The trap color would be:*

<b>Trap</b>	40	70	90	20
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*(These are the highest values of any of the colors involved.)*

**How big should a trap be?**

The size of a trap depends on the amount of variation you expect during printing. Since you may not always know the registration accuracy of the press, the chart below provides some estimates. Common trapping values range from .25 to 5 points (approximately from 1/300 to 1/16 of an inch).

One way to estimate the proper trap is to use screen ruling as a guide. When you inform your printer of the screen ruling you intend to use, they will choose a paper and press combination that can maintain that level of quality. Many printers feel that good registration on press means being off by no more than half the distance between one row of halftone dots. Based on this, the accompanying chart shows trapping estimates based on some common screen rulings. The low value assumes excellent press registration (1/2 row), while the high value is a more conservative estimate (2 rows):

Screen ruling (in lines per inch)	Trapping values in inches	Trapping values in points
65	.0077 to .0308	.55 to 2.20
100	.0050 to .0200	.36 to 1.44
133	.0038 to .0152	.27 to 1.08
150	.0033 to .0132	.24 to .96
200	.0025 to .0100	.18 to .72

It is important to build in traps of a reasonable size because too small a trap is ineffective, and too large a trap will create noticeable colors in the overlap.

**Types of trapping**

**Object types:**  
 Rules - Solids - Tints  
 Type - Halftones

There are five types of objects in an electronic page: rules, solids, tints, type, and halftones. Traps may be needed between any of these types of objects.

The way that each type of trap is handled may vary from one application to the next. There may be some traps that certain applications are unable to do. Of course, this is an important issue when you are considering buying an application. For now, we'll discuss how a generic trap may be created. This will form the basis for creating traps in any number of common applications.

**Trapping using stroke width**

Some applications that do not offer automatic trapping nonetheless allow some amount of trapping to be done manually. This can be done through a combination of stroke width changes, fills, and overprinting. What this amounts to is the creation of a gasket in the trap color. (See Figure 5.) If the object color is lighter, then the trap should be made in the object color. If the background color is lighter, then the trap should be in the background color. The trap should be set to overprint with no fill while the object should always

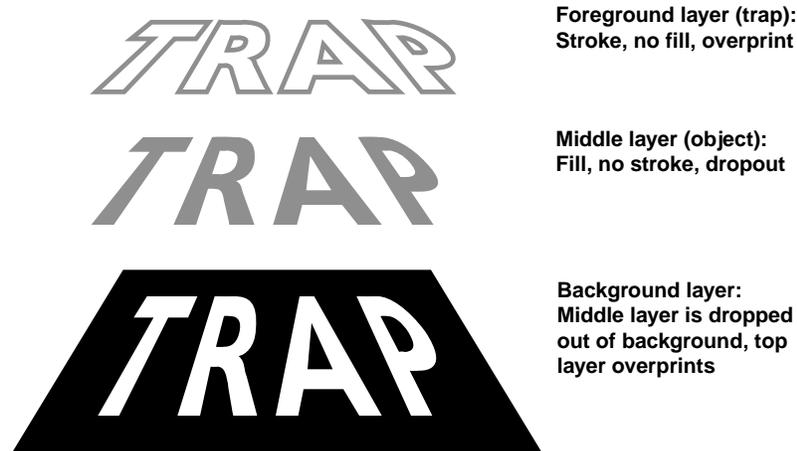


Figure 5 - Trapping using stroke width. Each layer is shown separately. If the trap is the same color as the object, a spread has been created. If the trap is the same color as the background, a choke has been created. Either way, the trap is equal to one half of the stroke width (because half of the stroke matches either the foreground or background color, and will not contribute to the trap).

drop out of the background. The amount of the trap is equal to half of the stroke width chosen. This is because half of the stroke goes into the object and half goes into the background; only one half contributes to the trap.

This scenario includes some assumptions. First of all, it requires that layers can be assigned variable strokes and fills, as well as overprints. Second, the stroke width of the rule must be centered on the edge of the object.

### Inside and outside rule traps

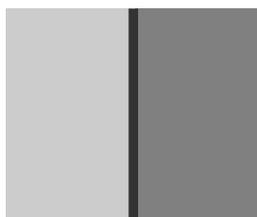


Figure 6 - Rule used to trap two adjacent areas of color.

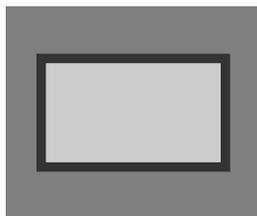


Figure 7 - Rule around colored box used to trap a color within a color.

When the rules surrounding objects may be placed either on the inside or outside of a box, and not centered on the edge, the technique for creating a trap changes. In addition, if all objects drop out what is beneath them, a different approach must be taken. The technique involves creating an artificial overprint. Rules or boxed rules are created to act as traps. These rules are assigned a color that is a combination of the foreground and background colors. This new color is set to separate as a process color. When the image is separated, traps are formed in the border areas.

To create a trap where a boxed color butts up against another boxed color, a rule must be created at the border between them. The rule is given a color that combines the adjacent colors. The placement of the rule in relation to the border of the colors determines whether a choke or spread is created. The width of the rule will be exactly equal to the width of the trap. (See Figure 6.)

Where a color is surrounded by a second color, the rule that surrounds the second color should be assigned a combination of the two colors. For example, if the object is 100% cyan and the background is 100% magenta, the rule should be created as a new color, 100% cyan/100% magenta, and set to be separated as process color. In a more complex color mixture, take the highest of the CMYK values of both colors and use them as the trap. To create a spread, make the rule on the object fall outside; to create a choke, make it fall inside. The width of the rule will be exactly equal to the width of the trap. (See Figure 7.)

Trapping a rule within an area of color requires the creation of a double rule. The top rule should be set to the desired width and color. The bottom rule should be wider and slightly longer, assigned a color that combines the rule color and the background color, and placed to fall exactly under the top rule. (See Figure 8.) The trap will be equal to half of the difference between the two rules. For narrow rules you may choose to assign the rule the combined

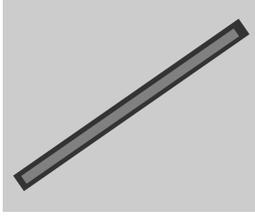


Figure 8 - Double rule used to trap a rule to an area of color.

color of the rule and background. This simply creates an overprint.

Trapping a single color to a surrounding rule requires the use of two boxes. The first box is drawn to the desired size, given no fill, and an outside rule of the desired color. A second box is then created within the first, sized to as large as possible within the parent box, and given the desired color. To create the trap, create a new color with the combined colors of the box and rule, and assign it to the inner rule. (See Figure 9.) The trap will be equal to the width of the inner rule.



Figure 9 - A box within a box used to trap a rule to the color it contains.

### Difficult traps

If all objects knock out what is beneath them (as is the case with some applications), certain types of trapping may become difficult. Halftone-to-rule traps are a good example of this. If the rule of a picture box drops out the image under it, there is no easy way to stretch the halftone so that it extends under the rule. Another difficult trapping situation applies to type. If an application doesn't give you control over the stroke width of type, there is no way to do what is shown in Figure 5.

The best way to see how to trap with an application is to run some tests. Important aspects to test include the knockout and overprint commands, as well as the controls over stroke width. Include examples of the types of traps you use most frequently. Where trapping is automatic, check to see whether all types of traps are addressed. If you exaggerate the stroke widths and run the separations to a laser printer, you have a fast and easy way to see what the program is doing.

### Other resources

Both Adobe and Aldus have position papers on trapping. If you have an interest in trapping using Adobe or Aldus products, contact the author at the address below to get a copy of either or both of these papers.

### Conclusion

Making effective traps is such a subtle point that it can be easily overlooked until you see the final printed piece. Of course by then it is too late. The most complex part of all of this is being able to create traps with the variety of applications available on the market today. It also means checking films to see that the trap you assigned has been reproduced on the film. (Checking a proof isn't enough; a well-registered proof won't reveal trapping problems.)

In light of it's complexity, some people have decided that trapping just isn't worth worrying about (particularly given the tight registration tolerances of many new printing presses.) For those of you who have no interest in doing traps manually, take heart in the direction that PostScript\*\* technology is taking. Systems have already been developed that make it possible to handle trapping automatically via post-processing in the RIP.

### Comments

Please direct any questions or comments to:

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