

TECHNICAL GUIDE

INK

INK SAVING TECHNIQUES

Second Edition

Ink saving techniques

After the substrate, ink is amongst the more expensive components in the printing process. You need to lay down enough ink to achieve a pleasing end result depending on the page images you want to reproduce. But there are several reasons why you should not use more ink than necessary, the most obvious of which is cost.

It makes no sense at all to print your ink layer too thick because this uses ink unnecessarily. There are also technical and practical reasons why you should establish the optimum, and often minimum, amount of ink that is required to achieve good results on a particular substrate.

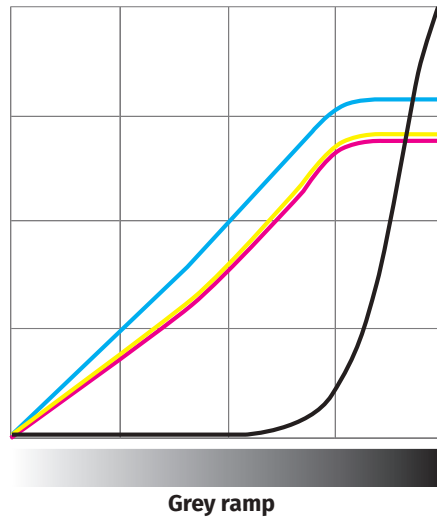
Classic repro wastes ink

In the early days of printing, repro technology was not particularly sophisticated, although it was pretty complicated. Using a camera, colour image was first separated into four separate images each of which would be printed with one of the four process colours: Cyan, Magenta, Yellow and Black (K because it is the Key colour). There was no real control over how much ink would be required to print each separation. This meant that deep shadows could very well contain up to 400% ink, with each channel printing up to a 100% tone value producing a solid tone. Not only is this obviously a waste of ink, it also means that drying times will be excessively long. In the worst case, if the inks haven't dried properly before the post-press operations start, problems will be created in post-press, such as smearing and rub-off.

UCR & GCR

With the introduction of computers to the repro process, a couple of technologies were introduced to provide control over the separation process. They could therefore help to limit the amount of ink expected to be used when separating an original image into the four channels that would be printed with CMYK inks. The most commonly used techniques were, and indeed still are, Under Colour Removal (UCR) and Grey Component Replacement (GCR). The first term, UCR, is a bit misleading, since we actually don't remove any colours in the process. We rather limit the chromatic amounts of C, M and Y used in the deep shadows, and may also limit the maximum amount of K allowed. A typical setting for UCR is to allow a 100% black, but to reduce the amount of CMY so that you never reach a higher amount of let's say 300% ink coverage in the deep shadows in any part of the image. TIC, Total Ink Coverage, is also referred to as TAC, Total Area Coverage. UCR is sometimes called using a chromatic repro technology, since the grey areas are still made up of a mix of the chromatic inks (CMY), plus black.

UCR (Under Colour Removal)



The black generation and separation technology known as UCR doesn't actually remove any colour, but rather limits the use of the CMY chromatic components at a set limit for the Total Ink Coverage. Here the total ink limit is set to 300%.

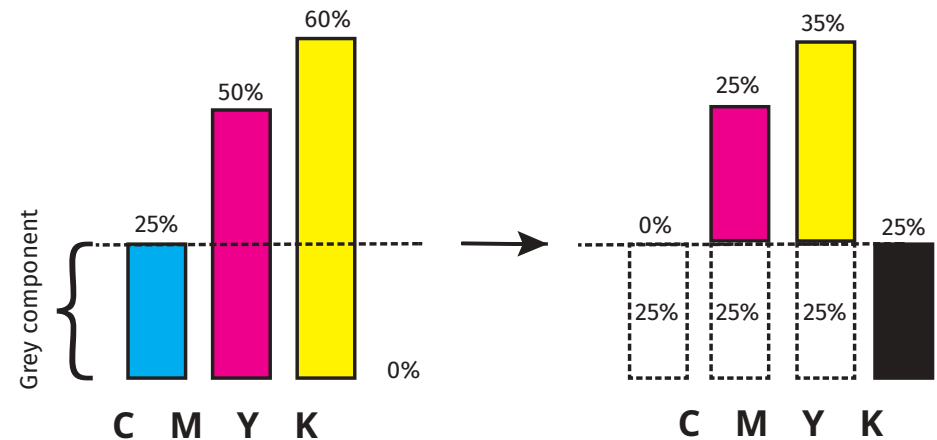
magenta and yellow. But it will also be easier to maintain a correct grey balance, since we only use the black ink there, and not a delicate balance of CMY.

When using UCR technology it's crucial to maintain precise densities for the CMY channels because if you get any drift in one or more channels, you will get a colour cast in what should be neutral grey areas. When using GCR separation technology a slight change in the densities of CMY won't affect the grey balance much, so it will be much easier to maintain neutral greys. This is why GCR is much more widely used today than UCR. GCR is sometimes referred to as achromatic separation technology, since the

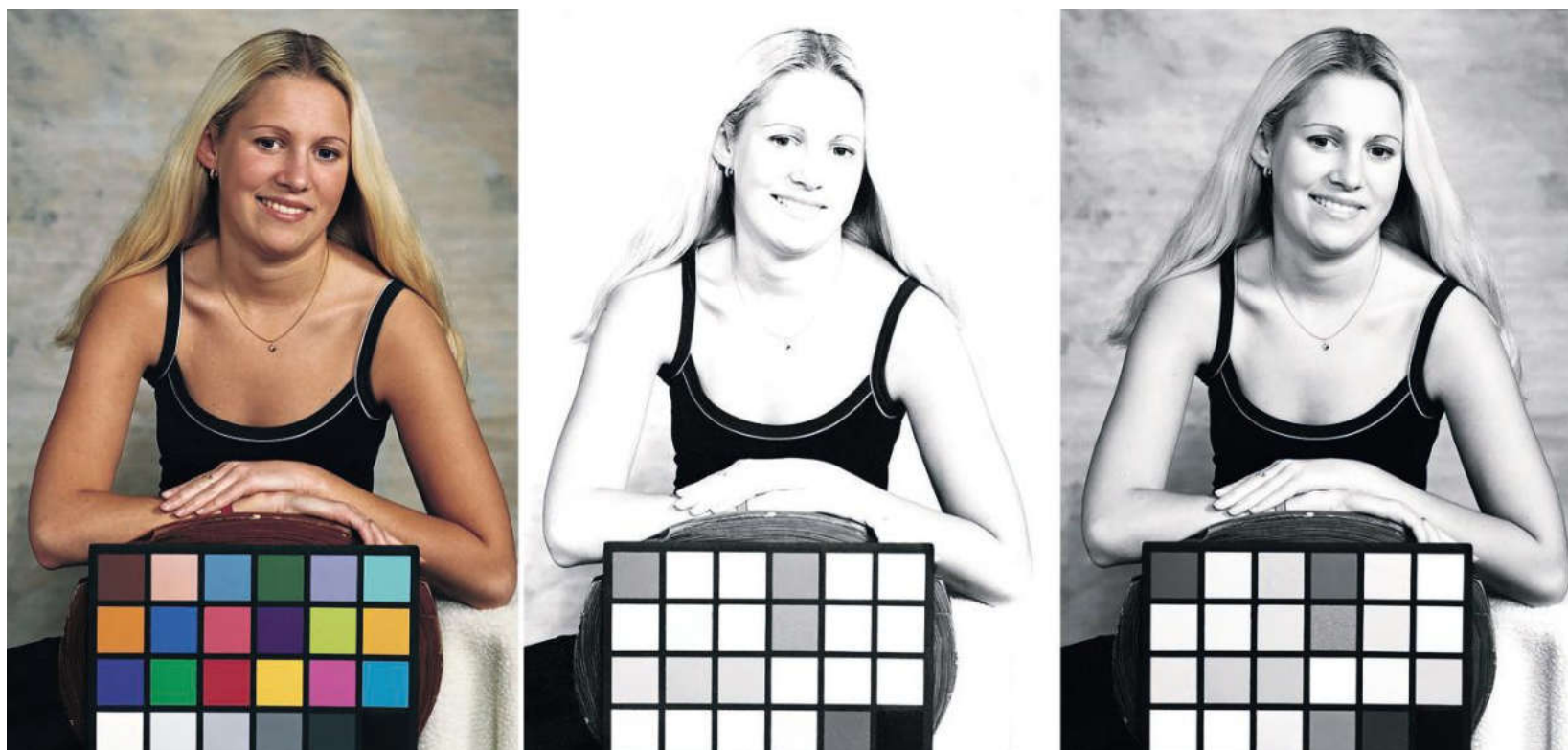
If you think about it, reducing the total amount of ink used makes complete sense if you can create a rich, dark black using 100% black plus let's say 70% cyan and 50% magenta added to it. You generally don't want to add yellow to a dark area, since yellow is a light ink and will only make the shadow parts lighter. The only reason to add yellow to the non-chromatic areas of an image (light grey to dark grey areas) is to maintain the overall grey balance.

This brings us to the second popular separation method, GCR. As the name suggests using GCR replaces the amounts of chromatic inks used (CMY) in the grey areas of a page, and instead uses black. This will reduce the total ink amount on the sheet, since you normally can achieve a certain tone value for grey using only black ink compared to when using a mix of cyan,

GCR (Grey Component Replacement)



The separation technology GCR reduces the use of CMY to create near neutral colours, and replaces those with black ink. Here no Cyan is used in the grey areas, and instead black ink is used to produce the same grey tone.



UCR, the classic black generation technology, used what was often called a "Skeleton black" setting, where the black ink was only used in the deep shadows (middle image, showing the black ink separation). GCR on the other hand use black ink in the mid tone greys, and with heavy GCR even in the highlights (image to the furthest right).

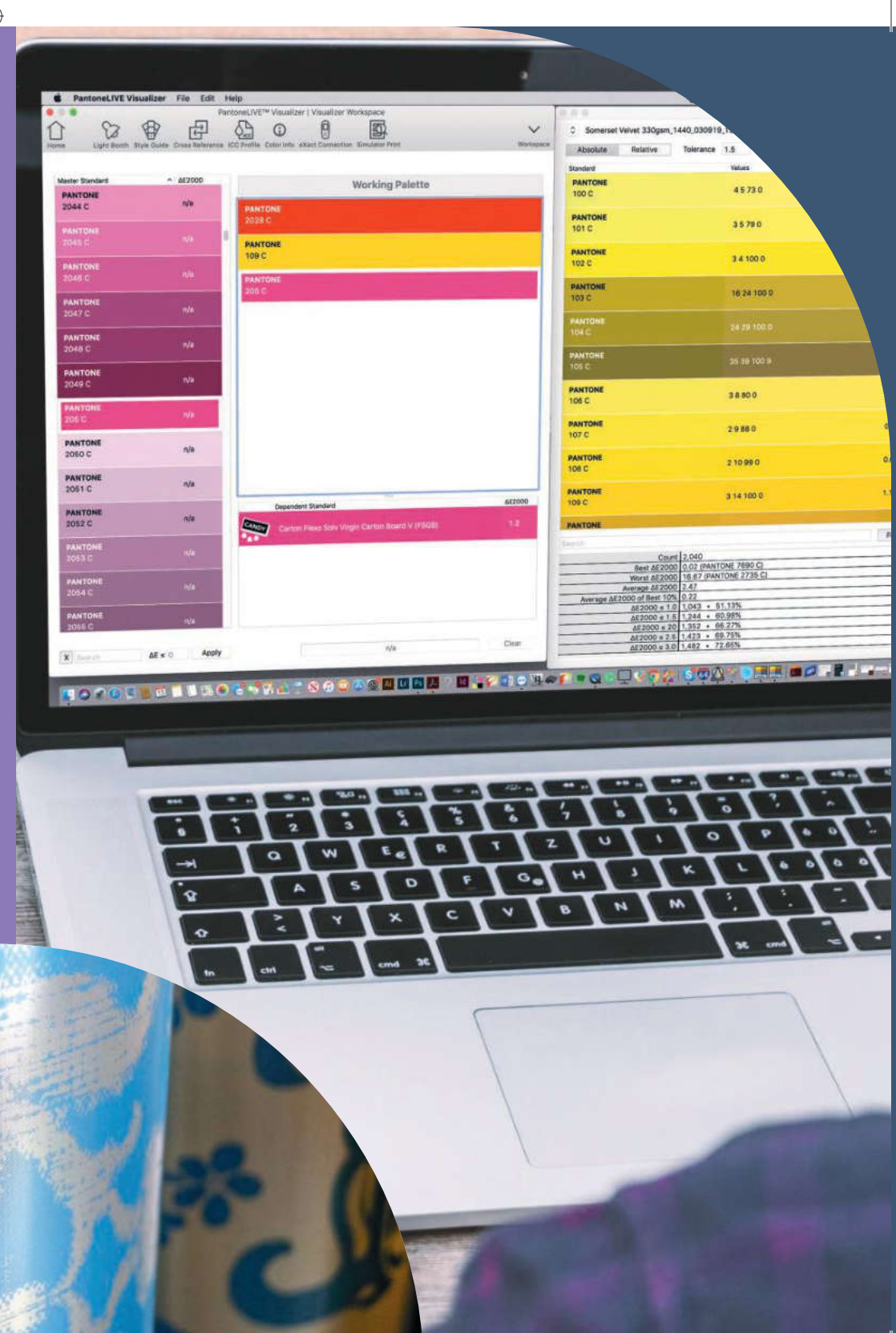
CMY chromatic inks are, to a large extent, replaced with black, nonchromatic ink. For many printing technologies the black ink is usually cheaper than the chromatic inks, so GCR can yield quite considerable savings because it reduces the required quantities of the more expensive chromatic inks (CMY).

Ink saving software works by analysing the page images and working out what the optimum ink coverage in a given area of the image should be. The software calculates pixel by pixel, and typically reduces total inks amount used. As a bonus the

printability of the image can often be improved in the process. The grey balance is also improved or at least assured. And as with all ink reducing technologies, the drying times for the ink is far lower. This has a positive effect on the post-press work, making it easier and less error-prone. Faster and more thorough drying can also reduce or even eliminate common problems in the binding process, related to the application of excess ink to the substrate. And faster drying obviously saves time and improves turnaround, so it has an added benefit to customers.

Saving even more ink

On top of exploiting clever settings using the GCR or UCR repro techniques, there are solutions on the market that can help you to save even more ink in the printing process. Among those solutions it is worth mentioning names such as Agfa, Alwan, CGS, GMG and Kodak as examples. In several objective tests a number of the solutions from these vendors have been shown to reduce the total ink amount used by 20-25%, without changing the visual appearance of the printed image. The savings are achieved without changing key colours by more than 2 ΔE . This is the tolerance below which most people cannot see any colour difference. However with perfect colour vision and under perfect viewing conditions, you may be able to see a deviation at as low as 1 ΔE . This level of colour discrimination capacity is rare.



Savings with using an extended ink setup

Quality control has been gradually moving away from the press to the front end system and software control, so there is another way to save ink, especially in digital printing. More and more printing systems offer the option of an extended ink setup, which is mainly used to expand the achievable colour gamut. The additional inks will most commonly be the colours that sit between CMY in the colour circle: Red/Orange, Green and Blue/Purple. If you only use the classical CMYK ink setup, you will have to use magenta and yellow in combination to produce red or orange. To produce green you will have to combine cyan and yellow, and finally to produce dark blue or purple you need to mix cyan and magenta, sometimes adding an amount of black ink to the mix.

In contrast, if you have an extended ink set, you have the benefit of being able to produce the Red, Green and Blue colours using only one ink. And so you can easily save up to 50% ink in this particular area, while at the same time most likely being more colour accurate than when trying to create that colour using two of the CMYK process colours. The positive added benefit that using an extended ink setup delivers is not all that widely recognised. However it should be taken into account when planning the system setup of your next digital press investment.

Another common extended ink setup is to use a light version of cyan and magenta, in tandem with the normal cyan and magenta. But this doesn't expand the colour gamut, or save any inks. The reason to use the light version of cyan and magenta is to be able to create smooth vignettes of the highlight areas of an image. In theory you should also have a light version of yellow in order to achieve this, but since the human eye isn't very good at detecting the light yellows this isn't necessary. But on the other hand there are reasons to use light version of black, that is light and medium greys. This again allows you to create smooth vignettes and tonal gradations, which are important for good reproduction of black and white photos. This process won't save you any ink however.

As has been described above there are several ways to save ink in the printing process that will be good for overall margins. However these techniques can also help to optimise how the prints perform in post-press. Whichever way you choose to go, whether its optimising colour management settings using GCR or UCR to control the total amount of ink used, or going for a dedicated ink saving software solution, you are likely to be able to both reduce the cost of your ink bill and increase the efficiency of your post-press operations. A win-win situation for you and your clients.

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