

Colour and the Printer

2. The Technology of Colour *by John B. Easson*

Having described the main principles of the theory of colour, I now come to the mechanics of colour — technology is perhaps too grand a term.

Colours are available as pigments, which are fine powders of coloured substances, or dyes which are coloured substances that will dissolve. Both are used in printing; pigments are in inks, dyes are used to colour paper fibres, and also, by colouring white powders, to form 'lake' pigments in inks. There are two main types of pigment: inorganic ones which are usually cheap (being simple to make), are less likely to fade, and are relatively heavy; and organic ones which are much more complex, but can be much more brilliant, and are light. Both are manufactured nowadays; originally the former were minerals ground down, and the latter were extracted from plant or animal products.

Modern technology has enabled much more saturated colours to be made, and such pigments as titanium dioxide — a brilliant white compared with the old lead and zinc whites — are relatively recent. Pigments are also ground much finer nowadays, which means that a thinner layer of ink is satisfactory (this being necessary in lithography for example, where a thick layer is not possible), and the ink is less likely to settle in the tin.

To add to the range, tinters and extenders are used. A tint is a hue diluted with white, and here the difficulty is that if you simply add white to an ink, the colour very often fades rapidly after printing. Hence specially matched pigments and whites are preferred. An extender is a pigment (or mixture) which is effectively transparent, and which thus adds to the volume of ink without altering its hue. If too much is used, the ink becomes weak and blotchy, but properly used, an extender allows a pigment that would otherwise be too expensive to be used.

Metallic colours of ink have flakes of aluminium mixed with them. These act like mirrors, and give the metallic lustre to the ink. A dye in the ink vehicle allows coloured effects. These are the most opaque inks of all, because the aluminium is completely opaque, and forms a complete layer, the flakes floating flat in the ink and overlapping.

Mattness and gloss

Glossiness is seen when a surface acts like a mirror, usually only partly. Thus a glossy red sheet of paper not only takes some of the light falling on it and scatters the red in it in all directions, but also reflects some of the original light directly off its surface unaltered (i.e. white).

Now a matt surface does manage to absorb all the light that falls on it of the colours which it absorbs, so in effect it scatters some white light in all directions along with its colour, this scattered white corresponding to the reflected white of a glossy colour. Thus a matt colour cannot be as saturated as a gloss one, for there is always a little white reducing the saturation. This is one reason why some bookjackets have a gloss finish — it makes the colours that small amount richer in effect.

Mixing colours

I have already mentioned a couple of the difficulties in mixing inks. However, a few of the main points to note when mixing inks follow.

The explanation of the theory given before will have indicated that it is only possible to mix a colour if you have the necessary hue available or if it is in the range of the hues you do have. Thus if you have a vermilion red and ultramarine, you will never be able to mix a strong hue of magenta, because the red hue, while containing some magenta also contains yellow, and no matter how much red you use, you cannot get rid of the yellow. The blue contains some magenta too, but has much more cyan in it, so again there is an unwanted hue.

On the other hand, if you had a pure magenta and yellow, you could mix red or orange, for these contain only yellow and magenta. One good way of picturing this idea is as a triangle (termed the subtractive primary colour triangle), as shown in the illustration. If you take two points to represent two hues of ink, then the colour, *s* produced by mixing them are given by the line joining them, its position depending on the relative amounts of the two used. You will see at a glance that what I have said in the previous paragraph is made clear in the diagram: the line from red to blue does not go near to magenta, but the line

Colour and the Printer

2. The Technology of Colour *by John B. Easson*

from magenta to yellow goes through red.

The diagram is intended to cover the mixing of saturated colours, which are all round the edges of the triangle, but it also shows that in most cases the result of mixing produces a colour inside the triangle, nearer to black, i.e. duller (less saturated). This is a practical effect that you may have noticed; when mixing inks, the tendency is to get a duller colour. Once you have got too dull (unsaturated) a colour, it is not possible to restore the full saturation, because it is clear that once inside the triangle, no matter what colour round the edge you use, you will never mix a colour that is back at the edge. Thus when mixing colours, first match the required hue, and only then desaturate it, adding black and/or white as necessary.

A similar practical point to this last one is that the eye is much more sensitive to slight changes in saturation at near-white shades than at full saturation; thus it is better to add the hue to the white ink to match a tint than to add the white to the hue, otherwise

you may find that far larger amounts of white are required than expected, and thus that too much colour is mixed. When darkening a hue, the reverse method is followed — the black is added to the colour.

In mixing inks, one danger is that the various inks used may not be compatible. Assuming that obviously incompatible inks such as writing and printing inks are not used, there are still difficulties. For each ink is made with carefully matched ingredients, and those of one ink can affect those of another. The two commonest effects are altered drying — either too rapid or too slow — and fading. Providing that one uses inks from the same maker, the risk is fairly slight, and experience shows when to expect trouble. The worst colours for fading are pale tints, and the worst colours for causing fast drying are lead pigments, commonest as ‘chrome yellow’, ‘chrome orange’ and chrome green’.

