

# Colour and the Printer

## 3. The Effects of Colour by *John B. Easson*

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The first two parts of this article describe the theory and practice of using colour. Here I wish to describe briefly what might be called the psychology of colour, or how various side effects can alter the effect of a colour.

### **Whiteness and white light**

‘Pure’ white contains visually equal amounts of the three primary colours of light, as described in the first part of this article. However, few lights are like this, and while the light from a north-facing window is a near approximation, most other sources of light are much worse. As mentioned before, this alters the appearance of the colour, and the illustration shows a rough comparison of the relative amounts of different colours in the three commonest types of lighting. You may be able to use it to make mental adjustments between the appearance of a colour when you print it in one kind of light to its appearance elsewhere, but it is always better to rely on a practical test.

One consequence of the different ‘colours’ of white lights is that certain colours can appear to match under one light but not under another. This is termed ‘metameric’ matching, and is especially common with matching greens under fluorescent lighting.

In the same way that not all white lights are truly white, so not all white papers are truly white. The wood fibres from which the paper is made are not naturally white, and are bleached. This does not achieve a true white, but a slightly yellowish shade, which was accepted until this century, and which is good for legibility. To improve on the whiteness of this, as required for four-colour printing, or requested by some printers, it is necessary either to add white pigments to the paper — forming art or imitation art papers — to use more powerful bleaching methods — at the risk of making the paper less durable — adding a blue dye (which by absorbing the red and green and scattering blue, cancels the effect of the yellowness, which was due to the paper absorbing blue and scattering green and red, i.e. yellow, but at the price of making the paper grey rather than white), or adding a fluorescent whitener (which absorbs ultra-violet and emits blue, thus supplementing the paper’s red and green, giving true white).

The trend is towards the wider use of such papers,

and fluorescent whiteners are now common. The snag here is that they tend to age, and also they vary in effect on the amount of ultraviolet they receive. Thus the paper colour varies according to the light it is under, even when the lights are visually the same.

### **Complementary colours**

Any two colours which are ‘opposites’ are termed complementaries. Usually the term is restricted to full-strength (saturated) colours. By opposites, I mean that the two colours when mixed will give black, and if you refer back to the second part’s colour triangle diagram, you will see that there are several pairs of colours that do this: blue and yellow, magenta and green for examples.

To the eye, such pairs are as extremely different as possible, and thus are seen as highly contrasting. If two such colours are put next each other, the eye finds the boundary between them dazzling and difficult to focus on. Any colour scheme using such pairs is inevitably disconcerting to the eye, as opposed to restful schemes which use colours which have some feature in common,

The eye always tries to compensate for any strong colour by cancelling its effect — you may like to think of it as the eye becoming tired with detecting that colour, so it finds it harder to see that one — and this means that any of the complementary colour that is around will be seen as even stronger. Thus a small red dot in a cyan background looks much redder than if it were on a grey background. This desensitizing effect explains why we do not notice the off-whiteness of papers or lights, our eye adjusts itself so that they appear white, but at the price of causing errors in the appearance of other colours.

A similar loss of colour is found if the area of colour is reduced: the eye sees a line coloured line as less colourful (saturated) than it really is. Thus in a half-tone picture printed with coloured ink, the colour appears to get greyer in the paler areas where the dots are smaller.

### **Choosing colours**

Although I do not wish to go into the held of choosing colours for aesthetic reasons, two aspects

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of choosing colours do come under the heading of factual information: legibility and connotations.

The choice of colours for legibility is a complicated subject in itself — as of course is legibility — but discounting such things as backgrounds, the most legible pair of colours is yellow and black. It seems that white gives too high a contrast. However, the many factors that affect this — such as intensity of lighting, gloss. etc., are so many that it is too broad a generalisation to be very useful.

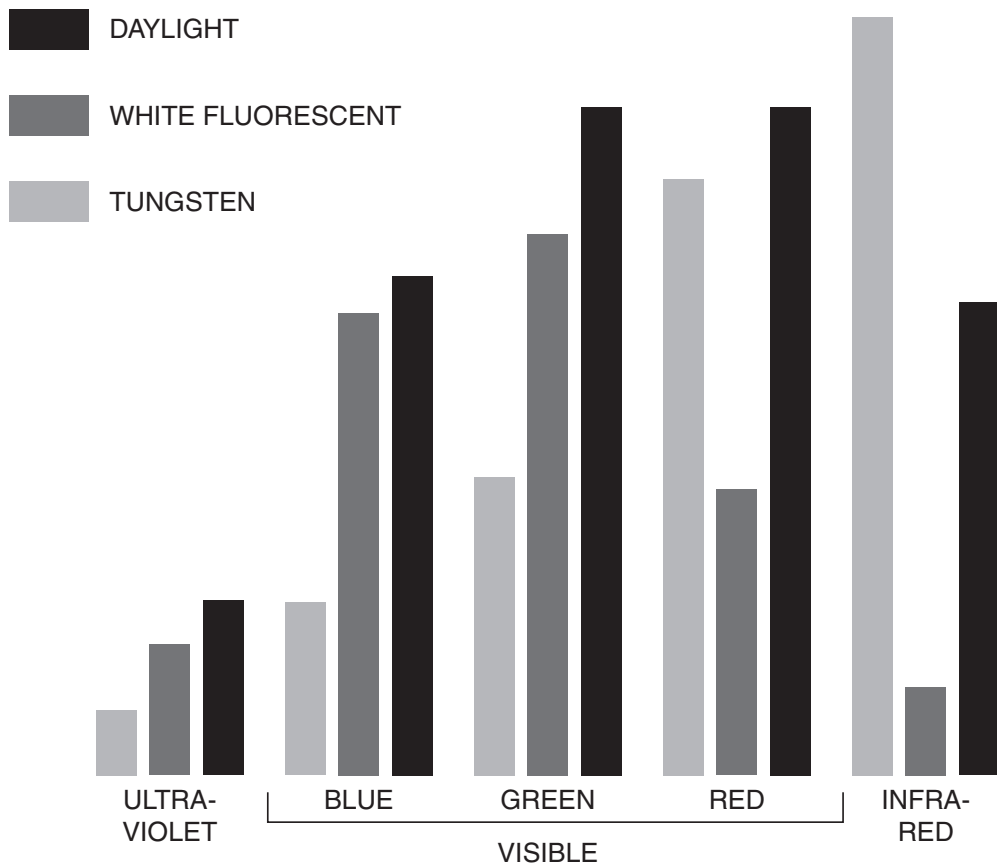
The ‘meanings’ of colours, on the other hand, are very much used, but are equally difficult to control. Psychologists have confirmed that colours do seem to convey general meanings to people, and not just the old idea that reds are warm and blues are ‘cold’. They have found that reds are ‘exciting, active’, while

blues are ‘calm’. Blue also suggests a distance — since distant objects are usually bluish due to the effect of the atmosphere.

This subject is difficult to study, and difficult to describe, so the practical method used is of course to use colours according to their effect on the designer himself. Perhaps, now that the field of colour in the technical side has been so far advanced, this will be the next area for advancement.

### Conclusion

In conclusion, I would like to add that I hope that those members who know about colour to a greater depth than I have attempted to describe, will forgive me for the simplifications — and consequent distortions — that I have made.



### The colours of different ‘white’ lights

The columns show the relative amounts of each colour given out by each light. The values for fluorescent lights are particularly liable to vary from light to light, and the values shown are very approximate anyway.