

Colour and contrast for people with sight loss

R N I B

See differently



The basic design principles and recommendations outlined here relate to the best possible use of colour and contrast in printed materials – and in screen environments – for people with sight loss. This information will also be useful when designing products or websites that will be used by people with sight loss. Accessibility improves design for everyone.

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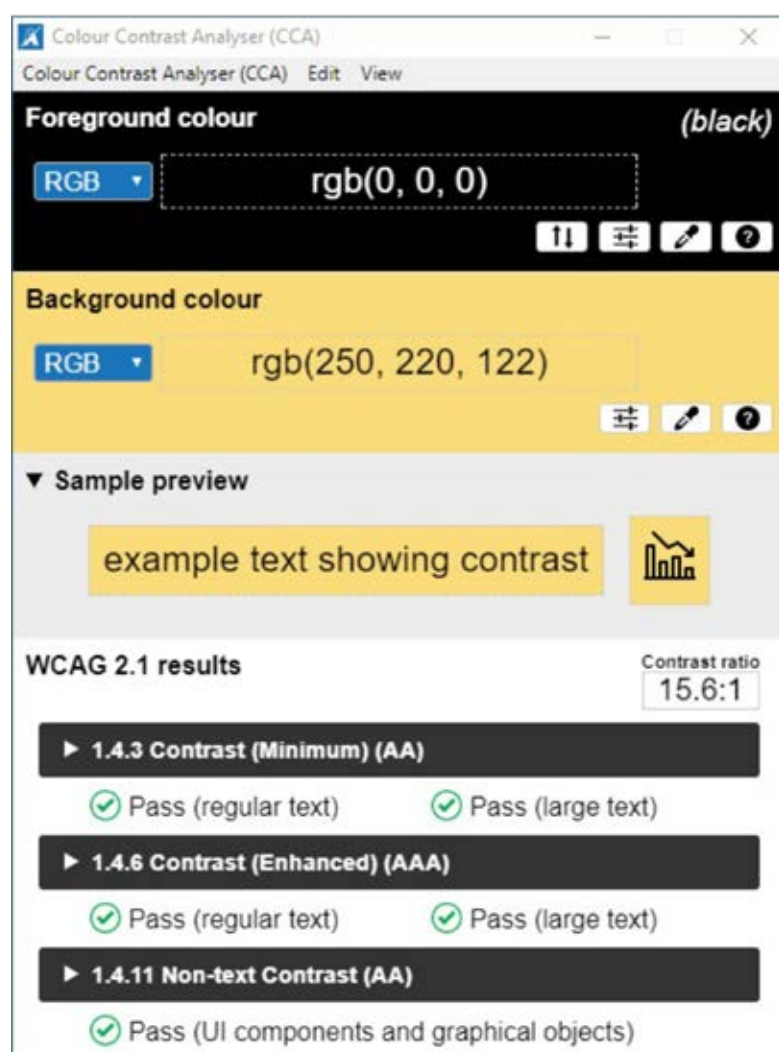
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General design principles: improving design for people with sight loss

This section describes colour principles to be taken into consideration when designing for people with sight loss. People with slight loss prefer to read text that stands out strongly against a background on screen, or paper. This can be achieved with good contrast between text and background colour.

Website designers should ensure the text and background colours they use are suitable for people with sight loss. Web Content Accessibility Guidelines (WCAG) – which are internationally-recognised – clear guidance on how to do this. Developed by the World Wide Web Consortium (W3C), the current guidelines are version WCAG 2.1 and can be viewed here. www.w3.org/TR/WCAG21/

Tools can be used for checking that text and background colours meet WCAG 2.1 guidelines. For instance, one useful tool, the Colour Contrast Analyser can be downloaded from the Paciello Group's website here. <https://developer.paciellogroup.com/resources/contrastanalyser/>



Here is an example of text and background colours being checked using Colour Contrast Analyser.



■ Colour

Some people with sight loss like to read black text on a white, or yellow, background as this provides good colour contrast. People with certain eye conditions, especially those that cause problems with glare, often prefer to read light text on a dark background. Text and background colour preference is very personal and is often determined by the severity of a person's eye condition, or a combination of several eye conditions. Two people with the same eye condition may see colour in a completely different way.

Some people have Colour Vision Deficiency (CVD) – also sometimes known as colour blindness. There are four types of CVD and depending on which type a person has, it will alter the way they perceive colour.

Using dark text on light backgrounds

It's acceptable to use a pale or tinted background on screen and in print as long as there is enough contrast to be able to read the text. Tints of colours can also be printed onto paper or used on screen to give a different overall background colour to all or part of a page. Text should not be reproduced as a low percentage tint on white, cream or pastel backgrounds on paper or on screen. If it is, it will be virtually invisible to a person with sight loss.

Examples of acceptable text on tints

Following values are based on a point size of 14 using an Arial regular font. This size is approximately (3.5 mm Capital letter height) font size.

Tint (%)	Yellow	Orange	Blue	Pink	Green
10%	Text	Text	Text	Text	Text
20%	Text	Text	Text	Text	Text
30%	Text	Text	Text	Text	Text

Using light text on dark backgrounds

If the paper colour or screen background is very dark, then the text must be white or very pale. It is very difficult to print white. The examples below show good colour contrast examples of white text on coloured or black backgrounds.

White text on dark red background

White text on dark blue background

White text on black background

The same can be used for screen environments and websites. Any dark text on light background combinations – and light text on dark background combinations – should be checked to make sure that they comply with the WCAG 2.1 guidelines.

Examples of acceptable colour contrast

The diagram below shows different densities of ink used in the text on a pale coloured background. The paler the ink in the text, the harder it is to read the text. The pale colour in the boxes is a 10 per cent tint. The text in column one is 100 per cent solid black and this provides enough contrast with the background tint. The text in column two is 100 per cent of a solid colour and this also provides enough contrast with the background tint. The text in column three is a 20 per cent tint of the colours used in column two. These tinted colours do not provide enough contrast with the background tint. The same colour combinations used on screen and websites would produce similar results.

✓	✓	✗
Black text	Coloured text	Coloured text
Black text	Coloured text	Coloured text
Black text	Coloured text	Coloured text
Black text	Coloured text	Coloured text
Black text	Coloured text	Coloured text

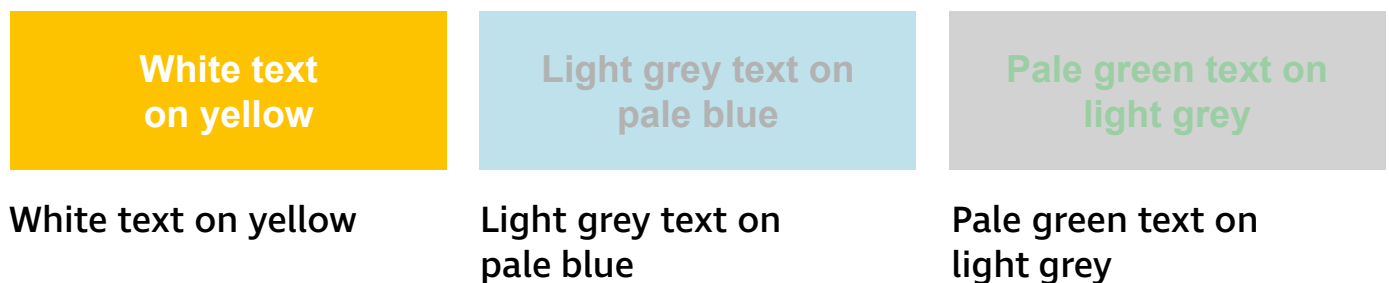
Text colour

Black on a white background is the most accessible text. Other colours can be used but care must be taken to choose a colour that contrasts with the paper or background colour on screen.

If other colours are used on a white or pale backgrounds, make sure the colour is as dark as possible to provide good contrast against the background.

Yellow must never be used as a colour to print or display text on white or pale backgrounds, as it is virtually invisible. Pale colour combinations should be avoided. For example, pale grey text on a pale blue background is almost illegible to a sighted person and would be inaccessible for a partially sighted person.

The three colour combinations in the diagram below all have poor colour contrast.



Tonal contrast

When designing for people with low vision, try not to rely on colour alone as the only way of providing contrast. Two colours next to each other such as green and brown in the diagram below might appear to be very different to people with unaffected colour vision but may appear very similar in tone to a person with low vision or CVD. This is because the saturation (or pureness) of the two colours is similar. If you remove the colour, then both are revealed as similar shades of grey.



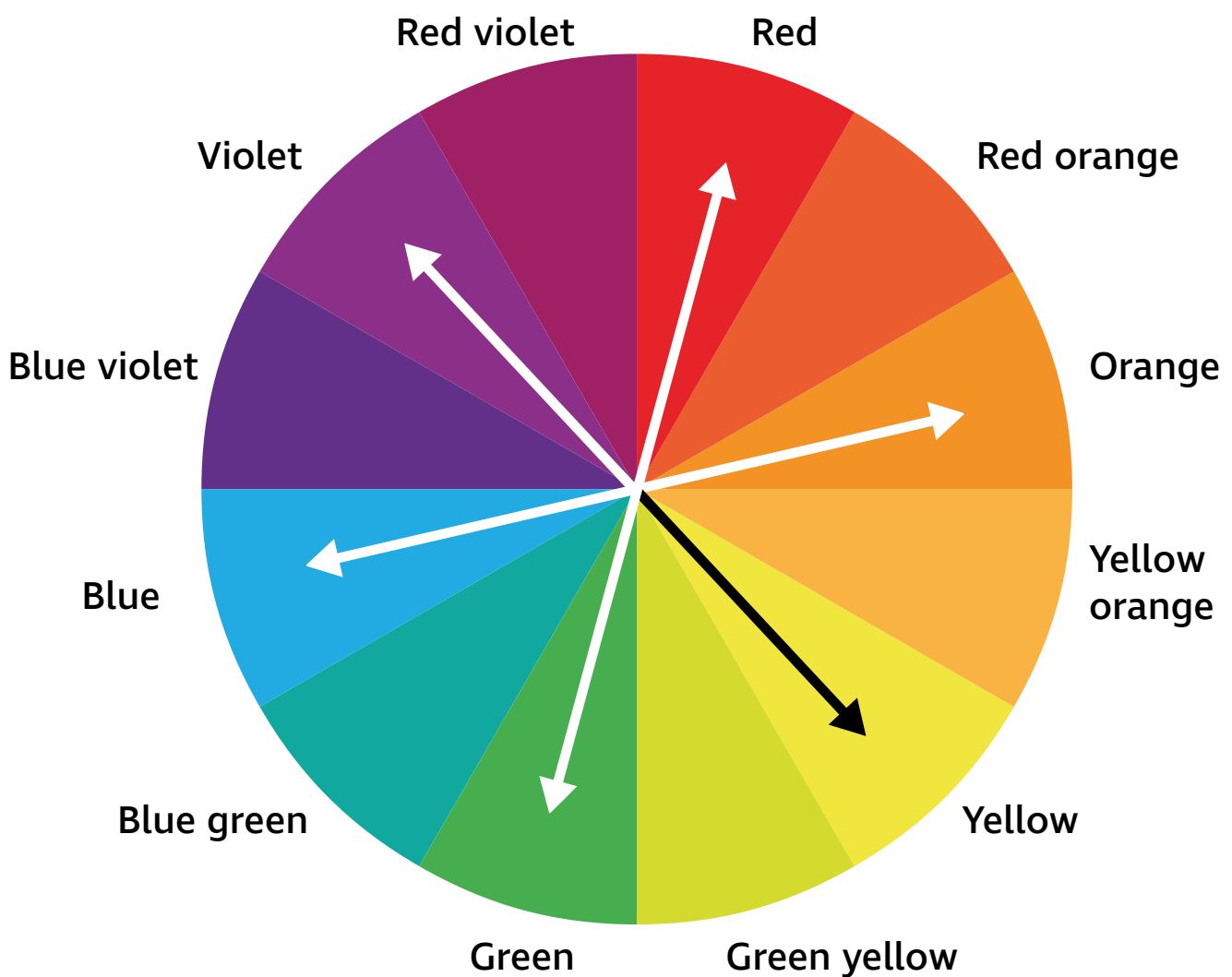
If there are any doubts about the tonal contrast between two colours, a good test is to photocopy the image in black and white or print out a website page in black and white. You can then pick the tonal contrast which is most acceptable.

Complementary colours

Care should be taken when using certain colour combinations, such as complementary colours. Complementary colours sit opposite each other on the colour wheel and they can produce colour combinations that are difficult for people with CVD to see. The two combinations that cause the most difficulty are red and green or yellow and violet/purple. These can be quite jarring if used closely together especially if similar tonal contrast is used. Complementary colour combinations can be used together if there is enough tonal contrast between the two colours.

Below is a diagram showing how complementary colours sit opposite each other on the colour wheel. Red is opposite green; Orange is opposite blue/green and yellow is opposite violet.

Colour Wheel







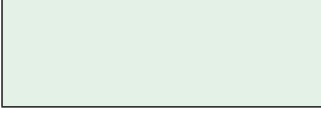


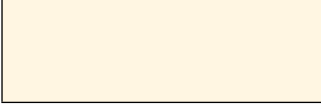




Colour issues for people with CVD

Some colour combinations should be avoided as they may cause problems for people with CVD. This is more apparent if the two colours are very similar in hue, saturation or contrast. The most difficult combinations are red and green or yellow and purple.

Never set text in red on a green background. This combination will be invisible to most people with CVD. This is mainly due to similarity in tonal contrast. For more information about CVD see RNIB's factsheet.

The diagram below shows four colours and their luminance (or lightness) at 15, 50 and 100 per cent.

Colour	15%	50%	100%
Red			
Blue			
Green			
Yellow			

■ Lighting

Contrast will only work for people with low vision if there is an appropriate quantity and quality of lighting with which to view the contrasting elements. At low light levels, the perception of contrast diminishes. Lighting levels should generally be relatively uniform and about 25 per cent higher for people with sight loss. Strong directional lighting casts shadows that can mask contrasting surfaces. Significant fluctuations in lighting level can reduce visibility due to the slower adaptive response of the eye for someone with sight loss.

In terms of visual contrast, British Standard 8300:2009 recommends a minimum difference in Light Reflectance Values (LRV) of at least 20 points, although 30 is preferred providing that the surfaces are illuminated to two hundred lux or more.

LRV describes the amount of light a surface reflects. It defines the lightness or darkness of a surface, which has a scale of 0 – 99: the higher the number, the lighter the surface.

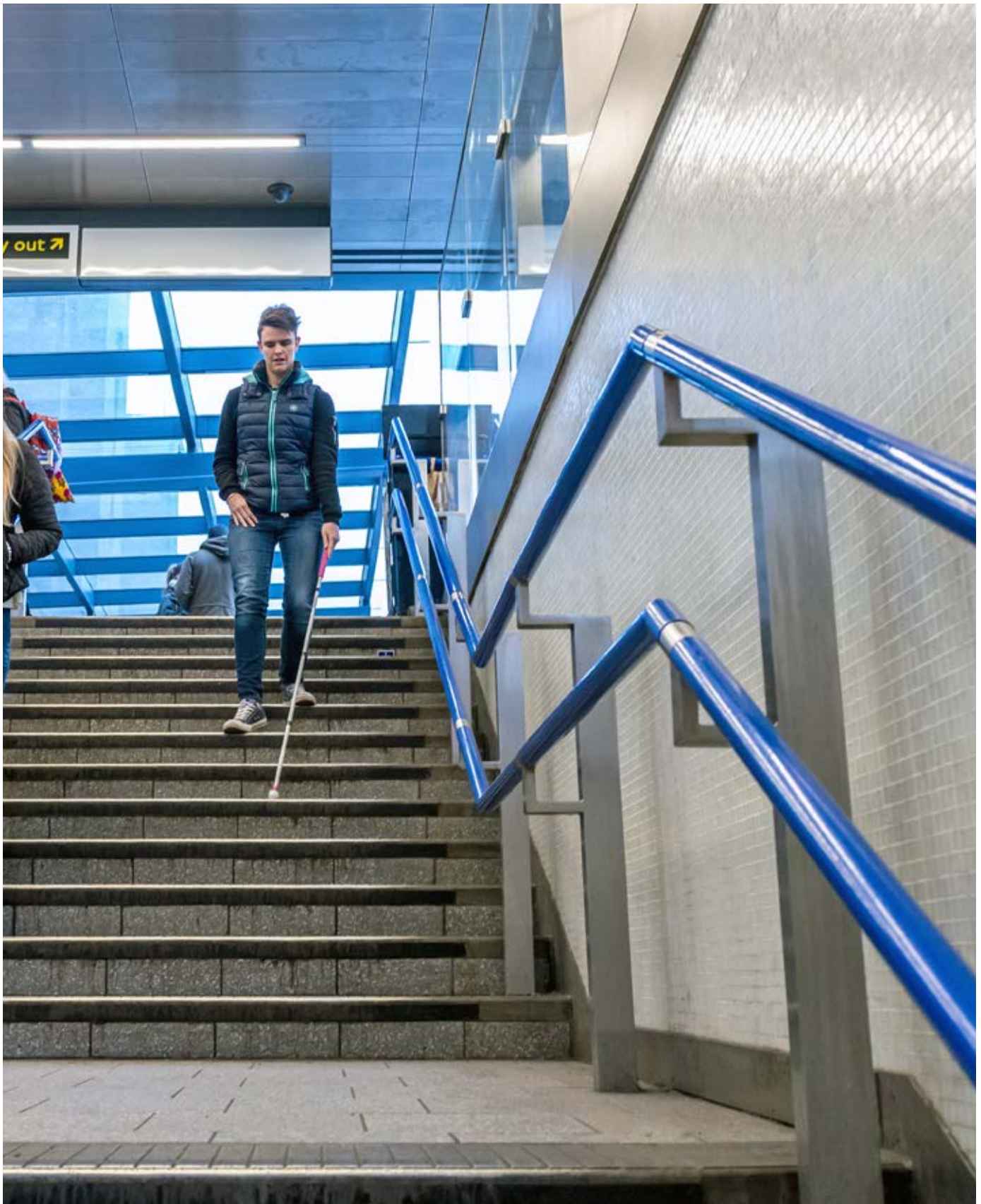
Enough visual contrast will be achieved if the difference in LRV between adjacent critical surfaces is 30 points or more.

The following examples relate to lighting contrast within buildings and have been provided for information.

Effective uses of lighting contrast include:

- Contrasting tactile warning strips to indicate the start and finish of a ramp.
- Contrasting doorframes, doors, skirting boards and architraves to assist with locating doors.
- Contrasting paving at doorways to assist with locating the entry.
- Contrasting edges of steps, a roadway or poles in play areas to highlight potential hazards.

Below is an image showing handrails that contrast against floors and walls. Tactile warning areas indicate the beginning and end of steps.



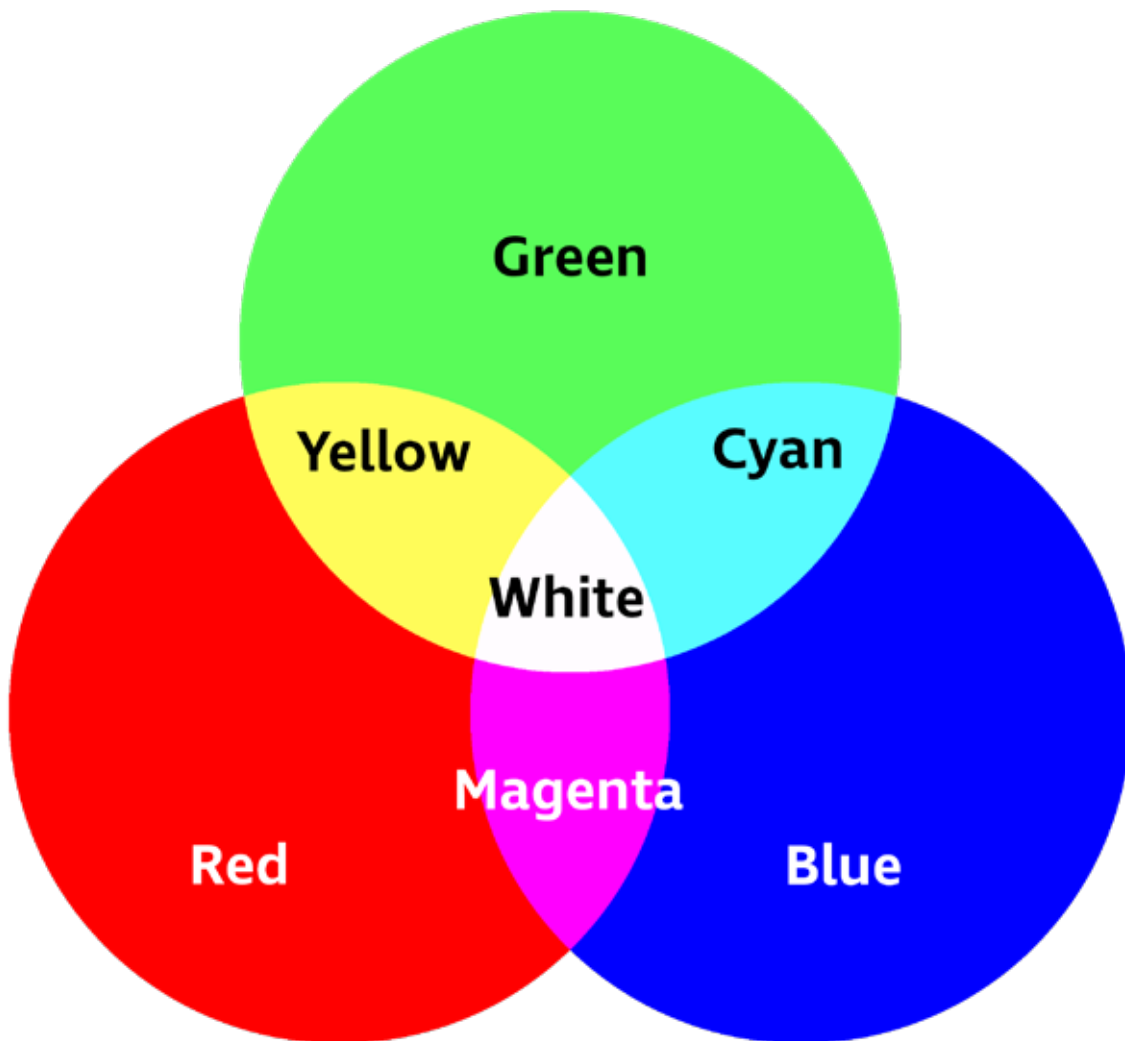
Basic colour theory

Colour models and colour terms

There are two main methods of mixing colours – additive and subtractive. The additive method is used in a screen environment (mixing light) and the subtractive in a printed environment (mixing pigments).

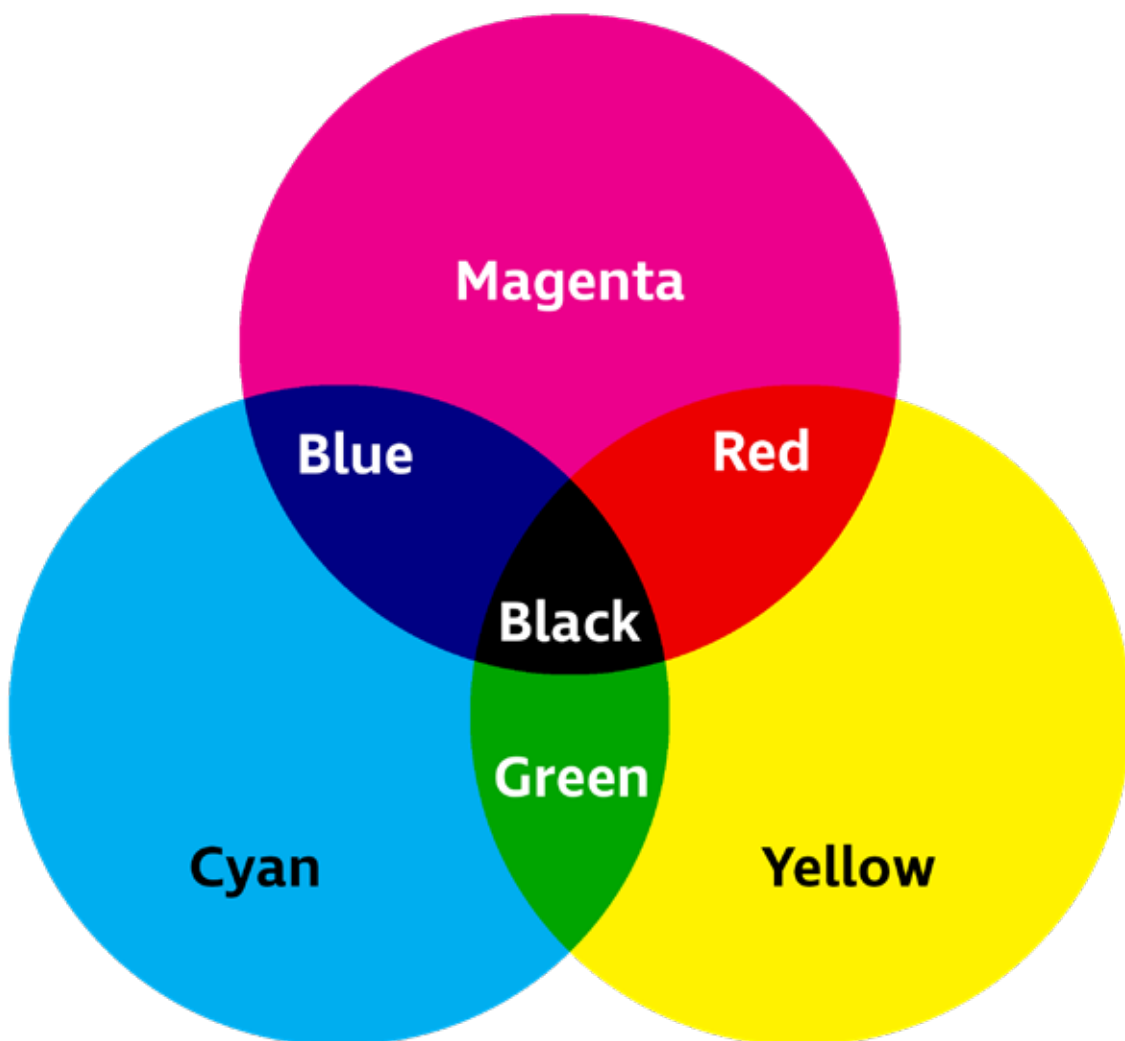
Additive method (for a screen environment)

The additive colour mixing process uses the primary colours of red, green and blue light to produce other colours. The diagram below shows how combining one of these primary colours with another in equal amounts produces the secondary colours cyan (mixing blue and green), magenta (mixing blue and red), and yellow (mixing red and green). Combining all three primary colours in equal intensities produces white.



Subtractive method (for a print environment)

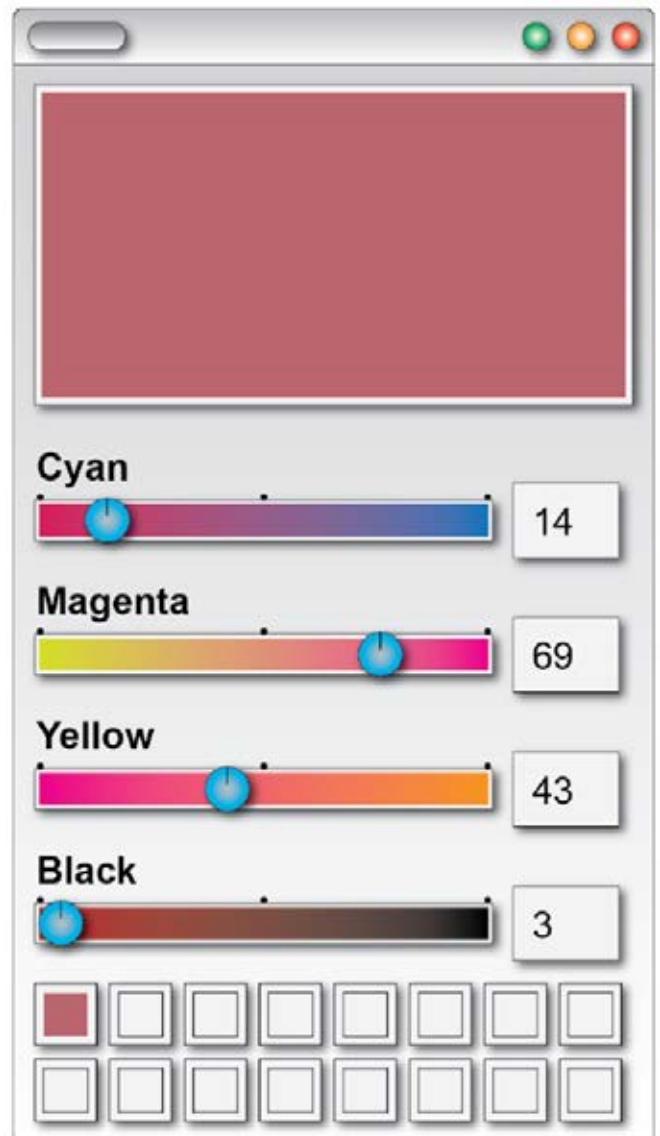
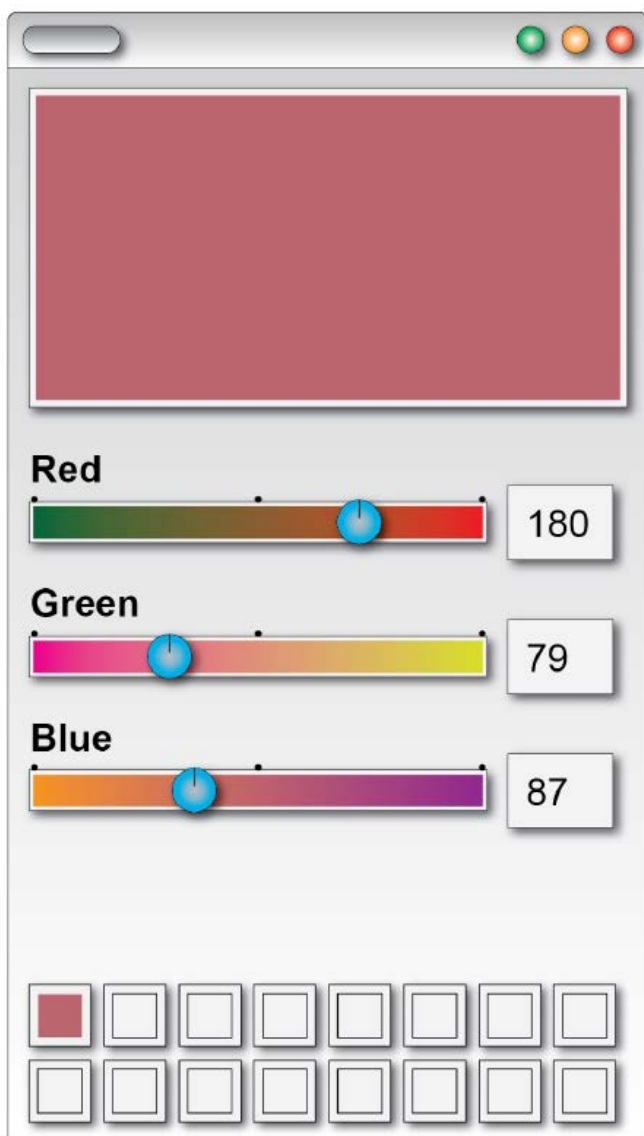
In colour printing, the primary ink colours used are cyan, magenta, and yellow. The subtractive method works by reflecting light from the paper (or substrate) through the cyan, magenta and yellow inks. The diagram below shows how combinations of different amounts of the three inks can produce a wide range of colours. A fourth colour – black – is added as cyan, magenta and yellow combined produce a muddy brown. Black helps to improve the final print image. Black is referred to as the “Key” colour, it is used to key, or align, the other colours.



How to mix colours on screen

Mixing additive colours on screen can be carried out using software that changes the values of Red, Green and Blue (RGB). Altering the RGB values produces a wide range of other colours. In the software screenshot example below, sliders are used to alter RGB values or, if known, the RGB values can be typed directly into a box.

Mixing subtractive colours or pigments uses the CMYK method (Cyan, Magenta, Yellow and Black). Other methods such as Pantone colours can also be used. Pantone colours use a system of number-codes that can be mixed using CMYK inks or produced as one-off special colours. In the screenshot below, software using sliders or value boxes can be used to mix CMYK colours in the same way as RGB colours.



■ Hue, Saturation and Luminosity (HSL)

Hue, Saturation and Luminosity (the HSL system) is another method of mixing colours on screen.

- Hue: The basic colour such as blue, green, yellow, red and purple.
- Saturation: How pure (compared to how dull) the colour is.
- Luminosity: How much light appears to be reflected from a coloured surface in relation to nearby surfaces.

Although it's impossible to use this system in a printed environment, printed colours are often referred to as having a hue, saturation or luminosity.

Glossary

General design principles for people with sight loss

Complementary colours

Complementary colours sit opposite each other on the colour wheel.

Substrate

The surface to be printed on, e.g, paper.

Tint

A tint is a percentage of a solid colour – a shade or variety of the same colour.

Reverse out

Allowing the background colour of the paper to show through where the text is, or a light-coloured text on a dark background on screen.

Tonal contrast

Tonal contrast is the difference between light and dark in two colours placed in proximity.

Specific issues arising from CVD

Colour Vision Deficiency

Colour Vision Deficiency is the inability to distinguish between certain colours e.g, red and green or blue and yellow.

Lighting

LRV – The acronym means Light Reflectance Values. It describes the amount of light a surface reflects.

Luminance contrast

The amount of light reflected from one surface or component, compared to the amount of light reflected from the background or base surfaces.

Colour mixing

Additive method

The additive colour mixing process uses the primary colours of red, green and blue light to produce other colours.

CMYK

The acronym means Cyan, Magenta, Yellow and Black. Black is referred to as “K” it is used to key, or align, the other colours when printing.

HSL

The acronym means Hue, Saturation and Luminosity. The HSL system is another method of mixing colours on screen.

Hue

Hue describes the basic colour such as blue, green, yellow, red and purple.

Luminance

Luminance describes how much light appears to be reflected from a coloured surface in relation to nearby surfaces.

Pantone

The Pantone colour system uses number-codes to mix colours using CMYK inks or they can be produced as one-off special colours.

RGB

The acronym means Red, Green and Blue.

Saturation

Saturation describes how pure (compared to how dull) a colour is.

Subtractive method

In colour printing, the primary ink colours used are cyan, magenta and yellow.

Further Information

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All websites checked June 2020

Further information

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