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SIEGWERK

COLOR NEWS

Business Unit Sheetfed

What is the COLOR?

Color is present everywhere around us. Rich in symbols and codes, it influences us on a daily basis in our decisions/ choices.

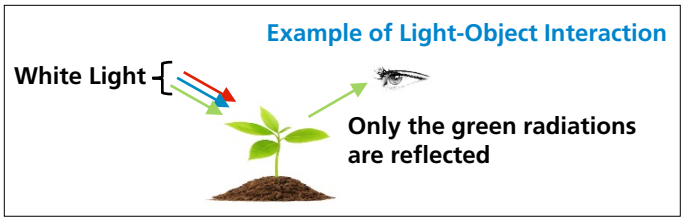
For centuries, scientists wondered where the color came from? Is this matter? Light? The answer is quite disconcerting ... color is omnipresent, but it doesn't really exist!

This is a sensation that comes from the combination of several elements: A **light source** that interacts with an **object,** an **eye** to scan information, and a **cortex** to interpret it. If only one of these 4 elements is missing, everything will be discolored ...



We can't speak about color without making reference to the light. The sun light considered as white light is an electromagnetic radiation, resulting from 3 components: Red, Green and Blue rays.

By mixing these 3 elements as «light» (and not as «matter»), white light can be obtained. When a light source is emitted on an object, some of the energy will be absorbed by the object, the other part will be reflected.
The «Light-Object» interaction can vary according to the object. Some of them will totally absorb the light energy received, they will be perceived «Black» by our eyes.
Some others will reflect the light entirely, our eyes perceive them as «White».



The young shoot absorbs the red and blue rays of the white light. It reflects only the green rays. That's why our eyes perceive the shoot in green color.

Thanks to the colorimetry, it is possible to describe the perception of colors in a scientific and objective way, and through universal language. The latest scientific progress, especially the development of ΔEcmc/ΔE2000 acceptability formulas allows a better match between visual and instrumental perception.

Black is Black you will tell me...

Not exactly, all blacks are not the same!
Our ink ranges are quite rich in Black and for good reasons. Each Black has its own specificity. Here below is a short summary to help you choose the right product according to your application.

	Comments	Application	+	-
Deep	Bluish shade Bright *strength: 2/5*	For solid prints. Optimal deepness in 2 passes	Usually print in 2 passes, best quality on press, without apparent default. Fast Drying	Low intensity in 1 pass No chemical resistance
Intense	The darkest, strongest black. Less toned as the Deep *strength: 5/5*	Intense Text / Solid prints to be made in 1 pass	High Intensity Low ink deposit on press 1 pass is enough to get intensity	
Neutral	"Natural" Warm shade without toning *strength: 3/5*	Advised as component for mixing	Bright, Neutral and possibility to modify the shade by mixing with other pigment	Not strong enough for solid prints
Process ISO	Middle Intensity Cool/Bluish shade *strength: 4/5*	Ideal for Process print jobs		

Our eye is a good tool to see the difference between 2 blacks, particularly to distinguish tone variations. We can easily observe that the **Neutral** and the **Deep** Blacks stand out from the others because of their color shade (rather «warm» for the Neutral black, or «cold» for the Deep black).
But our eyes are less sensitive to the intensity deviations, and the instrumental measurement (Lightness: L* value) can help us to classify the Blacks from lighter to stronger ones.

Strength

45/0°-D50, 2°, No filter	L*	a*	b*	C*	h*
Deep Black SP	11,97	-1,08	-5,21	5,32	258,33
Neutral Black SP	10,08	1,41	2,59	2,95	61,35
Process Black SP	9,82	0,51	-0,60	0,79	310,44
Intense Black SP	8,21	-0,01	0,64	0,64	91,05

Be careful not to confuse Deep with Intense Black. Although the applications are quite similar, the strength and colorimetry are quite different. The Deep Black is bluish and lighter than the Intense Black. This last one is the strongest and the most neutral in terms of toning.
Thanks to its high intensity, it can be used for solid prints in a single pass, with a low ink film thickness.

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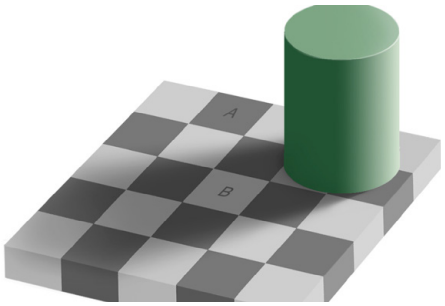
Vision & Illusions

In the bottom of the eye, many cells cover the retina and allow it to capture the light. These photoreceptors are composed of cones and rods. The rods are 25 to 100 times more sensitive to light than the cones. Thanks to the rods, we are able to see in twilight, but not to distinguish colors. Cones are fewer. They are responsible for the vision of colors and sharpness. They require a relatively high light intensity to fulfill their role, from which the saying comes: «at night, all cats are gray».

The received information is transferred from the eye to the brain via the optic nerve, as an electrical signal. Then, it will be analyzed by the cerebral cortex.
The process is quite complex because from all the received information, the brain must be able to decrypt the 3 fundamental characteristics of the color: Lightness, saturation and tone.
As you know, the brain is an extraordinary machine; but sometimes it can play tricks, and constrains us to see something which is not the reality!
You can discover it through the illusions below.

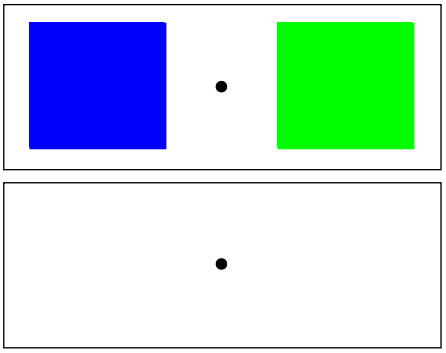


Illusion 1

Can you believe that the colors of checkers A and B are exactly the same? We are supposed to see the box A darker than the box B, finally it is what our brain interprets and tells us to see! If you print this drawing, you will see that without the environment the 2 boxes are the same color. Our brain is trapped by the effect of simultaneous contrast: Box B appears clearer to us, as the boxes around it are much darker than those around box A.

Several factors can interfere with our color perception: The environment, lighting, contrasts, tiredness, or many phenomena related to the eye functioning like the retinal persistence*).
The illustration below is a good example. Look at the black dot in the middle of the picture for 15 seconds, then look at the white screen just below it.

Illusion 2



What do you see? A yellow square at the left side and a pink square at the right? Are you sure? There is nothing to see yet ... the screen is totally white! Once again, our brain has been duped. This optical illusion is due to retinal persistence.

When we look at a colored image for a long time, the cones (photosensitive cells present in our eye) saturate. Then, if we look at a white surface, this image is perceived in the complementary colors:
This is called the «residual image».
Beware, our eyes are not always as reliable as we imagine!

**) Retinal persistence: When an image is formed on the retina, it doesn't disappear immediately but remains «frozen» approximately one tenth of a second before the retina's cells become sensitive again. The longer the image will be observed, the longer it will persist on the retina.*

ISO 12647-2: version 2013

As a reminder, the ISO 12647-2 standard for Lithographic Offset printing processes was revised in December 2013 and applied effectively in 2015.
The biggest change in the standard concerns the papers classification. There were 5 types of paper in the old version (12647: 2007), now the new standard includes 8 kinds of paper which is more in line with the current market. This also means that the L * a * b * characteristics of the process color inks have been modified, according to the new substrates classification. **For further details about colorimetric values, data can be obtained on request.**

The last relevant change for the colorimetry: Measurement conditions are now in accordance with ISO 13655 (0/45 ° or 45/0 ° geometry, D50 illuminant, 2 ° Observer, filter M1 recommended).

Examples of typical «coated and uncoated» substrates resulting from the new paper classification

	Paper type and surface			
	PS1	**PS2**	**PS3**	**PS4**
Type of surface	Premium coated	Improved coated	Standard glossy coated	Standard matte and semi-matte coated
Typical process	Sheet-fed offset Heat-set web offset	Heat-set web offset	Heat-set web offset	Heat-set web offset
Typical papers	Wood-free coated, gloss, semi-matte, matte (WFC) High and medium weight coated (HWC, MWC)	Medium weight coated (MWC) Light weight coated (LWC Improved)	Light weight coated, gloss and semi-matte (LWC)	Machine finished coated (MFC) Light weight coated, semi-matte (LWC)
	PS5	**PS6**	**PS7**	**PS8**
Type of surface	Wood-free uncoated	Super calendered uncoated	Improved uncoated	Standard uncoated
Typical process	Sheet-fed offset Heat-set web offset	Heat-set web offset	Heat-set web offset	Heat-set web offset
Typical papers	Offset, wood-free uncoated (WFU)	Super calendered (SC-A, SC-B)	Uncoated mechanical improved (UMI) Improved newsprint (INP)	Standard newsprint (SNP)

Sources: International Standard ISO 12647-2 3rd edition 2013-12-15