PROJECT
BBCG
A BETTER BRAND COLOR GUIDE

Brought to you by:

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INSIGHTS 4 PRINT.CEO
OBSERVATIONS FROM AN INDEPENDENT MIND

Special thanks to:

dr. Kai Lankinen, for triggering me on this project - Dr. Lankinen - Graphic Innovations

And thanks to the following experts for their feedback on the draft:

Henk W. Gianotten – long-time expert and author

Paul Sherfield – The Missing Horse Consultancy

Hauke Liefferink – Acme Graphics

Gary Courtney – DagwoodLinnetts Packaging Print and Prototypes

First edition 2022

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How to build better brand color guides
A tutorial on brand color communication

Brand colors are important. Some companies spend vast amounts of money to find the right kind of color that fits their business best. And when they pick the 'right' color, they want it reproduced within a certain tolerance. To be able to do that, both designers and printers need rock-solid brand color guides. And that's where it goes wrong: studies have shown that most brand color guides are flawed. Sometimes even seriously flawed, jeopardizing reproduction of the brand color.

And having a flawed brand color definition and guide, comes at a cost. A significant cost, a cost that will continue to grow. First there are all these discussions between brand owners, designers, prepress houses and printers about the reproduction of that precious brand color. A decent brand color guide tackles those discussions from the start. And what about all those proofing and print jobs that need to be redone, due to a bad color definition? These are huge losses.

Check, e.g., these three brand color guides from the Red Cross. Although they start from the same color (Pantone 485), they end up with different colors for the web, for print... **We need to do better than this.**
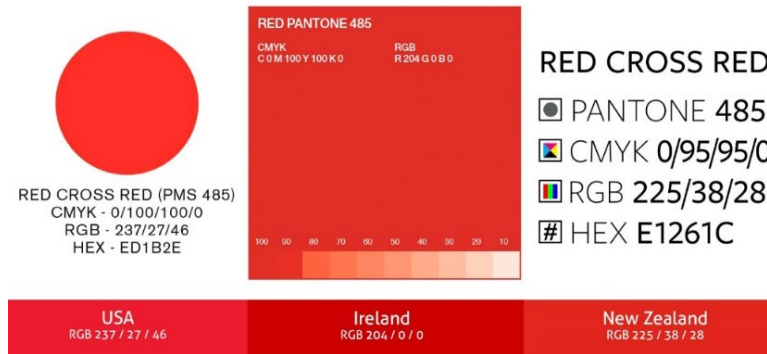
And we can do better than this, everybody can do better than this. With a little extra effort when defining the brand color, all these discussions and rework can be prevented. This tutorial will show you how you can convert the color you picked into a rock-solid brand color definition. It is not some new theoretical approach, it is based on proven concepts, years of experience, and many real-life examples and practical tests. And it's easy to implement, no color science degree needed!

It doesn't matter if you are only using general printing or packaging and labels, the Better Brand Color Guide approach works for every brand color! No matter what your market is!

Please read this tutorial from start to end! Don't skip parts, it's a logical story that will explain some essential concepts, in a way that you and all your colleagues can understand. And every part will build on the previous. So, don't cheat by running immediately to the end!

And if you are a color scientist or color geek: some details that confuse people will be left out. Remember: this tutorial aims to bring basic color knowledge to a large group of people. This is not a scientific paper.

Part A: Color basics

1: What is color?

Here we already have a concept that is often misunderstood. Color is the interaction between light, an object, and an observer. All three have specific properties, have variables. And don't forget that the environment can influence the light that falls on the object! That's why it's important to judge color in a neutral environment: grey.

Light sources can be very different, just look around you. One light source might look more blueish, the other more yellowish. What it looks like, depends on the energy a light source has in all parts of the spectrum (the 'rainbow': ROYGBIV). A blueish light source will emit more energy in the blue part of the spectrum, a yellowish less in the blue, and more in the yellow. Look at the graphs below. And we'll come back to this later on!

The horizontal axis shows the different wavelengths (frequencies), from 380 nm to 730 nm, the vertical how much energy a light source has in those wavelenghts. The lines show the energy for two different Daylight types of light (D50 and D65), this is also called the 'spectral power distribution'.
Image: Waveform Lighting
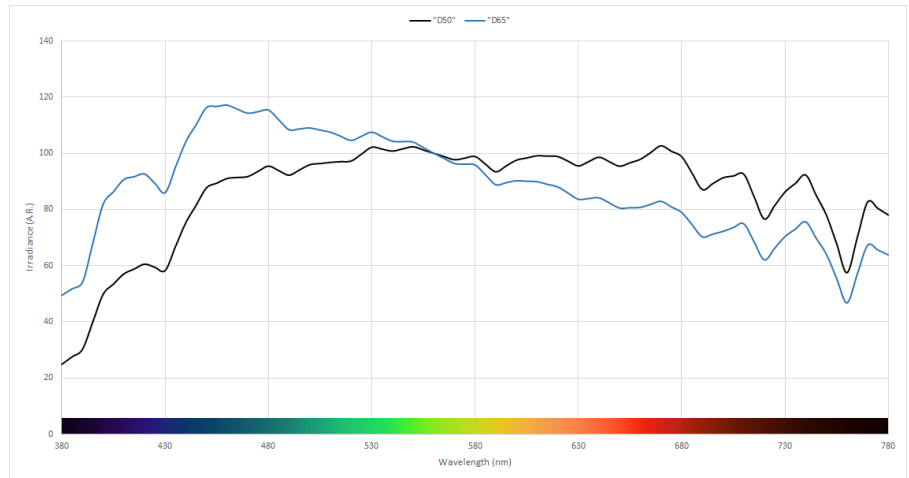
Next is an object. This can absorb a part of that spectrum (the rainbow) and reflect (or transmit if transparent) the rest. But it can also do other tricks: it can also change light. That's what we see in some papers, which have 'optical brightening agents' (OBA). These will transform (invisible) ultraviolet light into (visible) blue.

And then there is the observer, you. And your colleagues. And your customers. And as it goes with nature: no two are exactly the same. The way our eyes transform the light into signals for our brain, is via the 'photoreceptors' in the retina of our eyes. There are two types: the rods are very light sensitive, but don't see color. And the cones, which come in three types, are sensitive to different parts of the spectrum. And here is another variable: some people have deficiencies in these cones: color blindness. But recently, it has been found that a limited number of people (only genetic females), have four types of cones… These are women with 'super color vision'.
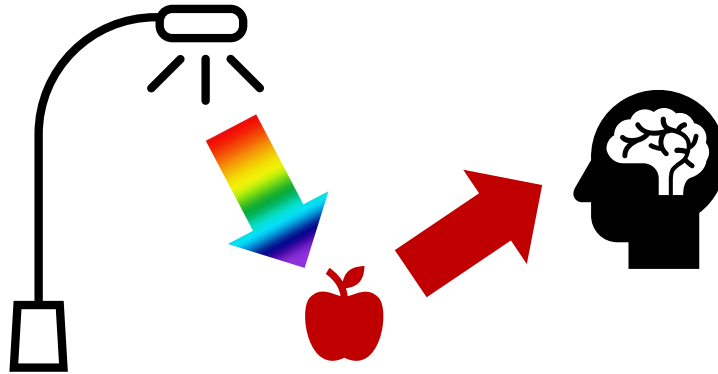
2: Naming a color

To be able to communicate color consistently, we need a way to name colors unambiguously. And this is where it often goes wrong. In many cases, Pantone colors are used. But this is not an unambiguous way, we'll get back to that later. So, we need a more reliable way, we need to look at science to name colors unambiguously.

Color has three dimensions, just like the world around you. So, let's imagine we are in a large room. At the center of the room, there is a pole. At the bottom, the pole is black, at the top, it's white, in between all shades of grey. This is the Lightness (L) axis.

Now, let's dance around that pole. Doing that, we will encounter all kinds of Hues (h).

And the further away we go from the central pole, the more intense colors become: Chroma (C).

When combining these three, we have a scientific description of a specific color: LCh.

But, you might not have heard from that LCh yet. Most of the time, Lab-values are used (or, to be correct: CIELab values). That's a mathematical conversion, like you can convert miles to kilometers.
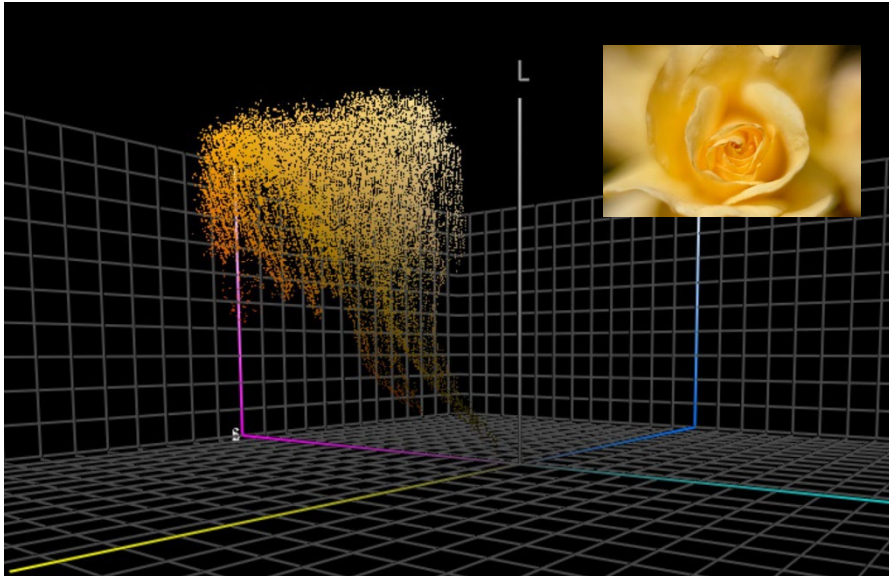
This graph shows all colors from the photo of the yellow rose plotted in the 3-dimensional space.
Tools like ColorThink Pro can visualize colors like this.

3. Measuring color

To be able to define and check tolerances for color reproduction, we need to be able to measure color. There are two types of devices used for that: spectrophotometers (which will measure the energy in the different parts of the spectrum) and colorimeters (which act similarly to the human eyes). To check print quality, spectrophotometers are used. Colorimeters are typically used for calibrating monitors. However, some colorimeters on the market can be used to measure print quality. Typically, colorimeters are the devices that cost less than 100 euros. The cheapest spectrophotometer is around 300 euros.

What is important to know, is that these measurement devices can be constructed in different ways, can use different light sources, and can measure in different ways. We will not get into the tiniest details of that, but you should know that it's essential to mention these properties when communicating color! We'll get back to that one later on.

When measuring a color, you might want to compare colors. E.g., a print of your brand color with the official brand color definition. Once again, think about that colorful room, the three dimensions. When you have two colors in that 3D space, you can just take a ruler and measure the distance between the two. It's as simple as that! That's what we call delta E. But, there is one complexity: we are more picky about changes in hue than intensity. That's why color scientists have come up with newer versions of that delta E, the one we are using these days is delta E 2000, dE00 in short.

A delta E of 1 is, generally, supposed to be the tiniest perceptible color difference. Below that, in general, you can't see a difference. And even not all people can see a difference of 1 delta E! BTW: being able to see a difference is not the same as considering it another color, nor being disturbed by that difference. You just see the two are not 100% the same.

There is, however, a flaw in delta E that you should know: it does not show direction. Why this is important: suppose the color you picked in your Pantone guide deviates 2 dE00 from the ideal value for that color and your Pantone number in the color guide of your printer also has a 2 dE00 deviation, but in the opposite direction. Both are 2 dE00 away from the ideal value, but they are 4 dE00 apart from one another… And these are the references used by you and your printer, for the same brand color… And both are within the tolerances set by Pantone for their color guides…
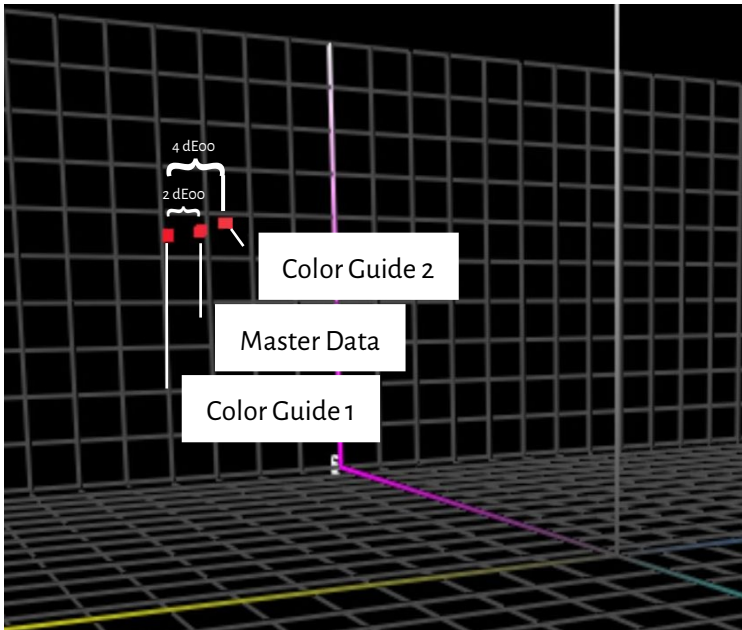

For this simulation I checked the Lab-values of Pantone Red 032C in Adobe Photoshop. Then I made changes only to the saturation (chroma) and checked for colors that are 2 dE00 apart from the 'master data' (the two 'color guides'), Which is conform the situation I explained above. You can see that there is difference of about 4 dE00 between the color guides. This is what is plotted on the left, in that 3D colorspace.

4. Reproducing color

There are two ways to reproduce a color: emitting light (what your screen is doing) or reflecting light (print). The first we call the additive system, the second the subtractive system.

In the additive system, we (usually) take a red, a green, and a blue (RGB) light source, and we play in some way with the intensity of these three lights and mix them, that's how we create different colors.

In the subtractive system, we have a (white) light source that will shine on a substrate. On top of that substrate are filters that will block part of the light. These filters, essentially the printing ink, come in three colors: cyan, magenta, and yellow (CMY). For practical reasons, we complement this in printing with a black (K) ink, to get CMYK. Using just one ink, a 'spot' color, is a variant of this subtractive system.
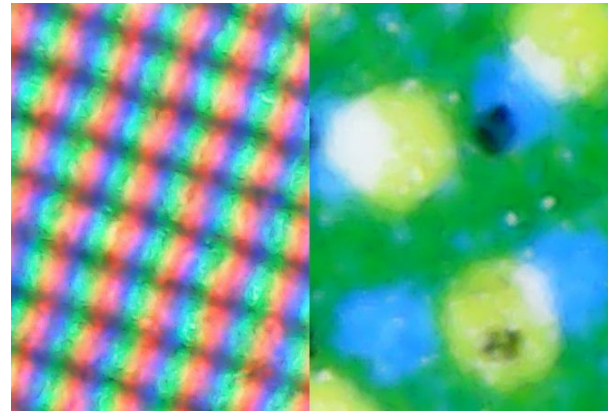

Left you see a close-up how colors are reproduced on a monitor (additive system). Right you see how it's reproduced on paper (subtractive system)

How much colors we can reproduce, depends. When looking at print: we can reproduce many more colors on a nice glossy coated paper than in a newspaper. These have a different 'gamut'.

The graph on the right shows the difference in 'gamut' of coated (wireframe) and uncoated paper (solid volume), in that three-dimensional room that we talked about above. The wireframe and solid color show the borders of what can be reproduced with standard CMYK inks on that specific substrate.

Information about the amount of colors that can be reproduced on a specific substrate, is listed in what is called an 'ICC profile'. ICC is the **International Color Consortium**, a worldwide group of color experts. These ICC profiles also have something clever built-in: a dictionary that can be used to translate colors.
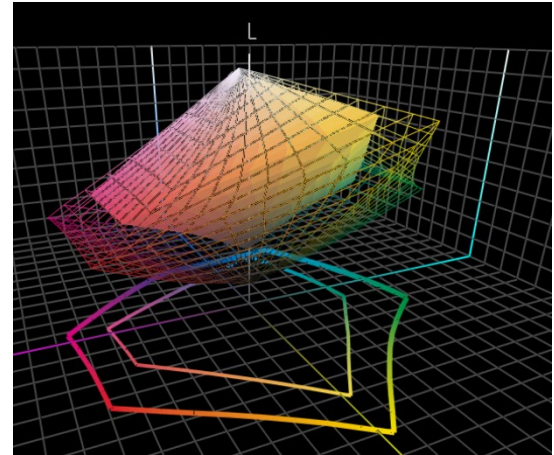
Let's skip the technical stuff, it's just like Google Translate: you enter your colors, e.g., for a coated paper, and applications like Adobe Photoshop, or the frontend of your digital press, will use that ICC profile to translate it into colors for uncoated paper. *Note for the color geeks: yes, it's more complicated, with more variables, but this tutorial is intended to be very basic, not to scare people away...* If you do like to know more: here is an article on color management, explained for designers and brand owners.

Well, that's it for the super technical stuff. Now it will become much more practical...

# Part B: Your brand color

1: Picking that perfect color

This is probably the most fun part: choosing, picking the perfect color for your brand, for your customers' brand. You probably will browse through some physical samples, maybe a Pantone Color Guide. But there are also multiple other printed color guides, e.g., HKS, DIC, Toyo Ink 1050+, RAL, NCS.

You might also use all kinds of internet references on color theory and people's feelings about a specific color. And things like color harmonies.

Please, go ahead! Enjoy yourself!

But do keep this in mind: discussing a slight difference, whether Pantone 2747 C or 2748 C would be the best fit, is just useless. Expensive color consultants might tell something different, but it doesn't matter. For one: reproducing color is not a perfect process. What you see as 2747 C and 2748 C, will probably look slightly different when you ask a printer to reproduce it. When you ask five printers to reproduce these colors, there will be a variety of colors, all a little bit different. Even the official versions are only 0,6 dE00 apart... Many people can't even see that difference.

And above all, consumers don't recognize or remember slight differences. Look at this test, where people were asked which one of 6 variations was the 'right' Coca-Cola red. Even though it's the most iconic color in the known universe, there was no agreement. The most popular color wasn't even the right one.
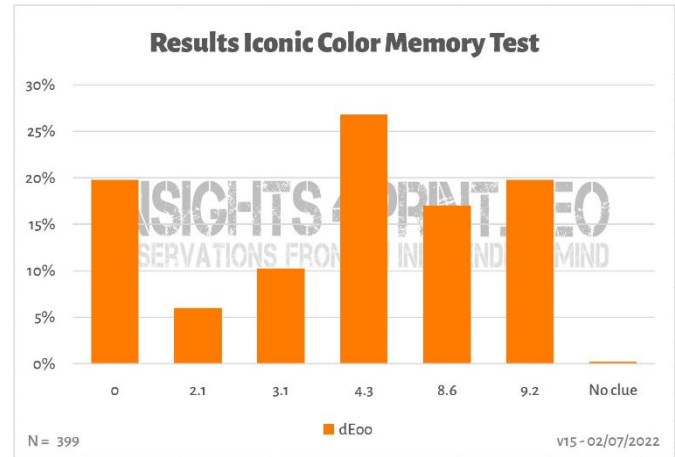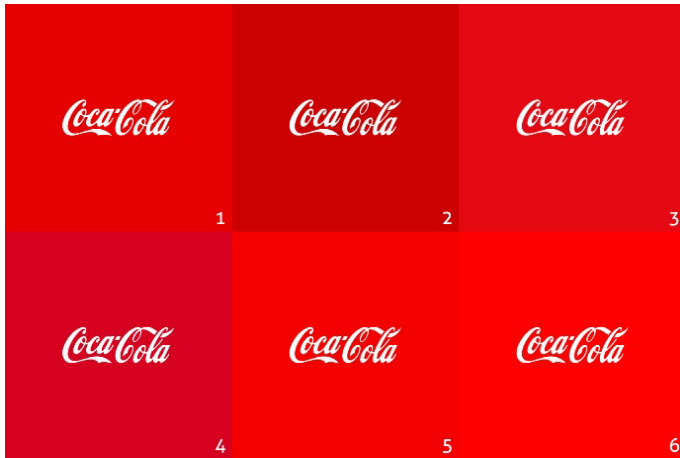
The image on the left shows the six variations of red used in the Coca-Cola test color memory test. On the right is the summary of the test with 399 participants. On the horizontal axis, you see the deviations from the selected color to the 'right' color. As you can see, the results are quite diverse, with the most popular color not being the right one. It's even 4,3 dE00 apart from the right one. And even the color that was 9 dE00 off, was picked by one in five participants. For the record: all six variations in this test are real brand colors, in alphabetical order: Adobe, Coca-Cola, KitKat, Netflix, Target and Vodafone.

BTW: if you need packaging or labels and want brand colors that really pop, check with your printers, they may help you to find a color that both pops and is easy to print!

2: The basic color definition: measure it!

Once you have picked a sample with the perfect color for your brand, you need to get the basic color definition. And that is NOT the Pantone number. Many, or even most, brand color guides start with a Pantone number. That is NOT a good idea. Why? For one: Pantone colors have changed over the years, the images below show the 'old' Pantone Matching System and 'new' Pantone Plus guides (2010).

Plus: the Pantone color you see in your color guide, is a reproduction of the 'ideal' color value. And as with every reproduction: there are deviations. Pantone claims that 90% of the colors are within 2 dE00, so: 10% is outside 2 dE00, sometimes even way outside. Which colors are outside that tolerance, Pantone doesn't specify. So, the color you picked, could be very different from the digital value.

Color guides: min., average, max. dE00

N = 14

Min dE00 · Average dE00 · Max dE00
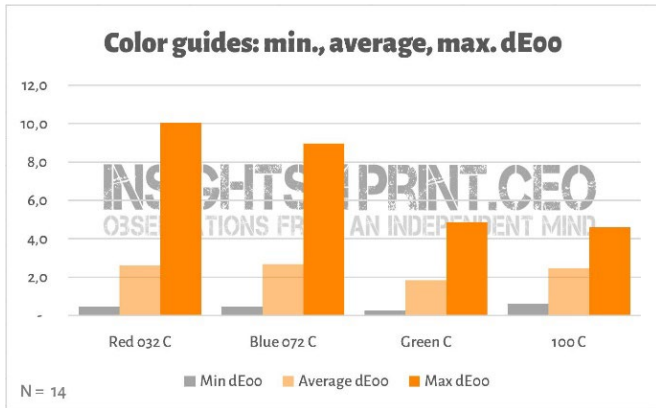
This graph shows the results of 14 companies measuring 4 patches in their Pantone Coated color guide. All of these 14 guides were still withing warranty.

And those differences can have rather significant consequences, just look at this comment on LinkedIn. They had to redo everything since the guide the customer used had a 7 dE00 deviation!

Gary Courtney · 1st   10h •••
Technical QC and Training at DagwoodLinnetts Proofing Ltd

We reproofed a job only today, because the previously printed one was matched visually to a swatch book which was less than 12 months old and yet 7 deltaE away from our book and the pantone digital library.

Insightful · 👍2 | Reply   · 3 Replies

Gary Courtney has no less than 10 copies of the current guides in his company. He was so kind to measure the same 4 patches in 7 of them, below you see the result for Blue 072 C. Please note: these are guides that were bought at the same moment, these are measurements with the same device, at the same moment. The only variable is the printed guide.

Blue 072 C	Digital	#1	#2	#3	#4	#5	#6	#7
Digital	-							
#1	2,06	-						
#2	2,67	0,92	-					
#3	2,16	0,17	0,75	-				
#4	2,15	0,30	0,82	0,28	-			
#5	2,21	0,21	**0,98**	0,29	0,36	-		
#6	2,19	0,33	0,74	0,26	0,08	0,39	-	
#7	2,03	0,66	0,83	0,61	0,44	0,79	0,43	-
Avg	**2,21**							

The table shows the dE00 between either the digital value (first column), or different guides (#1 to #7). As you can see, all of the guides were out of the 2 dE00 tolerance Pantone specifies for its products. And even between the guides, there can be difference you do not want from a product that many designers and brand owners consider a standard. E.g., between guides number 5 (row #5) and 2 (column #2), it's almost 1 dE00… Imagine you use number 5 as a reference and your printer uses number 2…

So, here is the solution: measure the color you picked! This, BTW, also eliminates the aging of pigments. Pantone only guarantees the color correctness of their guides for about 1 year… but if you measure the color, that is exactly what you see. You are not dependent on the conformance of the printed Pantone guide with the digital values anymore.

If you don't have a decent measurement device, ask your printer or prepress company for help. They will love to help you! And please repeat the measurement a few times to ensure you get the correct values.

In case you wonder, the cheapest spectrophotometer on the market is the Variable Spectro 1 (300 US$). Some others are Nix Spectro 2, the popular X-Rite i1 Pro, Myiro-1 (Konica-Minolta), and high end systems like: X-Rite eXact, Techkon SpectroDens. And please note that when you measure the same color with different devices, you might get slightly different results.

There is one essential thing when you do those measurements: you need to specify some conditions.

Do you remember the first variable in color? The light source? Well, that's also something you can encounter in measurement devices: they can have different light sources. Or act as if they have different light sources (it's impressive what clever color scientists can do!).

In the printing industry, we use D50 as a light source. The D stands for 'daylight', the 50 for 5000 degrees Kelvin. That is another way to specify a light source, it's a bit easier than describing the entire

Source: http://www.thouslite.com/Surfacecolorvisualassessment/

spectrum. Now, D50 isn't the only 'daylight', most industries use D65 as standard light... This is a bit 'colder' than D50, it is a bit more blueish. If you would measure the same color with D50 or with D65, you will get other numbers.

But it gets even a bit more complicated: we already mentioned those OBAs, which make paper light up. In the old days, the light source in spectrophotometers did not have UV in it, so paper with OBA would not become brighter. These days, the light sources used in spectrophotometers can emit UV. That's why we need to agree if we want to take into account those OBA's or not. This is specified in the Measurement condition: M0 (the old way), M1 (with UV, the preferred way), M2 (no UV), and M3 (wet ink). This might confuse you, but don't worry, the color geeks at your prepress house or printer will know what to do. For you, it's only important to know that you need to mention which mode is used when measuring the color you picked.

BTW: the Pantone digital libraries have values for M0, M1 and M2, Adobe Photoshop uses the M2 values of these libraries.

There are two extra parameters you need to mention. The first is 'geometry', which tells you how the light shines on a sample. There are different possibilities. What is being used in printing is 45/0, which means that the light shines under an angle of 45° on the sample, and it is viewed from an angle of 0°, which means: from above. There are other options, e.g., having light from all around the sample, kind of a ring light.

And then the most complex one is the viewing angle. There has been a lot of research on how we humans perceive color. And in one of those tests, it became clear that in the center of our eyes, we see colors slightly different. That's what eventually is translated into the viewing angle, which can be either 2° or 10°. Since there is a slight difference between the two, it needs to be noted in that brand color specification. And that's all you need to know: check that setting and take note.

That difference between light sources and certainly the viewing angle might look a bit abstract. Thanks to SpectralColor, we can visualize this.
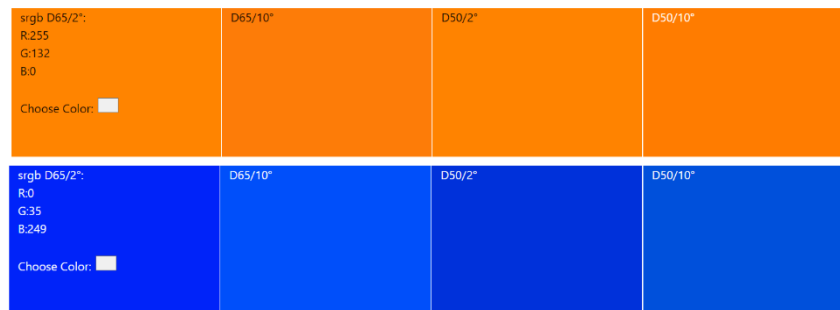
So, let's look at a practical example. This is the basic definition of 'insights4print Orange':

CIELab (D50 / 2° / M1): 70 / 47 / 79

Please note that there are no decimals in this description. That is on purpose. And for two reasons: the first is that applications like Adobe Photoshop don't accept decimals. The second: when using decimals, people might have the impression that these decimals matter a lot. Well, in real life, they don't matter a lot. As if you would discuss that a bag of salt of 1 kg has a few grams more or less in it. So, let's keep it simple, no decimals in your brand color definition!

3: The derived colors

Now that we have our basic, solid, color definition, we need to translate that definition into colors you can use in your documents. You could, of course, rely on fully automatic conversions, but in many cases, you might want to try something different.

3.1: Digital colors

Let's start with the easiest one: digital colors, being: RGB. What is essential here, is that you need to mention which RGB you are using. In case you don't know, there are different RGB profiles, with a different gamut. Just like a 'mile' can be very different: there is the international mile (1,609344 km), the nautical mile (1,852 km), the Chinese mile (0,5 km), and several others.

For web applications, sRGB is used the most. However, in prepress and design, AdobeRGB is often used. The gamut of AdobeRGB is larger than sRGB, meaning that you have more colors in AdobeRGB than in sRGB. And with monitors becoming more capable, e.g., photographers prefer working with a larger gamut, like AdobeRGB, but there are also others.

But the same numbers in sRGB and AdobeRGB will give a different color! That's why it is essential to include what RGB is used. Just like it is essential to say when you have to drive 10 miles, whether that's international miles or Chinese miles. Or another example: I'm a dollar billionaire, unfortunately, it's in Zimbabwe dollars…
(I own a banknote of 20 billion Zimbabwe dollars, which is worth close to nothing)
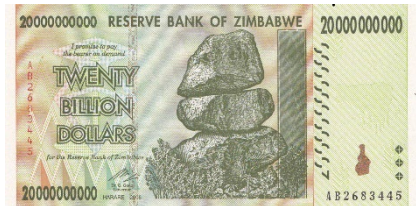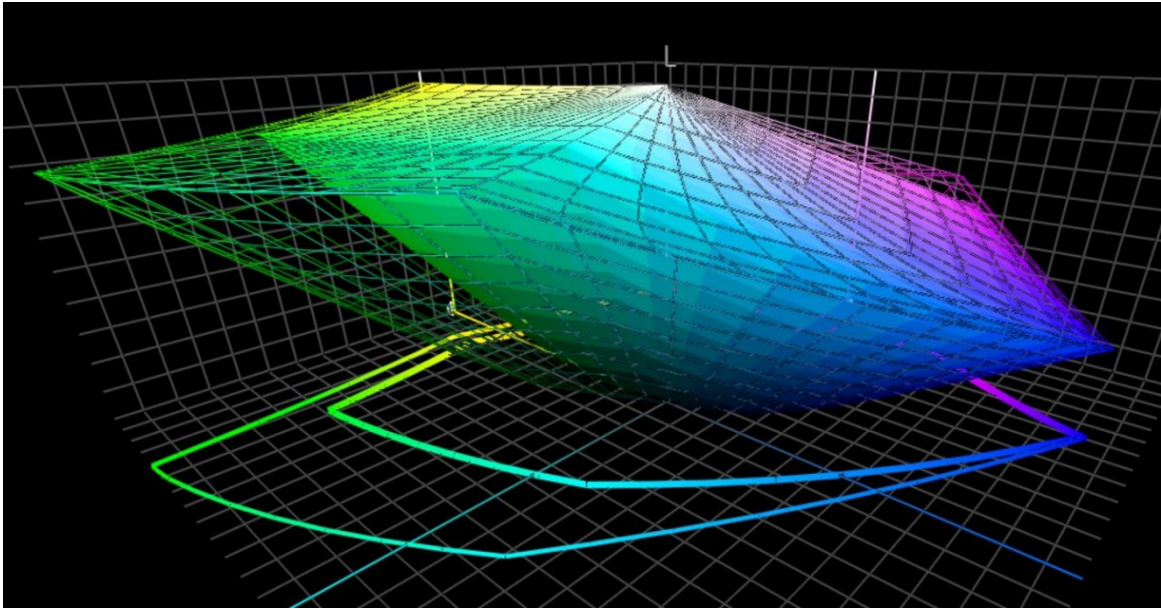
This graph shows the 'gamut' of sRGB (solid volume) and AdobeRGB (wireframe). Especially in the green, AdobeRGB is significantly larger.
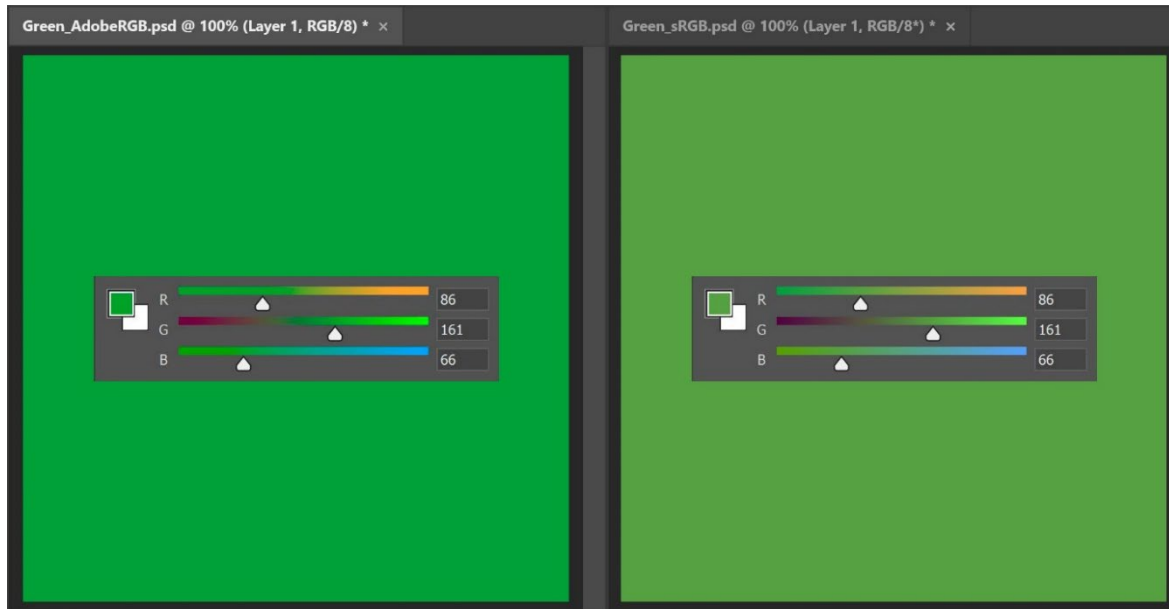
To show the practical implication of that different size in gamut: both greens above are the same RGB values, but the one on the left in AdobeRGB, the right in sRGB. If you don't mention the RGB profile used, you have literally no idea what the real color is.

For the conversion of Lab-values to sRGB or AdobeRGB, you can rely on Adobe Photoshop. Just make sure that you have the right document profile, enter the Lab-values and switch to RGB to see the RGB values.
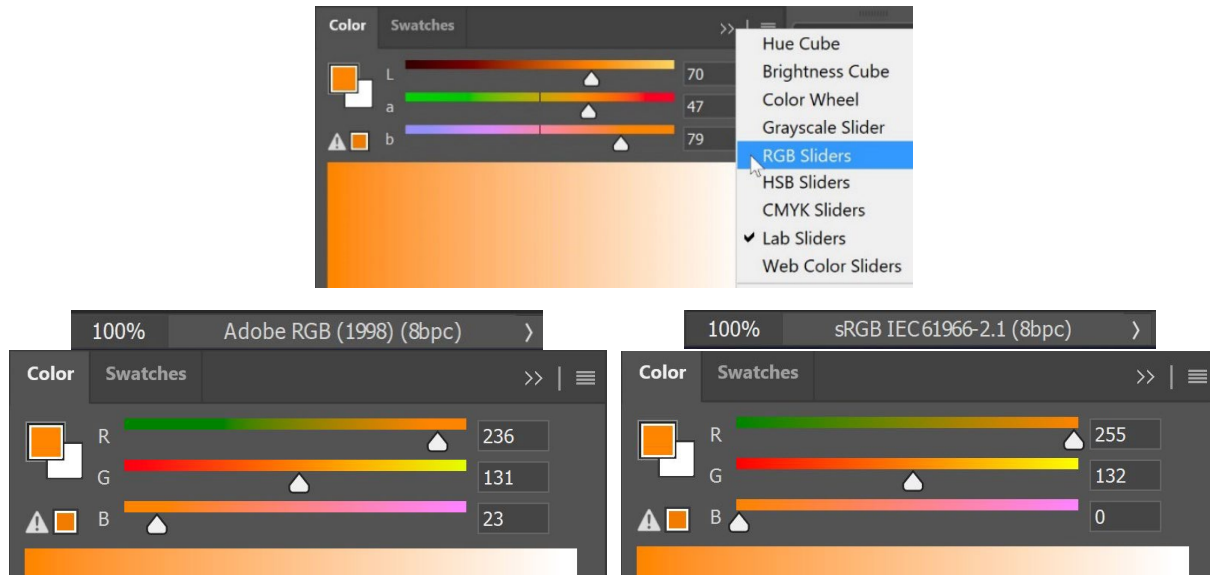
HEX-values, which are often used on the web, are essentially the same as 'normal' RGB values, but in a different encoding. That's the reason why you should also with HEX, mention the RGB profile. Most of the time, however, nobody does that, if nothing is mentioned, assume it is sRGB.

3.2: Printed colors

When defining how your brand color should be reproduced in print, you need to make some choices.

First and most important choice: is the cost important when going to print? If it is not, you can use a spot color definition. This means that this brand color will always be printed with a custom mixed ink. That's why it is more expensive.

Spot colors are still used a lot in packaging and labels, in general printing, they are not (maybe with the exception of some large or very large print runs).

If you choose not to use spot colors, and your brand color needs to be printed a lot on packaging or labels, you might want to opt for 'extended color gamut' (ECG) printing. This is slow but steadily growing in packaging and labels because it is much more cost effective than spot color printing and has a larger gamut than standard CMYK. The trick is to add one or a few extra colors, for example: Orange, Green and Violet. If you want to use that, consult your printer: at this moment, CMYKOGV is not yet fully standardized. Meaning: printer A might use slightly different OGV inks than printer B. Or even use Red, Green and Blue instead...

When only or primarily using standard CMYK to reproduce your brand colors in print, the next question pops up: do you want the closest colorimetric match (so: lowest delta E), or do you want the most pleasing color? Or in other words: do you have an absolute faith in current color transformations, or do you want to test several possibilities yourself? This also means that you can tweak the colors in such a way that they will be more consistent in print. And even look better... That's why I prefer the manual tweaking.

To do this, try different combinations, with the automatic conversion as a starting point. And get samples printed, on your preferred paper stock, and then decide which combination of CMYK fits best, which combination looks the most pleasing.

And for those different combinations, here are a few points to consider:

- Stay away from very low percentages of a specific CMYK ink. Just eliminate it. Low percentages can cause instabilities when printed, meaning: it might look a bit different every time.
- Convert close to 100% of a color into 100%. Usually, converting 96% and above to 100% won't make a large visual difference when printed, if you can detect it at all. And 100% will always be 100% in print.
- The fewer inks, the higher the stability in print. When both C, M, and Y are present in a color, you can eliminate one by raising the K and lowering CMY accordingly. Once again, this will improve the stability of print production, and will improve drying. We'll talk about that more in just a while!

The insights4print Orange is a nice example of the advantages of manual tweaking, especially the derived color for Uncoated papers. If you let automatic color transformations do the job (in this case: PSO uncoated v3 and relative colorimetric rendering intent), you will get: 0 / 54,52 / 87,44 / 0.

But that misses some Yellow, in my opinion, as 'brand owner'. When looking at the values of Pantone 151 UP, on which insights4print Orange is based, there is less Magenta and more Yellow in it: 0 / 50 / 99 / 0. This color looks much closer to my ideal of insights4print Orange! But I did one more tweak: that 99% Yellow, from a print production standpoint, that should better be 100%. A 99% will often become 100% in print, so why not just make it 100% from the start... Also, visually I didn't see a difference when I got samples of different conversions printed.

This is the test I did with the insights4print Orange, printed in offset on uncoated paper. Rectangle **A** shows what the color looks like when Pantone 151 U (the spot color) is converted with Adobe Photoshop from the Lab values to CMYK (for the color nerds: different rendering intents will give different results, play with this to check the results of these conversions). This is what happens if you have an unconditional faith in color science. But that's not the color that I want... I'm missing some yellow.

B shows the conversion used in Pantone Color Bridge (their CMYK version of the

A: 151U - 0 / 54,52 / 87,44 / 0
B: 151UP - 0 / 50 / 99 / 0
C: tweaked - 0 / 50 / 95 / 0
D: tweaked - 0 / 50 / 100 / 0

(C) INSIGHTS4PRINT.CEO

Bottom row:
from: 0 / 54 / 100 / 0
to: 0 / 54 / 95 / 0

Pantone libraries). That's already closer, but it has a 99% in it, which I'm not fond of. **C and D** are tweaked: C to 95% Y, D to 100% Y. Visually, there's not really a difference. So, let's just make it a 'print safe' color and set Y to 100%.

The bottom row, by the way, shows 6 variations in Y, from 95 to 100%. Visually, there is no difference, measurements show a 0,5 dE00 between the extremes. Which shows there is no reason not to convert these high percentages to 100%.
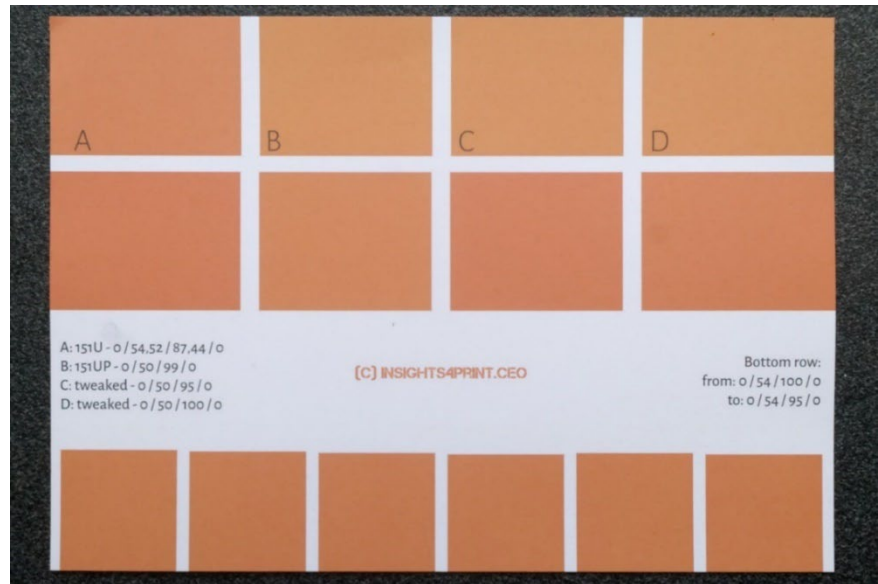
If you have a color that has a very low percentage of a certain color: check this, and try different possibilities, including eliminating that low percentage. In the past, I've seen nasty shifts in a green logo... And even though it was a closer colorimetric match, it looked bad. The customer wasn't happy with that conversion, he rejected the print job. The reprint that looked more pleasing had a higher delta E, but the customer liked it much better.
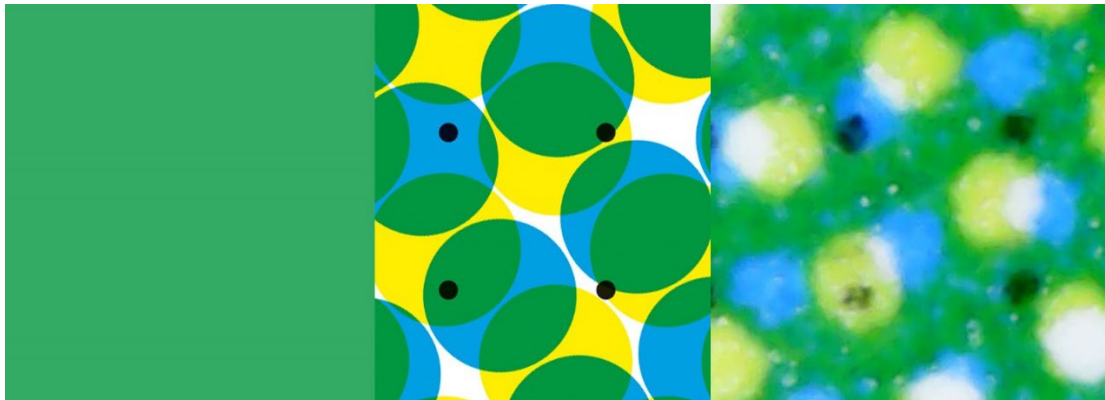
This green shows what can happen in print. The left is the digital color, the middle shows how that ideally is translated into CMYK dots. The right, however, shows the printed image. You can see, e.g., that the left bottom black dot is almost gone. That's reality in print. That's why you should eliminate small percentages in brand colors: too hard to get a stable reproduction.

BTW: clever software used in packaging and labels can set thresholds for both minimum and maximum percentages, to convert these in resp. 0% and 100%. Also the number of inks used can often be limited by this kind of clever software.

An even better example for manual tweaking is insights4print Dark Grey. The sRGB values are 40 / 40 / 40. When you convert this with regular color management, you will get values that your printers will not be happy with – and that's an understatement. And you will also not be happy with how this will be printed – and that's again an understatement.

The CMYK values when converted from sRGB to PSO coated v3 are: 66 / 57 / 46 / 75… Not a good idea, for multiple reasons.

When playing a little bit in Adobe Photoshop with the CMYK values, 0 / 0 / 0 / 95 is extremely close in sRGB and much better to print, that's what I want as my brand color. It's only one ink, the dark grey will always be a neutral dark grey. In the conversion with values in all four inks, the slightest deviation in C, M, and/or Y, will result in a grey that is not neutral anymore. I want a neutral grey. And printing that amount in the four inks, might also result in drying issues.

And these not so good combinations will also happen when you convert between similar profiles. The insights4print Dark Grey is defined as 0 / 0 / 0 / 95, the preferred profile is PSO coated v3. If you would convert that to the similar profile ISOcoated v2, that nice and 'clean' grey will be converted to 73 / 62 / 63 / 72… That's absolutely not what you want in print.

This is not something that is only limited to grey, it happens a lot, especially with darker colors. That's why it's a good idea to play around a bit in Adobe Photoshop and check alternatives. And get these printed! With real ink, on real substrates. Not just a simulation on an inkjet proofing device. Just like I did with insights4print Orange. Your precious brand color deserves a real print, with real ink on real substrates, not just a simulation. It's a small upfront cost, that will save you a lot of troubles and money afterwards.

C		66	%
M		57	%
Y		46	%
K		75	%

C		0	%
M		0	%
Y		0	%
K		95	%
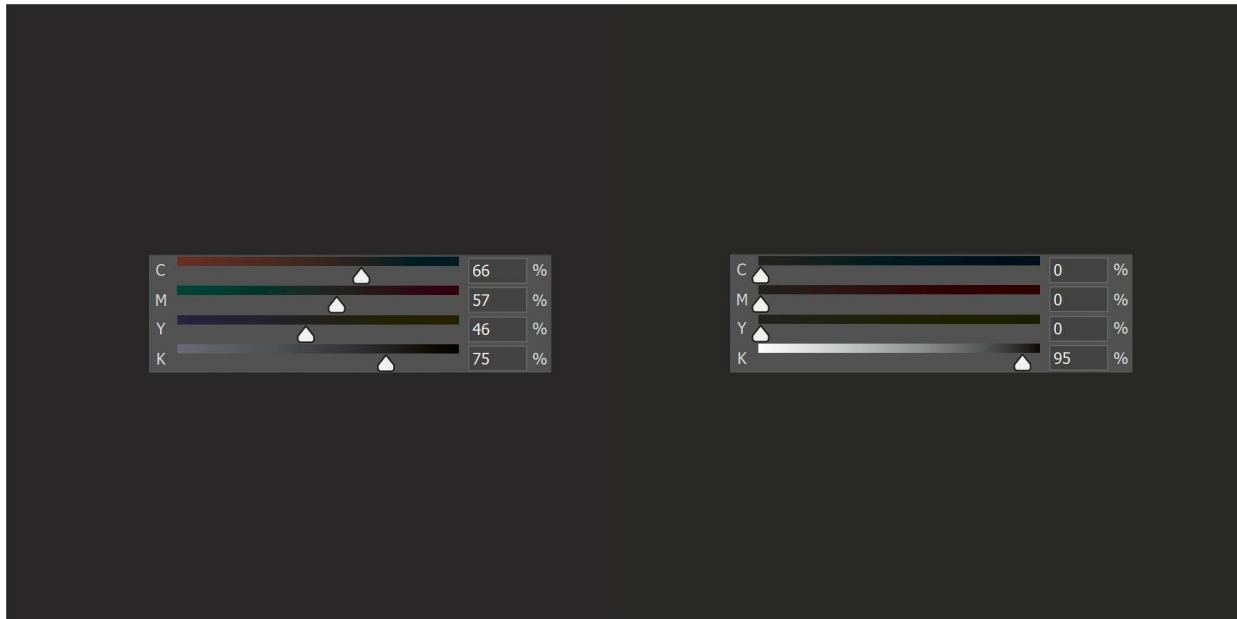
On the left you see the 'regular' color conversion of insights4print Dark Grey, which is a conversion that uses a lot of ink, a conversion that is very hard to keep neutral in print. On the right you see the 'tweaked' version, which looks identical, but it is much easier to print, it will always be neutral grey.

Let's do another test, this time with the spot color Pantone 161C. When coloring a square in Adobe Photoshop (same settings as above), this will be converted into 31 / 61 / 73 / 58. When playing a little bit with the CMYK colors, I easily found two other combinations that produce the same color. The first tweak: 10 / 52 / 66 / 69, the second: 0 / 48 / 62 / 72.

The image below on the left is composed of three squares. The left square is the automatic conversion, in the middle manual tweaking 1, on the right manual tweaking 2, the sliders show the CMYK values. The graph on the right shows the amount of ink used, for the four standard inks (CMYK). Manual tweaking 2 uses much less ink. And by eliminating Cyan, it will provide a more stable result in print, that's why I prefer that one. It's what you could call a more 'print safe color'.
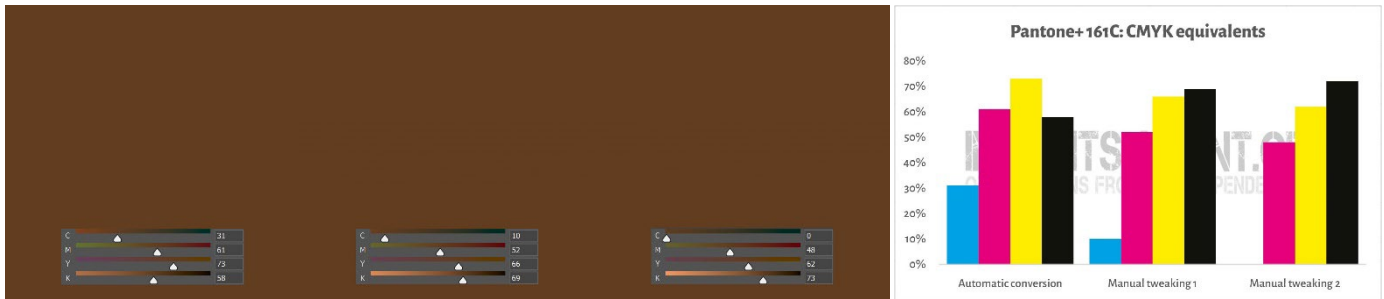
What I just did, is a trick called '**Grey Component Replacement**' (GCR). Since specific combinations of CMY are essentially viewed as grey, you could replace those CMY combinations by K, partially or completely. Which has interesting advantages: less ink consumption and a more stable print production. GCR is typically built into the ICC profiles used for conversions to CMYK, but you could – or better: should – experiment with this when defining the CMYK values for your brand colors!

This might be a bit confusing, I know. As shown above, there are multiple ways you can get a certain color with CMYK. Contrary to RGB, where there is only one possibility. A concept that shows that, is called '**Total Area Coverage**' (TAC), or in other words: the total ink coverage. This is a part of the ICC profiles we talked about, the translation dictionaries.

Traditionally, the TAC used to be rather high: up to 350% in case of the JapanColor 2001 Coated profile. Which has a very practical downside: more ink usually means slower drying... And it doesn't have to be this way! Below are two graphs showing the conversion of all kinds of grey (from white on the left to black on the right) into CMYK, with two different profiles, but for the same 'print condition'. The right one uses much less ink because it will already from a rather light grey transform those specific combinations of CMY into K: it uses much more GCR, the trick we just talked about, than the left one. And in real life, you won't notice that the darkest black of the right one is just a tiny bit less dark.
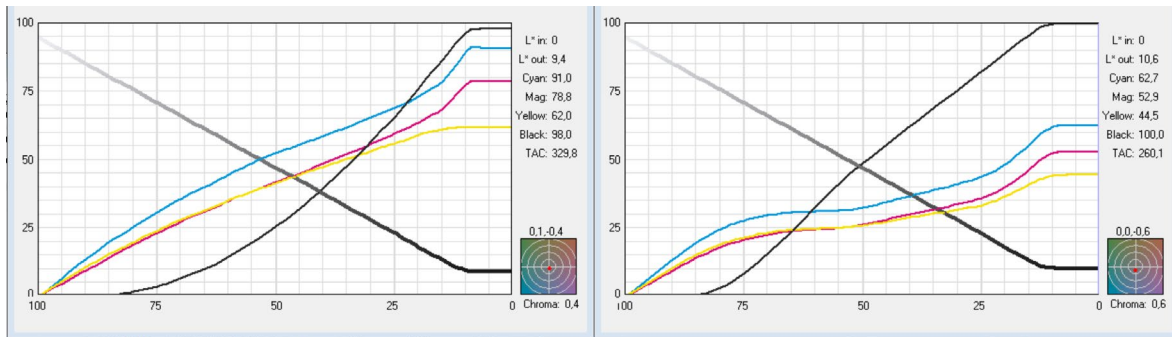
The graphs show how 'grey' is converted into CMYK. The profile on the left has a TAC of 330%, the one on the right only 260%, thanks to adding much more black (K) ink. In real life, these will visually look the same, but the one on the right is easier to print, and will dry faster.

3.3: Closest match in color systems

But maybe you also want to add the definition of your brand color in different color libraries, with Pantone and RAL probably being the best known.

Color measurement devices often have built-in libraries where you can find the closest match in color guides. E.g., this is what the NCS Colourpin SE showed when measuring a printed sample of insights4print Orange.
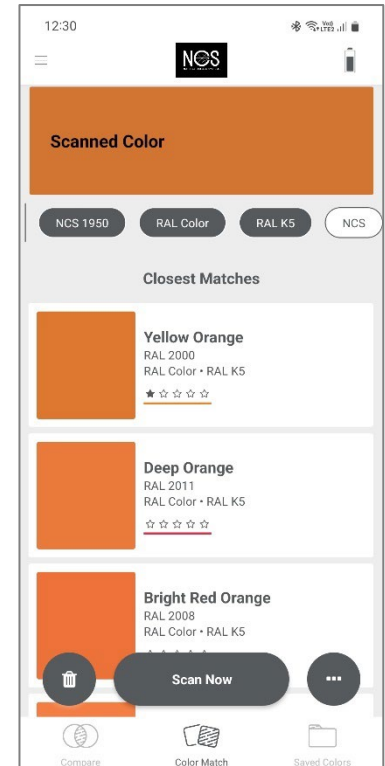
If you have Adobe Illustrator, there is a simple trick to convert a Lab-color into the best match from all the color books available in that application. To start: create a document and create an element that you color with your brand color, with the Lab-values. Then do the following: Edit > Edit colors > Recolor Artwork, and in the Color Library drop-down menu, choose Color Books and the Color guide you want to know the closest match from. But your printers might also have other software that can do that trick. Ask them!

When I do this with the insights4print Orange, it will convert it into Pantone 151 C, the color on which insights4print is based…

This is a video that shows you how to do this: CMYK / RGB to Pantone | Converting colours in Adobe Illustrator - YouTube
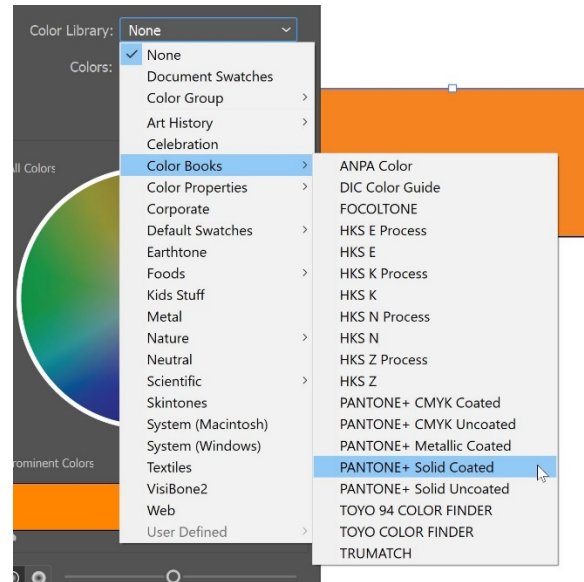
For other color systems, you could check online conversion websites. Here are a few:

- [E-Paint.co.uk](#)
- [RALcolorchart.com](#)
- [imi21.com](#)
- [ral-colours.co.uk](#)

[Nix Free Color Converter](#) doesn't convert to RAL and others, but it does offer you the possibility to use different illuminants and viewing angle.

And always check the suggestions! Eventually, I picked RAL Classic 2003 as the 'most pleasing' RAL color for the insights4print Orange…

With this, you might have all the color information you need!

Unless you want to go the expert way… that's for the next chapter. But before getting kind of nerdy, one more thing about sharing your colors: using ASE files! A hidden gem in the Adobe Creative Cloud applications.

3.4: Sharing color definitions with designers: use ASE files!

Building better brand color guides doesn't end with a nice document, which eventually only a few people might read, let's get realistic about that. The right way to move forward, the right way to get to consistent brand color reproduction from the start, is sharing it in the easiest way possible with designers, with people doing the layout. And there is an easy way: sharing color swatches via the **Adobe Swatch Exchange** (ASE) format. Everyone using one of the Adobe Creative Cloud applications can easily import these. And without any effort, they will always use the right color. It's even easier than finding the right color in the right Pantone library!

So, where do we start? You can best start in Adobe Illustrator, since that has a few extra options compared to Adobe Photoshop. First check your color settings (in this case: PSO coated v3 as CMYK profile). Create or open a document and make sure the swatches panel is empty, except for the two 'colors' you can't delete: [None] and [Registration].

Now create a new Swatch, as an example, I created one called 'i4p – orange – SPOT color + RGB' (i4p being short for insights4print). As Color Type, Spot Color is selected, and the Color Mode is Lab, so that I can get my rock-solid spot color definition in this swatch. After creating that, let's duplicate it, open that copy and change the options to the desired CMYK values for coated and then again a copy, this time for uncoated.

New Swatch

Swatch Name: i4p orange - SPOT color + RGB

Color Type: Spot Color

☑ Global

Color Mode: Lab

L — 70
a — 47
b — 79

OK   Cancel
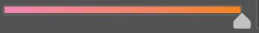
Swatch Options

Swatch Name: i4p orange - CMYK - Coated

Color Type: Process Color
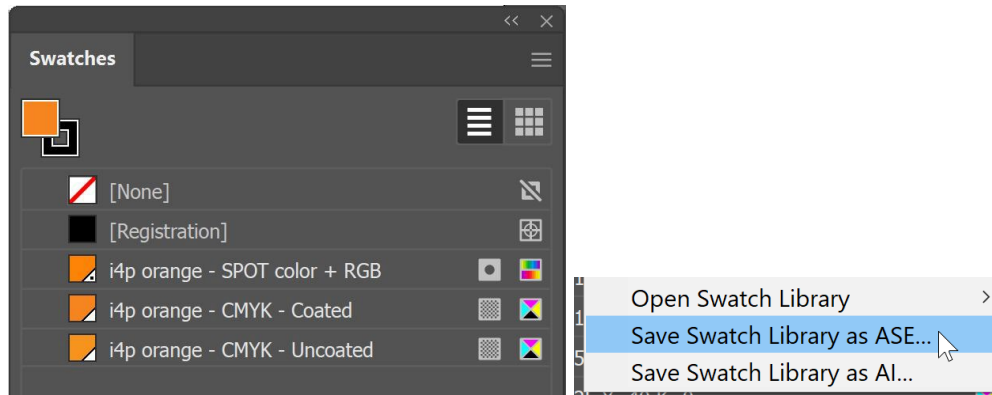
☑ Global

Color Mode: CMYK

C — 0 %
M — 59 %
Y — 100 %
K — 0 %

☐ Preview   OK   Cancel

So, now I have three swatches in the Illustrator document. And I can export the Swatch Library as ASE file.


If you have a lot of brand colors (especially with the different variants for spot, coated, and uncoated), make sure to organize them in a logical way. You could, e.g., group them in 'Color Groups' (folders), one per output type.

When you have exported your brand colors, you can import them into the other Adobe CC applications, and even into some other applications (e.g., Affinity Designer, Photo and Publisher). When importing them in, e.g., Adobe Photoshop, make sure to select the correct file type: default that is set to .ACO, you need to change this into .ASE to see the file.

And when you click OK, you will find these swatches in a new group (folder), with the name of the ASE file.

Now there is still one crucial thing to do: make that ASE file available to everyone who might need it! Why not publish it on your website, together with the complete brand color guide? And in case you might be reluctant to do that, because this way also competitors or even counterfeiters will know your brand colors, think again: with a 300 euro spectrophotometer, it's a piece of cake for them to know your brand colors if they want to...
Once it has been printed, there is nothing secret anymore about your brand color.
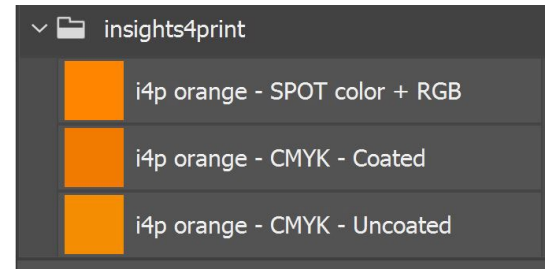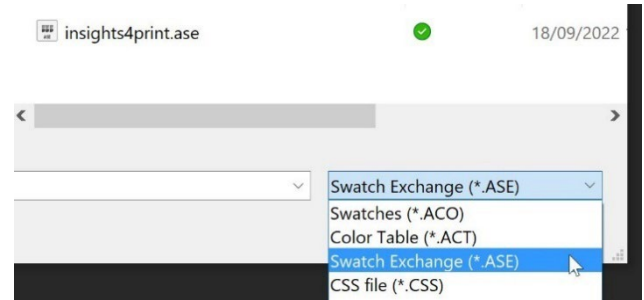
4: The Expert Way: CxF

If you have a lot of packaging or labels printed, and you are very picky about brand colors, you might want to know the expert way: using CxF, the **Color eXchange Format**. This is an international standard that has the most detailed description of a color possible. It describes how much energy needs to be reflected in every part of the visible spectrum.

At the moment of writing, you still do need a few extra tools to be able to use CxF throughout the entire workflow. But maybe that might change in the (near?) future: both the PDF file format and the Adobe PDF Print Engine (APPE) now support the use of 'spectral colors', which is probably based on CxF. So, it would not be a surprise if they were going to introduce the use of CxF in the Adobe Creative Cloud applications in the, hopefully near, future.

Let's first look at what a CxF file looks like. It is based on XML, meaning you can open it with a text editor (e.g., Notepad++ for Windows or TextEdit for Apple). And when you open it, it's a text you can read. It even looks a bit like HTML.

Below you can see the definition of the color 'Blue_000'. You can see the spectral reflectance of that color (all those numbers in line 13), that's the most detailed info you can get! Plus the CIELab specifications (lines 15, 16, 17).

```
10    <Object ObjectType="Standard" Id="A1_1" Name="Blue_000">
11        <CreationDate>2010-05-24T15:56:43+00:00</CreationDate>
12        <ColorValues>
13            <ReflectanceSpectrum ColorSpecification="CS1"> 0.41 0.4669 0.5359 0.6793 0.8762 0.9314 0.9316 0.9273
14            <ColorCIELab ColorSpecification="CS1">
15                <L>96.4258</L>
16                <A>0.9626</A>
17                <B>-0.4651</B>
18            </ColorCIELab>
```

Wonder what 20% of that Blue looks like? It's in the CxF! All steps from 10% to 100% are included in the CxF file.

```
66    <Object ObjectType="Standard" Id="C1_1" Name="Blue_020">
67        <CreationDate>2010-05-24T15:56:43+00:00</CreationDate>
68        <ColorValues>
69            <ReflectanceSpectrum ColorSpecification="CS1"> 0.2853 0.3254 0.378 0.4952 0.6569 0.7126 0.7249 0.7318
70            <ColorCIELab ColorSpecification="CS1">
71                <L>84.2887</L>
72                <A>0.6172</A>
73                <B>-6.4131</B>
74            </ColorCIELab>
75        </ColorValues>
```

Wonder how it was measured? It's in the CxF!

```
2621    <Device>
2622        <Manufacturer>X-Rite</Manufacturer>
2623        <Model>SpectroEye</Model>
2624        <DeviceFilter>Filter_UVD65</DeviceFilter>
2625        <DeviceIllumination>M1_Daylight</DeviceIllumination>
2626        <DevicePolarization>false</DevicePolarization>
2627    </Device>
```

It takes a little bit of effort to get this information, but it's not rocket science, nor super expensive.

The easy way is to get a 100% solid printed on the substrate you need to get a CxF file for. After measuring that printed patch, clever software will calculate the different percentages and export the CxF file, plus an associated ASE file. That ASE file can be used by designers and so on. Further down the output flow, the color definition from the ASE file will be swapped with the complete information from the CxF file.

But if you want to go all the way, the brand color needs to be printed on both a white and a black sheet, and in different tints (percentages). Based on the measurements of these printed patches, you will get the most detailed and accurate color information possible! And once you have that, you can create the CxF and ASE files.

And don't worry, you don't need to do this yourself. Ask your prepress house, your printer, to assist you on this. They will be happy to provide this service! *Note for prepress houses and printers reading this document: providing assistance with CxF files could be an interesting business opportunity!*
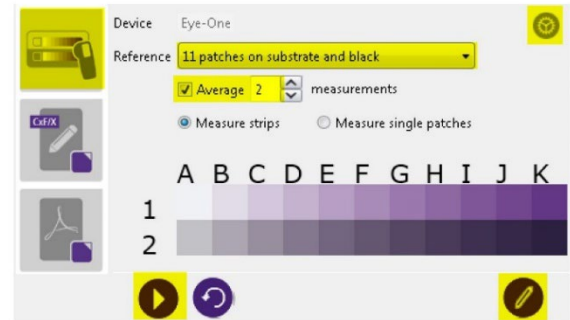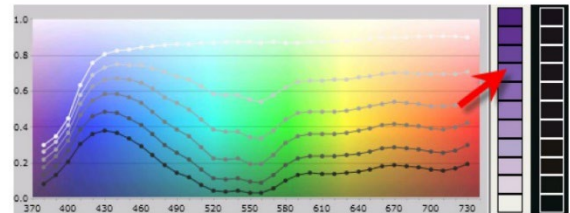

Figure 2-1: *Measuring Spot Ink Charts*

Figure 2-2: *Viewing Spectral Curves*

Image: CGS Oris

5: The essential extra information

There are also other factors that will influence the color appearance, next to the inks used. E.g., paper is known as the 'fifth color'. And finishing will also influence the color appearance: a matte finish will make your color look more dull, a glossy coating will make the same ink look more vibrant…

That's why a few extra lines of information are added to the Better Brand Color Guide:

- Which paper types are preferred, allowed, or not allowed?
- Are papers with OBAs allowed or not?
- Can tinted papers, e.g., like many eco-papers, be used or not?
- And which types of coatings, laminates are allowed, or not?

If other variables are important for reproducing your brand colors, do add them to the Better Brand Color Guide! Especially when you print a lot of packaging, you might want to add information here.

These documents are all part of the same Red Cross mailing. You can see the envelope (bottom left), the letter (right), and at the top two other documents that have a glossy coating.

6: Putting all together

Putting it all together, a Better Brand Color Guide, could look like this:

A Better Brand Color Guide

Basic color definition
Name: insights4print Orange
CIELab (D50 / 2° / M1): 70 / 47 / 79

Derived colors

Digital colors ⚠ (1)
sRGB: 255 / 132 / 0
HEX (sRGB): FF8400
AdobeRGB: 236 / 131 / 23

Printed CMYK colors (4 inks) ⚠ (2)
Coated paper: 0 / 59 / 100 / 0
    (PSO Coated v3)
Uncoated paper: 0 / 50 / 100 / 0
    (PSO Uncoated v3)
Similar profiles: keep CMYK numbers
    (Conversion NOT allowed)
Other profiles: use procedure described in Project BBCG tutorial
    Keep channels clean: no small percentages
    High percentages, >95% set to 100%
    The fewer channels, the better
    Make test prints with real ink!

Closest match in color systems

Science based color systems
Munsell: 5YR7/14
NCS 1950: S 0585-Y40R

Spot colors (specific ink for each color)
Pantone: 151 C (coated)
Pantone: 151 U (uncoated)
HKS: 7

Paint
RAL Classic: 2003

⚠ (1) The visual appearance of a brand color on digital devices depends on 1) the capabilities of the screen, 2) the calibration and 3) the color settings on the device. These are out of control of the brand owner.

⚠ (2) Simulating a brand color with 4 inks (CMYK) will result in higher deviations and require higher tolerances than printing brand colors with 1 ink only (spot color). Also, the 'tint' of the substrate will influence the color appearance, the choice of the substrates should be an essential part of a good brand color guide. E.g. the use of optical brightners (OBA) in paper will influence the color appearance.

General printing

Printing

CMYK: preferred

ECG (CMYKOGV): NOT recommended

Spot colors: NOT recommended

Substrates

Coated - Glossy: preferred

Coated - Satin: allowed

Uncoated: NOT for marketing material

OBA (Optical Brigthening Agents): allowed

Tinted papers: NOT allowed

Finishing

Coating/laminates- Glossy: allowed

Coating/laminates- Matte: NOT allowed

Packaging & Labels

Printing

Spot colors: NOT recommended

ECG (CMYKOGV): preferred, consult printers!

CMYK: allowed

Flexo: allowed, HD Flexo preferred

Gravure: allowed

Digital - toner: allowed

Digital - inkjet: allowed

Substrates

Brown corrugated: NOT allowed

Please note that the Lab-values are not what you will find in the digital Pantone Coated library. That is on purpose. This shows you that you need to be independent of that Pantone library. You need to measure the sample you have seen, the sample you like. In the case of the insights4print Orange, that was not 100% the same as the digital value for Pantone 151 C. By measuring it and using that value as the basic color, one important variable is eliminated: deviations in the printed Pantone guides... The Lab-values are rock-solid and unambiguous, if you mention the Measurement Mode and geometry.

As you can see, simulations of the closest matches in color systems are visualized, to set the expectations right. And some information about printing technologies used for packaging and printing was added, e.g., that when printing in flexo only HD flexo plates can be used. Check this with your prepress house, your printers, but keep it generic! Don't get locked into a specific brand! And the choices above, e.g. ECG not allowed for general printing, are **my choices, yours might be different**!
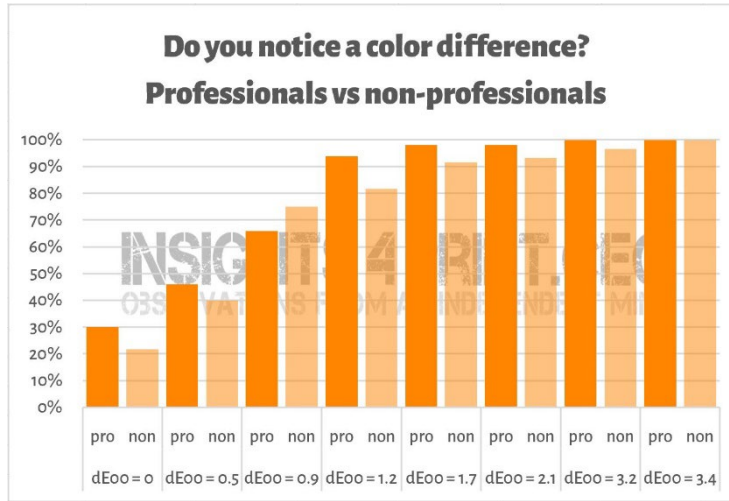
Part C: judging print

Now that you know how to define your brand color in the best possible way, we need to talk about the next step: judging print and print quality...

And this is a difficult one. It's much more complex than you might think... Next to physical variables, which we will check below, being objective about color is very difficult. Especially when your boss hired you to make sure the precious brand colors are correctly reproduced, all the time. You have to find color differences, you have to make sure the printer follows your directions. It's in your job description to find color differences and correct them! That's why you get paid.

1: It's psychology!

I know, this might look silly, but it isn't. It is psychology. It has to do with 'framing', a concept from 'behavioral economics'. Just the fact that you enter a printing company to check color, makes you more critical about color differences, it makes you look for color differences. And the effect of that can be huge! In a test with over 100 people judging color differences, nearly 1 out of 3 print professionals claimed to see a color difference between two identical copies... Just the fact that they were asked if they saw a color difference, made them look for a color difference... And if you want to see a color difference, you will eventually see one.

Do you notice a color difference?
Professionals vs non-professionals

	pro	non	pro	non	pro	non	pro	non	pro	non	pro	non	pro	non	pro	non
	30%	21%	46%		66%	75%	94%	81%	98%	91%	98%	93%	100%	96%	100%	100%

dEoo = 0 dEoo = 0.5 dEoo = 0.9 dEoo = 1.2 dEoo = 1.7 dEoo = 2.1 dEoo = 3.2 dEoo = 3.4

The results of a test with over 100 participants who were shown different variations of flat samples. One of the samples was identical to the reference. On the horizontal axis you see the difference between the sample and the reference. Almost 1 out of 3 print professionals claimed to see a difference between the identical copies... The reason? They were asked if they saw a color difference, and being print professionals, they had to see one.

This is, BTW, a very nice anecdote on the psychology of press checks...

That's why measurements should always support judging print. But then again: measurements should also be supported by vision.

2: Light sources

There are some technicalities you have to take into account. The first is the light source: this must be D50. That is the standard light source for printing. If you compare an inkjet proof with a sample of a print job, these will look identical under D50, but they might look slightly different under D65... That's due to metamerism: colors that look this way under one light source, but look that way under a different light source. As a practical example: I once bought pants that looked brown in the shop, but turned out to be green when I unpacked them at home...

The same two fabrics, but under different light sources. The left one changes from green to brown.

And then there is the intensity of the light. You may have noticed that there is a lot of light at the control station of a printing press. That's on purpose: the more light, the easier it is to detect the tiniest color differences. This is important for a press operator, but as a customer, you should judge it under a more normal amount of light. In technical terms, this is the difference between a P1 (critical comparison; 2000 lux) and P2 (practical appraisal of print; 500 lux). And that P1, that's much more light than, e.g., in a supermarket. Using that amount of light is like using a scale with microgram accuracy to check if a bag of 1 kg of salt is really 1 kg of salt. That's not something a consumer would ever do, a consumer would never notice a difference on that scale.

The ability to see color differences, depends on the amount of light. That' the reason why press operators have these gigantic lights on their press console. This is, however, much more light than, e.g. in a shop, or at home.

3: Lesser-known aspects

But even more factors can and will influence color perception! E.g., surrounding colors (that's why these lighting cabinets have grey walls). And even the position: when you put two samples on top of each other, even the tiniest color differences will become visible. Putting them a few millimeters apart, you might not notice them anymore. And even curvature of the samples will influence color perception, due to the slightly different way the light falls onto it. And that is also what

happens on the shelves in the supermarket: when boxes are tilted a little bit, the lighting will be slightly different, resulting in a different color perception. This is something a brand owner will never be able to control. So, let's get honest about this kind of differences...


The two packages of Kellogg's Trésor are probably identical in color. However, the right one looks a bit darker. This is entirely due to the light falling a bit different on the package, since it is placed slightly different.

To show you this is real, let's go back to the test where over 100 people were asked if they saw a color difference between two samples. That test didn't just include flat samples, it also included folded boxes… While the results with the flat samples were more or less what could be expected: a growing number of people seeing color differences when the delta E grew, this was NOT the case with the folded boxes! That was not a normal curve. The only explanation I can come up with is that some of the boxes were tilted a little bit, resulting in slightly different lighting and, therefore, a slightly different color perception. Look at the graph!
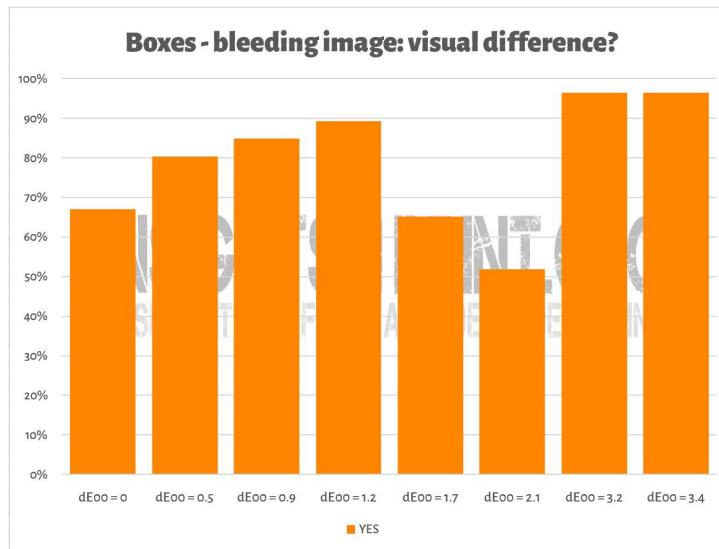
Something similar can be seen in the picture below, where two copies of the insights4print Orange test print were put on top of each other. If you want to see a color difference, you will notice that the bottom row is slightly darker. That's due to a slight curvature of the sheet (it's partly on top of the other), changing how the light falls on it slightly. And as we have seen in the first chapter: color is the interaction of an observer, an object, and light... Measurements showed only a 0,5 dE00 difference between the extremes.
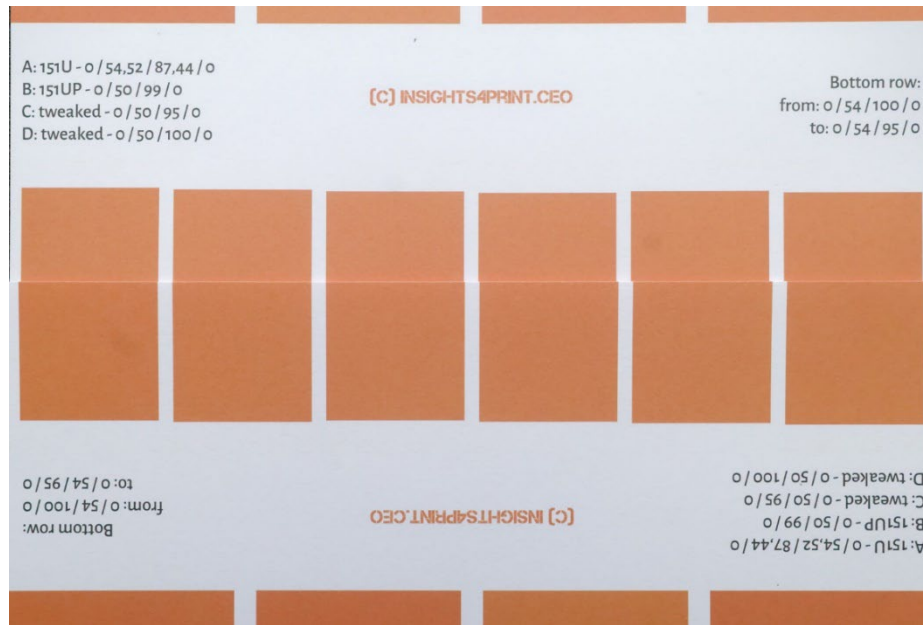
And there is one factor in color perception that a brand owner has complete control over: design elements... A few years ago, Kellogg's redesigned their packages, with large areas of specific colors. Even if the red were precisely the same on all packages, it will look different. Do a search on 'color contrast' and 'color constancy' if you want to know more about this effect.

4: Do small differences matter?

If you think differences of a few delta E would hurt your brand image, remember the test with 6 variations of Coca-Cola red, the most iconic color in the known universe. There was no agreement on the 'right' color, the most popular one wasn't even the right one. It was 4 dE00 away from the right one.

The picture on the right shows Coca-Cola cans in real life. If a different color would hurt sales, would the shop owner place these two different cans next to each other? Probably not...

And I even checked the website of Coca-Cola at that time, to see if there had been complaints and Coca-Cola put information about that in the Frequently Asked Questions, but I found no mention of such complaints...

In another study, with over 100 consumers, they were asked what could influence their buying behavior, what could make them switch from their favorite brand to a competing brand. Color was only mentioned a few times. What does make people switch, is promotions and being out of stock.

In the same survey, the Coca-Cola test was repeated, with similar results as shown above.

If you are a bit confused because you have heard that famous quote that says, 'color enhances brand recognition by 80%', that is from research on the effect of using color in newspaper ads, compared to black/white advertising... Which does make a significant difference. But this is not about tiny color differences. If you want to know more about that, check this article.

Of course, this is no excuse for bad print quality. There are ISO standards that define what acceptable tolerances are. Plus: print quality is about more than just color, there are other print defects that might hurt your brand image much more than a small deviation in color!
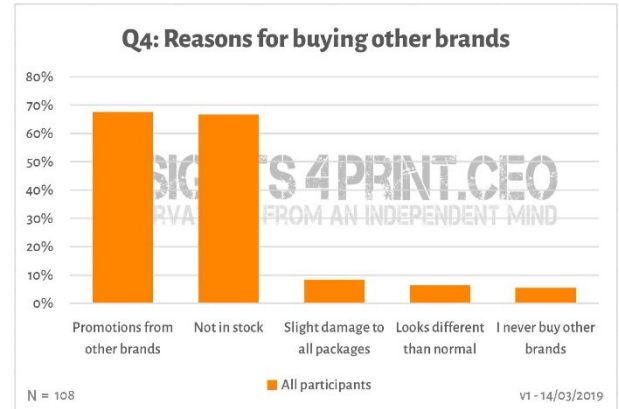
5: Don't forget your monitor!

And a final note on judging color: beware of the monitor you are using! Not every monitor shows the input in the same way. Just go to an electronics shop and look at the TV sets and computer monitors on display. They will probably all show the same TV program, the same computer interface, but I bet all these devices will look slightly, to very different...

5.1: Capabilities

Not every monitor has the same capabilities. Some can show many colors, others not. The typical office monitor can only show a limited amount of color, typically the size of sRGB, or even lower... This kind of monitor can never be used to judge color. In the graph on the right, you can see that part of the colors you can reproduce on coated paper (solid volume) are outside the sRGB gamut (wireframe).

The more expensive monitors that are used in photography, prepress, printing, usually have a much larger gamut. Many of these monitors can show all colors in the AdobeRGB gamut.
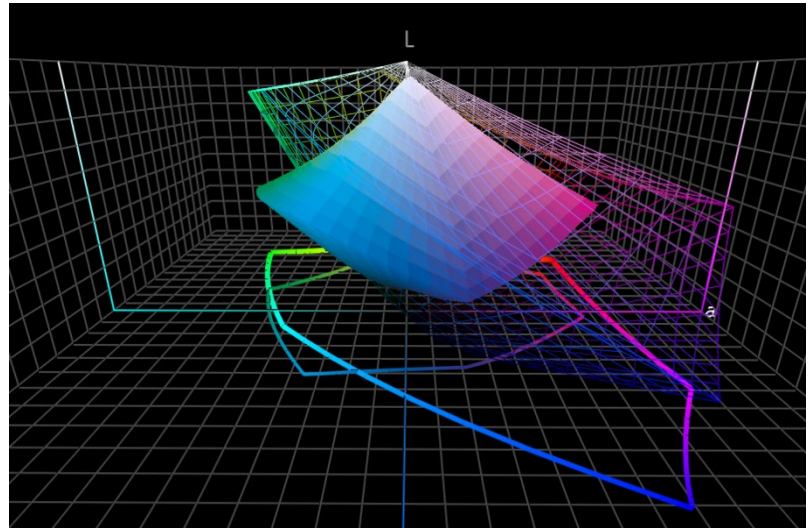
5.2: Calibration, and more

But the capabilities of a monitor is just one aspect. You also need to 'calibrate' it, to make sure that the monitor shows the colors in a document correctly. This is essential if you want to judge color on a monitor.

And even that's not all! Also, the surrounding environment can influence the way you see colors on a monitor. E.g., if you would sit next to a large window with direct sunlight, your vision will be influenced by that sunlight, you won't see the right colors.

More on why a color can look different on your monitor can be found in this article. And here is an article from Paul Sherfield with more about different types of monitors and calibration.

Four different screens showing the same image (two laptops, one tablet, one smartphone).

And that's all, folks!

Now you know how to deal with brand colors the best way possible, in a way that will probably give you fewer troubles.

And please: spread the message! Feel free to distribute this tutorial, but keep it free...

INSIGHTS 4 PRINT.CEO

OBSERVATIONS FROM AN INDEPENDENT MIND