Brand Color Tolerances: A Reality Check

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Abstract

Print quality management has come a long way over the last three decades. Long-time print quality used to be entirely in the hands of the press operator. Thanks to standardization and better tools, print quality and consistency have significantly improved. And so did the expectations, the quality demands. Up to a point where one could question whether tight brand color tolerances like a maximum of 2 ΔE00, often pushed by some technology providers and color consultants, make sense.

The main reasons to question such tight tolerances: are the tools up to the task? Can we be objective about color perception? And, above all, do consumers care? Does anyone outside the print echo chamber care about this kind of deviation? In the printing industry, we like to believe that color is THE decisive element that will convince consumers to buy product A over B. And therefore that the brand color of product A has the be spot on, every time.

Based on several studies, experiments, and surveys, we have to conclude that some of the key tools are not up to the task. Furthermore, humans – especially professionals – are often not objective about color differences. Finally, consumers have a broad tolerance when it comes down to brand colors.

Although very controversial, it's a discussion we need to start.

Introduction

Brands take pride in their brand color, it is part of their identity. Common believe is that consumers won't trust the brand, a product if the color is slightly off. To be able to reproduce the desired brand color consistently, several tools are essential.

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The Tools: Brand color guides

Following tools are needed to get to a minimal tolerance in print (e.g., 2 ΔE_{00}): brand guides that leave no room for interpretation, color measurement tools that can work within tight tolerances, and physical references within tight tolerances.

Let's start with brand guides. These are flawed, Michael Abildgaard Pedersen (2016) has already documented this in his paper 'Why most Brand Manuals fail when it comes to defining Brand Colors; And how to determine acceptable Color Deviations for specific Brand Colors'. [1] (http://i4p.ceo/TAGARef1)

Often brand guides start with a color reference that is not unambiguous. E.g., Belgian telecom provider Proximus uses a hex color as the starting point. [2] (http://i4p.ceo/TAGARef2) Without clarification from which RGB (sRGB, AdobeRGB, …) this is derived, this is very ambiguous.

Figure 1: *The Proximus brand guide*

Many brand guides use a Pantone color as the starting point, but this comes with downsides. First: Pantone does not share the translation of that Pantone color into a science-based color value, unless you subscribe to their Pantone Live service. Second: the physical references can differ. Not only over the years, but even within the same production, more on that later.

Let's take a look at the Red Cross brand guides from three countries: the USA (http://i4p.ceo/TAGARef3A), Ireland (http://i4p.ceo/TAGARef3B), and New Zealand (http://i4p.ceo/TAGARef3C). [3]

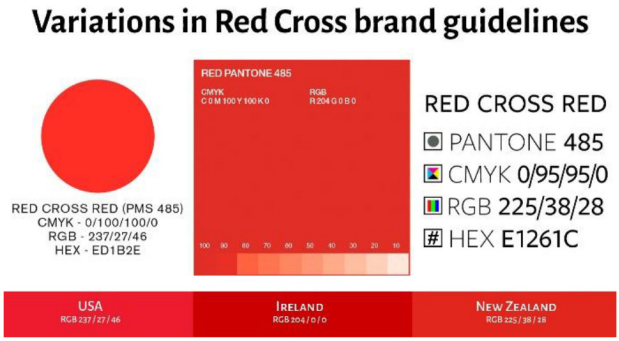


Figure 2: *The Red Cross brand color in the USA, Ireland and New Zealand*

They all start from the same Pantone color, 485, but when translating this into CMYK, RGB and HEX, there are differences, sometimes even significant

differences. The figure above shows excerpts from these branding guides, plus at the bottom the representation of the RGB values specified in these different branding guides.

These RGB, HEX, and CMYK values also differ from those found on the Pantone website for Pantone 485 C. [4] (http://i4p.ceo/TAGARef4)

	Pantone	USA	Ireland	New Zealand
RGB	218 / 41 / 28	237 / 27 / 46	204 / 0 / 0	225 / 38 / 28
HEX	DA291C	ED1B2E	EE2E24	E1261C
CMYK	0 / 95 / 100 / 0	0 / 100 / 100 / 0	0 / 100 / 100 / 0	0 / 95 / 95 / 0

Table 1: *Comparison of the color codes as mentioned in the different brand color guides. Please note that the HEX value for Ireland is not a typo in this table, it is like that in the brand guide.*

In these specifications, these different brand guides, we can identify multiple issues: there is no science-based value as the starting point, there is no reference to which Pantone guide is used, there is no clarification which RGB is used, and the CMYK values don't mention the associated profile.

What could a 'foolproof' brand color guide look like? Here is an attempt, starting with a science-based value, and from that value, the other references are derived. They should not only include print and digital references, but also look at other industries like paint.

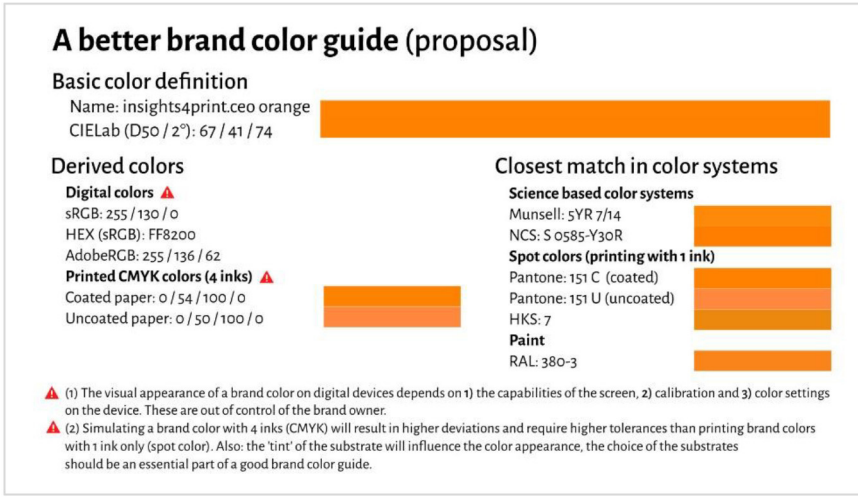


Figure 3: *Proposal for a better brand color guide*

Given the importance of the brand color guide and the need to get it the first time right, the involvement of a color scientist is recommended.

Especially the conversion to CMYK needs extra attention. Next to the conversion that Pantone suggests, you can find dozens of online sources offering conversion values. However: these are often limited in information. E.g., how was de conversion done, which printing condition was used?

An exception is the more print oriented, ICC based and media neutral 'Spot Matching System' by Spot Nordic. All colors of the system, 500 in total, are pre-adapted to CMYK printing on coated and uncoated paper, and next to that also for digital output like websites and TV. Each color is available for printing to all common printing standards, including PSO Coated v3, PSO Uncoated v3 and GRACoL standards. It can even be used for custom color gamuts.

For the example above, the values provided by Pantone were used, except that a 99% was set to 100%, which will provide a better stability.

Next to rounding very high values (e.g., 98 and 99%) to 100%, CMYK conversions with minimal percentages of a color (e.g., 1 and 2%) should get special attention: it is probably advisable to eliminate these. Not only does this improve stability, both within a print run and across printers, it might also give a better visual match. An anecdote from the past: a color consultant had calculated the closest colorimetric match for a specific green brand color, it contained a small percentage of magenta. Both printer and customer were very dissatisfied with the visual result. Eliminating that tiny dot gave a much more pleasing result, although it had a higher deviation from the ideal brand color.

It would probably not be a bad idea to address tolerances in print quality already in the brand guide. Depending on the type of products, the print quality requirements can be quite different: a luxury brand vs. FMCG products with a minimal lifetime. A critical point can be who decides on these deviations: the brand owner, a designer, a color consultant? Or real consumers? The latter is, in my opinion, the best choice: they will later decide whether to buy a product or not. Whether they will trust a specific deviation from the ideal color or not.

The Tools: Pantone Color Guides

Designers and brand owners often rely on Pantone Color Guides to choose a brand color and for the subsequent color quality control. However: these guides themselves have tolerances. These do not represent an absolute truth.

When Pantone released a new set of color guides in 2018, they published an article on these guides' consistency. The original article isn't online anymore, but the link now refers to a 'Color Alignment FAQ' [5] (http://i4p.ceo/TAGARef5), which still has the same information.

With our enhanced products you will appreciate:

- Better overall printed quality
- Tighter tolerances – 90% at a 2ΔE2000 or lower. (Formula Guide Coated)
- Colors better visually aligned to the 2010 Pantone Master Standards
- More tightly controlled, sustainable consistency with every production run

Figure 4: *The Pantone Formula Guide quality description*

With a tolerance set to 2 ΔE_{00}, two color guides could be 4 ΔE_{00} apart (2 ΔE_{00} in the opposite direction) and still be within the tolerance specified by Pantone… Also: about 10% of the colors in the guides are outside that 2 ΔE_{00} tolerance. BTW: do you know which of the colors are outside that 2 ΔE_{00} tolerance?

And this is the theory. In practice, this can be very different. In a small study on Pantone color guides, 21 people provided measurements of 4 different color patches in their Pantone Color Guide: Red 032 C, Blue 072 C, Green C, and 100 C. Below is a graph of the minimum, average and maximum deviation. The reference used for the measurements is the Lab-value derived from Adobe Photoshop for these colors, which is the way Pantone recommends if one doesn't have access to Pantone Live. (you can still participate in this study by submitting your measurements: http://i4p.ceo/my4patches)

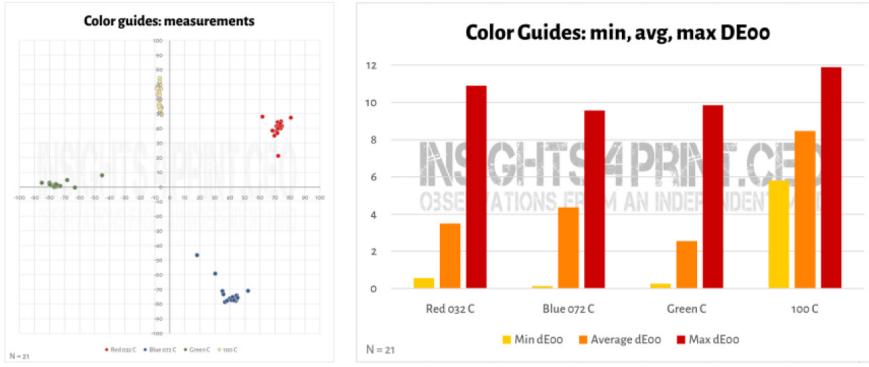


Figure 5: *Measurements plotted in a/b plane and statistics of the deviations found*

It has to be noted that not all color guides were within warranty, which is 12 to 18 months. But even taking into account only the guides that still were within warranty (14 of them), the average ΔE_{00} of all patches is still 4.4; the maximum deviation is 11.4 (compared to 11.9). And only 16 of the 56 measurements (14 guides, 4 patches) were below 2 ΔE_{00}. (full report: https://i4p.ceo/pantone)

This shows that while the Pantone Color Guides might be appropriate for the initial selection of a color, they should not be used in visual assessment of color acceptance in print, although this is a common practice. To be really sure about the 'exact' color, the selected color patch should be measured with a calibrated spectrophotometer.

Figure 6: *in the past different series of Pantone Color Guides could show rather big differences (picture from 2012)*

The Tools: Spectrophotometers

The deviations in Pantone Color Guides shown above could have multiple causes. Deviations in the guides themselves are, of course, a possibility, but deviations in measurement devices – spectrophotometers – could also be a reason, next to human errors.

This was already discussed by John Seymour (2011) in his paper "How well can you expect two spectros to agree?" [6] (http://i4p.ceo/TAGARef6) and his follow-up research.

Whether two devices agree or not on the measured color can be a real issue: suppose the brand owner works with type A from brand X, the printer with type B from brand Y. When measuring the same patch, one measurement could be within specifications, the other outside. This is not a theoretical issue, I've seen it in real life.

Here are the 'inter-instrument agreement' specifications (deviations between two devices of the same type) of several well-known spectrophotometers.

- X-Rite i1Pro 3: 0.4 ΔE_{00} average; 1.0 ΔE_{00} max
- X-Rite eXact: 0.25 dE_{ab} average; 0.45 dE_{ab} max (for M3: 0.55 dEab)
- Myiro-1: 0.3 ΔE_{00} (a quite recent model)

However, these are the tolerances 'right out of the box' and between the same type of device. In real life, these can be much higher. In the first large scale, real life test of spectrophotometers, with both different brands and different types, deviations up to nearly 4 dE_{ab} were found: "A spectrophotometer nightmare" (Hagen, 2008) [7] http://i4p.ceo/TAGARef7). The one with the highest deviation was used in the print room, the optics were covered with dust… Maintenance can be an issue.

Color Vision: can you trust visual perception?

There have been studies in the past to determine which color deviations are visible to people. However, in the context of brand colors: seeing a difference doesn't mean that the color deviation is disturbing. And even more: to what amount would a color difference influence a buying decision?

In 2015 I designed a study executed by a bachelor student, Jens Adriaensen from AP College in Antwerp (Belgium), as part of his internship. [8] He created a package that looks similar to the small boxes of Kellogg's Special K cereal you can see in hotels. Eight different versions of red were created and the boxes were printed alongside an actual production print, on a 4-color press with standard inks. The reference had 0/100/100/0 as red, the others had lower values of Magenta and Yellow, the highest deviation in print was 3.4 ΔE_{00}.

Over 100 people participated in the test, with a nice mix of gender, age, and relation to the printing industry. Eighty percent of the participants claimed to do the groceries at least once a week.

Figure 7: *Setup and samples of color study, courtesy of Jens Adriaensen*

Participants were shown the reference and another sample in a portable light booth. They were asked whether they could see a difference, whether that difference was disturbing and whether that difference would influence their buying decision. All of these were asked on a scale from 0 (no) to 3 (absolutely).

There was one big difference with previous studies on color perception: the test included a sample with an identical color as the reference (< 0.3 ΔE_{00}). And this showed to be very revealing: almost 1 out of 3 'print professionals' claimed to see a difference between the identical samples. A few even claimed to see a big difference between identical samples.

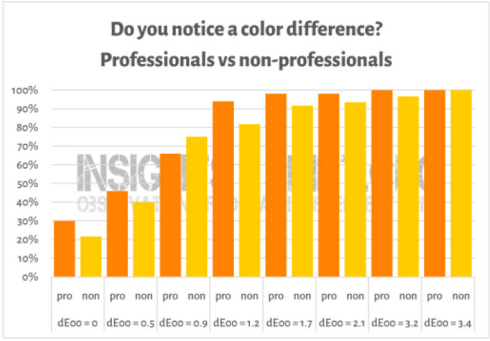


Figure 8: *Print professionals vs Non-professionals*

What could have caused this? Did some participants have some kind of super color vision? Probably it is not linked to color vision, but linked to phenomena known in psychology and behavioral economics: priming and framing. Participants were asked if they could see a color difference, making them look for color differences, even if there were none. With print professionals, the effect was even more prominent: they are color experts, of course they can see color differences! Even huge ones.

This observation made me formulate a theory: 'the uncertainty principle of visual color evaluations' [9] (http://i4p.ceo/uncertaintyprinciple). You can't objectively evaluate color differences if you know that you are judging color differences. This has real-life implications for press checks, we should rethink how we visually evaluate color in print.

Next to the flat samples in the test above, the study also included folded samples, which resembles a shop's experience. And this was even more revealing: when judging folded boxes with a bleeding image, 2 out of 3 participants claimed to see a color difference between identical samples.

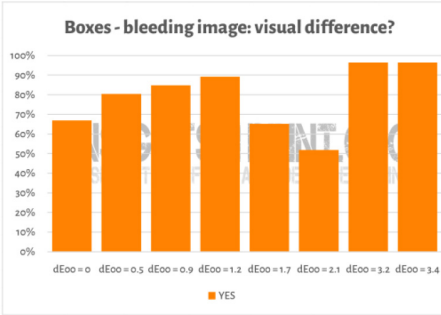


Figure 9: *Visual difference, bleeding boxes*

This graph also shows something very peculiar: two from the samples with a higher deviation got a lower score… What could be the reason for that?

The report by Adriaensen, which is publicly available in the AP Library, mentions the direction of the color deviation of these two samples as the cause. I disagree: if that were the case, we should have seen similar results with the flat samples, which isn't the case (please note that I didn't advise on or review his report, I had to stop working due to a health issue before the end of his internship).

The real reason for the deviation is, in my opinion, the placement of the samples: while it is easy with flat samples to be placed precisely in the same visual plane, this is not the case with folded samples. And a slightly different angle could result in different illumination and viewing angles and, therefore, a different visual perception. And that's what also happens in a store, on the shelves… John Seymour has already described this effect in relation to measurements. [10] (http://i4p.ceo/TAGARef10) But it is not limited to measurements, it also occurs in visual perception, all the time.

The study contained questions about seeing a difference and whether it was considered disturbing, and next to that, whether it would influence buying. The graph below shows the results from the folded boxes with a bleeding image.

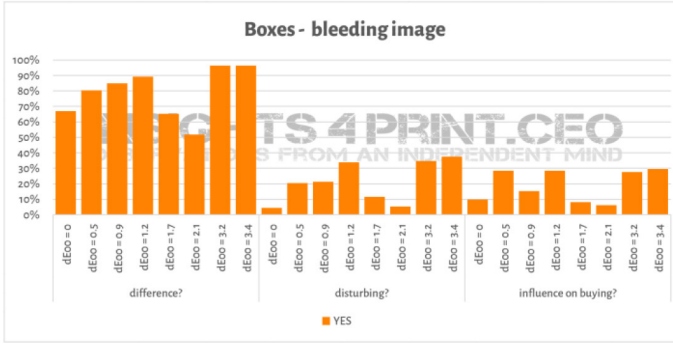


Figure 10: *Bleeding boxes, full evaluation*

As an after-thought: it would have been nice to have excluded the participants that claimed to see a color difference between identical samples. Given the fact that the number of participants that said that the deviations shown would influence buying is much lower than the number seeing a difference between identical copies, all variations might have been acceptable to the 'objective' participants. (full report: https://i4p.ceo/colorstudy)

It is not only priming and framing that can influence the visual evaluation; the way comparisons are set up make a difference. As an example, take the Farnsworth-Munsell 100 HueColor Vision Test. There is a lot of space between, the different hues in the physical test, next to a black border around every patch. When X-Rite launched a more limited online version, with only 40 tiles, (https://www.xrite.com/hue-test), the color patches touched, making the test super easy. In the current version, there is a small black border, making it already a bit harder. But certainly not as hard as the physical version.

A similar situation is a test I designed with different maximum TAC values (320%, 300%, 260%, and 220%). In the printed samples, there was a white border around the images, 1 cm wide. With that border, it's rather hard to see the differences. Cutting away the border and putting the samples on top of each other, they become apparent. But that's not how we see packages in a shop.

Color Vision: can correctly remember colors?

The most iconic color is probably the Coca-Cola brand color. The company claims: "There is no Pantone color for Coca-Cola red, but when you see it, you know it." (http://i4p.ceo/secretformula). And many print experts, color experts will state they know Coca-Cola red. To test the validity of that claim, I designed an online test with six variations of red. All variations were a 'unique' red and the color of a famous brand: Adobe, Coca-Cola, KitKat, Netflix, Target and Vodafone.

What is unique about this test is that the colors were shown in sequence, not next to each other, making it more difficult. But it also resembles real life much more: you don't have a press proof with you in the supermarket.

Less than one in five picked the right color, it was only the third most popular choice.

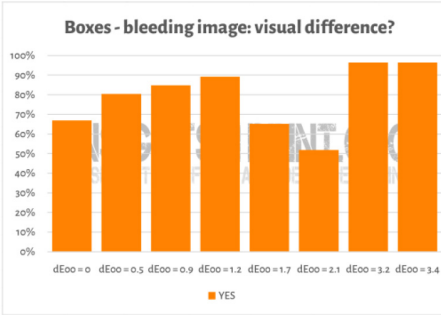


Figure 11: *Iconic color memory test*

Although the test's introduction explicitly stated that the test should be done on a capable and calibrated monitor, only 23% used a calibrated monitor. Even when looking at the 'print professionals', people who should know the importance of a calibrated device, this was still only 23%.

There was only a very slight difference between print professionals and others. The difference between females and males was slightly bigger, but the conclusion was still the same: the right color wasn't the most popular one.

There have been a few scientific studies on color memory outside the printing industry. Two are noteworthy.

The first is by Gi-Yeul Bae (2015) "Why Some ColorsAppear More Memorable Than Others: A Model Combining Categories and Particulars in Color Working Memory" [11] (http://i4p.ceo/TAGARef11). In one part of the study, participants had to pick the color that was the most similar to the 'study color' from a wheel with 180 colors. And this was done in two versions: an undelayed version, where both the study color and the color wheel were visible, and delayed, where the study color would only be visible for a short moment and after it disappeared, the color wheel was shown. The main results show that our color memory is biased towards the color category centers, even in the undelayed test.

The second study, 'Color matching from memory' by Helen H. Epps (2004) [12] (http://i4p.ceo/TAGARef12), is even more revealing. The researchers did an experiment with 40 students, half of them with, half of them without any color-related training. They picked four target colors and for each of these nine 'distractor colors' were created: variations close to the target color. During the test, the participants were shown the target color for five seconds. After that, they had to focus on a white card for five seconds, and then they were given a stack of ten randomly arranged color chips: the target and the nine distractors, and they had to pick the 'right' color from that stack.

Globally, in only 40% of the cases, the right color was picked. That means that in the large majority of cases the right color was NOT picked. The paper only mentions the target and distractor colors, but not the color devation. I calculated the minimum ΔE_{00} for all four targets and the closest distractor, the table below shows these, and the percentage of participants that got it right.

Target color (Munsell)	Min ΔE_{00}	Correct (%)
2.5Y8/8 (yellow)	3.5	73%
7.5YR7/8 (yellow/red)	5.9	35%
10G 6/6 (green)	1.8	13%
5PB 5/6 (purple)	9.8	40%

Table 2: *Results closes distractor color*

The second and fourth color have a quite high minimum color deviation, but even then only 35% and 40% got it right.

Coca-Cola Red: a three-part experiment

Knowing the influence of framing and priming, I did a small, three-part experiment on LinkedIn earlier this year. In a first post, I placed an image of three cans of Coca-Cola with the message: "Any thoughts?". One of the cans had a dent in it, another one had a different color red. Within a few days, it had over 1000 views, but only a handful of reactions (please note that the large majority of my LinkedIn contacts are from the printing industry). A few weeks later, I posted a similar image, asking which color is the right red. The reaction ratio was 5 times higher. Do people only notice color differences when you frame them to look at color? E.g., by asking it explicitly or by putting it in their job description?

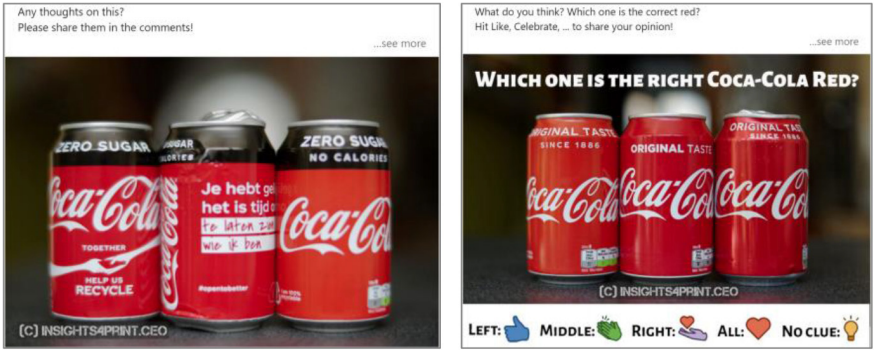


Figure 12: *the first two LinkedIn posts*

The second image was also placed in the LinkedIn group 'Print Production Professionals', with the message: "Since a lot of you are color experts, which one is the right Coca-Cola red?". This framing – "you are color experts" – triggered people to react. Within 24 hours, over 200 people reacted, a week later, that was over 400.

Figure 13: *The third LinkedIn post, in the 'Print Production Professionals' group*

Interestingly: the color experts disagreed on which color was the right one: 23% left, 16% middle, 53% right. But even more surprising: in the comment section there were 4 different Pantone numbers (485; 485 + 10%K; 484; 2347) and 4 different CMYK values (0/100/100/0; 4/100/95/0; 5/100/95/0; 0/100/90/10).

For the record: all three of the cans are genuine. The left can is from a few years ago when Coke red was a bit more towards orange. The middle one is recent. The right one is also recent but printed with transparent ink (on aluminium), while the other two are printed with opaque ink, with a white background (on steel). The visual perception of transparent ink is very different from opaque ink.

Real-world consumers

The experiments above were specifically on color and only related to color, and most participants were from the printing industry. Would it make a difference if the main subject was not color and participants were not from the printing industry?

To test this, a survey on 'shopping behavior' was designed, over 100 persons participated, only 8% had some relation to printing. There was a majority of women represented in this study (71%).

The survey focused on 'brand loyalty': when would you buy another brand than your favorite one?

Figure 14: *Reasons for buying other brands*

Contrary to common beliefs, color deviations ('looking different') play only a marginal role. Even slightly damaged packages usually won't make a difference. It's promotions from other brands and products that are out of stock that make consumers switch brands.

The survey also included the 'Coca-Cola Red' test, this time with the six colors next to each other. And it also included a second question: which ones would you NOT trust.

The question which one is the right Coca-Cola red had more correct answers than in the previous test. Also, many more consumers acknowledged that they didn't have a clue. In the original test, that was just one person.

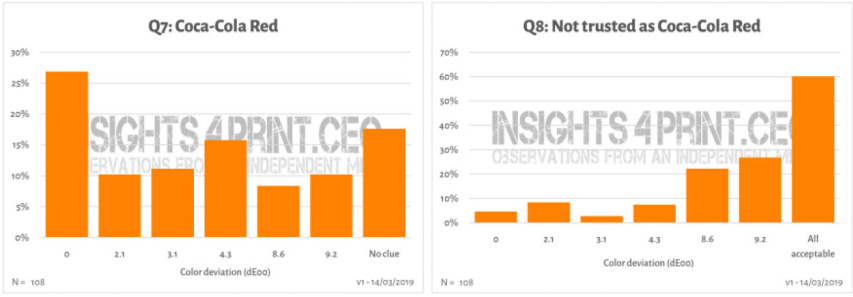


Figure 15: *The 'right' color red and which wouldn't colors be trusted*

It is also clear that most people would trust all variations. The premise that consumers would not trust a package with a slightly different color, a 2 ΔE_{00} deviation is often mentioned, is not founded by these test results.

And what would consumers do when they notice a different color? And how often does that happen?

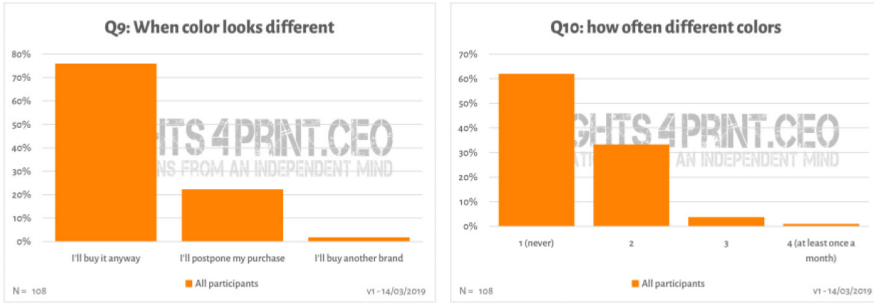


Figure 16: *what happens if colors look different and how often does this happen*

Contrary to common belief in the printing industry, most consumers claim they would still buy the product, and they rarely notice different colors. (full report: https://i4p.ceo/shoppingsurvey)

If consumers would reject products when the brand color deviates, would we have seen such a variation in Coca-Cola red the past few years, as shown below? Would the shop owner have placed the two very different Coca-Cola Zero Sugar cans next to each other? Probably not.

Figure 17: *Color variation of Coca-Cola cans in Belgium over a few years*

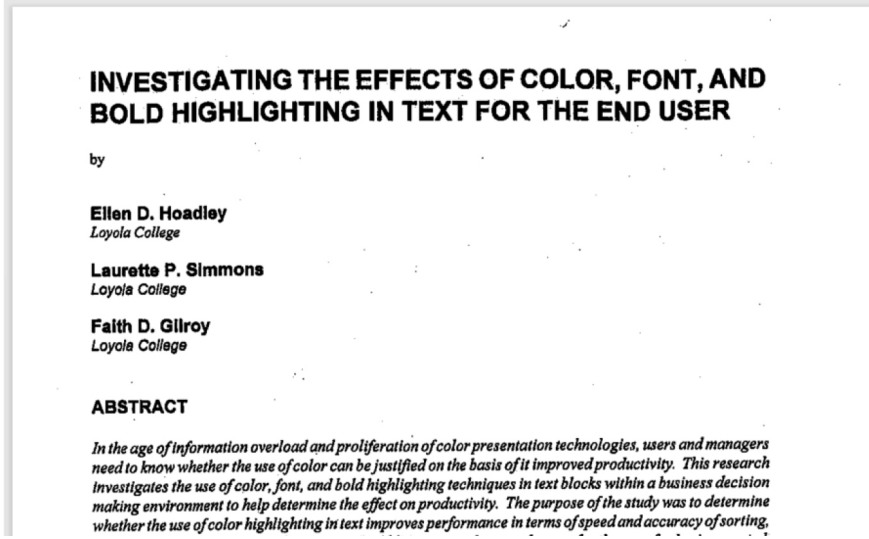
Figure 18: *Two very different versions of Coca-Cola red, next to eachother in a shop*

The importance of color: often cited studies, and some more

When discussing the importance of brand colors, two claims are often used as arguments pro (very) tight tolerances: "Color increases brand recognition by 80%" and "People make up their minds within 90 seconds of their initial interactions with either people or products. About 62-90 percent of the assessment is based on colors alone."

To start with the latter one: this quote comes from the paper 'Impact of color on marketing' by Satyendra Singh (2006) [13] (http://i4p.ceo/TAGARef13). The claim is mentioned in the Abstract, but without reference. Also, in the rest of the paper, there is no evidence to support this claim. I contacted the researcher to find out more about his claim's background, but he didn't reply.

The other claim, also known as 'the Loyola study', is (in)famous. When digging into the history of that quote, the oldest reference is probably a marketing leaflet from Xerox: '20 ways to share the color knowledge' [14] (http://i4p.ceo/TAGARef14). This includes a reference to research by Ellen D. Hoadley. She was so kind to send me a copy of that research: "Investigating the effects of color, font, and bold highlighting in text for the end user" (2000), [15], a follow-up of research from 1990: "Investigating the effects of color", [16] (http://i4p.ceo/TAGARef16). However, these studies are not on brand colors: they are on the effect of color in text and graphs.



INVESTIGATING THE EFFECTS OF COLOR, FONT, AND BOLD HIGHLIGHTING IN TEXT FOR THE END USER

by

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ABSTRACT

In the age of information overload and proliferation of color presentation technologies, users and managers need to know whether the use of color can be justified on the basis of it improved productivity. This research investigates the use of color, font, and bold highlighting techniques in text blocks within a business decision making environment to help determine the effect on productivity. The purpose of the study was to determine whether the use of color highlighting in text improves performance in terms of speed and accuracy of sorting,

Figure 19: *The paper by Ellen D. Hoadley on the effects of color*

There are other studies on the effect of color from that time and before. But all of them are on the effect of color compared to black and white (e.g., 'THE POWER OF COLOR', by Ithaca / TransAct, [17] http://i4p.ceo/TAGARef17). Not on the effect of tiny color deviations, the context in which they are used now. Please keep in mind that in, let's say the year 2000, printing presses, the printing process was absolutely not as accurate and predictable as in 2021. Acceptable color deviations in print were much higher at that time.

A study that is probably far more relevant but lesser-known, is research from 2013 by Jesper Clement (2013): 'Understanding consumers' in-store visual perception: The influence of package design features on visual attention' [18] (http://i4p.ceo/TAGARef18). This study is important since eye-tracking equipment was used during grocery shopping. A few notable quotes: "Physical design features such as shape and contrast dominate the initial phase of searching. (…) We conclude that consumers' first eye contact depends on simple physical design features, meaning features with little semantic content facilitates initial attention. (…) The regression analysis did not find a significant relation for design features like size, typography, brand letters, brand pictures, and color." So it seems that color might be less important than the printing industry claims.

This is also confirmed by Kate Goguen's thesis (2012) called: 'The Influence of color on purchasing decisions related to product design' [19] (http://i4p.ceo/TAGARef19). She concluded: "Both genders agree that quality is not something that would ever be sacrificed for the perfect color." Product quality convinces people, not the color of the package.

Further discussion

There is a need for more studies on brand colors, especially how consumers – not print professionals and color experts – react to differences in brand colors.

It would be nice if the study with both flat and folded boxes could be replicated, including the extra analysis that was not done in that study.

To check the objectivity of participants, all color evaluation studies should include an 'identical' copy, to be able to eliminate those that are unreliable by claiming to see differences between identical examples.

As shown in that same study: the possible influence of the position, a slightly different angle, of folded boxes should be further examined. If the hypothesis that a slightly different position caused the strange results, this could have important implications for products on a shelf. It would mean that even with identical boxes, a slightly different angle would influence color perception and would make it virtually impossible to reach the same color perception for every box on a shelf.

Another influence that has, as far as I know, not yet been investigated is the influence of curvature and shadow on color perception: which color deviation between two different cans (think Coca-Cola cans) is visible for an average person. Small scale experiments have shown that adding even a small distance between two colors makes it more challenging to assess color differences.

The above-suggested studies could be done in a lab. Although more challenging, it would be even more interesting to perform these in a shop, with real consumers that don't have a background in print, and using eye-tracking or other similar technology to be completely objective.

Also, expectations and requirements on deviations in print should become more in line with the technical possibilities: the chain of tool tolerances.

Further study should be done on the ideal brand guide: what information should be included? And how are tolerances defined? When a solid, foolproof design for brand guides is made, it would be nice to transform it into an ISO standard, make it official, and stress the importance of a good brand guide.

And it would be interesting to study the CMYK version of brand colors in more detail: especially whether the closest colorimetric match is also visually the best match. Whether eliminating tiny percentages of a process color provides a more pleasing result or not. The phenomenon is known, but a structural approach is, as far as I know, missing.

Conclusions

Accurate brand color reproduction is big business. It's how printers differentiate themselves over their competitors. It's how technology providers differentiate over their competitors. It's how color consultants make money. The printing industry takes pride in achieving the most accurate brand color reproduction possible. But it's mainly a pressroom echo-chamber discussion… One with several flaws.

The tools we have are not up to these tiny tolerances: brand color guides are inadequate, often highly inadequate. Physical color guides show tolerances in real life that are outside the illusive 2 ΔE00. Measurement devices can show relatively high 'inter-instrument' deviations, relatively high compared to the desired brand color tolerances.

The need for tight tolerances should be questioned: humans can't remember color correctly, we even have difficulties comparing colors. Both the setting and the questions asked highly influence visual color evaluation. Framing and priming will influence a person's color appreciation. A danger for color studies and 'press checks'.

And consumers care much less about brand color variations than print professionals and color experts. They don't mind a package that is a bit off-color. As long as it is their favorite brand and the product quality is guaranteed, it's OK for them. Tests with eye-tracking devices show that shapes and contrast attract us much more than color.

The often-cited studies to justify tiny color deviations either provide no proof for the claims or are taken out of context. Studies about color were about the difference between color and black/white. Or they were about color categories: you will make up your mind quickly if you want a red or a green jacket. Not if you want it to be Pantone 484 or 485.

This is, however, no excuse to produce bad print quality. But print quality is much more than just tiny color deviations. And when assessing color, the applicable ISO standards offer sound guidance and should be followed. They have good tolerances for both deviation tolerances (proof vs print) and variation tolerances (with one print run). They are within reach of every printing company.

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