

Color Evaluation using the Chromaticity CTI Target

October 13, 2003

Introduction

The CTI Target was developed by Chromaticity for the betterment of the color industry at large by providing a free test image for use in evaluating the quality of color reproduction and specifically the evaluation of ICC profiles.

The image is available as a free download from the Chromaticity technical support website: <http://www.chromaticity.com>. The file is a ZIP compressed JPEG image supplied in the ColorMatch RGB color space.

Uses for the CTI Target

The CTI Target is designed as a subjective test of general color reproduction in your workflow. There is no original image available for comparison of color *accuracy*. The intent is to examine the target result for proper color reproduction characteristics. This said however, the image is ideal for creating your own visual standard within your color reproduction workflow. The image can be printed on press to verify good color reproduction for the overall print production workflow and the resulting printed sheets can then be used to judge the color accuracy of on-screen previews in Photoshop or the quality of broadsheet inkjet proofs in pre-press.

How to use the CTI Target

The CTI is supplied as a known “good” digital original. As it moves through your color workflow, the result should be a “good” reproduction. If at any stage of the workflow the reproduction is less than optimal, you have identified a problem area that needs investigation. For our example we will test the quality of the RGB to CMYK separation process to the pressroom.

You can adapt this workflow to meet most any scenario. If you want to try something a bit less involved to get used to the process, simply replace the print process below with an inkjet printer and profile, but remember that an inkjet requires an RGB profile if you do not have a PostScript RIP driving the printer. The process will work just as well with RGB output as CMYK – but keep in mind - many RGB inkjet processes are not designed for professional print production and therefore demonstrate some fairly poor color reproduction with the CTI Target.

STEP 1: Convert the CTI target from RGB to CMYK

- Here we are using Adobe Photoshop with ICC profiles for our RGB to CMYK conversion – but you can use whatever process is specific to your workflow.

- Open the CTI target in Adobe Photoshop – make sure that the ColorMatch RGB profile remains as the assigned source profile. Check this by accessing the Assign Profile feature from the Image->Mode menu.
- Convert the image to CMYK as you would normally in Photoshop – in our case the CMYK settings in Photoshop use our newsprint press profile, the Adobe CMM, the relative colorimetric rendering intent selected and black point compensation applied.
- Save the CMYK version of CTI with a new name and drop it into the normal print production workflow.
- Place the image on a page. Make sure to include take-off bars and gray bars. Plate the image and go to press making sure to observe all the normal production and quality/process control procedures.
- Evaluate the printed target for proper color reproduction.

Evaluating the CTI Target

The following areas of the CTI Target demonstrate general areas of observation for color reproduction problems. There are many additional areas for inspection. When using the CTI Target to compare two separate color results to each other for color accuracy the entire target becomes more important as you evaluate color matching. As you use the CTI image, you will quickly develop your own approach to inspecting color. It is always recommended to view the CTI Target using a lighting system that conforms to the ISO Standard for color viewing in the graphic arts. While suggestions are made regarding potential cause and correction of reproduction failure in each area, specific testing will be required to properly determine how to best remedy individual problems identified in any given workflow. The four portraits are described as Portrait 1-4 from left to right.

Neutral Gray Balance Reproduction:

There are multiple areas on the CTI image where gray reproduction can be evaluated. The five gray patches of the GretagMacbeth ColorChecker target (3) have been digitally manipulated based upon actual spectral measurements of the target itself and should reproduce close to neutral. The grayscale step wedge (5) directly below the color checker is a digitally created neutral RGB scale. It should reproduce as gray. The grayscale mounted vertically along the right side of the image (8) is an actual grayscale in the photo shoot set which should be close to neutral but do not expect it to be perfect. The tin flower can, (14) should appear natural which again means close to neutral metallic gray. The background of Portrait Two (22) should appear neutral but will shift from warm to cool very easily.

Difficulties in reproducing grays can point to any number of reproduction problems. This is why a gray bar is an excellent tool for judging overall print quality on press. If anything is wrong, the gray bar will typically NOT be gray. This is the first thing to check – did the gray bar print gray. If not – here is where you must begin.

You can test the neutral quality of your ICC press profile using ICC Profile Viewer from Chromaticity or X-Rite's ColorShop X software. Poor neutral reproduction in the profile often points to gray balance problems when the profile target itself was printed or to poor black generation choices during the profile building stage of the process.

Image Areas: 2, 3, 5, 8, 12, 14, and 22

Shadow Tone Transition:

All information contained herein is considered the intellectual property of Chromaticity Incorporated
Chromaticity Incorporated Copyright 2003 All Rights Reserved

The tone transition from three-quarter tone to deep shadow tone areas of the CTI target are key indicators of proper black generation settings in the CMYK set-up of your process. Problems in these areas will appear as reversal effects often described as posterization where the shadow transition appears darker and darker then suddenly turns lighter instead of ending in a dark, solid overprint shadow. This can also be described as tone break in the smooth progression of tone from the three-quarter tone to the shadow area. This effect often appears in inkjet CMYK processes where black generation settings are less understood than in more traditional processes. The first place this often appears in the CTI image is in the shadow areas of the blue towel (9). Here the shadow areas will turn gray. A similar effect can occur in edge of the football (4), the bookend (16), the deep shadows around the 8-ball (15) and various places in the Portrait Images (19, 20, 24).

Poor Shadow transition is typically caused from a lack of black ink under the other primaries in the maximum overprint shadow areas. The effect can be a result of process calibration problems as well as poor black generation choices in profile creation. First make sure that the solid ink density of your process is set properly – low saturation of the individual ink channels can lead to this problem. If this looks fine, check the black generation setting of your CMYK set-up. If you are using an ICC profile – test the profile by converting a CIE L*a*b* black-to-white gradient to CMYK in Photoshop and sample the CMYK results, including total ink.

Image Areas: 4, 9, 15, 16, 19, 20, and 24

Shadow Saturation:

Shadow saturation is closely linked to shadow tone transition. Often the two problems are related to the same cause. Shadow saturation specifically relates to poor strength of the shadow area without necessarily the evidence of a tone reversal or break in the tone transition. The same areas noted for shadow tone transition will demonstrate saturation problems as well. The shadow areas of the blue towel (9) will be gray instead of black. A “trick” area of the CTI is the background of Portrait 1 (20). This image contains digital artifacts (big square image blocks) that will only appear when the shadow saturation is too low or the black ink density and/or total ink limit settings are not optimal.

Poor Shadow saturation is typically caused from a lack of black ink under the other primaries in the maximum overprint shadow areas or from a very weak black ink density under these same areas. First make sure that the solid ink density of black ink is set properly. If this looks fine, check the black generation setting of your CMYK set-up. If you are using an ICC profile – use the LAB gradient test described above to analyze the profile

Image Areas: 9, 15, 16, 19, 20, and 24

Overall Tonality and Detail

Proper tone transition ensures smooth blends in the subtle areas of the CTI image while also providing the right amount of detail in critical highlight and shadow areas. There are many areas in the CTI target to inspect for proper tonality. Make sure that no banding of tones or colors (sometime called the rainbow effect) in more neutral tone shifts that occur in the linen cloth (10), white scarf (12), the tin can (14) and the background of Portrait 2 (22). Look for smoothness in the cloth transitions as well (1).

Poor tonality can also be identified by a lack of tone differentiation in the highlight or shadow areas. This can be shown in lack of separation between patches in the gray scales (2, 5, 8). Highlight tone detail should appear in the patterns on the white tile (17). Also look for color difference in the pastel clay blocks. Shadow details should appear in the black hair in Portrait 1 (19) and in the depth of the shadow boxes (6).

Problem areas in tonality will also appear as obvious tone breaks when a single primary color exhibits poor tone transition in comparison to another. This is very evident in skin tone transitions. When yellow and Magenta are not set-up with consistent tonality to each other, tone breaks in the flesh-tones will appear quickly in Portraits 2, 3 and 4 (21, 23, 25).

Lack of detail or smooth transitions in any of these areas can require a more optimal compensation for tone value increase or dot gain on press, inadequate separation settings for your print process, or an investigation of the quality of your film and plate making. Some tones in the highlight or shadow areas may be purposely sacrificed due to the nature of the newsprint print process, but a better understanding of your process will enable you to get the most out of your production no matter the limitations.

Image Areas: 1, 2, 5, 6, 8, 10, 12, 17, 19, 21, 22, 23, and 25

Over-Saturation

Some colors in the CTI target are purposely well beyond the ability of almost any print production process to reproduce. A good test of your production process is to evaluate how well the tonality of these areas remains intact when they are moved into a more printable color range. Poor reproduction of over-saturated color will result in flat, often dirty color with no tone detail. The red cloth is often out of gamut for print (1) along with the more obvious fluorescent clay bricks (11) and the plastic green frogs.

Your ability correct problems of this nature will be dependant on the flexibility of your color toolset. Often the CTI target simply helps us to better understand this problem, which in turn allows us to know when custom image editing might be required.

Image Areas: 1, 11

Specular Highlight

Specular highlights should always reproduce without any CMYK dots. In newsprint this “drop-out” area become much more important when the color of our newsprint is further from “white.” The reflection off the chrome fishing lure (7) should absolutely be empty from CMYK dots. You may find other areas as well, in which you hope to dropout any printable areas.

Image Area: 11

Hue Shift

When using the CTI image to evaluate a color match between two reproduction processes there are a few key areas to investigate that will typically shift color very easily. These color are typically the overprint red, green and blue areas of the print, but some less obvious areas are good to look at as well. The blue towel and bottle are notorious for shifting towards purple (13, 9). The various colors in the GretagMacbeth ColorChecker (2) are good for evaluation color shift. Reds are often difficult – especially when out of gamut – as we find in the red cloth (1). Make sure to evaluate the clay bricks (11) and the pastel chalk (18). As always skin tones are important color indicators in Portraits 1-4 (20, 21, 23, 25). The inclusion of the HCT Scanner (3) (Hutch Color Target) Target is a good way to evaluate color back to a known original even if your target is slightly different from the one used in the photo shoot.

Image Areas: 1, 2, 3, 9, 11, 13, 18, 20, 21, 23, and 25

Evaluating Color with the CTI Target



Neutral Gray Balance Reproduction

areas: 2, 3, 5, 8,
12, 14, 22

Shadow Tone Transition

areas: 9, 15, 16,
19, 20, 24

Shadow Saturation

areas: 9, 15, 16,
19, 20, 24

Overall Tonality and Detail

areas: 1, 2, 5, 6, 8,
10, 12, 17, 19, 21,
22, 23, 25

Over- Saturation

areas: 1, 11

Specular Highlight

area: 7

Hue Shift

areas: 1, 2, 3, 9,
11, 13, 18, 20, 21,
23, 25

