

Colorimetric analysis of color image reproduction

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Introduction

Color image reproduction, as shown in Figure 1, is typically analyzed by means of visual judgment, and not by quantitative means. With the use of test targets, this lab is designed to analyze color image reproduction colorimetrically and to correlate such findings with visual perception.

Objective

This is a study to illustrate how ICC color management can be applied from scan to print using perceptual rendering. Colorimetric analysis of IT8.7/1 reproduction is used for grayscale and hue reproduction.

Resources

1. Scanner profiling software: GretagMacbeth ProfileMaker
2. Test image : IT8.7/1 target and photographs by Donna Crowe

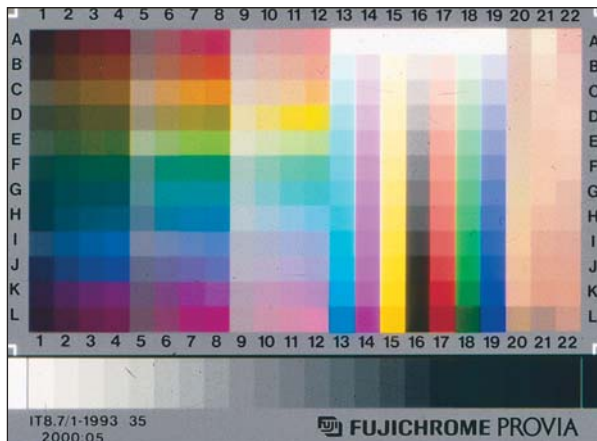


Figure 2. IT8.7/1Target

Procedures

1. Preparation

An IT8.7/1 target by Fujifilm is scanned along with the pictorial images on a Nikon Coolscan slide scanner. Scanner ICC profile is built using GretagMacbeth ProfileMaker 4.0.

2. Press Profiling

The output profile was created by printing the GretagMacbeth

profiling target on the Heidelberg M-1000B press. The printed target is then measured on the GretagMacbeth Spectrolino Spectroscan. The printer ICC profile is created using GretagMacbeth ProfileMaker using perceptual rendering.

3. Application of Profiles

After opening the raw RGB files in Photoshop 7.0, the Image was assigned Nikon Scanner ICC profile. The second step is to convert the image from the assigned RGB space to Heidelberg M-1000B CMYK space via "Convert to Profile". Adobe CMM with perceptual rendering was used in the conversion.

Analysis of tone and color reproduction

The colorimetric analysis procedures used were first published in a paper by Irving Pobboravsky and others (ISCC Proceedings, 1971) of which three different methods of tone and color analysis were performed as shown in Figures 3, 4, and 5.

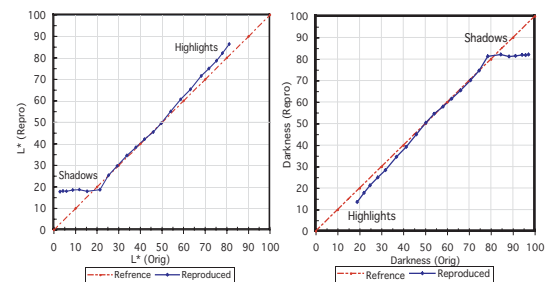


Figure 3. (a)Tone reproduction of $L^*(orig.)$ vs. $L^*(repro.)$
(b)Tone reproduction of Darkness (orig.) vs. Darkness (repro.)

Tone reproduction can be studied by plotting L^* of the gray scale in the Fujichrome original against L^* of the gray scale in the press sheet. Alternatively, it can also be studied by plotting the darkness of the original against the darkness of the reproduction. The latter is similar to using a density scale: the highlights of the tonal scale are in the lower left corner, the shadows are in the upper right corner (figure 3b).

Figure 3 shows that the dark steps were clipped in the reproduction. All other steps were reproduced at the correct lightness.

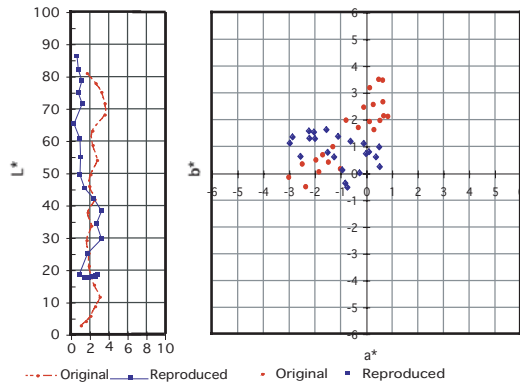


Figure 4. Colorimetric analysis of neutrality

Figure 4 shows that the gray scale steps remain the same as the original, they did not change hue or chroma in the reproduction.

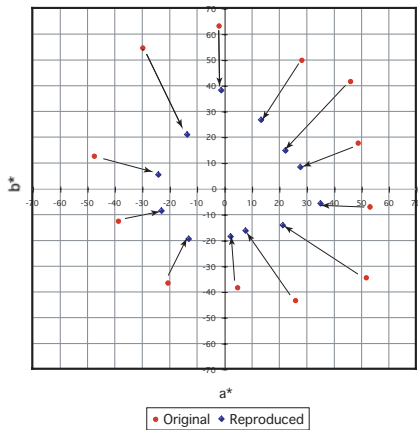


Figure 5. Hue reproduction

Using the data of column 8 of the IT8 7/1 target (fig. 2), the graph in Figure 5 shows that the hue angles were preserved and there was some gamut compression indicating a reduction of chroma.

Discussion

Visual and colorimetric analysis agree that there was no hue shift and that the dark colors were clipped. In theory perceptual rendering should not clip. To find out what happened, colorimetric rendering was also tried but it gave the same results. Therefore there is a question whether the profiling software really differentiates between perceptual and absolute colorimetry rendering.

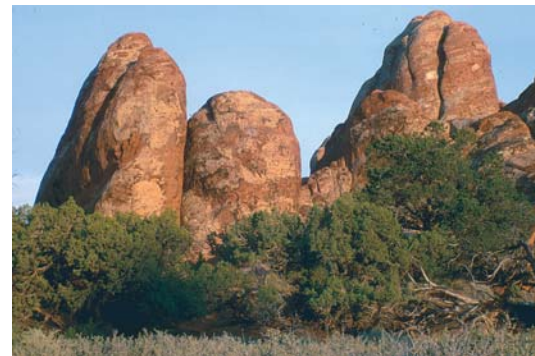


Figure 1. Samples of color managed reproduction.

Reference

The Relation Between Photomechanical Color reproduction and the Original Copy by Irving Pobboravsky, Milton Pearson, and John A.C.Yule, *ISCC Proceedings*, 1971.