Color matching comparison between generic and custom press profiles

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Objectives

It is not clear whether or not there is an advantage for using custom-built press profiles over generic press profiles. If there is no significant difference in color matching performances between a generic and custom-built profile, then a custom profile is not worth the effort to build. For determining the value of creating a custom profile, this study evaluated color gamut (A-to-B) differences between the generic profile (U.S. Web Coated SWOP) and the custom-built profile (Heidelberg M-1000B). Furthermore, the accuracy of color-matching (B-to-A) performance of the generic and custom-built profiles was compared on three a*b* slices, L*30, L*50 and L*70.

Resource

1. Press profiles: generic press profile (U.S. Web Coated SWOP) and custom press profile (Heidelberg_Oct_18_02.icc)
2. Test targets: a*b* slice test targets (L*30, L*50 and L*70). The color charts are defined by CIELab color space. The range of the color swatches goes from a* -100 to 100, and b*-100 to 100.
3. API: Adobe Photoshop 7.0.1
4. Profiling software: GretagMacbeth ProfileMaker 4.1.1
5. Data analysis: Gretag SpectroScan and Excel template "F_ab_slice(v1.0).xls." CIE ΔE76 was calculated to show color differences between source data and the press output.

Procedures

1. Press profiles

   Use USWebCoatedSWOP.icc as a generic profile. Using GretagMacbeth ProfileMaker 4.1.1, create a custom profile for Heidelberg M-1000B web press from the Oct. 18, 2002 press run. The press run was adjusted to SWOP specifications.

2. Color gamut evaluation

   ProfileEditor 4.1.1was used to evaluate the difference of color gamut between the generic profile and the custom profile.

3. Color-matching performance evaluation

   Generic and custom profiles were used in Photoshop 7.0.1 to convert the original a*b* slice files to CMYK files. All the targets were printed on the Heidelberg M-1000B web press. Gretag SpectroScan was used to measure L*a*b* values of each printed a*b* slice target. The "F_ab_slice(v1.0).xls" Excel template was used to evaluate color matching performance between generic profile and custom profile images.

Discussion

1. Color gamut comparison

   The colors defined in the a*b* slices cover the whole range of CIELab space (Figures 1, 2 and 3). However, those colors, lying outside of the press gamut, would be either clipped or rendered faithfully under absolute colorimetric intent.

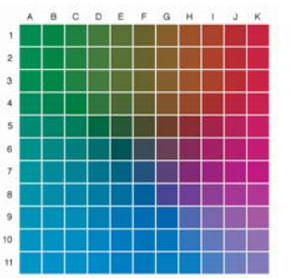

Figure 1. L*30 a*b* slice target embedded with the custom profile, Heidelberg M-1000B_Oct_18_02

Figure 2. L*50 a*b* slice target embedded with the custom profile, Heidelberg M-1000B_Oct_18_02

Figure 3. L*70 a*b* slice target embedded with the custom profile, Heidelberg M-1000B_Oct_18_02

The gamut boundaries of the custom and generic profiles are showed in Figures 4, 5 and 6. There is not much difference between each other because both profiles were calculated for SWOP condition. Therefore, we do not expect much difference between them.

2. Color-matching performance comparison

The color difference observed in tables 1 and 2 shows the difference between two printing conditions, Heidelberg M-1000B press and SWOP press. The SWOP generic profile was calculated from an average of several carefully controlled SWOP runs. Custom profile was calculated from our condition and it compensates for the fact that our process was within SWOP tolerance but not exactly at SWOP aim. (Figure 7)

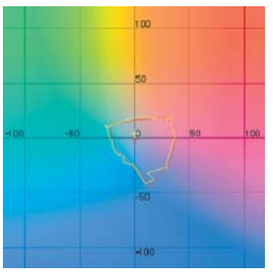

Figure 4. Gamut boundary comparison on L*30. (Yellow line -generic profile, red line - custom profile)

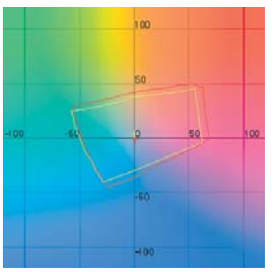

Figure 5. Gamut boundary comparison on L*50. (Yellow line -generic profile, red line - custom profile)

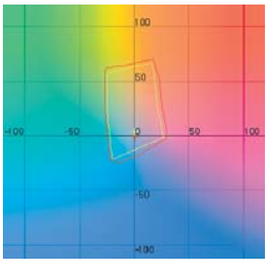

Figure 6. Gamut boundary comparison on L*70. (Yellow line -generic profile, red line - custom profile)

In table 1, only reproducible colors were used for color matching evaluation. In table 2, pairs of neutral color (a*=0 and b*=0) swatches were compared. Generally, the generic profile resulted in less reproducible color samples, higher ΔEs and higher a* values. By applying the custom profile, ΔE values dramatically decreased and color accuracy improved.

In conclusions, a precise printing system can achieve better color matching performance via correct custom device profiles.

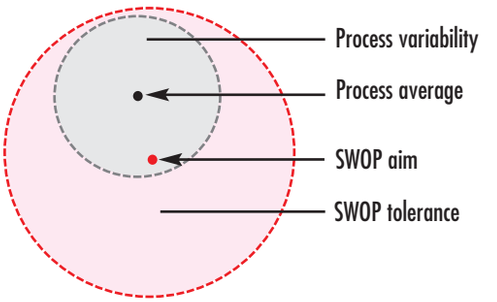

Figure 7. Concept of process variability and specifications

	L30		L50		L70	
	Generic	Custom	Generic	Custom	Generic	Custom
Samples	**9**	**13**	**19**	**20**	**10**	**12**
Min.	4.2	3.4	1.5	1.9	2.6	0.8
Max.	7.4	8.8	9.1	5.2	8.4	4.5
Ave.	6.1	5.5	5.5	3.5	5.1	2.6

Table 1. ΔE comparison (all colors inside the gamut boundary)

Aim point	L*=30	a*=0	b*=0	ΔE
Generic	31.75	5.76	-0.47	6.04
Custom	32.41	-0.08	-2.43	3.42

Generic Custom

Aim point	L*=50	a*=0	b*=0	ΔE
Generic	51.04	4.88	-0.28	5.00
Custom	51.33	1.27	-2.30	2.94

Generic Custom

Aim point	L*=70	a*=0	b*=0	ΔE
Generic	72.44	4.18	-2.00	5.24
Custom	71.74	1.45	-0.34	2.29

Generic Custom

Table 2. ΔE comparison (neutral colors)