

for Affiliates this month in Center research:

Variation in Premedia Color and the Potential Automation of Imaging Tasks

The affordability of software-based production tools has enabled the decentralization of premedia (prepress) services to creative professionals, advertising agencies and other imaging professionals. This has introduced an increase in variation of the quality and characteristics of color files submitted for print production. The lack of industry standards and specifications for most of the steps leading up to proofing is another factor extending the range of general practices. This month's research monograph, *Variation in Premedia Color and the Potential Automation of Imaging Tasks* by Michael Riordan, PICRM-2005-05, seeks to gain insight into the impact of variations in premedia imaging tasks related to color reproduction.

The research sample consisted of 27 U.S.-based companies comprised of 11 creative services providers (design firms, ad agencies, publishers) and 16 premedia and print services providers. Data was collected in several key areas:

- software color setting preferences,
- RGB and CMYK workflows,
- color correction workflows,
- use of color profiles,
- color proofing strategies,
- division of tasks between creative and premedia services,
- chargeable operations, and
- general comments about the process.

Color Imaging Workflows

Workflow typically begins with a creative professional trying to interpret the needs and interests of a specific client. Prepress/print production professionals then apply more technically-oriented changes to files in preparation for final print production. Industry professionals on both sides of this workflow benefit when the communication of specifications and expectations are clear and easy to understand.

The survey data collected indicated that, based largely on the different strengths of creative and technical service professionals, the approaches of each population to specific color management-related tools and workflows resulted in a high potential for color variability. Most creative professionals in this study take a "hands-off" approach to color management, leaving final color adjustments and proofing to the premedia and print services providers that follow them in the production sequence.

Creative Services Providers

Creative professionals use a variety of tools and techniques during the early stages of production and, because their

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emphasis is on creating good design, specific technical considerations are often de-emphasized in favor of more aesthetic considerations. For final color decisions, nearly all the participating design firms openly expressed a reliance on the expertise of the prepress professionals that receive their files to make corrections as necessary. Most also stated that they had a short list of preferred print services providers that they relied on regularly.

Several designers noted that they routinely rebuild digital work received from an art director, often from the ground up. This trade practice may seem redundant, but it actually illustrates the critical balance of the creative and technical components that are needed for successful file generation. The technical components that most influence color reproduction include:

- the setting of color preferences in specific software applications,
- the synchronization of color preferences between applications, and
- the handling of color profiles for images and layout files.

Nearly all creative participants surveyed left the color preferences ("settings") for each specific software applications at the manufacturer's default. The new Adobe Creative Suite (CS) 2, introduced during the period of time this research was conducted, provides a common default using sRGB and SWOP CMYK as preferences for all Adobe applications. Files created under this default, however, may have marked differences from files created using the North American Prepress default (formerly called the U.S. Prepress Defaults), which uses the broader gamut AdobeRGB, the RGB space endorsed by the International Prepress Association and the default for the current version of QuarkXPress.

The selection of these color settings influences both the rendering of specific colors in an image file and the operator's handling of existing embedded files. For example, opening an image file with an AdobeRGB profile embedded from Photoshop would result in a window warning of a profile "mismatch," and asking the operator whether to preserve, convert, or discard the profile. On the other hand, opening an image file created using Adobe CS2 defaults would leave the embedded profile preserved without any operator interaction or choice.

A slight majority of creative participants indicated that they preferred to work in CMYK (over RGB) for print work. Many of those preferring RGB converted their files to CMYK prior to sending them out to a prepress or print services provider. However, there is a lack of clear standards for handling RGB profiles, and a conversion from two different RGBs to the same CMYK profile will give different results. So, although all files may be embedded with the SWOP CMYK profile, they may still vary in the amount and type of color correction necessary to compensate for earlier decisions relating to the RGB profiles.

There was an overall agreement that accurate proofing was generally lacking, forcing creative firms to rely on the print services provider to generate color-accurate proofs. All firms expressed an interest in better low-cost proofing alternatives, particularly soft-proofing options.

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About the Center

Dedicated to the study of major business environment influences in the printing industry precipitated by new technologies and societal changes, the Printing Industry Center at RIT addresses the concerns of the printing industry through educational outreach and research initiatives.

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Providers of Premedia and Print Production Services

The nature of the premedia function is to prepare files for output; the slogan of one printer's premedia department was: "Anything you want to throw at us—we will make it work!" Premedia professionals see their role of file and color correction specialists as critical to their business, regardless of whether they explicitly charge for the service or not.

The most common file issues that premedia professionals see involve:

- mixing of RGB and CMYK files,
- insufficient resolution,
- no bleeds (typical on PDFs), and
- issues with the use of spot color.

Most of the premedia services providers in this study customize the color preference settings in their software to better match industry trade standards and/or in-house specifications. The specific RGB and CMYK color profiles they set determine the numeric values used for color correction and color specification within software. For example, within Photoshop, selecting AdobeRGB instead of sRGB as a default will result in variance of the CMYK numbers that appear in the Info Palette and Color Picker. Since 100% of the premedia services providers polled indicated that they do color correction "by the numbers," the deviation by varying profiles can be significant.

A surprisingly large percentage of premedia participants noted that they routinely discard embedded profiles of incoming image files. These participants were quick to explain that they do so because most of their customers do not understand color management, and the profiles embedded are often embedded in error or without the customers' knowledge. They maintained that the files are just as easy or easier to correct under these conditions.

In terms of RGB versus CMYK workflows, most premedia participants said they routinely accept both file types but generally prefer CMYK. For files that are already converted to CMYK by customers, participants were split as to whether they convert the existing CMYK (assumed to be SWOP CMYK) to the specific press CMYK profile, or discard the embedded profile in favor of reassigning the image file to their preferred CMYK. The difference in these two practices can result in a significant variation in the resulting output.

Technical Analysis of Color Differences

Based on the variations in color workflow cited from the data collected, a series of tests were conducted to quantify the visual impact of the various specific color workflows. Using an L*a*b* version of the MacBeth ColorChecker as the original, a series of tests were conducted where files were converted to specific RGB and CMYK profiles and then converted and/or reassigned to other RGB and CMYK profiles. The color variation that resulted was tabulated to derive the relative color difference (expressed as ΔE^*_{00}).

The analysis showed that many generally accepted trade practices, observed during the study, produced very significant

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visual and measured variance in the resulting color reproductions. The trade practice of converting all files to a common working space gained credence as the tone and color of the pictorial files converted from the larger AdobeRGB gamut down to the smaller sRGB gamut remained nearly identical in appearance to the AdobeRGB-based reference.

In contrast, the color shift observed by discarding embedded profiles at the image editing stage was significant. (See Table 1.)

Table 1. Difference from assigning sRGB profile

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	ΔL^*	Δa^*	Δb^*	ΔC	ΔE^*_{90}
Orange #7	-3.0	-9.0	-9.0	-12.17	4.76
Blue #13	1.0	-1.0	0.0	-0.32	1.01
Green #14	1.0	12.0	-1.0	-9.22	5.09
Red #15	-5.0	-9.0	-38.0	-29.64	16.78
Cyan #18	2.0	12.0	4.0	10.63	6.13
Neutral #20	0.0	0.0	0.0	0.0	0.0
Neutral #22	0.0	0.0	0.0	0.0	0.0

The magnitude of variation when converting from different RGB profiles to the same CMYK profile can be seen in Tables 2 and 3.

Table 2. Pantone 165C (orange) measurements (RIT orange)

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	L^*	a^*	b^*	ΔC	ΔE^*_{90}
Reference	63.0	61.0	75.0	-	-
AdobeRGB Photoshop	63.0	61.0	75.0	0.00	0.00
Default Photoshop	62.0	60.0	72.0	-2.95	1.18
AdobeRGB Illustrator	69.0	67.0	82.0	9.22	5.15
Default Illustrator	68.0	37.0	54.0	-31.21	8.68
AdobeRGB InDesign	67.0	40.0	66.0	-19.50	8.32
Default InDesign	67.0	33.0	68.0	-21.09	12.20
QuarkXPress	66.0	77.0	81.0	15.08	5.37

Table 3. Pantone 1675C (burnt umber) measurements (RIT brown)

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	L^*	a^*	b^*	ΔC	ΔE^*_{90}
Reference	41.0	44.0	48.0	-	-
AdobeRGB Photoshop	41.0	44.0	48.0	0.00	0.00
Default Photoshop	41.0	44.0	48.0	0.00	0.00
AdobeRGB Illustrator	49.0	60.0	64.0	22.61	9.14
Default Illustrator	53.0	32.0	38.0	5.68	27.13
AdobeRGB InDesign	50.0	34.0	54.0	0.34	10.28
Default InDesign	49.0	34.0	55.0	-0.45	10.67
QuarkXPress	44.0	58.0	56.0	15.51	5.21

Spot-to-process conversions done in different software applications or under different color settings produced more variations. While the impact of these variations will significantly impact CMYK proofing and CMYK-only output systems, the variations will also affect color communication and the color expectations of customers who view them in any form.

Conclusions

The study verifies that there are both great discrepancies in “acceptable” workflow practices among professionals in premedia services and, by extension, great opportunities for improved efficiencies. A more comprehensive study that analyzes specific groups based on market applications would be required to obtain a more meaningful analysis of trends and opportunities by market.

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