

# Variation in Premedia Color and the Potential Automation of Imaging Tasks

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A Research Monograph of the  
Printing Industry Center at RIT

No. PICRM-2005-05



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March 2006

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The research agenda of the Printing Industry Center at RIT and the publication of research findings are supported by the following organizations:



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## Executive Summary

To gain insight into the impact of variations in premedia imaging tasks related to color reproduction, a cross-section of creative and premedia professionals were interviewed. The data collected indicated that, based largely on the different focus of creative and premedia service professionals, the approaches of each population to specific color management-related tools and workflows resulted in a high potential for variability in color reproduction. While these results were somewhat expected, several clear trends into how those approaches were different indicate specific areas for possible improvements in production efficiencies and color consistency.

The primary objectives of this research were to:

1. Identify the standard operating procedures impacting color image processing in-place for a sample set of commercial print shops, publishers, design agencies and other media producers.
2. Analyze the specific image operations identified to quantify the visual impact of variance in operating procedures between production environments.
3. Evaluate results to determine optimal image processing workflows (“best practices”) for specific applications.
4. Correlate results to indicate imaging operations best suited for automation and/or integration in to JDF-compliant workflows.

The research sample consisted of 27 U.S.-based companies comprised of 11 creative services providers (design firms, ad agencies, publishers) and 16 premedia (prepress) and print services providers. Data was collected via a combination of surveys, interviews, and on-site direct observation. Interviews were conducted in-person, by phone, and via email correspondence and, relative to the research questions posed, provided the bulk of meaningful data collected.

Through the data collection, questions focused on the decision-making process and specific software settings that impacted color rendering of images through the premedia workflow. A great deal of information was gathered regarding color management policies and other general image processing tasks, but obtaining very detailed information about other imaging operations (e.g., tone reproduction, color correction methods, etc.) proved inconclusive.

Data collection varied in approach but focused on several key areas: (1) software color setting preferences, (2) RGB and CMYK workflows, (3) color correction workflows, (4) use of color profiles, (5) color proofing strategies, (6) division of tasks between creative and premedia services, (7) chargeable operations, and (8) general comments about the process.

Analysis of the research revealed the following key findings, summarized below.

### 1. Current Issues, Challenges and Trends in Color Workflow

- Overall, there was significant disparity between the specific workflow processes of creative and prepress/print production professionals that participated in this study.
- Many of the differences between the workflow procedures had a significant impact on color reproduction characteristics and predictability.
- Most variances in workflow practices were the result of different understandings of the technical implications of specific “acceptable” practices.

### 2. Creative Services Workflow Processes

- Most creative professionals put little focus on color setting preferences and other color management-related policies and actions, favoring default software settings for most applications and a general “hands-off” approach to color management.
- Most creative professionals left final color adjustments and proofing to the prepress and print services providers that followed them in the production sequence.

### 3. Premedia Services Workflow Processes

- While more standardized procedures were common among prepress and print services professionals, specific standard operating procedures (SOPs) and the understanding that underscored them varied.
- Most prepress and print services professionals saw their role of file and color correction specialists as critical to their business regardless of whether they explicitly charged for those services or not.

### 4. Technical Analysis of Color Differences

- Technical analysis revealed that many of the generally acceptable trade practices observed during the study produced very significant visual and measured variance in the resulting color reproductions.

It is important to note that the relatively broad spread of companies that participated in this study limits the relevance of the data analysis to more distinct populations. A more comprehensive study that analyzes each group based on market application would be required to determine specific trends and opportunities by market.



## Introduction

The affordability of software-based production tools has enabled the decentralization of premedia services to creative professionals, advertising agencies, and other imaging professionals. The dispersion of the production process that has followed has introduced a natural increase in variation in the quality and characteristics of files submitted for print production. Many of these files are submitted as “print-ready” but a significant number of others may require significant work before they meet a client’s approval in the form of an acceptable proof. While these changes may be necessary to obtain the go-ahead for print production, there is some disparity in determining how much of the file correction time is chargeable back to the customer. For many printers, the decision of what constitutes chargeable time may be quite different from what should constitute chargeable time, the final decision being a balance of managing expectations to ensure client retention in the face of the increasingly narrow margins in print production.

The range of skills, knowledge, and practices of the diverse professionals participating in components of the premedia production introduces variation by its very nature. The lack of industry standards and specifications for most of the steps leading up to proofing are another factor impacting the range in general practices.

The 2004 TrendWatch report on Color Management showed that, as of the 2003 survey conducted, 71% of printing companies reported that they used standard operating procedures (SOPs) in premedia activities relating to color reproduction. Though TrendWatch showed an increase in the SOP usage for publishers and design firms, the reported utilization of SOPs was only 33% overall. The increasing trend in utilization of SOPs is encouraging, but there is little available data quantifying that the SOPs of printers, publishers, and design firms are the same SOPs or produce the same results.

TrendWatch reported that the implementation of color management followed suit with nearly two-thirds of printers reporting using some form of color management, but “more than half of the firms that say they *do* use color management say that simply ‘eyeballing’ jobs is their primary means of color management.” According to the same report, about two-thirds of design firms and publishers do *not* use color management technology overall. Magazine publishers are slightly above average at 40%.

Factors influencing the creation of SOPs for color image reproduction would include the standardization of communications and image editing practices. Image-related adjustments requiring standardization would include the handling of resolution and tone and color adjustments and “soft-proofing.” The recent shift in workflow to include RGB-based image editing further complicates standardization attempts, with 39.6% of printers using RGB, 47.9% still using CMYK, and 12.5% using a blend of both RGB and CMYK for in-house workflow (GATE, 2004).

An investigation into the existing SOPs would lay the groundwork for more unification between operating practices within the diverse population that make up the decentralized premedia professionals in today’s production workflow. The results of this investiga-

tion would also provide the framework for, where appropriate, possible industry standards for image processing and automation.

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## Color Imaging Workflow

The proliferation of software tools available to both creative and print production professionals makes the potential for specific premedia workflow iterations almost innumerable, but there are several generalized statements that can be made concerning workflow today:

1. Workflow typically begins with a creative professional trying to interpret the needs and interests of a specific client.
2. Prepress/print production professionals carry the workflow forward by applying more technically-oriented changes to files in preparation for final print production.
3. Industry professionals on both sides of this workflow benefit when communication of specifications and expectations are clear and easy to understand.
4. Shorter turn-around times and the increased use of multiple print technologies, often for the same print job, further strain resources and influence the need for standardized approaches to workflow to improve efficiencies.

### Overview

Creative professionals use a variety of tools and techniques during the early stages of production and, as their emphasis is on creating good design, specific technical considerations are often deemphasized in favor of more aesthetic considerations. When combined with design tools that allow maximum creative freedom, files created for print production may contain any number of elements that will leave them subject to change as they progress through the production workflow. With respect to maintaining color integrity, the following issues may negatively impact color reproduction:

1. Mixing of RGB and CMYK files.
2. Specification of spot colors in jobs destined for CMYK-only output.
3. Little or inconsistent use of embedded color profiles.

For the prepress and print professionals that follow, the focus is on preflighting file content and adjusting files for proofing and final print production. This process often includes conversion or application of color profiles, color correction, and other image adjustments.

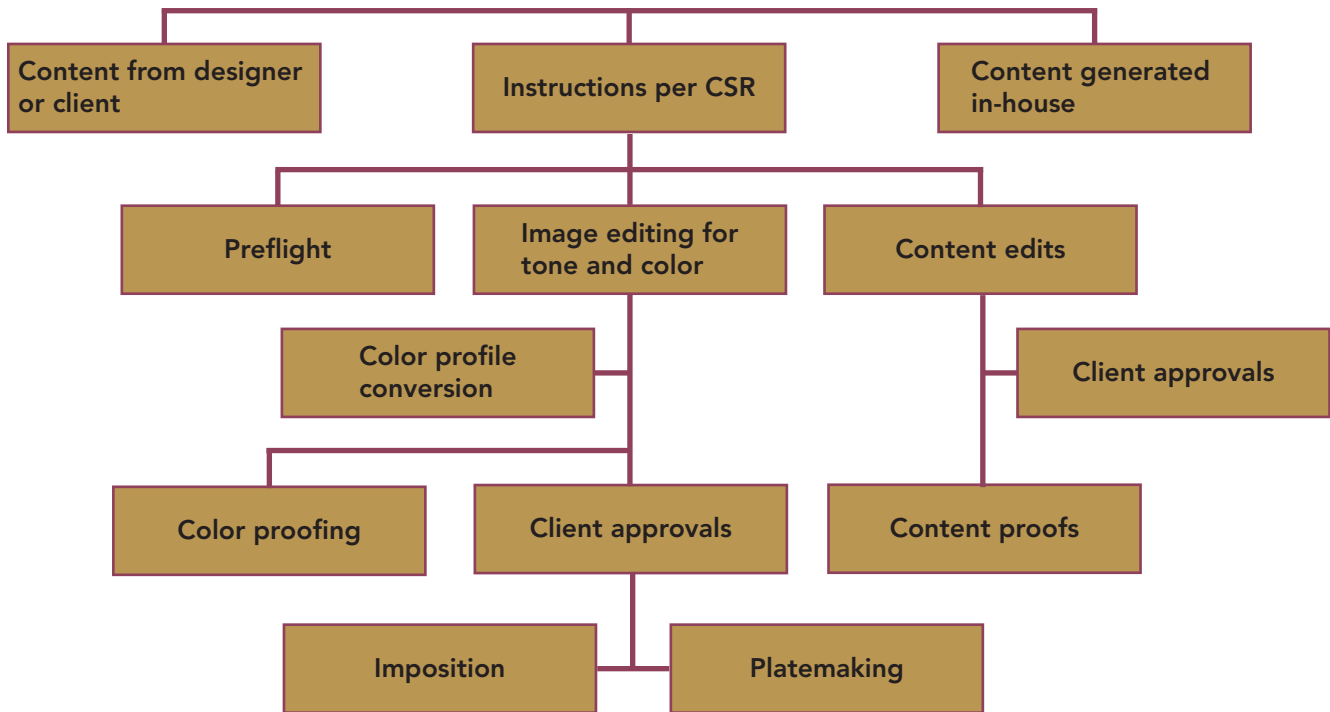


Figure 1. Sample premedia production workflow

As would be expected, this disparity between the workflow objectives of design and prepress professional may result in any number of variation of workflow practices, particularly in instances where the prepress professional is expected to adjust a variety of document components prior to print production. In an environment with an increasing focus on “lean” manufacturing, this high potential of variability during the earlier stages of production has impact on both quality and efficiencies.

## Research Objectives and Methodology

### Research Objectives

Challenges in the current workflow production cycle include the difficulty for many professionals in staying on top of the constantly changing software features, in adapting workflow practices to suit often unknown print outlets, and in simply communicating clearly throughout the production process. Depending on their background and area of professional expertise, common terms such as “calibrated” and “profile” can carry different meanings to different populations and result in unexpected discrepancies in files produced for print.

To gain insight into the impact of variations in premedia imaging tasks related to color reproduction, a cross-section of creative and premedia professionals were interviewed to address the following questions:

1. Identify the standard operating procedures impacting color image processing in-place for a sample set of commercial print shops, publishers, design agencies, and other media producers.
2. Analyze the specific image operations identified to quantify the visual impact of variance in operating procedures between production environments.
3. Evaluate results to determine optimal image processing workflows (“best practices”) for specific applications.
4. Correlate results to indicate imaging operations best suited for automation and/or integration in to JDF-compliant workflows.

## Research Methodology

### Sample

The research sample consisted of 27 U.S.-based companies, 11 of which were creative services providers (design firms, ad agencies, publishers) and 16 of which were premedia (prepress) and print services providers. Interviews conducted in-person, by phone and via email correspondence formed the primary means of data collection, and auxiliary data was collected through surveys, interviews, and on-site direct observation.

### Procedure

In this exploratory research project, an interview guideline was created based on the preliminary literature search and discussions with a number of professionals involved in creative, premedia and print production services. Several key points of inquiry were established as a basis for understanding both the nature and amplitude of the possible variation in color during premedia production. Key questions were focused in the following areas: (1) software color setting preferences, (2) RGB and CMYK workflows, (3) color correction workflows, (4) use of color profiles, (5) color proofing strategies, (6) division of tasks between creative and premedia services, (7) chargeable operations, and (8) general comments about the process.

Once the specific workflow trends that had the greatest impact on color variation had been identified, a series of tests were conducted to quantify amount and characteristics of the color variation likely to occur. These tests were conducted by taking a standardized target through each workflow step and quantifying the color variance via  $\Delta E_{00}$ .



## Results

### Synopsis of Responses from Providers of Creative Services

The design firms and agencies that participated in this study would be categorized as small- to mid-sized and all but one had clients internationally. Through the process of data collection, all participants commented on the challenge of keeping up with the rapid technology changes, particularly with keeping software and workflow practices up-to-date, and were very candid about expressing interest in resources to better aid their staff to meet that challenge.

While it varied in degree, each participant described the challenge of translating directions and preferences expressed by clients and art directors into effective instructions for the creation of digital files. The success with which concepts and design effectively made the transition into digital form were described as having a strong correlation to the art director's comfort and savvy with the design software that would be used to produce the work. As a result, several of the designers surveyed 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 the technical components that underlay successful design work.

The technical components that most influence color reproduction include the setting of color preferences in specific software application, the synchronization of color preferences between applications, and the handling of color profiles for images and layout files.

Nearly all participants surveyed left the color preferences ("settings") for each specific software application at the manufacturer's default. Among the Adobe Creative Suite for print publishing applications—Adobe Illustrator CS, Adobe Photoshop CS, Adobe InDesign CS and Adobe Acrobat 7.0—this results in different color management policies (how image profiles may be handled) and different default preferences for RGB.

It is important to note that this basic issue was resolved with the release of Adobe CS2, which came out during the period of this study. This version provided a common default for the Adobe applications in CS2 of Adobe's "North American General Purpose 2" defaults, effectively utilizing sRGB and SWOP CMYK as default preferences for all applications. Files created under this default may have marked differences from files created using the North American Prepress default (formerly called the U.S. Prepress Defaults). The Prepress default replaces sRGB with the broader gamut AdobeRGB, the RGB space endorsed by International Prepress Association and the default for the current version of QuarkXPress.

The selection of color settings influences both the rendering of specific colors created in an image file or design layout and also determines the operator's choices of how to handle existing embedded profiles. As an example, based on the default settings noted

above for Adobe CS, opening an image file that had the AdobeRGB profile embedded on it in Photoshop would result in a window that noted that there was a profile “mismatch” and ask the operator whether to preserve, convert, or discard that profile. Opening that same image file under Adobe CS2 defaults, the image file opens with the embedded profile preserved without any operator interaction or choice.

Designers faced with windows asking them whether to preserve, convert, or discard profiles communicated that they often opted to discard profiles (“Don’t Color Manage”) or to “just hit OK,” which, effectively, preserved embedded profiles. Of all of the design firms surveyed, only two had clear standard operating procedures documented for how and why to preserve, convert, or discard and, with further discussions with individual designers at both firms, it wasn’t clear that those procedures were regularly followed by everyone.

In terms of whether to work in RGB or CMYK, the results were mixed with a slight majority indicating that they preferred to work in CMYK for print work. For those that expressed they preferred to work in RGB, several offered that they frequently convert files to CMYK prior to sending them out to a prepress or print services provider.

In the context of the lack of clear standards for handling of RGB profiles, this last conversion to CMYK is significant in that a conversion from two different RGBs to the same CMYK profile will result in different results. For the designers polled, most indicated that CMYK conversions were made most frequently to the software default CMYK (SWOP). This effectively means that, for CMYK files that are forwarded to prepress and print services providers, all files may be embedded with the SWOP CMYK profile but still vary in the amount and type of color correction necessary to compensate for earlier decisions relating to the RGB profiles.

For the specification of spot colors (e.g., Pantone, TOYO, etc.), there was recognition that, depending on the specific software application used, some spot colors would render differently during digital production. Provided that the final print job was destined for a conventional press with a unit to run the actual spot color indicated, little concern was expressed about the visual mismatches earlier in the process. For CMYK process simulation of spot colors, however, several designers noted that final print results did vary depending on the specific software was used for production.

There was indication overall that accurate proofing was generally lacking in their workflows and that they relied on the print services provider to generate color-accurate proofs. All firms interviewed expressed interest in better low-cost proofing alternatives, particularly accurate soft-proofing options.

For final color decisions, nearly all firms openly expressed a reliance on the expertise of the prepress professionals that receive their files to make corrections as necessary. Further, there was a clear indication that the quality of this expertise strongly influenced their selection of one print services provided over another. As one participant stated,

“...I make certain I know by name the [prepress] operator/technician...” and continued “there are times I live and die by the competence of the prepress departments with printers, and it definitely influences my choice of printers.”

Comments from other design firms echoed the reliance on quality prepress departments to make the final adjustments to files to prepare them for production. Most also stated that they had a short list of preferred print services providers that they relied on regularly.

The critical role the prepress service plays in the final stages of production was exemplified by one agency that shared a story of a recent job where the first three components of the job had gone through their prepress service bureau while the last, because of a truly last-minute rush status, went straight from the ad agency to the print services provider. The first three components of the job printed without incident. The fourth component that by-passed the prepress service bureau ended up failing when it got to the print services provider. The discussions that followed between the ad agency and their prepress service bureau revealed that the bureau routinely made certain file corrections without the agency’s knowledge. While this value-added service made for customer satisfaction, it also exposed the informal codependence between the agency and their prepress service bureau.

For many of the creative agencies interviewed, it is this relationship with the prepress service bureaus they work with that allows them to focus on what they do best: design. Despite the technical issues detailed above, the quality of work coming from each of the creative agencies was of very high, often award-winning, quality.

## Synopsis of Responses from Providers of Premedia and Print Production Services

The premedia and print services providers that participated in this study would be categorized as small- to mid-sized and all offered a diverse range of services typical of a commercial printer. Like the creative professionals surveyed, there was a consistent message conveyed about the price of keeping up with technology

The nature of the premedia function is to prepare files for output and the slogan of one printer’s premedia department sums it up the situation nicely: “anything you want to throw at us; we will make it work.” Amid the many comments about the problem files that had been submitted, there was a universal agreement that the technical problem-solving expertise of the premedia departments presented a value-added proposition, even if they were only perceived as a means to an end.

Common file issues cited included problems with mixing of RGB and CMYK files, insufficient resolution, no bleeds (typically on PDFs) and issues with the use of spot colors. “We still get the same problems we always had,” one printer offered, “but it is getting better.” For the printers who had a higher percentage of repeat customers, the percentage of files with errors went down considerably. However, as the ad agency example noted above illustrated, the familiarity some premedia departments may have

with their customers may not result in better file submission so much as it results in a better understanding of what to watch for.

For the files received, most premedia services providers contacted noted that they had customized the color preference settings in their software to better match industry trade standards and/or in-house specifications. For most, this translated into an adoption of the North American Prepress default (a.k.a. U.S. Prepress Defaults) which uses the AdobeRGB and SWOP CMYK for color interpretation and, by default, preserves embedded profiles and request operator intervention when there is a color profile mismatch. Several printers deviated from this specification by replacing the AdobeRGB with an alternate RGB (ECIRGB, ColorMatchRGB, etc.) and/or replacing the SWOP CMYK profile with a color profile for their own press.

The importance of the color preferences noted here is significant as the specific RGB and CMYK color profiles set determine the numeric values used for color correction and color specification within the software. For example, within Photoshop, selecting AdobeRGB instead of sRGB as a default will result in a variance of the CMYK numbers that appear in the Info Palette and Color Picker. Since 100% of premedia services providers polled noted that they do color correction “by the numbers,” the deviation caused by varying profiles can be significant.

The practice of preserving or converting to profile when opening an image file will do much to preserve the color appearance of the incoming file while also yielding meaningful numeric data in the Info Palettes, Color Pickers, etc., to follow. However, a surprisingly large percentage of participants noted that they routinely discarded embedded profiles of incoming image files. The participants who followed this procedure were quick to explain that they did so because they understood that most of their customers did not understand color management and the profiles embedded were often embedded in error or without the customer’s knowledge. The participants further noted that files were just as easy or easier to correct under these conditions.

Within the context of the tendency of creative service providers to use software default color settings, the premedia services providers’ trade practice of discarding embedded profiles is significant because removing an embedded color profile effectively remaps all of the color data of a file to the default settings of the software currently being used. If the color preferences between creative and premedia professionals are in sync, discarding a profile would result in no change. If the color preferences are different, as has been the case documented here, the resulting variation in color can be very significant.

Beyond imaging software like Photoshop, premedia services providers were more likely to synchronize some or all of the color preference settings within the software they regularly used for print. For most that did synchronize settings, the IPA-endorsed AdobeRGB and SWOP CMYK were the most common color settings selected. However, just as many had variations of this that included custom CMYK press profiles as well as the synchronization of some software applications, most commonly Photoshop, Quark, and InDesign, and not others (e.g., Illustrator).



While they used them in different ways, most participants had profiles available for the specific presses and printers used for production. For some, it was a matter of policy to convert to the specific CMYK output profile as early in the process as possible. This practice insured that all subsequent color correction and proofing was correlated closely to the limits of the actual output system. For most printers surveyed, while many made these output device specific profiles available to some or all of their customers, the actual conversion to the specific output profile was most frequently done by the premedia services provider after the file was received.

In terms of RGB versus CMYK workflows, most participants surveyed noted that they routinely accepted both file types but still generally preferred CMYK. For files that had already been converted to CMYK by customers, participants were split as to whether they converted the existing CMYK (assumed to be SWOP CMYK) to the specific press CMYK profile or discarded the embedded profile in favor of reassigning the image file to their preferred CMYK. As noted earlier, the difference in these two practices can result in a significant variation in the resulting output.

For spot colors, while most participants surveyed didn't synchronize the color swatch palettes between applications, spot color matching was done "by the numbers" and/or through the simple specification of the correct spot color during production. Participants did note that there were some issues with accurate proofing of spot colors, but, aside from a continued need to educate some customers on spot to process color conversions, most participants claimed little issue meeting customer expectations for reproducing spots colors.

## 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 specific color workflows frequently cited.

The first set of tests was for profile-to-profile conversions. Using an L\*a\*b\* version of the MacBeth ColorChecker as the original, a series of test 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 here as  $\Delta E^*_{00}$ ).

While it was quickly determined that a broader range of image files that included a wider range of input profiles and the inclusion of more than one rendering intent would need to be factored in to provide more meaningful insight into the amount of variance that could be encountered, this limited test gave a clear view into the magnitude of variance that resulted from specific color management practices.

As expected, preserved embedded profiles created no color variance, converting to the working space RGB created only minimal variance, while ignoring or discarding embedded profiles in favor of the working space RGB created the most variation in color. For converted files, it is important to note that the trade practice of converting all

## Results

files to a common working space gained further credence as the tone and color of the pictorial files converted from 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).

As each file was effectively remapped to the new RGB gamut, a significant reduction in overall color saturation was apparent in the files that were assigned the sRGB profile. The overall color shift was significant enough to require color correction by most customers prior to acceptance.

Files placed from Photoshop into Illustrator CS where both software applications used the U.S. Prepress Defaults as their color settings showed no difference in the resulting file. However, files placed under Illustrator CS's Default incurred significant shifts, particularly in warmer colors (see Table 2).

The magnitude of variation when converting from different RGB profiles to the same CMYK profile echoed the results noted above (see Tables 3 and 4). More troubling, however, was the magnitude of spot-to-process conversions done in different soft-

Table 1. Difference from assigning sRGB profile

	$\Delta L^*$	$\Delta a^*$	$\Delta b^*$	$\Delta C$	$\Delta E^*_{\infty}$
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

Table 2. Difference from Illustrator default settings

	$\Delta L^*$	$\Delta a^*$	$\Delta b^*$	$\Delta C$	$\Delta E^*_{\infty}$
Orange #7	4.0	10.0	10.0	13.72	4.99
Blue #13	-2.0	1.0	-4.0	4.11	2.01
Green #14	-2.0	-21.0	1.0	17.88	7.16
Red #15	6.0	10.0	-21.0	-5.01	13.46
Cyan #18	-1.0	-10.0	-3.0	9.37	4.02
Neutral #20	0.0	1.0	0.0	0.0	0.68
Neutral #22	0.0	1.0	0.0	0.0	0.99

ware applications or under different color settings. Overall, specifying the Default color settings in each software application produced spot color renderings with the furthest deviation from the reference spot color made in Photoshop CS. Illustrator CS's default (using the Emulate Illustrator 6.0 settings) consistently produced values that were the furthest out and values that varied the greatest between its two most commonly used settings. QuarkXPress proved to be the most consistent regardless of color settings and produced identical files both under its default settings and with color management active.

Table 3. Pantone 165C (orange) measurements (RIT orange)

	L*	a*	b*	$\Delta C$	$\Delta E^*_{\text{oo}}$
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 4. Pantone 1675C (burnt umber) measurements (RIT brown)

	L*	a*	b*	$\Delta C$	$\Delta E^*_{\text{oo}}$
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

While the impact of these variations has the greatest implications on CMYK proofing systems and CMYK-only output systems, they also have impact on color communication and color expectations of the customers who view them in any form.

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## Summary of Findings

An analysis of the data collected for this exploratory study revealed a number of consistent trends related to how color image files were processed as they progressed through the workflow. The trends that most related to the research objectives were as follows:

1. Current Issues, Challenges, and Trends in Color Workflow
  - Overall, there was significant disparity between the specific workflow processes of creative and prepress/print production professionals that participated in this study.
  - Many of the differences between the workflow procedures had a significant impact on color reproduction characteristics and predictability.
  - Most variances in workflow practices were the result of different understandings of the technical implications of specific “acceptable” practices.
2. Creative Services Workflow Processes
  - Most creative professionals put little focus on color setting preferences and other color management-related policies and actions, favoring default software settings for most applications and a general “hands-off” approach to color management.
  - Most creative professionals left final color adjustments and proofing to the prepress and print services providers that followed them in the production sequence.
3. Premedia Services Workflow Processes
  - While more standardized procedures were common among prepress and print services professionals, specific standard operating procedures (SOPs) and the understanding that underscored them varied.
  - Most prepress and print services professionals saw their role of file and color correction specialists as critical to their business regardless of whether they explicitly charged for those services or not.
4. Technical Analysis of Color Differences
  - Technical analysis revealed that many of the generally acceptable trade practices observed during the study produced very significant visual and measured variance in the resulting color reproductions.



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## Conclusions

As conducted, the study verifies that there are both great disparities in “acceptable” workflow practices among the professionals participating in the premedia phases of production and, by extension, great opportunities for improved efficiencies. However, it is important to note that, while there were 27 companies that fully participated in this study, the diversity of those companies was significant, making the relevance of the data analysis to more distinct populations limited. A more comprehensive study that analyzes specific groups based on market application would be required to obtain a more meaningful analysis of trends and opportunities by market.

### Implications of the Study

There are implications of this preliminary research that could impact the development of software tools, industry training, general trade practices, and possible industry standards.

#### Software Development

As has already been the case with Adobe’s release of its Creative Suite 2 software package, closer attention to color setting preferences during the development of software products will help to minimize color variation during premedia production by making color management tasks more invisible and more consistent.

#### Industry Education and Training

This study revealed a very wide range of understanding of color management and optimal color imaging workflows. Most of those contacted expressed great interest in obtaining accessible low-cost industry training geared toward their needs, making the opportunity for providing educational services to both prepress/print production and creative professionals significant.

#### Industry Trade Practices and Standards

For the specific tasks like color conversion that are meant to be both repeatable and rely on objective decision-making processes, the further development of more widely-accepted trade practices or, where possible, standards, would greatly improve color consistency through production.

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## Agenda for Further Research

1. During the preliminary data collection for this study, it became evident that getting meaningful data relating to the specific SOPs for image operations relating to resolution, exposure, sharpening, file format (PDF, TIF, JPEG, RAW, etc.), tone compression, tone reproduction, adjustment for neutrality, and color correction would require more in-depth study.

2. Significant changes in the default color settings for the Adobe Creative Suite introduced a new set of color variables that require further technical analysis.
3. The diverse nature of the commercial printing arena requires that subsets for specific applications or market segments must be studied to gain the depth necessary to establish more meaningful insight into the color workflows of the commercial printing industry. Further, a broader-based survey would establish better context and yield insight into trends by market application.

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