Then & Now!

We've Come a Long Way, But…

Standards for the Printing and Publishing Industry

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Then

In a 1982 TAGA paper I included the following statements:

Computer systems and software designed by different computer manufacturers often cannot talk to each other. The simplest solution to this problem would be for all trade houses, publishers, and printers to use a system made by the same manufacturer. That's not very feasible. Short of this, a common standard for both data format and electronic exchange media would have to be established to enable information to be exchanged between different kinds of systems.

In terms of data format, it would be ideal if the actual raster scan exposing information could be used as a standard. However, this isn't feasible either, because the specific raster scan information required is a function of the printing equipment and conditions existing at each printer. In fact, at this point a common standard is not obvious but will require a great deal of effort to define.

When I wrote those comments there was no electronic exchange of data, there were no accredited graphic arts standards groups in either ISO (International Organization for Standardization) or ANSI (American National Standards Institute). SWOP (Specifications for Web Offset Publications), formed in 1975, was a fledgling group; and the general feeling in the industry was that standards represented the lowest-common denominator and "who wanted to print that way?"

Now

Twenty-one years ago we were struggling with the concept of how to move data! We had not even begun to think about all of the other issues such as the meaning of the data, printing process definition, process control, etc.

Today, the PDF/X (Portable Document Format/Exchange) family of standards represents the third generation of electronic data exchange standards for our industry—predecessors were the IT8 (Image Technology) DDES (Digital Data Exchange Standards) magnetic tape standards and TIFF/IT (Tag Image File Format/Image Technology).

BUT, even more significant is the family of supporting standards that has evolved to provide the basis for an integrated systems approach to printing and publishing. Most of us get so heavily focused on a single aspect that we do not step back and look at the overall picture and see the system that is in place to allow us to take maximum advantage of the ability to work with digital data.

What Is That Picture?

•We have effective PDF/X and TIFF/IT file formats to efficiently carry content data. These formats also allow us to define the intended appearance of that data (we hadn't even worried about that in 1982).

•We have printing process definition standards such as ISO 12647, CGATS 6 (Committee for Graphic Arts Technologies Standards), SWOP, GRACoL (General Requirements and Applications for Commercial Offset Lithography), etc., which build on the 2846 family of ink color standards. We also have characterization data based on these printing definitions—CGATS TR001; FOGRA (an international graphic technology

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research association) data; IFRA (an international association for newspaper and media) data, etc.

•We have color management tools based on the International Color Consortium (ICC) architecture and profile formats that allow us to define the desired color transforms to be applied to the data we exchange.

•We have a body of process control standards and tools (the 2846 ink standards, colorimetry standards, and densitometry standards) that enable the individual printer to match and maintain printing aims.

The system has four interdependent legs—file formats, data definition, printing aims, and process control. Together, they can support an efficient, responsive, and cost effective printing and publishing industry based on content information defined as digital data.

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How Should This Model Work?

Although most discussions of the emerging graphic arts system model focus on the publication world (because its many-to-one workflow is the most complex), it works equally well for any business segment. As you will see, I have chosen to describe this model using words that apply equally to publication, commercial printing, quick/utility printing, variable data printing, and even packaging using any printing process.

It is most easily described as having four major participants (although there may be more and/or their functions may be merged or split even further in any actual job):

•A customer who is paying the bill and must approve the work at several stages—design, proof, and final printed piece;

•A design or creation house that creates the content and specifies components to be used (printing substrate/paper, ink colors, printing process, etc.);

•A preparatory service that converts the design into content data that can be used to create printing masters;

•A printer that prepares the printing masters and converts the content data into marks on paper.

The easiest place to begin looking at this system's model is with the printing process definition standards in combination with the ink standards. These establish colorimetrically defined aims for the inks themselves, as well as colorimetric aims for the solids, two color overprints, and total ink coverage when these inks are printed on specific classes of substrates. This defines the available color gamut for that combination of inks and substrate. The printing process standards also include reference aim values for tone value increase and other process control parameters.

These color gamuts provide both aims for the printer to use in setting up printing process control and reasonable color expectations for the customer and designer to use in selecting inks and paper for the intended printed piece and when designing the content to be included.

While conceptually a printer could have process aims for an infinite number of ink/paper/process combinations, most printers will restrict their operations to a moderate set based on the equipment available and the market segment he serves. For those combinations, one of his most important goals (and value added services) should be repeatability and consistency of results that match reference characterization data. Variations or deviations from printing aims (small changes in color gamut) do not add value to what the printer offers. While proofs will still be used in many jobs, "printing to the numbers" to match aim characterization data is becoming an accepted practice as the final printing step becomes essentially a manufacturing process.

One area that seems to be misunderstood is the concept that although reference printing conditions and printing gamuts are defined colorimetrically, densitometry is still the printer's main process control workhorse once a specific combination of ink and paper are selected and printing aims are established. Colorimetry is used to establish aims but densitometry is still effective in maintaining those aims.

Once a particular aim printing condition (paper/ink/process) is selected by the customer and designer, the printer and preparatory service can agree on the best characterization data to use for that printing condition. Ideally, this will be the reference characterization data that is tied to the printing process definition and prepared by one of the various standards groups. This characterization data will be used as the basis for color separation by the preparatory service, color proofing throughout the workflow, and within gamut process control aims (e.g., tone value increase, trapping, etc.) at the printer.

Color management profiles based on this characterization data may also be used by the designer for preliminary soft or hard proofing used in the creation process and/or to gain initial customer approval. These same profiles may also be used by the preparatory service in preparing the printing data.

It is important to note that our model workflow is totally based on the exchange of content material as digital data, which seems to be representative of most of the industry today. One interesting advantage this brings to the printer is, that as long as the printing capabilities of his equuipment matches the outer gamut of the selected printing condition, he can use color management to adjust for differences between his within gamut conditions (e.g., tone value increase, etc) and those of the reference characterization data.

Remember, output characterization data represents the relationship between CMYK data in the computer data file and the resultant color on the printed sheet. This means that all changes in the data between the computer file and the printed sheet are included—plate exposure curves, compensation or linearization curves, tone value increase from both physical and optical sources, ink trapping effects, etc. The printer has the responsibility of managing the sum of these adjustments to the data so characterization aims that were used for design, preparation, and proofing are matched in the final printed piece. This is both a new freedom and a new responsibility that comes with the exchange and use of digital data.

One other aspect of the all digital workflow is that the printing data can be sent as either CMYK data (PDF/X-1a) or color managed data (PDF/X-3). For color managed data (sometimes called virtual CMYK), the data itself may be in a variety of forms—RGB, LAB, or CMYK—and color management profiles are included to define the specific relationship intended between data provided and the final CMYK. Where some of the data are already at the printer, or sent separately, PDF/X-2 enables the identification of such data and supports both CMYK and color managed workflows.

The PDF/X files used for data exchange require that the intended printing condition be identified. Often, such as in U.S. publication printing where CMYK data based on SWOP is the norm, this simply requires a pointer to the reference characterization data. The TC130 (Technical Committee) group that created PDF/X and the ICC have worked together to make this easy to accomplish.

The ICC is maintaining a registry of the reference names of both CMYK characterized printing conditions and 3-component color data spaces at www.color.org. This registry also provides pointers to a full definition of the printing conditions, the associated characterization data, and in some cases ICC profiles.

The PDF/X file format makes use of the names in that registry as optional values for the required "OutputConditionIdentifier" key. These reference names can be used to facilitate communication among all participants in the workflow whenever standard printing conditions are being used. (The entry for SWOP printing in the ICC registry is CGATS TR 001.) Alternatively, full color management profiles may be included where non-standard printing conditions are being used or color managed data are being exchanged.

So Why Aren't We Done?

We are and we aren't! First, and foremost, we need to do a lot more work to help people understand:

•A new system is evolving,

•How it works, and

•Unless all four legs of the system are supported and implemented, it won't work effectively.

Second, vendors need to supply easy-to-use tools that are based on an overall systems view, that implement each of the interdependent legs, and that work together.

Finally, as an industry we need to gain experience in working with these new approaches, refine them, and then put behind us the errors and misunderstandings that are based on obsolete ideas and concepts.

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What Are Some of the Issues?

As I monitor the various PrintPlanet forums and other industry discussion groups several issues related to such a system's view of printing seem to predominate. Not in any order of importance or priority, some of the key issues are:

Education, Education, Education

Traditionally, from the practitioner's point of view, graphic arts has been seen as more of a craft-based industry than a technology based industry. There will continue to be many aspects that are more craft than science—creation and design, image editing to create a better original, etc. However, as we use more tools to manipulate and control digital data and build process control aims based on colorimetry, there is an increasing need to add some science-based knowledge.

Further, as responsibilities for various steps in the process get moved among the participants, they must build the knowledge base to do the work correctly. A common theme on the forums is that the designer or whoever did the separations didn't know what was required. Having content data in digital form and the widespread availability of tools to manipulate that data have led many people to believe that training is not required and that the applications (including color management) will do the job automatically.

Too often the separator or other downstream professional will simply fix the errors without pointing out to the person(s) who made the error that they did it wrong. Yes, folks who say that we need to provide better training in the educational system are correct, but as an industry we also need to be less willing to cover up for bad input (even if it is done to avoid embarrassing the customer).

Colorimetric vs. Densitometric Aims

As mentioned above, colorimetry is the most effective tool to use to set up a process to meet characterized printing condition aims. Once established, density is an effective tool to maintain these aims. ISO 13656:2000, *Graphic technology—Application of reflection densitometry and colorimetry to process*

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control or evaluation of prints and proofs, provides an excellent guide in the applicability of each type of measurement.

Even more important, we need to find some way to help key people in both the preparatory and process control areas to begin to understand how to use colorimetry as a companion tool to densitometry. Our industry educational groups need to help demystify colorimetry and enable it to be used effectively.

What Color Management Can/Should Do

In a recent forum posting the following statement was made. "Color management promises 'better color' but how can it? When we made separations, we automatically opened up the 3/4 tones, increased contrast, adjusted flesh, grass and sky tones—we improved the original! Color management only 'matches the original'."

If color management helps us do a better job of "matching the original" then it is accomplishing what it was intended to do.

Improving the original is an art not a science and has never been the goal of any color management system. However, color management can be used to simplify the application of the same enhancements to multiple images once the initial "art" has been accomplished

The two principal goals of color management are:

•To simplify the process of matching the appearance of the same image between multiple processes/media that have different reproduction characteristics (including original to reproduction), and

• To provide a mechanism to specify and enable color transforms to be carried along with an image (profiles) to either describe the color characteristics of the image encoding or specify transforms to be applied to the image.

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The Desire to Proliferate Characterized Printing Conditions

The definition of output color characterization data is the relationship between printing data (typically CMYK) in the computer file and the measured color on the printed sheet corresponding to that data. All changes in the data between the computer file and the printed sheet are included—plate exposure curves, compensation or linearization curves, tone value increase from both physical and optical sources, ink trapping effects, etc.

As we look at different printing workflows each has unique transforms to the data. Tone value increase varies with screen ruling, with positive or negative plates or with various direct plate making systems. We have two choices. We can have different characterizations for every combination of these variables. Or, we can define a single reference relationship based on the most common of these processes and allow the printer to manage the summation of these variables so that each individual combination matches the aim.

Today, the U.S. gravure publication cylinder engraver adds the "engraving curves" necessary to match the CGATS TR 001 relationship that is based on offset printing. Most direct-to-plate systems include "linearization curves" to compensate for differences between film-to-plate exposures and/or their unique characteristics.

Let's treat the printer with the respect he deserves and give him the responsibility to match the defined reference. We don't need an ongoing proliferation of characterization data that will only confuse rather than simplify the process. We have the tools–let's learn to use them.

How to Set Process Control Aims

Until we started to deliver content information to the printer as digital data, the only logical way to set process control aims was to build on industry standards for density, tone value increase, trapping, etc. Unless the process matched the reference there was no easy way to "fix" data so results were correct. Often, solid

ink density (color gamut) was compromised so tone value increase would be correct, or tone value increase was compromised so overprint values would be correct, etc.

However, now that we are in a digital world, we can begin to rethink that process. Now the printer has the freedom to find the best point to operate the press. The primary goal should be to match the single and two-color solids so the color gamut will be correct. The second is stable operating conditions. Once these are achieved, any within-gamut differences from the reference characterization can be compensated for by color management adjustments. Many of the process control aims have become a local issue, and a local tool.

Because we now have other ways to correct data, the printer's most important contribution is consistent, process controlled printing to the agreed upon aims.

The Future

I realize that my vision of the graphic arts "system" may be a little ahead of where most of us are today. I will not apologize for that because I firmly believe that unless we have a vision we will not make progress. It is easier to make progress by editing and modifying a vision, than not having one at all. Therefore, I invite all who are willing to discuss, edit, modify, and share your thoughts about what the future system's model for the printing and publishing industry can and/or should be.

People involved in the CGATS and ISO TC 130 standards activities have already done (and continue to do) a lot of that kind of visioning as they have created the various accredited standards for the printing and publishing industry through ANSI CGATS and ISO TC130. These standards enable far more flexibility than we are taking advantage of today and, in some cases (like PDF/X requiring intended printing condition definition), begin to nudge the industry along the road to the future.

I have deliberately not tried to identify and list all of the various standards that are available but simply refer you back to the article in the July/August 2002 issue of the *IPA Bulletin* that did that in detail, www.ipa.org/bulletin/standards.php.

I welcome input and dialogue either by e-mail or on the various PrintPlanet forums. Let's build the future together.

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