A Pressman's View of Printing Color Managed Files...or How to Appreciate Don Quioxte

In any aesthetic endeavor where you can't actually define quality, the only measure of quality is consistency.

BY LARRY WARTER

An old industry saying goes: "Manure runs down hill, and the pressman lives in the valley." It's a little offensive, but basically true, especially in the commercial printing world. In a printing workflow, everyone upstream of the press inputs everything they know about how they want the image to look—including all the techniques and crafts passed down since Gutenberg, the idealized wishes of the creatives, and the cost cutting measures of the ultimate customer—but not one of them alone has more than a small influence on the appearance of the final image.

The pressman, on the other hand, has to accept everything everyone has done before him. Then, with an inconsistent press that has probably just finished a job that was pushed to achieve a "look" totally different from the present job, the pressman must try to match the appearance envisioned by the creative who is usually standing beside the press. Unfortunately, the pressman has only four levers to push. He can increase or decrease the overall cyan, magenta, yellow or black of the image; and these changes will have large visual effects in the shadows, medium visual effects in the midtones (at least until the press is completely out of control), and little effect in the highlights. This is generally inversely proportional to the sensitivity of the eyes and, therefore, the magnitude of the complaints of the critic beside him. No wonder another old saying is that "lithographer is between liquor and loans in the yellow pages."

Maybe a good analogy would be playing golf on a different course each day. Each hole would be a totally new experience with unique conditions that are difficult to anticipate and specific requirements for each shot that require intelligent guesswork and superb execution. Conditions like wind would change constantly and others like grass would change on a seasonal, if not weekly, basis. In addition, manufacturers of clubs and balls are constantly changing the tools. If you take away the ability to practice technique, the golfer's dilemma would be similar to what a pressman faces in his daily job.

The only saving grace is that many otherwise sane people regard golf as fun; and, for many of the same reasons, most pressmen seem to regard their job as satisfying if not, in fact, fun. But that doesn't mean they wouldn't appreciate any attempt to make their jobs easier. The question is how do we really make it easier?

The first thing everyone would agree on is to strive for consistency. In any aesthetic endeavor where you can't actually define quality (what makes a picture look "good" or a wine taste "good"), the only measure of quality is consistency. For printing, that amounts to some measure of how each of the four colors of ink is transferred to the paper selected for a job. This is a multilevel variable. The press has to be working in a repeatable environment. All gaps and pressures must be established to "optimum" levels. Blankets must be qualified for their ability to take ink off the plate and transfer it to the paper or on top of the previous inks (trap). Water must be fed in a uni-

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Consistency in printing amounts to some measure of how each of the four colors of ink is transferred to the paper selected for a job. This is a multilevel variable including the press working in a repeatable environment, gaps and pressures established to "optimum" levels, blankets qualified for their ability to take ink off the plate and transfer it to the paper or on top of previous inks, water be fed in a uniform film over the printing plate in proper volume, and ink fed in a very uniform way so it has proper ink film.

form film over the printing plate in enough volume that it prevents ink from adhering to the non-image area, but not so much it interferes with the ability to transfer ink to the image areas of the plate. Ink must be fed in a very uniform way so it has the proper ink film thickness in the image areas that will give the most color saturation in the far shadows without being so thick a layer that it squeezes out around the dots and makes them grow in size, which greatly changes the visual weight.

That's a brief list of the variables we have to deal with in printing, but there are problems in establishing and setting tolerances for every one of them. The physical variables like gaps can be measured, but there is no way of determining the optimum setting except to print and measure over and over again until a correlation is established (and that correlation is always influenced by the other variables).

The variables that affect the transfer of ink are even less exact and intertwined and must all be implied from secondary characteristics that can actually be measured. We can measure the surface roughness of the plates, blankets and paper. We can measure all the physical parameters of the inks: viscosity, color saturation versus thickness, transparency, etc. We can measure ink flow indirectly by measuring the color of strategically placed solid patches of ink directly on the paper and on top of previously printed inks. We can try to measure water flow minus evaporation and estimate the thickness of the layer of water on the plate. We can measure some aspects of the ink/water interaction: pH, solvent levels, etc., which affect their ability to touch without repelling one another, on one hand, and without dissolving each other, on the other hand.

Once we have these measurements we have to translate them into predicting the appearance of different images on a press. This would be difficult on a one-time basis using large patches of ink; but in practice the ink is transferred onto paper traveling over 300 feet per minute, and the control of the image appearance is based on properly splitting and transferring the ink film onto dots that are as small as ten microns in size (a 10 percent change in circumference of the resulting dot could actually double the visual weight in some parts of the picture).

Obviously this is a dynamic process where static secondary non-visual measurements can only give, at best, an approximate indication of what might be happening to affect the visual image—and where the number of variables is too large and interdependent to be able to actually measure and analyze them while the press is running.

Instead, we have to pick the most sensitive, easy-to-measure indicators to tell us when there is a problem so we can then stop and analyze the problem. And that is what we do. Good quality control on press means we try to use the appropriate measurement at the most beneficial point in the process. We should monitor the press mechanicals on a continuing basis, and we should measure or record the incoming paper and ink

properties whenever there is a change in batches. If these measurements correlate to any permanent change in the printed results, it gives us a good idea of the potential problem, and we can see if the problem is resolved by simply adjusting the press mechanical back into tolerance or changing to a new paper or ink. That's the easy part.

In order to check the ink film splitting, good quality control says we should pick the variables most likely to indicate process variation. For printing we have chosen density and dot gain as the proper start up variables. Density indicates when the ink film thickness is proper. (In Europe they also measure the CIELAB "visual" color, which also indicates that the ink is printing to the right "visual" color when the thickness is right.) We also measure dot gain—or tone value increase, as it is more rightly called—which indicates the ink film is splitting and transferring correctly so it prints to a mathematically predicted visual weight for that given solid ink density and paper value.

Density and dot gain are the two major variables we have chosen and they are **essential** to the startup and control of a running press. If they are not held constant, we have chaos and the pressrun will fail. As long as they are held consistent, we have some chance of producing predictable results. However, they are only two of the many intertwined variables for the process; and, while they are essential for success, they are **not sufficient** to guarantee a good pressrun. Focusing only on these two numbers is not enough.

Pressmen are not paid to print the proper numbers; they are paid to print images that look like the proofs, and because of all the other variables, there can only be general guidelines/ranges for density and dot gain numbers for any given press printing given batches of paper and inks. After they bring the press to these goal numbers, they still have to further adjust the press to give the right look to the image. Under ideal circumstances, little or no adjustment would be required, but go back and read paragraph one and see if that sounds like ideal circumstances. The numbers give consistency, but they do not guarantee the colors of the image being printed.

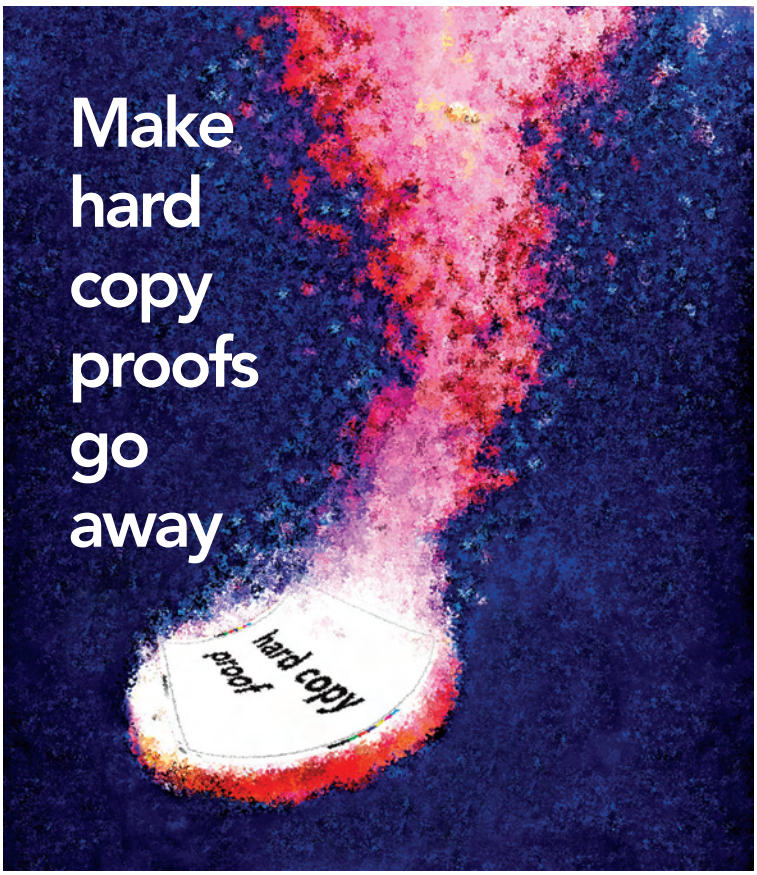
Returning to the golf analogy, we can measure the variables: hole length, direction, elevation, wind, club trajectory/distance with a given impact, etc.; but, when it comes down to a given shot, that information is necessary but not sufficient for the golfer to make a good shot. If he is facing the wrong way, he is doomed before he swings; but even knowing all these factors will not give him a good swing. He must use his skill and experience in order to put the ball in the hole in the least number of shots.

Likewise, the pressman is a craftsman who uses quality control numbers to keep his printing consistent and his own visual skill to adjust the four printing inks (tweak the press) to give a closer visual match to the proof—all while trying not to introduce added variation into the process.

Now, where does color management fit into this picture? Color management is a very predictable way to make an image look the same on two different media like a proof and a press. Unfortunately, it is based on VISUAL consistency. So, for all the reasons mentioned above, color management has been worthless on press in the past. It is difficult enough to keep a press visually consistent to itself on a day-in, day-out basis. To expect it to be visually consistent to an idealized representation has been a fool's errand.

Remember the pressman is responsible for the way the image looks, so—even with a color managed file based on an idealized standard like SNAP, GRACoL or SWOP—he is responsible for tweaking the image to make up for all the idiosyncrasies of his unique printing system. In addition, it is almost certain he will have to make some adjustments because even when printing to quality control numbers for density and dot gain, his unique press will only match the proof under ideal circumstances. Any pressman will tell you this is unlikely to happen, therefore, color management doesn't improve his life at all. It just raises the customer's expectations, which he has to meet using the same old techniques. This is the reason most commercial printers stop color management at the proofing step and let the pressman do his traditional role of matching the proof visually on press,

Again back to the golf analogy, it's like giving the golfer one lesson on how the professional would play every hole (which clubs to use, whether to hit it low or high or draw or fade, etc.). It may sound good, but as soon as the golfer sees he is still hitting his shots into the rough—and probably more often because he isn't allowing for the inherent problems in his unique golf swing—he will reject the advice and regret the increased expectations that resulted from it. Obviously, if he has the time



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and patience to practice and slowly take advantage of the lesson, it will eventually become worth his while. However, the pressman does not have the luxury of time and patience to practice; he is responsible for every job. Color management assumes his press visually matches the proof when he is at the proper numbers. It doesn't help him adjust the press if the press is out.

As a footnote, color management has been much more successful in the publication market because that market, with its large number of content creators feeding separate ads and editorial to be printed together at several regional printers, is much more amenable to standards of all types. The commercial printer, on the other hand, often views his work as creating a unique masterpiece; and that does not lend itself to wanting standards even if they benefit the process. Left to itself, the commercial market would probably not adopt color management on press for a very long time for many well-founded reasons. In the past we have accepted this rationale, but in the future this will have to change!

As press runs get shorter and shorter and printers receive content from more and more different creative sources, the commercial industry will no longer have the luxury of creating masterpieces through trial and error. Commercial printers are finding they need to be better/cheaper/faster to survive; and standardization based on very demanding, if not idealized, goals is the only answer. We must learn how to make color management work on press so we get the color the client expects with the least amount of makeready.

In theory color management can do this. As long as the press can be kept visually consistent, it can be profiled and images can be tailored to print correctly without any adjustment. The creatives upstream could develop their content using a standardized commercial color space like GRACoL

(which is presently being balloted as CGATS Technical Report 006); and, using a device link profile, the images could be adjusted to print to match the proof on any press using proper paper and ink.

The question then is how and why should a pressman go about keeping his press *visually consistent*? This flies in the face of everything he has done in the past where he adjusted the visual look of the image to match the proof. The "why" is easy. Our industry can't afford a custom process of visually matching the proof with each pressrun when clients want better/cheaper/faster.

Any pressman will agree with this, but they need a process they can trust. Color management has the answer, but it's too impractical. We could measure every color in the test target each time and compare them on average to the predicted values of the profile for that press and that would eventually develop into appropriate tolerances. Obviously we can't afford the time or paper to do that. What we need is the best representation of those values that we can get in the least space available as the target on the press sheet.

Historically, our industry has always known the answer. Gray balance!! The best visual representation of the image on average is the neutral patches throughout the scale. Grays are the easiest to define and the eye is most sensitive to variations at the neutral point. For this reason, they have always been used to check that a press is running as closely to idealized as possible. Pressman have printed to density and dot gain and then looked at the gray patches to check that their process was working. All we are proposing is that they add two more steps—set up plate curves so the press prints to industry standard gray balance numbers and use those gray patches to control the running press after it has been brought to the right density/dot gain.

For the purposes of color management, grays give us the most information on visual consistency for the least amount of wasted paper and process control time. They also do one other thing that is very important. They tell the pressman what to adjust. If the gray patches don't have the right amount of yellow, magenta or cyan, he can see or measure it immediately and adjust for it.

The same can be said for density and dot gain, but they are measurements of the process before all the other ink interaction variables (trap, transparency, etc.) affect the image on press. Gray balance takes them all into account. It is the single best indication of how to maintain visual consistency on a running press; and it is, therefore, a prerequisite for printing color managed files.

If pressmen can maintain gray balance in highlights, midtones and shadows on the running press, they have some hope of benefiting from color management. It has also been the general experience that they will find that adjusting for gray balance will actually agree with the changes their eyes will tell them to make to match the press sheet to the proof. If they can maintain gray balance to standard goal numbers, they can start to move out of the valley.

To complete the analogy, printing to gray balance is like custom clubs that are built to correct for imperfections in the swing. All the golfer has to do is aim down the middle and hit his normal swing and the ball will land in the right place even if he has a bad hook or slice. He still has to be consistent; but, if he is, he will be successful.

Does this mean gray balance is foolproof? Of course not or the industry would have adopted it years ago for much more than checking the press. The problem with gray balance is that, because it takes all the variables into account, it has trouble isolating which ones are really at fault; and it doesn't give much indication of what is happening to the colors furthest from gray. So while it is a good way of maintaining visual consistency on a running press, it is still essential for the pressman to measure other variables like density and dot gain. Otherwise they could be varying from run to run and being visually compensated for by adjusting gray balance. The press must always be under control on a run-to-run, day-to-day basis.

Most important, if the press can be brought under control and made visually consistent, there is an added benefit. Standard printing conditions like GRACoL and SWOP are already being established with optimized gray balance curves inherent in them. It would be very simple for printers to adjust their plate curves to match these industry standards for gray balance, and they would be well on their way to printing to match the standard with minimal profiling needed.

Using density/dot gain for consistency; printing to gray balance; and profiling for difficult colors—if a printer can do all that, he won't have to worry about liquor or loans in the yellow pages. IPA