Tolerating Color Tolerances

When matching colors, how close is close enough?

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We all have an opinion about how close two colors have to be to one another to be "acceptable" to meet customers' expectations. Up until now there has been no good way to quantify that value, but now we have a process to help quantify values associated with acceptability.

Those persons in our industry responsible for producing accurate color matches are always searching to achieve that perfect color match for their customers. Of course, some customers are pickier than others and through an often painful trial-and-error process color producers eventually learn how close of a color "mis-match" they can get away with. Unfortunately, such a trial-and-error process results in:

- Losing money on jobs when attempting to satisfy unrealistic customer expectations for many reasons, including operator inconsistency, device inconsistency, and color judgment inconsistencies.
- Not knowing what a customer expects until after numerous experiences with trying to attain a color match.
- Overselling a customer on a proof that might be more accurate than the customer needs.

Wouldn't it be nice if we could determine what level of color match a customer desired before running a job for them? In this way we could:

❶Determine if the measurement and output devices can achieve the desired accuracy.

❷Provide accurate price quotations commensurate with the degree of color accuracy desired. This would allow for higher-cost proofs versus lower-cost proofs, as well as allowances for re-makes if the customer's tolerances are on the edge of what our equipment and/or training and/or operator skills are capable of and if more waste occurs due to longer makeready costs in getting the press up to exact numbers.

❸Ideally, provide a proof of attainment of a certain level of defined accuracy at the completion of a job.

Attempts in the past at determining acceptable tolerance levels have focused mainly on densitometric data, which do not correlate well with how the human eye distinguishes color difference. For example, a .05 of density difference in a saturated red will look quite different from the same .05 density difference in a light gray. Densitometric data are good for ensuring that one device reproduces color consistently to itself and are often used in calibration procedures to compensate for device drift. Obviously, we need a different method.

Fortunately, color scientists have developed two accurate formulas that better correlate how a human sees color differences. Known as Delta E-CMC and Delta E-94, they allow anyone with the proper equipment to quantify color difference in a uniform manner based on how the human eye sees and interprets color. The formulas are designed so a unit of measure of "1 delta E" becomes the minimum level a trained human observer can perceive a color difference while also taking into consideration three important color attributes—hue, saturation, and lightness. These considerations provide important distinctions because our eyes will notice a shift in lightness or hue before perceiving a shift in color saturation.

Using the delta E methodology, a difference in 5 delta E units for a light gray will be seen as the same difference in a 5 delta E for a saturated red. So now we possess a standard way to define color difference that can be defined as a customer's tolerance.

Now we have a standard to define Tolerance, but how do you know what is right for you and your customers? A unique and proven methodology to define each customer's Color Tolerance is to use the *Pilot Color Tolerance Exercise*. The exercise consists of a tool whereby multiple color-squares are precisely manufactured to differ from one another by a certain delta E value.

The Pilot Color Tolerance exercise includes a self-guiding manual to ensure users first evaluate the colors in the correct color-temperature light and then visually determine which colors match and which do not. This allows users to then determine their color tolerance expressed by a quantified delta E number value.

Using this approach, it is easy to get a person, group, department or customer defined in terms of their level of Tolerance, thus allowing us to make intelligent decisions that we did not have the ability to make before—without some amount of guessing.

Once the customer's Color Tolerance has been defined, the color producers can make the necessary production and business decisions required including:

▸Determining how often to recalibrate measurement and output devices. By tracking our devices' drift in terms of delta E, we will be able to establish concrete maintenance schedules to compensate for the differences in all our devices.

▸Purchasing color-measurement devices with the accuracy and precision to accommodate our customers' needs. (Tip: Review the devices' delta E specifications.)

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▸Purchasing color-profiling software that meets your quality requirements (you will not find this information on the spec sheet today: there is a reason why some packages cost $200 and others $5000).

▸Establishing—once you obtain the color-profiling software—how many patches and which targets you should use in generating your profiles.

▸Determining if the devices are capable of reproducing color across the imageable area consistent to the level of Tolerance. (Again, these data may not be available on the product spec sheets—another reason why scanners/monitors and output devices vary so much in price.)

In general, to maintain smaller delta E Color Tolerances greater amounts of time, speed, and monetary investment are to be required. Agreement on this point is essential to a successful and profitable relationship between color producers and customers.

This is a practical side of color management, the side most people have not heard about; or if they have heard about it, they do not know how to implement it. For too long, this has been the exclusive domain of the experts. However, a group of industry experts set out to change this by creating the *IPA Color Management Professional (CMP) Certification Program*—a comprehensive color management program designed to provide a consistent worldwide understanding of the best practices associated with color management implementation in a graphic communication production environment. Learn more about this program in the following article. IPA