Media-relative correction for substrate colour

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Process aims

Aim points for printing are defined by ISO 12647 printing definitions.

Process characterization data conforming to these printing conditions is available on the ICC web site.

For process control, a subset of patches is used.
Substrates vary

In practice the actual paper white is often different from that in the process definition or the target characterization data.

ISO 12647 aim

Correct ink weights and tone values printed on substrate with different white point (simulations)
Effect of substrate variation

The resulting change in colour can take the printed colours out of tolerance, even though the results may be visually acceptable due to adaptation.
White point adjustment

A common procedure is to adjust the target data using a media-relative transform (equivalent to a Media-Relative Colorimetric conversion).
Rationale

Previous research has demonstrated that observers adapt to a coloured substrate analogously to a white substrate illuminated by a coloured light. Green and Otahalova (2002) showed that observers partially adapted to the substrate colour when judging neutrals. The degree of adaptation was approximately 0.7 across all substrates.
Green and Oicherman (2004) found that observers were partially adapted to the substrate colour when judging the colour balance of images printed on highly-coloured substrates. The typical degree of adaptation was approximately 0.66.

These results are consistent with other findings (e.g. Katoh, 1994) on adaptation in mixed illumination conditions.
The media-relative substrate correction in effect is based on an assumption of complete adaptation to substrate colour.

Green and Baah (2012) showed that the tolerance for media-relative adjusted colours was determined by the substrate itself – i.e. if the paper white was judged acceptably close to the reference, the media-relative adjusted colours were also judged acceptable.
Conclusion

The simple media-relative adjustment gives acceptable results over a wide range of substrate white points.

Hence for a given paper, we can use characterization data for the closest ISO 12647 paper type and adjust the characterization data using the media-relative correction.

It is possible that a partial adaptation approach would give better results, but this would be more complex to implement and is not required for differences between reference papers in ISO 12647.
Further experiments

Coordinated international experiment in progress, participation invited

Duplicate sample sets printed and measured for participating labs
  - Samples expanded to include flesh tones and neutrals

Web page for experiment at
  http://www.color.org/substratecorrection.xalter

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