Media-relative correction for substrate colour
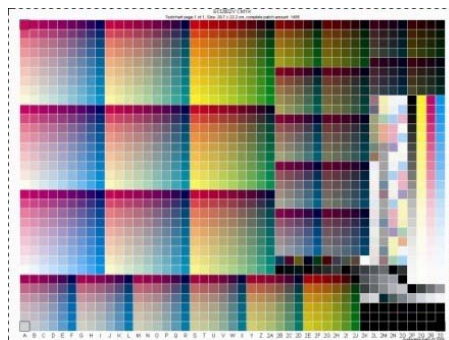
Phil Green

June 12 2013

Process aims

Aim points for printing are defined by ISO 12647 printing definitions

Process characterization data conforming to these12647 printing
   conditions is available on the ICC web site
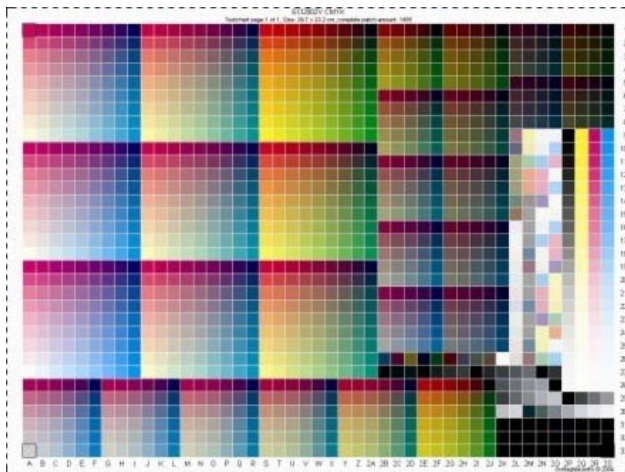

For process control, a subset of patches is used

Ugra/FOGRA-Medienkeil CMYK-TIFF V2.0 COPYRIGHT 2004   Liz.: 62FO160304
                                                       User: FOGRA Forschungsgesellschaft Druck e. V.
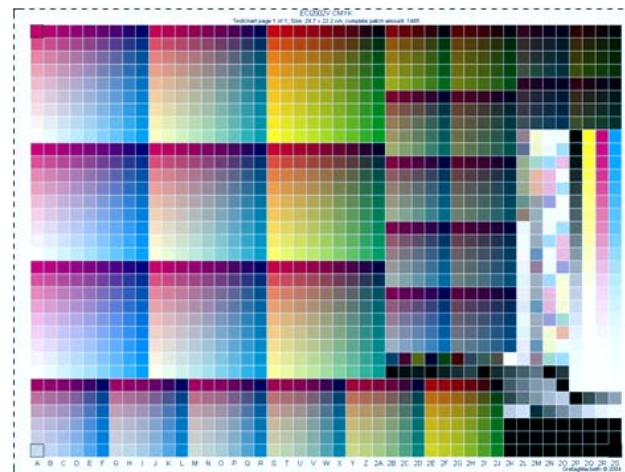
Substrates vary

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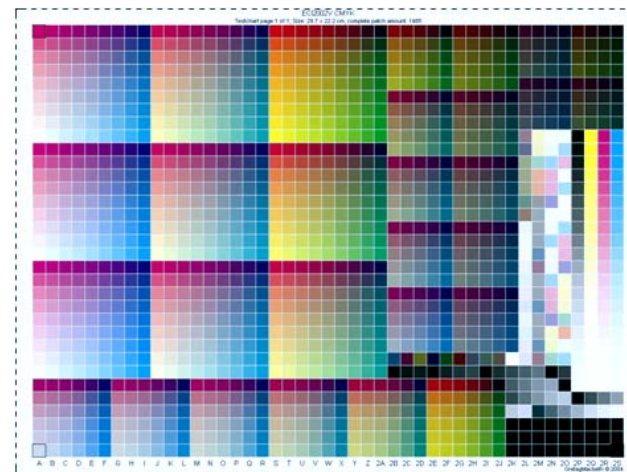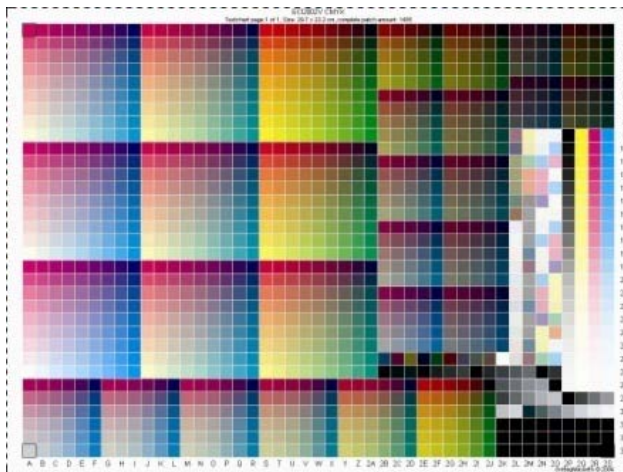

ISO 12647 aim

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
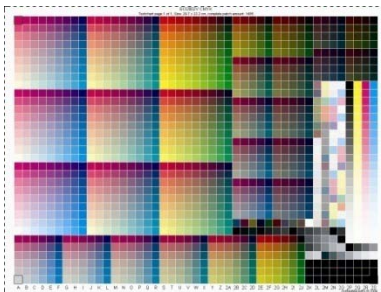

Ugra/FOGRA-Medienkeil CMYK-TIFF V2.0 COPYRIGHT 2004 Liz.: 62FO160304
User: FOGRA Forschungsgesellschaft Druck e. V.
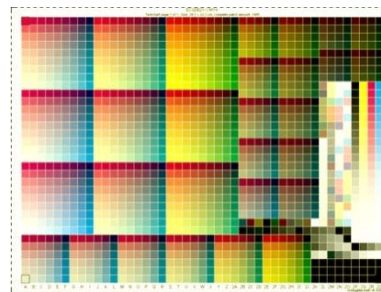
White point adjustment

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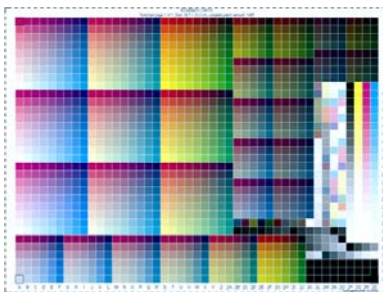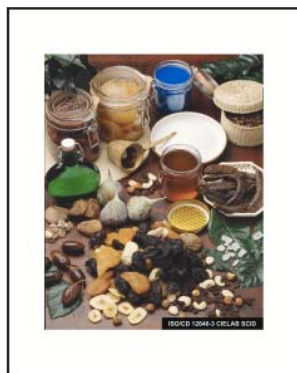

Characterization data target

ICC PCS

Adjusted characterization data

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
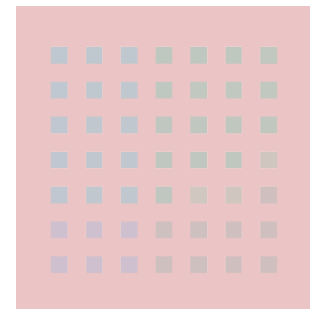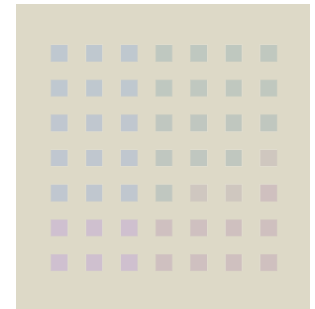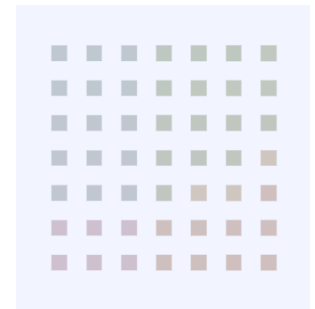
Rationale

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

Rationale

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

Contact for details: green@colourspace.demon.co.uk