Process Color Profiling: Syncing a Digital Printer with an Offset Press

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Kate Blout, having been admitted to the Carl and Winifred Lee Honors College in Fall 2003, successfully presented the Lee Honors College Thesis on April 17, 2007.

The title of the paper is:

"Process Color Profiling: Syncing a Digital Printer with an Offset Press"

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Mr. Larry Ahleman, Paper Engineering, Chemical Engineering, and Imaging

Dr. Sasha Pekarovicova, Paper Engineering, Chemical Engineering, and Imaging
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Syncing a Digital Printer with an Offset Press

Kate Blout
Honor's Thesis Presentation
Process Color Profiling:
Syncing a Digital Printer with an Offset Press

Kate Blout
Laura Kraft
April 2007 Senior Design Project

Presentation Overview

- Introduction
- Background
- Project Objective
- Methodology
- Results
- Conclusions
- Recommendations
Introduction

Why is color management important?
- Color consistency between devices
- RGB vs CMYK
- Various device gamuts
- Substrates
Background

- Printing Process
  - Electronic file
  - RIP
  - Imagesetter
  - Color Separations
  - Plate exposure
  - Plates transfer ink to substrate

Background

- Color Basics
  - What is color?
  - What affects color?
Electromagnetic Spectrum

Increasing energy

Increasing wavelength

0.0001 nm 0.01 nm 10 nm 1000 nm 0.01 cm 1 cm 1 m 100 m

Gamma rays X-rays Ultraviolet Infrared Radio waves

Radar TV FM AM

Visible light

400 nm 500 nm 600 nm 700 nm

Background

- L*a*b*
  - Main color space
  - L* - lightness
  - a* - green to red
  - b* - blue to yellow
  - 3-D sphere
Background

- Delta E
  - Difference between two colors
  - Uses $L^*a^*b^*$ values
  - $\sqrt{(L_1-L_2)^2+(a_1-a_2)^2+(b_1-b_2)^2}$
  - Acceptable range is 2-6
Background

• Color Gamut
  • Device color range
  • Affected by
    • Phosphors (monitors)
    • Inks (printers)
    • Technology/media (scanners)

Color Gamut
Background

♦ Profiles
  ♦ ICC
  ♦ Translate color specifications
  ♦ Device Dependent
    ♦ RGB, CMYK
  ♦ Device Independent
    ♦ L*a*b*

Project Objective

To create a color management system that would allow the WMU Print Lab to print color proofs on its Docucolor 12 digital printer that would match the color output of the Shinohara offset press.
Methodology

- Equipment
  - Shinohara offset press
  - Docucolor 12 digital printer
  - Gretag MacBeth Spectrophotometer
  - X-Rite 530 Densitometer
  - Adobe Photoshop CS2 and Adobe InDesign CS2
  - Gretag MacBeth Measure Tool and Profilemaker
  - Linotronic 530 Imagesetter and Harlequin RIP
  - Flint Ink Arrowstar Fast Setting Litho Process Inks
Methodology

1. Print ECI2002R CMYK target on Shinohara using 3 substrates
   - Create InDesign Document
   - Output film - no color management
   - Strip up film
   - Make Plates
   - Run Press
Methodology
Methodology

2. Measure the printed targets with the Gretag MacBeth Spectrophotometer
2. Measure the printed targets with the Gretag MacBeth Spectrophotometer
   - Create 3 substrate-specific profiles
   - Using Measure Tool and Profilemaker

3. Apply profiles to MacBeth Colorchecker and print on the Shinohara again

4. Measure L*a*b* values of the printed MacBeth Colorchecker on each substrate
Methodology

5. Print ECI2002R CMYK target on Docucolor 12 using 3 substrates
6. Measure the printed targets and create 3 substrate-specific profiles
   - reference to the Shinohara's L*a*b* values
7. Apply profiles to MacBeth Colorchecker and print on the Docucolor 12
8. Measure L*a*b* values of the printed colorcheckers on each substrate

9. Convert MacBeth Colorcheckers to appropriate profiles in Photoshop to retrieve L*a*b* values
10. Enter printed and Photoshop values into Excel
11. Calculate Delta E values
12. Compare Delta E values to determine if the profiles worked accurately
Results

Profiled Shinohara (print) vs. Photoshop

Avg Delta E
GLOSS = 10.23
MATTE = 11.31
OFFSET = 13.14

Results

Profiled Doc 12 (print) vs. Photoshop

Avg Delta E
GLOSS = 7.69
MATTE = 11.85
OFFSET = 8.99
Results

Profiled Shinohara (print) vs. Profiled Doc (print)

Avg Delta E

GLOSS = 11.35
MATTE = 12.22
OFFSET = 18.17

Results

Visual Comparisons

(Use Light Booth)
Conclusions

- Printed L*a*b* values did not match the predicted Photoshop values
- The Docucolor 12 did not accurately reproduce the Shinohara’s print
- Delta E > 6
  - What does this mean?
  - THE PROFILES DID NOT WORK! :( 

What went wrong?

- Different batches of Ink
- Decreasing ink density with drying
  - Values dropped more than .10
Recommendations

- Use the same batch of ink for both runs
- Run ink heavier than desired density

Thank you!

Any questions?