Color Gamut Extension on a 4-color Sheet-fed Offset Press Using Ink Fountain Divider Method

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Overview

- Background
- Problem Statement
- Innovation and Significance
- Materials and Methodology
- Experimental Procedures
- Conclusion and Future Work

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Background

- Color Gamut
- Process color
- 4-color sheet-fed offset press
- 7-color sheet-fed offset press

Figure 1 CIE color gamut

Problem Statement

- The capacity of a four-unit offset press is limited for reproducing photo-heavy print jobs with vibrant color presentation.
- Dry trap 7 or 8 colors on a 4-color press is not cost-effective due to slow turnaround and labor cost.

Innovation and Significance

- This research is aimed to offer a more cost-effective way to enable 4-color offset press to deliver 7-color jobs with wet trap and significantly extended color gamut with premium quality.

Heidelberg SM CD 74

Materials and Devices

- Printing Machine: Heidelberg Speedmaster CD74
- Screen method: Staccato
- Screen Resolution: 10 µm
- Screen Angle: Cycle through screen angles
- Plate: Kodak Sonora Processless plate
- Paper: Spicers 135gsm Dull Coated
- Ink: Heidelberg Saphira process: Cyan, Magenta, Yellow, Black; Heidelberg Saphira Spot: Orange, Green, Violet.
- Density Measurements: X-Rite Spectrophotometer, i1 Profiler

Procedures Overview

- Create a test chart with 7 color channels
- Print the test chart with wet trap on the 4-color press
- Read the test chart with i1 Profiler and calculate the color gamut, generate and load the color profile.
- Create a test photo, print with 4-color and 7-color respectively.
- Color Gamut Calculation and Comparison

Procedures Overview

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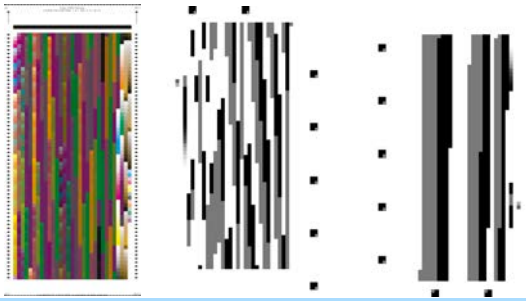
Test Chart Creation

- Using the advanced version of i1 Profiler, a 7-color patch set was created. The size was limited to 9.5 x 19 inches.
- I1 Profiler needs to know the +colors: orange, violet, green
- I1 Profiler generates an .eps file (actually a .dcs file) with 7 colors
- The file can only be opened in Adobe Photoshop as a .dcs file
- In Photoshop, the individual channels can be manipulated



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Test Chart Reproduction

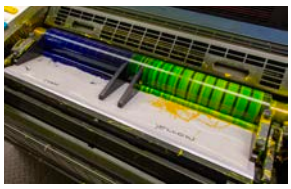
- Print Specs: 2400 Spot per Inch @ 3400 sheets/min
- Density Target: GRACol 2006 Coated 1; VGO – L* values

Density				L*		
K	C	M	Y	O	G	V
1.70	1.40	1.50	1.05	61	58	19

Density Standard: GRACoL 2006 Coated 1

Ink Fountain Settings

- Two ink dividers are set in the center of each ink fountain tray, except for the unit 3.



Ink fountain tray split by the ink divider: Unit 4 - C+Y

Ink Fountain Settings

- The color sequence are set as following based on lightness value of each color.
- The print sequence will be from dark to light

	O.S.	L* values	D.S.	L* values
Unit 1	K	10	G	58
Unit 2	V	19	O	61
Unit 3	M	50	M	50
Unit 4	C	57	Y	94

O.S: Operator Side; D.S.: Driver Side

Test Chart Reproduction

- Wet trap: IR drier off, drying powder off
- Switch gripper side and Side guide - run 2nd pass
- Operator side guide– driver side guide
- Density Check
- Once reached- run 100 good sheets

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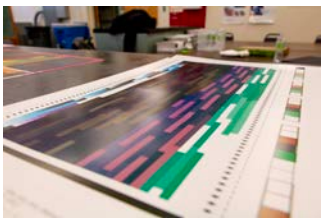
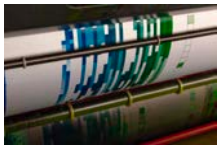
Read Test Chart

- I1 Profiler can't recognize the same color with too much variance.
- This is due to the gradually mixing of the two colors in one ink tray.
- This is done by the oscillators in each unit.



Ink Contaminations

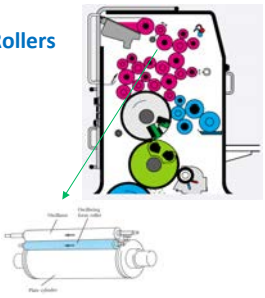
- The ink dividers are not sufficient to keep two colors separated
- Two color gradually blended in and cause various levels of color variations on each unit.



Unit 4- Cyan bleeds into yellow results in greenish color

Trouble shooting: Oscillator Rollers

- Move laterally to spread ink evenly across the inking train.
- Main challenge for divided inking train with dual colors – gradually get mixed.



Oscillator Rollers

- Disengage oscillator rollers
  - *Mechanically*
  - *Digital control*
- After consulting the Heidelberg technicians, we managed to disengage all the oscillators in each unit.

Inking train side view– driver side

2nd Press Run - Test Chart Reproduction

- The ink dividing is significantly improved after oscillator disengagement.
- However, ink weren't being fed across inking train uniformly.
- As a result, there are obvious ink stripes on the prints.

Unit 4 - After disengage the oscillator

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Test Photo Reproduction

- Create a photo file (image), run with 4 color and 7 color respectively
- I1 profiler read the color gamut
- Compare the color gamut of the 2 prints

Results and Discussion

- Unfortunately, on this press the oscillators cannot be partially defeated; other Heidelberg presses have variable oscillation options.
- As a result of the oscillator problem, we were unable to make a Color Gamut Comparison
- We were forced to stop and reconsider our options

Conclusion and Future Work

- We might try a dry-trap version of the same job, running colors in the darkest-to-lightest order as either 4-then-3, or vice versa
- Run the same photos on a 4-color process run
- Compare the differences
- "Learn by doing!"

Thank you!
Questions?

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