ICC Color Experts Day
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Textile Color Management

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Colored Textiles

- Traditionally, textiles are woven from colored threads
- Threads are formed from dyed fibers
- Patterns in textiles are formed by weaving multiple threads of different colors
Color management of threads

- Threads are woven into solid-color fabrics or thread windings
- Colors of solid-color fabrics or thread windings are measured by specialized color devices
- Experimentally Speaking - Woven fabric measurements can also be estimated from spectral image capture of individual threads (HKRITA)
- Dye recipes are often formulated by trial and error
Textile Digital Printing Applications

- Apparel
- Interior décor
- Furniture
- Soft signage
Textile Printing Approaches

- **Direct Printing without Dye Sublimation**
  - Latex/UV/Hotmelt Printers

- **Direct Dye Printing**
  - Media treated to enable fixation
  - Media loaded into printer
  - Ink jetted onto media
  - Dye fixing process applied

- **Transfer Dye Sublimation**
  - Transfer media loaded into printer
  - Image printed reflected on transfer media
  - Image transferred to media with heat press

**Issues:**
- Ink adhesion (washing, rubbing)
- Color fastness (light)
Transfer Dye Sublimation Process

1. Prepare source image in RIP
2. Print reflected on transfer paper with sublimation inks
3. Sublimate from paper to fabric
   — Heated dye becomes gas and infuses into fabric fibers
   — Color of dyes on paper not the same as final color
   — Final output may change size due to heat
Colorant Surface Interactions

Coated Paper
• Single “Flat” Surface
• Colorant Absorbs into Media

Textile
• Lots of Rounded Surfaces
• Uneven application of colorant
How a photon interacts with a surface is dependent on its wavelength and the surface characteristics.

Results in challenges for measurement of printed textiles to correspond to visual appearance.
Managing Color

• **Manual**
  — Print color swatches and use color recipes in design applications
  — Use Named Spot Colors with device based color replacement
  — Setup and use device color based Colorways palettes in RIP

• **Automated**
  — Profile Media and Print Mode
  — Use ICC Color Management
Textile Gamut Differences

- **Good gamut coverage of bright/saturated yellow, orange, red, magenta, and blues**
- **Limits to dyes**
  - Magenta is more of a red
  - Cyan is more of a blue
- **Results in loss of green and violet portions of gamut**
  - Additional inks may be required to achieve these kinds of colors
- **Cannot get very dark**
  - Black Ink Issues
    - Black often formed by mixing Cyan, Magenta, Yellow dyes
  - Fibers of fabric scatter light resulting in lower densities
Ink Channel Selection

- To get larger gamuts you may need to use additional inks
  - As supported by the print device
- Software should be configured to correspond to inks in printer
- Support for color profiling of custom ink configurations is required
Potential for using iccMAX with textile?

- iccMAX provides a flexible and extensible platform for modeling and defining color workflows
  - Support for fluorescence based PCS
  - Support for custom illuminants
  - Support for modeling observing conditions
  - Extended “programmable” transform encoding
- Advancements in color measurement technology are needed to take advantage of many iccMAX possibilities
- Implementation of iccMAX functionality that takes advantage of these features is yet to be seen
Textile Profiling Issues and Tips Part 1

• **Fabrics can have optical brighteners**
  — This results in false reading of blue light resulting in addition of yellow in final output

• **Dyes can Fluoresce**
  — Get really bright saturated colors
  — Results in very unreliable measurements

• **Tip: Use M1 (part 1) measurements or manual color management**
Textile Profiling Issues and Tips Part 2

- **Color changes due to sublimation**
  - Measure all color from final sublimated output
  - Process control of sublimation process is critical
  - Dyes result in different gamut shape
    - Black ink is actually a combination of CMY
  - Print with as much ink as possible to get richest blacks

- **Things get reversed with transfer printing**
  - Set up your workflow for printing your final images reflected
  - Make sure color management swatches are also printed reflected
Textile Profiling Issues and Tips Part 3

- Weave directionality causes variability in the measurements
  - Tip: Print two swatches with second swatch rotated 90° from first swatch
    - Measure first and second swatch with averaging for single reading for each patch
  - Use M3 measurement mode (with polarizing filter) to reduce impact of measurement light source

- Fabric shrinks or stretches
  - Tip: Use resolution adjustment to compensate for shrinking / stretching
Textile Profiling Issues and Tips Part 4

- Consider the number of patches when performing tone calibration
  - More patches may reduce severity of spikes with measurements
    - The transition from zero to full color is very sharp
    - Sublimation is a very NON-linear process
  - Less patches avoids characterizing measurement noise
Conclusions

• Textile printing offers many opportunities
• Textile surface, media, and inks provide challenges to getting measurements of color that correspond to actual perception of color
• Managing color on textile has its challenges
  — Manual approaches can work really well
  — Automated approaches are nearly the same as printing on conventional media when differences are accounted for
• Important concepts:
  — Getting good measurements, implementing process control, and using production workflow and color management software that you can trust
Thank You!