Connecting Color Science and Color Engineering using iccMAX

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What is Color?

- Color is a way that we describe an object based on the way that it reflects or emits light
- Your eye can see different colors because a part of your eye called the retina is sensitive to different wavelengths of light

https://www.mensaforkids.org/teach/lesson-plans/introduction-to-color/
The Elements of Color

Light Sources

Objects

Observers

Perception
(Processing)
Color Science

The study and quantification of light, its interactions, and its perception

This involves:
- Physics
- Chemistry
- Biochemistry
- Vision Science
- Neural Science
- Material Science
- Psychophysics
- Psychology
- ...

Color Engineering

The design and implementation of systems that create, manipulate or capture light

This involves:
- Colorant formulation
- Printing
- Filter and sensor design
- Lighting design
- Chemical Engineering
- Hardware and Software
- Mechanical and Electrical Engineering
- ...

...
Quantification of Light and Perception

Surface Properties

Reflectance

Emission

Transmittance

Fluorescence

Color Appearance

Lab

CAM

Color Matching

XYZ

Cones
Creating, Manipulating, and Capturing Light
Color Management Connects Science and Engineering
ICC.1 Connections

- Color Matching
- RGB
- CMYK
- 1931 Standard Observer
- D50
- LAB
- XYZ
- Color Naming
- Color Appearance

- Color Matching
iccMAX: Custom Colorimetric connections

Custom colorimetric PCS defined by illuminant and observer in spectralViewingConditionsTag
iccMAX: Spectrally-based Object Connections

Using spectral PCS with illuminant and observer in spectralViewingConditionsTag

Transmittance

Reflectance

Flouresence

CMYK+

Color Appearance

Lab

CAM

XYZ

Color Matching

Cones
Using `emissiveMatrixElement` with illuminant and observer in `spectralViewingConditionsTag`
iccMAX: Spectral Image Capture

Using processing elements with spectral PCS

RGB

Emission

Transmittance

Reflectance

CMYK+

N-Channel
ICCMAX: Connecting Between Observing Conditions

The customToStandardPccTag and standardToCustomPccTag are used as part of PCS processing to convert colorimetry between different observers and/or illuminants.
Using BRDF, surface map, and surface normal tags
iccMAX: Color Naming Connections

Using spectral PCS and extended namedColorTag
Multiplex channel tags utilize named channels for connection to device channels or PCS. Useful for things like pigment identification or visualization.
Conclusions
iccMAX is About Color in the Real World

• iccMAX enables various connections between Color Science and Color Engineering
• iccMAX provides a platform with both flexibility as well as extensibility for modeling and defining color workflows
• Many of the complexities of color in the Real World are encompassed by iccMAX
Reference Material

- ICC web page
  — http://www.color.org

- iccMAX web page:
  — http://www.iccmax.org

- ICC specification documents:
  — http://www.color.org/icc_specs2.xalter

- iccMAX demonstration implementation:
  — https://github.com/InternationalColorConsortium/DemoIccMAX

- Max Derhak’s PhD dissertation
  — Spectrally Based Material Color Equivalency: Modeling and Manipulation
  — http://scholarworks.rit.edu/theses/8789/
Thank You

Questions?