

## Announcing a workshop with Charles Poynton

Wednesday, July 26, 2006  
Deluxe Toronto, DI Grading Suite,  
424 Adelaide St. E., Toronto  
9:00 am–5:30 pm

### Colour Science for the Digital Intermediate: LINs, LOGs, and LUTs

**Digital technology** is now the preferred alternative to film for the capture, post-production, and exhibition of motion pictures. Integration of digital imagery with film leads to hybrid film-digital workflows; however, film and electronic media capture and reproduce images in fundamentally different ways. Film uses subtractive colourants (CMY), but digital cinema uses additive primaries (RGB). Film is characterized using logarithms, but digital video, HDTV, and computer graphics are typically characterized using power functions; computer-generated imagery (CGI) uses linear-light representations. Film and digital cinema have different colour gamuts, and are optimized for different contrast ratios.

**In this 1-day workshop**, portions of which were presented recently at Panavision in Los Angeles and at the Digital Cinema Testbed in London, Charles Poynton will detail the colour science that underlies image reproduction in digital cinema. He explain how colour is captured, encoded, and reproduced in HDTV, computer graphics, digital cinema, and film. He will discuss practical details of maintaining colour quality through the imaging pipeline, paying particular attention to the digital intermediate. Participants will gain an understanding of the factors that need to be addressed to achieve accurate colour, and learn practical techniques that can be used to successfully implement digital cinema. See the reverse of this flyer for a Syllabus.

#### Who Should Attend:

The attendee should be very familiar with digital video, HDTV, and/or digital cinema, and have no fear of mathematics. The workshop will be suitable for people in positions such as these:

- Film scanner and film recorder engineers and technicians
- Post-production and Visual effects engineers
- Technically-oriented lighters, shaders, and compositors
- Digital cinema, digital video, and CGI software developers
- Digital cinema product developers and technical managers

**Charles Poynton** specializes in the physics, mathematics, and engineering of digital colour imaging systems, including digital video, HDTV, and digital cinema (D-cinema). He is the author of *Digital Video and HDTV Algorithms and Interfaces*, and a Fellow of both the Society of Motion Picture and Television Engineers (SMPTE) and the BKSTS.

**Registration:** Fee, CAD \$400. Lunch is included; colour handout notes will be provided. To enroll, contact [charles@poynton.com](mailto:charles@poynton.com) or call +1 416 535 7187. About a dozen places are available; please register early. On-site registration is *not* planned; please register in advance.

## ***Colour Science for the Digital Intermediate***

### **Morning: THEORY**

#### **Tone reproduction**

Radiometry and photometry; lightness terminology; various contrast measurements; lightness sensitivity; importance of perceptual uniformity; gamma in video, HDTV, and CGI; rendering for the viewing environment.

#### **Colour reproduction**

Concepts of color – lightness, hue, and saturation; classical CIE colorimetry; trichromaticity; scanner/camera metamerism; necessity of colour matrixing; additive and subtractive reproduction; white reference and colour temperature; colour transforms (including 3×3 matrixing).

#### **Film**

Film capture and reproduction; sensitometry and film gamma ( $D\text{-log } E$  curves); optical density (Status A, Status M); film gamma; emulsion sensitivities and dye spectral characteristics; unwanted absorptions; Cineon/RP 180 printing density and encoding; film gamut.

#### **Image coding for acquisition, CGI, video, HDTV, and film**

Gamut limitations; codeword utilization issues; chroma subsampling; implications for compression; constant luminance; colour measurement ( $XYZ$ ,  $LAB$ ); image encoding (linear  $RGB$ , nonlinear  $R'G'B'$ , sRGB,  $Y'CbCr$ , log  $RGB$ , CPD/DPX, OpenEXR).

#### **Colour management and colour appearance**

Colour transform techniques; ICC architecture; profiles; device characterization and calibration; 1-D and 3-D lookup tables; polynomial, spline, and simplex models; gamut mapping; limitations of classical colour science; subjective effects; chromatic adaptation; introduction to colour appearance models.

### **Afternoon: PRACTICE**

#### **Acquisition**

Camera characteristics; on-set previsualization and look management; chromatic adaptation and white balancing; camera GAMMA, BLACK GAMMA, KNEE POINT, and KNEE SLOPE controls; dependence of display gamma upon display surround and contrast ratio.

#### **Digital intermediate**

Traditional film workflow; timing/grading; choice of coding system and gamut; integration of CGI and visual effects; Cineon/DPX and OpenEXR coding issues; colour calibration and colour management.

#### **Film recording**

Behaviour, characterization, and calibration of film recorders; colour grading and approval prior to film recording.

#### **Display and exhibition**

DLP/DTIM/P3/P7V2 primaries; colorimetric matching; appearance matching; gamut issues; display characterization and calibration; use of profiles and LUTs.