A seminar with Charles Poynton

Scene-linear workflow/ACES

Saturday, Oct. 13, 2012,
9:30–17:00

in association with the Toronto section of SMPTE

and hosted by

Technicolor
49 Ontario St.
Toronto, ON M5A 2V1

Previously presented in Vancouver (May 2012), and Montréal (Aug. 2012).

For nearly 20 years, cinema production and post-production has been based upon the conceptual model of film acquisition: Even if digitally acquired, imagery was typically processed using the Cineon/DPX model – technically, Cineon Printing Density (CPD) coding. That coding incorporates the technical parameters of film; in particular, the S-shaped tone response and the colour crosstalk of film are built-into the image encoding. The CPD scheme has made CGI and VFX difficult.

Digital cinema cameras are now commonplace. Some of them generate data comparable to a film scan (e.g., ARRI log C). Others generate data comparable to HD video (BT.709/BT.1886), or are based upon HD video (Hypergamma). Still others use "log" formats of various kinds (Panalog, SI $\log_{90}$, Sony log, Red Log). DI houses and CGI/VFX facilities have to deal with image data in new forms.

The Academy of Motion Picture Arts and Sciences is standardizing a technique (formerly called IIF, now ACES) to acquire and process "scene-linear" data – that is, image data closely coupled to scene exposure. Colour transforms imposed during the DI process create the desired "look" and systematically compensate for the viewing conditions of cinema. The ACES scheme is being deployed commercially. Even without strict technical conformance to the various elements of the ACES system – the ACES colourspace, IDT, LMT, RRT, ODT – the concepts are important.

In this 1-day seminar, hosted by Technicolor, Charles Poynton will discuss the technical and visual requirements for acquisition and processing using the ACES scene-linear model. I will introduce the basic technical parameters of various camera encodings and describe their dynamic range and noise properties. I will outline how "picture rendering" must be imposed in the DI pipeline, for example, by the AMPAS reference rendering transform, RRT. I will describe the ACES colourspace (and its close relative, OCES), and describe the four key colour transforms in the scheme: IDT, LMT, RRT, and ODT. I will explain how the scene-linear model is applied to the DI pipeline, and how it aids CGI/VFX integration.

Who Should Attend: The seminar will be suitable for people in positions such as these:

- HD engineers and Digital Imaging Technicians (DITs)
- Compositors, lighters, shaders, and pipeline engineers
- Post-production and visual effects supervisors, post/VFX engineers, and technically minded colourists
- Digital cinema, digital video, and CGI/VFX software developers

The attendee should be familiar with digital video, HD, and digital cinema. Knowledge of mathematics isn't required; nonetheless, many graphs and several equations will be shown!

Registration: CAD 350 + HST = 395.50. SMPTE members receive a 10% discount. Detailed handout notes – some of which form portions of the second edition of Mr. Poynton's book – will be provided. Seating is limited, and on-site registration will not be available; please register early. For information, or to register, contact Charles Poynton, charles@poynton.com, +1 416 535 7187.

SCENE-LINEAR WORKFLOW/ACES – OUTLINE

Introduction to ACES	The key concept: Picture rendering. Colour appearance effects (Hunt, Stevens, Bartleson-Breneman), how they are issues in digital cinema and HD, and how they are addressed in ACES. Contrast ratio ("dynamic range"). The primacy of the reference display (art and craft upstream, science downstream).
ACES	The two ACES colourspaces (ACES, OCES). The four ACES transforms: IDT, LMT, RRT, ODT. The two reference devices: RICD, RP.
Colour science	Colour acquisition, the XYZ system and its derivatives, colour display, additive primaries, nonphysical primaries. Colourspace transformations. Colorimetry and densitometry; CPD, DPX, APD, and ADX. Perceptual uniformity and integer ACES encodings.
DI and Colour grading	The concept of working space. "Linear" mode (lift/gamma/gain) and "log" mode. CONTRAST and BRIGHTNESS reinterpreted.

— lunch —

Cameras and input transforms	Camera spectral sensitivities. White balance. The necessity of 3×3 matrix transform (colour formation matrix). Power function coding, log coding, quasilog coding. How to acquire or build an IDT.
Displays and output transforms	Display spectral properties and chromaticities. 3×3 matrix transforms for primary interchange. Digital cinema reference projector (DCI P3); HD colourspace (BT.709/BT.1886), SD colourspace (BT.601). How to acquire or build an ODT. Colour calibration.
Software technology	OpenEXR, CTL, OpenColorIO.
Emerging technology	HDR acquisition. HDR displays; spatially modulated backlights. Tone mapping. OLED and laser displays.

Questions & discussion

Charles Poynton specializes in the physics, mathematics, and engineering of digital colour imaging systems, including HD and digital cinema (D-cinema). He is the author of *Digital Video and HD Algorithms and Interfaces,* recently published in its second edition, and he is a Fellow of the Society of Motion Picture and Television Engineers (SMPTE). Twenty years ago, he chose the number 1080 (as in 1920×1080) for HD and digital cinema standards, thereby establishing "square pixels" for HD. In 1998, he was responsible for creation of the Adobe RGB (1998) colourspace.