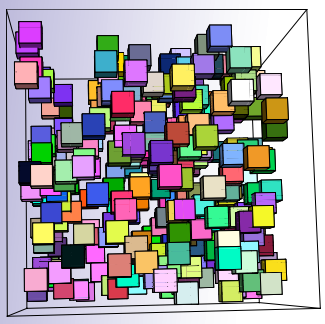
A seminar with Charles Poynton

Stops, Steps, Looks, and LUTs: The Art and Science of Digital Cinematography



Sydney, Fri. Jan. 20, 2012
fxphd/Future Reality/Deluxe
706 Mowbray Rd, Unit 2
Lane Cove NSW 2066 (Sydney)

This seminar was presented in Lisbon in Apr. 2009, organized by Associação de Imagem Cinema e Televisão Portuguesa (AIP), and in Munich in June 2010, organized by HFF München. It has also been presented in Toronto and Vancouver.

In discussion for Wellington, N.Z.; Berlin; New York; and Oslo.

Cinematographers and their colleagues – camera operators and assistants, colourists, visual effects supervisors and artists, and others – are making the transition to digital acquisition. Digital imaging technicians (DITs), digital intermediate engineers, and digital intermediate technicians are also involved. All of these people are engaged in translating aspects of film into the equivalents in digital technology. Many questions arise. How many stops of exposure latitude does a digital camera offer? What exposure index should be used? What is the "film look" and where should it be imposed? Why does noise arise, and what can be done to minimize it? Should I record and process "log" or "linear"? Is there one kind of "log" and one kind of "linear," or are those terms ambiguous? Is it valuable to have an on-set display? Where do the LUTs go, and who should determine their content? Under what conditions is on-set colour grading useful?

In this 1-day seminar, organized by fxphd/Future Reality and hosted in Lane Cove, Charles Poynton will introduce digital cinema acquisition in a manner that's accessible to cinematographers, colourists, and related craftspeople. He will introduce logarithmic coding, and relate that to conventional photography and to digital cinema. He will describe camera sensitivity and ISO/EI ratings. He will describe the zone system, and discuss what aspects of that system are valuable in connection with digital acquisition. He will discuss the tone scale and colour modifications that impart the "film look," and he will discuss the roles of camera controls (GAMMA, KNEE, SLOPE) and 1-D and 3-D lookup tables in achieving these modifications. See overleaf for a detailed outline.

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

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

The attendee should be familiar with digital video, HD, and/or digital cinema. Knowledge of mathematics isn't required; nonetheless, we'll show many graphs and several equations!

Registration: AUD 200. Detailed handout notes – some of which form portions of Mr. Poynton's forthcoming book – will be provided. For information, e-mail info@future.com.au, or telephone +61 2 9925 4355.

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,* and is a Fellow of both the Society of Motion Picture and Television Engineers (SMPTE) and the BKSTS. Twenty years ago, he chose the number 1080 (as in 1920×1080) for HD and digital cinema standards.

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Morning

Introduction: Two views of imaging – the engineering view and the creative view; lightness terminology; contrast ratio and its measurement(s); the relative nature of lightness sensitivity; perceptual uniformity; logarithms and power functions, stops and steps (DCVs); zone system; introduction to radiometry and photometry (lumens, lux, candelas, and $cd \cdot m^{-2}$ [nt]); picture rendering and image state.

Camera characteristics: CCD and CMOS sensors; beamsplitter cameras; mosaic (Bayer) sensors and demosaicking; photosite and pixel counts; mosaic patterns and demosaicking algorithms; sensitivity, saturation, dynamic range, exposure latitude, and ISO/EI ratings; noise; highlight handling; histograms and "exposing to the right/top" (EttR/EttT).

Image coding for CGI, video, HD, and digital cinema: Linear-light (and OpenEXR); quasilog/log *RGB* (Panalog, Red log, SI-log, S-log, etc.); power function (BT.709/BT.1886) encoding and its variants (HyperGamma, FILM REC, Cine Gamma); log-neg (CPD) coding; gamma 1.0, 1.7, 1.8, 2.0, 2.2, 2.4, 2.6, 2.8, and 3 in video, HD, CGI, and film; code efficiency and its visual impact; gamut limitations; bit depths; sRGB; $Y'C_BC_R$; chroma subsampling; implications for compression.

Display: Studio reference displays (CRTs, LCDs, PDPs, AMOLEDs); emergent display standards (BT.1886); digital cinema projectors; projection primaries; colorimetric matching and appearance matching; gamut issues; display characterization and calibration; using profiles and LUTs.

Afternoon

Acquisition: Exposure; white balance; choice of data encoding; GAMMA, BLACK GAMMA, KNEE POINT, and KNEE SLOPE controls; on-set previsualization and look management; ASC color decision lists (CDLs). Characteristics of real cameras: ARRI Alexa, Sony SRW-9000/F35/F65, Phantom, SI-2K, RED, others.

Colour management and colour appearance: Workflow; choice of coding system and gamut; integration of CGI and visual effects; emergent AMPAS IIF workflow and the RRT; "Printer lights"; colour characterization and calibration; LUTs: 1-D and 3-D; "view" LUTs and "print" LUTs; CTL; ICC colour management and ICC profiles; DCI standards; concepts of DCDM, DCP, and the reference projector; D-cinema $XYZ^{1/2.6}$ encoding.

Digital intermediate: Digital cinema workflows (including "raw" workflows and demosaicking); wavelet compression; timing/grading; choice of coding system and gamut; integration of CGI and visual effects; colour calibration and colour management.

Wide gamut: Traditional video gamut (SMPTE, EBU, and BT.709); graphics arts (Adobe *RGB* 1998); digital cinema production (SMPTE FS/709, ACES); wide gamut in consumer space (xvYCC, x.v.Color, "Deep color"); digital cinema distribution and exhibition (P7V2; DCI P3 *RGB; XYZ,* and $Y'C_XC_Z$); future LED and laser primaries.