

## Announcing a seminar with Charles Poynton

April 17–19 (Fri.–Sun.)  
9h00–18h00 (Fri. 14h00–)  
Tobis Portuguesa,  
Praça Bernardino Machado  
Lisboa, Portugal



## Stops, Steps, Looks, and LUTs: The Transition to Digital Cinematography

**Cinematographers** and their colleagues – camera operators and assistants, colorists, 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? Where is the “film look” imposed? Why does noise arise, and what steps can be taken to minimize it? Should I record and process “linear,” “log,” or “BT.709”? Is it valuable to have an on-set display, or is that practice unnecessary? Where do the LUTs go? Who determines their content? Is on-set colour grading feasible?

**In this 2.5-day seminar**, organized by [Associação de Imagem Cinema e Televisão Portuguesa \(AIP\)](#), Charles Poynton will introduce digital cinema acquisition in a manner that's accessible to cinematographers 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 modifications that impart the “film look,” and he will discuss the roles of camera controls (“gamma”) and lookup tables in achieving these modifications. See overleaf for a Syllabus.

### Who Should Attend:

The attendee should be familiar with digital video, HDTV, and/or digital cinema. Knowledge of mathematics isn't required; nonetheless, we'll show some equations and graphs! The seminar will be suitable for people in positions such as these:

- Cinematographers and Assistant cinematographers
- Digital image technicians (DITs) and HD engineers
- Film scanner and film recorder engineers and technicians
- Post-production and Visual effects supervisors and technicians
- Digital cinema, digital video, and CGI/VFX software developers

**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:** EUR 450 for AIP members, EUR 550 for nonmembers, including lunch and refreshments. Handout notes will be provided. To enroll, contact [Associação de Imagem Cinema e Televisão Portuguesa \(AIP\)](#). Seating is limited; please register early.

## ***Stops, Steps, Looks, and LUTs: The Transition to Digital Cinematography***

### **Day 1**

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; zone system; introduction to radiometry and photometry (lumens, lux, candelas, and  $\text{cd}\cdot\text{m}^{-2}$ ); picture rendering and image state; gamma in video, HDTV, CGI, and film.

### **Day 2**

**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" (ETTR).

**Image coding for CGI, video, HDTV, and digital cinema:** Linear-light, log-light ( $\log RGB$ ), video, and log-neg (CPD/DPX) coding; code efficiency and its visual impact; chroma subsampling; implications for compression; image encoding (linear  $RGB$ , nonlinear  $R'G'B'$ , sRGB,  $Y'CbCr$ ,  $\log RGB$ , Cineon/CPD/DPX, OpenEXR); gamut limitations; bit depths.

**Colour management and colour appearance:** Workflow; choice of coding system and gamut; integration of CGI and visual effects; "Printer lights"; colour characterization and calibration; LUTs: 1-D and 3-D; "view" LUTs and "print" LUTs; ICC colour management and ICC profiles; DCI standards; the concept of DCDM, DCP, and the reference projector;  $XYZ^{1/2.6}$  colour data coding.

### **Day 3**

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

**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 D-21, Sony F950/F950/F23, Panavision Genesis, Sony F35, Thomson Viper FilmStream, Red One, others.

**Digital intermediate:** Traditional film workflow; emergent 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.

**Film scanning and recording:** Sensitometry and film gamma ( $D\text{-log } E$  curves); optical density; behaviour, characterization, and calibration of film scanners and recorders; Cineon printing density (CPD); film scanning equipment (telecine, Thomson DataCine, Imagica, ARRISCAN, Northlight), film recording (ARRILASER, Aaton); colour grading and approval prior to film recording.