New Technologies for Picture Quality Improvement
HFF- Munich Seminars with Charles Poynton

(Workshops in English)

- 04.03.2015 Emerging UHD Technology, BT.2020, 4K/8K, HFR
- 05.03.2015 Scene-linear workflow / ACES
- 06.03.2015 Colour technology for video designers, Video artists and Editors

Emerging UHD Technology, BT.2020, 4K/8K, HFR

In the development of motion imaging systems beyond 1080p HD, various proponents have proposed (and in some cases deployed) three schemes alleged to improve quality:

(i) bit depths beyond the 10-bit colour components standard for studio HD,
(ii) (ii) pixel counts (“4 K” and “8 K”) higher than the 1920x1080 of HD, and
(iii) (iii) frame rates higher than 60 Hz.

However, the tradeoffs among these various options are not well understood; it is not immediately clear into which of these three domains additional bits should be placed in order to achieve maximum improvement in perceptual quality. Also, traditional image quality criteria for moving images have mainly been carried over from still imaging; few criteria are available to assess motion portrayal. Finally, motion portrayal is often described by terms such as “strobing” that have no consistent definition.

In this course, we address the fundamental physics constraints of motion image cameras and displays, and we reach into psychophysics to understand how the visual system interacts with the physics. We describe the properties of vision that relate to the choice of bit depth, and their dependence upon visual adaptation and absolute luminance (of the display and the viewing environment). The fundamental concept of eye tracking by the viewer is described. The key concept that links physics to vision in motion imaging is the optic-flow axis; that concept clarifies the mechanisms that cause loss of resolution in the presence of motion. Such losses are characterized by dynamic resolution.

At the completion of the course, attendees will have a complete understanding of the drawbacks of today's imaging systems, but, more importantly, will have knowledge and information that allows informed decisions to be made about key parameters of future systems such as bit depth, pixel count, and frame rate.

Workshops with Charles Poynton

ACES 1.0 & Scene-linear workflow

Upcoming in-person workshops, full-day:

New York: AbelCine
Thu. Feb. 26, 2015
09:30–16:30

Munich: HFF Munich
Thu. Mar. 5, 2015
09:30–16:30

Consult poynton.com/w to see announcements of upcoming webinars.

DRAFT ANNOUNCEMENT

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 coding that 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 HD video (BT.709/BT.1886), or are based upon HD video (Hypergamma). Others use "log" formats of various kinds (ARRI log C, Sony log, Red log, SI $\log_{90}$). DI houses and CGI/VFX facilities have to deal with image data in new forms.

The Academy of Motion Picture Arts and Sciences has standardized a technique, 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 has been released at version 1.0, and is being deployed commercially.

In this workshop, Charles Poynton will discuss the technical and visual requirements for acquisition and processing using the ACES scene-linear model. He will introduce the basic technical parameters of various camera encodings and describe their dynamic range and noise properties. He will describe the *input device transform* (IDT) by which image data from different cameras is transformed to a common colourspace (ACES). He will outline how "picture rendering" must be imposed in the DI pipeline, for example, by the ACES *reference rendering transform* (RRT). He 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. He will explain how the scene-linear model is applied to the DI pipeline, and how it aids CGI/VFX integration. He will describe various output device transforms to yield imagery suitable for D-cinema, HD, and other displays.

See overleaf for a detailed outline.

Who Should Participate: This Webinar will be suitable for people in positions such as these:

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

Participants should be familiar with digital video, HD, and digital cinema. Knowledge of mathematics isn't required; nonetheless, many graphs and equations will be shown! Detailed handout notes – some of which form portions of the second edition of Mr. Poynton's book – will be provided.

Registration:
New York, USD 300. To register, access the AbelCine training web site, *training.abelcine.com.*
Munich, EUR 250. To register, contact Katrin Richthofer at HFF Munich, sft@hff-muc.de, +49 89 68957 9438.

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ACES 1.0 & SCENE-LINEAR WORKFLOW – OUTLINE

Introduction to ACES	The logarithmic nature of human visual perception – or is it a power function? The zone system, the importance of 18% grey. The key ACES 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).
Colour science	Colour acquisition, the XYZ system and its derivatives, colour display, additive primaries, nonphysical primaries. Colourspace transformations. Perceptual uniformity.
ACES	The two central ACES colourspaces (ACES, OCES). The four ACES transforms: IDT, LMT, RRT, ODT. The two reference devices: RICD, RP. The two primary sets (AP0, AP1). The two log formats, ACESproxy and ACEScc. ACES*cg* colourspace.
DI and Colour grading	The concept of working space. "Linear" mode (lift/gamma/gain) and "log" mode; CONTRAST and BRIGHTNESS reinterpreted.
Cameras and input transforms	Camera spectral sensitivities. White balance. The necessity of 3×3 matrix transform (*colour formation matrix,* CFM). Power function coding, log coding, quasilog coding. Overview of IDTs.
Displays and output transforms	Digital cinema reference projector (DCI P3); HD colourspace (BT.709/BT.1886), BT.2020 colourspace. How to acquire or build an ODT. Colour calibration.
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 aFellow of the Society of Motion Picture and Television Engineers (SMPTE). Twenty five years ago, he chose the number 1080 (as in 1920×1080) for HD and digital cinema standards, thereby establishing "square pixels" for HD and digital cinema. In 1998, he was responsible for introduction of the Adobe RGB (1998) colourspace.

Colour technology for video designers, artists, and editors

During the last decade, major changes have occurred in professional video production. Computer technology has been embraced; HD has replaced SD; and the CRT display has been superseded. All of these changes have introduced challenges in establishing and maintaining the intended image colours. Computer graphics subsystems (both hardware and software) use different colour coding parameters than video; HD colourspace is somewhat different than SD colourspace; and emergent displays don't share the same colour physics as CRTs. In the consumer arena, fixed-pixel displays – mainly LCD, but also plasma panels – have become the norm. Production methodology needs to be adapted to the new technology and standards, keeping in mind SD compatibility. In the near future, we can expect IPbased distribution to become increasingly important; attention needs to be paid to colour parameters in video intended for IP transport. It is important for content creators to understand the differences in image presentation between these technologies, both in the studio and in the consumers' premises.

In this 1-day course,
Charles Poynton will review digital video, HD, and computer graphics image and colour science. He will explain how creative intent is supposed to be preserved, how that goal is often compromised, and how video production artists, editors, and technologists can make the most of the situation. Knowledge of colour science and colour image coding is useful in colour correction; Charles will explain the lift-gammagain and 6-way models. He will describe how viewing conditions affect colour appearance, and how faithful image display can be achieved.

Who Should Attend:
The attendee should be very familiar with the technical aspects of creation and manipulation of digital imagery and motion sequences. The course is appropriate for people in positions such as these: Video graphics designers, artists, compositors, colorists, and editors • Technology managers, engineers and technicians**.**

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 introduction of the Adobe RGB (1998) colourspace.

OUTLINE

Introduction	The big picture: establishing and maintaining creative intent. Lightness and colour terminology. The pixel array; sampling and quantization; contrast, brightness, CONTRAST, and BRIGHTNESS (why the controls are misnamed); Image structure & resolution; sharpness and SHARPNESS; Raster Images in computing; Filtering and sampling; resampling & interpolation
Luminance, luma, and gamma	Luminance, lightness; gamma in video and computing; appearance phenomena (Hunt, Stevens, and Bartleson/Breneman effects); viewing conditions; visual acuity for lightness and colour; implications for visual design
Introduction to colour science	Introduction to colour science; Colour spaces: *XYZ, LMS, RGB, xyY, HSL, HSB, HSI,* CIELAB, CIELUV, and the rest; who so many? Additive and subtractive systems; CMY[K]; colour temperature; white balance

Still image colour coding	Vector art (eps, svg); colour standards (sRGB, AdobeRGB, boutique colourspaces, LAB); File formats (bmp, tiff, png, gif, jpeg, psd); historical Mac gamma; colour management systems; ICC profiles; profile embedding
Video colour coding	BT.601 and BT.709 colour; Constant luminance; Luma and colour differences (loosely, "YUV"); ${}^{601}Y'C_BC_R$, and ${}^{709}Y'C_BC_R$; Chroma subsampling (4:4:4, 4:2:2, 4:1:1, and 4:2:0); Footroom/headroom, studio/full (PC/studio) swing ("full-range"); highlight handling; video processing; historical concerns of composite NTSC; CHROMA and HUE adjustment; "NTSC-safe," "hot" colours, and "broadcast legality"; Gamut alarms, clipping and limiters.
Colour correction	Colour correction: setup/pedestal/lift, lift-gamma-gain, shadows/midtones/highlights, 6-way and 16-way correction
The PC/IT to Studio/CE interface	BT.601 and BT.709 colourspaces; luma coefficients; 219 > 255 level conversion; Quicktime; codecs (e.g., ProRes, DNxHD); four-character codes; metadata
Studio displays	Studio reference displays and standards; colour calibration; use of industrial, computer (PC), and consumer displays (e.g., LCD, plasma) in production
Emerging technology	Wide gamut colour (xvYCC/x.v.Colour); high dynamic range; high-end consumer equipment; home theatre as example of high-quality consumer presentation

Registration:

The courses cost 250,-€/day plus 19% MWSt.
For more informations and registration please contact

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We are looking forward to welcome you at our new HFF!