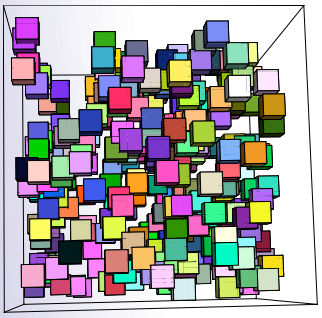
Final announcement – A workshop with Charles Poynton

Camera Designers' Algorithm Workshop



Munich,
Mon Oct. 18, 2010
at HFF München,
near Giesing U-Bahn Station

Digital cinema cameras are now mainstream, but diverse. Many different image data encoding and signal processing options are possible. It is not easy to balance theory and practice, and it is not easy to sort out which techniques are truly valuable and which are the result of naïvety or marketing hype. What are the important technical parameters of CCD or CMOS sensors that affect visual performance? Many different "log" coding schemes are offered; does any one of them have a substantive advantage over the others? Does the choice of coding depend upon sensor characteristics? Some cameras tout "wide latitude," but what exactly is latitude? How are camera spectral sensitivities chosen, and what are the overall requirements? Several camera vendors advertise wide-gamut: Do these cameras deliver wide gamut? Is there such a concept as native optical gamut? How are metamerism and colour mapping errors distinguished?

In this 1-day workshop, organized by HFF Munich, Charles Poynton will explain the optics and physics at the front end of a camera, the characteristics of CCD and CMOS sensors, and the signal and colour processing that is done at the camera or at the front-end of the DI process. The workshop is primarily concerned with digital cinema cameras and HD cameras; however, the concepts are applicable to cameras used in scientific and medical applications as well. See overleaf for a detailed description.

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

- Camera optics and sensor engineers
- Camera signal processing and algorithm developers
- Digital cinema, HD, and CGI/VFX software developers
- Highly experienced and math-savvy visual effects supervisors, HD (video) engineers, and post/DI engineers

Attendees should be very familiar with digital video, HD, and digital cinema, and should have quite a bit of experience designing, programming, or using HD and/or digital cinema cameras. You need not have a PhD, but we assume background in mathematics (functions, derivatives, and linear [matrix] algebra); good working knowledge of physics; and familiarity with the basic principles of colour science.

Registration: 450,– € (400,– € for bvk or HFF members), including refreshments. Lunch will be provided; you will have a chance to socialize with your colleagues. Detailed handout notes – some of which form portions of Mr. Poynton's forthcoming book – will be provided. For information, contact Katrin Richthofer, k.richthofer@hff-muc.de, or telephone +49 89 68957 251.

Charles Poynton specializes in the physics, mathematics, and engineering of digital colour imaging systems, including digital 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. He was the founding chairman of the SMPTE committee that developed the DPX standard.

Camera Designers' Algorithm Workshop

OECF and EOCF: Two fundamental views of imaging sometimes conflict – the engineering view and the creative view. The engineering view concentrates on accuracy, but usually neglects the effect of viewing conditions on the appearance of colours. The creative view places highest importance on the establishment and preservation of creative intent. In entertainment applications the creative view must win in the end, but must use the engineering view to get there! Even in scientific and medical applications it turns out that precise replication of the chromaticity values in the scene is not a suitable objective. We'll explore what that philosophy means in terms of building a pipeline. Different cameras use logarithmic, quasi-log, and power-function coding – we have FilmStream ($\log_{60}$)/Arri log F, CPD/Arri log C, Panalog, Sony Log, SI $\log_{90}$, REDLOG, and more. We'll discuss whether any of these offer a substantive performance advantage, and whether any such image data coding schemes dependent upon particular camera characteristics. These "curves" affect perceptual uniformity, camera noise, and highlight handling; we'll describe how. Gamma values of 1, 1.7, 1.8, 2.0, 2.2, 2.4, 2.6, 2.8, and 3 have all been used in HD and CGI; we'll explain the underlying, unifying principle.

Exposure, sensitivity, latitude: We'll discuss EI/ISO rating; noise, and dynamic range. The concepts of noise-equivalent exposure and saturation-equivalent exposure are central for CCD and CMOS sensor designers; we'll explore why. We'll describe when it is and isn't appropriate to acquire the original scene with S-curve or highlight compression. We'll explain noise rectification, and describe why it's a problem and how to avoid it. Power function (BT.709) encoding and its variants (HyperGamma, FILM REC, Cine Gamma) are common in HD acquisition; we'll explain why they're generally not useful for D-cinema.

Gamut and colour: We'll describe an optimal set of camera spectral sensitivities, describe whether the curves are wideband or narrowband, say whether they have rapid or slow transitions, and explain the nature of the overlap between the curves. Several camera vendors are touting wide-gamut cameras; we'll explain whether these cameras deliver wide gamut, and explain how *any* sensor can be made to deliver wide gamut. When you're watching F35 output on a BVM, and you switch the camera into WIDE GAMUT mode, the gamut shrinks, it doesn't stretch! We'll explain why. We'll discuss the importance of the spectrum of the illuminant, explain how to decide whether to shoot with the linear 3×3 matrix on or off, and explain how the coefficients of a 3×3 matrix can be determined. We'll introduce the concept of *native optical gamut,* and describe how metamerism and colour mapping errors are related. We'll explore whether a camera has a native colour temperature, and describe the best way to compensate colour temperature variations. Film has colour crosstalk, where (for example) the developed red-sensitive layer influences medium-wave absorption. We'll discuss when it is and isn't appropriate to retain film's crosstalk, and describe whether it's better to apply the colour crosstalk terms at the camera or in grading. CCD and CMOS sensors also have colour crosstalk; we'll explain how that crosstalk differs from that of film.

Scene-referred workflows: Linear-light scene-referred image data representation is now used in grading and in high-end CGI/VFX, often using OpenEXR coding. That scheme is expected to be adopted across a wider swatch of the DI chain. We'll explore why. We'll also explore the emergent AMPAS IIF workflow and its reference rendering transform (RRT).