Charles Poynton

I am an independent contractor specializing in the physics, mathematics, and engineering of digital color imaging systems, including digital video, HDTV, and digital cinema (D-cinema). I do technology forecasting, systems modelling, algorithm development (including digital filter design), video signal processing architecture, color characterization and calibration, and image quality assessment. (More...)

tel: +1 416 413 1377
e-mail: concatenate *surname* at *surname* dot com (poynton@poynton.com)
[email protocol]
www.poynton.com

What's new?	to 2004-12-09. I'm back from London. I'll present a half-day tutorial *HDTV and Digital Cinema Camera Technology* at the HPA Tech Retreat in Palm Springs, on January 25, 2005.
Digital Video and HDTV	My book *Digital Video and HDTV Algorithms and Interfaces* is holding fairly steady between the 10,000-th and 20,000-th most popular book at Amazon.com. The Table of Contents is available; the Errata were updated on 2004-10-19. Today, Amazon indicates that DVAI is #1 (the most popular book purchase) at Texas Instruments; it's #18 in San Jose, Calif.! My partner Barbara finds all of this quite frightening.
Courses, seminars &c.	Upcoming (and past) events.
Color technology	Includes *Frequently Asked Questions*(FAQs) about Gamma and Color.
Video engineering	Information concerning technical aspects of video.
Digital Signal Processing	Where to find digital filter design packages.
Typography and design	Articles I've written concerning typography, information design, and presentation in the digital world. Also, archaic information is available concerning making web pages usable, "This site is best experienced"; archaic information concerning the FrameMaker publication system is also available.
Hire me!	I'm an independent contractor.
Personal stuff & biographical data	

Someone once asked Peggy Lee who she thought was the best jazz singer. Her answer was, "You mean besides Ella?"

Charles Poynton

Momaku

Calligraphy by Judth Dowling of the Japanese kanji for retina: *Momaku. Mo*, the upper character, means "net". *Maku*, the lower character, means "membrane."

This is adapted from the title page of *The Retina: an approachable part of the brain*, by John E. Dowling (Cambridge, Mass.: Belknap Press of Harvard University Press, 1987). Highly recommended!

Mr. Ogawa of Toshiba pointed out to me, via Greg De Priest, that Judith Dowling's character is in old-style Kanji. I have added the horizontal bar at the top of the lower-left character, so as to present the modern character.

Charles Poynton
1998-03-19

Charles Poynton - Independent contractor

I am an independent contractor - all me a consultant if you must - specializing in the physics, mathematics, and engineering of digital color imaging systems, including digital video, HDTV, and digital cinema (D-cinema). I do technology forecasting, systems modelling, algorithm development (including digital filter design), video signal processing architecture, color characterization and calibration, and image quality assessment. I live and work in Toronto.

For about a decade, I have been using Mathematica to do analysis, design, modelling, and simulation of signal, color, and video processing systems. I have recently added MATLAB to my toolkit, including Simulink, the DSP Blockset, the Image Processing Toolbox, the Optimization Toolbox, and the Signal Processing Toolbox.

I pay a great deal of attention to communicating my work, both to my clients (by writing technical reports, proposals, analysis documents, and the like), and to the wider community (by teaching courses and seminars and by writing books). I execute my own illustrations (using Adobe Illustrator), and typeset my own work (using Adobe FrameMaker).

I have been working primarily in these areas:

- **Analyzing color** specification, calibration, capture, processing, storage, and display for digital cinema, computer animation, computer generated imagery (CGI), and broadcast, industrial, and consumer video.

  For two different manufacturers of emerging displays for digital cinema, I consulted on color science, helped establish image coding standards, and assisted in the development, testing, and evaluation of signal processing algorithms.

  I have consulted to several film studios on the establishment of image coding standards, and helped to introduce color characterization, color calibration, and color management into their production pipelines.

  I have an extensive implementation, in Mathematica, of code for color image encoding, decoding, matrixing, and processing. You can obtain more information.

- **Developing, characterizing, modeling, and analyzing algorithms for motion image**

processing at quality levels from digital cinema, through studio broadcast, down to PCs, with implementation technologies from high-level software, through microcode, to commercially-available VLSI. Generally I perform high-level architectural work, and deliver algorithms as some combination of textual description, equations, and/or Mathematica code. Sometimes I provide bit-accurate C-code as well. My clients typically implement these algorithms themselves in VHDL or Verilog. (I read these languages, but don't [yet] write them.)

For a startup company developing a revolutionary new film scanning technology, I assisted in color characterization of their highly unusual device, and in the development of unique image signal processing algorithms.

For a manufacturer of graphics accelerator chips, I designed filtering algorithms associated with NTSC decoding and encoding, deinterlacing, reinterlacing, resizing, and frame rate conversion.

For a startup company manufacturing very large scale full-color LED display systems, I designed the color signal processing architecture including uniformity correction and color matrixing; great attention was paid to motion artifacts associated with the interaction between eye tracking and pulse-width modulation (PWM).

Though this is somewhat old hat, I have an implementation, in Mathematica, of bit-accurate models of NTSC and PAL encoding and decoding. You can obtain more information.

- **Technology assessment and forecasting.** I assess the value of intellectual property, to assist companies to exercise due diligence with respect to licensing or acquisition. I assess how technological developments in digital video, compression, HDTV, and accurate color technology are likely to affect companies. Sometimes, this verges into product planning.

  For a company that designs and manufactures standard (commercial) integrated circuits, I consulted on the technological aspects of a business strategy to enter the domain of consumer electronics.

  For a large manufacturer of studio video equipment, I assisted in the evaluation of the technology of a company that was a candidate for acquisition.

- **Expert witness in patent litigation.** I assess and evaluate patents and patent portfolios, and occasionally I act as an expert witness in patent litigation.

  For a company that designs and manufactures video equipment, I examined the claims of an inventor that claimed that his patent had been infringed. I gave a deposition in which I cast doubt on the validity of the claims; this resulted in

an out-of-court settlement.

- **Writing.** I have written several white papers - some attributed, some published anonymously - on various topics within my expertise.

  For Discreet Logic, a developer of large-scale application software for the creation of digital media, I wrote a white paper concerning conversion between R'G'B' (4:4:4) and $Y'C_BC_R$ (4:2:2) video coding systems. A competitor was making suspect claims about their own video coding, and implied that Discreet's R'G'B' system was inferior. Discreet needed an authoritative voice to politely refute these claims in public.

- **Teaching courses and seminars.** In addition to the many public tutorials, courses, and seminars that I have presented over the last decade, I have organized and presented many in-house events for large semiconductor manufacturers, film studios, manufacturers of camera and display systems, and system and application software companies. Most of my teaching gigs provide for "open" consulting time for individual contributors and design teams.

Many of the companies that I work for prefer that fact not to be made public. So I cannot tell you here - or perhaps even at all - who they are.

Sometimes, I charge a *per diem* rate; sometimes I take fixed-price contracts. Sometimes I perform contracts without leaving my office in Toronto; sometimes I travel to my clients' facilities. Sometimes I consult over the telephone, for an hourly rate. If you're interested in having me consult for your organization, telephone me and we'll discuss your needs, my references, and my rates.

If you're considering hiring me, perhaps you're interested in my medium and long-term goals.

Charles
2005-01-11

Charles Poynton - Courses & seminars (upcoming)

I'll present a half-day tutorial *HDTV and Digital Cinema Camera Technology* at the HPA Tech Retreat in Palm Springs. The seminar takes place in the afternoon of Tuesday, January 25, 2005; the retreat proper takes place Wednesday through Friday.

You can review past public courses and seminars that I have presented, in the 1990s, 2000, 2001, 2002, 2003, 2004, and 2005.

In addition to open, public courses such as the ones listed above, I frequently develop and teach on-site courses or seminars for commercial organizations. I have taught courses for film and animation studios, workstation and PC manufacturers, companies that design and manufacture integrated circuits, and companies that make display systems and subsystems. I have presented courses on digital video, color science, color management, and other topics. You can review the syllabus for the 1-day, 2-day, and 3-day versions of the Digital Video Technology course.

When I teach a course on digital video, I usually arrange for each participant to be given a copy of my book, and I also distribute customized course note handouts. If you're interested in having me teach at your organization, telephone me, and we'll discuss your needs, my references, and my rates. I may also be available for consulting (much as I hate the word).

Charles Poynton
2005-01-11

Palm Springs, Calif.
Thursday, Jan. 25, 2005, 13h00-17h00

HDTV and Digital Cinema Camera Technology

Instructor: Charles Poynton
Duration: 1/2 day

In association with 2005 Tech Retreat

Synopsis:

The 3CCD "beamsplitter" camera has ruled video for about a quarter of a century. This is set to change - single-sensor "mosaic" cameras have already been announced by at least three companies, and more are surely on the way. In this 1/2-day seminar, Charles Poynton will start by reviewing optics and lens design for HDTV and digital cinema cameras. He will then outline the task of color separation with both the tried-and-true prism beamsplitter and emergent color filter array (CFA) technology that originated in the digital still camera world. He will describe the "demosaicking" algorithms necessary to reconstruct color in these cameras. He will then discuss the optics, physics, and electronics of CCD and CMOS image sensors themselves, paying particular attention to the sources and treatment of noise. He will conclude by discussing the emergent technologies of wide color gamut and high dynamic range imaging. Much of the material that he will present constitutes "work in progress" for his next book.

Audience: This seminar is appropriate for technical professionals who are experienced in creating and manipulating color imagery for SDTV, HDTV, or digital cinema. It is also suitable for programmers and engineers.

Materials provided: Course handouts will be provided. Portions of the seminar will be based upon Charles Poynton's book *Digital Video and HDTV Algorithms and Interfaces,* copies of which will be available for purchase.

Registration: TBD, Approx. USD 150, including lunch. Register through HPA; contact Hollywood Post Alliance Executive Director, Eileen Kramer at +1 213 614 0860.

Charles Poynton - Courses & seminars
www.poynton.com/notes/events/
2004-12-09

Digital Video and HDTV

Algorithms and Interfaces

by Charles Poynton,
(San Francisco: Morgan Kaufmann Publishers, 2003)
[hardcover, 736 pages, USD 59.94].
available from the publisher, online retailers, and bookstores.

Placing video in the context of computing

Rapidly evolving computer and communications technologies have achieved data transmission rates and data storage capacities high enough for digital video. But video involves much more than just pushing bits! Achieving the best possible image quality, accurate color, and smooth motion requires understanding many aspects of image acquisition, coding, processing, and display that are outside the usual realm of computer graphics. At the same time, video system designers are facing new demands to interface with film and computer system that require techniques outside conventional video engineering.

Charles Poynton's 1996 book *A Technical Introduction to Digital Video* became an industry favorite for its succinct, accurate, and accessible treatment of standard definition television (SDTV). In *Digital Video and HDTV*, Poynton covers not only SDTV, but also high definition television (HDTV) and compression systems. With the help of hundreds of high quality technical illustrations, this book presents the following topics:

- Basic concepts of digitization, sampling, quantization, gamma, and filtering
- Principles of color science as applied to image capture and display
- Scanning and coding of SDTV and HDTV
- Video color coding: luma, chroma (4:2:2 component video, $4f_{SC}$ composite video)
- Analog NTSC and PAL
- Studio systems and interfaces
- Compression technology, including M-JPEG and MPEG-2
- Broadcast standards and consumer video equipment

CHARLES POYNTON is an independent contractor specializing in the physics, mathematics, and engineering of digital color imaging systems, including digital video, HDTV, and digital cinema (D-cinema). He designed and built the digital video equipment used at NASA to convert video from the Space Shuttle into NTSC, initiated Sun Microsystems' HDTV research project in the early 1990s, and has taught many popular courses on HDTV and video technologies. A Fellow of the Society of Motion Picture and Television Engineers (SMPTE), Poynton was awarded the Society's prestigious David Sarnoff Gold Medal for his work to integrate video technology with computing and

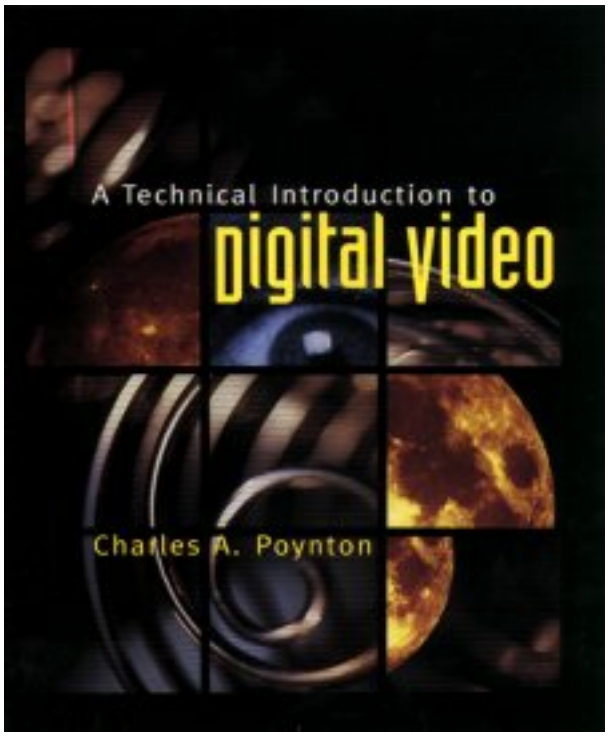
communications.

The Table of Contents is available. Errata are available.

Sample chapters will soon be available here.

You can order from the publisher, or Amazon, or Barnes & Noble.

2003-09-25b
Charles Poynton



A Technical Introduction to digital video

by Charles Poynton, published by John Wiley & Sons, 1996 (ISBN 0-471-12253-X, hardcover, USD 49.99).

Computers and communication systems have now reached the stage where is it possible to have photographic-quality color pictures. But smooth motion and accurate color, though easy to achieve in video equipment, remain beyond the reach of general purpose computers. This book will help computer system designers, engineers, programmers and technicians to learn the techniques of digital video, to bring smooth motion and accurate color to computing. If you are a television professional, this book will help you to understand the technology at the core of digital video.

The book was published in 1996, and reached fifth printing. The superseding edition, *Digital Video and HDTV Algorithms and Interfaces* was published in January, 2003, by Morgan Kaufmann. Because the superseding edition is on the streets, *A Technical Introduction to Digital Video* will soon be of print.

If you search on "Poynton," you'll encounter Henry James' book *The Spoils of Poynton* - that is what a former boss of mine, Hugh Lawford, used to call my computer programs!

Send e-mail if you have any corrections or suggestions!

Table of Contents

The Table of Contents is available online.

Sample chapters

Two chapters are available online, in typographic-quality Acrobat PDF format:

- Chapter 1, *Basic Principles* Acrobat PDF format
- Chapter 6, *Gamma* Acrobat PDF format

Errata

Known errors are listed in the *Errata.* If you discover an error that is not listed, please report it to me by e-mail.

2003-09-25
Charles Poynton

A Technical Introduction to
digital video

Contents

1997-06-23
Charles Poynton - A Technical Introduction to Digital Video