Color Enhancement and Rendering in Film and Game Production

Course Organizer

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Presenters

Haarm-Pieter Duiker
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Yoshiharu Gotanda
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Lou Levinson
Laser Pacific

Joshua Pines
Technicolor

Jeremy Selan
Sony Pictures Imageworks

Course Description

Production of convincing and compelling scene representations on limited display media is a challenge common to painting, photography, film production, and computer graphics. The core of the problem is finding a transformation from the colors in the original scene to those in the final image. For almost 200 years, this transformation has been primarily determined by the chemical and optical properties of film, which have been carefully engineered for pleasing results (the "film look"). Digital color enhancement has vastly extended the variety of possible looks, but the "film look" remains the default baseline.

Despite its importance in film and game production, the transformation from scene-referred to display-referred colors (also called "rendering"; not to be confused with the more common computer graphics meaning of the term) is little-understood by many practitioners. This course covers the relevant theory, practical production methods, techniques and considerations relating to color enhancement and rendering in both film and game production.

LEVEL OF DIFFICULTY: Intermediate

Intended Audience

Practitioners from the videogame, CG animation, and VFX fields, as well as researchers interested in color enhancement, tone mapping, and rendering from scene-referred to display-referred image data.

Prerequisites

Basic familiarity with computer graphics.

Course Website

All course materials can be found at `http://renderwonk.com/publications/s2010-color-course`

Contact

Address questions or comments to `s2010course@renderwonk.com`

About the Presenters

HAARM-PIETER DUIKER founded Duiker Research following research and development work on film projects such as *The Matrix* sequels, *The Fantastic Four*, and *Catwoman* where his field experience spanned data capture, on-set photography, visual effects shot production and more. Duiker more recently finished work as a CG Supervisor for Lighting on *2012* and *Speed Racer* at Digital Domain. Prior to that he worked on the unnamed Spielberg project at Electronic Arts, focusing on ways to bring a more "filmic" experience to video games. Duiker's work has been patented and published, with papers and sketches featured at conferences such as SIGGRAPH. He has also been nominated for a Scientific and Technical Academy Award. Duiker holds a degree in Computer Science focusing on Computer Graphics from the University of California at Berkeley.

DOMINIC GLYNN is a color scientist, mathematician & lead engineer at Pixar Animation Studios. He heads a group of like-minded geeks responsible for the mastering of all Pixar's features & shorts in all delivery formats ranging from theatrical exhibition through to home video & beyond. He has worked on *Cars*, *Ratatouille*, *WALL-E*, *Up* and *Toy Story 3*, and continues to augment the color-centric foundation in production for successful delivery of Pixar's upcoming slate of films.

JOSEPH GOLDSTONE has authored, edited or contributed heavily to several of the documents defining the Academy of Motion Picture Arts and Sciences' Image Interchange Framework; designed and built two systems for spectral measurement of projected film print (and directed the construction of a third); created mathematical models of film scanners and digital projectors; written probably 150K lines of color-related code over the last ten years, and consulted on the establishment of color-managed workflows as well as straightening out some pretty contorted existing pipelines. He resides in New York City, at least as much as a rather volatile schedule allows.

YOSHIHARU GOTANDA is the CEO and CTO of tri-Ace, Inc, which is a game development studio in Japan.

NATY HOFFMAN is a Technical Director at Activision Studio Central, where he assists Activision's worldwide studios with graphics research and development. Prior to joining Activision in 2008, Naty worked for two years on *God of War III* at SCEA Santa Monica Studio. Naty has also worked at Naughty Dog (where he had an instrumental role in the development of the ICE libraries for first-party PS3 developers), at Westwood Studios (where he was graphics lead on *Earth and Beyond*) and at Intel as a microprocessor architect, assisting in the definition of the SSE and SSE2 instruction set extensions.

LOU LEVINSON has been a colorist in the Hollywood post-production community since 1980, and rumors of an earlier career yet still occasionally leak from Chicago. Currently a supervising colorist at Laser Pacific, he has been an associate member of the American Society of Cinematographers, and hence a member in good standing of the "walking volunteered brigade", since 1992. He is currently the chair of the Digital Intermediate Subcommittee of the ASC Technology Committee. He received a Masters degree of Fine Arts in 1979 from the School of the Art Institute of Chicago, and since then

has been trying to figure out how he fell into this career path. He has worked with many of the most recognizable names in Hollywood and still has some of his hair left, although this may to some degree be hereditary.

JOSHUA PINES is currently in charge of imaging and color science projects at Technicolor Digital Intermediates, which provides the motion picture industry with digital color correction processes for theatrically released films. He joined Technicolor after more than 10 years at Industrial Light & Magic, where he supervised their film scanning/recording department from its inception, and worked extensively with both traditional and digital cinema technologies. He started his career teaching film courses at the Cooper Union in New York City after earning his degree in electrical engineering there. He began working in visual effects at MAGI in 1982 at the tail end of their work on *Tron*, went on to lead the computer graphics division at R/Greenberg Associates in New York City, and then supervised film effects and film recording at deGraf/Wahrman in Los Angeles before working for ILM. He has received a technical achievement award from the Academy of Motion Picture Arts and Sciences, and has credits on several zillion feature films. Joshua has always thought that computers could be a useful tool in making movies better, and he still hopes that one day this may come true.

JEREMY SELAN is the Color Pipeline Lead at Sony Pictures Imageworks—focused on the areas of color, lighting, and compositing. His work has been used on numerous films including *Spider-Man 2*, *Cloudy With a Chance of Meatballs*, and most recently *Alice in Wonderland*. Jeremy is also one of the founders of Katana, Sony's in-house lighting and compositing tool. His work on colorimetry has been featured in GPU Gems 2 and Siggraph's Electronic Theater, and he is proud to spearhead Sony's new effort to create an open source color pipeline - the OpenColorIO project.

Presentation Schedule

9:00–9:05   **Introduction** *(Hoffman)*

9:05–9:35   **From Scene to Screen** *(Pines)*

9:35–9:55   **Color Management** *(Goldstone)*

9:55–10:15   **Color Spaces and Operations** *(Selan)*

10:15–10:35   **Color at Pixar: Ingredients for Creativity** *(Glynn)*

10:35–10:50   **Break**

10:50–11:10   **The Craft of Color Grading** *(Levinson)*

11:10–11:30   **Filmic Tonemapping for Real-time Rendering** *(Duiker)*

11:30–12:00   **Film Simulation for Videogames** *(Gotanda)*

12:00–12:15   **Color Enhancement for Videogames** *(Hoffman)*