Practical HDR and Wide Color Techniques in Gran Turismo SPORT

SIGGRAPH ASIA 2018 Course - Course Notes

Complete course materials are available from
http://www.polyphony.co.jp/publications/sa2018/

Lecturers

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Abstract

A consistent workflow is important to fully demonstrate the attractiveness of high-quality CG content, especially when such content uses high dynamic range (HDR) and wide color gamut (WCG) techniques. This course explains a practical workflow useful for both game developers and creators involved in HDR / Wide color content.

Even though CG quality has significantly improved over the past years, final output quality is restricted by limitations of luminance and color gamut of conventional output devices such as televisions. Recently HDR and Wide color technology has expanded these limitations but it is problematic to output high quality HDR images on each device, because consistent interpretations of both hardware behavior and software specification is difficult. Therefore, it is necessary to carefully establish reliable standards for stable outputs on various devices.

For that purpose, we need a consistent theory-based approach for each aspect of the workflow (asset collecting and editing, interchangeable formats, encoding, preview environment, verification) and rendering pipeline (lighting, tone mapping, etc.). Using reliable standards enables us to gain robust outputs with high color reproducibility and high dynamic range accuracy.

This course shares a wide range of knowledge from the basics of color science to the concrete solution used in the production of Gran Turismo SPORT, a photo realistic racing game with high quality HDR images. Participants can learn about real experience in developing HDR and WCG content.

Intended Audience

Game developers and technical artists who are interested in HDR and wide color content creation.

Prerequisites

Basic knowledge of color science and physics of lights.

Course Overview

1. Introduction of this course
    1. Past games which have fewer colors and limited dynamic range
    2. Recent games expanded color and dynamic range
    3. Our practical knowledge about wide color and HDR content creation
2. Introduction of color theory and HDR
    1. Fundamental color theory
    2. Wide color gamut
    3. High dynamic range output
3. Implementation and results in our real game
    1. Asset creation
        1. Capturing wide color and HDR images
        2. Handling HDR still images and movies
    2. Rendering and output
        1. Variable tone mapping for HDR output (also SDR)
        2. Calibrating method for output devices
        3. Rendering in wide color and HDR
        4. HDR color grading in our real-time game
4. Building and verification of HDR work environments
    1. Requirements for output devices from basic
    2. Output devices testing methods and results
    3. Our examples
5. Conclusions

About the Lecturers

Hajime Uchimura *Polyphony Digital Inc.*

Hajime Uchimura is a graphics programmer at Polyphony Digital Inc. He started computer graphics with MSX at age of 6. He joined Polyphony Digital Inc. after high-precision calculation research at master’s course. His main topics are image processing and color science. A girl and a boy 's father.

Kentaro Suzuki *Polyphony Digital Inc.*

Kentaro Suzuki is a graphics programmer at Polyphony Digital Inc. His computer graphics life began with 00’s demoscene culture. After majoring in computer graphics at university, he joined Polyphony Digital Inc., developing world famous racing game series “Gran Turismo”. His main interest is developing various real-time rendering techniques and exploring off-line ray tracing algorithms.