


Lecture 12

**Color Theory
and Visible Surface Data Structures**

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Readings:
Chapter 13, Sections 15.1-15.2, Foley *et al*
(Reference) Hearn and Baker 2^e
Slide Set 6, VanDam (5, 10/05/1999)



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Lecture Outline


- **Readings**
 - Chapter 13 and Sections 15.1-15.2, Foley *et al*
 - Outside reading (optional): Hearn and Baker 2^e
 - Outside reading (required): Slide Set 5, VanDam (10/05/1999)
- **Recently**
 - Surface models
 - Solid modeling, CSG
- **Today**
 - Quick review: BSP trees, Constructive Solid Geometry (CSG)
 - Color theory
 - Basic issues: representing color (intensity-based and chromatic color, etc.)
 - Theories of color from psychophysics, colorimetry, neurobiology
 - Important color models: RGB, CIE Chromaticity Diagram, HSV
 - Visible surface determination: basics (data structures)
- **Next Week**
 - Wrap-up of visible surface determination (Wednesday)
 - Realism in CG: overview (Wednesday)
 - Midterm review (Friday)



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Terminology


- **Theory of Color**
 - Achromatic light: intensity (quantity) only
 - Chromatic light: hue, saturation, vividness (value)
 - Modeling color transmission (object) and perception (viewer)
 - Psychophysics: based on cognitive (psychological) model; subjective
 - Colorimetry: based on physical (optical) model; objective
 - Neurobiology: study of brain, central nervous system (including sensorimotor system – in color perception, visual cortex and retina are important)
- **Color Ranges (aka Color Gamuts) and Color Models**
 - Gamut: range of wavelengths (visible subspace of color space)
 - Model: coordinate system, subset corresponding to gamut
 - Red-Green-Blue (RGB) / Cyan-Magenta-Yellow (CMY): Cartesian
 - Commission Internationale de l'Éclairage (CIE): normalized color space
 - Hue-Saturation-Value (HSV): ???
 - Interpolation in color space: Gouraud shading, antialiasing, blending (fading)
- **Using Color in CG**
 - Applications: aesthetics, communication (e.g., visualization)
 - Criteria for effectiveness: harmony, coding redundancy



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Summary Points

- **Quick Review: BSP Trees and CSG**
- **Color**
 - Light and images: achromatic (e.g., bitmaps, halftoning, grayscale), chromatic
 - Modeling color transmission (colorimetry) versus perception (psychophysics, neurobiology)
 - Modeling color
 - CIE: luminance-independent model, chromaticity diagram (normalized color space for computing coefficients in color matching function)
 - Color gamuts; color models (RGB/CMY, CIE, HSV; others)
- **Using Color Effectively in CG**
 - Criteria: functionality (transmitting information; GUI), minimal distraction
 - Goals, methods, and pitfalls (see Section 13.5 FVDI)
 - Harmony: modulation of intensity versus hue contrast
 - Coding: vary fine detail from background in brightness and chromaticity
- **Next Week**
 - Visible surface determination (read Sections 15.3-15.8)
 - Visual realism (skim Chapter 14, FVD)



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