The Art and Science of Depiction

Tone and color system

Fredo Durand
MITLab for Computer Science

Representation systems

- Drawing and projection
- Denotation
- Tone & color

Tone & color system

- (Often a mix)
- Extrinsic
- Intrinsic
- Symbolic

Extrinsic color

- Renzo Piano
  - Tjibaou cultural center
  - 1991-98

Extrinsic black and white

- Gordon Park,
  - Red Jackson
  - Gang Leader
**Optical intrinsic**
- Boticelli *Primavera* 1482

**Pure intrinsic colors**
- Jawlensky
  - *Girl with Peonies*
- +symbolic+harmony

---

**Plan**
- Intro
- Shading
- Shadows
- Atmospheric perspective
- Light transfers
- Photography

**Why a separate system?**
- Willats discusses it only/mainly for the optical denotation system
- But historically it is the major issue with drawing
- It is clearly a different problem from that of dimension and denotation
- Relevant as well for other denotation systems

---

**Denotation system and tone & color**
- Silhouette: color of the regions
- Line drawing
  - Line color
  - Line thickness
- Optical
  - Point color & tone
  - Texture
- More an “attribute system” than just tone & color

---
**Denotation system and tone & color**

- Braque Un Poeme Dans Chaque Livre

**Denotation system and tone & color**

- Amedeo Modigliani
  *Tete et buste de profil avec boucle d'oreille*
  1912

**Picture color dimensions**

- Tone
- Hue
- Saturation
- Simultaneous contrast
- Texture

**Beyond color**

- Material properties
- Painting
- Gold
- Etc.
**Color origin**

- Physical extrinsic
- Physical intrinsic
- Symbolic/importance
- Color harmony
- Limitation compensation (or accentuation)

**Color and symbol**

![Image of two figures]

**Issues**

- 2D/3D
  - 2D color composition
  - Color linked to the 3D scene
- Per mark/per primitive
  - Is the color constant on a mark?
  - Is it constant on a primitive?
  - Does it vary in the mark

**Example**

- Paul Klee
  - *Hoffmanneske Szene*
  - 1921

![Image of a map]

**Palette and medium**

- Different media permit different ranges of colors
  - E.g. pastels, pencil, watercolor, b/w photo
- The medium can be chosen for the palette
Color and aging

Restoration

• Michelangelo The Creation of Adam 1508-1512

Church and color

Church and color

Light in the scene

• Intrinsic reflectance
• Different light sources
• Outgoing light
• Shadows
  – Self shadows
  – Cast shadows
• Shading
• Inter-reflection
• Atmospheric perspective

Constancy and scene analysis

• Segmentation into layers
  – Illumination
  – Reflectance
  – Transparency
Light
- Point light source
- Directional light source (sun)
- Extended light source
- Hemispherical light source (sky)
- Ambient light
- Global illumination

Light
- Fall-off
- Attenuation

Light in CG

Plan
- Intro
- Shading
- Shadows
- Atmospheric perspective
- Light transfers
- Photography

Light and shape depiction
- Shading
- Highlight
- Shadow
- Inter-reflection

Shading & BRDF
- Bi-Directional Reflectance distribution function
- Ratio of light arriving from one direction bouncing in another direction
- 4D function (2*2 angles)
**Shading & BRDF**

- 2 main components
  - Diffuse (omni-directional)
  - Specular (directional): highlight

**Shading & BRDF**

- Diffuse
  - Depends on angle between light and normal

---

**Chiaroscuro**

- Andreas Mantegna, *Madonna and Child with St John the Baptist and Mary Magdalene*, 1495

**Saturation shading**

- Andreas Mantegna, *Madonna and Child with St John the Baptist and Mary Magdalene*, 1495
**Saturation shading**

- Andreas Mantegna, *Madonna and Child with St John the Baptist and Mary Magdalene*, 1495

**Shading and make up**

**Shading and corrective lighting**

**Lighting and shading**

- Alfred Krupp photographed in 1963 by Arnold Newman
- Because Krupp had benefited from the nazis
- Un-friendly lighting

**Plan**

- Intro
- Shading
- Shadows
- Atmospheric perspective
- Light transfers
- Photography

**Shadow**

*Plato III*

David Milne,
*The Figure of Neocles (The Head of Socrates)*,
1775. Oil on canvas, 24.5 x 35 cm. Edinburgh, National Gallery of Scotland
Shadow

- Self, cast and attached shadows
  - (or primary and secondary, double shadow, etc.)
- Not local
- Can be distracting
- Have been depicted or not depending on period
- Hard/soft shadow

Self and cast shadow

Soft shadow

Shadow

- Pozzo

Shadows

- 18th century

Shadows

- 18th century
- Lambert
**Shadow**

- Raphael vs. Master of the Mornauer

- Campin, *Trinity* 1427-32

- Caravaggio *The Supper at Emmaus* 1601

- Guardi 1755

- Rembrandt
**Shadow**

- Follower of Rembrandt
  A Man seated reading at a table in a lofty room 1631-50

---

**Shadow & Trompe-l’oeil**

- Rembrandt

---

**Shadow & Trompe-l’oeil**

---

**Shadow reveal shape**

---

**Colored shadow**

---

**Shadow reveal**

---
Shadow reveal

Tone & color system

Shadow reveal

Plate 52 Grandville, The Shadows (The French Cabinet) from La Carnavalesque, 1830

Tone & color system

Shadow

- [Waltz 75]

Plan

- Intro
- Shading
- Shadows
- Atmospheric perspective
- Light transfers
- Photography

Atmospheric perspective

- Saturation
- Hue
- Precision

Atmospheric perspective

- Leonardo
**Atmospheric perspective**

- Titian, *Bacchus*

**Plan**

- Intro
- Shading
- Shadows
- Atmospheric perspective
- Light transfers
- Photography

**Global illumination**

- Light inter-reflection
- Each surface is a secondary light source
- Crucial for indoor scenes
Global illumination

Counter-example: painting with light

Global illumination & production

- Mostly unused
- Because artists want local control
**Plan**
- Intro
- Shading
- Shadows
- Atmospheric perspective
- Light transfers
- Photography

**Three Point Lighting**
- Key light
  - Main and visible lighting
- Fill light
  - Fill-in shadows
- Back light
  - Emphasize silhouette
  - Make subject stand out
- Independent lighting

**Portrait lighting**

**Filter for black and white**

**Dodging and Burning**
- Clearing Winter Storm

**Haze filtering**
- Haze is bluish

- No filter
- Blue filter
- Red filter
Example

- Edgar Degas
  Ballet Dancer
  in Position
  facing 3/4 front
  1872

Example

- Tom Purvis 1935