The Art and Science of Depiction

Limitations of the Medium, compensation or accentuation: Contrast & Palette

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Assignments for Monday 16.

- Solso Cognition and the Visual Arts
  - Chapter 5 & 6
- Essay
  - Exploratory or Picture comment
  - Choose subject
  - Outline of the issues

Personal Meeting II

- Class
- Essay
- Project

Limitations: contrast & palette

Plan

- The picture is flat
- The viewpoint is unique
- The image is finite, it has a frame
- The picture is static
- The contrast is limited

Context

- Real world: $10^6$ to $10^6$ cd/m$^2$
- Picture
  - Max contrast 1:500
  - Typically 1:50

Limitations: contrast & palette

Two problems

- The image intensity does not match the real conditions

Limitations: contrast & palette

Sunny scene

$10^6$ $10^6$

Watched in a dark room

$10^6$ $10^6$

Limitations: contrast & palette

High dynamic range

$10^6$ $10^6$

Low contrast

$10^6$ $10^6$
**Three contexts**

- Photo
- Computer Graphics
- Painting and drawing

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**The limit of illusion**

- Pozzo’s ceiling: the Sky is not bright enough

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**The limit of illusion**

- Bruneleschi’s experiment
  - Used a mirror for the sky

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**Edge detection**

- Similar to center-surround
- Measured using micro-electrodes

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**Land Retinex**

- Local contrast

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**Plan**

- Problem 1: intensity does not match
  - Exposure
  - Viewing conditions
  - Night scenes
- Problem 2: insufficient contrast
  - Tone Reproduction
  - Lighting
  - Tone mapping in CG
  - Flares
  - Painting
**Photo exposure**

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**Metering**

- Centered average
- Spot
- Incident
  - Measure incoming light

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**Nikon 3D Color Matrix**

- Database of 30,000 photos
- Multiple captors (segments)
- Exposure depends on
  - Brightness from each segments
  - Color
  - Contrast
  - Distance
  - Focus (where is the subject)

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**Hunt and Stevens effect**

- Stevens effect
  - Contrast increases with luminance

Limitations: contrast & palette 29

**Hunt and Stevens effect**

- Stevens effect
  - Contrast increases with luminance
- Bartleson-Breneman effect
  - Image contrast changes with surround
  - A dark surround decreases contrast
    (make the black of the image look less deep)
- Hunt effect
  - Colorfulness increases with luminance
- Hence the need for gamma correction

Limitations: contrast & palette 30
**Suprathreshold**

- Subjective brightness
- Power law
- Exponent: -0.33 to 0.5
- Gamma correction

**Tone mapping**

- Real scene: large range of luminance
  - from $10^6$ to $10^{-6}$ cd/m²
- Limitation of the display
  - 1-100 cd/m²
- Goal: Reproduce a faithful impression

**Perceptual tone mapping**

- [Ferwerda et al. 1996]
- Match the smallest perceptible intensity in the simulated scene and in the display condition
- Rod and cone vision

**Threshold**

- Smallest perceptible stimulus
- Smallest perceptible stimulus difference

**Time-dependent tone mapping**

- Dazzling
- Slow dark adaptation
**Dark adaptation**

- Slow recovery after dramatic decrement

![Graph showing dark adaptation with time in dark and luminance levels]

**Time-dependent tone mapping**

![Images showing time-dependent tone mapping]

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**Representing night scenes**

- Rods, no color vision
- Blue shift
- Lower acuity
- Unable to adapt in shadows

**Representing night scenes**

- James Abbott Mc Neil Whistler
  *Nocturne in Blue And Silver The Lagoon Venice*
  1879-1880

**Representing night scenes**

- Pissaro, Montmartre
Representing night scenes

- Whistler, Old Battersea Bridge

Limitations: contrast & palette

Representing night scenes

- Archibald J. Motley Jr, Gettin’ Religion 1948

Limitations: contrast & palette

Night scenes in the movies

- Often Day for night
- Film during the day
- Few fill light (dark shadows)
- Add blue cast
- Avoid the sky

Limitations: contrast & palette

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Limitations: contrast & palette

Tone Reproduction

- Not linear

Limitations: contrast & palette

Tone Reproduction

- Not linear
- Gamma correction
**Texture and contrast**

- Image of texture samples with varying contrast.

**The Zone System**

- Diagram showing the Zone System with different exposure levels.

**Expansion and contraction**

- Graphs showing expansion and contraction effects.

**Contraction**

- Image demonstrating contraction in photography.

**Pre-exposure**

- Slide showing the effect of pre-exposing a photo with uniform white.
  - *Exposure with uniform white before taking the photo.*
  - *Raise the dark tones.*

**Pre-exposure**

- Image comparing pre-exposed and standard photos.
Two-solution development

• Different development of high and low value

Red Filter

The Print

• W. Eugene Smith photo of Albert Schweitzer
• 5 days to print!

Dodging and Burning

• Locally darken or lighten
• Use masks to expose some parts less
• Has to be done for each print!

Dodging/burning

• The sky is too bright
  – Gradient filter for the top of the photo
• The house is too dark
  – Gradient filter for the bottom of the photo

Gradient Filter
The infamous 8 bits
- Digital photography
- 8 bits means 1 to 255 contrast
- Enough for display
- Not enough for
  - Editing
  - Tone reproduction
  - Dodging & burning
  - Etc.

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

Lighting
- Fill light

Portrait Lighting
- Ansel Adams
**Fill-in**

- Contrast & palette

**Lighting**

- Painting with light

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**Local contrast**

- [Tumblin 1999]
- Organization into regions

**Local compensation**

- Use local average to compensate
- Haloing effects
**Local contrast**
- [Tumblin 1999]
- Organization into regions

**Histogram adjustment**
- [Larson et al. 1997]
- Disregard empty portions of the histogram

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**Flare, halo**
Flare, halo

- Van Gogh, *Le Semeur*, 1880

Blue-yellow

- Karl Schulpig, 1925

Flare in CG

- [Spencer et al. 1995]
- Flare: scattering in the eye

Flare in CG

- [Spencer et al. 1995]
- Flare: scattering in the eye
- Size is constant

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**Local lighting**
- Typically Florence Renaissance
- Mostly to reveal shape
- Raphael

**Chinese painting**

**Tenebrism**
- Early 17th
- Caravaggio

**Rembrandt**

**Radial balance**
- Georges de La Tour, Joseph the Carpenter, 1645

**White**
- Filippo Lippi
Silhouette
- Wolfang Weber
  *The Lash Bird Dancer On Madagascar*
  Late 20s

Contrast
- Bert Stern

Pure drawing
- Diego Riviera
  *Mother And Child*
  1936

Pure color

Limitations: contrast & palette