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

Plan

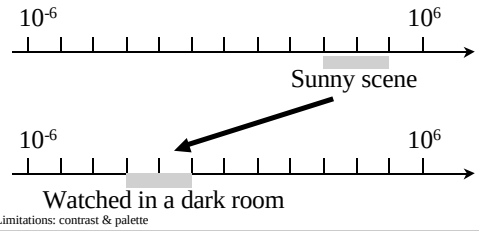
- The picture is flat
- The viewpoint is unique
- The image is finite, it has a frame
- The picture is static
- The contrast is limited

Context

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

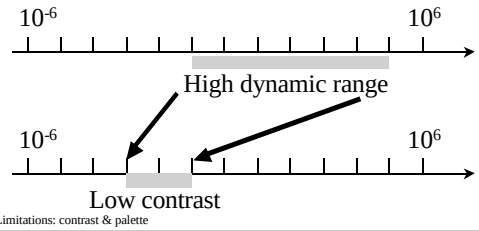
Two problems

- The image intensity does not match the real conditions



Two problems

- The image intensity does not match the real conditions
- The contrast is not sufficient



Three contexts

- Photo
- Computer Graphics
- Painting and drawing

The limit of illusion

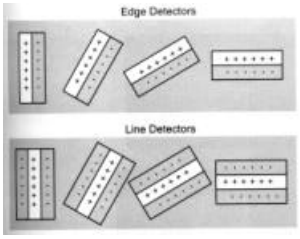
- Pozzo's ceiling: the Sky is not bright enough

The limit of illusion

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

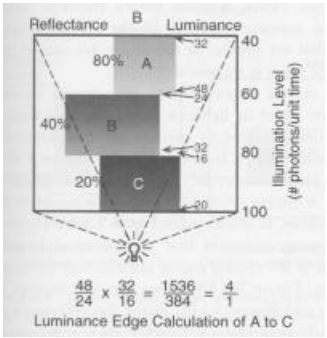
Edge detection

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



Land Retinex

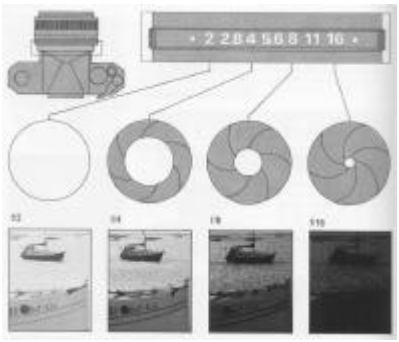
- Local contrast



Plan

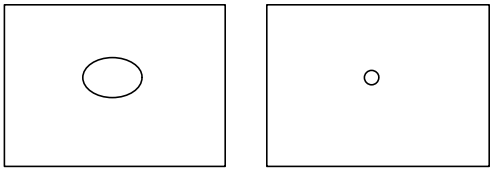
- Problem 1: intensity does not match
  - Exposure
  - Viewing conditions
  - Night scenes
- Problem2: insufficient contrast
  - Tone Reproduction
  - Lighting
  - Tone mapping in CG
  - Flares
  - Painting

Photo exposure



Metering

- Centered average
- Spot
- Incident
  - Measure incoming light



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

Hunt and Stevens effect

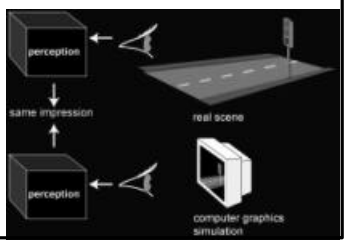
- Stevens effect
  - Contrast increases with luminance
- Bartleson-Breneman effect
  - Image contrast changes with surround
  - A dark surround decreases contrast (make the black of the image look less deep)
- Hunt effect
  - Colorfulness increases with luminance
- Hence the need for gamma correction

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/m^2)
- Limitation of the display
  - 1-100 cd/m^2
- Goal: Reproduce a faithful impression



Perceptual tone mapping

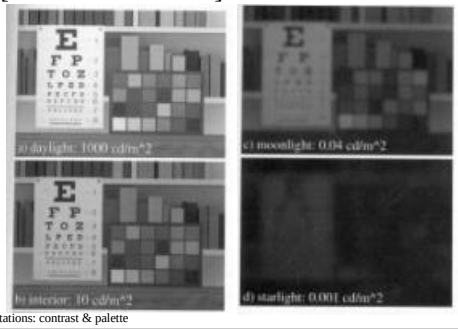
- [Ferwerda et al. 1996]
- Match the smallest perceptible intensity in the simulated scene and in the display condition
- Rod and cone vision

Threshold

- Smallest perceptible stimulus
- Smallest perceptible stimulus difference

Perceptual tone mapping

- [Ferwerda et al. 1996]



Time-dependent tone mapping

- Dazzling
- Slow dark adaptation

Dark adaptation

- Slow recovery after dramatic decrement

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

- Pissaro, Montmartre

Representing night scenes

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

Representing night scenes

- Whistler, *Old Battersea Bridge*

Representing night scenes

- Archibald J. Motley Jr, *Gettin' Religion* 1948

Night scenes in the movies

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

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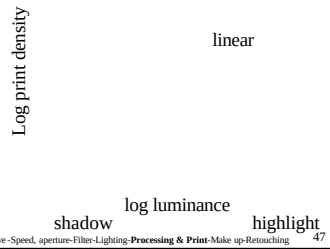
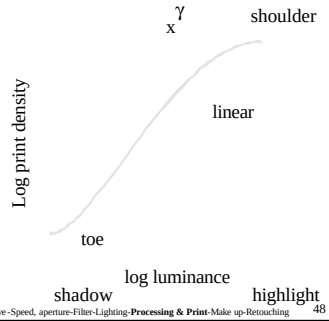
Tone Reproduction

- Not linear

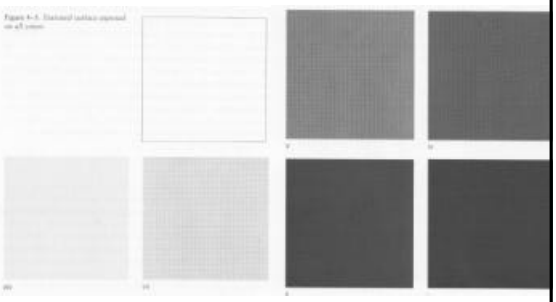


Tone Reproduction

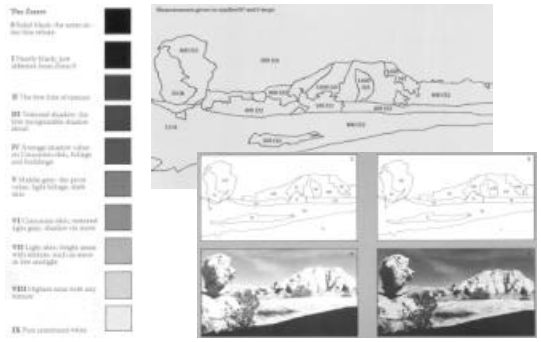
- Not linear
- Gamma correction



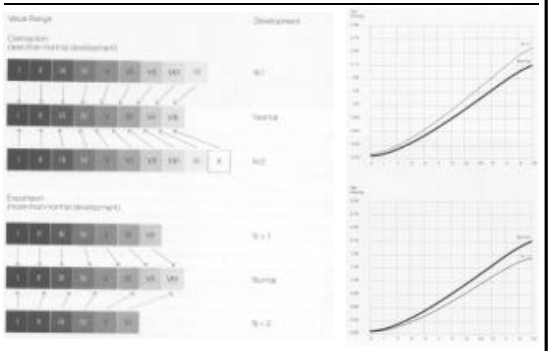
Texture and contrast



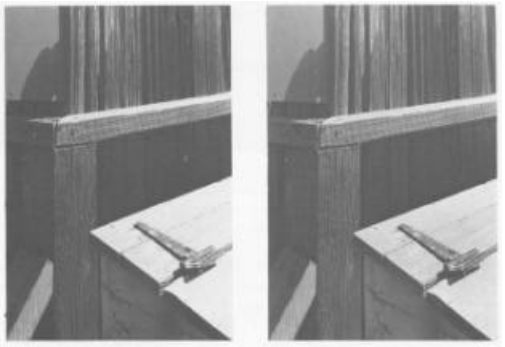
The Zone System



Expansion and contraction



Contraction



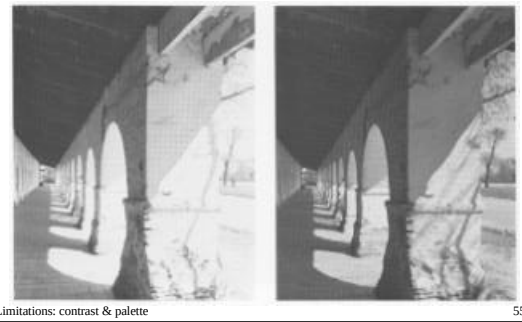
Pre- exposure

- Expose with uniform white before taking the photo
- Raise the dark tones

Pre- exposure

Two-solution development

- Different development of high and low value



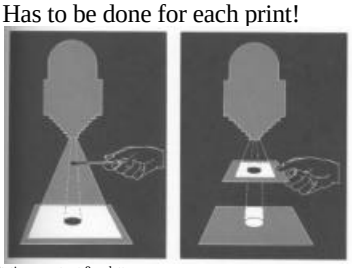
Red Filter

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!

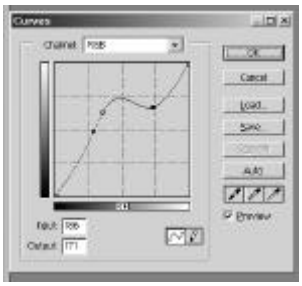


Dodging/burning

Gradient Filter

- 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

Curve tool in photo editing software



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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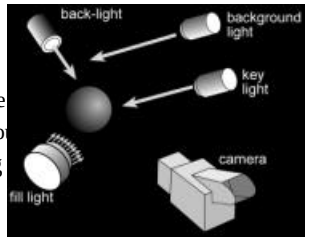
Three Point Lighting

- Key light
  - Main and visible lighting
- Fill light
  - Fill-in shadows
- Back light
  - Emphasize silhouette
  - Make subject stand o
- Independent lighting



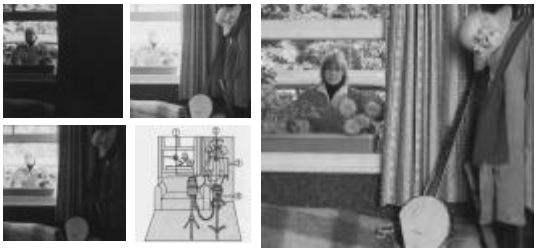
Lighting

- Fill light

Portrait Lighting

- Ansel Adams

Fill-in

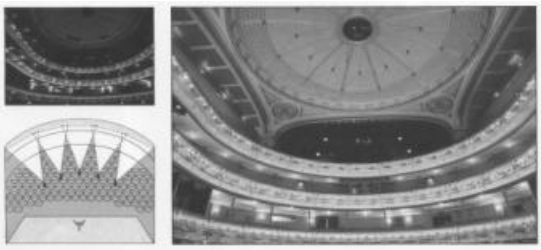


Limitations: contrast & palette

Subject-Photographer-Perspective-Speed, aperture-Filter-**Lighting**-Processing & Print-Make up-Retouching

Lighting

- Painting with light



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Limitations: contrast & palette

Local contrast

Limitations: contrast & palette

Local compensation

- Use local average to compensate
- Haloing effects

Limitations: contrast & palette

Local contrast

- [Tumblin 1999]
- Organization into regions

Limitations: contrast & palette

Local contrast

- [Tumblin 1999]
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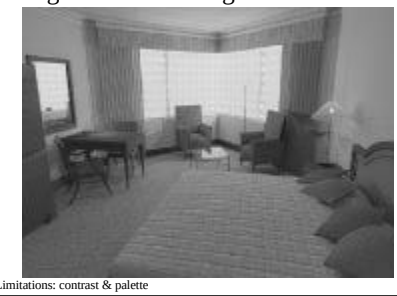
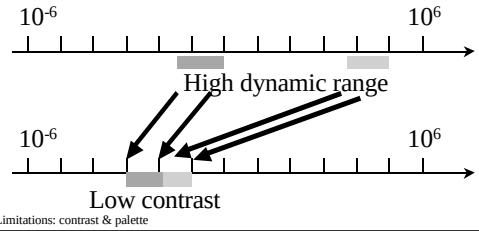


Histogram adjustment

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



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Flare, halo

- Le Corbusier, *Notre Dame du Haut,* 1950-55

Flare, halo

Flare, halo

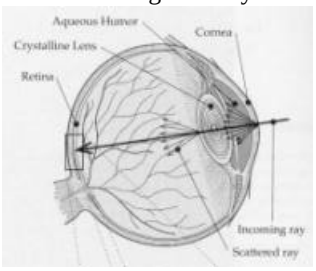
- Van Gogh, *Le Semeur*, 1880

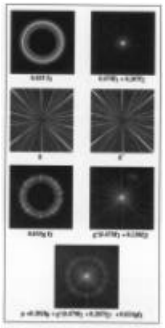
Blue-yellow

- Karl Schulpig, 1925

Flare in CG

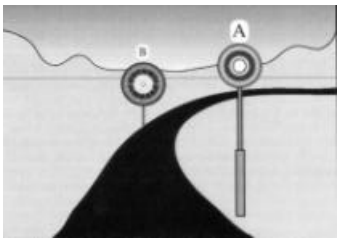
- [Spencer et al 1995]
- Flare: scattering in the eye





Flare in CG

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



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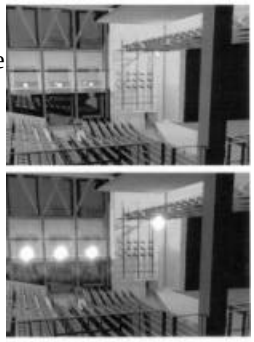

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Local lighting

- 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

- Wolfrang Weber
  The Lash Bird Dancer On Madagascar
  Late 20s

Contrast

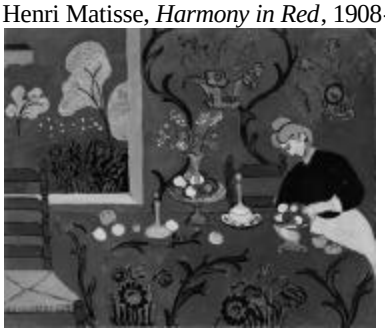
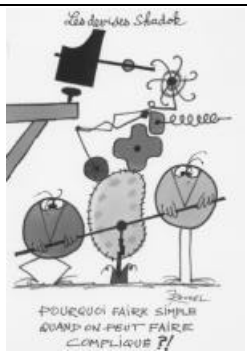
- Bert Stern

Pure drawing

- Diego Riviera
  Mother And Child
  1936

Pure color

- Henri Matisse, *Harmony in Red*, 1908-1909



Pure color