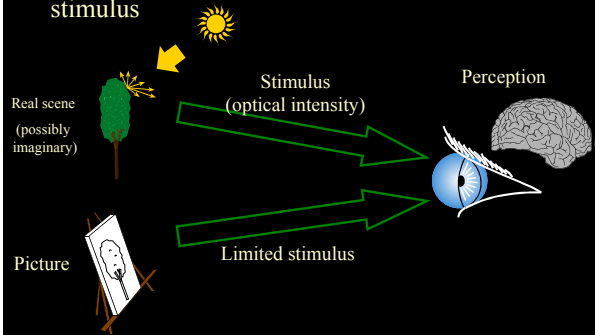


The Art and Science of Depiction
**Limitations of the Medium,
compensation or accentuation**

Fredo Durand
MIT- Lab for Computer Science

Limitations of the medium

- The medium cannot usually produce the same stimulus



Limitations of the medium

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



Limitations of the medium

- Notion pioneered by H. von Helmholtz
 - Physicist and vision scientist (19th century)
- Crucial aspects of art are defined by limitations
 - E.g. composition, color palette



Millet

Weston

Strategies

- Elimination
 - Technological
- Compensation
 - Pictorial technique
- Accentuation
 - Because limitation can be good

Elimination of flatness

- e.g. Stereo images, head-mounted displays, holograms, autostereoscopic displays, sculpture



Compensation of flatness

- Enhancement of occluding silhouettes, aerial perspective, etc.
- Some cues are missing
 - Here stereo, parallax
- Compensated through other channels
 - Occlusion



Occlusion

- Titian



Occlusion



No filter

Blue filter

Red filter

Other compensations of flatness

- Accentuate pictorial cues
 - Aerial perspective
 - Convergence of parallels
 - Relative sizes of objects
 - Texture gradient
 - Shading and shadows
 - Position wrt horizon



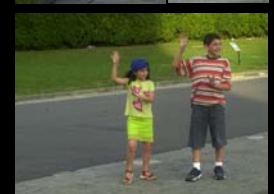
Accentuation of flatness

- Here, occlusion boundaries are blurred
 - To enhance the 2D composition



Monet

Special effects: relate different depths



The limitation is good

- Relate objects at different depths
- But still have a 3D impression thanks to compensation



Dissonance

- Magritte



These strategies are general

- Elimination
 - Technological, extend the medium
- Compensation
 - Through different channels
 - Allow to juggle between accentuation & elimination
- Accentuation
 - Because limitations can be a plus

These strategies are general

- For most media
 - Limitation can be more or less pronounced
- Are also relevant if the medium is NOT limited!
 - In order to increase effects

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
- The gamut (palette) is limited



The picture is static

- Pose (not at rest)
- Motion Blur & path
- Multiple snapshot
- Composition
- Op' Art

Egyptian vs. Greek



Pose accentuated

- Cartoons
- Even when there is no limitation!



Path of Movement – Motion Blur



Motion Blur

- Luxo Jr., Pixar

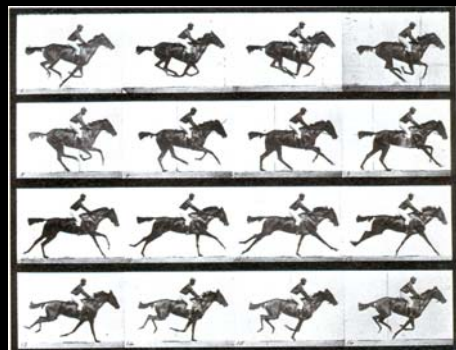


Motion Blur

- Velasquez: does not imitate a camera!



Multiple snapshots



Multiple Snapshots

- Marcel Duchamp
Nude Descending a Staircase
1912



Multiple snapshots

- Sassetta,
The Meeting of St Anthony and Saint Paul,
1440



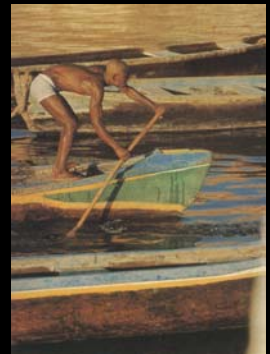
Viewpoint

- + lines +pose



Composition - lines

- + Balance



La Gioconda

- Sfumato



La Gioconda

- Sfumato
- [Dr. Livingstone]
- Multiresolution vision



A Paradigm...



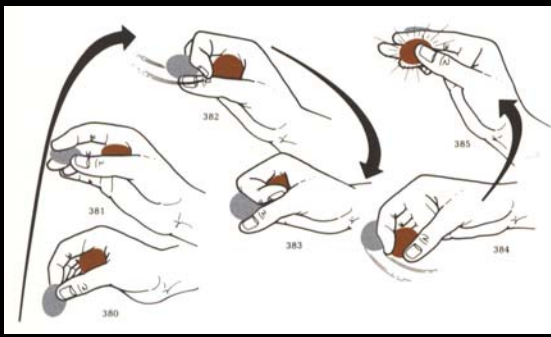
The limitation is good!

- Tak Kwong Chan
The Horse –
Away He Goes 1980
- Static and dynamic quality



The limitation is good!

- Static+dynamic allows us to visualize everything



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**
- The gamut (palette) is limited



Contrast limitation

- Real world: 10^{-6} to 10^6 cd/m²
- Picture
 - Max contrast 1:500
 - Typically 1:50



Low contrast

Two problems

- The image intensity does not match the real conditions



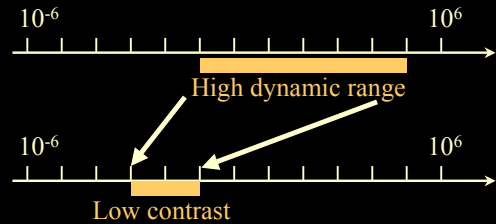
Watched in a dark room

Hunt and Stevens effect

- Perceived contrast increases with luminance
- Colors are more vivid in bright environments
- Hence gamma correction
 - Well, at least one form of gamma correction

Two problems

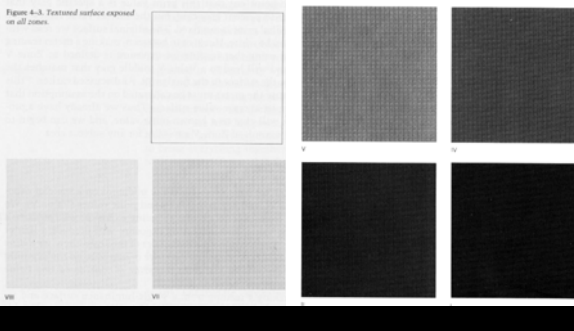
- The image intensity does not match the real conditions
- The contrast is not sufficient



Photography & contrast management

- Try to preserve texture (details)

Figure 4-3. Textured surface exposed on all zones.



Photography & contrast management

- Try to preserve texture (details)
- When the picture is shot
- Film processing
- Printing

Filterering: red



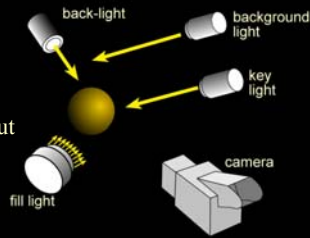
Gradient Filter

- The sky is too bright
 - Gradient filter for the top of the photo



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



Portrait lighting

- Strong back light
- Enhances occlusion
- Enhance subjective brightness of main character



Fill-in

- Add flash to illuminate the interior
- Brings interior to the level of the exterior



Fill-in & planes of light

- Lighting: contrast & flatness



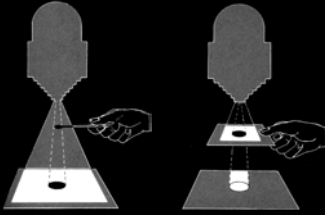
The Print

- W. Eugene Smith photo of Albert Schweitzer
- 5 days to print!
- Composition thanks to limitation



Dodging and Burning

- Locally darken or lighten
- Mask to expose some areas less
- Has to be done for each print!



dodging

burning



dodging



burning

Dodging and Burning

- Clearing Winter Storm



Snapshot-Perspective-Speed, aperture-Filter-Lighting-Processing & Print-Make up-Retouching

The limitation is good!

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



The limitation is good!

- The Godfather



Tuesday at 8:30, technical session

- Three papers about digital contrast management
 - Gradient Domain High Dynamic Range Compression
 - Raanan Fattal, Dani Lischinski, Michael Werman
 - Photographic Tone Reproduction for Digital Images
 - Erik Reinhard, Mike Stark, Peter Shirley and Jim Ferwerda
 - Fast Bilateral Filtering for the Display of High-Dynamic-Range Images
 - Frédo Durand and Julie Dorsey

