The Art and Science of Depiction

Limitations of the Medium, compensation or accentuation

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Limitations of the medium

- The medium cannot usually produce the same stimulus

Real scene (possibly imaginary)

Stimulus (optical intensity)

Limited stimulus

Perception

Picture
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
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
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• 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!

ANIMATOR: Ollie Johnston—Bambi.
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...

Calvin and Hobbes

It's true, Hobbes. Ignorance is bliss!

Once you know things, you start seeing problems everywhere... And once you see problems, you feel like you ought to try to fix them.

And fixing problems always seems to require personal change... And change means doing things that aren't fun! I say Phoeey to that!

But if you're willfully stupid, you don't know any better, so you can keep doing whatever you like.

The secret to happiness is short-term, stupid self-interest!

We're heading for that cliff! I don't want to know about it.

I'm not sure I can stand so much bliss. Careful! We don't want to learn anything from this.
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

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Contrast limitation

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

\[ 10^{-6} \quad 10^6 \]

Low contrast
Two problems

- The image intensity does not match the real conditions

Sunny scene

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 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