The Art and Science of Depiction

Gaze Movement and Focal Points

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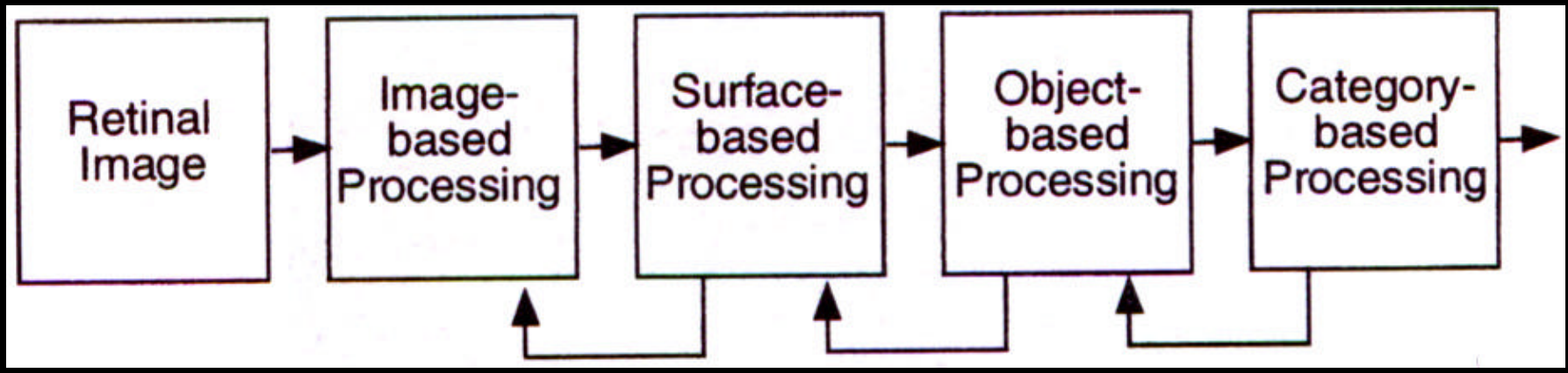
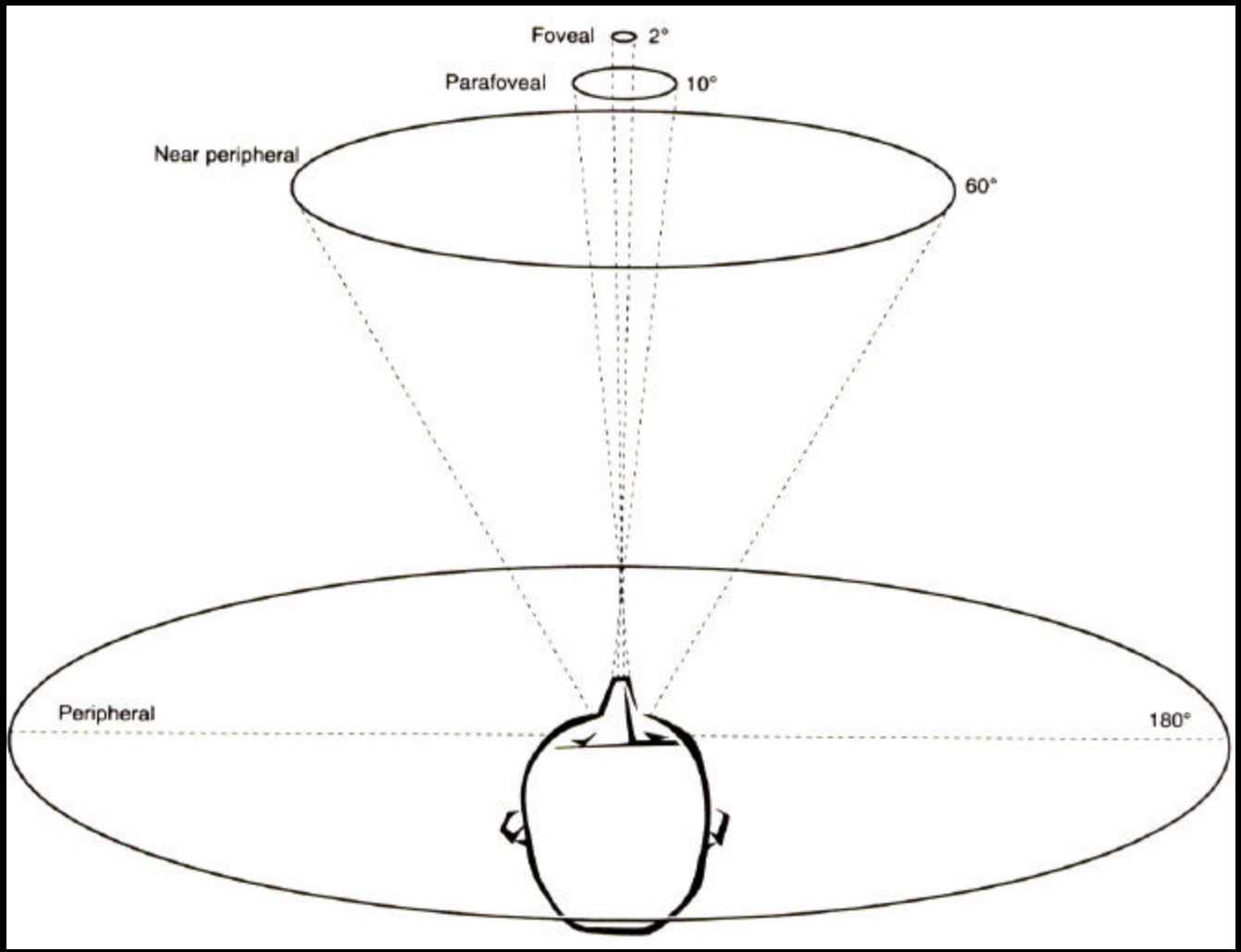
Summary

- Visual field, highest precision in the fovea (~2°)
- Contrast processing
- Different pathways
- Computational theory of vision
- Invariants



Need for exploration

- We need to align the fovea with relevant features



Plan

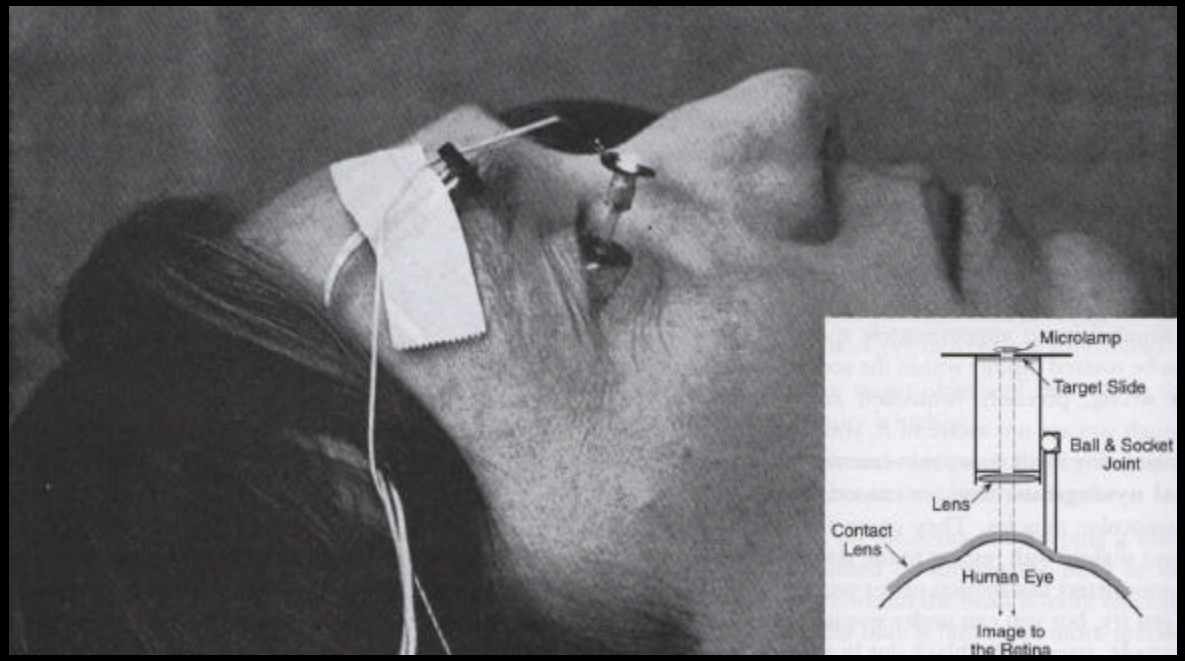
- Different eye movements
- Visual exploration
- Saliency
- Focal points, composition

Eye movements

- Physiological nystagmus (involuntary)
- Saccade (scan visual field)
- Smooth pursuit (track moving objects)
- Vergence (depth adjustment)
- Vestibular (compensate head movement)
- Optokinetic (in moving environment)

Physiological nystagmus

- Involuntary movement
- All the time
- Avoid stabilized images
  - Because they disappear!

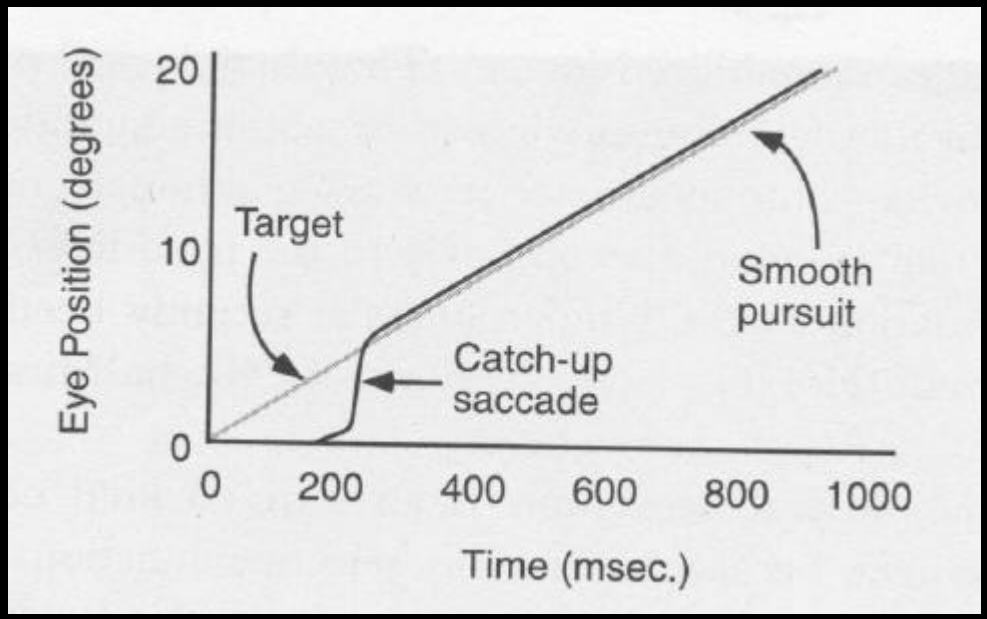


Saccade

- Scan the visual field
- Can be controlled
- The most important for us
- Ballistic movement: 30 ms and up to 900°/s
- Fixation ~300ms
- Saccadic suppression
  - No blur is experienced during movement

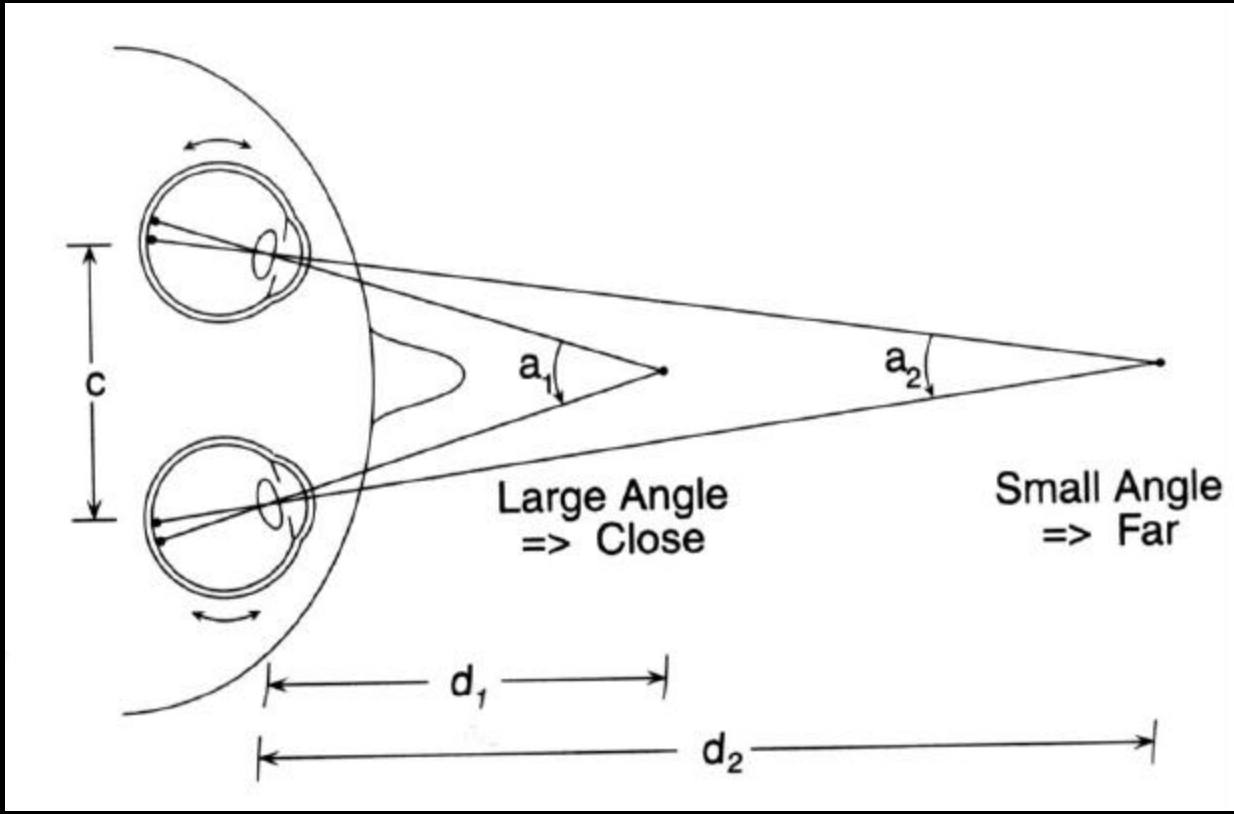
Smooth Pursuit

- Track moving objects
- Smooth
- Constant feedback and readjustment
- Slower than saccades (max 100°/s)
- Acuity
  - The image of the tracked object remains sharp



Vergence

- Depends on object distance (depth cue)
- Less than 10°/s



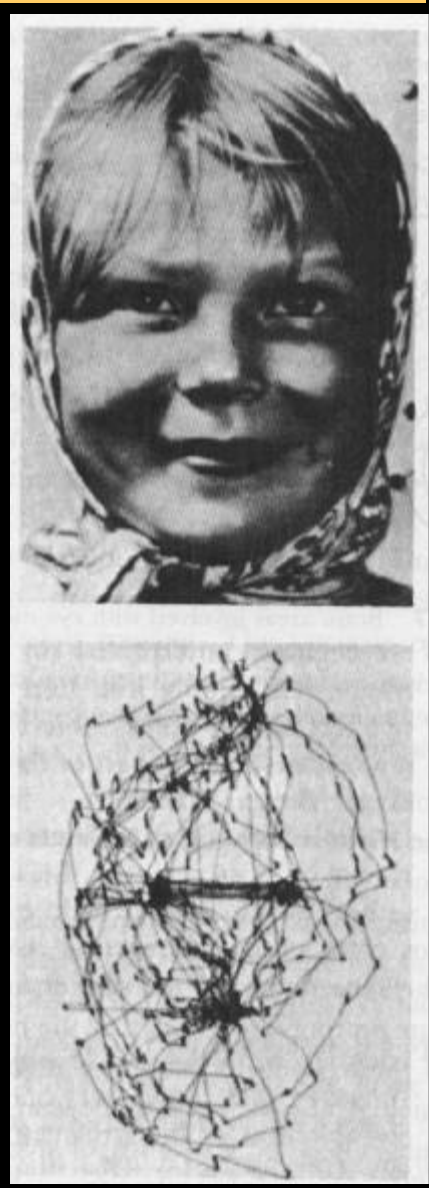
Other movements

- Vestibular
  - compensate head movement
- Optokinetic
  - in moving environment

Saccadic exploration

- Reading: Javal, 1878
- Images: Yarbus, 1965

- Path
- Fixation time



David Hockney's collages

- 1 photo= 1 gaze
- Distorted perspective because saliency

David Hockney's collages

- Temporal too

Gaze movement & cubism

- Picasso
  Portrait of Kuhnweiler

Gaze movement & cubism

- George Bracque
  Le Portugais
  1911-1912

Gaze attraction

- Bottom-up (stimulus-driven)
  - Contrast
  - Color
  - Patterns
- Top-bottom (High-level driven, potentially conscious)
  - Semantic information, familiarity
  - Human beings, eyes
  - Task
  - Personal context

Computational model

- Itti et al. (Caltech)
- Bottom-up only
- Different channels (colors, edges)
- Multi-resolution
- Lateral inhibition

Focal point

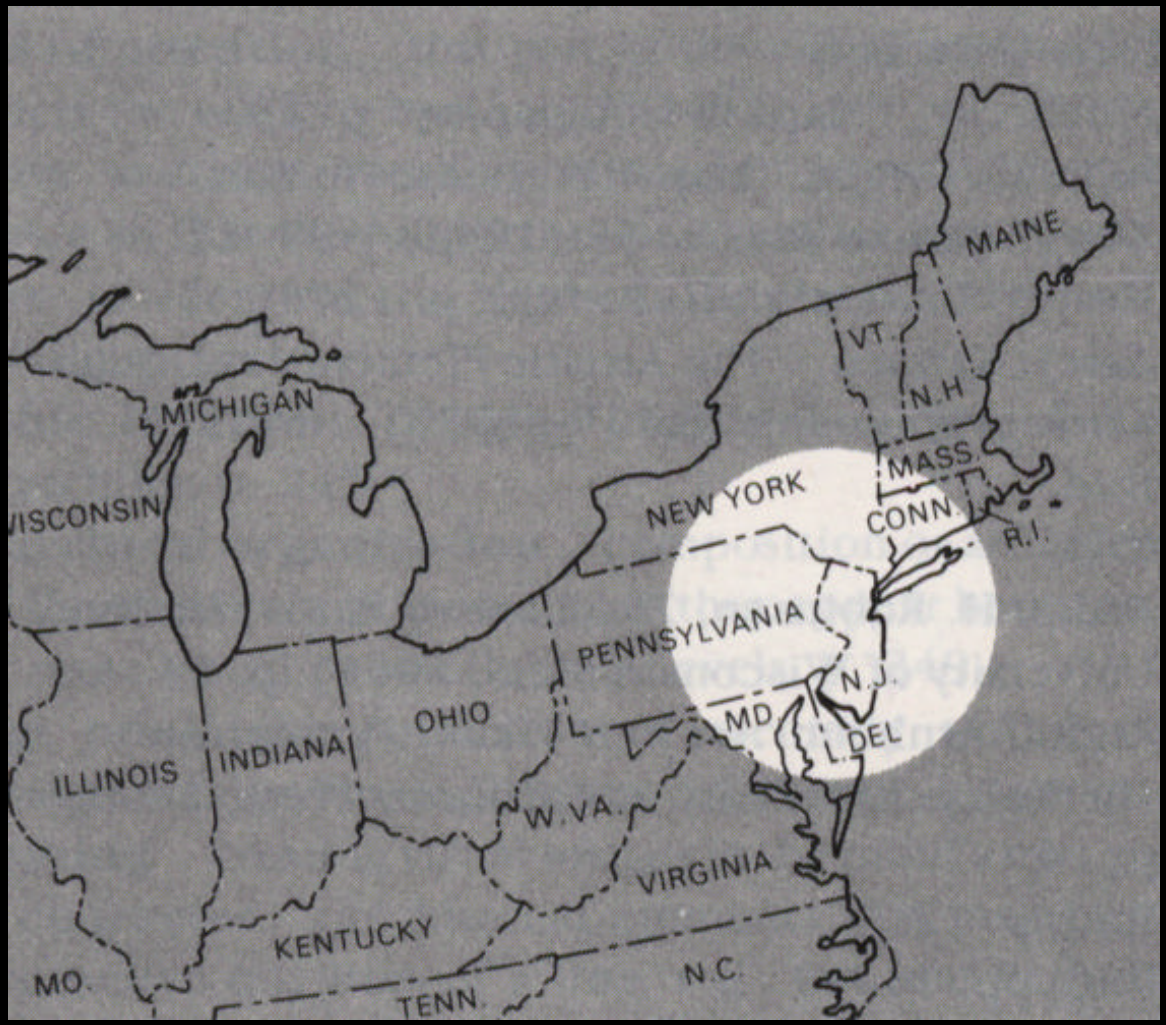
- Contrast
- Amount of details
- Image dynamics (lines)
- Semantics

Creating focus: edge burning

Image 1

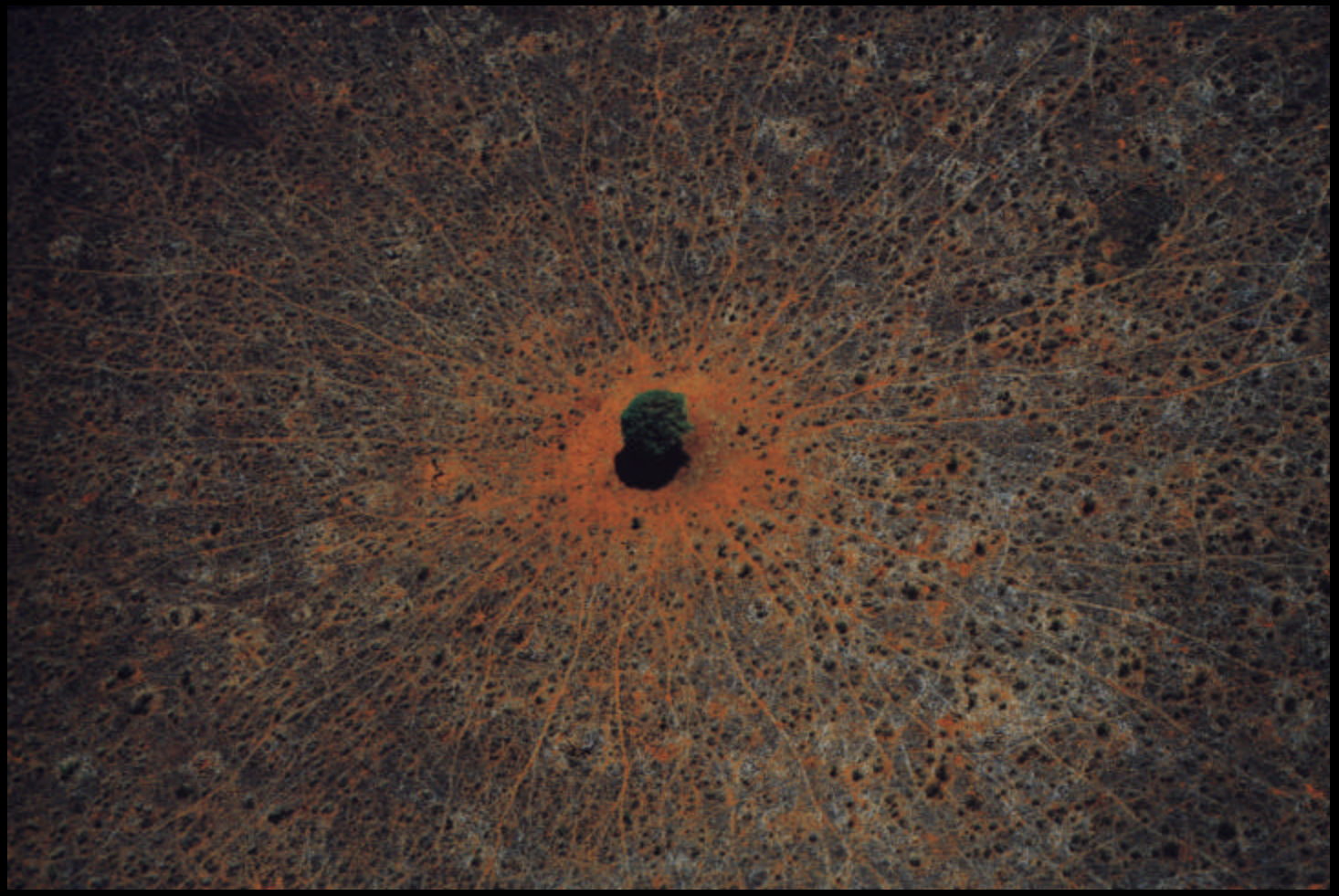
Focus

Focus via "spotlight"



Focus

- Arthus-Bertrand



Focus via contrast

Focus via contrast

- Tofoli

Focus through contrast

- Rembrandt

Focus through perspective

- Raphael, The School of Athens

Foveal zone

- Eugene Delacroix Study for a portrait of Chopin

Focus through make up

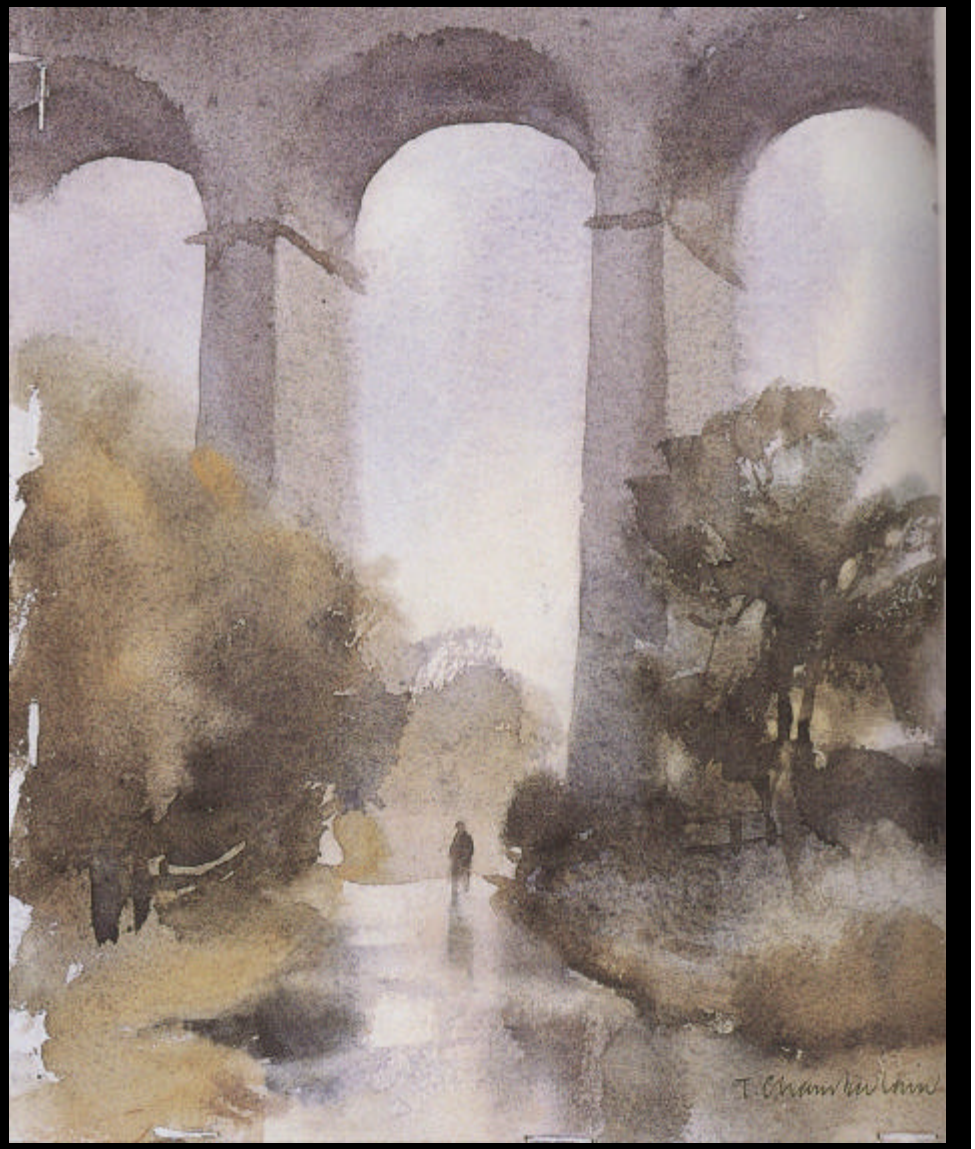
- Make-up: Aucoin

Focus using detail and color

- A. M. Cassandrd, 1925

Focus on human

- Trevor Chamberlain
  Railway viaduct
- Human being
- Highlighted by closure

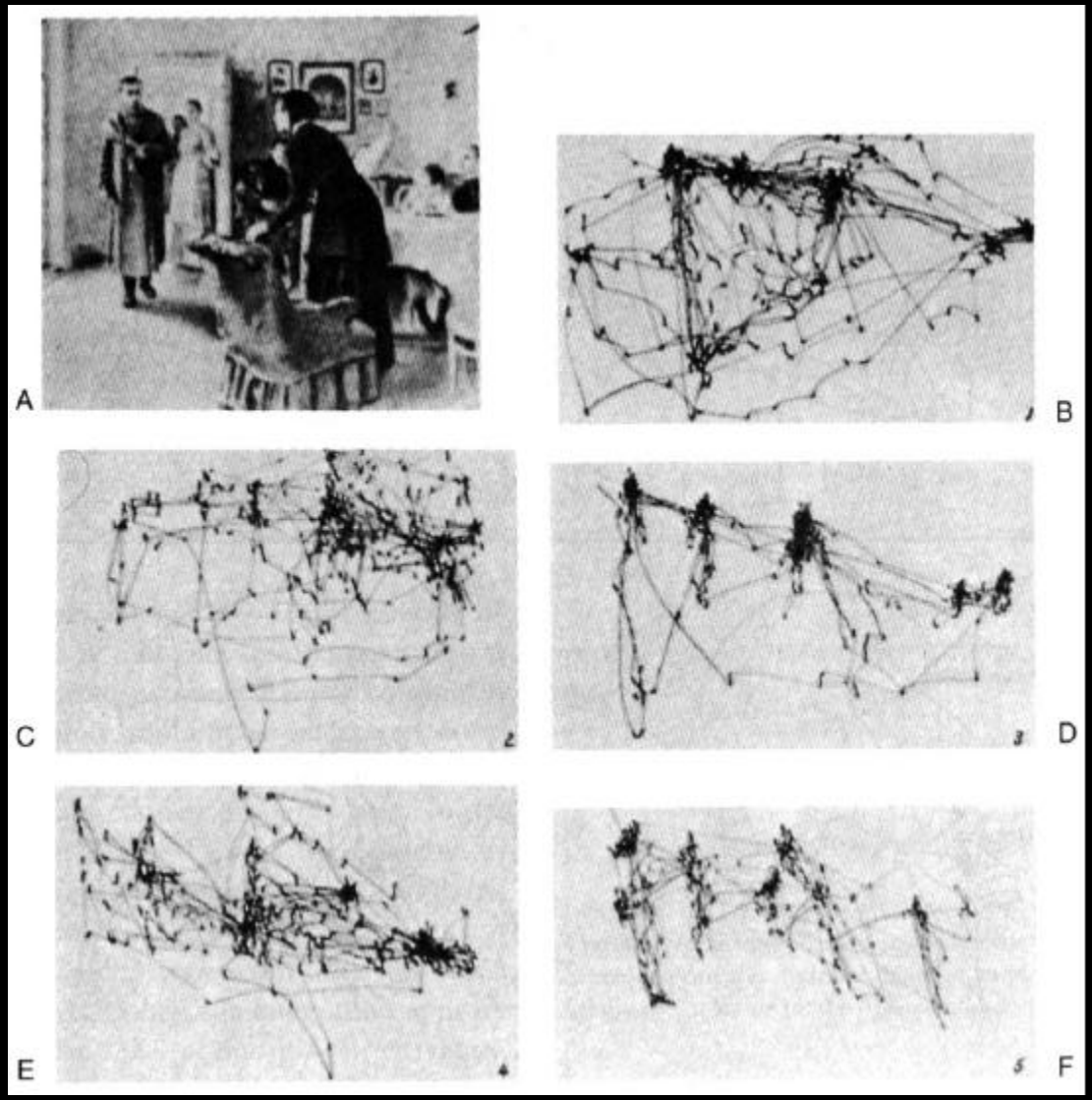


Gaze and image cognition

- Similar to scientific method
  - Make hypothesis
    (mental model of the scene)
  - Perform experiments
    (gaze)

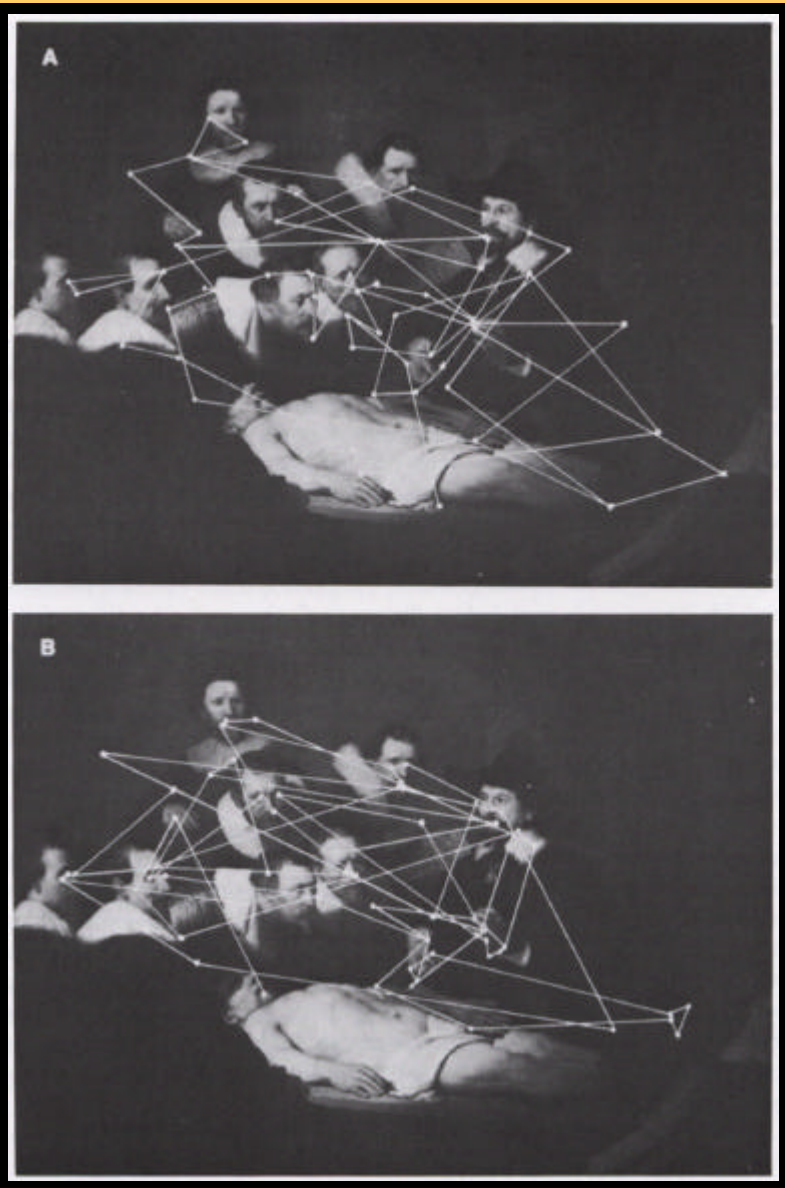
Depends on task

- painting by Repin
- B: free
- C: economic level
- D: ages
- E: what were they doing
- F: remember cloth



Depends on task?

- Rembrandt,
  The Anatomy Lesson
- Different tasks:
  - A: Aesthetic
  - B: Semantic
- Very similar paths



Diversive vs. specific

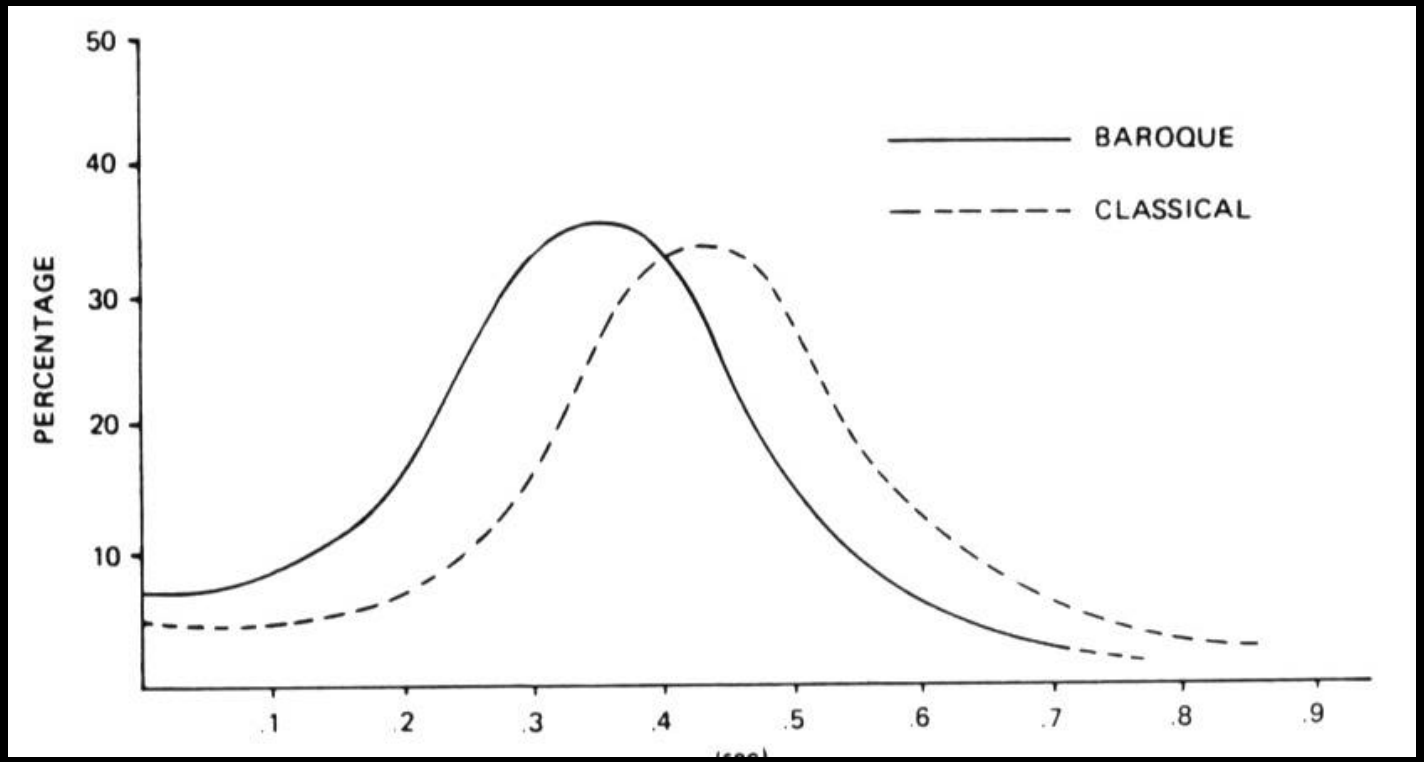
- Different strategies (Berlyne 1971)
- Diversive exploration
  - Hunt for new stimulation
  - Dispersed
  - Shorter fixation (<300ms)
- Specific exploration
  - Seeks specific information
  - Longer fixation (>400ms)

Effect of training

- Compare naïve beholders with specialists
  - Radiologists
  - Art students, art historians
- Specialists more specific
- Naïve more diversive

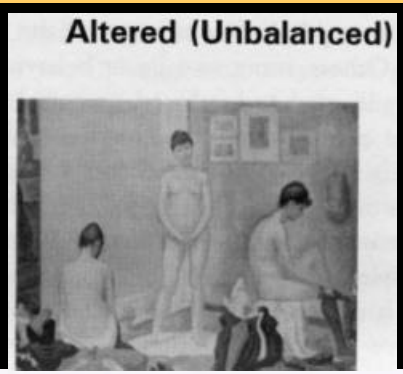
Fixation time & style

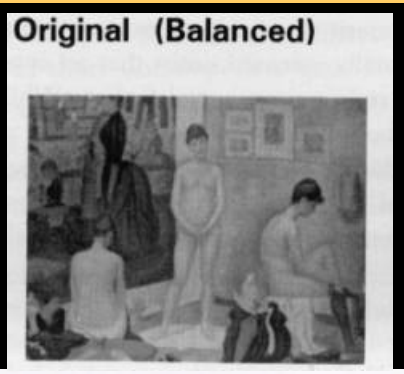
- Depends on style “complexity”
- Shorter fixation for more complex style

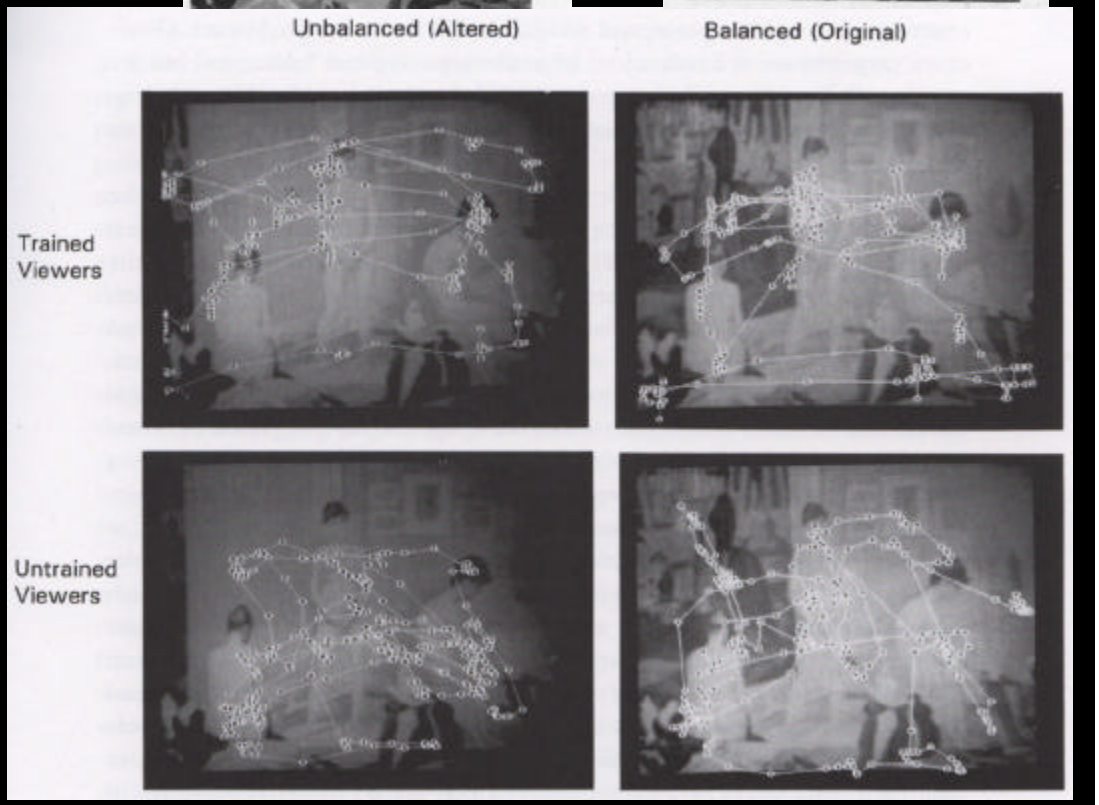


Gaze & balance

- Altered painting
- Inverses strategy of naïve and specialists







Number of focal point

- Dynamic of the image
- 1 region: imitates 1 foveation, striking
- Many regions: the gaze is transported, dynamism
- Path

Focus: Color contrast

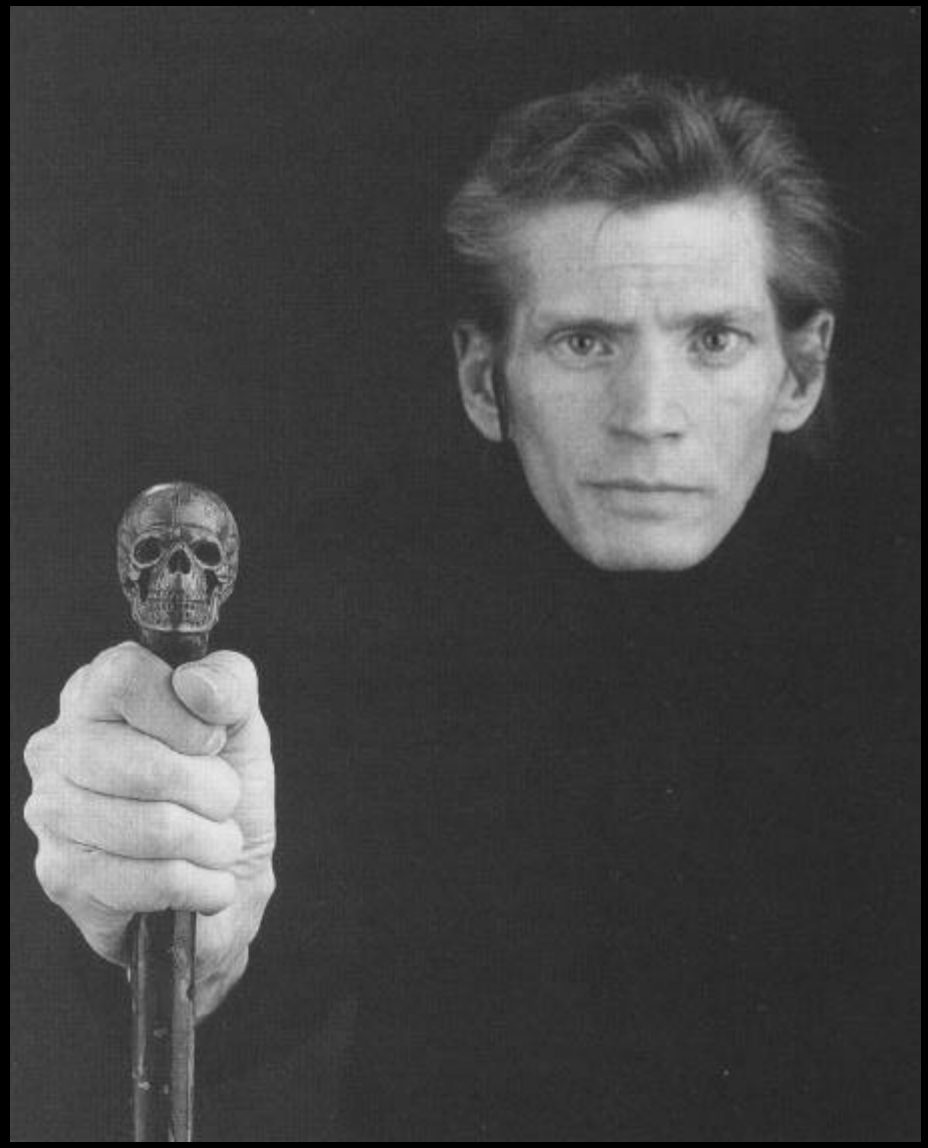
- Arthus-Bertrand

Focus through contrast

- Rembrandt

Two focal zones

- Robert Mapplethorpe *Self-portrait*, 1988



Focus through perspective

- Raphael, The School of Athens

Focus: saliency + semantics

Turner's Loire journey

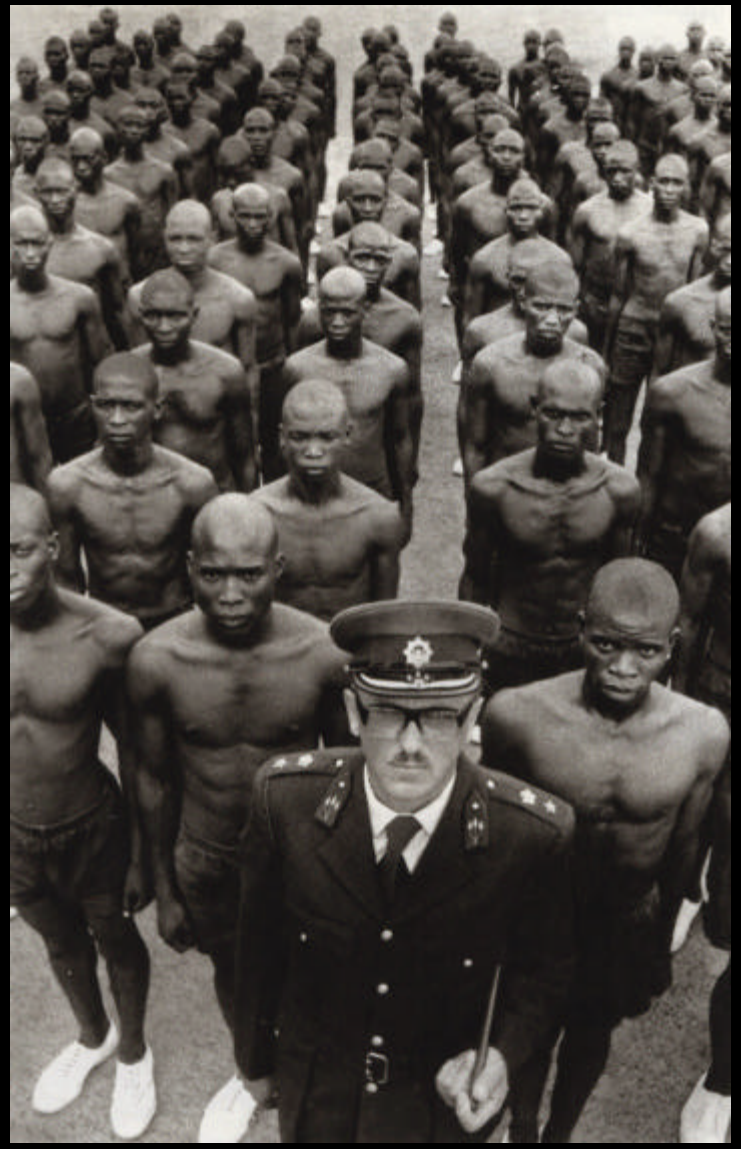
- The gaze follows the journey

Triple focus and subject gaze

- Robert Doisneau
  Les Gosses
  de la place
  Hebert

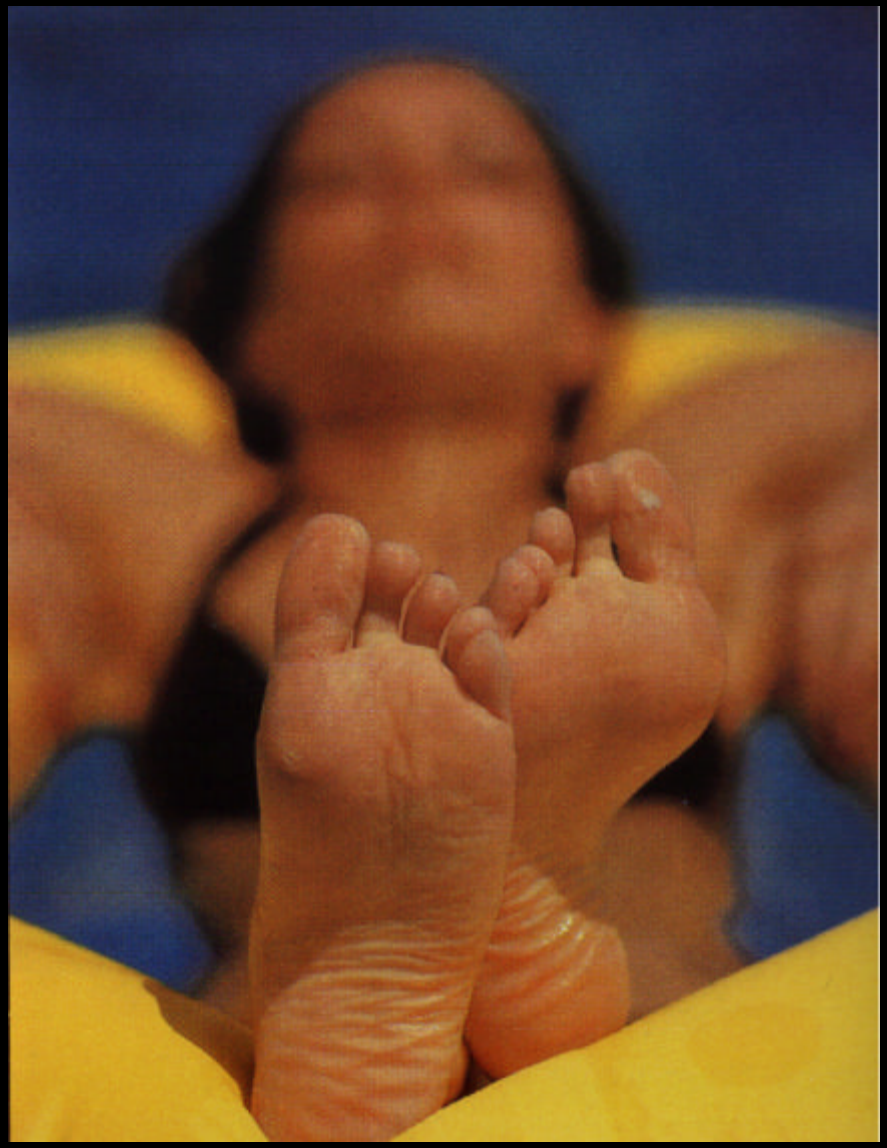
Focal point and dynamics

- Abbas, 1978
- Pop-out leads to uniform
- Perspective leads to top



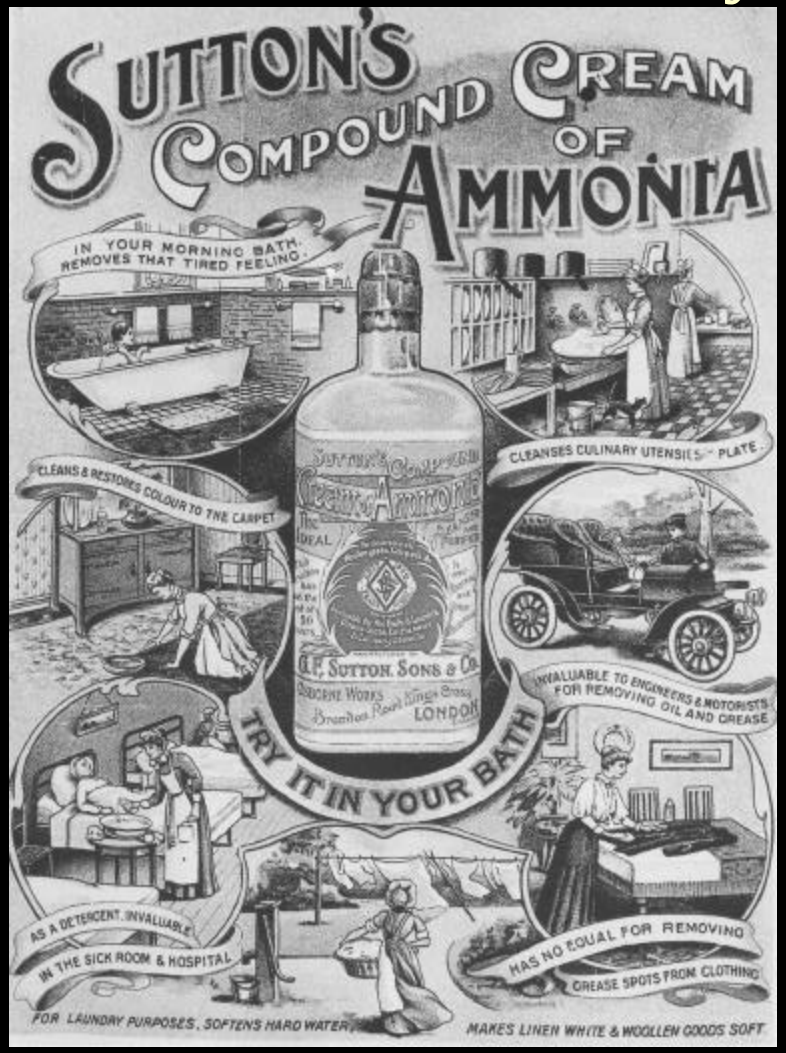
Focal point conflict

- Bottom-up is different from top down
- Makes image dynamic



Advertisement and focal points

- Evolution of saliency



The End…

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