

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

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Need for exploration

- We need to align the fovea with relevant features

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Plan

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

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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)

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Physiological nystagmus

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

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Saccade

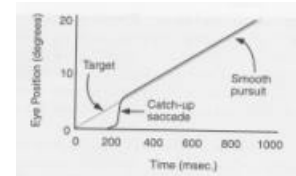
- Scan the visual field
- Can be controlled
- The most important for us
- Ballistic movement: 30 ms and up to 900°/s
- Fixation ~300ms
- Saccadic suppression
 - No blur is experienced during movement

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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

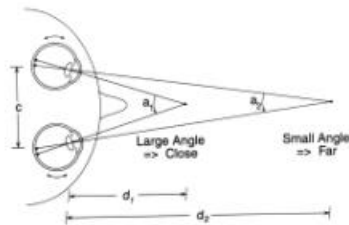


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Vergence

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



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Other movements

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

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Saccadic exploration

- Reading: Javal, 1878
- Images: Yarbus, 1965
- Path
- Fixation time



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David Hockney's collages

- 1 photo= 1 gaze
- Distorted perspective because saliency



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David Hockney's collages

- Temporal too



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Gaze movement & cubism

- Picasso
Portrait of Kuhnweiler



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Gaze movement & cubism

- George Bracque
Le Portugais
1911-1912



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Gaze attraction

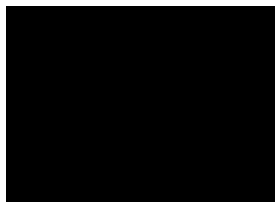
- Bottom-up (stimulus-driven)
 - Contrast
 - Color
 - Patterns
- Top-bottom (High-level driven, potentially conscious)
 - Semantic information, familiarity
 - Human beings, eyes
 - Task
 - Personal context

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Computational model

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



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Focal point

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

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Creating focus: edge burning



Image 1



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Focus



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Focus via "spotlight"

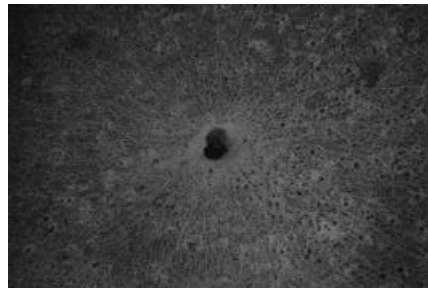


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Focus

- Arthus-Bertrand



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Focus via contrast



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Focus via contrast

- Tofoli



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Focus through contrast

- Rembrandt



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Focus through perspective

- Raphael, The School of Athens



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Foveal zone

- Eugene Delacroix
Study for a portrait of Chopin



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Focus through make up

- Make-up: Aucoin



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Focus using detail and color

- A. M. Cassandre, 1925



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Focus on human

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



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Gaze and image cognition

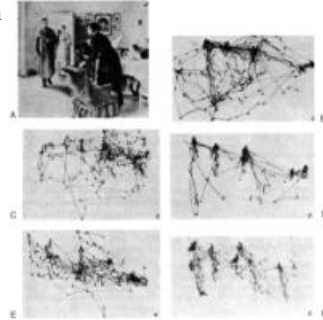
- Similar to scientific method
 - Make hypothesis (mental model of the scene)
 - Perform experiments (gaze)

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Depends on task

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

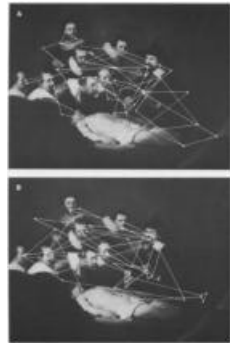


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Depends on task?

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



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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)

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Effect of training

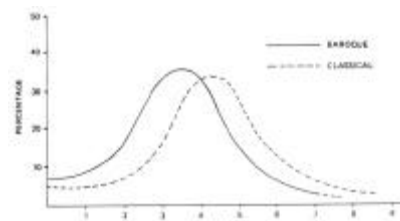
- Compare naïve beholders with specialists
 - Radiologists
 - Art students, art historians
- Specialists more specific
- Naïve more diversive

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Fixation time & style

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

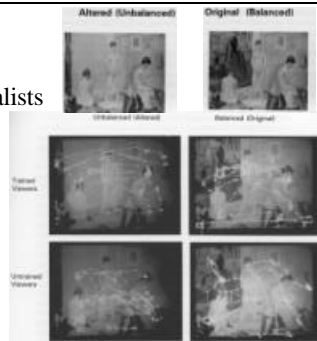


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Gaze & balance

- Altered painting
- Inverses strategy of naïve and specialists



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Number of focal point

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

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Focus: Color contrast

- Arthus-Bertrand



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Focus through contrast

- Rembrandt



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Two focal zones

- Robert Mapplethorpe
Self-portrait, 1988



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Focus through perspective

- Raphael, *The School of Athens*



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Focus: saliency + semantics



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Turner's Loire journey

- The gaze follows the journey



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Triple focus and subject gaze

- Robert Doisneau
Les Gosses de la place
Hebert



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Focal point and dynamics

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



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Focal point conflict

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



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Advertisement and focal points

- Evolution of saliency



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The End...

- Of part I