Neural aspects of visual attention
The parietal lobes:

- “crossroads of the brain” (Critchley, 1953)
- well situated topographically
- multimodal
- requisite cortical and subcortical connectivity
- Distribution of MCA, little collateral supply
Neglect
Federico Fellini
(1920-1993)
Neglect

• Asymmetry in incidence: RH (66%) in humans not monkeys
• Inferior parietal lobule
  – Areas 39 and 40;
  – non-human primate analog: IPL (7) vs STS
  – bimodal: short-lived vs persistent
• Affects different sensory modalities
• Not sensory deficit
Not just parietal

- Distributed network: (Mesulam; Heilman)
  - dorsolateral prefrontal, medial frontal (cingulate, thalamus, basal ganglia, white matter).
  - Same network activated in eye movement studies
    - Close relationship between attention and eye movements (Corbetta et al.)
Extent of effect

• Other sensory modalities
  – Auditory
  – Olfactory
  – Tactile

• Mental imagery
  – Piazza del Duomo (Bisiach and Luzzatti)

• Affects output: not surprisingly
Vision and eye movements

(Behrmann et al.)

- 45 x 36 degrees visual angle
- magnetic scleral coil in right eye
- indicate number of As in display
Lesions: neglect patients
Lesions:
BD controls with hemianopia
Location and duration of fixations
Eye movements reflect left-sided neglect

(a) Fixations

(b) Duration

Quartile Bands

Percentage

0 10 20 30 40 50

1 2 3 4

Controls
Neglect
Hemianopic
Disengage deficit?
Suggests competition
What gives rise to neglect?

Gradient consistent with neuronal distribution:
68 bilateral, 29 contra, 3 ipsi
Visual search paradigm

I. ‘Pop-out’ Task.
Target defined by a distinctive feature:
specifically, an intersecting line.

II. ‘Serial’ Task.
Target defined by the lack of a distinctive feature.
Normal subjects

Feature search          Conjunction search

a. Normal controls

- left target
- right target
- no target
Patients with LHD

[Graphs showing data for LHD N- and LHD N+ with measurements in ms for different time points (1, 6, 12).]
Patients with RHD
So:

- Spatial deficit apparent in visual search

- Generally scaled with severity of neglect
  - But more in RHD than LHD

  - Some competition: better on right side as neglect severe in conjunction
Eglin and Robertson
Dynamics of attention

(Note: all positions actually fell on horizontal midline)

Single stimulus locations

Double stimuli positions

Pos 1
Pos 2
Pos 3
Pos 4

A   B   C   D   E   F

3.0 °
Cate and Behrmann, 2002

![Graph showing percent correct responses for single stimuli with SOA ranging from -1100 to 1100. The graph includes data points for left and right hemispheres with 88% and 83% correct responses respectively.](attachment:image)
Mechanism

• Neuronal imbalance
  – Gradient from left to right
  – Competition as function of temporal offset
  – Competition also as a function of spatial position
Fate of neglected information

• Do patients process unattended information normally?
  – failure to reach consciousness?
  – degraded processing?
Volpe, Ledoux and Gazzaniga (1979)

Same or different?

Response: different

Name the objects

Response: A star

Unconscious processing/ failure to explicitly report information that is available
E: "Are the houses the same or different?"

PS: "The same"

E: "Which house would you prefer to live in"

9/11 nonburning house
Priming paradigm
McGlinchey Berroth et al.

Normal subjects: faster lexical decision time if related than unrelated
Results

• Patients faster to say ‘yes’ when semantic related pic on right (eye-nose) compared to eye-ship

• Patients faster to say ‘yes’ when semantic related pic on left

• SAME AMOUNT OF PRIMING/FACILITATION FROM BOTH SIDES! Even though report the information.

• Patients process neglected info normally.
Results … Continued

• BUT: normals show double priming on left than right

• Cannot conclude processing is normal!

• Priming not as demanding as explicit report.