Topic 11 - Parietal Association Cortex

1. Sensory-to-motor transformations

2. Activity in parietal association cortex and the effects of damage

Sensory to Motor Transformation
Sensory information (visual, somatosensation etc.) is integrated and used to generate an appropriate motor output.


Posterior Parietal Cortex (PPC) association area

PPC association area

- PPC is neither purely sensory nor purely motor ("association cortex")
- important for integration of sensory information
- sends information to motor areas (e.g. premotor and M1)
- important for "sensory-to-motor" transformation

Topic 11 - Parietal Association Cortex

1. Sensory-to-motor transformations

2. Activity in parietal association cortex and the effects of damage

Parietal Association Cortex

- integrates information from several sensory modalities (e.g. V1 and S1)
Visual control of motor output
Absolute metrics
Moment-to-moment computations
‘Unconscious’

Object identification
Relational metrics
Long term representation
‘Conscious’

Lesions of parietal association cortex produce complicated deficits...

### Why study lesions?

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
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<tr>
<td>• Provides insight into normal functioning of the brain.</td>
<td>• Lesions are rarely focal</td>
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<td>• Tells you which areas are necessary for which functions</td>
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### Astereognosis
- inability to recognize objects by touch alone

![Image of a hand holding an apple]

### Balint’s syndrome
- Visuomotor and visuospatial disorders
- Bilateral damage to posterior parietal lobes
  - Simultanagnosia – inability to interpret the visual field as a whole
  - Ocular apraxia – deficit of visual scanning
  - Optic ataxia – inability to reach accurately under visual guidance
Simultanagnosia

- Difficulty copying/drawing/writing because they can’t see the end of the pen and what is on the paper at the same time.
- Spatial disorientation: unable to discern spatial properties of objects e.g. distance and size.
- Difficulty describing complex scenes (e.g. Boston cookie theft)

Simultanagnosia

Ocular Apraxia

- Impaired visual scanning (moving the eyes voluntarily)
  - Not an oculomotor deficit
  - Reflexive movements are spared
  - Eye movements toward auditory stimuli are spared
  - Gaze restricted to narrow band, right of midline (similar to neglect)
Ocular Apraxia

Optic Ataxia
"dorsal" and "ventral" streams

Optic Ataxia
The inability to accurately reach for visible objects

Optic Ataxia

- Visuomotor deficits - errors in visually-guided movements
- No other perceptual or motor deficits
- Two types of optic ataxia patients

Optic Ataxia

- Unilateral Optic Ataxia
- Bilateral Optic Ataxia

Optic Ataxia

- Unilateral Optic Ataxia
Bilateral Optic Ataxia


Bilateral Optic Ataxia

Milner et al., 1999; 2001; 2003

Optic Ataxia Patient

Control

Immediate

Delayed

Miner et al., 1999; 2001; 2003

Ideomotor Apraxia

Loss of ability to perform previously learned motor tasks

Parietal lobe

Dorsal stream

Primary visual area (V1)

Temporal lobe

Ventral stream
Personal neglect syndrome
- lack of awareness of a body part

Neglect
- Mostly found with right lesions in the IPL.
- May be in the superior temporal cortex – site in monkeys that is associated with spatial awareness.
- Some subcortical damage: basal ganglia and thalamus.


Neglect
- Lack of awareness of personal and extra-personal space contralateral to lesioned hemisphere, e.g.
  - patient may believe the left side of body is someone else’s.
  - patient eats only the food in the right half of plate.
  - patient may only dress or shave on side.
• Visuo-motor deficits.

Neglect

• Anosognosia- The loss of recognition or awareness of a disease.
  • Most people with neglect are also unaware that they have the disorder.
IT Functions

- Object perception, recognition, memory
- Face perception

Visual Agnosia

- Inability to recognize objects from sight
- Deficient shape perception
- Famous case D.F.
  - Can’t recognize or copy drawings of common objects (such as an apple or a key) but can draw from memory
  - Can’t estimate size, distance of objects

Milner & Goodale, 1995
**Prosopagnosia**

- Inability to recognize faces by sight,
  - Even themselves
  - Can by recognize by voice
- Can recognize faces as faces and name parts
- Can discriminate faces (tell two faces apart)
  - Based on feature comparison not global recognition

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**Summary**

**Dissociation between ventral and dorsal streams**

<table>
<thead>
<tr>
<th>Parietal Damage</th>
<th>Inferior Temporal Damage</th>
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<tbody>
<tr>
<td>• Can recognize objects</td>
<td>• Cannot recognize objects, faces</td>
</tr>
<tr>
<td>• Can judge relative distance, size</td>
<td>• Cannot judge relative distance, size, size</td>
</tr>
<tr>
<td>• Cannot make accurate visual guided actions e.g. saccades, pointing, grasping</td>
<td>• Can make accurate visually guided action (taking shape into account)</td>
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<tr>
<td>• Lack of attention of space</td>
<td>• Aware of space</td>
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_Milner & Goodale, 1995_

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**General Take-Home Message!**

PPC is involved in transforming sensory cues into info regarding

- the locations of objects in the environment
- the location of our limbs in the environment
- relative location of body segments

→ helps provide a “reference frame” for the world around us.