Neuropsychological Studies in Attention (Hemispatial Neglect)

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What is Hemispatial Neglect

“Hemispatial Neglect is a common, disabling disorder that results from brain damage”, characterized by both spatial and non-spatial deficits

• Core spatial deficits include mechanisms for: saliency coding, spatial attention, and short-term memory
• Core non-spatial deficits include reorientation, target detection, and arousal/vigilance

Affected cortical areas include:
• TPJ (temporal-parietal junction)
• IPL (inferior parietal lobe)
• IPS (inferior parietal sulcus)
• STG (superior temporal gyrus)
• IFG (inferior frontal gyrus)
• MFG (middle frontal gyrus)

Husain and Rorden (2003) argue for these five key concepts:
1. Non-lateralized components might combine with spatially lateralized mechanisms to exacerbate the severity of neglect
2. Non-lateralized mechanisms are not necessarily specific to the neglect syndrome
3. Brain regions that are typically associated with neglect and that are considered to have spatial functions also have non-lateralized functions
4. An understanding of this functional anatomy provides a new way to view the mechanisms driving neglect, with different combinations of spatially lateralized and non-lateralized impairment occurring in individual patients
5. Non-spatially lateralized mechanisms, when combined with lateralized components, might reduce the potential for recovery from neglect


Spatially lateralized mechanisms in neglect
• Spatially biased sensory account
• Motor account
• Representational or attentional account

But:
“The interaction of spatially lateralized mechanisms with non-lateralized components offers a different way of viewing the behaviour of neglect patients.”

Non-spatially lateralized mechanisms in neglect
• Selective attention
• Sustained attention

Attentional Blink Task
When neglect patients with either anterior or posterior lesions identify a white letter, their ability to detect a subsequent target is impaired for more than 1,200 ms.

Salience Encoding: Oddball Task
Some neurons in the iPC respond only when a particular stimulus is salient among distractor objects, but not when the same stimulus acts as a distractor in a different visual array.

TPJ to also play a key role in the oddball paradigm.

Similar experiment used in visual search and recording saccadic activity as it relates to spatial working memory.
Spatially lateralized and non-lateralized functions might be anatomically segregated, possibly explaining why different patients display different symptoms.

Clinical “treatments”?  
- Training in stimulus tracking (behavioral)  
- Cholinergic or dopaminergic targets (pharmacological)

Corbetta and Shulman argue that:

“Neglect is better explained by the dysfunction of distributed cortical networks for the control of attention than by structural damage of specific brain regions.”

“Neglect is mediated by the abnormal interaction between brain networks that control attention to the environment in the healthy brain”

“Egocentric spatial deficits in neglect correspond much more closely to the clinical syndrome both behaviorally and anatomically than do allocentric deficits, and represent core features of the syndrome.”
Egocentric Biases in Spatial Neglect

Eye movements associated with VSTM (visuospatial memory)

Similar to Husain & Rorden (2003) review on saccadic activity in neglect patients.

Physiological Correlates:

1) At three weeks post-stroke a widespread cortical hypoactivation during a spatial attention task was observed in both right and left hemispheres.
   • Large interhemispheric imbalance of activity in dorsal parietal cortex, which normalized at the chronic stage, 9 months post-stroke, in parallel with an overall improvement of cortical activity and spatial neglect

2) Neglect patients have shown anomalies in the pattern of spontaneous activity fluctuations within the dorsal attention network

Further Discussion?