Space- vs. object-based attention


Object-based attention

- Positions in visual field selected together because they belong to the same object

- Evidence
  - Judgments/comparisons are faster within a single object than between two objects (Duncan, Baylis & Driver, Kramer & Jacobson)
  - Inhibition of return moves with objects (Tipper)
  - Simultanagnosia (Balint's syndrome)
    - Bilateral parietal damage
    - Inability to perceive more than one object at a time

Space-based attention

- Attention directed to particular locations
  - “Spotlight”, “zoom-lens” analogies

- Evidence
  - Precuing paradigm (Posner)
    - Exogenous cues (e.g., box brightening)
    - Endogenous (central) cues (e.g., arrow; no object at cued location)
  - Distance effects in attention shifting
  - Hemispatial neglect
    - [but note that there are object-based effects....]
Egly et al. stimuli

<table>
<thead>
<tr>
<th>STIMULUS FIELDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIXATION</td>
</tr>
<tr>
<td>+</td>
</tr>
<tr>
<td>+</td>
</tr>
</tbody>
</table>

Predictions for parietal patients

- Evidence favoring a **disengage role for the parietal lobe** in space-based selection would be a greater overall cost for invalidly cued targets in the contralesional versus ipsilesional field for both within- and between-objects shifts.

- Evidence for a **role in nonspatial components of visual attention** would be provided if any additional cost for between-objects versus within-object shifts interacted with target field. That is, we expect the object effect found for normal subjects in Experiment 1 to be exaggerated for targets in the contralesional field relative to the ipsilesional field if parietal lobe damage leads to particular difficulties in shifting attention between objects.

Egly et al. results: Normals

- Graph plots **invalidity cost**: invalid RT - valid RT

- Cost for responding to uncued rectangle greater than cued rectangle

- Additional cost of between-object shift shows object-based attention

Egly et al. results: Patient RTs

- Patients are slower overall to targets in their **contralesional** field, particularly for invalid trials

- Ascribed to selective deficit in **disengaging** from ipsilesional (good) cue

[but why doesn't the disengage deficit also apply to ipsilesional targets?]
Egly et al. results: Patient cueing costs

- **Left parietal lesion** exaggerates object-based effect in contralesional field; none in ipsilesional field
- **Right parietal lesion** leaves object-based attention intact

Relation to neglect

- the conventional finding is that attentional deficits such as neglect are more common and severe following right- rather than left-hemisphere lesions
- the fact that clinical neglect is usually more severe following right-hemisphere damage may arise because of damage to other right-lateralized systems in addition to the disengage systems examined here, such as the **right-hemisphere arousal system** postulated by Posner et al.

Egly et al.: Conclusions

- Space-based and object-based attention can operate in the same task
- Hemispheres represent object-based attention to different degrees
  - Left hemisphere may be relatively specialized for shifting attention between objects

  "For right-hemisphere patients, the object cost was equivalent for contralesional and ipsilesional targets, indicating a spatial deficit, whereas the object cost for left-hemisphere patients was larger for contralesional targets, indicating an object deficit." (abstract)

Shomstein and Behrmann

- What are the sources of control for shifts of space- and object-based attention?
- Activation pattern of space vs. object selection in occipital cortex
- Differences in activation for within- vs. between-objects shifts
Shomstein & Behrmann: Task

Top-down object-based effect

a

b

Left parietal

Right parietal

Fit Coefficient

Velocity

VAF Difference

Time (s)

Time (s)
Shomstein & Behrmann: Conclusions

- Object-based selection results from an object-sensitive reorienting signal issued by the left (but not right) posterior parietal cortex (PPC)

- Dynamic circuit between the PPC and earlier sensory regions then enables observers to attend preferentially to objects of interest in complex scenes