Hemispheric Attention Networks: Automatic vs. Controlled Orienting

Zaidel, Eran1,2, Li, Yuan Hang1, Greene, Deanna1, & Barnea, Anat3

1. Department of Psychology, UCLA, Los Angeles, CA 90095-1563
2. Brain Research Institute, UCLA, Los Angeles, CA 90095
3. Bio-Keshev Clinic, Kibbutz Givat-Chaim Ichud, Israel

Introduction

• Posner and associates developed the Attention Network Test (ANT) to measure 3 independent networks of attention: 1) Conflict resolution (Prefrontal, Dopaminergic), 2) spatial Orienting (Parietal, Collenergic) 3) Alerting (Parietal-Frontal, Noradrenergic).

• Spatial Orienting can occur with non-predictive (i.e., 50% valid) peripheral cues (Automatic), or with predictive (i.e., 75% valid) central cues (Controlled). At cue-to-target intervals (CTIs) > 300ms, valid Automatic cues inhibit rather than facilitate target identification (Inhibition of Return (IOR)). IOR does not occur with Controlled cues.

• We lateralized the ANT (LANT) in order to measure the attention networks of each hemisphere, using both Automatic and Controlled cues, at short and long CTIs.

Methods

LANT:

• Targets presented tachistoscopically to the left visual field (LVF) or right visual field (RVF).

• Target: Middle arrow pointing up/down (see figure)

• Flanker Arrows: Congruent: same direction as target
  Incongruent: opposite direction than target

• Cues: Precede the target

<table>
<thead>
<tr>
<th>Cues</th>
<th>Controlled (75% valid)</th>
<th>Automatic (50% valid)</th>
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<tbody>
<tr>
<td></td>
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<td>Peripheral</td>
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<td>Central</td>
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<td>Valid</td>
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<td>Valid</td>
<td>Indicates VF in which target will appear</td>
<td>Occurs at location where target will appear</td>
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<td>Invalid</td>
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<tr>
<td>Invalid</td>
<td>Indicates VF opposite that in which target will appear</td>
<td>Occurs at location opposite that in which target will appear</td>
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<td>Double</td>
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<td></td>
<td>Indicates both target and cue appear</td>
<td>Lateralized LVF or RVF</td>
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<tr>
<td></td>
<td>No Cue</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No cue appears</td>
<td>No cue appears</td>
</tr>
</tbody>
</table>

We ran several conditions of the LANT. Here, we illustrate 4 conditions.

Condition 1: Automatic

- N=25
- Cue: unilateral asterisk
- CTI: 150ms

Condition 2: Automatic

- N=22
- Cue: unilateral pointing triangle
- CTI: 700ms

Condition 3: Controlled

- N=25
- Cue: bilateral pointing hands
- CTI: 150ms

Condition 4: Controlled

- N=22
- Cue: bilateral pointing triangles
- CTI: 500ms

Definitions:

• Conflict: C = Reaction time for targets with Incongruent minus targets with Congruent flankers
• Orienting Benefit: OB = Reaction time for targets with Central cue minus targets with Valid cue
• Orienting Cost: OC= Reaction time for targets with Invalid cue minus targets with Central cue
• Alerting: A = Reaction time for targets with No cue minus targets with Double cue

Conclusions

• There are independent networks of attention in the two hemispheres.
  The RH is more sensitive to automatic cues and can show greater Inhibition of Return.
  The LH is more sensitive to Controlled cues and shows smaller Orienting Cost.

Results

• Significant and reliable measures of all networks of attention in each hemisphere.
  There are independent networks in the two hemispheres, e.g., OC is larger than OB in the LVF in Condition 2, but OB is larger than OC in the RVF in Condition 4.
  IOR with Automatic cues: larger in LVF (Figure 2a.).

References