



# Hemispheric Attention Networks: Automatic vs. Controlled Orienting

Zaidel, Eran<sup>1,2</sup>, Li, Yuan Hang<sup>1</sup>, Greene, Deanna<sup>1</sup>, & Barnea, Anat<sup>3</sup>

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



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Contact: ezaidel@psych.ucla.edu

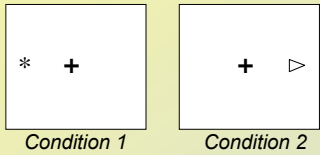
## Introduction

- 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.

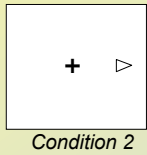
## Methods

### 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



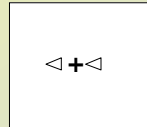
Condition 1



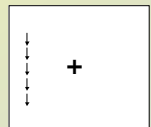
Condition 2



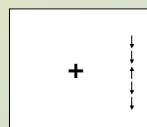
Condition 3



Condition 4



Congruent Flankers



Incongruent Flankers

Cue	Cues	
	Controlled (75% valid)	Automatic (50% valid)
Center	indicates central fixation	occurs at central fixation
Valid	indicates VF in which target will appear	occurs at location where target will appear
Invalid	indicates VF opposite that in which target will appear	occurs at location opposite that at which target will appear
Double	indicates both LVF and RVF	occurs in both LVF and RVF
No Cue	no cue appears	no cue appears

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

## 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.).

Figure 1a.

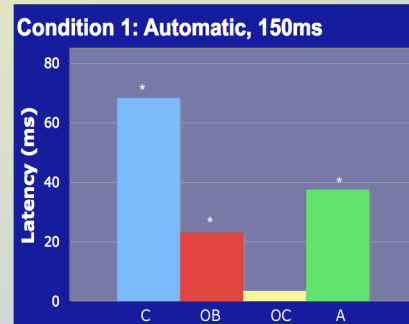
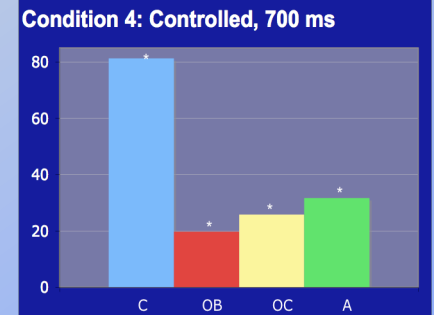
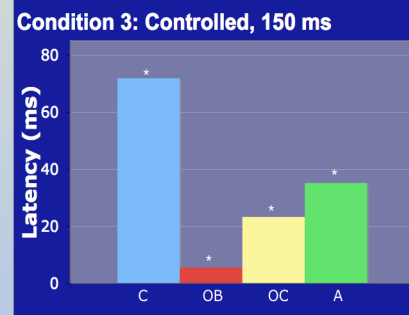
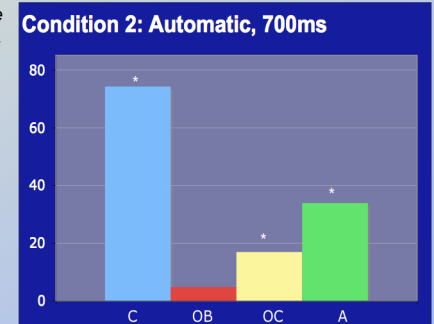


Figure 1b.



\* = sig. p<.05

Figure 2a.

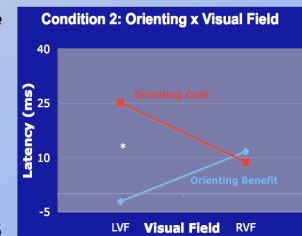
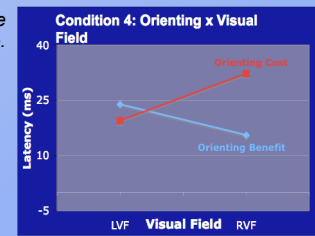


Figure 2b.



## 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.

### References:

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- Greene, D. J., Barnea, A., Herzberg, K., Rassis, A., Neta, M., Raz, A., & Zaidel, E. (In press). Measuring attention in the hemispheres: The Lateralized Attention Network Test (LANT). *Brain and Cognition*.
- Klein, R.M. (2000). Inhibition of return. *Trends in Cognitive Sciences*, 4, 138-147.