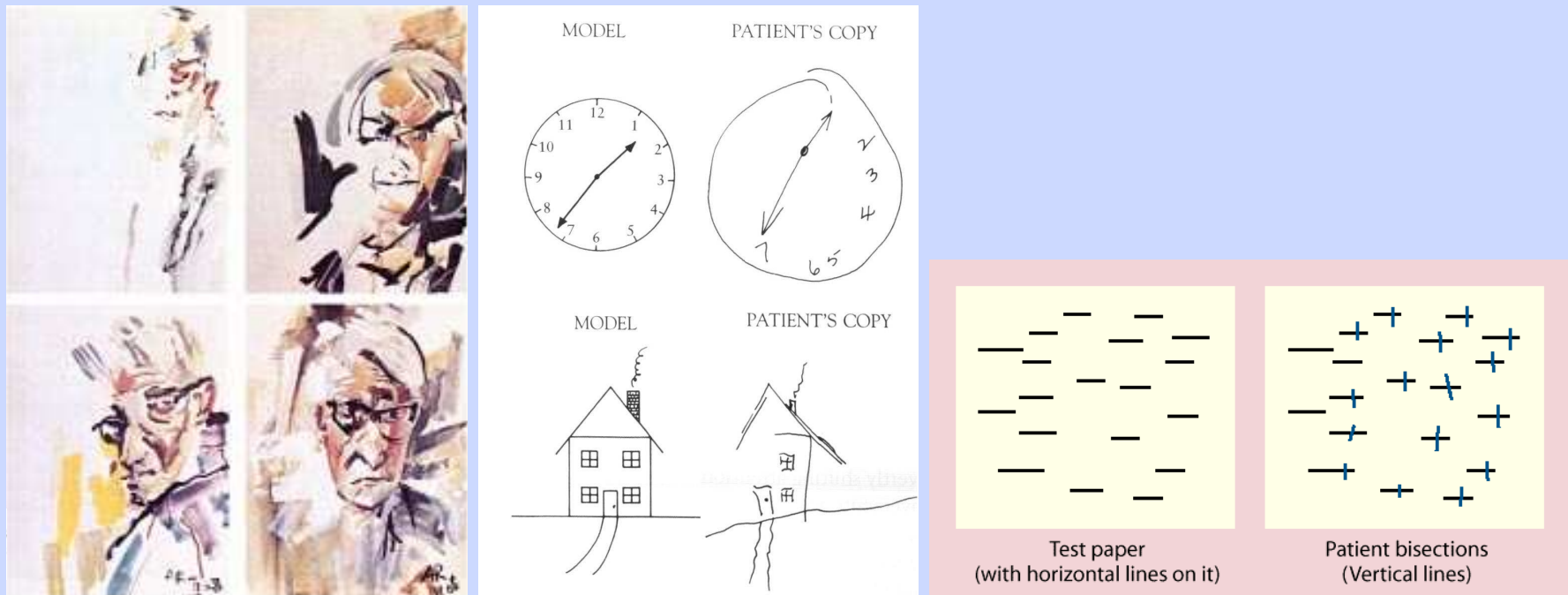


Spatial Attention: Unilateral Neglect



Self portrait, copying, line bisection tasks:
In all cases, patients with parietal/temporal lesions seem to forget about 1/2 of space! *but they still see it!*

Posner Spatial Cuing Task

Valid cue

- Fixation



Posner Spatial Cuing Task

Valid cue

- Cue appears



Posner Spatial Cuing Task

Valid cue

- Target appears, respond with target location



Posner Spatial Cuing Task

Invalid cue

- Fixation



Posner Spatial Cuing Task

Invalid cue

- Cue appears



Posner Spatial Cuing Task

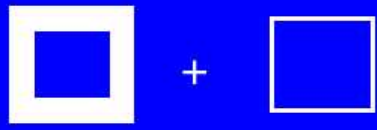
Invalid cue

- Target appears, respond with target location



Posner Spatial Cuing Task

Valid cue

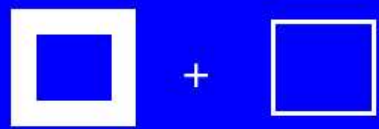


Invalid cue

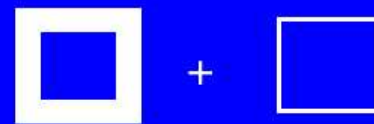


Posner Spatial Cuing Task

Valid cue

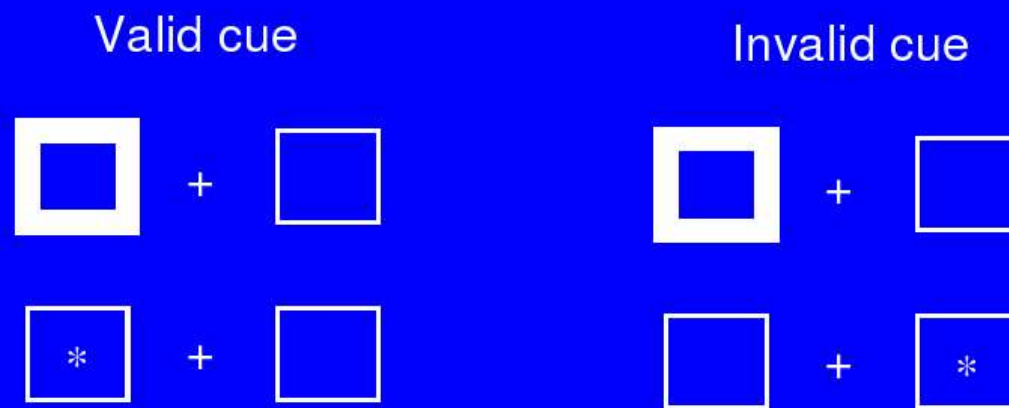


Invalid cue



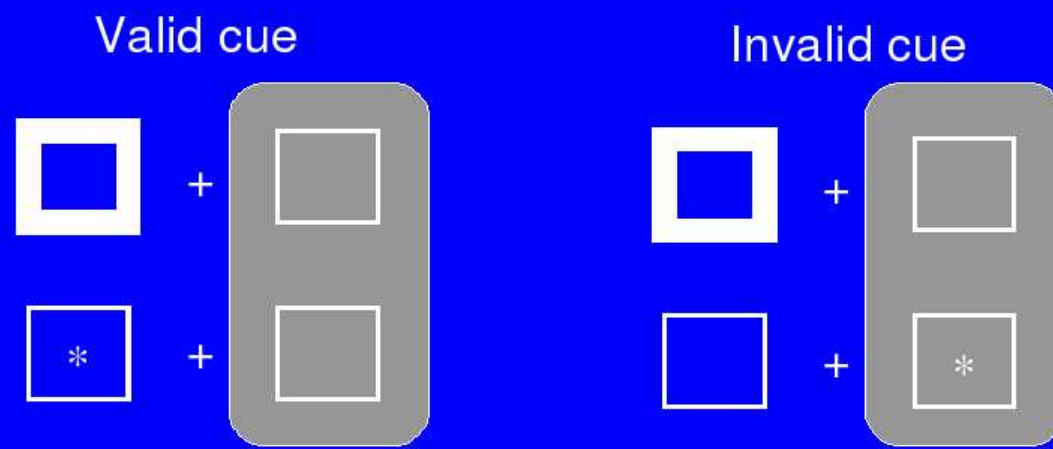
- Valid cues speed up performance (relative to “no cue” condition)
- Invalid cues slow down performance (relative to “no cue” condition)

Effects of Parietal Lesions on Posner Task



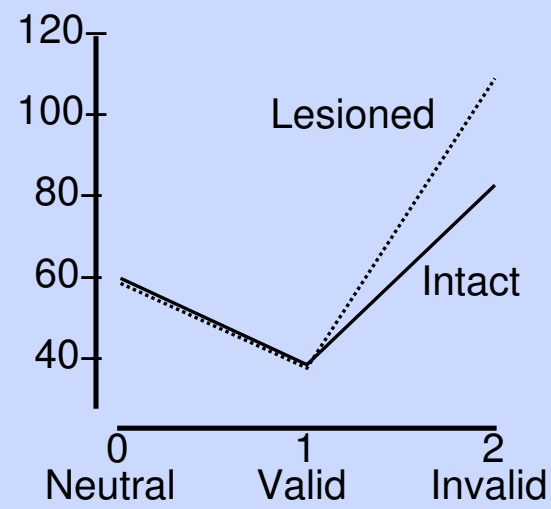
- Large, unilateral parietal lesions result in **neglect** of the opposite (contralateral) side of space
- Subjects do not respond to targets in the neglected hemifield
- What about smaller, unilateral parietal lesions?

Effects of Parietal Lesions on Posner Task



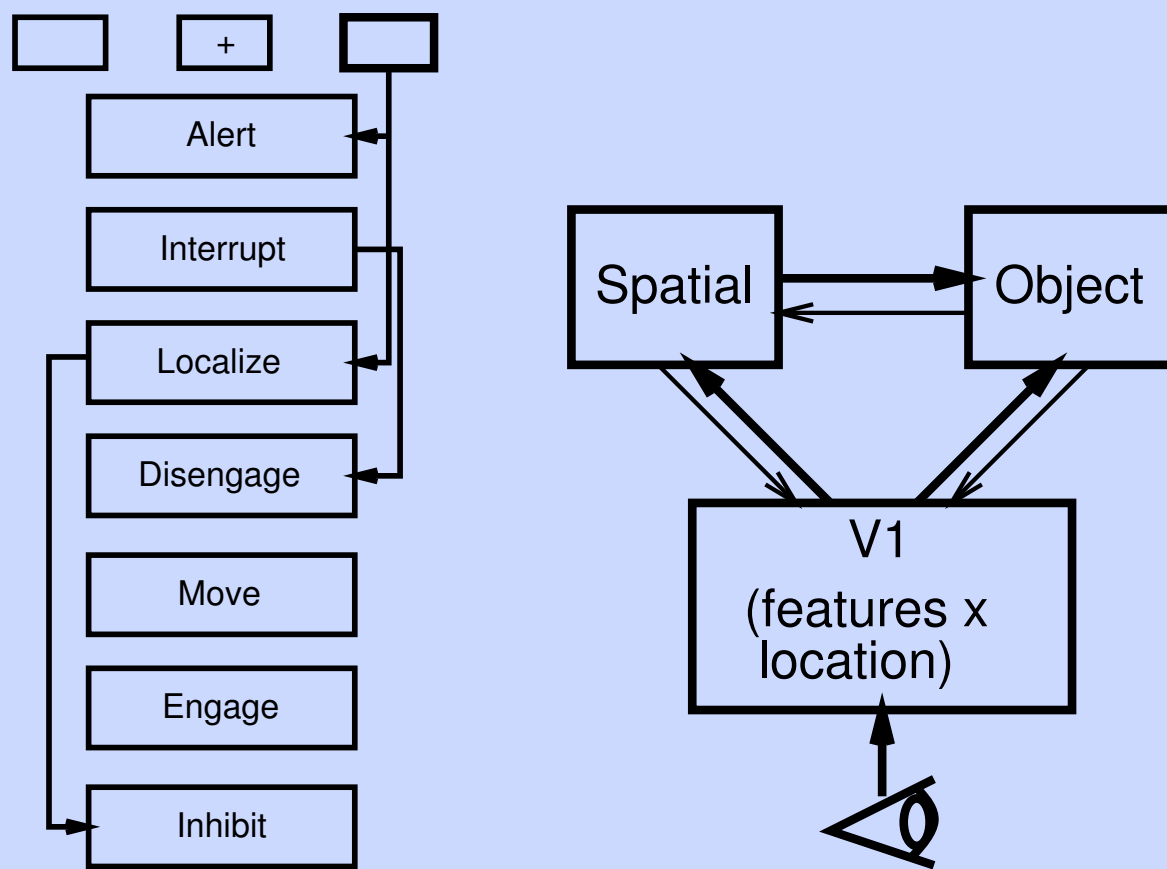
- Say that you have a small, left parietal lesion, so the right side is affected
- Run the Posner task with cues in the ipsilateral (left) side of space

Effects of Parietal Lesions on Posner Task



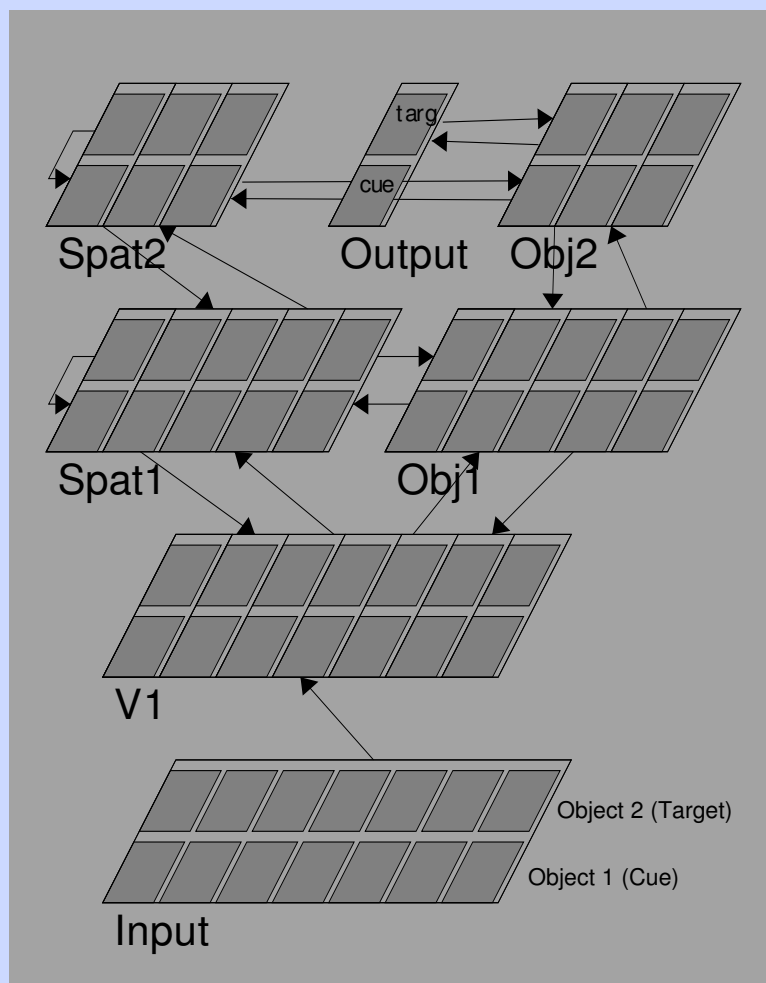
- Patients perform normally in the “neutral” (no cue) condition, *regardless* of where the target is presented
- Patients benefit just as much as controls from valid cues
- Patients are hurt more than controls by invalid cues

Possible Models



Attention *emerges* from bidirectional constraint satisfaction & inhibitory competition.

Simple Model



[attn_simple.proj.gz]

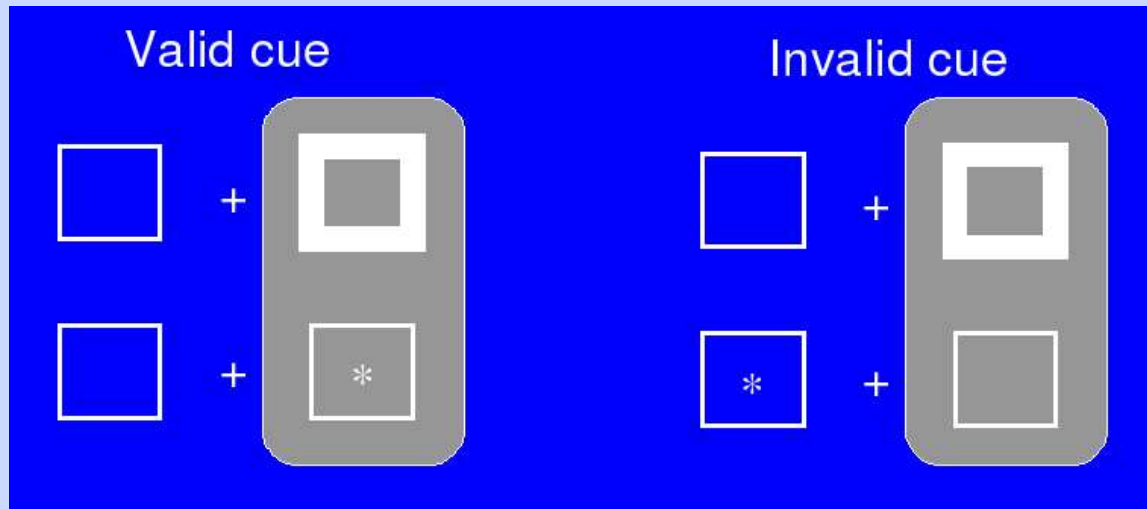
Posner Task Data

	Valid	Invalid	Diff
Adult Normal	350	390	40
Elderly Normal	540	600	60
Patients	640	760	120
Elderly normalized (*.65)	350	390	40
Patients normalized (*.55)	350	418	68

Posner Task Sims

- The model explains the basic finding that valid cues speed target processing, while invalid cues hurt
- Also explains finding that patients with small unilateral parietal lesions benefit normally from valid cues in ipsilateral field but are disproportionately hurt by invalid cues.
- No need to posit “disengage” module!
- Also explains finding of **neglect** of contralateral visual field after large, unilateral parietal lesions when some stimulus is present in ipsilateral field (“extinction”)

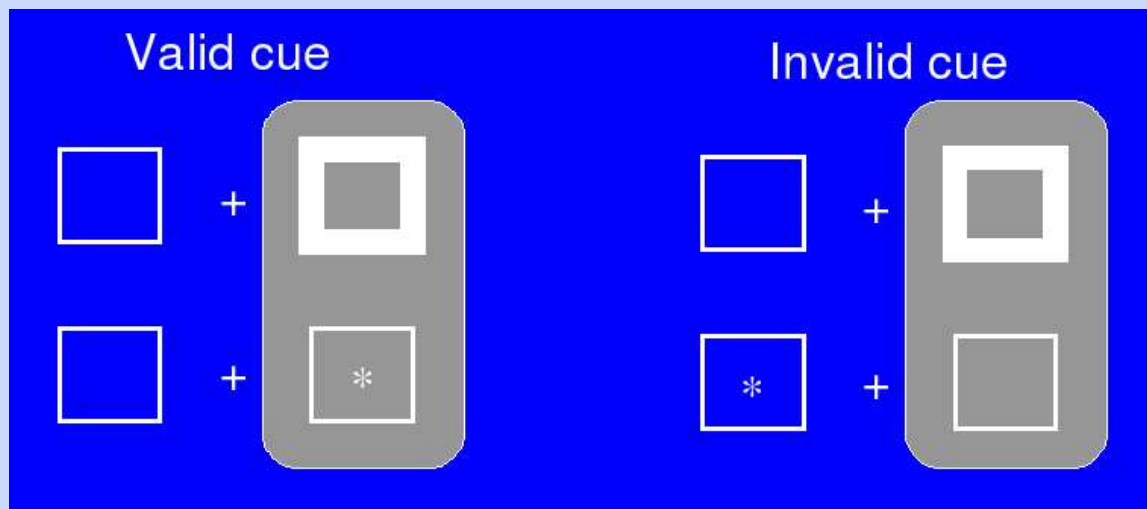
More Posner Lesion Fun



- Returning to patient with left parietal lesion...
- What happens if cues are presented in **contralateral** (affected) hemifield?

[attn_simple.proj.gz]

More Posner Lesion Fun



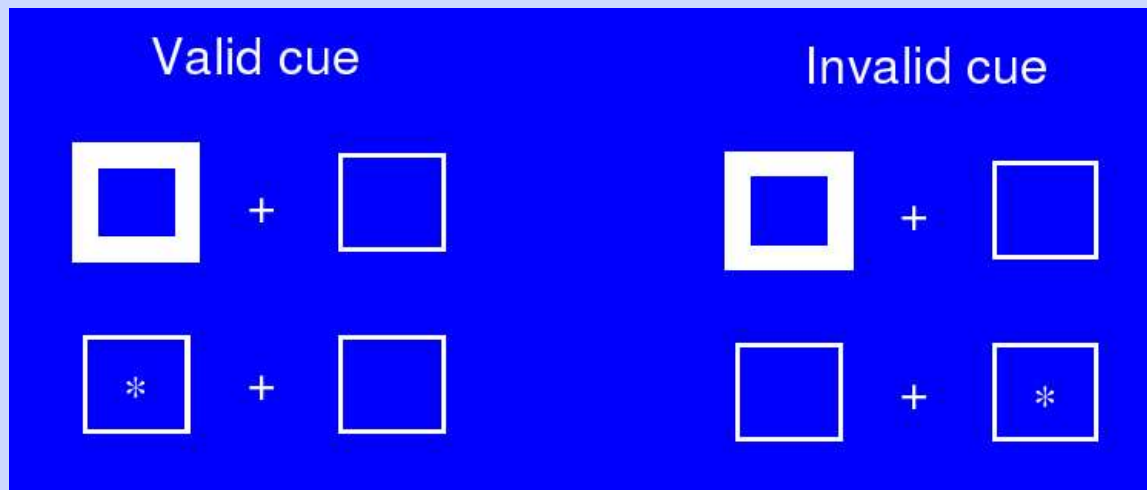
Returning to patient with left parietal lesion...

- What happens if cues are presented in **contralateral** (affected) hemifield?

Predictions:

- Smaller benefit for valid cues
- Patients should be hurt less than controls by invalid cues.

Inhibition of Return



- Typically, target detection is faster on trials with valid vs invalid cues
- **However**, if the cue is presented for a longer time (eg. 500 ms), performance is faster on **invalid** vs valid trials
- Can explain in terms of **accommodation** (neural fatigue)

[attn_simple.proj.gz]

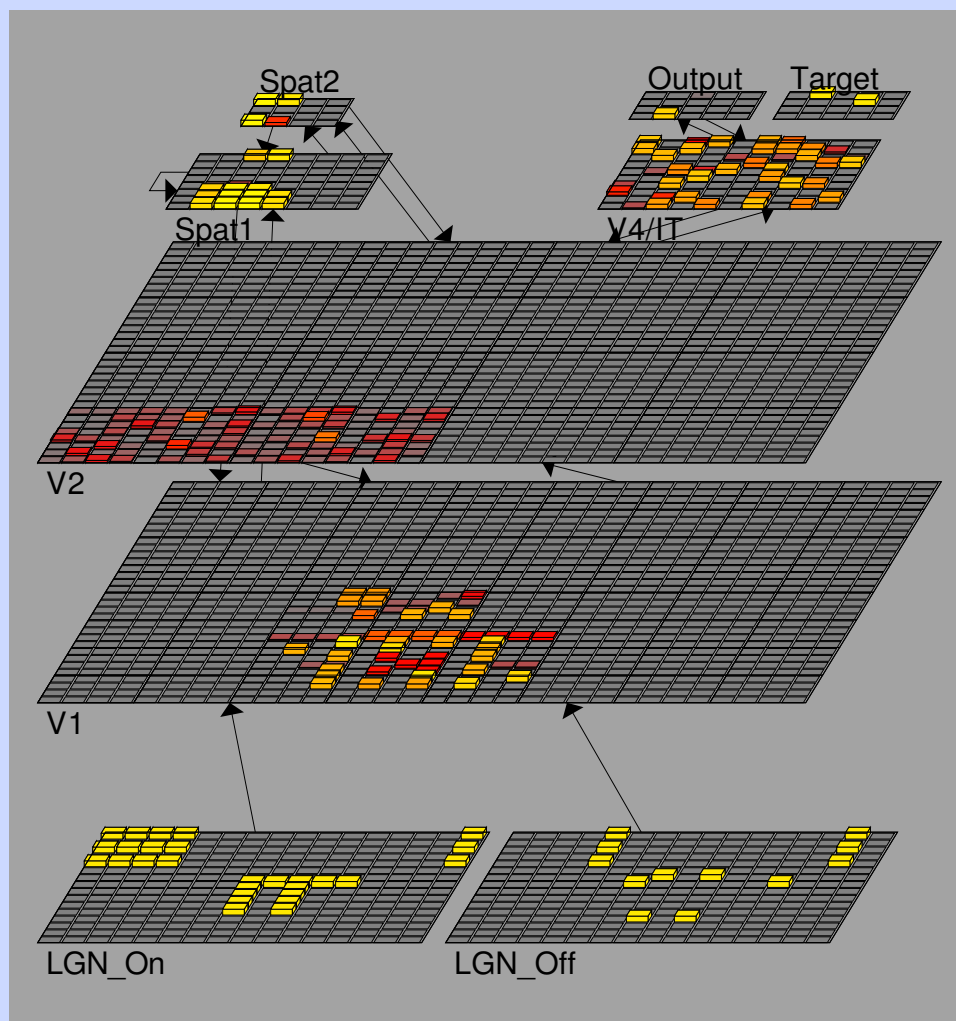
Simple model: too simple?

- Has unique one-to-one mappings between low-level visual features and object representations (not realistic)
- Does not address issue of spatial attention when trying to perceive multiple objects simultaneously

Simple model: too simple?

- Has unique one-to-one mappings between low-level visual features and object representations (not realistic)
- Does not address issue of spatial attention when trying to perceive multiple objects simultaneously
- “Complex” model combines more realistic model of object recognition (starting from LGN) with simple attention model
→ Can use spatial attention to restrict object processing pathway to one object at a time, enabling it to sequentially process multiple objects.
- Lesions of entire spatial pathway cause *simultanagnosia*: inability to concurrently recognize two objects

Complex Model



[objrec_multiobj.proj.gz]

Perception and Attention

1. Why does primary visual cortex encode oriented bars of light?
Correlational learning based on natural visual scenes.
2. How do we recognize objects (across locations, sizes, rotations with wildly different retinal images)? *Transformations: increasingly complex featural encodings, increasing levels of spatial invariance; Distributed representations.*
3. Why is visual system split into what/where pathways?
Transformations: emphasizing and collapsing across different distinctions
4. Why does parietal damage cause attention problems (neglect)?
Attention as an emergent property of competition

General Issues in Attention

Attention:

- Prioritizes processing.
- Coordinates processing across different areas.
- Solves binding problems via coordination.