

TO 4.11 Memory Encoding and Recognition

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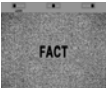

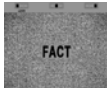
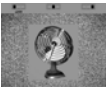


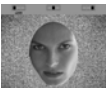

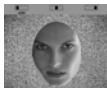
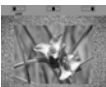

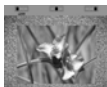
Rationale

- Memory complaints are prominent in GWI patients.
 - Preliminary studies have suggested dysfunction of the *hippocampus** in GWI, and damage to the *thalamus* is also hypothesized.
 - Animal studies have demonstrated exposure to low-dose organophosphates damages *medial temporal lobe (MTL)** structures (including the *hippocampus*).
 - Neuroimaging studies of memory in Gulf War veterans have been inconclusive.

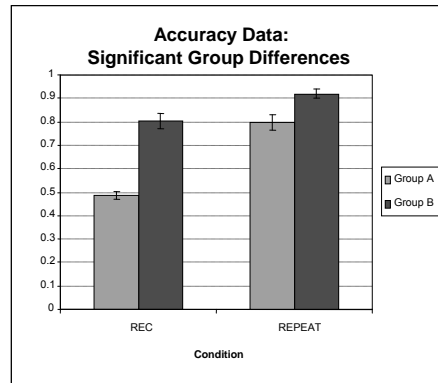
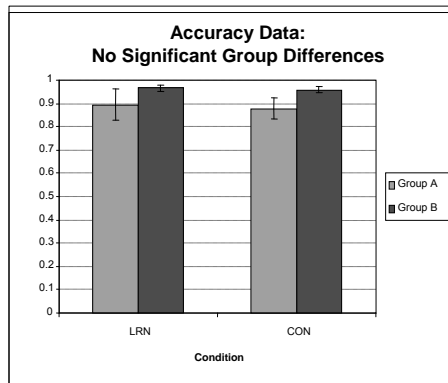
*The hippocampus is part of the MTL.

Methods

- Performed fMRI on GW veterans and looked at brain activity during learning (LRN) and recognition (REC) of words, objects, faces, and nature scenes.

STIMULI	LEARN	SEEN MANY	SEEN ONCE
WORDS			
OBJECTS			
FACES			
NATURE SCENES			

Behavioral Results



- Grp A and Grp B: equal performance on scrambled (control) items.
- Grp A less accurate than Grp B on Recognition (REC) items.

Functional MRI Results

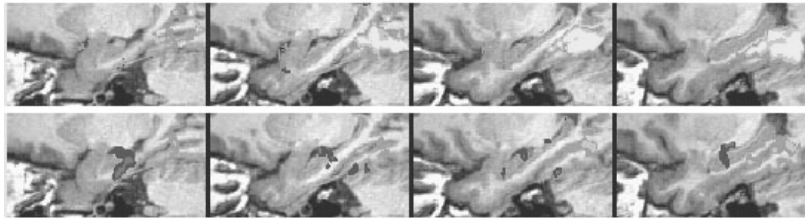
- Significant whole task differences were found between the two groups in MTL structures.

- LEARN

- Grp B: more positive activation in right hippocampal head and body.
- Grp A: bilateral deactivation throughout MTL.

Significant LRN activations in the right hippocampus for Grp B (top) and Grp A (bottom)

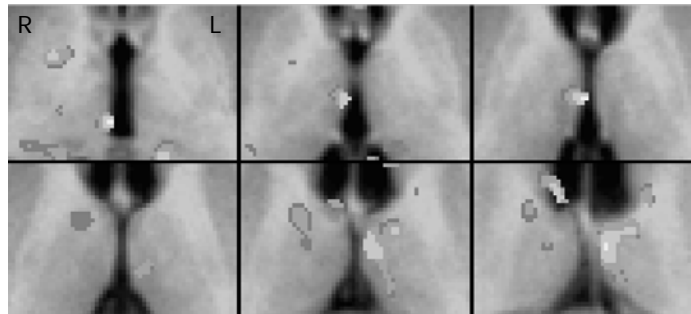
Right Hippocampus: Medial-to-Lateral



- REC: Grp A activation < Grp B in right hippocampal body and tail and bilateral MTL cortex.
- REPEAT: Grp A activation < Grp B in bilateral hippocampus tail and bilateral parahippocampal cortex.

Functional MRI Results

- Significant group differences (Grp A less positive activation than Grp B) were found in the thalamus.



- These group differences were found in several parts of the MTL bilaterally:
 - mediodorsal nuclei, left anterodorsal nucleus, bilateral lateral geniculate, left ventral anterior nucleus, right medial geniculate, and right ventral lateral posterior nucleus.

Summary & Ongoing Work

- Significant differences in activation in the MTL and surrounding cortex and thalamus suggest this fMRI test is useful in:
 - Distinguishing GWI Syndrome subjects with memory complaints from normal controls.
 - Explaining the basis for the GWI-associated memory problems.

- Assuming Grp A is Syndrome 2...
 - The opposite direction of activation as compared with the control group suggests possible suppression of MTL structures.
 - Differences in Thalamic activation reflect increased activation in the control group and lack of activation in syndrome 2 group.

- Ongoing work includes further data collection and more specific anatomical analyses to pinpoint the most involved structures, such as individual sub-regions of the hippocampus and specific thalamic nuclei.