

# Concreteness Effects in Dominant Hemisphere Temporal Lobe Epilepsy

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**Background:** In normal readers, processing of different semantic classes of nouns (e.g. concrete versus abstract) has been shown to recruit distinct cortical regions. Specifically, concrete word processing elicits activation in a bilateral network of regions involving frontal cortex and superior and middle temporal gyri, whereas abstract word processing is associated predominantly with increased activation in the left inferior frontal and superior temporal cortices. Previous functional MRI (fMRI) studies have suggested that patients with temporal lobe epilepsy (TLE) show interhemispheric reorganization for language processes near the seizure focus. However, the degree of functional reorganization within the distinct neural systems for concrete versus abstract word processing was not explored. We therefore used event-related fMRI to determine whether patients with TLE show differential representation of semantic information for the different noun classes during a lexical decision task (LDT) containing concrete and abstract noun stimuli.

**Methods:** Seven patients with left temporal TLE confirmed by video-EEG monitoring were recruited. Ten age and gender-matched controls were also studied. All subjects were right handed, had English as their native language, and completed secondary school. Event-related fMRI was performed at 3 Tesla during a lexical decision task, involving semantic class stimuli manipulation (e.g. concrete versus abstract nouns). The concrete noun stimuli used in this task were taken from Billingsley et al. (Brain 124, 1218-1227, 2001). Abstract noun stimuli were selected and matched to the concrete nouns on printed frequency, length, and orthographic neighborhood size. Word stimuli were all pilot tested for concreteness using 20 control participants that did not participate in the imaging study. We compared reaction time data and fMRI activation patterns in patients with left TLE to the control participants.

**Results:** Both patients and controls showed a significant processing advantage for concrete noun stimuli (Table 1). In addition, controls showed a significant processing advantage over TLE patients for both noun stimuli. Control participants showed significant overlapping activation in several regions in both frontal and temporal cortices for both concrete and abstract word processing (Figure 1). Patients with left TLE showed significant activation in bilateral superior temporal and right middle temporal gyri for concrete word processing. However, for abstract word processing, patients showed significant activity only in *right* superior temporal cortex, contralateral to the seizure focus (Figure 2).

Table 1. Mean lexical decision response latencies, standard deviations and significance values for concrete and abstract noun stimuli.

Group	MEAN reaction time +/- SD (msec)		p-value
	Concrete	Abstract	
Patients (n=7)	883.22 +/- 157.81	1004.61 +/- 115.19	.005
Controls (n=10)	642.58 +/- 81.19	691.85 +/- 97.71	.008
<b>p-value</b>	<b>.007</b>	<b>.009</b>	

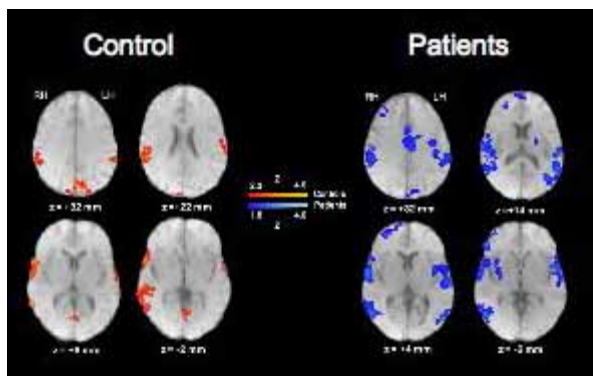


Figure 1. Mean (n = 7) fMRI activation for control participants and patients with dominant hemisphere TLE during concrete word processing in LDT.

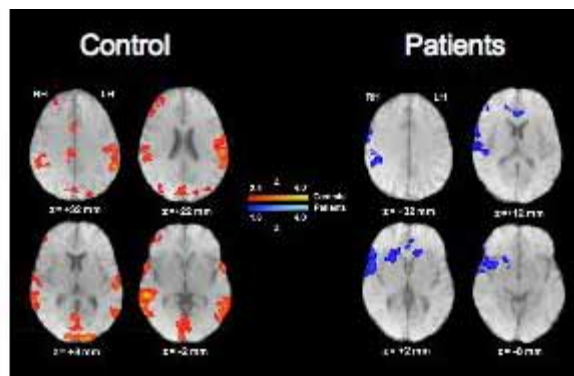


Figure 2. Mean (n = 7) fMRI activation for control participants and patients with dominant hemisphere TLE during abstract word processing in LDT.

**Conclusion:** These findings suggest that patients with left TLE show some degree of interhemispheric reorganization for the processing of abstract semantic information. This reorganization, however, was not complete as patients' reaction times for both abstract and concrete stimuli were slower than normal controls.

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