Training set of 10 words
100 vowel / 25 consonant strings

3T Phillips; T1 structural: TR=26ms, 128 1.3mm
Chooses 6 features that belong to the word

Event-related design
• 3T Phillips; 71 structural TR=26ms, 128 1.3mm slices; BOLD: TR=2000ms, 31 3mm slices
• Patients scanned both before and after treatment, data analyzed with SPM8

Training Protocol

Semantic Feature Analysis (variation of Boyle & Coelho, 1995)
Training set of 10 words

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ifMRI Results

Legend:
Red: activation for abstract + control (post vs. pre) contrast, Blue: activation for control + constraint (post vs. pre) contrast, Purple: overlap in activation.

P1: Improved on trained abstract items, generalized to concrete items in same context [also slightly improved on abstract items in untrained category and concrete items in control category].
P2: Improved on trained abstract items only.
P3: Improved on trained abstract items, generalized to concrete items in same context.

P1: Like P1, showed increased activation post-treatment, but only for abstract words during the SJ task and concrete words during word judgment (WJ). Note that increased activation for abstract words was accompanied by increased accuracy during the SJ task.
P2: Like P1, showed increased activation post-treatment, but only for abstract words during the SJ task and concrete words during word judgment (WJ). Note that increased activation for abstract words was accompanied by increased accuracy during the SJ task.
P3: Like P1 and P2, showed increased activation post-treatment. Furthermore, he showed increases for both abstract and concrete words in distinct regions. Note this coincides with treatment outcomes.

Discussion

All three patients improved on the trained abstract words; two patients also generalized to concrete words in the same context.

All three patients showed increased activation in spared left hemisphere language areas after treatment. This supports the notion that better language recovery in chronic aphasia is associated with transfer of language function from compensation of the right hemisphere to spared language areas of the left hemisphere (Saur et al., 2006).

In both P1 and P2, much of left IJF was spared by the lesion and in P1, much of the left temporal lobe was also spared; however, P3’s lesion was quite large yet he showed similar results as the other two patients.

Although abstract and concrete nouns tended to overlap in activation both before and after treatment, there were subtle differences that appear to be exaggerated after treatment, possibly becoming more ‘normal’.

Notably, the trained structure (abstract words) showed more increased activation than concrete words. This matches the behavioral results seen both during treatment and while scanning.

P1: Increased activation from pre to post-treatment with overlap between abstract and concrete words. Note that more perilesional activation occurred with abstract words and accuracy for abstract words improved during the synonym judgment (KJ) task.

P2: Increased activation from pre to post-treatment with overlap between abstract and concrete words. Note that more perilesional activation occurred with abstract words and accuracy for abstract words improved during the synonym judgment (KJ) task.

P3: Like P1, showed increased activation post-treatment, but only for abstract words during the SJ task and concrete words during word judgment (WJ). Note that increased activation for abstract words was accompanied by increased accuracy during the SJ task.

Note this coincides with treatment outcomes.

References


Neural correlates of treatment effects on abstract and concrete words in aphasia: A pilot study

Chaleece Sandberg & Swathi Kiran
Aphasia Research Laboratory, Speech Language and Hearing Sciences, Boston University, Sargent College

Background

Behavioral data from both normal and brain-injured subjects suggests that abstract words and concrete words are processed differently (i.e. concrete/abstract effect). For example, the Dual Coding Theory (Paivio, 1991) suggests that abstract words are encoded into the semantic system with only verbal information and concrete words are encoded into the semantic system with both verbal and multi-modal sensory information.

Evidence from recent neuromaging studies suggests the possibility of dissociable neural correlates for abstract and concrete word processing (Binder et al., 2009, Sandberg & Kiran, manuscript in preparation).

Patients with aphasia exhibit an exaggerated concreteness effect behaviorally (Nichols & Howard, 1995, Barry & Gerhand, 2003) and concreteness has been successfully manipulated in treatment to increase effectiveness (Kiran, & Abbott, Sandberg, 2009).

Do neural activation patterns following the treatment of abstract words support the hypothesis that training concrete abstract (complex) concepts engages the less complex (concrete) concept network?

Participants

Patients with aphasia
N=3, R-handed, monolingual English-speaking
EVA in LH with subsequent difficulties in word retrieval

Age Sex Aphasia Severity (WAB AQ) SAT
P1 SF F 39 Anoma (mild) 77 93.3
P2 SS M 77 Conduction (mild to moderate) 86.7 75.8
P3 M M 25 Motor (mild to moderate) 83.3 75.8

Note: ifMRI = functional magnetic resonance imaging; SAT = Speech Assessment Tool

fMRI Paradigm

Event-related design
• 50 abstract / 50 concrete words
• 25 vowel / 25 consonant strings
• Is the word abstract or concrete?
• Is the letter string consonants or vowels?

Tasks

Word Judgment
• 50 abstract / 50 concrete word pairs
• 100 nonword pairs
Are these words similar in meaning?
Are these words the same?

P1: Improved on trained abstract items, generalized to concrete items in same context [also slightly improved on abstract items in untrained category and concrete items in control category].
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