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Published in:
[Publication information missing]

2010

MODELLING THE MEANING OF WORDS: NEURAL CORRELATES OF ABSTRACT AND CONCRETE NOUN PROCESSING

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The present study outlines a proposal to relate linguistic modelling of word meaning to a general model of neurocognitive information processing (Fuster, 2009). It is shown how lexical semantic models based on componential analysis of meaning (e.g. 'semantic features' (Weinreich, 1966)), as well as models focussing on larger contextual structures (e.g. 'frames' (Fillmore, 1985), 'scripts' (Schank & Abelson, 1977) and 'idealized cognitive models' (Lakoff, 1987)), can be seen as corresponding to different levels of processing in the brain. Fuster (2009) assumes a hierarchical structure of processing, where sensory-related information is processed on the lowest level whereas more abstract and contextually related information is processed on higher cognitive levels. These levels are associated with neuronal activity in partly different areas in the brain. While concrete, imaginable words (e.g. *strawberry*) are associated with features and feature constellations involving sensorimotor information, mainly processed in posterior cortices, the interpretation of less imaginable words (e.g. *exception*) is more dependent on higher cognitive functions including abstract conceptualization and retrieval of semantic frame-based, contextual information. The processing of low-imageability words has been shown to implicate greater activity in anterior, e.g. frontal brain areas (Sabsevitz et al, 2005). On the basis of this, persons with anterior lesions can be expected to have problems with more abstract tasks such as accessing superordinate terms (Crutch & Warrington, 2008) and interpreting and producing associations to words of low imageability. Persons with damage to posterior (visual) areas of the brain on the other hand can be expected to have problems accessing words which are strongly associated with visual information, but not to have problems in abstracting tasks.

The processing of concrete and highly abstract words was investigated in Swedish speakers with stroke-related aphasia as well as in healthy controls. In a semantic similarity judgment task, where subjects were instructed to choose from four alternative words (one target and three distractors) the alternative which was most semantically similar to a cue word, subjects with left hemisphere anterior (fronto- and temporoparietal) lesions were more inaccurate in abstract word interpretation, whereas the opposite pattern was observed in a subject with left hemisphere posterior (occipital) lesions. Further, in a free word association test, the lexical-semantic relationships between cue word-associated word pairs differed depending on cue word concreteness and group (control, anterior aphasic, posterior aphasic). When cue words were abstract, the anterior aphasic group produced relatively fewer associations based on general semantic frames, and instead relied more on personal, episodic memory information, whereas associations for concrete cue words often were based on sensory-based feature similarity. In contrast, the subject with posterior lesions produced mainly superordinate terms which were related to general semantic frames rather than to sensory-based features as associations to both concrete and abstract cue words.

In summary, the results support the assumption that sensory-based (e.g. visual) semantic feature representations are crucial for concrete noun processing, whereas abstract noun processing is more dependent on the ability to access relevant semantic frame-based information. When access to general semantic frames is hampered, lower-level representations can still be retained. Personal/episodic frames can be seen as a level of representation which is more concrete than general semantic frames, but less concrete than sensory-based information. Future studies will focus on how the processing of emotion-related words can be related to the same general model.

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