

Verb thematic roles and thematic hierarchy: Evidence from the performance of Alzheimer's Patients

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The present paper provides experimental evidence from pathological language on the existence of thematic roles and their realization at the sentence level. Patients with probable Alzheimer's Disease (pAD) were thought to have problems with various noun classes (Chan, Butters, and Salmon, 1997). However, recent studies have shown impaired verb naming & comprehension of verb-related information at the sentence level (e.g. Price and Grossman, 2005). Furthermore, studies on verb production in pAD (Mobayyen, 2007) have shown that patients' performance is also impaired when it comes to certain verb classes, such as perception and psychological verbs. These findings suggest that the language deficits in pAD may extend beyond impairments relating to nouns and that syntactic as well as semantic aspects of verb representation may be selectively affected. In an attempt to redefine the verb deficit in pAD, we targeted the processing of verbs which demonstrate *non-canonical argument realization*, such as subject-experiencer (e.g., *fear*) and object-experiencer (e.g., *frighten*) verbs.

In the heart of non-canonical argument realization is the notion of *thematic hierarchy* (e.g., Fillmore, 1968). Thematic Hierarchy is the most widely used method to explain the mapping between an ordered list of semantic roles and an ordered list of grammatical relations, thus allowing a particular argument of a verb to be referred to in terms of its relative position (subject vs. object), instead of in terms of its semantic role. Thus, rather than having invariable correspondence relations, typical of the direct mapping approaches, the mapping is controlled by strategies relative to the hierarchies. Although there is considerable controversy among linguists regarding the ranking of various thematic roles, they all seem to agree on the fact that whenever there is an Agent, it occupies the subject or external position. Thus, in a *canonical thematic hierarchy*, the Agent thematic role occupies the most prominent position in the sentence. Consequently, any thematic hierarchy lacking the Agent thematic role would be considered as *non-canonical*. For instance, in a sentence such

as *The toddler fears the dog*, the ranking of the thematic roles goes as follows: *Experiencer* > *Theme*. Thus, non-canonical argument realization can be thought of as increasing verb *complexity*. Non-canonical thematic hierarchies appear with *subject-experiencer verbs*, such as psychological verbs (*fear, love, hate, etc.*), and perception verbs (*hear, listen, see, etc.*). This class of verbs appears to be problematic for aphasic patients especially when used in passive constructions (e.g., Beretta and Campbell, 2001). However, passive voice also involves other complications, such as syntactic movement and morphological marking, thus not being a secure measurement for a potential processing cost of non-canonical subjects. The present study compared the performance of pAD patients in a sentence completion task with subject-experiencer, object-experiencer verbs, subject-agent verbs, as well as their passive equivalents. We hypothesized that pAD patients would demonstrate difficulties with the production of subject-experiencer and object-experiencer verbs as well as with passives, due to their non-canonical argument realization.

The Experiment: A sentence completion task was conducted.

Participants: 10 individuals with the diagnosis of pAD (mean age: 75.8; s.d. 5.99), 4 elderly controls (mean age 87.25; s.d. 2.5). The pAD patients' Mini Mental State Examination (MMSE; Folstein, Folstein, and McHugh, 1975) scores ranged from 19 to 27 indicating mild to moderate cognitive impairment. They were all native speakers of English with a minimum education level of sixth grade.

Materials: Patients were required to complete 72 active and passive written sentences. Materials were divided into 6 conditions, with 12 sentences in each of them: (1) subject-experiencer verbs (e.g., *fear*); (2) the reverse equivalent of subject-experiencer verbs, i.e. object-experiencer verbs (e.g., *frighten*); (3) and (4) were the passive equivalent of (1) and (2), respectively (e.g., *was feared* and *was frightened*); (5) subject-agent verbs (e.g., *kick*); (6) the passive equivalent subject-agent verbs (e.g., *was kicked*).

Design and Procedure: Participants were presented with the sentences with the verb missing marked by a blank line (e.g., *The boy _____ the thunder*). They had to choose the correct verb from a list of four verbs, which included the two main alternatives (e.g., *fear* and *frighten*), one syntactically anomalous (e.g., *sleep*) and one semantically unrelated (e.g., *cook*). Sentences were presented on a computer screen and participants had to choose the correct verb by pressing a key on the keyboard. Each verb on the screen lead to a specific key by an arrow to facilitate the choice by the patients. Testing was completed in two sessions one week apart.

Results: Percentages of correct responses were calculated for each condition. A 2 (group: patients vs. elderly controls) x 2 (frame type: canonical vs. reversed) x 3 (sentence type: subject-experiencer, object-experiencer, subject-agent) repeated-measures ANOVA showed that patients' data differed significantly from those of the elderly controls ($p < .0001$); also, a main effect of sentence type was obtained ($p = .013$), but not of frame type ($p = .13$). Repeated measures ANOVAs on the patient data showed a main effect of sentence type ($p < .001$) and a tendency for a main effect of sentence frame ($p = .067$). Patients chose the reverse distractor more times when confronted with a psych verb than when confronted with an agent verb. They seldom

chose the unrelated distractors. Thus, for example, when confronted with a sentence frame such as *The thunder ___ the boy* patients selected *frightened* only 58% of the time—confusing it with *fear* the other times. There was also a difference between (1) (subject-experiencer) and (2) (object-experiencer) in the active voice ($p = .02$) but no difference between their passive equivalents ($p = .46$).

Discussion: The results show that pAD patients have difficulties with non-canonical realization of argument structure, as originally predicted. The difficulty is independent of the voice. In other words, it is not the case that the difficulties result from the “complexity” of passive voice. The results of the present study allow us to discuss issues pertaining to the nature of the language deficits in Alzheimer’s disease, but also to the nature of verb-structure and verb-conceptual representations. It is clear that patients with pAD show signs of semantic deficit, as it has been shown in a variety of studies. When it comes to verb deficit, though recent studies have demonstrated difficulties with certain verb classes, such as psychological verbs (e.g. Mobayyen, 2007), the main contribution of the present study is that it has shown *why* AD patients might have problems with these classes of verbs. It is obvious that the patients have access to the core meaning of the verbs, since they seldom chose the unrelated distractors. However, when it comes to the realization of arguments (i.e. *who causes certain feelings to whom*), their knowledge seems to be impaired. This study is a first indication that pAD patients may have an impairment in more fine-grained aspects of verb-semantic representation. One possible interpretation for these preliminary data is that the problem lies in the mapping between higher-cognitive and linguistic levels. When it comes to thematic hierarchy and verb representation in general, the present study provides evidence of the complexity associated with non-canonical argument structure. As for the verb meaning representation, it seems that thematic roles (or their structure) have distinct functions and they are essential complements to the core meaning of verbs.

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