Why verbs could be more demanding of executive resources than nouns: Insight from a case study of a fv-FTD patient

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Introduction

Verb processing has been found to be more impaired than noun processing in patients suffering different forms of degenerative dementia, and especially in patients with frontal variant-frontotemporal dementia (fv-FTD) who presented the greatest discrepancy in performance between verb and noun comprehension and/or naming (Rhee, Antiquena, & Grossman, 2001; Silveri, Salvigni, Cappa, Della Vedova, & Puopolo, 2003). Rhee et al. (2001) and Silveri et al. (2003) suggested that the reduction of executive resources, which prevails in fv-FTD, might be the underlying cause for the disproportionate verb deficit in dementia patients. This suggestion was based on the finding of a significant correlation between measures of executive resources and the severity of the verb deficit.

Within this account, verb processing is thought to be more demanding of executive resources than noun processing because of the massive amounts of information represented in verbs (i.e., grammatical and thematic information further to semantic information). However, in these studies, the patients' performance with verbs and nouns was assessed only with a picture naming or/and a word–picture verification task, in which verbs had to be named or understood from actions depicted by static, black-and-white line drawings. Yet recognizing actions from such drawings might be a less familiar and more difficult task than recognizing objects. Therefore, it is unclear from these studies whether the disproportionate difficulties with verbs in fv-FDT patients are caused by the retrieval of verb linguistic representations or rather by the processing of static pictures of actions, being more demanding in executive resources.

In the present case study of a fv-FTD patient (JB), we addressed this issue by assessing the patient's abilities in noun and verb processing with (i) static pictures of objects and actions; (ii) written word stimuli; (iii) videos of actions.

Case history

JB is a 76-year-old, right-handed woman with 8 years of formal education. When she presented to the hospital in 2002, the neuropsychological examination revealed a dysexecutive syndrome and the neuroanatomical data concurred with the diagnosis of frontotemporal dementia. At the time of this study, the patient presented with severe word-finding difficulties in spontaneous speech, temporal disorientation, and behavioural disorders; moreover, planification, flexibility, attention, and memory were severely impaired (MMSE= 16/30).

Experimental study

The following tasks were presented to JB between March and May 2004. Except for the video naming task, each task was also presented to at least six control subjects matched to the patient for age and education. Crawford and Garthwaite's (2005) revised t test for dissociations was used for the result analyses (except for the video naming task). JB's and the controls' performance is summarized in Fig. 1.

Picture naming and word-to-picture verification task

JB was asked to name 108 colour photographs depicting 54 objects and 54 actions. The target nouns and verbs were closely matched for both objective and subjective name frequency and concept familiarity. The same items were used in the word-to-picture verification task, where each word was successively presented with the correct picture and three distractor pictures. JB's naming performance was significantly impaired for both nouns [$t(10) = -45.68$; $p < .0001$] and verbs [$t(10) = -70.52$; $p < .0001$] and she was significantly more impaired for verbs than nouns [$t(10) = 13.59$; $p < .0001$]. Likewise, in the word-to-picture verification task, JB was significantly impaired both in comprehending nouns [$t(9) = -37.92$; $p < .0001$] and verbs [$t(9) = -72.68$; $p < .0001$], and significantly more impaired in comprehending verbs than nouns [$t(9) = 20.68$; $p < .0001$].

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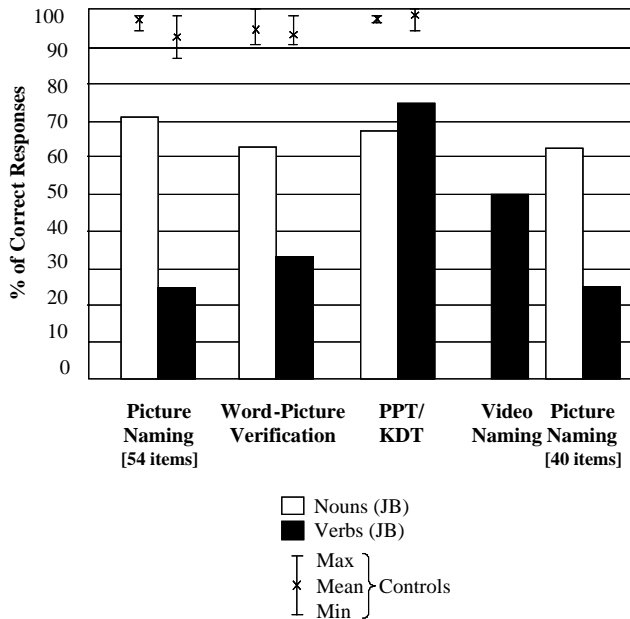*E-mail address:* peggy.dhonincthun@psp.ucl.ac.be (P. d'Honincthun).

Fig. 1. JB's and controls' percentage of correct responses for nouns and verbs in the picture naming, word–picture verification, PPT/KDT and the video naming tasks.

Semantic association task with written nouns and verbs

A French version of the "Pyramid and Palm Trees Test" (PPT; Howard & Patterson, 1992) and of the "Kissing and Dancing Test" (KDT; Bak & Hodges, 2003) was prepared. The 52 noun triplets and the 52 verb triplets were matched in name frequency. Each triplet was composed of a written word (the target) and two semantically-related words written below it. JB was asked to point to the word that was more closely related to the target. Her performance was significantly impaired for both nouns $[t(5) = -26.19; p < .0001]$ and verbs $[t(5) = -9.63; p < .0001]$ but nonetheless significantly *less* impaired for verbs than nouns $[t(5) = -9.06; p < .001]$.

Video naming task

Forty actions selected from the items used in the picture naming task were performed by one of the author and videotaped. The actions were performed in such a way that they resemble as closely as possible those depicted in the photographs, without providing any additional information except for movement. JB was asked to name the actions from the videos in one session and, in a subsequent session, to name again these 40 actions from the photographs and 40 objects matched in frequency and concept familiarity. JB's named better the videotaped actions than their corresponding photographs $[\chi^2(1) = 5.33; p = .021]$ and her performance for videotaped actions and pictured objects did not significantly differ $[\chi^2(1) = 1.27; p = .26]$.

Discussion

JB was disproportionately impaired with verbs by comparison with nouns in both picture naming and word-to-picture verification. This finding replicates the results obtained by Silveri et al. and Rhee et al. with a group of FTD patients tested with very similar tasks. However, the same pattern was not found in JB when she had to name the same verbs from videotaped actions and to understand them from word stimuli. This suggests that she was not disproportionately impaired in retrieving the linguistic information associated with *verbs* but, rather, encountered particular difficulties with the processing of static *pictures of actions*.

We suggest that recognizing actions from static scenes is more demanding of executive resources than recognizing objects because not only the task is less familiar in everyday life, it also requires retrieving/computing information that is lacking in static scenes (the temporal and movement features) and yet crucial for the recognition of the action.

The results of this study thus point to the need of selecting appropriate stimuli for assessing verb and noun processing in brain-damaged patients (whatever the etiology) who are likely to have reduced executive resources.

References

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