Category-Specific Verb Deficits in Alzheimer’s: Argument structure effects in naming and sentence production with dynamic scenes

Roberto G. de Almeida & Caitlyn Antal
Department of Psychology, Concordia University, Montreal, Canada

Semantic Deficits in Alzheimer’s

- Several studies have found that individuals with probable Alzheimer’s disease (pAD) have impaired knowledge for categories of objects, which are lexicalized by nouns. (e.g., Zaninno et al., 2002).
- Deficits in categories lexicalized by verbs (e.g., events and states) has been more difficult to characterize.
- Relatively few studies have investigated verb semantic deficits in Alzheimer’s.
- These studies differ considerably both in terms of verb classes investigated and methods employed (e.g., Grossman et al., 1996; Kim & Thompson, 2004; Manouldou et al., 2009).

Current Study

- Our goals were to understand (a) how different syntactic & semantic classes of verbs might be affected in Alzheimer’s; and, consequently, (b) which principles underlie verb classifications.
- pAD patients and controls named and generated sentences describing actions depicted in video clips representing verbs said to form three classes.

Verb Classes Investigated

- Verb classes varied along three hypothetical dimensions:
  - argument structure: number of arguments
  - thematic roles: semantic roles assigned to arguments
  - semantic templates: internal semantic properties of Verbs (e.g., Jackendoff, 1990; Levin & Rappaport-Hovav, 2005).
- Lexical causatives (e.g., peel), hypothesized to be semantically more complex (multiple internal predicates: \([x \text{ ACT} [\text{CAUSE} [\text{BECOME} [y < \text{PEELED}]]]]\]) and structurally complex (two arguments: \(x \text{ and } y\)).
- Verbs of perception (e.g., hear), are structurally complex (two arguments) but semantically simple (one predicate: \([x \text{ PERCEIVE } y < ]\)).
- Verbs of movement (e.g., run), are semantically and structurally simple (\([x \text{ MOVE} < z]\); one argument).
- These verbs also differ with regards to the thematic-role hierarchy: causatives and movement verbs assign the most prominent Agent role to the \(x\) argument; in perception verbs, the Experiencer role is assigned to \(x\) (e.g., Grimshaw, 1990; see de Almeida & Manouldou, 2015).

Method

Participants: Action naming: 19 pAD patients (mean MMSE = 24.4) and 29 age and education matched healthy controls (mean MMSE = 29.6); Sentence Production: 16 pAD patients (MMSE = 24.6), 21 controls (MMSE = 29.9).

Materials & Procedure:

- Dynamic Action Naming task: 34 short movies of events probing three classes of verbs. Participants were asked to name, using one word, the action depicted in the movie.
- Dynamic Sentence Production task: same 34 short movies of. Participants were instructed to produce a sentence describing the action depicted in the scene.

Dynamic Sentence Production Task: Results

- Main effect of group \(F(1, 26) = 21.35, p < .001, \eta_p^2 = .451\).
- Main effect of verb class, \(F(2, 52) = 3.46, p = .039, \eta_p^2 = .117\).
- One-way ANOVAs revealed category-specific verb deficits for causatives \((F(1, 26) = 4.41, p = .046)\) and perception verbs in pAD patients, \(F(1, 26) = 11.44, p = .002\).

Discussion

✓ Probable Alzheimer’s disease patients have more difficulty with causative and perception verbs.

✓ These data suggest that verb argument structure might be affected in AD; this could also be an effect of thematic structure.

✓ Similarly to Agrammatic speakers, pAD patients seem to have problems with verbs with more complex argument structures.

✓ This is at least in part consistent with the Argument structure complexity hypothesis. (Thompson, 2000)

✓ Verb-semantic deficits do not seem to be predicted by template complexity, i.e., by the number of hypothetical internal predicates (the likes of CAUSE and BECOME).

✓ Consistent with other studies employing imaging and groups of patients, verbs may be represented in the brain by their argument structures.