

Longitudinal pattern of knowledge loss for plants and manufactured objects in a patient with Alzheimer's disease

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Category-specific semantic deficits have been reported in patients with Alzheimer's Disease (AD). Most reported cases concern patients showing impaired knowledge in the living domain (i.e., animals and plants) while still having relatively spared knowledge in the nonliving domain (i.e., manufactured objects). However, the reverse pattern of dissociation is also on record (e.g., Gonnerman, Andersen, Devlin, Kempler, & Seidenberg, 1997). Devlin, Gonnerman, Andersen, and Seidenberg (1998)'s account for this double dissociation is based on the assumption that the conceptual impairment in AD patients is caused by a diffuse process affecting many parts of a unitary distributed conceptual system simultaneously and that conceptual representations of living and nonliving things disintegrate at different rates because of differences in their internal structure. Thus, the semantic features of the concepts in the living domain would be more strongly intercorrelated than the features of the concepts in the nonliving domain. This would make the living concepts more resilient to initial mild damage to the semantic system than the concepts of nonliving things. However, as the degree of damage increases, the intercorrelated features would collapse en masse, which would then result in living concepts being disproportionately impaired in comparison with nonliving concepts.

In this study, we assessed the integrity of conceptual knowledge in an AD patient on three occasions during a 18-month period and for three categories of concepts: animals, plants, and manufactured objects. Considering separately two categories of concepts within the living domain (animals and plants) allowed us to evaluate an additional prediction that can be drawn from the Devlin et al.'s account. This account predicts that the patient's performance for both categories of living things should pattern similarly through the disease progression, because both are claimed to have strongly intercorrelated features. In particular, both living thing categories should be relatively spared, at the initial stage of the disease, in comparison with manufactured objects, and both should be more impaired than manufactured objects in a subsequent stage.

Case history

MO (born in 1922), a right-handed man with 17 years of formal education, presented in March 1999 with memory and word-finding difficulties. The neuropsychological examination concurred to the diagnosis of probable dementia of Alzheimer's type. An MRI scan

revealed generalised cortical and subcortical atrophy with no specific area implicated. The Mini Mental State Examination situated the patient in the early first stage of dementia of Alzheimer type (28/30= lower normal range).

Experimental study

Material

We selected 120 items including 40 plants, 40 animals, and 40 manufactured objects, closely matched for word frequency and gender-specific concept familiarity (based on the ratings on 78 aged male normal subjects). Colour photographs of these items were used in an oral picture naming and a spoken word/picture verification task.

Subjects and method

Both tasks were presented to 13 control subjects, matched for age, gender, and education level with MO. MO was administered both tasks three times during one and a half years from August 1999. In the picture naming task, subjects were asked to name the object depicted on the photographs without cueing. In the word/picture verification task, each photograph was presented once with the correct word, once with a close semantic coordinate of the correct word, and the subjects were asked to tell, on each presentation, whether the word was the correct one for the object. An item was scored as correct when the subject both accepted the correct word and rejected the incorrect one.

Results

The results are displayed in Fig. 1. MO's performance was considered impaired if it deviated from the controls' mean by more than -2.5 SD. In the picture naming task, and in the three examinations (E1, E2, and E3), MO's performance was impaired for plants (E1: -4.44 SD; E2: -4.44 SD ; E3: -4.74 SD) and manufactured objects (E1: -2.80 SD; E2: -3.24 SD ; E3: -4.22 SD), but not for animals (E1: -1.08 SD; E2: -0.44 SD ; E3: -1.72 SD). In the word/picture verification task, MO's performance was impaired for plants (-6.60 SD), but not for animals (-0.55 SD) or manufactured objects (-2.37 SD), in the first examination. However, in the second and third examinations, MO's performance was impaired for both plants (E2: -8.23 SD; E3: -8.77 SD) and manufactured objects (E2: -3.82 SD;

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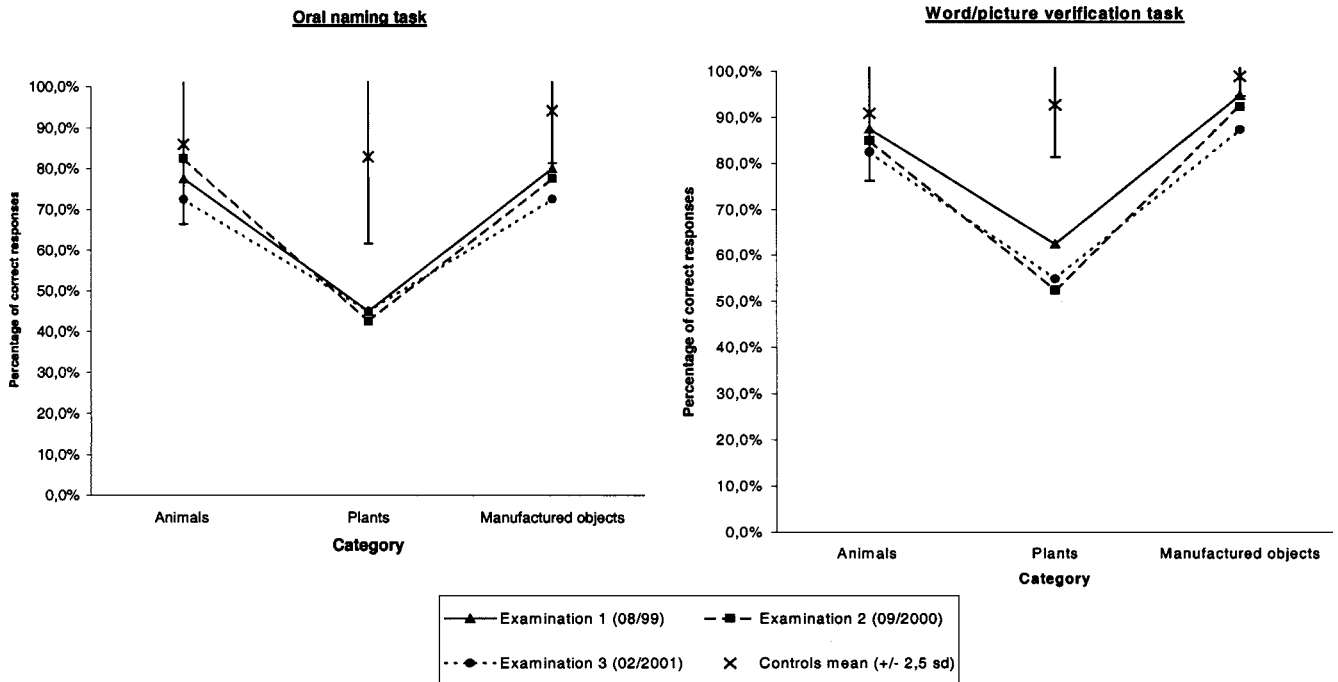


Fig. 1. Percentage of MO's correct responses in the oral picture naming task and the word/picture verification task for animals, plants, and manufactured objects, in the three examinations, and in comparison with the controls' performance.

E3: $-6.76 SD$), while his performance for animals remained not significantly different from that of controls (E2: $-1 SD$; E3: $-1.45 SD$).

Conclusion

Two features of MO's pattern of performance do not conform to the predictions drawn from Devlin et al.'s account for category-specific semantic deficits in AD patients. First, in spite of both having strongly intercorrelated features, the categories of plant and animal were not affected similarly through the disease progression: MO showed impaired performance for plants, and spared performance for animals, in the three examinations and both in the naming and in the picture/word verification tasks. Second, with the progression of the disease, performance for manufactured objects (a category with weakly intercorrelated features) began to be impaired in both tasks, while performance for animals (a category with strongly intercorrelated features) remained unimpaired, a pattern that is just the reverse of the expected one under the Devlin's account. Overall, the findings of the present

case study are consistent with the view that brain damage in Alzheimer's disease does not affect semantic memory uniformly and with theories assuming segregated neural systems for processing the concepts of animals and plants (e.g., Caramazza & Shelton, 1998).

References

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