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# Word Class-Based Clustering and Switching Analyses of Phonemic Fluency in Alzheimer's Disease

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## Introduction

Verbal fluency tasks are well known to sensitively detect cognitive-linguistic declines in Alzheimer's disease (AD) (Murphy et al., 2006). Word class dissociations have been a critical issue in research on cognitive and linguistic deficits of neurological diseases. However, no studies examined whether word class dissociations can be identified in phonemic verbal fluency in AD and how the word class-based analyses of clustering and switching behaviors affected overall performance on the fluency measures. The current study investigated whether the word class dissociations emerged in the phonemic fluency task and explored the best predictors to account for the number of correct responses among word class-based clustering and switching behaviors in addition to demographic variables of AD.

## Methods

Participants were 58 individuals with probable AD from the dementia bank project, Pitt Corpus (Becker et al., 1994). Participants generated words beginning with f for 60 seconds. We categorized the word class for each item and analyzed word class-based mean cluster size and number of switching.

## Results

### *Word Class Analyses*

Nouns were the most frequently generated word class, consisting of 71% of the total words, followed by verbs (15%) and adjectives (13%) (Table 1, Figure 1). The proportions of adverbs and prepositions were less than 1%, which were excluded from the following regression analyses.

### *Multiple Regression Analyses*

To examine the best predictors for the number of correct responses, we conducted stepwise multiple regression analyses with word class-based mean cluster size, the number of switches, and demographic variables as predictors. The results revealed that the models with the number of switches,  $F(1,56)=61.946$ ,  $p<.0001$ ,  $R^2=.525$ , and with the number of switches and mean cluster size,  $F(2,55)=44.911$ ,  $p<.0001$ ,  $R^2=.620$ , significantly predicted the number of correct responses, suggesting that the number of switches is the most influential predictor for correct responses, accounting for 52.5% of the total variance.

Furthermore, we explored significant predictors for the number of switches as a dependent variable with the numbers of nouns, verbs and adjectives, demographic variables as independent variables. The models with the number of verbs,  $F(1,56)=61.060$ ,  $p<.0001$ ,  $R^2=.522$ , with the numbers of verbs and adjectives,  $F(2,55)=98.468$ ,  $p<.0001$ ,  $R^2=.782$ , with the numbers of verbs, adjectives and nouns,  $F(3,54)=76.270$ ,  $p<.0001$ ,  $R^2=.809$ , and with the numbers of verbs, adjectives, nouns and education,  $F(4,53)=62.071$ ,  $p<.0001$ ,  $R^2=.824$ ,

significantly predicted the number of switches. Results indicate that the most influential variables are the number of verbs, which explains 52.2% of the variance.

### **Conclusions**

The current results revealed a strong advantage for nouns over verbs or adjectives in line with previous findings showing that individuals with AD have more difficulties in retrieving verbs than nouns (Cotelli et al., 2006). Switching contributed most to increasing the correct responses. Although the nouns are the most frequently generated word class, verbs turned out to be the most crucial factor for facilitating switching, indicating that the abilities to generate more verbs are related to elicit more switching behaviors. The results suggest individuals with AD who can activate a diverse linguistic word class can successfully generate more numbers of correct responses with more frequent switching behaviors.

### **References**

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Table 1. Descriptive statistics for each word class

	Noun	Verb	Adjective	Adverb	Preposition	Total numbers of correct responses
Frequency per word class	247	51	46	3	1	348
Proportion (%) of each word class	70.98	14.66	13.22	0.86	0.29	100
Mean frequency per individual	4.26	0.88	0.79	0.02	0.05	6.00
(SD)	(±2.67)	(±1.11)	(±1.28)	(±0.13)	(±0.22)	(±3.54)

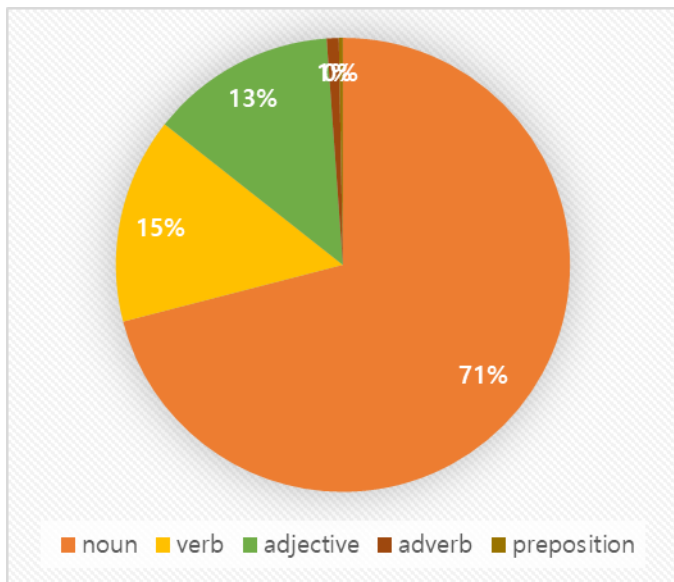


Figure 1. The proportion of each word class