

Using a Multinomial Model to Differentiate Alzheimer's Disease, Vascular Disease, and Elderly Controls Based on an Immediate Recall Task

Jamie Chosak-Reiter¹, William H. Batchelder¹, W. Rodman Shankle²,
and Malcolm B. Dick³

¹Dept. Cognitive Sciences, ²Dept. Neurology, ³Dept. Psychobiology
University of California, Irvine

Irvine, CA 92717

jchosak@aris.ss.uci.edu, whbatc@aris.ss.uci.edu, rshankle@uci.edu,
mbdick@uci.edu

Can the ability to freely recall words immediately after reading them from a list differentiate early stages of Alzheimer's Disease (AD), Vascular Dementia (VD), and healthy, elderly controls? Previous studies have suggested that immediate free recall ability does not help to differentiate early AD from controls, while performance on delayed recall can (e.g., Welsh et al., 1991; 1992). However, the methods used typically analyzed only part of the available information, namely, the mean number of items recalled per trial. General Processing Tree (GPT) modeling is a form of multinomial modeling (described in Riefer & Batchelder, 1988) that analyzes more of the available information and may help differentiate these diagnoses. The GPT method provides estimates and confidence intervals for parameters reflecting the probabilities of hypothesized, underlying cognitive processes.

In the present study, we used the GPT approach to analyze AD, VD and control subjects for their pattern of immediate, free recall of each word over the three trials of the CERAD 10-item Word List test. The hypothesized parameters of the model were 1) storing the word into a temporary state, 2) retrieving the word from a partially stored state, and 3) storing and retrieving the word from a more permanent state. In contrast to previously used methods, the GPT model for these data differentiated between early stages of AD, VD, and elderly controls.

Results of the parameter estimates based on the GPT model revealed that early stages of AD affected these parameters in a different way than early stages of VD. As AD and VD progressed, the parameters had a different sequence of changes, which may reflect differences in their pathophysiological mechanisms. Additionally, the results suggested that very mild AD patients stored items into a temporary state better than very mild VD patients, and very mild AD patients had significantly poorer retrieval from the temporary state than healthy elderly controls. However, as the disease progressed, AD patients relied more heavily on temporary storage of the words as their ability to achieve long-term storage diminished. This finding is consistent with neurological evidence of hippocampal damage in AD, which results in a reduced ability for these patients to transfer information to long-term memory for more permanent learning.

References

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