

Verbal Working Memory Abilities of School-Age Children with and without Language Impairment

Susan Ellis Weismer¹ & Elin T. Thordardottir²

¹University of Wisconsin-Madison, ²McGill University

INTRODUCTION

Various models of language processing have been proposed that incorporate the notion of a limited capacity system (e.g., Gathercole & Baddeley, 1993; Just & Carpenter, 1992). According to this view, success in comprehending and producing language is dependent upon the ability to maintain and integrate linguistic material in working memory. Associations between working memory capacity and language abilities have been demonstrated for typically developing children (Gaulin & Campbell, 1994; Gathercole, Willis, Emslie, & Baddeley, 1992; Swanson, 1996). Recently, investigators have proposed that children with language impairment have particular limitations in their capacity to process and store information (Ellis Weismer, 1996a; Gathercole & Baddeley, 1990; Lahey & Bloom, 1994). This investigation compared the performance of children with and without language delay on several measures designed to tap differing aspects of verbal working memory and secondarily examined the role of nonverbal cognitive level relative to this issue.

METHODS

Participants

- * A total of 134 school-age children (Grades 2-3) participated in this investigation who were part of a longitudinal epidemiologic study of language impairment.
- * None of the children had sensory or motor deficits, emotional disturbance, or mental retardation, yet they exhibited a range of nonverbal cognition and language skills (from -2 SD to +2 SD on standardized measures).

Tasks

Verbal Working Memory Measures:

- * **Dual Processing Comprehension Task** (Ellis Weismer, 1996b) - comprehension of sentences presented under competing and non-competing listening conditions
- * **Competing Language Processing Task** (Gaulin & Campbell, 1994) - comprehension of T/F statements and concurrent recall of the last word in each set of sentences
- * **Nonword Repetition Task** (Dollaghan & Campbell, 1998) - repetition of nonsense words ranging from 1-4 syllables.

Direct contributions of extant language abilities were taken into account in that the first two measures included controls for individual comprehension levels and the third task involved use of novel stimuli.

Nonverbal Cognitive Measure:

Wechsler Intelligence Scale for Children - III (WISC-III, Wechsler, 1991)
Performance IQ

Language Measure:

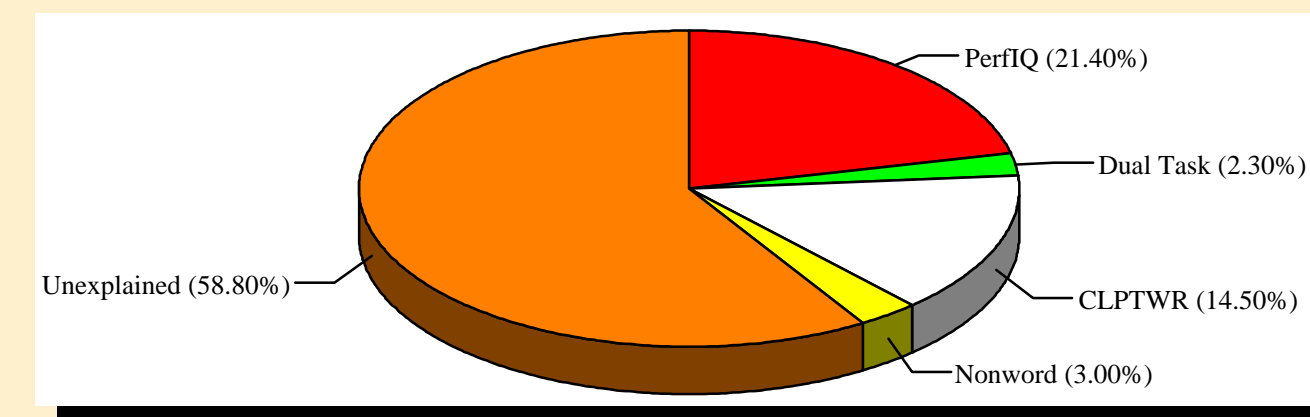
Clinical Evaluation of Language Fundamentals-3 (CELF-3, Semel & Wiig, 1995)
Receptive and Expressive Subtests

RESULTS

Predicting Language Abilities

Hierarchical multiple regression analysis revealed:

- * nonverbal cognitive scores (WISC PIQ) and performance on working memory measures predicted performance on a composite measure of language comprehension and production (CELF-3), $F(4,129)=22.62, p=.000, r^2=.41$
- * after the contribution of nonverbal cognition was accounted for, each of the working memory measures added significant unique variance in language scores.

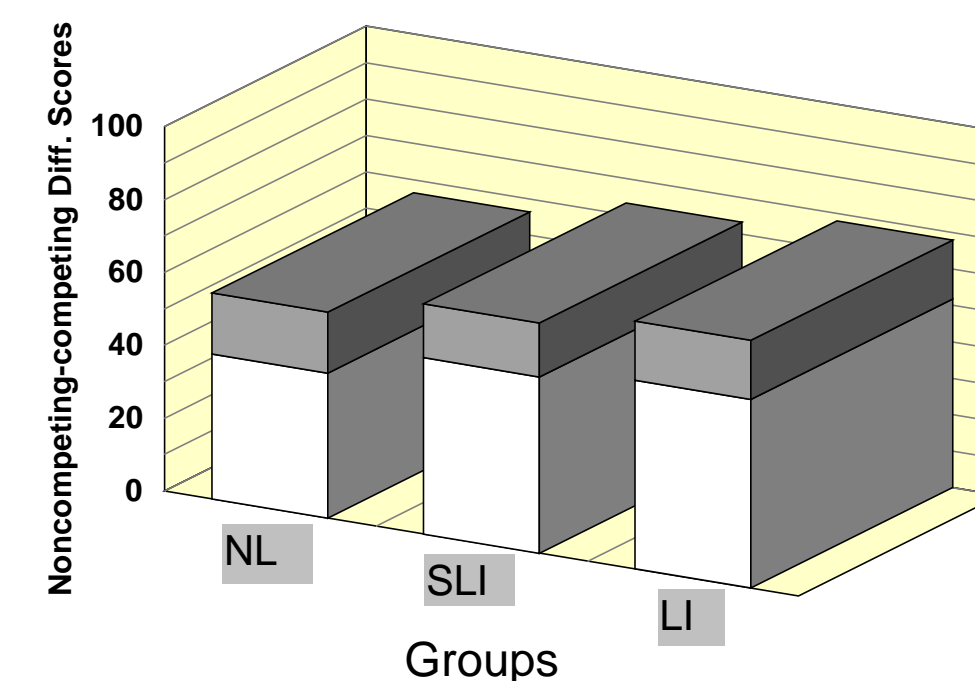


Group Differences in Verbal Working Memory

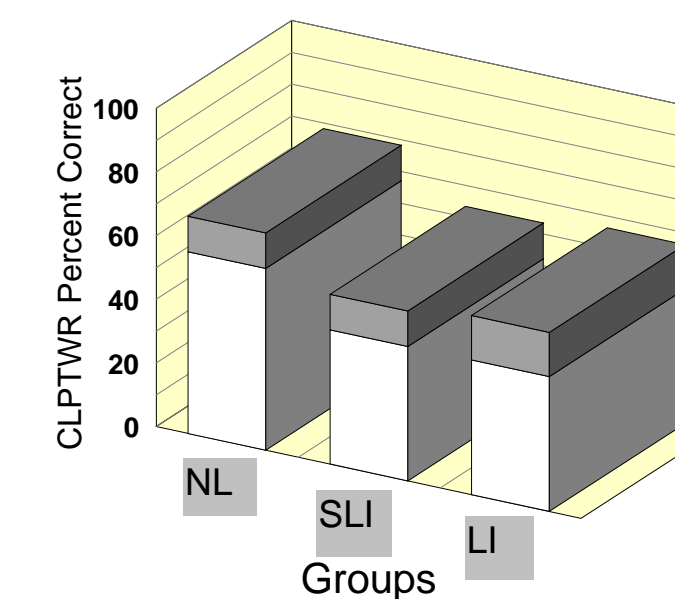
ANOVAs (excluding children who exhibited normal language skills at 2nd grade but had a history of language delay) revealed that:

- * children with 'specific language impairment' (SLI) (N=73) who met the cognitive discrepancy criterion (normal cognitive skills) performed significantly worse than controls on each of the working memory measures
- * the same pattern of results was found for analyses involving a broader definition of 'language impairment' (LI) (N=94) which included children with low cognitive and low language skills who did not meet the cognitive discrepancy criterion

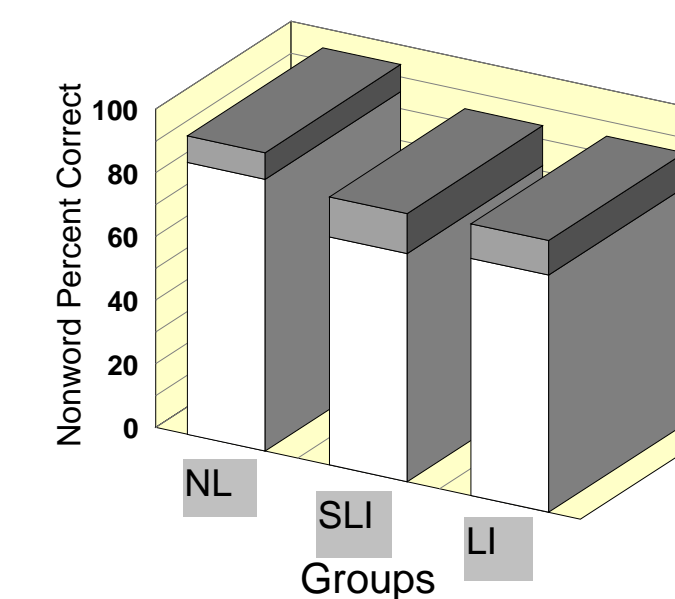
DUAL PROCESSING COMPREHENSION TASK



CLPTWR WORD RECALL



NONWORD REPETITION



CONCLUSIONS

- * The findings support claims of an association between working memory and language abilities in school-age children.
- * Results indicate that children with language impairment, whether defined in terms of cognitive discrepancy criteria or not, evidence deficits in verbal working memory.

REFERENCES

- Dollaghan, C., & Campbell, T. (1998). Nonword repetition and child language impairment. *Journal of Speech, Language, and Hearing Research, 41*, 1136-1146.
- Ellis Weismer, S. (1996a). Capacity limitations in working memory: The impact on lexical and morphological learning by children with language impairment. *Topics in Language Disorders, 17*, 33-44.
- Ellis Weismer, S. (1996b). Language as process: Interactions with memory. Invited panel presentation at the annual convention of the American Speech-Language-Hearing Association, Seattle, WA.
- Gathercole, S., & Baddeley, A. (1990). Phonological memory deficits in language disordered children: Is there a causal connection? *Journal of Memory and Language, 29*, 336-360.
- Gathercole, S., & Baddeley, A. (1993). *Working memory and language processing*. Hove: Lawrence Erlbaum Associates.
- Gathercole, S., Willis, C., Emslie, H., & Baddeley, A. (1992). Phonological memory and vocabulary development during the early school years: A longitudinal study. *Developmental Psychology, 28*, 887-898.
- Gaulin, C., & Campbell, T. (1994). Procedure for assessing verbal working memory in normal school-age children: Some preliminary data. *Perceptual and Motor Skills, 79*, 55-64.
- Just, M., & Carpenter, P. (1992). A capacity theory of comprehension: Individual differences in working memory. *Psychological Review, 99*, 1-28.
- Lahey, M., & Bloom, L. (1994). Variability and language learning disabilities. In G. Wallach and K. Butler (Eds.), *Language learning disabilities in school-age children and adolescents* (pp. 354-372). New York: Macmillan.
- Swanson, H.L. (1996). Individual and age-related differences in children's working memory. *Memory and Cognition, 24*, 70-82.

ACKNOWLEDGMENT

This project was supported by funding from the National Institutes of Health, NIDCD 5 P50 DC02746-03, Midwest Collaboration on Specific Language Impairment, J. Bruce Tomblin, Director.