

# Why Is Word Learning Related to List Memory? Empirical and Neuropsychological Tests of a Computational Account

Prahlad Gupta (prahlad-gupta@uiowa.edu)

Department of Psychology; University of Iowa

Iowa City, IA 52242 USA

## Introduction

A growing body of evidence indicates that human word learning, nonword repetition, and immediate serial recall (ISR) abilities are related in some way (e.g., Baddeley et al., 1998). It seems clear why word learning might be related to nonword repetition: every known word was once a nonword to a particular learner, so greater facility in processing nonwords should lead to greater facility in eventually learning them. But why might nonword repetition and list recall be related?

## Nonwords as Lists

One possibility is that a nonword is processed like a list when first encountered, and is thus directly dependent on list sequencing mechanisms. If this were the case, we would expect to observe serial position effects in repetition of the sequence of sounds comprising nonwords, just as in ISR of lists of words. We conducted three experiments to examine syllable serial position effects in repetition of individual polysyllabic nonwords, and obtained significant primacy and recency in all three experiments (Gupta, 2004).

## Testing Alternate Models

There are two possible explanations of these results in terms of our previous computational work (Gupta, 1996). The two formulations can be distinguished by differing predictions with regard to correlations between ISR, nonword repetition, and word learning. The original formulation explains the fact that these correlations arise developmentally but predicts their absence in adults. An alternative formulation predicts that such correlations obtain not only developmentally, but also in adults. We conducted two experiments to examine whether ISR, nonword repetition, and word learning are correlated in adults (Gupta, 2003). The results indicated that the developmental relationships between all three abilities also exist in adults, thus supporting the revised model over the original model.

## Neuropsychological Investigation

The revised version of our model incorporates the view that there is a functional relationship between the abilities, all of which invoke the same sequencing mechanisms. If this is really the case, we would expect relationships between these abilities to obtain even following early neurological injury across a variety of lesion sites. This is because in the case of early lesions, there is a real possibility for remission of deficits as a result of neural reorganization; persistence of correlations would thus support the hypothesis of an underlying functional relationship. We examined this question by administering tests of word learning, nonword repetition, and ISR to 5-10 year old children who had suffered perinatal brain injury across a variety of sites, and to age-matched controls (Gupta et al., 2003). The results indicate that the relationships between ISR, nonword repetition, and word learning are exhibited even under conditions of early brain injury. These findings thus provide further support for the functional architecture of our revised model.

These various lines of evidence together clarify how common sequencing mechanisms may underlie both nonword processing and immediate list recall, thereby offering an explanation of why word learning is related to list memory.

## References

- Baddeley, A. D., Gathercole, S. E., and Papagno, C. (1998). The phonological loop as a language learning device. *Psychological Review*, 105:158–173.
- Gupta, P. (1996). Word learning and verbal short-term memory: A computational account. In Cottrell, G. W., editor, *Proceedings of the Eighteenth Annual Meeting of the Cognitive Science Society*, pages 189–194. Lawrence Erlbaum, Mahwah, NJ.
- Gupta, P. (2003). Examining the relationship between word learning, nonword repetition, and immediate serial recall in adults. *Quarterly Journal of Experimental Psychology (A)*, 56:1213–1236.
- Gupta, P. (2004). Primacy and recency in nonword repetition. *Memory*. In press.
- Gupta, P., MacWhinney, B., Feldman, H., and Sacco, K. (2003). Phonological memory and vocabulary learning in children with focal lesions. *Brain and Language*, 87:241–252.