

Language-Specific Working Memory Capacity in Second Language Proficiency

Wai Men Noel Chung (nchung@vax2.concordia.ca) & Norman Segalowitz (norman.segalowitz@concordia.ca)

Department of Psychology & Centre for the Study of Learning and Performance, Concordia University
7141 Sherbrooke Street West, Montréal, QC H4B 1R6 Canada

Introduction

In a previous study using a *non-matching to sample task*, Chung and Segalowitz (2004) investigated language-specific attention control. They found that second language (L2) proficiency correlated positively with performance in a task of L2 attention or *executive control* for grammatical elements, but only for the most proficient bilinguals. The results raised questions about how other aspects of working memory, such as *memory capacity*, are related to L2 proficiency. Past research has already demonstrated a relationship between working memory capacity and first language (L1) reading comprehension (Daneman & Carpenter, 1980), as well as L2 reading comprehension (Walter, 2004). The goal of the present study was to investigate whether language-specific working memory capacity plays a role in L2 proficiency.

Method

Bilingual undergraduates ($n=24$; L1=English; L2=French) performed the following tasks to assess the association between L2 *proficiency* and *working memory* capacity.

L2 Proficiency was operationalized, as in Chung and Segalowitz (2004), as efficiency of accessing word meaning in a *lexical categorization task*. In separate L1 and L2 blocks, subjects (Ss) indicated by panel press whether a word referred to a living or non-living object (72 trials in each language). Intra-individual variation in reaction time (based on the coefficient of variation—CV) was used as the measure of processing efficiency (Segalowitz & Segalowitz, 1993). L2-specific measures of lexical access efficiency were obtained by partialling out L1 from L2 measures.

Working memory capacity (WM) was operationalized as processing and storage of information in a modified version of the Walter (2004) verbal WM measure. In this *reading memory span task*, Ss first had to decide whether a given sentence was logical or illogical by pressing a left or right key, and then to remember the final word of the sentence for later recall. After a set of two, three, four, or five sentences they were asked to recall as many of the final words in that set, in order, as possible. L1 and L2 versions of a series of simple declarative sentences were constructed. The task consisted of 70 test sentences in total, half semantically logical (e.g., *The doctor is reading this medical book*) and half semantically illogical (e.g., *This medical book is reading the doctor*). All the sentence-final concrete nouns to be remembered were different from each other. An L2-specific WM capacity index was computed by partialling out L1 from L2 reading memory storage scores (measure of correctly remembered sentence-final words in order).

Results

The data were submitted to regression with L2-specific lexical access proficiency as the dependent measure and the L2-specific WM capacity index as the predictor. For the 12 most proficient Ss, $\Delta R^2 = .014$ (*n.s.*) and for the 12 least proficient Ss, $\Delta R^2 = .342$ ($p = .046$).

Discussion

In the least proficient bilinguals, WM capacity accounted for 34% of unique variance of L2 proficiency, suggesting that at lower, but not higher, levels of proficiency, individual differences among L2 learners reflect differences in WM capacity, indicating the importance of memory storage abilities in the earlier phases of learning. Because all L2 measures had been residualized against L1, the results reflect a language-specific form of WM capacity, not general storage abilities.

In contrast, in the most proficient bilinguals, WM capacity accounted for only 1% of unique variance of L2 proficiency. However, in Chung and Segalowitz (2004), in the most proficient bilinguals, individual differences in L2 attention (executive) control for grammatical elements accounted for 42% of unique variance of L2 proficiency.

Taken together, these results suggest that once the bilinguals reach some appropriate higher level of L2 proficiency in lexical access, individual differences among them reflect differences in attention control for grammatical elements. Prior to that, individual differences among them reflect differences in L2-specific working memory capacity. These two aspects of language-specific working memory contribute to the overall development of L2 proficiency.

References

- Chung, W.M.N., & Segalowitz, N. (2004). Language-Specific Grammatical Attention in Second Language Proficiency. *Cognitive Science Society Conference*, Chicago.
- Daneman, M., & Carpenter, P. (1980). Individual differences in working memory and reading. *Journal of Verbal Learning and Verbal Behavior*, 19, 450-466.
- Segalowitz, N., & Segalowitz, S. (1993). Skilled performance, practice, and the differentiation of speed-up from automatization effects: Evidence from second language word recognition. *Applied Psycholinguistics*, 14, 369-385.
- Walter, C. (2004). Transfer of reading comprehension skills to L2 is linked to mental representations of text and to L2 working memory. *Applied Psycholinguistics*, 25, 315-339.