

## Processing and Cognitive Demands of Complex Structures Containing Sequential Temporal Order

Edalat Shekari & Elisabet Service  
McMaster University

Complex sentences containing finite adverbial clauses that do not match the successive presentation of events cause comprehension difficulty in normal and impaired subjects and children. The functional and cognitive pressures from syntactic parsing, discourse pragmatics, and semantics can influence the ordering of main and adverbial clauses. If the sequential ordering of the subordinate and main clauses does not match the conceptual order, it requires revising the order of clauses to construct a coherent mental representation. However, it is not yet fully clear how linguistic complexity, the order of the temporal adverbial clause, and memory resources can affect the comprehension and recall of temporal order in complex sentences, especially in L1 and L2. We tested a group of skilled Persian-English bilinguals in their L1 and L2 and a group of native English speakers as the control group. The complex structures, in matching and reverse temporal orders with *after* and *before* connectives, were embedded in sequences of four auditory instructions, e.g., *Scan the notice, then before you sign the complaint form, print the questionnaire, and last, file the agreement.* We presented the stimuli in the form of instructions since their processing and computational loads are at the sentence level, but performing them in the correct sequential order or re-arranging the order requires additional computations and relies on more memory resources. We asked the subjects to listen to each sequence of instructions, keep them in mind, and then perform them in the correct sequential order of occurrence, regardless of the order of presentation, on the computer screen. Also, we measured subjects' functional and phonological memory and assessed bilinguals' L2 proficiency and use. The results revealed that there was the main effect of linguistic complexity ( $p < 0.01$ ), with lower accuracy in recalling and performing the instructions containing the adverbial clause. There was the main effect of the order of the temporal adverbial clause ( $p < 0.01$ ), with the advantage of the matching condition, where the order of the mention matched the conceptual order, producing more accurate performance responses. Bilinguals' performance was affected by the language of presentation ( $t_{(34)} = 3.94, p < 0.01$ ), with higher accuracy in L1. While there was a correlation between following the oral instructions and working memory span in L1 ( $r = 0.53$  &  $0.23$ ), L2 performance was modulated by language proficiency ( $r = 0.47$ ). Thus, bilinguals with higher proficiency and larger working memory capacity had more efficient comprehension and performance. Overall, it seems that comprehending and recalling two-clause instructions containing sequential temporal order are affected by linguistic complexity, memory resources, and language proficiency. Thus, revising and constructing a coherent mental representation, when the order of mention is incongruent with the conceptual order, have greater processing and cognitive costs. The findings of the study have implications for sentence and information processing and performance in the domains of SLA, Psycholinguistics, and Neurolinguistics.

**Key Words:** Cognitive costs, complex structures, temporal order, mental representations, L2 acquisition