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# Intra-clause Constraints in Think-Aloud Protocols

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Clauses in verbal protocols produced during reading reflect relationships among entities (e.g., arguments) and events (e.g., verb predicates) in the reader's unfolding situation model (e.g., Trabasso & Magliano, 1996). The content of the clauses come from three knowledge sources: the current sentence, the prior text, and the reader's world knowledge. In this study, the relative impact of text elements, as pertaining to dimensions of situation model construction during reading was examined (Zwaan & Radvansky, 1998). Specifically, we measured the extent to which producing an argument (or predicate) influences the likelihood of producing a predicate (or argument) within each knowledge source.

## Method

The study included 64 participants enrolled in a critical thinking class at Northern Illinois University. Participants read and self-explained two of four science texts. The four texts were adopted from high-school textbooks on life sciences. Self-explanations were collected after each sentence was presented.

## Protocol Analysis

Reader's utterances were parsed into clauses containing main verbs. The verb predicates and arguments within each clause were identified as belonging to one of three sources: the current sentence, the prior text, or world knowledge.

## Results and Discussion

We computed the extent to which one constituent type (i.e., verb predicate vs. argument) determines the use of the other within a knowledge source with the following two equations:

$$\text{Equation 1: Argument Determines Predicate (ADP)} = p(\text{generate P} | \text{generate A}) - p(\text{generate P} | \text{not generate A})$$

$$\text{Equation 2: Predicate Determines Argument (PDA)} = p(\text{generate A} | \text{generate P}) - p(\text{generate A} | \text{not generate P})$$

Table 1 presents the mean constraint scores as a function of the source of a verb (i.e., current sentence, prior text, or world knowledge). A 2 (Constituent Constraint: argument or predicate) X 3 (Source: current sentence, prior text, or world knowledge) repeated measures ANOVA was conducted on the constraint scores. This analysis yielded a main effect for constraint score, such that ADP scores ( $M = .46$ ) were significantly different from PDA scores ( $M = .51$ ),  $F(1, 126) = 32.03$ ,  $MSE = .008$ ,  $p < .01$ . This main effect was qualified by a significant Constituent Constraint X Source interaction ( $F(2, 126) = 142.94$ ,  $MSE = .005$ ,  $p < .01$ ). Post hoc analyses revealed that constraint scores differed across the knowledge sources. With respect to current sentence and prior text, verb predicates constrained the arguments more than arguments constrained the verb predicates. With respect to world knowledge, the opposite pattern was found.

These data suggest that intra-clause constraints may be source dependent. Specifically, when readers describe information from the current sentence, or are accessing information from the prior discourse, they tend to describe the events and entities associated with those events. On the contrary, when entities from world knowledge are activated, readers must construct the events which than link them to the current discourse information.

Table 1: Constraint scores as a function of source and constituent.

Source	ADP Score	PDA Score
Current sentence	0.47	0.52
Prior text	0.37	0.57
World knowledge	0.53	0.43

## References

- Trabasso, T. & Magliano, J.P. (1996). Conscious understanding during comprehension. *Discourse Processes*, 21, 255-287.
- Zwaan, R.A., & Radvansky, G.A. (1998). Situation models in language comprehension and memory. *Psychological Bulletin*, 123(2), 162-185.