Predictive constraints on sentence processing: Argument structure and semantic priming

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Listeners appear (based on eye movements) to use expectations based on verb argument structure and possible referents in the visual world to anticipate upcoming sentence information (Altman & Kamide, 1999). However, anticipation is also consistent with semantic priming from verbs to associated objects in a display (based on evidence for noun-noun semantic competition; Huettig & Altmann, 2005; Yee & Sedivy, 2006).

Methods. To contrast these possibilities, we compared the time course of fixations to compatible agents and patients of verbs (e.g., cop, crook, arrest). Participants heard imperative sentences while they saw a display of four pictures. We manipulated whether verbs predicted patients, and whether the display included a semantic competitor of the patient in a 2 x 2 design (see Examples). Semantic competitors were words with high ratings for “agenthood” for the verb. Agent and patient associations with the verbs were based on agenthood and patienthood ratings for verb-noun pairs (McRae, Ferretti, & Amyote, 1997).

Predictions. If listeners actively anticipate upcoming information based on integrating verb argument-based expectations with environmental information, we would expect anticipatory looks to patients in predictive conditions (1 and 3). If anticipatory looks are driven by semantic associations, we should see equivalent anticipatory fixations for agents and patients in Condition 1, even though the agent in the display is not implied by the sentence. Condition 2 provides opportunities for “pure” noun-noun semantic competition (cf. Huettig & Altmann, 2005; Yee & Sedivy, 2006).

Results. Condition 2 replicated previous work on semantic competition: semantic associates of target patients were fixated more than unrelated distractors. In the predictive verb conditions (1 and 3), verb-patient association led to anticipatory patient fixations. The results from condition 1 were consistent with the simple semantic priming hypothesis: overall, participants were approximately equally likely to fixate the agent and the patient, suggesting the basis for fixating patients might be associations of nouns and verbs rather than anticipatory use of argument structure. However, while all subjects made anticipatory looks to the patient, only a subset fixated the agent, and those who did tended to fixate the agent before the patient, suggesting they were identifying the agent as the unnamed agent of the sentence. A second experiment examines this possibility in more depth by using named agents. If an agent has been specified before verb onset, the basis for fixating a different agent with a strong relation to the verb would be semantic rather than syntactic.

Conclusions. Our results link previous evidence of fixations triggered automatically by semantic relatedness (Huettig & Altmann, 2005; Yee & Sedivy, 2006) and anticipatory fixations based on verb argument structure (Altman and Kamide, 1999). We replicated both basic results, and when we examined both influences simultaneously, we found evidence that both likely play a role in the on-line comprehension of sentences about the visual world.

Examples

Condition 1: Predictive verb, related agent/semantic competitor.

"Arrest the crook." (visual display: crook, cop, bull, surfer)

Condition 2: Nonpredictive verb, semantic competitors.

"Pester the crook." (crook, cop, bull, surfer)

Condition 3: Predictive verb, no competitors.

"Arrest the crook." (crook, photographer, horse, cowboy)

Condition 4: Nonpredictive verb, no competitors.

"Pester the crook." (crook, photographer, horse, cowboy)

References


